IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Chen	Docket No.:	HW 82713780US09
Serial No.:	TBD	Art Unit:	TBD
Filed:	herewith	Examiner:	TBD
For:	Method, Base Station, and User Equipment for Feeding Back Ack/Nack Information for Carrier Aggregation		

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Dear Sir:

Prior to examination on the merits, Applicant respectfully submits this Preliminary Amendment and remarks as set forth hereinafter.

Samsung Exhibit 1002, Page 1

In the Claims:

1-16. (Canceled)

17. (New) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

configuring a common field preset in Downlink Control Information (DCI) as at least one type of command field related to ACK/NACK feedback, wherein the common field can be configured as the at least two types of command fields related to ACK/NACK feedback; and

sending the DCI to a user equipment, so that the user equipment feeds back the ACK/NACK information according to the DCI.

18. (New) The method according to claim 17, wherein configuring the common field comprises configuring common field preset in the DCI as at least one type of command field related to ACK/NACK feedback according to an acknowledgement information feedback mode and/or a downlink component carrier type.

19. (New) The method according to claim 17, wherein the at least two types of command fields related to ACK/NACK feedback are:

a downlink assignment index (DAI) command field and an ACK resource indication (ARI) command field;

a transmission power control (TPC) command field and an ARI command field;

a TPC command field and a DAI command field; or

a TPC command field, a DAI command field, and an ARI command field.

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20. (New) The method according to claim 17, wherein configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a downlink primary component carrier as a TPC command field.

21. (New) The method according to claim 20, wherein the at least one piece of DCI transmitted by the downlink primary component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of the downlink primary component carrier.

22. (New) The method according to claim 20, wherein configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a downlink non-primary component carrier as an ACK resource indication (ARI) command field and/or a DAI command field.

23. (New) The method according to claim 17, wherein the common field can be configured as a transmission power control (TPC) command field and an ACK resource indication (ARI) command field, and wherein configuring the common field further comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command field.

24. (New) The method according to claim 23, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises:

DCI corresponding to physical downlink shared channel, PDSCH, transmission of a

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downlink primary component carrier; and/or

at least one piece of DCI transmitted by the downlink PCC.

25. (New) The method according to claim 17, wherein the common field can be configured as a transmission power control (TPC) command field and an ACK resource indication (ARI) command field, and wherein configuring the common field further comprises configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as an ARI command field.

26. (New) The method according to claim 17, wherein the common field can be configured as a TPC command field and a DAI command field and configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a DAI command field.

27. (New) The method according to claim 17, wherein the common field can be configured as a TPC command field and a DAI command field and configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a DAI command field.

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28. (New) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

receiving downlink control information (DCI) which is sent by a base station and transmitted by a downlink component carrier; and

feeding back ACK/NACK information according to a command field which is related to ACK/NACK feedback and configured in a common field preset in the DCI, wherein the common field can be configured as at least two types of command fields related to ACK/NACK feedback.

29. (New) The method according to claim 28, wherein the at least two types of command fields related to ACK/NACK feedback are:

a downlink assignment index (DAI) command field and an ACK resource indication (ARI) command field;

a transmission power control (TPC) command field and an ARI command field;

a TPC command field and a DAI command field; or

a TPC command field, a DAI command field, and an ARI command field.

30. (New) The method according to claim 29, wherein the common field can be configured as a transmission power control (TPC) command field and an ARI command field;

if the received DCI is at least one piece of DCI transmitted by a system-linked downlink component carrier, the command field in the DCI is the TPC command field; and

if the received DCI is at least one piece of DCI transmitted by a non-system-linked downlink component carrier, the command field in the DCI is the ARI command field.

31. (New) The method according to claim 29, wherein the common field can be configured as a transmission power control (TPC) command field and an ARI command field:

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if the received DCI is at least one piece of DCI transmitted by a non-system-linked downlink component carrier, the command field in the DCI is the TPC command field; and

if the received DCI is at least one piece of DCI transmitted by a system-linked downlink component carrier, the command field in the DCI is the ARI command field.

32. (New) A base station, comprising:

a configuring module, configured to configure a common field preset in a downlink control information (DCI) as at least one type of command field related to Acknowledgement/Negative-acknowledgement (ACK/NACK) feedback, wherein the common field can be configured as the at least two types of command fields related to ACK/NACK feedback; and

a sending module, configured to send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

33. (New) The base station according to claim 32, wherein the common field can be configured as a transmission power control (TPC) command field and an ACK resource indication (ARI) command field;

wherein the configuring module comprises a third unit and a fourth unit;

wherein the third unit is configured to configure the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as the TPC command field; and

wherein the fourth unit is configured to configure the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as the ARI command field.

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34. (New) A user equipment, comprising:

a receiving module, configured to receive downlink control information (DCI) that is sent by a base station and transmitted by a downlink component carrier; and

a feedback module, configured to feed back Acknowledgement/Negative-acknowledgement (ACK/NACK) feedback information according to a command field that is related to ACK/NACK feedback and configured in a common field preset in the DCI, wherein the common field can be configured as at least one type of command field related to ACK/NACK feedback of at least two types of command fields related to ACK/NACK feedback.

35. (New) The user equipment according to claim 34, wherein the receiving module is configured to receive at least one piece of DCI transmitted by a system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a system-linked downlink component carrier is configured as a TPC command field; and is configured to receive at least one piece of DCI transmitted by a non-system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a non-system-linked downlink component carrier is configured as an ARI command field.

36. (New) The user equipment according to claim 35, wherein the receiving module is configured to receive at least one piece of DCI transmitted by a non-system-linked downlink component, wherein the common filed in the at least one piece of DCI transmitted by a non-system-linked downlink component is configured as a TPC command field; and is configured to receive at least one piece of DCI transmitted by a system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a system-linked downlink component carrier is configured as an ARI command field.

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REMARKS

Entry of this amendment prior to examination is respectfully requested. In this amendment, the original claims have been replaced with new claims. No new matter is added by this amendment. The Commissioner is hereby authorized to charge any fees that are due, or credit any overpayment, to Deposit Account No. 50-1065.

Examination and allowance of the pending claims are respectfully requested.

Respectfully submitted.

June 1, 2012
Date

/Ira S Matsil/
Ira S. Matsil
Attorney for Applicant
Reg. No. 35,272

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Ste. 1000
Dallas, Texas 75252
Tel.: 972-732-1001
Fax: 972-732-9218

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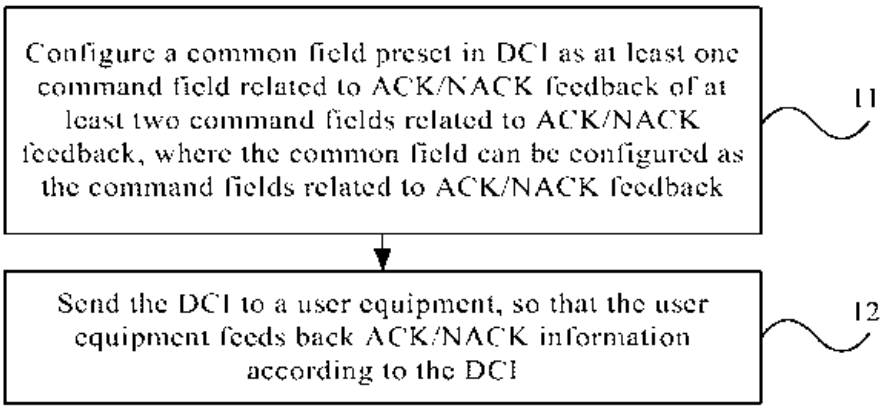

Configure a common field preset in DCI as at least one command field related to ACK/NACK feedback of at least two command fields related to ACK/NACK feedback, where the common field can be configured as the command fields related to ACK/NACK feedback
11
Send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI
12

FIG. 1

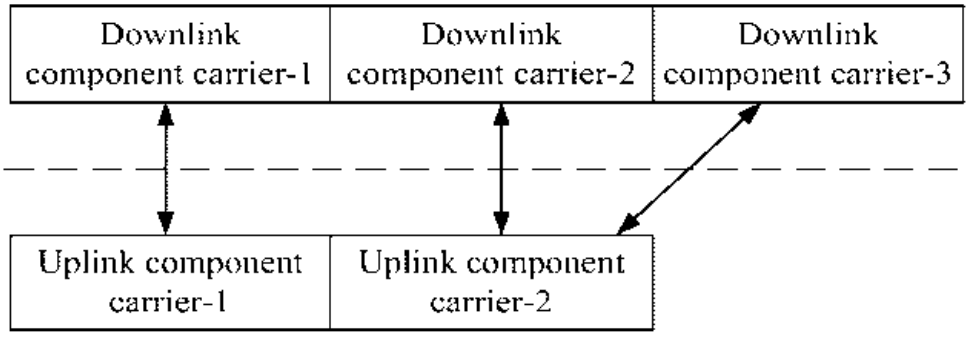

Downlink component carrier-1
Downlink component carrier-2
Downlink component carrier-3
Uplink component carrier-1
Uplink component carrier-2

FIG. 2

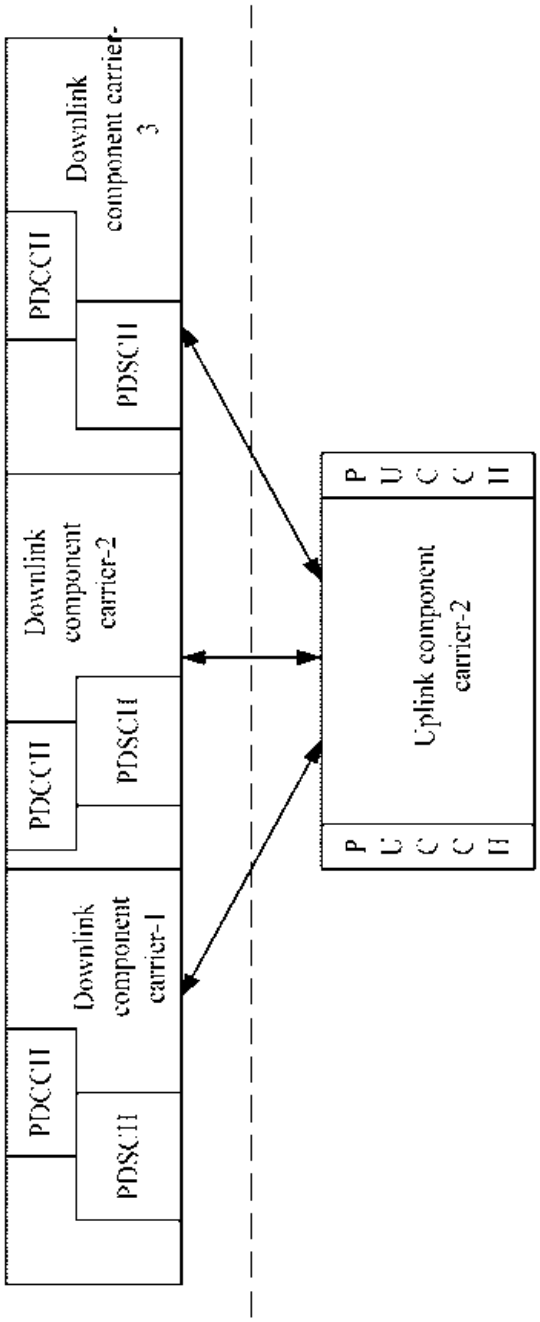


FIG. 3

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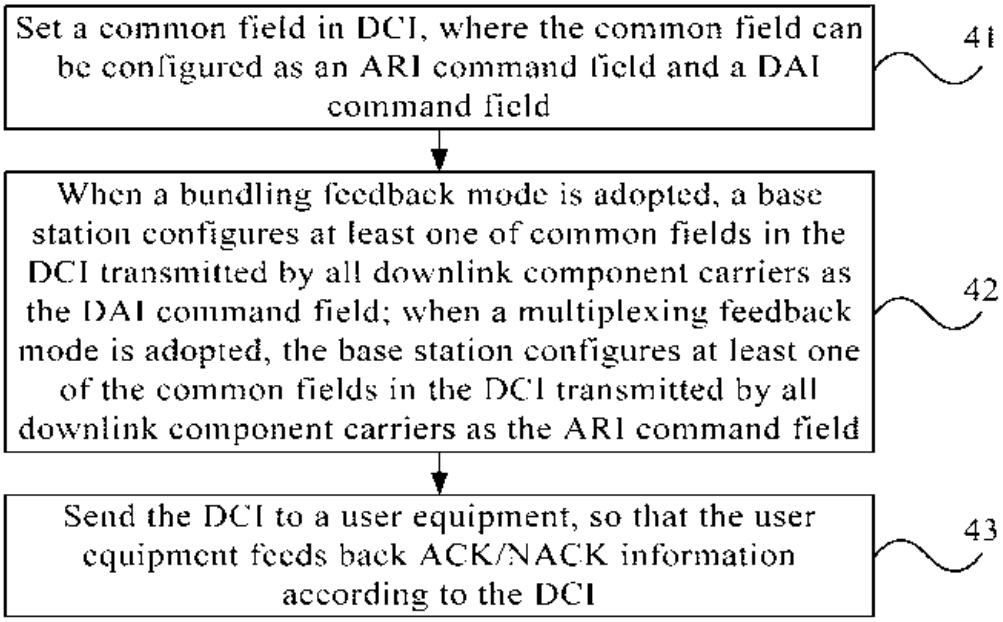

Set a common field in DCI, where the common field can be configured as an ARI command field and a DAI command field
41
When a bundling feedback mode is adopted, a base station configures at least one of common fields in the DCI transmitted by all downlink component carriers as the DAI command field; when a multiplexing feedback mode is adopted, the base station configures at least one of the common fields in the DCI transmitted by all downlink component carriers as the ARI command field
42
Send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI
43

FIG. 4

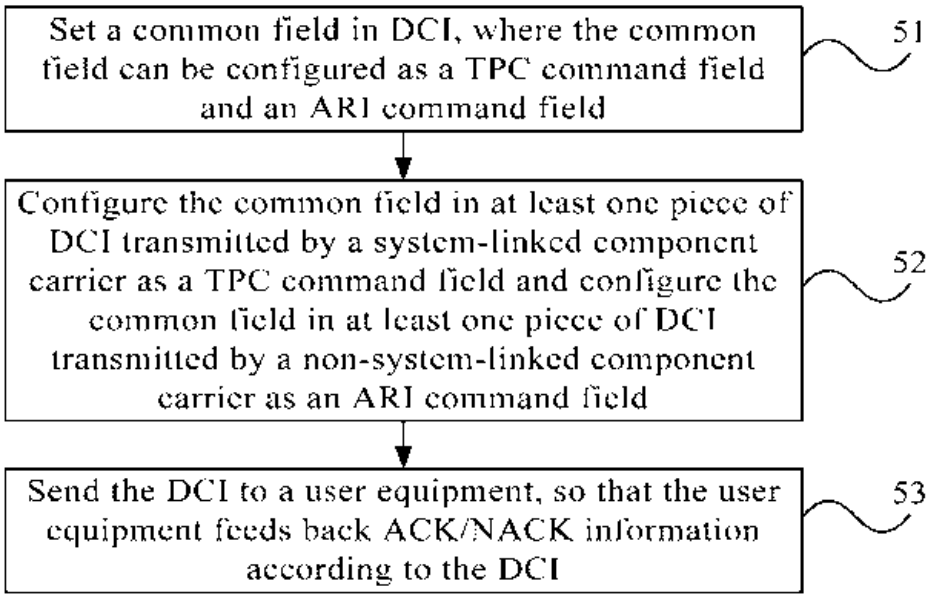

Set a common field in DCI, where the common field can be configured as a TPC command field and an ARI command field
51
Configure the common field in at least one piece of DCI transmitted by a system-linked component carrier as a TPC command field and configure the common field in at least one piece of DCI transmitted by a non-system-linked component carrier as an ARI command field
52
Send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI
53

FIG. 5

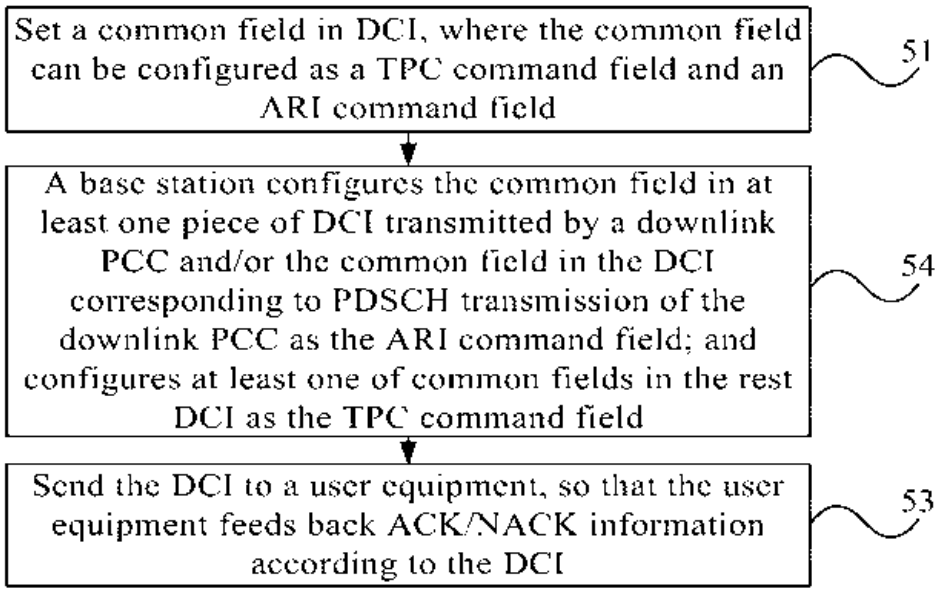

Set a common field in DCI, where the common field can be configured as a TPC command field and an ARI command field
51
A base station configures the common field in at least one piece of DCI transmitted by a downlink PCC and/or the common field in the DCI corresponding to PDSCH transmission of the downlink PCC as the ARI command field; and configures at least one of common fields in the rest DCI as the TPC command field
54
Send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI
53

FIG. 5a

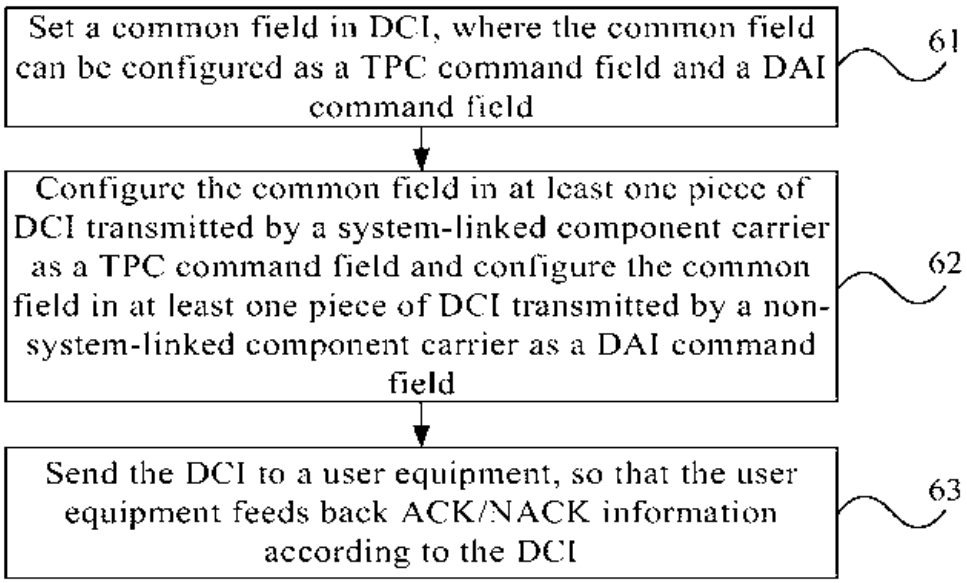

Set a common field in DCI, where the common field can be configured as a TPC command field and a DAI command field
61
Configure the common field in at least one piece of DCI transmitted by a system-linked component carrier as a TPC command field and configure the common field in at least one piece of DCI transmitted by a non-system-linked component carrier as a DAI command field
62
Send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI
63

FIG. 6

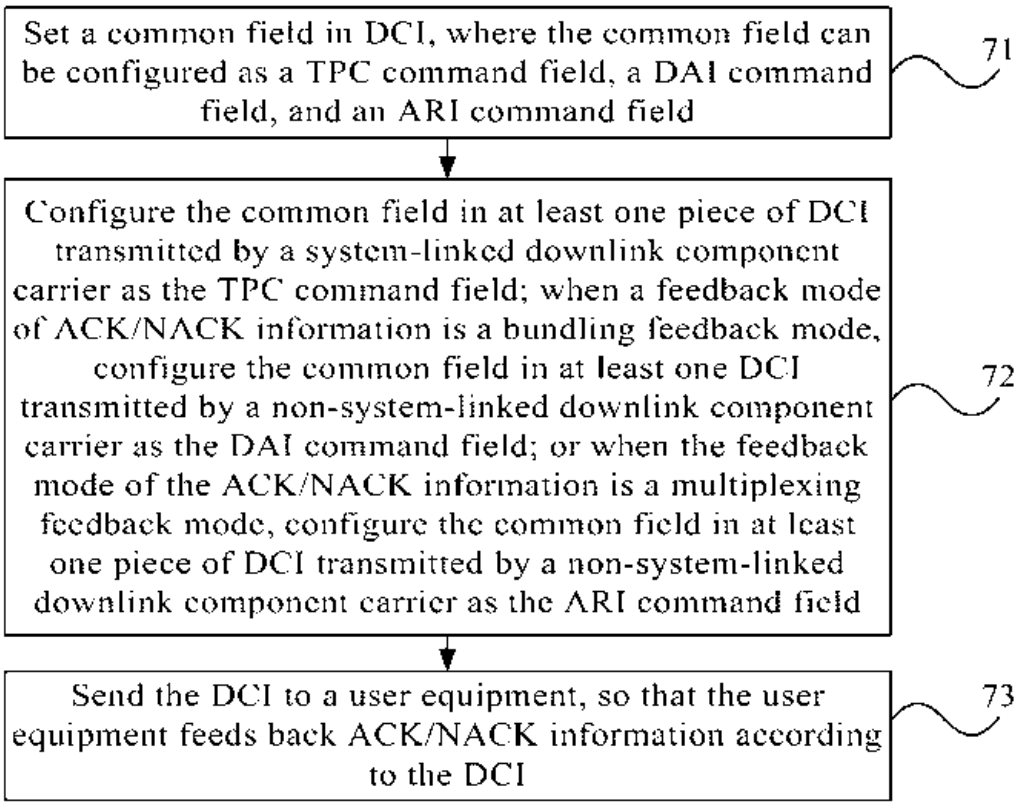

Set a common field in DCI, where the common field can be configured as a TPC command field, a DAI command field, and an ARI command field
71
Configure the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as the TPC command field; when a feedback mode of ACK/NACK information is a bundling feedback mode, configure the common field in at least one DCI transmitted by a non-system-linked downlink component carrier as the DAI command field; or when the feedback mode of the ACK/NACK information is a multiplexing feedback mode, configure the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as the ARI command field
72
Send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI
73

FIG. 7


Configuring module
Sending module
81
82

FIG. 8

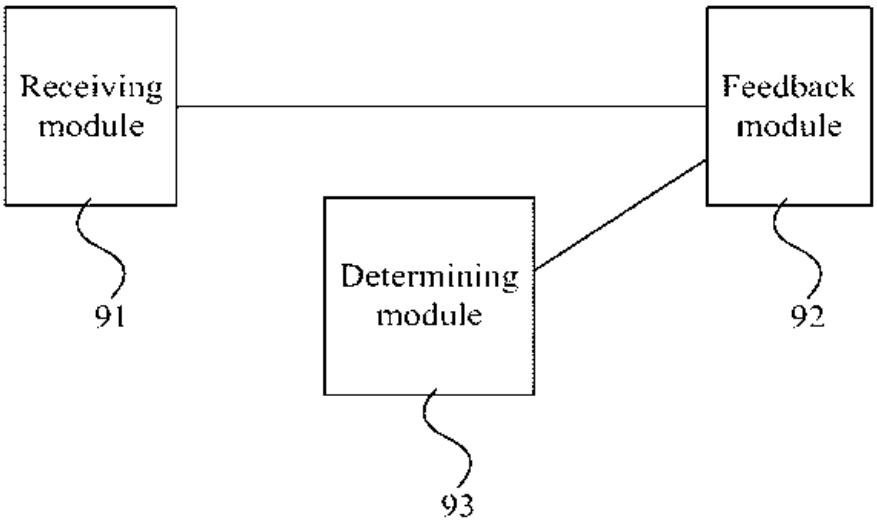

Receiving module
Feedback module
Determining module
91
92
93

FIG. 9

Doc Code: Oath
Document Description: Oath or declaration filed

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☑ Declaration Submitted With Initial Filing OR ☐ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)

Attorney Docket Number	
First Named Inventor	Xiaobo CHEN
COMPLETE IF KNOWN	
Application Number	
Filing Date	
Art Unit	
Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/NACK INFORMATION FOR CARRIER AGGREGATION

(Title of the invention)

the application of which

☑ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) _____ as United States Application Number or PCT International Application Number _____ and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

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In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified patent application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Claim of Foreign Priority Benefits

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
200910251390.9	CN	12/3/2009	☐	☐	☑
201010137731.2	CN	3/24/2010	☐	☐	☑
PCT/CN2010/079423	WO	12/3/2010	☐	☐	☑
			☐	☐	☐

☐ Additional foreign application number(s) are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle (if any)): Xiaobo	Family Name or Surname: CHEN
Inventor's Signature: Xiaobo CHEN	Date: May 26, 2012

Residence: City	State	Country	Citizenship
Beijing	Beijing	China	Chinese

Mailing Address: Huawei Administration Building Bantian, Longgang District Shenzhen, 518129, GuangdongP.R. CHINA

City	State	Zip	Country
Shenzhen	Guangdong	518129	China

☑ Additional inventors or a legal representative are being named on the 1 supplemental sheet(s) PTO/SB/02A or 02LR attached hereto

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DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle (if any))	Family Name or Surname
Chaojun	LI

Inventor's Signature	Date

Beijing Residence: City	Beijing State	China Country	Chinese Citizenship

Huawei Administration Building, Bantian, Longgang District, Shenzhen, 518129, Guangdong, P.R. China

Mailing Address

Shenzhen City	Guangdong State	518129 Zip	China Country

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle (if any))	Family Name or Surname

Inventor's Signature	Date

Shenzhen Residence: City	Guangdong State	China Country	Chinese Citizenship

Huawei Administration Building, Bantian, Longgang District, Shenzhen, 518129, Guangdong, P.R. China

Mailing Address

Shenzhen City	Guangdong State	518129 Zip	China Country

Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle (if any))	Family Name or Surname

Inventor's Signature	Date

Shanghai Residence: City	Shanghai State	China Country	Chinese Citizenship

Huawei Administration Building, Bantian, Longgang District, Shenzhen, 518129, Guangdong, P.R. China

Mailing Address

Shenzhen City	Guangdong State	518129 Zip	China Country

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Attorney Docket Number	
First Named Inventor	Xiaobo CHEN
COMPLETE IF KNOWN	
Application Number	
Filing Date	
Art Unit	
Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/NACK INFORMATION FOR CARRIER AGGREGATION

(Title of the invention)

the application of which

☑ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) _____ as United States Application Number or PCT International Application Number _____ and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Authorization To Permit Access To Application by Participating Offices

☐ If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified patent application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2

PTO/SB/01 (04-09)
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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

DECLARATION — Utility or Design Patent Application

Claim of Foreign Priority Benefits

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
200910251390.9	CN	12/3/2009	☐	☐	☑
201010137731.2	CN	3/24/2010	☐	☐	☑
PCT/CN2010/079423	WO	12/3/2010	☐	☐	☑
			☐	☐	☐

☐ Additional foreign application number(s) are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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DECLARATION — Utility or Design Patent Application

Direct all correspondence to:	☑ The address associated with Customer Number:	74365	OR ☐	Correspondence address below

Name		
Address		
City	State	Zip
Country	Telephone	Email

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. Petitioner/applicant is advised that documents which form the record of a patent application (such as the PTO/SB/01) are placed into the Privacy Act system of records DEPARTMENT OF COMMERCE. COMMERCE-PAT-7. System name: *Patent Application Files*. Documents not retained in an application file (such as the PTO-2038) are placed into the Privacy Act system of COMMERCE/PAT-TM-10, System name: *Deposit Accounts and Electronic Funds Transfer Profiles*.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle [if any])	Family Name or Surname
Xiaobo	CHEN
Inventor's Signature	Date

Residence: City	State	Country	Citizenship
Beijing	Beijing	China	Chinese

Mailing Address

Huawei Administration Building Bantian, Longgang District Shenzhen, 518129, GuangdongP.R. CHINA

City	State	Zip	Country
Shenzhen	Guangdong	518129	China

☑ Additional inventors or a legal representative are being named on the 1 supplemental sheet(s) PTO/SB/02A or 02LR attached hereto

PTO/SB/02A (07-07)
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DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet

Page ___ of ___

Name of Additional Joint Inventor, if any: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))	Family Name or Surname
Chaojun	LI

Inventor's Signature Chaojun LI Date May 26, 2012

Beijing	Beijing	China	Chinese
Residence: City	State	Country	Citizenship

Huawei Administration Building., Bantian, Longgang District, Shenzhen, 518129, Guangdong, P.R. China

Mailing Address

Shenzhen	Guangdong	518129	China
City	State	Zip	Country

Name of Additional Joint Inventor, if any: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))	Family Name or Surname

Inventor's Signature Date

Shenzhen	Guangdong	China	Chinese
Residence: City	State	Country	Citizenship

Huawei Administration Building., Bantian, Longgang District, Shenzhen, 518129, Guangdong, P.R. China

Mailing Address

Shenzhen	Guangdong	518129	China
City	State	Zip	Country

Name of Additional Joint Inventor, if any: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))	Family Name or Surname

Inventor's Signature Date

Shanghai	Shanghai	China	Chinese
Residence: City	State	Country	Citizenship

Huawei Administration Building., Bantian, Longgang District, Shenzhen, 518129, Guangdong, P.R. China

Mailing Address

Shenzhen	Guangdong	518129	China
City	State	Zip	Country

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Chen, et al.

Application No./Patent No.: TBD Filed/Issue Date: Herewith

Titled:
Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation

Huawei Technologies Co., LTD. , a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy therefore is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature — Date: 6/2/2012

Ira S. Matsil, Reg. No.: 35,272 — Attorney for Assignee
Printed or Typed Name — Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT

Attorney Docket No. _____

Client Reference No. 82713780US09

ASSIGNMENT

WHEREAS, WE,

Xiaobo CHEN
Huawei Administration Building
Bantian, Longgang District
Shenzhen, 518129, Guangdong
P.R. CHINA; and

Chaojun LI
Huawei Administration Building
Bantian, Longgang District
Shenzhen, 518129, Guangdong
P.R. CHINA;

have invented and own a certain invention entitled:
METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/NACK INFORMATION FOR CARRIER AGGREGATION
for which invention we have executed an application (provisional or non-provisional) for a U.S. patent, which was filed on_____, under U.S. Application No._____and

WHEREAS, HUAWEI TECHNOLOGIES CO., LTD., of Huawei Administration Building, Bantian, Longgang District, Shenzhen, 518129, Guangdong, P.R. China, hereinafter referred to as Assignee, is desirous of acquiring the entire domestic and foreign right, title, and interest in and under the invention described in the patent application.

NOW, THEREFORE, for good and valuable considerations, the receipt and sufficiency of which are hereby acknowledged, we assign and transfer to the Assignee and the Assignee's legal representatives, successors and assigns the full and exclusive rights in and to the invention in the U.S. and every foreign country and the entire right, title, and interest in and to the patent application and other such applications (e.g., provisional applications, non-provisional applications, continuations, continuations-in-part, divisionals, reissues, reexaminations, National phase applications, including petty patent applications, and utility model applications) that may be filed in the United States and every foreign country on the invention, and the patents, extensions, or derivations thereof, both foreign and domestic, that may issue thereon, and we do hereby authorize and request the Commissioner of Patents to issue U.S. patents to the above-mentioned Assignee agreeably with the terms of this assignment document.

WE HEREBY AUTHORIZE the Assignee to insert in this assignment document the filing date and application number of the application if the date and number are unavailable at the time this document is executed.

WE DO HEREBY COVENANT and agree with the Assignee that we will not execute any writing or do any act whatsoever conflicting with the terms of this assignment document set forth herein, and that we will at any time upon request, without further or additional consideration, but at the expense of the Assignee, execute such additional assignments and other writings and do such additional acts as the Assignee may deem necessary or desirable to perfect the Assignee's enjoyment of this assignment, and render all necessary assistance in making application for and obtaining original, continuation, continuation-in-part, divisional, reissued, reexamined, and National phase patents of the U.S. or of any and all foreign countries on the invention, and in enforcing any rights or chooses in action accruing as a result of such applications or patents, and by executing statements and other affidavits, it being understood

Samsung Exhibit 1002, Page 24

In re Appln. of Chen et al.
Attorney Docket No. _____

IN WITNESS WHEREOF, we have hereunder set our hands on the dates shown below.

Date May 26, 2012 — Xiaobo CHEN
Xiaobo CHEN

Date May 26, 2012 — Qiang WU
Witness

Date May 26, 2012 — JianQin Liu
Witness

Date May 26, 2012 — Chaojun LI
Chaojun LI

Date May 26, 2012 — Qiang WU
Witness

Date May 26, 2012 — Jianqin Liu
Witness

Samsung Exhibit 1002, Page 25

PTO/SB/80 (11-08)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 74365

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 74365

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

HUAWEI TECHNOLOGIES CO., LTD.
Huawei Administration Building, Bantian, Longgang District, Shenzhen, Guangdong 518129, P.R. China

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	[signature]	Date	4th Aug. 2009
Name	Sun Yafang	Telephone	+86 755-28356888
Title	President		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HW 82713780US09
	Application Number	
Title of Invention	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Xiaobo		Chen	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Shenzhen	Country Of Residence i	CN

Citizenship under 37 CFR 1.41(b) CN

Mailing Address of Applicant:

Address 1	Huawei Administration Building, Bantian,		
Address 2	Longgang District, Guangdong		
City	Shenzhen	State/Province	
Postal Code	518129	Country	CN

Applicant 2

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Chaojun		Li	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Shenzhen	Country Of Residence i	CN

Citizenship under 37 CFR 1.41(b) CN

Mailing Address of Applicant:

Address 1	Huawei Administration Building, Bantian,		
Address 2	Longgang District, Guangdong		
City	Shenzhen	State/Province	
Postal Code	518129	Country	CN

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HW 82713780US09
	Application Number	
Title of Invention	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation	

Customer Number	74365		
Email Address	docketing@slater-matsil.com	Add Email	Remove Email

Application Information:

Title of the Invention	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		
Attorney Docket Number	HW 82713780US09	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	6	Suggested Figure for Publication (if any)	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	74365		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	PCT/CN2010/079423	2010-12-03

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

PTO/SB/14 (11-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HW 82713780US09
	Application Number	
Title of Invention	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation	

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country[i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
200910251390.9	CN	2009-12-03	(•) Yes ( ) No

Remove

Application Number	Country[i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
201010137731.2	CN	2010-03-24	(•) Yes ( ) No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1

If the Assignee is an Organization check here. ☒

Organization Name	Huawei Technologies Co., Ltd.		
Mailing Address Information:			
Address 1	Huawei Administration Building, Bantian,		
Address 2	Longgang District, Guangdong		
City	Shenzhen	**State/Province**	
Country[i] CN		Postal Code	518129
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button.

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Ira S Matsil/			Date (YYYY-MM-DD)	2012-06-01
First Name	Ira S.	Last Name	Matsil	Registration Number	35272

PTO/SB/14 (11-08)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	HW 82713780US09
	Application Number	
Title of Invention	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Patent Application Fee Transmittal	
Application Number:	
Filing Date:	
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Filer:	Ira Stuart Matsil/Courtney Danglade
Attorney Docket Number:	HW 82713780US09

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	380	380
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	250	250
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
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First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
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1		PTO_82713780US09_Specification_PTO.pdf	199211	yes	37

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	31
Claims	32	36
Abstract	37	37

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2		PTO_82713780US09_Prelim_Amendment_PTO.pdf	36880	yes	8

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Document Description	Start	End
Preliminary Amendment	1	1
Claims	2	7
Applicant Arguments/Remarks Made in an Amendment	8	8

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3	Drawings-only black and white line drawings	PTO_82713780US09_Drawings_PTO.pdf	234970	no	6

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4	Oath or Declaration filed	PTO_82713780US09_Declaration_PTO.pdf	222732	no	8

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5		PTO_82713780US09_POA_Assignment_PTO.pdf	564324	yes	4

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Assignee showing of ownership per 37 CFR 3.73(b).		1	3	
	Power of Attorney		4	4	
Warnings:					
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6	Application Data Sheet	PTO_82713780US09_ADS_Form_PTO3.pdf	41524	no	5
Warnings:					
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7	Fee Worksheet (SB06)	fee-info.pdf	36590	no	2
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METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/NACK INFORMATION FOR CARRIER AGGREGATION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of International Application No. PCT/CN2010/079423, filed on December 3, 2010, which claims priority to Chinese Patent Application No. 200910251390.9, filed on December 3, 2009 and Chinese Patent Application No. 201010137731.2, filed on March 24, 2010, all of which are hereby incorporated by reference in their entireties.

FIELD OF THE INVENTION

[0002] The present invention relates to the filed of mobile communications technologies, and in particular to a method, a base station, and a user equipment for feeding back ACK/NACK information for carrier aggregation.

BACKGROUND OF THE INVENTION

[0003] In the hybrid automatic repeat request (Hybrid Automatic Repeat Request, HARQ) technology, a data receiver needs to feed back acknowledgement/negative-acknowledgement (Acknowledgement/Negative-acknowledgement, ACK/NACK) information to a data sender to help to determine whether data is correctly received. In an uplink direction of a 3rd Generation Partnership Project (3rd Generation Partnership Project, 3GPP) Evolved Universal Terrestrial Radio Access (Evolved Universal Terrestrial Radio Access, E-UTRA) system, a user equipment feeds back ACK/NACK information about downlink data reception to a base station through a physical uplink control channel (Physical Uplink Control Channel, PUCCH). The 3GPP E-UTRA system is also known as a Long Term Evolution (Long Term Evolution, LTE) system. In the following description, the PUCCH channel used by the user equipment to feed back ACK/NACK

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information about downlink data reception to the base station is referred to as an uplink ACK channel.

[0004] In the LTE system, the feedback of the ACK/NACK information may be controlled through downlink control information (Downlink Control Information, DCI). The DCI is used to indicate scheduling information transmitted over a PDSCH and is transmitted over a physical downlink control channel (Physical Downlink Control Channel, PDCCH) corresponding to the physical downlink shared channel (Physical Downlink Shared Channel, PDSCH) indicated by the DCI. The DCI includes a transmission power control (Transmission Power Control, TPC) command field, which is used to adjust transmission power of the uplink ACK channel to send the ACK/NACK information. The TPC command field is generally 2 bits long. Particularly, in an LTE time division duplex (Time Division Duplex, TDD) system, one user equipment may feed back ACK/NACK information corresponding to PDSCH data transmission of multiple downlink subframes in one uplink subframe. Specifically, the LTE TDD system supports two ACK/NACK information feedback modes, which are an ACK/NACK multiplexing mode (ACK/NACK Multiplexing Mode) and an ACK/NACK bundling mode (ACK/NACK Bundling Mode) respectively. In the ACK/NACK multiplexing mode, uplink ACK/NACK information corresponding to each PDSCH data transmission is fed back to the base station independently. In the ACK/NACK bundling mode, uplink ACK/NACK information corresponding to multiple times of PDSCH data transmission is fed back to the base station together after a logic AND operation. To support the ACK/NACK bundling mode, a 2-bit downlink assignment index (Downlink Assignment Index, DAI) command field is introduced in the DCI and is used to indicate the number of PDCCHs that carry the DCI.

[0005] In an LTE-Advanced (LTE-Advanced, LTE-A) system, a carrier aggregation technology is chosen to support wider bandwidth so as to meet requirements of the International Telecommunication Union (International Telecommunication Union, ITU) on a peak data rate of the 4th generation communications technology. In the carrier aggregation technology, the spectrums of two or more component carriers are aggregated together to get wider transmission bandwidth, and every component carrier has an independent HARQ process. An LTE-A user equipment may be configured with different numbers of uplink and downlink component carriers. When the LTE-A user equipment accesses multiple downlink component carriers simultaneously, ACK/NACK information corresponding to the data transmission over PDSCH of every downlink

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component carrier is fed back over the uplink ACK channel. When the ACK/NACK information corresponding to the data transmission of multiple downlink component carriers needs to be fed back over a same uplink component carrier, a problem of feeding back the ACK/NACK information corresponding to the data transmission of multiple downlink component carriers over the same uplink component carrier needs to be solved.

[0006] With reference to the LTE TDD system, in the LTE-A system, when a user equipment is configured with multiple downlink component carriers to receive data, feedback of the uplink ACK/NACK information corresponding to the data transmission of the multiple downlink component carriers may also adopt the ACK/NACK multiplexing mode or ACK/NACK bundling mode. Likewise, the DCI information may be adopted to control the feedback of ACK/NACK information. For example, a TPC command field is used to control the transmission power of an uplink component carrier and a DAI command field is used to support the ACK/NACK bundling mode.

[0007] Particularly, in a carrier aggregation LTE-A system, considering the relatively small number of users simultaneously scheduled over multiple downlink component carriers, the uplink ACK channel assignment for the user equipment may be notified by the base station through explicit signaling. One manner is that the base station directly notifies the assigned uplink ACK channel resources through high-level signaling. To increase the statistical multiplexing probability of uplink ACK channels of different user equipment, another manner is that the base station assigns a group of ACK channel resources to the user equipment through high-level signaling and adds an ACK resource indication (ACK Resource Indication, ARI) command field to the DCI information carried by the PDCCH to further indicate which one of the group of high-level assigned uplink ACK channel resources is used currently. The ARI command field does not exist in the LTE system and needs to be introduced additionally in the LTE-A system. The number of bits depends on the number of the high-level assigned uplink ACK channel resources, and generally 2 bits are considered enough.

[0008] In the carrier aggregation LTE-A system, to solve the problem of feeding back ACK/NACK information corresponding to the data transmission of multiple downlink component carriers over the same uplink component carrier, it may be necessary to introduce a DAI command field and/or an ARI command field on the basis of the DCI in the LTE system.

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Therefore, an ACK/NACK information feedback solution that is backward compatible with the LTE system needs to be provided.

SUMMARY OF THE INVENTION

[0009] Embodiments of the present invention provide a method, a base station, and a user equipment for feeding back ACK/NACK information for carrier aggregation, which realize the ACK/NACK information feedback that is backward compatible with an LTE system in carrier aggregation.

[0010] An embodiment of the present invention provides a method for feeding back ACK/NACK information for carrier aggregation, including:

configuring a common field preset in downlink control information, DCI, as at least one type of command field related to ACK/NACK feedback, where the common field can be configured as the command fields related to ACK/NACK feedback; and

sending the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0011] An embodiment of the present invention further provides a method for feeding back ACK/NACK information for carrier aggregation, including:

receiving downlink control information, DCI, which is sent by a base station and transmitted by a downlink component carrier; and

feeding back ACK/NACK information according to a command field which is related to ACK/NACK feedback and configured in a common field preset in the DCI, where the common field can be configured as at least two types of command fields related to ACK/NACK feedback.

[0012] An embodiment of the present invention provides a base station, including:

a configuring module, configured to configure a common field preset in downlink control information, DCI, as at least one type of command field related to ACK/NACK feedback, where the common field can be configured as the at least two types of command fields related to ACK/NACK feedback; and

a sending module, configured to send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0013] An embodiment of the present invention provides a user equipment, including:

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a receiving module, configured to receive downlink control information, DCI, which is sent by a base station and transmitted by a downlink component carrier; and

a feedback module, configured to feed back ACK/NACK information according to a command field which is related to ACK/NACK feedback and configured in a common field preset in the DCI, where the common field can be configured as at least two types of command fields related to ACK/NACK feedback.

[0014] It can be known from the foregoing technical solutions that, in the embodiments of the present invention, a common field that can be configured as at least two types of command fields related to ACK/NACK feedback is preset in the DCI, so the common field may be configured as different command fields so as to be different required command fields related to ACK/NACK feedback for LTE-A carrier aggregation, which realizes the ACK/NACK information feedback that is backward compatible with an LTE system in carrier aggregation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] To explain the technical solutions in the embodiments of the present invention more clearly, accompanying drawings required in the description of the embodiments are briefly introduced below. Apparently, the accompanying drawings to be described in the following are only some embodiments of the present invention. Those of ordinary skill in the art may also derive other drawings from these accompanying drawings without creative efforts.

[0016] FIG. 1 is a schematic flowchart of a method according to a first embodiment of the present invention;

[0017] FIG. 2 is a schematic composition diagram of a system-linked downlink component carrier according to an embodiment of the present invention;

[0018] FIG. 3 is a schematic diagram of adopted uplink and downlink component carriers according to an embodiment of the present invention;

[0019] FIG. 4 is a schematic flowchart of a method according to a second embodiment of the present invention;

[0020] FIG. 5 is a schematic flowchart of a method according to a third embodiment of the present invention;

[0021] FIG. 5a is a schematic flowchart of a method according to a third embodiment of the present invention;

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[0022] FIG. 6 is a schematic flowchart of a method according to a fourth embodiment of the present invention;

[0023] FIG. 7 is a schematic flowchart of a method according to a fifth embodiment of the present invention;

[0024] FIG. 8 is a schematic structural diagram of a base station according to a sixth embodiment of the present invention; and

[0025] FIG. 9 is a schematic structural diagram of a user equipment according to a seventh embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0026] To make the purpose, technical solutions and benefits in the embodiments of the present invention clearer, the technical solutions in the embodiments of the present invention are described below in detail with reference to the accompanying drawing in the embodiments of the present invention. Apparently, the described embodiments herein are only part of rather than all embodiments of the present invention. Based on the embodiments of the present invention, all other embodiments derived by those of ordinary skill in the art without creative efforts shall fall within the protection scope of the present invention.

[0027] FIG. 1 is a schematic flowchart of a method according to a first embodiment of the present invention, including:

[0028] Step 11: A base station configures a common field preset in DCI as at least one type of command field related to ACK/NACK feedback of at least two types of command fields related to ACK/NACK feedback, where the common field can be configured as the command fields related to ACK/NACK feedback.

[0029] The at least two types of command fields related to ACK/NACK feedback include at least a DAI command field and/or an ARI command field. In addition, the at least two types of command fields related to ACK/NACK feedback may further include a TPC command field or other command fields that the DCI may have, such as a carrier indication command field and a redundant version command field.

[0030] In different scenarios, the common field may be configured as different command fields. The different scenarios may be different feedback modes. For example, when the feedback mode of the ACK/NACK information is a bundling feedback mode, the common field is

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configured as the DAI command field; when the feedback mode of the ACK/NACK information is a multiplexing feedback mode, the common field is configured as the ARI command field. The different scenarios may also be different types of downlink component carriers. For example, the common field in the DCI transmitted over a system-linked downlink component carrier is configured as the TPC command field; and the common field in the DCI transmitted over a non-system-linked downlink component carrier is configured as the ARI command field and/or the DAI command field. For the specific definitions of the system-linked downlink component carrier and non system-linked downlink component carrier, reference may be made to the following description.

[0031] Specifically, at one moment, the common field in the DCI transmitted over every downlink component carrier is respectively configured as a specific command field. The common field transmitted by every downlink component carrier may be configured as a same command field; or the common field transmitted by the system-linked downlink component carrier and the common field transmitted by the non system-linked downlink component carrier may be configured as different command fields respectively.

[0032] Step 12: The base station sends the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0033] Specifically, through the foregoing flexible configuration of the common field, the DCI may have different control command fields related to ACK/NACK information feedback. Therefore, the user equipment may parse the DCI to obtain the related control command field so as to realize the feedback of ACK/NACK information for carrier aggregation.

[0034] Further, before step 11, the method may include that: the base station sets the common filed in the DCI, which realizes the flexible configuration of the common field.

[0035] In the embodiment of the present invention, a public field is set in the DCI and the public field may be configured as different command fields in different scenarios. Therefore, from the perspective of effectiveness, the common field is equivalent to the sum of command fields that the common field may be configured as, which realizes the representation of more command fields by using a smaller number of bits, and reduces bit overheads and the complexity of design and implementation. Therefore, the number of bits of the DCI information in an LTE-A system is kept consistent with that in an LTE system as much as possible, which realizes

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compatibility with the LTE system, so that most design in the LTE system is passed down to the LTE-A system.

[0036] In a carrier aggregation LTE-A system, it may be necessary to add an ARI command field; in an FDD system, an additional DAI command field may be required further. If the command fields are added independently, and in an example in which the ARI command field and the DAI command field are both 2 bits long, 4 more bits are occupied by the DCI information in the FDD system. This is not good for the compatibility with the LTE system and what's more, increases the bit overheads and the complexity of design and implementation. For example, more bits occupied by the DCI information complicate the design of blind detection. Therefore, in the embodiment of the present invention, a common field is set in the DCI. The command filed represented by the common field is not fixedly configured but may be configured as the DAI command field, or the ARI command field, or the TPC command field, or other command fields according to different scenarios. Therefore, one filed has the meanings of multiple command fields, which realized that the required multiple command fields are represented by fewer fields so that the bit overheads and the complexity of design and implementation is reduced.

[0037] In a specific embodiment, the common field may be set in a manner of adding bits in the DCI. For example, a 2-bit field is added as the common field, and, according to different scenarios, the common field may be configured as the DAI command field or ARI command field. Compared with the conventional manner where the DAI command field and the ARI command field need to be added, the manner in the embodiment of the present invention occupies fewer bits. That is, in the embodiment of the present invention, only 2 bits need to be added, while 4 bits need to be added in the conventional mode.

[0038] Although the manner of adding a new common field has advantages over the prior art, the manner of adding the new common field still adds to the bits of the DCI. For compatibility with the prior art, a more preferable manner is to make full use of the existing command fields in the DCI to set a common field without increasing the bits occupied by the DCI.

[0039] To keep compatibility with the LTE system, the command fields in the DCI of the LTE system, such as the TPC command field, modulation and coding scheme command field, new data indication command field, and redundant version command field, are passed down to the DCI of the LTE-A system. In addition, to support some LTE-A specific functions, some special

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command fields are added for the LTE-A user equipment. for example, a carrier indication command field used to support cross-carrier scheduling of PDSCH transmission by a PDCCH.

[0040] One or more of the foregoing LTE-A command fields may be used as the common field. For example. the DCI information of an LTE-A user equipment that supports cross-carrier scheduling of a PDSCH by a PDCCH includes a 3-bit carrier indication command field; when the number of aggregated carriers of the user equipment is small, the 3-bit carrier indication command field has some redundant bits or redundant states. The 3 bits may be used as a common field, and the redundant bits or redundant states may be used to transmit the carrier indication command field, and/or the ARI command field, and/or the DAI command field simultaneously. For another example, the redundant version command field is used to indicate the redundant version of the current PDSCH transmission in a physical layer HARQ process, and the 2 bits corresponding of the redundant version command field may be used as the common field. For an initial PDSCH transmission. the common field is used as the ARI command field and a preset default redundant version is used. For a PDSCH retransmission, the common field is used as the redundant version command field and the same uplink ACK channel as that for the initial transmission is assigned for the retransmission. However, no matter whether the common field is designed based on the existing carrier indication command field or redundant version command field, a great loss of scheduling flexibility is brought.

[0041] During the implementation of the present invention, the inventor finds that, in the case of one user equipment, for a PDSCH transmitted over a downlink component carrier that are configured to feed back ACK/NACK information over the same uplink component carrier, the DCI that carries scheduling information of the PDSCH has the same TPC command field at a same moment. This is because the TPC command fields are all used to control the transmission power of the uplink ACK channel on a same uplink component carrier. Because the TPC command field included in each DCI is the same, the TPC command field is redundant to the system, so the TPC command field may be fully utilized and configured as a common field. According to whether the common field is carried in the DCI of a system-linked downlink component carrier, the common field that replaces the original TPC command field may be configured as a TPC command field, a DAI command field and/or an ARI command field.

[0042] In the LTE system, the uplink ACK channel may be mapped implicitly from a PDCCH that carries the DCI. In a carrier aggregation LTE-A system, to keep compatibility with

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user equipment that only supports an early version of the LTE, uplink ACK channel resources are reserved on one uplink component carrier for implicit mapping from the PDCCH transmitted over one or more downlink component carriers. For ease of description, if an uplink ACK channel resource implicitly mapped from a PDCCH is reserved on one uplink component carrier for a certain downlink component carrier, the downlink component carrier is described as a "system-linked downlink component carrier" of the uplink component carrier. FIG. 2 is a schematic composition diagram of a system-linked downlink component carrier according to an embodiment of the present invention. As shown in FIG. 2, there are three downlink component carriers in a carrier aggregation LTE-A system, namely, downlink component carrier-1, downlink component carrier-2, and downlink component carrier-3, and two uplink component carriers, namely, uplink component carrier-1 and uplink component carrier-2. An uplink ACK channel resource implicitly mapped from a PDCCH is reserved on uplink component carrier-1 for downlink component carrier-1; uplink ACK channel resources implicitly mapped from PDCCHs are reserved on uplink component carrier-2 for downlink component carrier-2 and downlink component carrier-3. Therefore, downlink component carrier-1 is a system-linked downlink component carrier of uplink component carrier-1; and downlink component carrier-2 and downlink component carrier-3 are system-linked downlink component carriers of uplink component carrier-2. In a carrier aggregation LTE-A system, to avoid high overhead of uplink ACK channel resources reserved on an uplink component carrier through implicit mapping from PDCCHs, the number of system-linked downlink component carriers of the uplink component carrier may be small.

[0043] In the following embodiments, the case that the multiple downlink component carriers of one user equipment are configured to feed back ACK/NACK information over a same uplink component carrier is taken for example. When one user equipment is configured to feed back ACK/NACK information over multiple uplink component carriers at the same time, downlink component carriers that feed back ACK/NACK information over the same uplink component carrier are regarded as one downlink component carrier group, and different downlink component carrier groups is processed respectively according to the manner described in the embodiment of the present invention.

[0044] FIG. 3 is a schematic diagram of adopted uplink and downlink component carriers according to an embodiment of the present invention. As shown in FIG. 3, in the embodiment of

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the present invention, for a user equipment, it is assumed that the ACK/NACK information of PDSCHs transmitted over downlink component carrier-1, downlink component carrier-2, and downlink component carrier-3 are all fed back over uplink component carrier-2, where the PDSCH is used to transmit data, the PDCCH is used to transmit the scheduling information DCI of the PDSCH, and the PUCCH is the uplink ACK channel used to feed back the ACK/NACK information. In addition, among downlink component carrier-1, downlink component carrier-2, and downlink component carrier-3, only downlink component carrier-2 is a system-linked downlink component carrier of the uplink component carrier-2.

[0045] FIG. 4 is a schematic flowchart of a method according to a second embodiment of the present invention. This embodiment takes a TDD system for example. As shown in FIG. 4, the method includes:

[0046] Step 41: A base station sets a common field in DCI, where the common field can be configured as an ARI command field and a DAI command field.

[0047] For a non-system-linked downlink component carrier, an ARI command field needs to be used to indicate an assigned ACK channel resource. After the ARI command field is added in the DCI, the number of bits of the DCI definitely increases, which increases bit overheads and causes incompatibility with an LTE system. To reduce the bit overheads and accomplish better compatibility with the LTE system, in this embodiment, the common field is designed based on the existing DAI command field in the conventional DCI, so that the common field may be configured as a DAI command field or an ARI command field.

[0048] Because an LTE TDD system may support the ACK/NACK bundling feedback mode, the DCI in the TDD system includes the DAI command field. For compatibility with the LTE system, in a carrier aggregation LTE-A TDD system, the existing DAI command field may be used, and the DAI command field is set as a common field to represent not only the DAI command field but also the ARI command field. Therefore, when the DCI needs to include an ARI command field, no new field needs to be added in the DCI. Certainly, in the case of an FDD system, the common field may be set in a manner of newly adding 2 bits to represent the DAI command field or the ARI command field. Compared with the independent setting of both the DAI command field and the ARI command field where 4 bits are required, this also reduces the bit overheads.

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[0049] Step 42: When the bundling feedback mode is adopted, the base station configures at least one of common fields in the DCI transmitted by all downlink component carriers as the DAI command field; when the multiplexing feedback mode is adopted, the base station configures at least one of common fields in the DCI transmitted by all downlink component carriers as the ARI command field.

[0050] Specifically, of all downlink component carriers, only the common field in the DCI transmitted by the primary downlink component carrier is configured as the DAI command field or ARI command field; or the common field in the DCI transmitted by other one or more downlink component carriers is configured as the DAI command field or ARI command field. That is, the DCI that includes a common field configured as the DAI command field or ARI command field may be transmitted over one or more multiple downlink component carriers, where the one downlink component carrier may be a primary component carrier or a non-primary component carrier.

[0051] Specifically, one downlink component carrier may transmit one piece of DCI or transmit multiple pieces of DCI. When the downlink component carrier transmits only one piece of DCI, the common field in the DCI is configured as the DAI command field or ARI command field. When the downlink component carrier transmits multiple pieces of DCI, the common field in one or more pieces of DCI is configured as the DAI command field or ARI command field.

[0052] Specifically, one or more common fields may be configured in the DCI.

[0053] For ease of design, when the bundling feedback mode is adopted, the base station may configure the common fields in the DCI transmitted by all downlink component carriers as the DAI command fields; when the multiplexing feedback mode is adopted, the base station may configure the common fields in the DCI transmitted by all downlink component carriers as the ARI command fields.

[0054] Taking FIG. 3 for example, the common fields in the DCI corresponding to downlink component carrier-1, downlink component carrier-2, and downlink component carrier-3 are all configured as the DAI command fields in the bundling feedback mode, and are all configured as the ARI command fields in the multiplexing feedback mode. The uplink ACK/NACK information feedback mode may be specific to a cell. That is, all user equipments in a cell adopt a same uplink ACK/NACK information feedback mode. Alternatively the uplink ACK/NACK

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information feedback mode may be specific to a user equipment. That is, different user equipment may adopt different uplink ACK/NACK information feedback modes.

[0055] Alternatively, when the bundling feedback mode is adopted, for example, the base station configures the common field in at least one piece of DCI transmitted by the downlink PCC (Primary Component Carrier, primary component carrier) and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the DAI command field; when the multiplexing feedback mode is adopted, for example, the base station configures the common field in at least one piece of DCI transmitted by the downlink PCC and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the ARI command field.

[0056] For a user equipment in a carrier aggregation mode, one downlink PCC and one uplink PCC may be defined. The downlink PCC may be used for radio link failure detection and system message updating of the user equipment, and after configured, the downlink PCC cannot be deactivated. The uplink PCC may be used by the user equipment to feed back uplink control information. Taking FIG. 3 for example, downlink component carrier-2 and uplink component carrier-2 may be respectively defined as the downlink PCC and uplink PCC of the user equipment.

[0057] When the bundling feedback mode is adopted, if the DAI command field is used to indicate the total number of PDCCHs that carry DCI at the moment, the base station may configure only the common fields in part of the DCI transmitted by the downlink PCC and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the DAI command fields, and configure the common field in other DCI as a preset default value to use the common field in other DCI for other purposes. When the multiplexing feedback mode is adopted, one ACK/NACK information feedback manner is to assign a different uplink ACK channel, for example, the PUCCH format 1a/1b channel, to the PDSCH transmission of each downlink component carrier, and feed back the ACK/NACK information over the selected uplink ACK channel through a preset approach. For ease of description, this manner is referred to as a channel selection manner. Another ACK/NACK information feedback manner is to assign a common uplink ACK channel, for example, the PUCCH format 2/2a/2b channel or a new format PUCCH channel, to the PDSCH transmission of all downlink component carriers, and feed back the jointly coded ACK/NACK information over the assigned uplink ACK channel. For ease of

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description, this manner is referred to as a joint coding manner. When the joint coding manner is adopted to feed back ACK/NACK information, because a common uplink ACK channel is assigned to the PDSCH transmission of all downlink component carriers, the base station may configure only the common fields in part of the DCI transmitted by the downlink PCC and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the ARI command fields, and configure the common field in other DCI as a preset default value or use the common field in other DCI for other purposes.

[0058] Step 43: The base station sends the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0059] In this embodiment, a common field is designed based on the conventional DAI command field, where the common field may be configured as a DAI command field or an ARI command field, which realizes the representation of two pieces of information by using the existing command field that can only represent one piece of information without the need of an additional command field, and reduces the bit overheads and the complexity of design and implementation.

[0060] FIG. 5 is a schematic flowchart of a method according to a third embodiment of the present invention. This embodiment takes a TDD system or an FDD system for example. As shown in FIG. 5, the method includes:

[0061] Step 51: A base station sets a common field in DCI, where the common field can be configured as a TPC command field and an ARI command field.

[0062] Because the TPC command field is used to control power transmission, the TPC command field exists in both the TDD system and the FDD system. For compatibility with an LTE system, in a carrier aggregation LTE-A system, the existing TPC command field may be used, and the TPC command field may be set as a common field that may represent not only the TPC command field but also the ARI command field. In this way, when the DCI needs to include an ARI command field, no new field needs to be added in the DCI.

[0063] Step 52: The base station configures a common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field; and configures a common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command field.

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[0064] Specifically, for one user equipment, when ACK/NACK information corresponding to PDSCHs transmitted by N_{DL} downlink component carriers is configured to be fed back over one uplink component carrier, the system-linked downlink component carrier of the uplink component carrier may possibly transmit n PDCCHs simultaneously, where $1 \le n \le N_{DL}$ and the n PDCCHs respectively carry the DCI information for scheduling PDSCH transmission of n downlink component carriers. The case that n is greater than 1 is possibly caused by the following two factors: in the N_{DL} downlink component carriers, there are at least two system-linked downlink component carriers of the uplink component carrier; and the PDCCH performs cross-carrier scheduling on the PDSCH transmission of other carriers. There is one common field respectively in the DCI carried by the n PDCCHs.

[0065] In step 52, the base station configures the common field in at least one piece of DCI transmitted by the system-linked downlink component carrier as the TPC command field, where the at least one piece of DCI transmitted by the system-linked downlink component carrier may be the DCI corresponding to the PDSCH transmission of the downlink PCC and/or at least one piece of DCI transmitted by the downlink PCC.

[0066] In step 52, the base station configures the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the ARI command field. The configuring the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the ARI command field may Specifically be: configuring the common field in the DCI transmitted by the non-system-linked downlink component carrier as the ARI command field, for example, when the ACK/NACK information is fed back in a channel selection manner or joint coding manner; or configuring the common field in a piece of pre-designated DCI transmitted by the non-system-linked downlink component carrier as the ARI command field, where, for example, when the ACK/NACK information is fed back in the joint coding manner, the pre-designated DCI may specifically be DCI which is transmitted first or last by the non-system-linked downlink component carrier and corresponds to the PDSCH transmission of a downlink non-PCC in the activated downlink component carriers. In this step, the at least one piece of DCI transmitted by the non-system-linked downlink component carrier may be one or more pieces of DCI transmitted over one of the

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non-system-linked downlink component carriers, or one or more pieces of DCI transmitted over multiple carriers.

[0067] Taking FIG. 3 for example, the common field in the DCI corresponding to downlink component carrier-2 is configured as the TPC command field, and the common fields in the DCI corresponding to downlink component carrier-1 and downlink component carrier-3 are configured as the ARI command fields; or the common field in the DCI corresponding to downlink component carrier-2 is configured as the TPC command field, and the common field in pre-designated DCI is configured as the ARI command field, where the DCI corresponding to downlink component carrier-3 is the pre-designated DCI.

[0068] Step 53: The base station sends the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0069] In this embodiment, the base station assigns ACK channel resources for the user equipment in the following manner: An uplink ACK channel resource for implicit mapping is reserved in one uplink component carrier for each PDCCH transmitted over the system-linked downlink component carrier of the uplink component carrier. Therefore, the uplink ACK channel resource assigned to the PDSCH transmission of sending a corresponding PDCCH over the system-linked downlink component carrier may be obtained through implicit mapping from the corresponding PDCCH; the uplink ACK channel assigned to the PDSCH transmission of sending the corresponding PDCCH over the non-system-linked downlink component carrier cannot be obtained through implicit mapping from the corresponding PDCCH, but may be obtained in an explicit signaling notification manner. In this case, for the PDSCH transmission of each downlink component carrier, if the corresponding PDCCH may be sent over a non-system-linked downlink component carrier, the base station assigns a group of uplink ACK channel resources through high-level signaling. The group of uplink ACK channel resources assigned through high-level signaling may be different or the same for the PDSCH transmission of different component carriers. The common fields in the DCI carried by the PDCCHs sent over the system-linked downlink component carrier may all be configured as the TPC command fields; the common fields carried by the PDCCHs sent over the non-system-linked downlink component carrier may all be configured as the ARI command fields.

[0070] In addition, as shown in FIG. 5a, this embodiment may further include:

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[0071] Step 51: The base station sets a common field in the DCI, where the common field can be configured as a TPC command field and an ARI command field.

[0072] Step 54: The base station configures the common field in at least one piece of DCI transmitted by the downlink PCC and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the ARI command field; and configures at least one of common fields in the rest DCI as the TPC command field.

[0073] Specifically, when the joint coding manner is adopted to feed back ACK/NACK information, because a common uplink ACK channel is assigned to the PDSCH transmission of all downlink component carriers, the base station may configure only the common field in at least one piece of DCI transmitted by the downlink PCC and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the ARI command field; configure the at least one of common fields in the rest DCI as the TPC command field; and configure the common field in other DCI as a preset default value or use the common field in other DCI for other purposes.

[0074] Taking FIG. 3 for example, downlink component carrier-2 is a downlink PCC and downlink component carrier-3 is a downlink non-PCC. In this case, the common field in the DCI corresponding to downlink component carrier-2 may be configured as the ARI command field, the common field in the DCI corresponding to downlink component carrier-3 may be configured as the TPC command field, and the common field in the DCI corresponding to downlink component carrier-1 may be configured as a preset default value.

[0075] Step 53: The base station sends the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0076] That is, in this embodiment and the fourth and fifth embodiments, the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier, for example, the downlink PCC, may be configured as the DAI command field and/or the ARI command field, and the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier, for example, a downlink non-PCC, may be configured as the TPC command field. Reference and applications may be made in other cases.

[0077] In this embodiment, a common field is designed based on the conventional TPC command field, where the common field may be configured as a TPC command field or ARI command field, which realizes the representation of two pieces of information by using the

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existing command field that can only represent one piece of information without the need of an additional command field, and reduces the bit overheads and the complexity of design and implementation.

[0078] FIG. 6 is a schematic flowchart of a method according to a fourth embodiment of the present invention. This embodiment takes an FDD system for example. As shown in FIG. 6, the method includes:

[0079] Step 61: A base station sets a common field in DCI, where the common field can be configured as a TPC command field and a DAI command field.

[0080] Step 62: The base station configures the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field; and configures the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a DAI command field.

[0081] The at least one piece of DCI transmitted by the system-linked downlink component carrier may specifically be the DCI corresponding to the PDSCH transmission of a downlink PCC and/or at least one piece of DCI transmitted by the downlink PCC. The configuring the common field in the at least one piece of DCI transmitted by a non-system-linked downlink component carrier as the DAI command field may specifically be, for example, configuring the common fields in the DCI transmitted by the non-system-linked downlink component carrier as the DAI command field; or configuring the common field in one piece of pre-designated DCI transmitted by the non-system-linked downlink component carrier as the DAI command field. The one piece of pre-designated DCI may specifically be, for example, DCI which is transmitted first or last by the non-system-linked downlink component carrier and corresponds to the PDSCH transmission of a downlink non-PCC among activated downlink component carriers.

[0082] Specifically, for one user equipment, when ACK/NACK information corresponding to the PDSCHs transmitted by N_{DL} downlink component carriers is configured to be fed back over one uplink component carrier, the system-linked downlink component carrier of the uplink component carrier may possibly transmit n PDCCHs simultaneously, where $1 \le n \le N_{DL}$ and the n PDCCHs respectively carry the DCI for scheduling PDSCH transmission of n downlink component carriers. The case that n is greater than 1 is possibly caused by the following two factors: in the N_{DL} downlink component carriers, there are at least two system-linked downlink

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component carriers of the uplink component carrier; and the PDCCH performs cross-carrier scheduling on the PDSCH transmission of other carriers. There is one common field respectively in the DCI carried by the n PDCCHs.

[0083] Taking FIG. 3 for example, the common field in the DCI corresponding to downlink component carrier-2 is configured as the TPC command field, and the common fields in the DCI corresponding to downlink component carrier-1 and downlink component carrier-3 are configured as the DAI command fields.

[0084] Step 63: The base station sends the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0085] In this embodiment, the base station assigns ACK channel resources to the user equipment in the following manner: An uplink ACK channel resource for implicit mapping is reserved in one uplink component carrier for each PDCCH transmitted over the system-linked downlink component carrier of the uplink component carrier. Therefore, for the PDSCH transmission of sending a corresponding PDCCH over the system-linked downlink component carrier, the assigned uplink ACK channel resource may be obtained through implicit mapping from the corresponding PDCCH. The common fields carried by n PDCCHs transmitted over the system-linked downlink component carrier may all be parsed as the TPC command fields; or only one PDCCH may be selected, for example, the first PDCCH or a pre-designated PDCCH transmitted by a system-linked downlink component carrier, and the common field carried by the selected PDCCH can be configured as the TPC command field while the common fields carried by the rest $n-1$ PDCCHs are all configured as the DAI command field.

[0086] As described above, the DAI command field is used to indicate the number of PDCCHs that carry DCI and is mainly used when the uplink ACK/NACK information is in the bundling feedback mode. In the bundling feedback mode, the uplink ACK/NACK information corresponding to multiple PDSCH transmissions is fed back together through logic AND operation, which requires only one uplink ACK channel. Therefore, for PDSCH transmission of send a corresponding PDCCH over the non-system-linked downlink component carrier, the uplink ACK channel resource may not be assigned; in this case, only the DAI command field is required to be used to indicate the total number of PDCCHs that are used to carry DCI at the current moment. Taking the configuration shown in FIG. 3 for example, suppose that the corresponding PDCCH that schedules the PDSCH transmission of each downlink component

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carrier is sent over the downlink component carrier itself, and then an uplink ACK channel is assigned to the user equipment through implicit mapping from the PDCCH sent over downlink component carrier-2 and no uplink ACK channel is assigned for the PDSCH transmission over downlink component carrier-1 and downlink component carrier-3. If the user equipment receives the PDCCH sent over downlink component carrier-2 successfully, and meanwhile, receives the PDCCHs sent over downlink component carrier-1 and downlink component carrier-3 incorrectly, because the common field in the PDCCHs received by the user equipment is not the DAI command field, the user equipment cannot detect loss of PDCCHs, which causes an incorrect uplink ACK/NACK information feedback. The channel condition of a user equipment configured in the ACK/NACK bundling feedback mode is usually poor. Therefore, the number of control channel unit resources occupied by a PDCCH may be always constrained to be more than one. This may be guaranteed by keeping sending more than one PDCCH is over a system-linked downlink component carrier or the PDCCH sent by a system-linked downlink component carrier occupies resources of more than one control channel unit. In the process of implicit mapping of uplink ACK channels from PDCCHs, one uplink ACK channel can be mapped from each control channel unit. When a PDCCH occupies more than one control channel unit resource, the number of uplink ACK channels that can be mapped implicitly from the PDCCH sent over a system-linked downlink component carrier is also more than one. In this case, two uplink ACK channels may be selected, for example, the two uplink ACK channels mapped from the first two control channel units occupied by the PDCCH, where the two selected uplink ACK channels are marked as $ACK0$ and $ACK1$. To avoid the possible incorrect uplink ACK/NACK information feedback caused by not receiving a PDCCH that includes a common field which can be configured as a DAI command field. $ACK0$ may be selected to feed back uplink ACK/NACK information when none of the common fields in the successfully received PDCCHs can be configured as the DAI command field, and $ACK1$ may be selected to feed back uplink ACK/NACK information when a common field in the successfully received PDCCHs is configured as the DAI command field.

[0087] However, for a user equipment configured in the bundling mode, it may possibly cause unnecessary waste of PDCCH resources that the number of the control channel units occupied by a PDCCH is always constrained to be more than one. For PDSCH transmission of sending a corresponding PDCCH over the non-system-linked downlink component carrier, an

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uplink channel resource may be assigned in an explicit signaling notification manner. In this case, one uplink ACK channel resource may be assigned to one user equipment directly through high-level signaling; or one group of uplink ACK channel resources are assigned through high-level signaling, and one default uplink ACK channel resource, for example, the first uplink ACK channel resource, is selected when the user equipment is in the bundling feedback mode. When one group of uplink ACK channel resources are assigned through high-level signaling, a manner in which one group of uplink ACK channel resources is assigned through high-level signaling in the multiplexing feedback mode may be adopted so as to keep a simple system design. In addition, when one default uplink ACK channel resource is selected from a group of assigned uplink ACK channel resources, different user equipment may select different default uplink ACK channels. For example, UE-1 selects by default the first uplink ACK channel resource assigned through high-level signaling when in the bundling feedback mode and UE-2 selects by default the last uplink ACK channel resource assigned through high-level signaling when in the bundling feedback mode. Mark an uplink ACK channel assigned implicitly as ACK_{imp} and an uplink ACK channel assigned explicitly as ACK_{esp}. To avoid the possible incorrect uplink ACK/NACK information feedback caused by not receiving a PDCCH that includes a common field which can be configured as a DAI command field, ACK_{imp} may be selected to feed back uplink ACK/NACK information when none of the common fields in the successfully received PDCCHs can be configured as the DAI command field, and ACK_{esp} may be selected to feed back uplink ACK/NACK information when a common field in the successfully received PDCCHs is configured as the DAI command field.

[0088] In this embodiment, a common field may be configured as a TPC command field and a DAI command field, and the UE may determine the assigned first ACK/NACK channel; after correctly receiving the first DCI, the UE feeds back the ACK/NACK information through the determined first ACK/NACK channel, where the first DCI is DCI with a common field configured as a DAI command field, and the first ACK/NACK channel is dedicated to feed back the ACK/NACK information when the first DCI is correctly received. The first ACK/NACK channel may be determined through an implicit rule or notified through high-level signaling. When the first ACK/NACK channel is determined according to a high-level signaling notification, a group of ACK/NACK channels may be notified through the high-level signaling and the user

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equipment selects one or more ACK/NACK channels from the group of ACK/NACK channels; or the user equipment uses all ACK/NACK channels notified through high-level signaling.

[0089] In this embodiment, a common field may be configured as a TPC command field and a DAI command field, and the UE may determine the assigned second ACK/NACK channel; and when the first DCI is not correctly received, the UE feeds back the ACK/NACK information through the determined second ACK/NACK channel, where the second ACK/NACK channel is dedicated to feed back the ACK/NACK information when the first DCI is not correctly received. The second ACK/NACK channel may be determined through an implicit rule or notified through high-level signaling. When the second ACK/NACK channel is determined according to a high-level signaling notification, a group of ACK/NACK channels may be notified through the high-level signaling and the user equipment selects one or more ACK/NACK channels from the group; or the user equipment uses all ACK/NACK channels notified through the high-level signaling.

[0090] In this embodiment, a common field is designed based on the conventional TPC command field, where the common field may be configured as a TPC command field or DAI command field, which realizes the representation of two pieces of information by using the existing command field that can only represent one piece of information without the need of an additional command field, and reduces the bit overheads and the complexity of design and implementation.

[0091] FIG. 7 is a schematic flowchart of a method according to a fifth embodiment of the present invention. This embodiment takes an FDD system for example. As shown in FIG. 7, the method includes:

[0092] Step 71: A base station sets a common field in DCI, where the common field can be configured as a TPC command field, a DAI command field, and an ARI command field.

[0093] Step 72: The base station configures the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as the TPC command field; when the feedback mode of ACK/NACK information is a bundling feedback mode, the base station configures the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as the DAI command field; or when the feedback mode of the ACK/NACK information is a multiplexing feedback mode, the base station configures the

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common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the ARI command field

[0094] The at least one piece of DCI transmitted by the system-linked downlink component carrier may specifically be the DCI corresponding to PDSCH transmission of a downlink PCC and/or at least one piece of DCI transmitted by the downlink PCC. When the feedback mode of the ACK/NACK information is the bundling feedback mode, the configuring the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the DAI command field may be, for example, configuring the common fields in the DCI transmitted by the non-system-linked downlink component carrier as the DAI command fields; or configuring the common field in a pre-designated DCI transmitted by the non-system-linked downlink component carrier as the DAI command field. When the feedback mode of the ACK/NACK information is the multiplexing feedback mode, the configuring the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the ARI command field may be, for example, configuring the common fields in the DCI transmitted by the non-system-linked downlink component carrier as the ARI command field; or configuring the common field in one piece of pre-designated DCI transmitted by the non-system-linked downlink component carrier as the ARI command field. The one piece of pre-designated DCI may specifically be DCI which is transmitted first or last by the non-system-linked downlink component carrier and corresponds to the PDSCH transmission of a downlink non-PCC among activated downlink component carriers.

[0095] Specifically, for one user equipment, when the ACK/NACK information corresponding to the PDSCHs transmitted by N_{DL} downlink component carriers is configured to be fed back over one uplink component carrier, the system-linked downlink component carrier of the uplink component carrier may possibly transmit n PDCCHs simultaneously, where $1 \le n \le N_{DL}$ and the n PDCCHs respectively carry the DCI information for scheduling PDSCH transmission of n downlink component carriers. The case that n is greater than 1 is possibly caused by the following two factors: in the N_{DL} downlink component carriers, there are at least two system-linked downlink component carriers of the uplink component carrier; and the PDCCH performs cross-carrier scheduling on the PDSCH transmission of other carriers. There is one common field respectively in the DCI information carried by the n PDCCHs.

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[0096] Taking FIG. 3 for example, the common field corresponding to downlink component carrier-2 is configured as the TPC command field; in the bundling feedback mode, the common fields corresponding to downlink component carrier-1 and downlink component carrier-3 are both configured as the DAI command fields; and in the multiplexing feedback mode, the common fields corresponding to downlink component carrier-1 and downlink component carrier-3 are both configured as the ARI command fields.

[0097] Step 73: The base station sends the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0098] In this embodiment, the base station may assign ACK channel resources to the user equipment in the following manner: when the feedback mode of the ACK/NACK information is the multiplexing feedback mode, reference may be made to the embodiment shown in FIG. 5 for assignment; when the feedback mode of the ACK/NACK information is the bundling feedback mode, reference may be made to the embodiment shown in FIG. 6 for assignment.

[0099] In this embodiment, the common field may be configured as the TPC command field, the DAI command field, and the ARI command field. When the feedback mode of the ACK/NACK is the bundling feedback mode, the UE may determine an assigned first ACK/NACK channel; and when receiving the first DCI correctly, the user equipment feeds back the ACK/NACK information through the determined first ACK/NACK channel, where the first DCI is DCI with a common field configured as the DAI command field, and the first ACK/NACK channel is dedicated to feed back the ACK/NACK information when the first DCI is correctly received. The first ACK/NACK channel may be determined through an implicit rule or notified through high-level signaling. When the first ACK/NACK channel is determined according to a high-level signaling notification, a group of ACK/NACK channels may be notified through the high-level signaling, and the user equipment selects one or more ACK/NACK channels from the group; or the user equipment uses all ACK/NACK channels notified through the high-level signaling.

[0100] In this embodiment, the common field may be configured as the TPC command field, the DAI command field, and the ARI command field. When the feedback mode of the ACK/NACK information is the bundling feedback mode, the UE may determine an assigned second ACK/NACK channel; and if the first DCI is not correctly received, the UE feeds back the ACK/NACK information through the determined second ACK/NACK channel, where the second

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ACK/NACK channel is dedicated to feed back the ACK/NACK information when the first DCI is not correctly received. The second ACK/NACK channel may be determined through an implicit rule or notified through high-level signaling. When the second ACK/NACK channel is determined according to a high-level signaling notification, a group of ACK/NACK channels may be notified through the high-level signaling, and the user equipment selects one or more ACK/NACK channels from the group; or the user equipment uses all ACK/NACK channels notified through the high-level signaling.

[0101] In this embodiment, a common field is designed based on the existing TPC command field, where the common field may be configured as a TPC command field, a DAI command field, or an ARI command field, which realizes the representation of three pieces of information by using the existing command field that can only represent one piece of information without the need of additional command fields, and reduces the bit overhead and the complexity of design and implementation.

[0102] Note that in the first to the fifth embodiments of the present invention, for the data transmission of the downlink component carrier, the corresponding ACK/NACK information feedback is controlled according to the common field in the DCI. For the data transmission scheduled semi-statically on the downlink component carrier, the initial transmission is not controlled through the DCI, and the feedback of ACK/NACK information may reutilize the LTE system mechanism, which is beyond the discussion scope of the present invention. In an LTE-A system, some multi-antenna technologies, for example, transmit diversity or space division multiplexing, may be introduced for the feedback of uplink ACK/NACK information; in this case, the data transmission of one downlink component carrier may require the assignment of two or more uplink ACK channels. In an example in which the data transmission of one downlink component carrier requires assignment of two uplink ACK channels, the second ACK channel may be obtained by adding a fixed offset to the assigned first ACK channel; or in the case that the uplink ACK channel is assigned through implicit mapping from the PDCCH, each PDCCH occupies at least two control channel unit resources, and in the case that the uplink ACK channels is assigned through an explicit signaling notification, a group of uplink ACK channel resource pairs may be configured directly through high-level signaling, and the ARI command field in the DCI indicates the currently assigned uplink ACK channel resource pair. This is not the focus of the present invention, and is not further described here.

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[0103] FIG. 8 is a schematic structural diagram of a base station according to a sixth embodiment of the present invention, where the base station includes a configuring module 81 and a sending module 82. The configuring module 81 is configured to configure a common field preset in DCI as at least one type of command field related to ACK/NACK feedback of at least two types of command fields related to ACK/NACK feedback, where the common field can be configured as the command fields related to ACK/NACK feedback. The sending module 82 is configured to send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

[0104] Further, the base station in this embodiment may include a setting module, where the setting module is configured to set the common field in the DCI.

[0105] The common field may be configured as a DAI command field and an ARI command field. In this case, the configuring module 81 includes a first unit or a second unit. The first unit is configured to configure at least one common field as the DAI command field when the feedback mode of the ACK/NACK information is a bundling feedback mode, for example, to configure all common fields as the DAI command fields or configure the common field in at least one piece of DCI transmitted by a downlink PCC and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the DAI command field. The second unit is configured to configure at least one common field as the ARI command field when the feedback mode of the ACK/NACK information is a multiplexing feedback mode, for example, to configure all common fields as the ARI command fields or configure the common field in at least one piece of DCI transmitted by the downlink PCC and/or the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC as the ARI command field.

[0106] Alternatively, the common field may be configured as a TPC command field and an ARI command field. In this case, the configuring module 81 includes a third unit and a fourth unit. The third unit is configured to configure the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as the TPC command field, for example, specifically configured to configure the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC and/or the common field in at least one piece of DCI transmitted by the downlink PCC as the TPC command field. The fourth unit is configured to configure the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as the ARI command field, for example, specifically configured to

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configure all common fields in the DCI transmitted by the non-system-linked downlink component carrier as the ARI command fields, or configure the common field in one piece of pre-designated DCI transmitted by the non-system-linked downlink component carrier as the ARI command field.

[0107] Alternatively, the third unit is configured to configure the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the TPC command field; and the fourth unit is configured to configure the common field in at least one piece of DCI transmitted by the system-linked downlink component carrier as the ARI command field.

[0108] Alternatively, the common field may be configured as a TPC command field and a DAI command field. In this case, the configuring module 81 includes a fifth unit and a sixth unit. The fifth unit is configured to configure the common field in at least one piece of DCI transmitted by the system-linked downlink component carrier as the TPC command field, for example, specifically configured to configure the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC and/or the common field in at least one piece of DCI transmitted by the downlink PCC as the TPC command field. The sixth unit is configured to configure the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the DAI command field, for example, specifically configured to configure all common fields in the DCI transmitted by the non-system-linked downlink component carrier as the DAI command fields, or configure the common field in one piece of pre-designated DCI transmitted by the non-system-linked downlink component carrier as the DAI command field.

[0109] Alternatively, the fifth unit is configured to configure the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the TPC command field; and the sixth unit is configured to configure the common field in at least one piece of DCI transmitted by the system-linked downlink component carrier as the DAI command field.

[0110] Alternatively, the common field may be configured as a TPC command field, and a DAI command field, and an ARI command field. In this case, the configuring module 81 includes a seventh unit and an eighth unit. The seventh unit is configured to configure the common field in at least one piece of DCI transmitted by the system-linked downlink component carrier as the

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TPC command field, for example, specifically configured to configure the common field in the DCI corresponding to the PDSCH transmission of the downlink PCC and/or the common field in at least one piece of DCI transmitted by the downlink PCC as the TPC command field. The eighth unit is configured to configure the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the DAI command field when the feedback mode of the ACK/NACK information is the bundling feedback mode, for example, specifically configured to configure all common fields in the DCI transmitted by the non-system-linked downlink component carrier as the DAI command fields or configure the common field in one piece of pre-designated DCI transmitted by the non-system-linked downlink component carrier as the DAI command field; or the eighth unit is configured to configure the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the ARI command field when the feedback mode of the ACK/NACK information is the multiplexing feedback mode, for example, specifically configured to configure all common fields in the DCI transmitted by the non-system-linked downlink component carrier as the ARI command fields or configure the common field in one piece of pre-designated DCI transmitted by the non-system-linked downlink component carrier as the ARI command field.

[0111] Alternatively the seventh unit is configured to configure the common field in at least one piece of DCI transmitted by the non-system-linked downlink component carrier as the TPC command field; and the eighth unit is configured to configure the common field in at least one piece of DCI transmitted by the system-linked downlink component carrier as the DAI command field when the feedback mode of the ACK/NACK information is the bundling feedback mode, or configured to configure the common field in at least one piece of DCI transmitted by the system-linked downlink component carrier as the ARI command field when the feedback mode of the ACK/NACK information is the multiplexing feedback mode.

[0112] For the specific functions performed by the foregoing modules, reference may be made to the method embodiments, which are not repeatedly described here. The base station provided in this embodiment may, for example, execute the methods provided in the foregoing method embodiments.

[0113] In this embodiment, a common field is set in the DCI and the common field may be configured as different command fields in different scenarios. Therefore, from the perspective of effectiveness, the common field is equivalent to the sum of command fields that the common

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field may be configured as, which realizes the representation of more command fields by using a smaller number of bits, and reduces the bit overheads and the complexity of design and implementation. Therefore, the number of bits of the DCI information in the LTE-A system is kept consistent with that in the LTE system as much as possible to achieve compatibility with the LTE system, so that most design in the LTE system is passed down to the LTE-A system.

[0114] FIG. 9 is a schematic structural diagram of a user equipment according to a seventh embodiment of the present invention, where the user equipment includes a receiving module 91 and a feedback module 92. The receiving module 91 is configured to receive DCI which is sent by a base station and transmitted by a downlink component carrier. The feedback module 92 is configured to feed back ACK/NACK information according to a command field which is related to ACK/NACK feedback and configured in a common field preset in the DCI, where the common field can be configured as at least two types of command fields related to ACK/NACK feedback.

[0115] The at least two types of command fields related to ACK/NACK feedback, where the common field can be configured as the command fields related to ACK/NACK feedback, may be a DAI command field and an ARI command field; or a TPC command field and an ARI command field; or a TPC command field and a DAI command field; or a TPC command field, a DAI command field, and an ARI command field.

[0116] In this embodiment, the common field may be configured as the TPC command field and the DAI command field, or be configured as the TPC command field, DAI command field, and ARI command field, and when the feedback mode of the ACK/NACK information is the bundling feedback mode, the user equipment may further include a determining module 93. The determining module 93 is configured to determine an assigned first ACK/NACK channel; and the feedback module 92 is specifically configured to feed back ACK/NACK information through the first ACK/NACK channel determined by the determining module 93, when a first DCI is correctly received. In this embodiment, the first DCI is DCI with a common field configured as the DAI command field; and the first ACK/NACK channel is dedicated to feed back the ACK/NACK information when the first DCI is correctly received.

[0117] In this embodiment, the determining module 93 may further be configured to determine a second ACK/NACK channel. The feedback module 92 is specifically configured to feed back ACK/NACK information through the second ACK/NACK channel determined by the determining module 93, when the first DCI is not correctly received. In this embodiment, the

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second ACK/NACK channel is dedicated to feed back the ACK/NACK information when the first DCI is not correctly received.

[0118] For the specific functions executed by the foregoing modules, reference may be made to the method embodiments, which are not repeatedly described here. The user equipment provided in this embodiment may, for example, execute the methods provided in the foregoing method embodiments.

[0119] In this embodiment, a common field is set in the DCI and the common field may be configured as different command field in different scenarios. Therefore, from the perspective of effectiveness, the common field is equivalent to the sum of command fields that the common field may be configured as, which realizes the representation of more command fields with a smaller number of bits, and reduces the bit overhead and the complexity of design and implementation. Therefore, the number of bits of the DCI information in the LTE-A system is kept consistent with that in the LTE system as much as possible to achieve compatibility with the LTE system, so that most design in the LTE system is passed down to the LTE-A system.

[0120] Those of ordinary skill in the art may understand that all or part of the steps in the foregoing method embodiments may be implemented through a program instructing relevant hardware. The program may be stored in a computer readable storage medium and when the program is run, the steps in the foregoing method embodiments are performed. The foregoing storage medium includes any medium that may store program codes, such as an ROM, an RAM, a magnetic disc, or a compact disc.

[0121] It may be understandable that the illustrations in the accompanying drawings or the description in the embodiments are schematic only and represent logic structures, where modules displayed or described as separate parts may be or may not be physically separated, parts displayed or described as modules may be or may not be physical units, which means that they may be located in one place or distributed in several network entities.

[0122] Finally, it should be noted that, the foregoing embodiments are merely used to describe instead of to limit the technical solutions of the present invention; although the present invention has been described in detail with reference to the foregoing embodiments, those of ordinary skill in the art should understand that; they may still make modifications to the technical solutions described in the foregoing embodiments or make equivalent replacements to part of the technical characteristics of the technical solutions; however, all these modifications and

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replacements do not make the corresponding technical solutions depart from the spirit and scope of the technical solutions in the embodiments of the present invention.

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what is calimed:

CLAIMS

1. A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, comprising:

configuring a common field preset in Downlink Control Information (DCI) as at least one type of command field related to ACK/NACK feedback, wherein the common field can be configured as the at least two types of command fields related to ACK/NACK feedback; and

sending the DCI to a user equipment, so that the user equipment feeds back the ACK/NACK information according to the DCI.

2. The method according to claim 1, wherein the configuring a common field preset in the DCI as at least one type of command field related to ACK/NACK feedback comprises: configuring common field preset in the DCI as at least one type of command field related to ACK/NACK feedback according to a acknowledgement information feedback mode and/or a downlink component carrier type.

3. The method according to claim 1, wherein the at least two types of command fields related to ACK/NACK feedback are:

a downlink assignment index (DAI) command field and an ACK resource indication (ARI) command field;

a transmission power control (TPC) command field and an ARI command field;

a TPC command field and a DAI command field; or

a TPC command field, a DAI command field, and an ARI command field.

4. The method according to claim 1, wherein the configuring a common field preset in DCI as at least one type of command field related to ACK/NACK feedback comprises: configuring the common field in at least one piece of DCI transmitted by a downlink primary component carrier as a TPC command field.

5. The method according to claim 4, wherein

the at least one piece of DCI transmitted by the downlink primary component carrier is DCI corresponding to physical downlink shared channel, PDSCH, transmission of the downlink primary component carrier.

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6. The method according to claim 4, wherein

the configuring a common field preset in DCI as at least one type of command field related to ACK/NACK feedback further comprises:

configuring the common field in at least one piece of DCI transmitted by a downlink non-primary component carrier as an ARI command field and/or a DAI command field.

7. The method according to claim 1, wherein the common field can be configured as a transmission power control, TPC, command field and an ARI command field; and

the configuring a common field preset in DCI as at least one type of command field related to ACK/NACK feedback further comprises:

configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command field; or

configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as an ARI command field.

8. The method according to claim 1, wherein the common field can be configured as a TPC command field and a DAI command field; and

the configuring a common field preset in DCI as at least one type of command field related to ACK/NACK feedback further comprises: configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a DAI command field; or

configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a DAI command field.

9. The method according to claim 7, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises:

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DCI corresponding to physical downlink shared channel, PDSCH, transmission of a downlink primary component carrier; and/or

at least one piece of DCI transmitted by the downlink PCC.

10. A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, comprising:

receiving downlink control information (DCI) which is sent by a base station and transmitted by a downlink component carrier; and

feeding back ACK/NACK information according to a command field which is related to ACK/NACK feedback and configured in a common field preset in the DCI, wherein the common field can be configured as at least two types of command fields related to ACK/NACK feedback.

11. The method according to claim 10, wherein the at least two types of command fields related to ACK/NACK feedback are:

a downlink assignment index (DAI) command field and an ACK resource indication (ARI) command field;

a transmission power control (TPC) command field and an ARI command field;

a TPC command field and a DAI command field; or

a TPC command field, a DAI command field, and an ARI command field.

12. The method according to claim 11, wherein the common field can be configured as a transmission power control (TPC) command field and an ARI command field; and

if the received DCI is at least one piece of DCI transmitted by a system-linked downlink component carrier, the command field in the DCI is the TPC command field, and if the received DCI is at least one piece of DCI transmitted by a non-system-linked downlink component carrier, the command field in the DCI is the ARI command field; or

if the received DCI is at least one piece of DCI transmitted by a non-system-linked downlink component carrier, the command field in the DCI is the TPC command field, and if the received DCI is at least one piece of DCI transmitted by a system-linked downlink component carrier, the command field in the DCI is the ARI command field.

13. A base station, comprising:

a configuring module, configured to configure a common field preset in a downlink control information (DCI) as at least one type of command field related to Acknowledgement/Negative-acknowledgement, ACK/NACK, feedback, wherein the common

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field can be configured as the at least two types of command fields related to ACK/NACK feedback; and

a sending module, configured to send the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI.

14. The base station according to claim 13, wherein the common field can be configured as a transmission power control, TPC, command field and an ACK resource indication, ARI, command field;

the configuring module comprises a third unit and a fourth unit;

the third unit is configured to configure the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as the TPC command field; and

the fourth unit is configured to configure the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as the ARI command field.

15. A user equipment, comprising:

a receiving module, configured to receive downlink control information, DCI, which is sent by a base station and transmitted by a downlink component carrier; and

a feedback module, configured to feed back ACK/NACK information according to a command field which is related to ACK/NACK feedback and configured in a common field preset in the DCI, wherein the common field can be configured as at least one type of command field related to ACK/NACK feedback of at least two types of command fields related to ACK/NACK feedback.

16. The user equipment according to claim 15, wherein the receiving module is configured to receive at least one piece of DCI transmitted by a system-linked downlink component carrier, wherein the common filed in the at least one piece of DCI transmitted by a system-linked downlink component carrier is configured as a TPC command field; and is configured to receive at least one piece of DCI transmitted by a non-system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a non-system-linked downlink component carrier is configured as an ARI command field; or,

the receiving module is configured to receive at least one piece of DCI transmitted by a non-system-linked downlink component, wherein the common filed in the at least one piece of

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DCI transmitted by a non-system-linked downlink component is configured as a TPC command field; and is configured to receive at least one piece of DCI transmitted by a system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a system-linked downlink component carrier is configured as an ARI command field.

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ABSTRACT

The present invention provides a method, a base station, and a user equipment for feeding back ACK/NACK information for carrier aggregation. The method includes: configuring a common field preset in DCI as at least one type of command field related to ACK/NACK feedback of at least two types of command fields related to ACK/NACK feedback, where the common field can be configured as the command fields related to ACK/NACK feedback; and sending the DCI to a user equipment, so that the user equipment feeds back ACK/NACK information according to the DCI. The present invention may realize backward compatibility of the ACK/NACK information feedback with an LTE system in carrier aggregation.

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PATENT APPLICATION FEE DETERMINATION RECORD

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Application or Docket Number	Filing Date	To be Mailed
13/487,172	06/02/2012	☐

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	x $		OR	x $	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	x $ =			x $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	06/02/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x $		OR	x $60	0
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	- 0	x $ =		OR	x $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x $ =		OR	x $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x $ =		OR	x $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

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Legal Instrument Examiner:
/ANTJUAN RIVERA/

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74365
Slater & Matsil, L.L.P.
Ira Matsil
17950 Preston Road, Suite 1000
Dallas, TX 75252

FILING RECEIPT

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Applicant(s)

Xiaobo Chen, Shenzhen, CHINA;
Chaojun Li, Shenzhen, CHINA;

Assignment For Published Patent Application

Huawei Technologies Co., Ltd., Shenzhen, CHINA

Power of Attorney: The patent practitioners associated with Customer Number 74365

Domestic Priority data as claimed by applicant

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Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
CHINA 200910251390.9 12/03/2009
CHINA 201010137731.2 03/24/2010

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If Required, Foreign Filing License Granted: 06/12/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/487,172**

Projected Publication Date: 09/20/2012

Non-Publication Request: No

Early Publication Request: No
Title

Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation

Preliminary Class

370

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/487,172

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20=	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 250 =	250
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1500

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09

CONFIRMATION NO. 5823

74365
Slater & Matsil, L.L.P.
Ira Matsil
17950 Preston Road, Suite 1000
Dallas, TX 75252

POA ACCEPTANCE LETTER

OC000000054799075

Date Mailed: 06/14/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/02/2012.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/tnnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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OF THE PEOPLE'S REPUBLIC OF CHINA

证　明

本证明之附件是向本局提交的下列专利申请文件副本。

申请号：200910251390.9

申请类型：发明专利

发明名称：载波聚合时反馈ACK/NACK信息的方法、基站和用户设备

申请日：2009年12月03日

申请人：华为技术有限公司

发明人或设计人：陈小波、李超君

中华人民共和国国家知识产权局局长

2012 年 06 月 28 日

09.12.03

权 利 要 求 书

1、一种载波聚合时反馈确认应答/否认应答 ACK/NACK 信息的方法，其特征在于，包括:

将下行控制信息 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段;

将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

2、根据权利要求 1 所述的方法，其特征在于，还包括: 在所述 DCI 中设置所述公共字段。

3、根据权利要求 1 或 2 所述的方法，其特征在于，所述公共字段能够被配置成下行分配指示 DAI 命令字段和 ACK 资源指示 ARI 命令字段;

所述将 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段包括:

当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将所有公共字段均配置成 DAI 命令字段;

或者，

当 ACK/NACK 信息的反馈模式为复用反馈模式时，将所有公共字段均配置成 ARI 命令字段。

4、根据权利要求 1 或 2 所述的方法，其特征在于，所述公共字段能够被配置成发射功率控制 TPC 命令字段和 ARI 命令字段;

所述将 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段包括:

将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC

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命令字段;

将非系统关联下行成员载波传输的DCI中的公共字段均配置成ARI命令字段。

5、根据权利要求1或2所述的方法，其特征在于，所述公共字段能够被配置成TPC命令字段和DAI命令字段;

所述将DCI信息预设的公共字段配置为，所述公共字段能够被配置成的至少两种ACK/NACK反馈相关的命令字段中的至少一种ACK/NACK反馈相关的命令字段包括:

将系统关联下行成员载波传输的至少一个DCI中的公共字段配置成TPC命令字段;

将非系统关联下行成员载波传输的DCI中的公共字段均配置成DAI命令字段。

6、根据权利要求1或2所述的方法，其特征在于，所述公共字段能够被配置成TPC命令字段和DAI命令字段及ARI命令字段;

所述将DCI信息预设的公共字段配置为，所述公共字段能够被配置成的至少两种ACK/NACK反馈相关的命令字段中的至少一种ACK/NACK反馈相关的命令字段包括:

将系统关联下行成员载波传输的至少一个DCI中的公共字段配置成TPC命令字段;

当ACK/NACK信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的DCI中的公共字段均配置成DAI命令字段；或者，当ACK/NACK信息的反馈模式为复用反馈模式时，将非系统关联下行成员载波传输的DCI中的公共字段均配置成ARI命令字段。

7、一种载波聚合时反馈确认应答/否认应答ACK/NACK信息的方法，其特征在于，包括:

接收基站发送的下行成员载波传输的下行控制信息DCI;

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根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，所述公共字段能够被配置成至少两种 ACK/NACK 反馈相关的命令字段。

8、根据权利要求 7 所述的方法，其特征在于，所述至少两种 ACK/NACK 反馈相关的命令字段为：

下行分配指示 DAI 命令字段和 ACK 资源指示 ARI 命令字段；或者，

发射功率控制 TPC 命令字段和 ARI 命令字段；或者，

TPC 命令字段和 DAI 命令字段；或者，

TPC 命令字段和 DAI 命令字段及 ARI 命令字段。

9、一种基站，其特征在于，包括：

配置模块，用于将下行控制信息 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种确认应答/否认应答 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段；

发送模块，用于将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

10、根据权利要求 9 所述的基站，其特征在于，还包括：

设置模块，用于在所述 DCI 中设置所述公共字段。

11、根据权利要求 9 或 10 所述的基站，其特征在于，所述公共字段能够被配置成下行分配指示 DAI 命令字段和 ACK 资源指示 ARI 命令字段；

所述配置模块包括第一单元或第二单元；

所述第一单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将所有公共字段均配置成 DAI 命令字段；

所述第二单元用于当 ACK/NACK 信息的反馈模式为复用反馈模式时，将所有公共字段均配置成 ARI 命令字段。

12、根据权利要求 9 或 10 所述的基站，其特征在于，所述公共字段能够被配置成发射功率控制 TPC 命令字段和 ARI 命令字段；

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所述配置模块包括第三单元和第四单元;

所述第三单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段;

所述第四单元用于将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段。

13、根据权利要求 9 或 10 所述的基站，其特征在于，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段;

所述配置模块包括第五单元和第六单元;

所述第五单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段;

所述第六单元用于将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段。

14、根据权利要求 9 或 10 所述的基站，其特征在于，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段及 ARI 命令字段;

所述配置模块包括第七单元和第八单元;

所述第七单元用于将系统关联下行成员载波传输的至少一个 DCI 信息中的公共字段配置成 TPC 命令字段;

所述第八单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段；或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段。

15、一种用户设备，其特征在于，包括:

接收模块，用于接收基站发送的下行成员载波传输的下行控制信息 DCI;

反馈模块，用于根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，所述公共字段能够被配置成至少两种 ACK/NACK 反馈相关的命令字段。

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说　明　书

载波聚合时反馈 ACK/NACK 信息的方法、基站和用户设备

技术领域

本发明涉及移动通信技术，尤其涉及一种载波聚合时反馈 ACK/NACK 信息的方法、基站和用户设备。

背景技术

混合自动重传请求（Hybrid Automatic Repeat Request，HARQ）技术中，数据接收方需要向数据发送方反馈确认应答/否认应答（Acknowledgement/Negative-acknowledgement，ACK/NACK）信息，以帮助确认数据是否正确接收。在第三代合作伙伴计划（3rd Generation Partnership Project，3GPP）演进全球地面无线接入（Evolved Universal Terrestrial Radio Access，E-UTRA）系统的上行链路方向，用户设备通过物理上行控制信道（Physical Uplink Control Channel，PUCCH）信道向基站反馈下行数据接收的 ACK/NACK 信息。3GPP E-UTRA 系统也称为长期演进（Long Term Evolution，LTE）系统。在下面描述中，将用于用户设备向基站反馈下行数据接收的 ACK/NACK 信息的 PUCCH 信道称为上行 ACK 信道。

在 LTE 系统中，ACK/NACK 信息的反馈可以通过下行控制信息（Downlink Control Information，DCI）进行控制，DCI 用于指示 PDSCH 传输的调度信息，DCI 在与其指示的物理下行共享信道（Physical Downlink Shared Channel，PDSCH）对应的物理下行控制信道（Physical Downlink Control Channel，PDCCH）上传输，其中包含发射功率控制（Transmission Power Control，TPC）命令字段，TPC 命令字段用于调整上行 ACK 信道发送 ACK/NACK 信息时的发射功率，TPC 命令字段通常

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为 2 比特。特别地，在 LTE 时分双工（Time Division Duplex，TDD）系统中，一个用户设备在一个上行子帧中可以反馈多个下行子帧 PDSCH 数据传输对应的 ACK/NACK 信息。具体地，LTE TDD 系统支持两种 ACK/NACK 信息反馈模式，分别是复用反馈模式（ACK/NACK Multiplexing Mode）和捆绑反馈模式（ACK/NACK Bundling Mode）。在复用反馈模式中，与每个 PDSCH 数据传输对应的上行 ACK/NACK 信息独立反馈给基站；在捆绑反馈模式中，将与多个 PDSCH 数据传输对应的上行 ACK/NACK 信息通过逻辑与操作后一起反馈给基站。为了支持捆绑反馈模式，在 DCI 中引入了 2 比特的下行分配指示（Downlink Assignment Index，DAI）命令字段，用于指示携带 DCI 的 PDCCH 的数目。

在 LTE 系统的进一步演进和增强（LTE-Advanced，LTE-A）系统中，载波聚合技术被选择用来支持更宽的带宽，以满足国际电信联盟对于第四代通信技术的峰值数据速率要求。载波聚合技术中，两个或更多的成员载波的频谱被聚合在一起以得到更宽传输带宽，每个成员载波有独立的 HARQ 过程。LTE-A 用户设备可以配置不同的上行和下行成员载波数目。当 LTA-A 用户设备同时接入多个下行成员载波时，每个下行成员载波 PDSCH 上的数据传输，都要在上行 ACK 信道反馈对应的 ACK/NACK 信息。当多个下行成员载波数据传输对应的 ACK/NACK 信息需要在同一个上行成员载波中反馈时，需要解决在相同上行成员载波中反馈多个下行成员载波数据传输对应的 ACK/NACK 信息的问题。

参照 LTE TDD 系统，在 LTE-A 系统中，当一个用户设备被配置在多个下行成员载波接收数据时，对多个下行成员载波数据传输对应的上行 ACK/NACK 信息反馈，也可以采用复用反馈模式或者捆绑反馈模式。同样可以采用 DCI 信息进行 ACK/NACK 信息反馈的控制。例如，用 TPC 命令字段控制上行成员载波的发射功率；用 DAI 命令字段来支持捆绑反馈模式。

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特别地，在载波聚合的 LTE-A 系统中，考虑到同时在多个下行成员载波上调度的用户数目较少，对这些用户设备，其上行 ACK 信道分配可以采用基站通过显示信令通知的方式，一种方式是基站通过高层信令直接通知分配的上行 ACK 信道资源。为了增加不同用户设备对上行 ACK 信道的统计复用概率，另一种方式是基站通过高层信令为用户设备分配一组上行 ACK 信道资源，同时在 PDCCH 携带的 DCI 信息中增加 ACK 资源指示（ACK Resource Indication，ARI）命令字段，用于进一步指示当前使用高层分配的一组上行 ACK 信道资源中的哪一个。ARI 命令字段在 LTE 系统中不存在，需要在 LTE-A 系统中额外引入，比特数取决于高层分配的上行 ACK 信道资源个数，通常认为 2 比特就足够了。

在载波聚合的 LTE-A 系统，为了解决相同上行成员载波中反馈多个下行成员载波数据传输对应的 ACK/NACK 信息的问题，可能需要在 LTE 系统的 DCI 的基础上进一步引入 DAI 命令字段和/或 ARI 命令字段，为此需要提供一个与 LTE 系统后向兼容的反馈 ACK/NACK 信息的方案。

发明内容

本发明实施例是提供一种载波聚合时反馈 ACK/NACK 信息的方法、基站和用户设备，实现载波聚合下的 ACK/NACK 信息反馈与 LTE 系统的后向兼容。

本发明实施例提供了一种载波聚合时反馈确认应答/否认应答 ACK/NACK 信息的方法，包括：

将下行控制信息 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段；

将所述DCI发送给用户设备，以便所述用户设备根据所述DCI反馈ACK/NACK信息。

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本发明实施例还提供了一种载波聚合时反馈确认应答/否认应答ACK/NACK信息的方法，包括：

接收基站发送的下行成员载波传输的下行控制信息DCI；

根据所述DCI预设的公共字段中配置的ACK/NACK反馈相关的命令字段反馈ACK/NACK信息，所述公共字段能够被配置成至少两种ACK/NACK反馈相关的命令字段。

本发明实施例提供了一种基站，包括：

配置模块，用于将下行控制信息DCI预设的公共字段配置为，所述公共字段能够被配置成的至少两种确认应答/否认应答 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段；

发送模块，用于将所述DCI发送给用户设备，以便所述用户设备根据所述DCI反馈ACK/NACK信息。

本发明实施例提供了一种用户设备，包括：

接收模块，用于接收基站发送的下行成员载波传输的下行控制信息DCI；

反馈模块，用于根据所述DCI预设的公共字段中配置的ACK/NACK反馈相关的命令字段反馈ACK/NACK信息，所述公共字段能够被配置成至少两种ACK/NACK反馈相关的命令字段。

由上述技术方案可知，本发明实施例通过在DCI中预设能够被配置成至少两种的 ACK/NACK 反馈相关的命令字段的公共字段，可以通过将该公共字段配置成不同的命令字段，使之为 LTE-A 载波聚合时所需的不同的ACK/NACK 反馈相关的命令字段，实现载波聚合下的 ACK/NACK 信息反馈与 LTE 系统的后向兼容。

附图说明

为了更清楚地说明本发明实施例中的技术方案，下面将对实施例描述中所需要使用的附图作一简单地介绍，显而易见地，下面描述中的附图是本发

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明的一些实施例，对于本领域普通技术人员来讲，在不付出创造性劳动性的前提下，还可以根据这些附图获得其他的附图。

图 1 为本发明第一实施例的方法流程示意图；

图 2 为本发明实施例中系统关联下行成员载波的组成示意图；

图 3 为本发明实施例采用的上下行成员载波的示意图；

图 4 为本发明第二实施例的方法流程示意图；

图 5 为本发明第三实施例的方法流程示意图；

图 6 为本发明第四实施例的方法流程示意图；

图 7 为本发明第五实施例的方法流程示意图；

图 8 为本发明第六实施例的基站的结构示意图；

图 9 为本发明第七实施例的用户设备的结构示意图。

具体实施方式

为使本发明实施例的目的、技术方案和优点更加清楚，下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述，显然，所描述的实施例是本发明一部分实施例，而不是全部的实施例。基于本发明中的实施例，本领域普通技术人员在没有作出创造性劳动前提下所获得的所有其他实施例，都属于本发明保护的范围。

图 1 为本发明第一实施例的方法流程示意图，包括：

步骤 11：基站将 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段。

其中，所述至少两种 ACK/NACK 反馈相关的命令字段至少包含 DAI 命令字段和/或 ARI 命令字段。此外，还可以包含 TPC 命令字段，或者 DCI 中会有的其余的命令字段，例如，载波指示命令字段、冗余版本命令字段等。

在不同的场景下，该公共字段可以被配置成不同的命令字段。其中，不

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同的场景可以是反馈模式的不同，例如，当 ACK/NACK 信息的反馈模式为捆绑反馈模式时，该公共字段被配置成 DAI 命令字段，当 ACK/NACK 信息的反馈模式为复用反馈模式时，该公共字段被配置成 ARI 命令字段。不同的场景也可以是不同类型的下行成员载波，例如，在系统关联下行成员载波传输的 DCI 中的公共字段被配置成 TPC 命令字段，在非系统关联下行成员载波传输的 DCI 中的公共字段被配置成 ARI 命令字段和/或 DAI 命令字段。系统关联下行成员载波及非系统关联下行成员载波的具体定义可以参见下述描述。

具体地，在某一时刻，每个下行成员载波传输的 DCI 中的公共字段被分别配置成具体的一种命令字段。其中，每个下行成员载波传输的公共字段可以被配置成相同的命令字段；也可以将系统关联下行成员载波传输的公共字段与非系统关联下行成员载波传输的公共字段分别配置成不同的命令字段。

步骤 12：基站将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

具体地，通过上述对公共字段的灵活配置，实现 DCI 中具有使用户设备可以进行 ACK/NACK 信息反馈的相关控制命令字段，因此，用户设备可以通过解析 DCI 获知相关的控制命令字段，实现载波聚合时的 ACK/NACK 信息的反馈。

进一步地，在步骤 11 之前还可以包括：基站在所述 DCI 中设置所述公共字段。实现公共字段的灵活配置。

本实施例通过在 DCI 中设置公共字段，在不同的场景下，该公共字段可以被配置成不同的命令字段，因此，可以在效果上使得该公共字段相当于其可以被配置成的命令字段的总和，实现用较少的比特数表明较多的命令字段，降低比特开销及设计和实现的复杂度，实现 LTE-A 系统的 DCI 信息的比特数尽量与 LTE 系统的一致，实现对 LTE 系统的兼容性，使得 LTE 系统的绝大部分设计都将在 LTE-A 系统中得到继承。

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在载波聚合的 LTE-A 系统中，可能需要增加 ARI 命令字段；对 FDD 系统可能还需要增加 DAI 命令字段。如果将这些命令字段独立增加，以 ARI 命令字段和 DAI 命令字段均为 2 比特为例，则在 FDD 系统中 DCI 信息占用的比特数会增加 4 比特。这样既不利于与 LTE 系统的兼容，更会增加比特开销及设计实现复杂度。为此，本发明实施例中通过在 DCI 中设置公共字段，该公共字段表征的命令字段并不是固定配置的，根据场景不同，可以被配置成 DAI 命令字段或者 ARI 命令字段或者 TPC 命令字段或者其余的命令字段，实现一个字段具有多个命令字段的含义，实现用较少的字段表征所需的多个命令字段，以便降低比特开销及设计实现复杂度。

在具体实施例时，可以通过在 DCI 中增加比特的方式设置公共字段，例如，增加 2 比特的字段作为公共字段，根据场景的不同，该公共字段可以被配置成 DAI 命令字段或者 ARI 命令字段。与现有需要增加 DAI 命令字段及 ARI 命令字段的方式相比，本发明实施例中的这种方式可以减少比特占用，即本发明实施例只需增加 2 比特，而现有需要增加 4 比特。

虽然通过新增公共字段的方式相比现有技术具有一定的优势，但是，新增公共字段的方式还是会增加 DCI 的比特数。为了与现有技术的兼容，更优的方式则是充分利用 DCI 中已有的命令字段，在不增加 DCI 占用的比特数的基础上设置公共字段。

为了保持对 LTE 系统的兼容，LTE 系统 DCI 的命令字段将在 LTE-A 系统 DCI 信息中得到继承，例如 TPC 命令字段、调制编码方式命令字段、新数据指示命令字段和冗余版本命令字段等。此外，为了支持一些 LTE-A 特有的功能，对 LTE-A 用户设备会增加一些特有的命令字段，例如，用于支持 PDCCH 跨载波调度 PDSCH 传输的载波指示命令字段。

LTE-A 上述命令字段中的一个或者多个可以用来作为公共字段，例如，对支持 PDCCH 跨载波调度 PDSCH 的 LTE-A 用户设备，其 DCI 信息中存在 3 比特的载波指示命令字段；当该用户设备的聚合载波数较少时，3 比特的载

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波指示命令字段会有一些冗余比特或冗余状态，可以将这 3 比特作为公共字段，并利用冗余比特或冗余状态来同时传输载波指示命令字段和/或 ARI 命令字段和/或 DAI 命令字段。又例如，冗余版本命令字段用于在物理层 HARQ 过程中指示当前 PDSCH 传输的冗余版本的；可以将冗余版本命令字段对应的 2 比特作为公共字段，对 PDSCH 初传该公共字段用作 ARI 命令字段并使用一个预设的缺省冗余版本，对 PDSCH 重传该公共字段用作冗余版本命令字段且为重传分配与初传相同的上行 ACK 信道。但是，不论是基于已有的载波指示命令字段还是冗余版本命令字段来设计公共字段，都会带来较大的调度灵活性损失。

在实现本发明的过程中，发明人发现，对一个用户设备，对于配置在相同上行成员载波反馈 ACK/NACK 信息的下行成员载波上传输的 PDSCH，携带其调度信息的 DCI 中，在相同时刻具有相同的 TPC 命令字段。这是因为这些 TPC 命令字段都是对同一个上行成员载波的上行 ACK 信道的发射功率的控制。由于各 DCI 中包含的 TPC 命令字段是相同的，对于系统来讲，该 TPC 命令字段属于冗余的，可以充分利用 TPC 命令字段，将 TPC 命令字段设置为公共字段。根据是否为系统关联下行成员载波传输的 DCI 中的公共字段，可以把替换原有的 TPC 命令字段的公共字段配置成 TPC 命令字段、DAI 命令字段和/或 ARI 命令字段。

LTE 系统中，上行 ACK 信道可以通过携带 DCI 的 PDCCH 来隐式映射。在载波聚合 LTE-A 系统中，为了保持对只支持 LTE 早期版本的用户设备的兼容性，在一个上行成员载波，也会为一个或多个下行成员载波传输的 PDCCH 预留用作隐式映射的上行 ACK 信道资源。为了描述方便，如果在一个上行成员载波为某个下行成员载波预留了通过 PDCCH 隐式映射的上行 ACK 信道资源，称下行成员载波为上行成员载波的“系统关联下行成员载波”。图 2 为本发明实施例中系统关联下行成员载波的组成示意图，如图 2 所示，载波聚合的 LTE-A 系统中有三个下行成员载波，分别为下行成员载波

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-1、下行成员载波-2 和下行成员载波-3 和两个上行成员载波，分别为上行成员载波-1、上行成员载波-2。在上行成员载波-1 为下行成员载波-1 预留了通过 PDCCH 隐式映射的上行 ACK 信道资源，在上行成员载波-2 为下行成员载波-2、下行成员载波-3 预留了通过 PDCCH 隐式映射的上行 ACK 信道资源，那么下行成员载波-1 是上行成员载波-1 的系统关联下行成员载波，下行成员载波-2、下行成员载波-3 是上行成员载波-2 的系统关联下行成员载波。载波聚合的 LTE-A 系统中，为了避免每个上行成员载波中通过 PDCCH 隐式映射预留的上行 ACK 信道资源开销过大，与其系统关联的下行成员载波数目可能较少。

在下面的实施例中，都是以一个用户设备的多个下行成员载波均被配置在同一个上行成员载波反馈 ACK/NACK 信息为例。当用户设备同时被配置在多个上行成员载波反馈 ACK/NACK 信息时，将在一个相同上行成员载波反馈 ACK/NACK 信息的下行成员载波看作一个下行成员载波组，对不同下行成员载波组分别按照本发明实施例所述方式来处理即可。

图 3 为本发明实施例采用的上下行成员载波的示意图，参见图 3，本发明实施例中，都假设配置了某一用户设备在下行成员载波-1、下行成员载波-2 和下行成员载波-3 上传输的 PDSCH 的 ACK/NACK 信息都在上行成员载波-2 上反馈，其中，PDSCH 用于数据传输，PDCCH 用于传输 PDSCH 的调度信息 DCI，PUCCH 为用于反馈 ACK/NACK 信息的上行 ACK 信道。并且行成员载波-1、下行成员载波-2 和下行成员载波-3 中，只有下行成员载波-2 是上行成员载波-2 的系统关联下行成员载波。

图 4 为本发明第二实施例的方法流程示意图，本实施例以 TDD 系统为例。参见图 4，包括：

步骤 41：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 ARI 命令字段和 DAI 命令字段。

对于非系统关联下行成员载波需要采用 ARI 命令字段指示分配的 ACK

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信道资源。当在 DCI 中增加 ARI 命令字段后，无疑会增加 DCI 的比特数，这样会造成比特开销的增加及不能与 LTE 系统的兼容。为降低比特开销以更好的与 LTE 系统兼容，本实施例基于现有 DCI 中已有的 DAI 命令字段来设计公共字段，以便该公共字段可以被设置成 DAI 命令字段或者 ARI 命令字段。

由于 LTE TDD 系统可以支持 ACK/NACK 信息的绑定反馈模式，因此，TDD 系统的 DCI 中包含 DAI 命令字段。为了与 LTE 系统兼容，载波聚合 LTE-A TDD 系统中可以利用该已有的 DAI 命令字段，将该 DAI 命令字段设置为公共字段，不仅可以表征 DAI 命令字段，也可以表征 ARI 命令字段。这样就可以在 DCI 中需要包含 ARI 命令字段时，无需在 DCI 中新增字段。当然，对于 FDD 系统，可以通过新增 2 比特的方式设置公共字段来表征 DAI 命令字段或 ARI 命令字段，相比于将 DAI 命令字段及 ARI 命令字段均独立设置时需要的 4 比特相比，同样可以降低比特开销。

步骤 42：当采用绑定反馈模式时，基站将所有下行成员载波传输的 DCI 中的公共字段，均配置为 DAI 命令字段；当采用复用反馈模式时，基站将所有下行成员载波传输的 DCI 中的公共字段，均配置为 ARI 命令字段。

以图 3 为例，将与下行成员载波-1、下行成员载波-2 和下行成员载波-3 对应的 DCI 中的公共字段，在处于捆绑反馈模式时，均设置为 DAI 命令字段，在处于复用反馈模式时，均设置为 ARI 命令字段。其中，上行 ACK/NACK 信息反馈模式可以是小区特定的，即小区中所有用户设备采用相同的上行 ACK/NACK 信息反馈模式；也可以是用户设备特定的，即不同用户设备可以采用不同的上行 ACK/NACK 信息反馈模式。

步骤 43：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

本实施例通过基于现有的 DAI 命令字段来设计公共字段，该公共字段可以被配置成 DAI 命令字段或者 ARI 命令字段，实现用已有的只能表征一个信息的命令字段表征两个信息，无需新增命令字段，降低比特开销及设计实现

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复杂度。

图 5 为本发明第三实施例的方法流程示意图，本实施例以 TDD 或者 FDD 系统为例。参见图 5，包括：

步骤 51：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 TPC 命令字段和 ARI 命令字段。

由于 TPC 命令字段是用于控制功率发射的，不论在 TDD 系统还是 FDD 系统中均会有该 TPC 命令字段。为了与 LTE 系统兼容，载波聚合 LTE-A 系统中可以利用该已有的 TPC 命令字段，将该 TPC 命令字段设置为公共字段，不仅可以表征 TPC 命令字段，也可以表征 ARI 命令字段。这样就可以在 DCI 中需要包含 ARI 命令字段时，无需在 DCI 中新增字段。

步骤 52：基站将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段。

具体地，对一个用户设备，当配置了 N_{DL} 个下行成员载波传输的 PDSCH 对应的 ACK/NACK 信息在一个上行成员载波上反馈时，在上行成员载波的系统关联下行成员载波上可能同时传输 n 个 PDCCH，其中 $1 \le n \le N_{DL}$，且这 n 个 PDCCH 分别携带了调度 n 个下行成员载波 PDSCH 传输的 DCI 信息。n 取值大于 1 的情况可能是由于以下两种因素导致：N_{DL} 个下行成员载波中有该上行成员载波的至少两个系统关联下行成员载波，PDCCH 跨载波调度其他载波的 PDSCH 传输。在这 n 个 PDCCH 携带的 DCI 信息中，分别各有一个公共字段。

以图 3 为例，将与下行成员载波-2 对应的 DCI 中的公共字段，配置成 TPC 命令字段；将与下行成员载波-1 和下行成员载波-3 对应的 DCI 中的公共字段，均设置为 ARI 命令字段。

步骤 53：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

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本实施例中，基站为用户设备分配 ACK 信道资源可以采用如下方式：在一个上行成员载波中，为其系统关联下行成员载波上传输的 PDCCH 分别预留了用做隐式映射的上行 ACK 信道资源。因而，对于在系统关联下行成员载波上发送相应 PDCCH 的 PDSCH 传输，对应分配的上行 ACK 信道资源可以通过相应 PDCCH 来隐式映射获取；对于在非系统关联下行成员载波上发送相应 PDCCH 的 PDSCH 传输，对应分配的上行 ACK 信道无法通过相应 PDCCH 来隐式映射获取，可以通过显示信令通知的方式获取。此时，对每个下行成员载波的 PDSCH 传输，如果其相应的 PDCCH 可以在非系统关联下行成员载波上发送，基站就通过高层信令为其分配一组上行 ACK 信道资源。通过高层信令所分配的上行 ACK 信道资源组，对不同成员载波的 PDSCH 传输可以不同、也可以相同。对于在系统关联下行成员载波上发送的 PDCCH，其携带的 DCI 信息公共字段可以全部配置成 TPC 命令字段；对于在非系统关联下行成员载波上发送的 PDCCH，其携带的公共字段可以全部配置成 ARI 命令字段。

本实施例通过基于现有的 TPC 命令字段来设计公共字段，该公共字段可以被配置成 TPC 命令字段或者 ARI 命令字段，实现用已有的只能表征一个信息的命令字段表征两个信息，无需新增命令字段，降低比特开销及设计实现复杂度。

图 6 为本发明第四实施例的方法流程示意图，本实施例以 FDD 系统为例。参见图 6，包括：

步骤 61：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段。

步骤 62：基站将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段。

具体地，对一个用户设备，当配置了 N_{DL} 个下行成员载波传输的 PDSCH

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对应的 ACK/NACK 信息在一个上行成员载波上反馈时，在上行成员载波的系统关联下行成员载波上可能同时传输 n 个 PDCCH，其中 $1 \le n \le N_{DL}$，且这 n 个 PDCCH 分别携带了调度 n 个下行成员载波 PDSCH 传输的 DCI 信息。n 取值大于 1 的情况可能是由于以下两种因素导致：N_{DL} 个下行成员载波中有该上行成员载波的至少两个系统关联下行成员载波，PDCCH 跨载波调度其他载波的 PDSCH 传输。在这 n 个 PDCCH 携带的 DCI 中，分别各有一个公共字段。

以图 3 为例，将下行成员载波-2 对应的 DCI 中的公共字段，配置成 TPC 命令字段，将下行成员载波-1 和下行成员载波-3 对应的 DCI 中的公共字段，均设置为 DAI 命令字段。

步骤 63：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

本实施例中，基站为用户设备分配ACK信道资源可以采用如下方式：在一个上行成员载波中，为其系统关联下行成员载波上传输的PDCCH分别预留了用做隐式映射的上行ACK信道资源。因而，对于在系统关联下行成员载波上发送相应PDCCH的PDSCH传输，对应分配的上行ACK信道资源可以通过相应PDCCH来隐式映射获取。对于在系统关联下行成员载波上传输的 n 个PDCCH，其携带的公共字段可以都解释成TPC命令字段；也可以只从中选择一个PDCCH、例如第一个PDCCH或调度预先指定的系统关联下行成员载波PDSCH传输的PDCCH，其携带的公共命令字段能够配置成TPC命令字段，剩余 $n-1$ 个PDCCH携带的公共字段则配置成DAI命令字段。

如前所述，DAI命令字段用于指示携带DCI的PDCCH的数目，主要是为上行ACK/NACK信息处于捆绑反馈模式时使用的。对于捆绑反馈模式，与多个PDSCH传输对应的上行ACK/NACK信息通过逻辑与操作一起反馈，只需要一个上行ACK信道分配即可。因而对于在非系统关联下行成员载波上发送相应PDCCH的PDSCH传输，可以不分配上行ACK信道资源，这时候只需要DAI命令字段用于指示当前时刻用于携带DCI的PDCCH的总数即可。以图3所示配

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置为例，假设调度每个下行成员载波PDSCH传输的相应PDCCH都在本载波发送，那么此时为用户设备通过在下行成员载波-2上发送的PDCCH隐式映射来分配上行ACK信道，为下行成员载波-1、下行成员载波-3上的PDSCH传输不分配上行ACK信道。如果用户设备成功接收了下行成员载波-2上发送的PDCCH，同时错误接收了下行成员载波-1、下行成员载波-3上发送的PDCCH，因为这时用户设备接收到的PDCCH中的公共命令字段不是DAI命令字段，无法发现有PDCCH丢失，造成上行ACK/NACK信息反馈的错误。配置捆绑反馈模式的用户设备信道条件通常较差，因而可以强制PDCCH占用的控制信道单元资源数目总是大于一个，这一点可以通过在系统关联下行成员载波总是发送大于一个PDCCH、或者系统关联下行成员载波发送的PDCCH占用大于一个控制信道单元的资源来保证。在从PDCCH隐式映射上行ACK信道的过程中，每个控制信道单元都能够映射出一个上行ACK信道。在PDCCH占用的控制信道单元资源数目大于一个时，通过在系统关联下行成员载波发送的PDCCH能够隐式映射出的上行ACK信道数目也大于一个。这时可以从中选择出两个上行ACK信道、例如PDCCH占用的前面两个控制信道单元映射出的两个上行ACK信道，分别记为*ACK0*和*ACK1*。为了避免没有接收到含有能配置成DAI命令字段的公共字段的PDCCH时可能造成的上行ACK/NACK信息反馈错误，可以在成功接收到的PDCCH中的公共命令字段都不能配置成DAI命令字段时选择*ACK0*来反馈上行ACK/NACK信息，在成功接收到的PDCCH中有公共命令字段配置成DAI命令字段时选择*ACK1*来反馈上行ACK/NACK信息。

但是，对于配置捆绑模式的用户设备，强制 PDCCH 占用的控制信道单元资源数目总是大于一个可能造成不必要的 PDCCH 资源浪费。对于在非系统关联下行成员载波上发送相应 PDCCH 的 PDSCH 传输，可以通过显示信令通知的方式分配上行 ACK 信道资源。此时可以直接通过高层信令对一个用户设备分配一个上行 ACK 信道资源；或者通过高层信令分配一组上行 ACK 信道资源，在用户设备处于捆绑反馈模式时从中选出一个缺省的上行 ACK 信道

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资源、例如第一个上行 ACK 信道资源。当通过高层信令分配一组上行 ACK 信道资源时，可以采用与复用反馈模式下通过高层信令分配一组上行 ACK 信道资源的方式，以保持一个简单的系统设计。此外，在从一组配置的上行 ACK 信道资源中选出一个缺省的上行 ACK 信道资源时，不同的用户设备可以选择不同的缺省上行 ACK 信道，例如 UE-1 在捆绑反馈模式时缺省选择高层信令配置的第一个上行 ACK 信道资源、UE-2 在捆绑反馈模式时缺省选择高层信令配置的最后一个上行 ACK 信道资源。记隐式分配的上行 ACK 信道为 ACK_{imp}，显示分配的上行 ACK 信道为 ACK_{exp}。为了避免没有接收到含有能配置成 DAI 命令字段的公共字段的 PDCCH 时可能造成的上行 ACK/NACK 信息反馈错误，可以在成功接收到的 PDCCH 中的公共命令字段都不能配置成 DAI 命令字段时选择 ACK_{imp} 来反馈上行 ACK/NACK 信息，在成功接收到的 PDCCH 中有公共命令字段配置成 DAI 命令字段时选择 ACK_{exp} 来反馈上行 ACK/NACK 信息。

本实施例通过基于现有的 TPC 命令字段来设计公共字段，该公共字段可以被配置成 TPC 命令字段或者 DAI 命令字段，实现用已有的只能表征一个信息的命令字段表征两个信息，无需新增命令字段，降低比特开销及设计实现复杂度。

图 7 为本发明第五实施例的方法流程示意图，本实施例以 FDD 系统为例。参见图 7，包括：

步骤 71：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 TPC 命令字段、DAI 命令字段和 ARI 命令字段。

步骤 72：基站将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段；或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将非系统关

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联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段。

具体地，对一个用户设备，当配置了 N_{DL} 个下行成员载波传输的 PDSCH 对应的 ACK/NACK 信息在一个上行成员载波上反馈时，在上行成员载波的系统关联下行成员载波上可能同时传输 n 个 PDCCH，其中 $1 \le n \le N_{DL}$，且这 n 个 PDCCH 分别携带了调度 n 个下行成员载波 PDSCH 传输的 DCI 信息。n 取值大于 1 的情况可能是由于以下两种因素导致：N_{DL} 个下行成员载波中有该上行成员载波的至少两个系统关联下行成员载波，PDCCH 跨载波调度其他载波的 PDSCH 传输。在这 n 个 PDCCH 携带的 DCI 信息中，分别各有一个公共字段。

以图 3 为例，将下行成员载波-2 对应的公共字段，配置成 TPC 命令字段；在捆绑反馈模式下，将下行成员载波-1 和下行成员载波-3 的公共字段均设置为 DAI 命令字段，在复用反馈模式下，将下行成员载波-1 和下行成员载波-3 的公共字段均设置为 ARI 命令字段。

步骤 73：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

本实施例中，基站为用户设备分配 ACK 信道资源可以采用如下方式：当 ACK/NACK 信息的反馈模式为复用反馈模式时，可以参见图 5 所示的实施例进行分配，当 ACK/NACK 信息的反馈模式为捆绑反馈模式时，可以参见图 6 所示的实施例进行分配。

本实施例通过基于现有的 TPC 命令字段来设计公共字段，该公共字段可以被配置成 TPC 命令字段或者 DAI 命令字段或者 TPC 命令字段，实现用已有的只能表征一个信息的命令字段表征三个信息，无需新增命令字段，降低比特开销及设计实现复杂度。

注意，在本发明第一实施例到第五实施例中，对下行成员载波数据传输，根据 DCI 中的公共字段来控制对应 ACK/NACK 信息的反馈。对于在下行成员载波半静态调度的数据传输，初传没有 DCI 进行控制，对应 ACK/NACK

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信息反馈可以重用 LTE 系统的机制，不属于本发明讨论范围。对于 LTE-A 系统，上行 ACK/NACK 信息反馈可能引入一些多天线技术，例如发射分集或者空分复用，这时候可能对一个下行成员载波数据传输需要分配两个或更多的上行 ACK 信道。以一个下行成员载波数据传输需要分配两个上行 ACK 信道为例，可以根据分配的第一个 ACK 信道加上一个固定的偏置得到分配的第二个 ACK 信道；或者，对于 PDCCH 隐式映射分配上行 ACK 信道的情况，通过每个 PDCCH 至少占用两个控制信道单元资源来实现，对于显示信令通知分配上行 ACK 信道的情况，可以高层信令直接配置一组上行 ACK 信道资源对，DCI 中的 ARI 命令字段指示当前具体分配的上行 ACK 信道资源对。这也不是本发明的关注点，在此不再赘述。

图 8 为本发明第六实施例的基站的结构示意图，包括配置模块 81 和发送模块 82，配置模块 81 用于将 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段；发送模块 82 用于将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

进一步地，本实施例还可以包括设置模块，所述设置模块用于在所述 DCI 中设置所述公共字段。

其中，可以是，所述公共字段能够被配置成 DAI 命令字段和 ARI 命令字段；此时，所述配置模块 81 包括第一单元或第二单元；所述第一单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将所有公共字段均配置成 DAI 命令字段；所述第二单元用于当 ACK/NACK 信息的反馈模式为复用反馈模式时，将所有公共字段均配置成 ARI 命令字段。

也可以是，所述公共字段能够被配置成 TPC 命令字段和 ARI 命令字段；此时，所述配置模块 81 包括第三单元和第四单元；所述第三单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第四单元用于将非系统关联下行成员载波传输的 DCI 中的公共字段均配

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置成 ARI 命令字段。

也可以是，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段；此时，所述配置模块 81 包括第五单元和第六单元；所述第五单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第六单元用于将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段。

也可以是，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段及 ARI 命令字段；此时，所述配置模块 81 包括第七单元和第八单元；所述第七单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第八单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段；或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段。

上述模块具体执行的功能可以参见方法实施例，不再赘述。

本实施例通过在 DCI 中设置公共字段，在不同的场景下，该公共字段可以被配置成不同的命令字段，因此，可以在效果上使得该公共字段相当于其可以被配置成的命令字段的总和，实现用较少的比特数表明较多的命令字段，降低比特开销及设计和实现的复杂度，实现 LTE-A 系统的 DCI 信息的比特数尽量与 LTE 系统的一致，实现对 LTE 系统的兼容性，使得 LTE 系统的绝大部分设计都将在 LTE-A 系统中得到继承。

图 9 为本发明第七实施例的用户设备的结构示意图，包括接收模块 91 和反馈模块 92，接收模块 91 用于接收基站发送的下行成员载波传输的 DCI；反馈模块 92 用于根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，所述公共字段能够被配置成至少两种 ACK/NACK 反馈相关的命令字段。

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其中，公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段可以是： DAI 命令字段和 ARI 命令字段；或者， TPC 命令字段和 ARI 命令字段；或者，TPC 命令字段和 DAI 命令字段；或者，TPC 命令字段和 DAI 命令字段及 ARI 命令字段。

上述模块具体执行的功能可以参见方法实施例，不再赘述。

本实施例通过在 DCI 中设置公共字段，在不同的场景下，该公共字段可以被配置成不同的命令字段，因此，可以在效果上使得该公共字段相当于其可以被配置成的命令字段的总和，实现用较少的比特数表明较多的命令字段，降低比特开销及设计和实现的复杂度，实现 LTE-A 系统的 DCI 信息的比特数尽量与 LTE 系统的一致，实现对 LTE 系统的兼容性，使得 LTE 系统的绝大部分设计都将在 LTE-A 系统中得到继承。

本领域普通技术人员可以理解：实现上述方法实施例的全部或部分步骤可以通过程序指令相关的硬件来完成，前述的程序可以存储于一计算机可读取存储介质中，该程序在执行时，执行包括上述方法实施例的步骤；而前述的存储介质包括：ROM、RAM、磁碟或者光盘等各种可以存储程序代码的介质。

可以理解的是，附图中或实施例中所示仅仅是示意性的，表示逻辑结构，其中所述作为分离部件显示的模块可能是或者可能不是物理上分开的，作为模块显示的部件可能是或者可能不是物理单元，即可以位于一个地方，或者分布到几个网络实体上。

最后应说明的是：以上实施例仅用以说明本发明的技术方案，而非对其限制；尽管参照前述实施例对本发明进行了详细的说明，本领域的普通技术人员应当理解：其依然可以对前述各实施例所记载的技术方案进行修改，或者对其中部分技术特征进行等同替换；而这些修改或者替换，并不使相应技术方案的本质脱离本发明各实施例技术方案的精神和范围。

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说 明 书 附 图

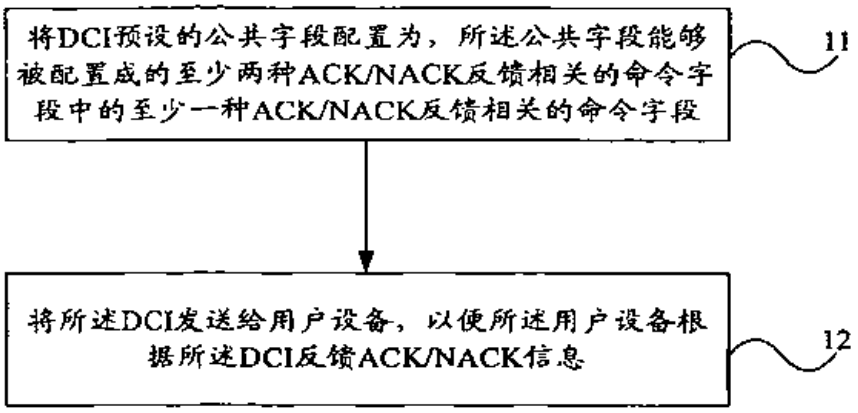


图 1

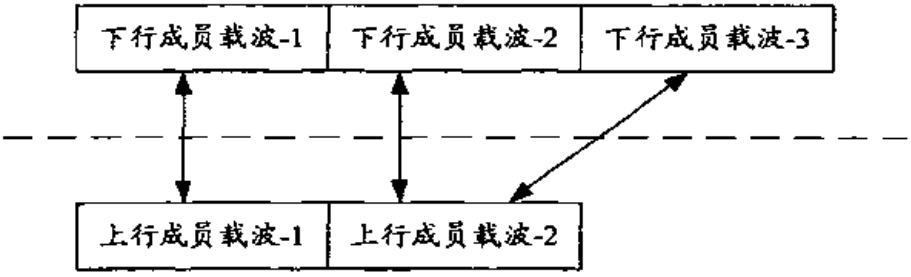


图 2

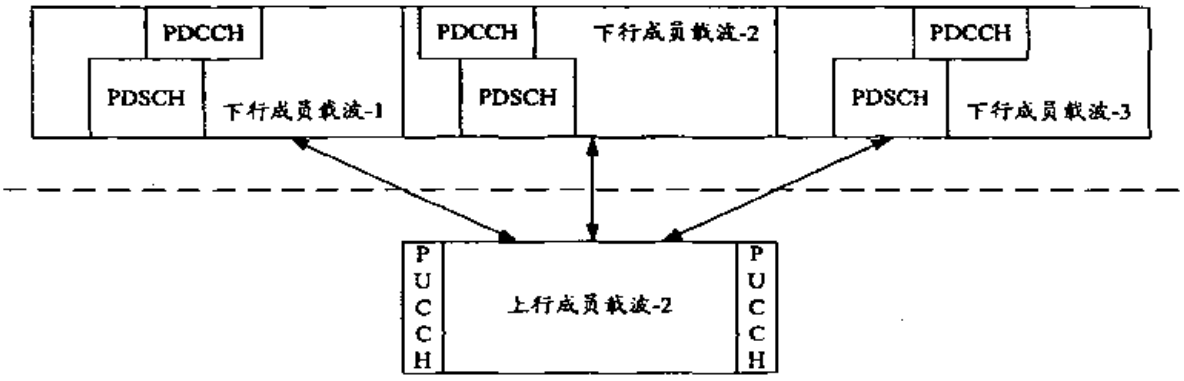


图 3

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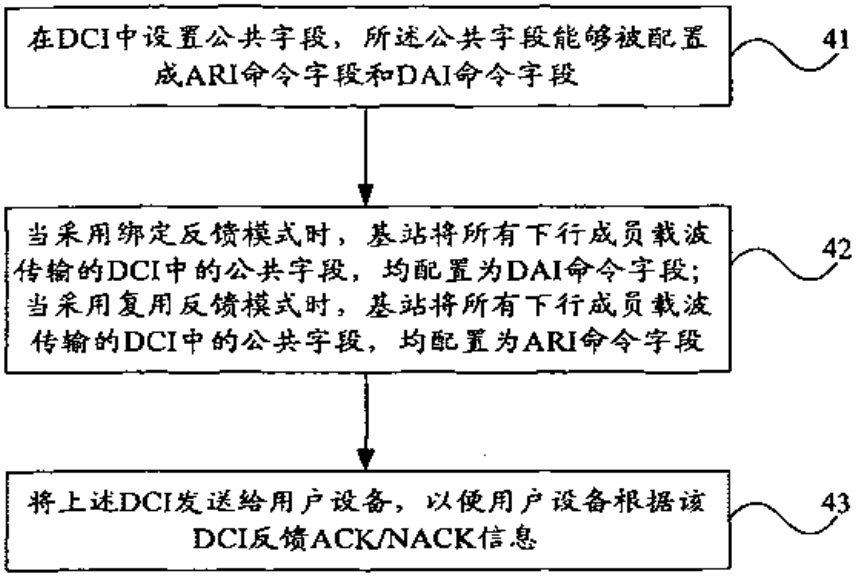


图 4

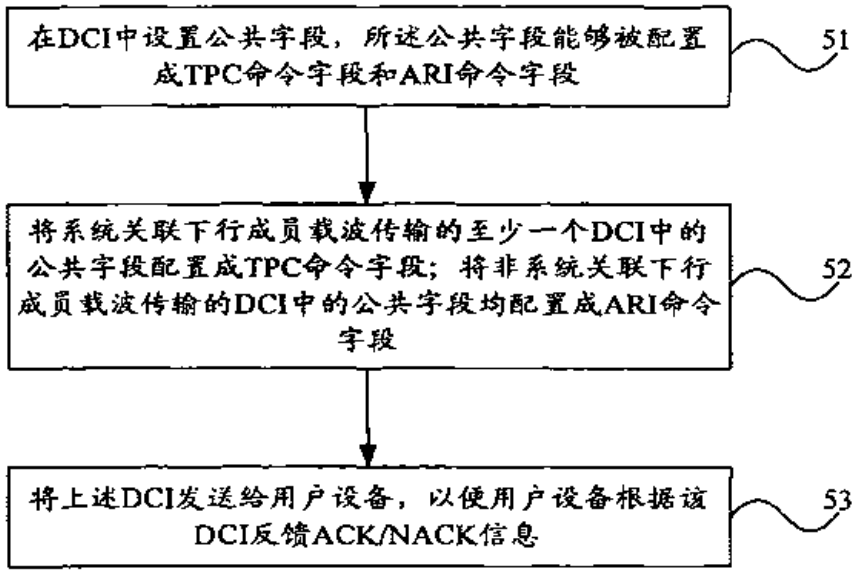


图 5

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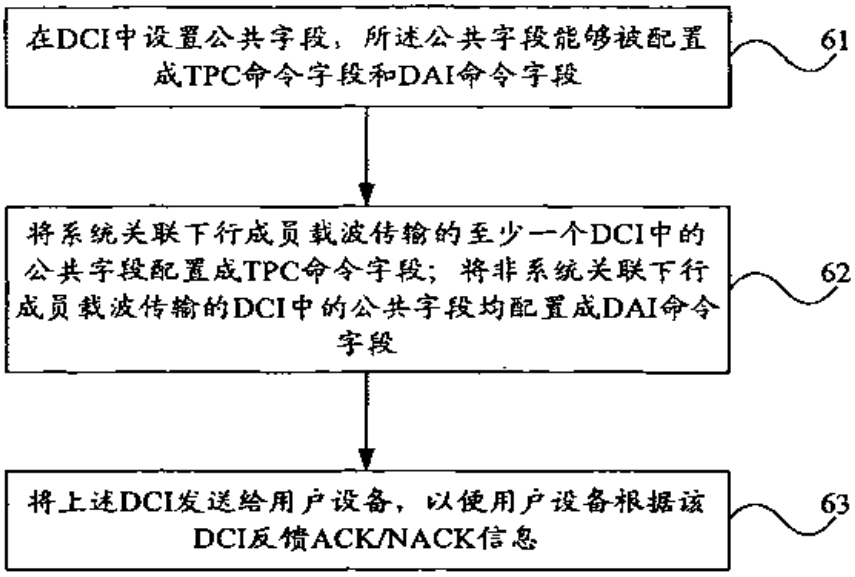


图 6

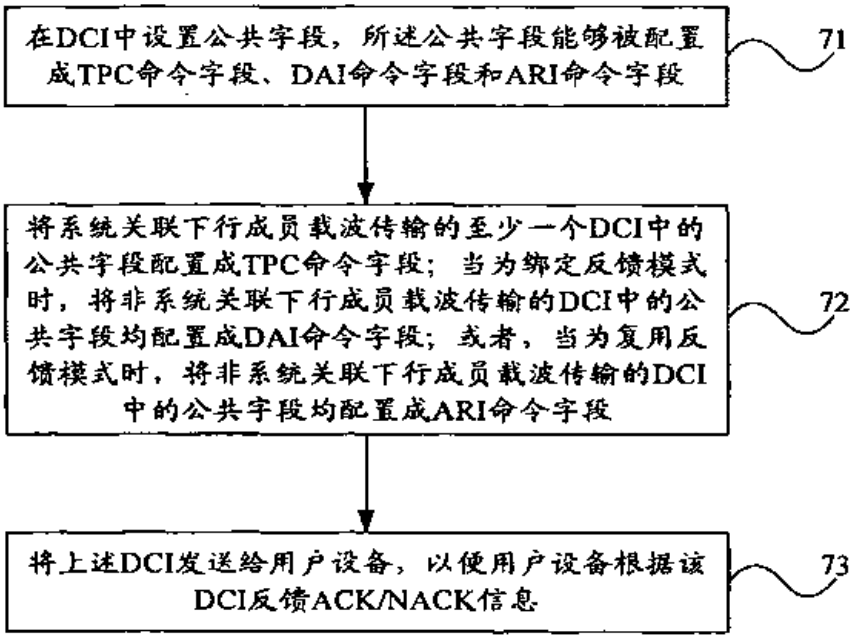


图 7

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09.12.03

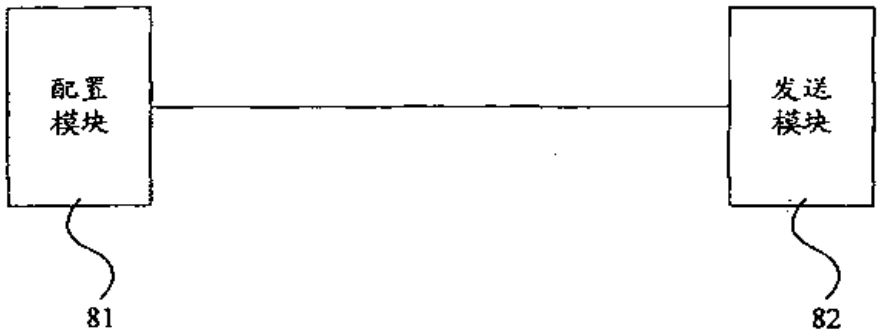


图 8

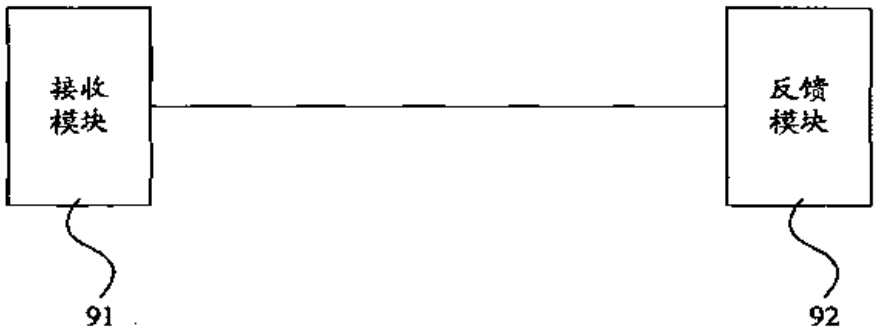


图 9

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中华人民共和国国家知识产权局
STATE INTELLECTUAL PROPERTY OFFICE
OF THE PEOPLE'S REPUBLIC OF CHINA

证　明

兹证明之附件是向本局提交的下列专利申请文件副本。

申　　号：201010137731.2

申　　型：发明专利

发明　　称：载波聚合时反馈ACK/NACK信息的方法、基站和用户设备

申　　日：2010年03月24日

申　　人：华为技术有限公司

发明人或　　：陈小波、李超君

中华人民共和国国家知识产权局局长

田力普

2012 年 06 月 28 日

权 利 要 求 书

1、一种载波聚合时反馈确认应答/否认应答 ACK/NACK 信息的方法，其特征在于，包括：

将下行控制信息 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段；

将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

2、根据权利要求 1 所述的方法，其特征在于，还包括：在所述 DCI 中设置所述公共字段。

3、根据权利要求 1 或 2 所述的方法，其特征在于，

所述公共字段能够被配置成下行分配指示 DAI 命令字段和 ACK 资源指示 ARI 命令字段；

所述将 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段包括：当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将所有公共字段中的至少一个配置成 DAI 命令字段；或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将所有公共字段中的至少一个配置成 ARI 命令字段。

4、根据权利要求 1 所述的方法，其特征在于，所述公共字段能够被配置成发射功率控制 TPC 命令字段和 ARI 命令字段；

所述将 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段，

包括：将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，将非系统关联下行成员载波传输的至少一个 DCI 中的公共

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字段配置成 ARI 命令字段;

或者包括：将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

5、根据权利要求 1 所述的方法，其特征在于，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段;

所述将 DCI 信息预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段，包括：将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段;

或者包括：将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段。

6、根据权利要求 1 所述的方法，其特征在于，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段及 ARI 命令字段;

所述将 DCI 信息预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段，包括：将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段，或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段;

或者包括：将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，当 ACK/NACK 信息的反馈模式为绑定反馈模式时，

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将系统关联下行成员载波传输的至少一个DCI中的公共字段配置成DAI命令字段，或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

7、根据权利要求 4 至 6 中任一项所述的方法，其特征在于，所述系统关联下行成员载波传输的至少一个 DCI，包括：

与下行主成员载波的物理下行共享信道 PDSCH 传输对应的 DCI；和/或

下行主成员载波传输的至少一个 DCI。

8、一种载波聚合时反馈确认应答/否认应答 ACK/NACK 信息的方法，其特征在于，包括：

接收基站发送的下行成员载波传输的下行控制信息 DCI；

根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，所述公共字段能够被配置成至少两种 ACK/NACK 反馈相关的命令字段。

9、根据权利要求 8 所述的方法，其特征在于，所述至少两种 ACK/NACK 反馈相关的命令字段为：

下行分配指示 DAI 命令字段和 ACK 资源指示 ARI 命令字段；或者，

发射功率控制 TPC 命令字段和 ARI 命令字段；或者，

TPC 命令字段和 DAI 命令字段；或者，

TPC 命令字段和 DAI 命令字段及 ARI 命令字段。

10、根据权利要求 9 所述的方法，其特征在于，在所述至少两种 ACK/NACK 反馈相关的命令字段为：TPC 命令字段和 DAI 命令字段；或者 TPC 命令字段和 DAI 命令字段以及 ARI 命令字段，且 ACK/NACK 信息的反馈模式为绑定反馈模式时，

所述方法进一步包括：确定分配的第一 ACK/NACK 信道；

所述根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，包括：在正确接收到第一 DCI 时，通过所述

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第一 ACK/NACK 信道，根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关命令字段反馈 ACK/NACK 信息，所述第一 DCI 为公共字段被配置为 DAI 命令字段的 DCI;

其中所述第一 ACK/NACK 信道专用于在正确接收到第一 DCI 时反馈 ACK/NACK 信息。

11、根据权利要求 10 所述的方法，其特征在于，

所述方法进一步包括：确定分配的第二 ACK/NACK 信道;

所述根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，包括：在未正确接收到第一 DCI 时，通过所述第二 ACK/NACK 信道，根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息;

其中所述第二 ACK/NACK 信道专用于在未正确接收到第一 DCI 时反馈 ACK/NACK 信息。

12、根据权利要求 10 或 11 所述的方法，其特征在于，

所述确定第一 ACK/NACK 信道，包括：根据隐式规则确定第一 ACK/NACK 信道，或者，根据高层信令确定第一 ACK/NACK 信道;

和/或，所述确定第二 ACK/NACK 信道，包括：根据隐式规则确定第二 ACK/NACK 信道，或者，根据高层信令确定第二 ACK/NACK 信道。

13、一种基站，其特征在于，包括:

配置模块，用于将下行控制信息 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种确认应答/否认应答 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段;

发送模块，用于将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

14、根据权利要求 13 所述的基站，其特征在于，还包括:

设置模块，用于在所述 DCI 中设置所述公共字段。

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15、根据权利要求 13 或 14 所述的基站，其特征在于，所述公共字段能够被配置成下行分配指示 DAI 命令字段和 ACK 资源指示 ARI 命令字段；

所述配置模块包括第一单元或第二单元；

所述第一单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将所有公共字段中至少一个配置成 DAI 命令字段；

所述第二单元用于当 ACK/NACK 信息的反馈模式为复用反馈模式时，将所有公共字段中至少一个配置成 ARI 命令字段。

16、根据权利要求 13 或 14 所述的基站，其特征在于，所述公共字段能够被配置成发射功率控制 TPC 命令字段和 ARI 命令字段；

所述配置模块包括第三单元和第四单元；

所述第三单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；

所述第四单元用于将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

17、根据权利要求 13 或 14 所述的基站，其特征在于，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段；

所述配置模块包括第五单元和第六单元；

所述第五单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；

所述第六单元用于将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段。

18、根据权利要求 13 或 14 所述的基站，其特征在于，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段及 ARI 命令字段；

所述配置模块包括第七单元和第八单元；

所述第七单元用于将系统关联下行成员载波传输的至少一个 DCI 信息中的公共字段配置成 TPC 命令字段；

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所述第八单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段；或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

19、一种用户设备，其特征在于，包括：

接收模块，用于接收基站发送的下行成员载波传输的下行控制信息 DCI；

反馈模块，用于根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，所述公共字段能够被配置成至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段。

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说　明　书

载波聚合时反馈 ACK/NACK 信息的方法、基站和用户设备

技术领域

本发明涉及移动通信技术，尤其涉及一种载波聚合时反馈 ACK/NACK 信息的方法、基站和用户设备。

背景技术

混合自动重传请求（Hybrid Automatic Repeat Request，HARQ）技术中，数据接收方需要向数据发送方反馈确认应答/否认应答（Acknowledgement/Negative-acknowledgement，ACK/NACK）信息，以帮助确认数据是否正确接收。在第三代合作伙伴计划（3rd Generation Partnership Project，3GPP）演进全球地面无线接入（Evolved Universal Terrestrial Radio Access，E-UTRA）系统的上行链路方向，用户设备通过物理上行控制信道（Physical Uplink Control Channel，PUCCH）信道向基站反馈下行数据接收的 ACK/NACK 信息。3GPP E-UTRA 系统也称为长期演进（Long Term Evolution，LTE）系统。在下面描述中，将用于用户设备向基站反馈下行数据接收的 ACK/NACK 信息的 PUCCH 信道称为上行 ACK 信道。

在 LTE 系统中，ACK/NACK 信息的反馈可以通过下行控制信息（Downlink Control Information，DCI）进行控制。DCI 用于指示 PDSCH 传输的调度信息，DCI 在与其指示的物理下行共享信道（Physical Downlink Shared Channel，PDSCH）对应的物理下行控制信道（Physical Downlink Control Channel，PDCCH）上传输，其中包含发射功率控制（Transmission Power Control，TPC）命令字段，TPC 命令字段用于调整上行 ACK 信道发送 ACK/NACK 信息时的发射功率，TPC 命令字段通常

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为 2 比特。特别地，在 LTE 时分双工（Time Division Duplex，TDD）系统中，一个用户设备在一个上行子帧中可以反馈多个下行子帧 PDSCH 数据传输对应的 ACK/NACK 信息。具体地，LTE TDD 系统支持两种 ACK/NACK 信息反馈模式，分别是复用反馈模式（ACK/NACK Multiplexing Mode）和绑定反馈模式（ACK/NACK Bundling Mode）。在复用反馈模式中，与每个 PDSCH 数据传输对应的上行 ACK/NACK 信息独立反馈给基站；在绑定反馈模式中，将与多个 PDSCH 数据传输对应的上行 ACK/NACK 信息通过逻辑与操作后一起反馈给基站。为了支持绑定反馈模式，在 DCI 中引入了 2 比特的下行分配指示（Downlink Assignment Index，DAI）命令字段，用于指示携带 DCI 的 PDCCH 的数目。

在 LTE 系统的进一步演进和增强（LTE-Advanced，LTE-A）系统中，载波聚合技术被选择用来支持更宽的带宽，以满足国际电信联盟对于第四代通信技术的峰值数据速率要求。载波聚合技术中，两个或更多的成员载波的频谱被聚合在一起以得到更宽传输带宽，每个成员载波有独立的 HARQ 过程。LTE-A 用户设备可以配置不同的上行和下行成员载波数目。当 LTE-A 用户设备同时接入多个下行成员载波时，每个下行成员载波 PDSCH 上的数据传输，都要在上行 ACK 信道反馈对应的 ACK/NACK 信息。当多个下行成员载波数据传输对应的 ACK/NACK 信息需要在同一个上行成员载波中反馈时，需要解决在相同上行成员载波中反馈多个下行成员载波数据传输对应的 ACK/NACK 信息的问题。

参照 LTE TDD 系统，在 LTE-A 系统中，当一个用户设备被配置在多个下行成员载波接收数据时，对多个下行成员载波数据传输对应的上行 ACK/NACK 信息反馈，也可以采用复用反馈模式或者绑定反馈模式。同样可以采用 DCI 信息进行 ACK/NACK 信息反馈的控制。例如，用 TPC 命令字段控制上行成员载波的发射功率；用 DAI 命令字段来支持绑定反馈模式。

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特别地，在载波聚合的 LTE-A 系统中，考虑到同时在多个下行成员载波上调度的用户数目较少，对这些用户设备，其上行 ACK 信道分配可以采用基站通过显示信令通知的方式，一种方式是基站通过高层信令直接通知分配的上行 ACK 信道资源。为了增加不同用户设备对上行 ACK 信道的统计复用概率，另一种方式是基站通过高层信令为用户设备分配一组上行 ACK 信道资源，同时在 PDCCH 携带的 DCI 信息中增加 ACK 资源指示（ACK Resource Indication，ARI）命令字段，用于进一步指示当前使用高层分配的一组上行 ACK 信道资源中的哪一个。ARI 命令字段在 LTE 系统中不存在，需要在 LTE-A 系统中额外引入，比特数取决于高层分配的上行 ACK 信道资源个数，通常认为 2 比特就足够了。

在载波聚合的 LTE-A 系统，为了解决相同上行成员载波中反馈多个下行成员载波数据传输对应的 ACK/NACK 信息的问题，可能需要在 LTE 系统的 DCI 的基础上进一步引入 DAI 命令字段和/或 ARI 命令字段，为此需要提供一个与 LTE 系统后向兼容的反馈 ACK/NACK 信息的方案。

发明内容

本发明实施例是提供一种载波聚合时反馈 ACK/NACK 信息的方法、基站和用户设备，实现载波聚合下的 ACK/NACK 信息反馈与 LTE 系统的后向兼容。

本发明实施例提供了一种载波聚合时反馈确认应答/否认应答 ACK/NACK 信息的方法，包括:

将下行控制信息 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段;

将所述DCI发送给用户设备，以便所述用户设备根据所述DCI反馈ACK/NACK信息。

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本发明实施例还提供了一种载波聚合时反馈确认应答/否认应答ACK/NACK信息的方法，包括：

接收基站发送的下行成员载波传输的下行控制信息 DCI;

根据所述DCI预设的公共字段中配置的ACK/NACK反馈相关的命令字段反馈ACK/NACK信息，所述公共字段能够被配置成至少两种ACK/NACK反馈相关的命令字段。

本发明实施例提供了一种基站，包括：

配置模块，用于将下行控制信息 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种确认应答/否认应答 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段;

发送模块，用于将所述DCI发送给用户设备，以便所述用户设备根据所述DCI反馈ACK/NACK信息。

本发明实施例提供了一种用户设备，包括：

接收模块，用于接收基站发送的下行成员载波传输的下行控制信息 DCI;

反馈模块，用于根据所述DCI预设的公共字段中配置的ACK/NACK反馈相关的命令字段反馈ACK/NACK信息，所述公共字段能够被配置成至少两种ACK/NACK反馈相关的命令字段。

由上述技术方案可知，本发明实施例通过在 DCI 中预设能够被配置成至少两种的 ACK/NACK 反馈相关的命令字段的公共字段，可以通过将该公共字段配置成不同的命令字段，使之为 LTE-A 载波聚合时所需的不同的 ACK/NACK 反馈相关的命令字段，实现载波聚合下的 ACK/NACK 信息反馈与 LTE 系统的后向兼容。

附图说明

为了更清楚地说明本发明实施例中的技术方案，下面将对实施例描述中所需要使用的附图作一简单地介绍，显而易见地，下面描述中的附图是本发

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明的一些实施例，对于本领域普通技术人员来讲，在不付出创造性劳动性的前提下，还可以根据这些附图获得其他的附图。

图 1 为本发明第一实施例的方法流程示意图；

图 2 为本发明实施例中系统关联下行成员载波的组成示意图；

图 3 为本发明实施例采用的上下行成员载波的示意图；

图 4 为本发明第二实施例的方法流程示意图；

图 5 为本发明第三实施例的方法流程示意图；

图 5a 为本发明第三实施例的方法流程示意图；

图 6 为本发明第四实施例的方法流程示意图；

图 7 为本发明第五实施例的方法流程示意图；

图 8 为本发明第六实施例的基站的结构示意图；

图 9 为本发明第七实施例的用户设备的结构示意图。

具体实施方式

为使本发明实施例的目的、技术方案和优点更加清楚，下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述，显然，所描述的实施例是本发明一部分实施例，而不是全部的实施例。基于本发明中的实施例，本领域普通技术人员在没有作出创造性劳动前提下所获得的所有其他实施例，都属于本发明保护的范围。

图 1 为本发明第一实施例的方法流程示意图，包括：

步骤 11：基站将 DCI 预设的公共字段配置为，所述公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段。

其中，所述至少两种 ACK/NACK 反馈相关的命令字段至少包含 DAI 命令字段和/或 ARI 命令字段。此外，还可以包含 TPC 命令字段，或者 DCI 中会有的其余的命令字段，例如，载波指示命令字段、冗余版本命令字段等。

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在不同的场景下，该公共字段可以被配置成不同的命令字段。其中，不同的场景可以是反馈模式的不同，例如，当 ACK/NACK 信息的反馈模式为绑定反馈模式时，该公共字段被配置成 DAI 命令字段，当 ACK/NACK 信息的反馈模式为复用反馈模式时，该公共字段被配置成 ARI 命令字段。不同的场景也可以是不同类型的下行成员载波，例如，在系统关联下行成员载波传输的 DCI 中的公共字段被配置成 TPC 命令字段，在非系统关联下行成员载波传输的 DCI 中的公共字段被配置成 ARI 命令字段和/或 DAI 命令字段。系统关联下行成员载波及非系统关联下行成员载波的具体定义可以参见下述描述。

具体地，在某一时刻，每个下行成员载波传输的 DCI 中的公共字段被分别配置成具体的一种命令字段。其中，每个下行成员载波传输的公共字段可以被配置成相同的命令字段；也可以将系统关联下行成员载波传输的公共字段与非系统关联下行成员载波传输的公共字段分别配置成不同的命令字段。

步骤 12：基站将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

具体地，通过上述对公共字段的灵活配置，实现 DCI 中具有使用户设备可以进行 ACK/NACK 信息反馈的相关控制命令字段，因此，用户设备可以通过解析 DCI 获知相关的控制命令字段，实现载波聚合时的 ACK/NACK 信息的反馈。

进一步地，在步骤 11 之前还可以包括：基站在所述 DCI 中设置所述公共字段。实现公共字段的灵活配置。

本实施例通过在 DCI 中设置公共字段，在不同的场景下，该公共字段可以被配置成不同的命令字段，因此，可以在效果上使得该公共字段相当于其可以被配置成的命令字段的总和，实现用较少的比特数表明较多的命令字段，降低比特开销及设计和实现的复杂度，实现 LTE-A 系统的 DCI 信息的比特数尽量与 LTE 系统的一致，实现对 LTE 系统的兼容性，使得 LTE 系统的绝大

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部分设计都将在 LTE-A 系统中得到继承。

在载波聚合的 LTE-A 系统中，可能需要增加 ARI 命令字段；对 FDD 系统可能还需要增加 DAI 命令字段。如果将这些命令字段独立增加，以 ARI 命令字段和 DAI 命令字段均为 2 比特为例，则在 FDD 系统中 DCI 信息占用的比特数会增加 4 比特。这样既不利于与 LTE 系统的兼容，更会增加比特开销及设计实现复杂度，例如增加 DCI 信息占用的比特数会导致盲检测设计的复杂化。为此，本发明实施例中通过在 DCI 中设置公共字段，该公共字段表征的命令字段并不是固定配置的，根据场景不同，可以被配置成 DAI 命令字段或者 ARI 命令字段或者 TPC 命令字段或者其余的命令字段，实现一个字段具有多个命令字段的含义，实现用较少的字段表征所需的多个命令字段，以便降低比特开销及设计实现复杂度。

在具体实施例时，可以通过在 DCI 中增加比特的方式设置公共字段，例如，增加 2 比特的字段作为公共字段，根据场景的不同，该公共字段可以被配置成 DAI 命令字段或者 ARI 命令字段。与现有需要增加 DAI 命令字段及 ARI 命令字段的方式相比，本发明实施例中的这种方式可以减少比特占用，即本发明实施例只需增加 2 比特，而现有需要增加 4 比特。

虽然通过新增公共字段的方式相比现有技术具有一定的优势，但是，新增公共字段的方式还是会增加 DCI 的比特数。为了与现有技术的兼容，更优的方式则是充分利用 DCI 中已有的命令字段，在不增加 DCI 占用的比特数的基础上设置公共字段。

为了保持对 LTE 系统的兼容，LTE 系统 DCI 的命令字段将在 LTE-A 系统 DCI 信息中得到继承，例如 TPC 命令字段、调制编码方式命令字段、新数据指示命令字段和冗余版本命令字段等。此外，为了支持一些 LTE-A 特有的功能，对 LTE-A 用户设备会增加一些特有的命令字段，例如，用于支持 PDCCH 跨载波调度 PDSCH 传输的载波指示命令字段。

LTE-A 上述命令字段中的一个或者多个可以用来作为公共字段，例如，

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对支持 PDCCH 跨载波调度 PDSCH 的 LTE-A 用户设备，其 DCI 信息中存在 3 比特的载波指示命令字段；当该用户设备的聚合载波数较少时，3 比特的载波指示命令字段会有一些冗余比特或冗余状态，可以将这 3 比特作为公共字段，并利用冗余比特或冗余状态来同时传输载波指示命令字段和/或 ARI 命令字段和/或 DAI 命令字段。又例如，冗余版本命令字段用于在物理层 HARQ 过程中指示当前 PDSCH 传输的冗余版本的；可以将冗余版本命令字段对应的 2 比特作为公共字段，对 PDSCH 初传该公共字段用作 ARI 命令字段并使用一个预设的缺省冗余版本，对 PDSCH 重传该公共字段用作冗余版本命令字段且为重传分配与初传相同的上行 ACK 信道。但是，不论是基于已有的载波指示命令字段还是冗余版本命令字段来设计公共字段，都会带来较大的调度灵活性损失。

在实现本发明的过程中，发明人发现，对一个用户设备，对于配置在相同上行成员载波反馈 ACK/NACK 信息的下行成员载波上传输的 PDSCH，携带其调度信息的 DCI 中，在相同时刻具有相同的 TPC 命令字段。这是因为这些 TPC 命令字段都是对同一个上行成员载波的上行 ACK 信道的发射功率的控制。由于各 DCI 中包含的 TPC 命令字段是相同的，对于系统来讲，该 TPC 命令字段属于冗余的，可以充分利用 TPC 命令字段，将 TPC 命令字段设置为公共字段。根据是否为系统关联下行成员载波传输的 DCI 中的公共字段，可以把替换原有的 TPC 命令字段的公共字段配置成 TPC 命令字段、DAI 命令字段和/或 ARI 命令字段。

LTE 系统中，上行 ACK 信道可以通过携带 DCI 的 PDCCH 来隐式映射。在载波聚合 LTE-A 系统中，为了保持对只支持 LTE 早期版本的用户设备的兼容性，在一个上行成员载波，也会为一个或多个下行成员载波传输的 PDCCH 预留用作隐式映射的上行 ACK 信道资源。为了描述方便，如果在一个上行成员载波为某个下行成员载波预留了通过 PDCCH 隐式映射的上行 ACK 信道资源，称下行成员载波为上行成员载波的“系统关联下行成员载

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波”。图 2 为本发明实施例中系统关联下行成员载波的组成示意图，如图 2 所示，载波聚合的 LTE-A 系统中有三个下行成员载波，分别为下行成员载波-1、下行成员载波-2 和下行成员载波-3 和两个上行成员载波，分别为上行成员载波-1、上行成员载波-2。在上行成员载波-1 为下行成员载波-1 预留了通过 PDCCH 隐式映射的上行 ACK 信道资源，在上行成员载波-2 为下行成员载波-2、下行成员载波-3 预留了通过 PDCCH 隐式映射的上行 ACK 信道资源，那么下行成员载波-1 是上行成员载波-1 的系统关联下行成员载波，下行成员载波-2、下行成员载波-3 是上行成员载波-2 的系统关联下行成员载波。载波聚合的 LTE-A 系统中，为了避免每个上行成员载波中通过 PDCCH 隐式映射预留的上行 ACK 信道资源开销过大，与其系统关联的下行成员载波数目可能较少。

在下面的实施例中，都是以一个用户设备的多个下行成员载波均被配置在同一个上行成员载波反馈 ACK/NACK 信息为例。当用户设备同时被配置在多个上行成员载波反馈 ACK/NACK 信息时，将在一个相同上行成员载波反馈 ACK/NACK 信息的下行成员载波看作一个下行成员载波组，对不同下行成员载波组分别按照本发明实施例所述方式来处理即可。

图 3 为本发明实施例采用的上下行成员载波的示意图，参见图 3，本发明实施例中，都假设配置了某一用户设备在下行成员载波-1、下行成员载波-2 和下行成员载波-3 上传输的 PDSCH 的 ACK/NACK 信息都在上行成员载波-2 上反馈，其中，PDSCH 用于数据传输，PDCCH 用于传输 PDSCH 的调度信息 DCI，PUCCH 为用于反馈 ACK/NACK 信息的上行 ACK 信道。并且下行成员载波-1、下行成员载波-2 和下行成员载波-3 中，只有下行成员载波-2 是上行成员载波-2 的系统关联下行成员载波。

图 4 为本发明第二实施例的方法流程示意图，本实施例以 TDD 系统为例。参见图 4，包括：

步骤 41：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 ARI

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命令字段和 DAI 命令字段。

对于非系统关联下行成员载波需要采用 ARI 命令字段指示分配的 ACK 信道资源。当在 DCI 中增加 ARI 命令字段后，无疑会增加 DCI 的比特数，这样会造成比特开销的增加及不能与 LTE 系统的兼容。为降低比特开销以更好的与 LTE 系统兼容，本实施例基于现有 DCI 中已有的 DAI 命令字段来设计公共字段，以便该公共字段可以被设置成 DAI 命令字段或者 ARI 命令字段。

由于 LTE TDD 系统可以支持 ACK/NACK 信息的绑定反馈模式，因此，TDD 系统的 DCI 中包含 DAI 命令字段。为了与 LTE 系统兼容，载波聚合 LTE-A TDD 系统中可以利用该已有的 DAI 命令字段，将该 DAI 命令字段设置为公共字段，不仅可以表征 DAI 命令字段，也可以表征 ARI 命令字段。这样就可以在 DCI 中需要包含 ARI 命令字段时，无需在 DCI 中新增字段。当然，对于 FDD 系统，可以通过新增 2 比特的方式设置公共字段来表征 DAI 命令字段或 ARI 命令字段，相比于将 DAI 命令字段及 ARI 命令字段均独立设置时需要的 4 比特相比，同样可以降低比特开销。

步骤 42：当采用绑定反馈模式时，基站将所有下行成员载波传输的 DCI 中的公共字段中的至少一个配置为 DAI 命令字段；当采用复用反馈模式时，基站将所有下行成员载波传输的 DCI 中的公共字段中的至少一个配置为 ARI 命令字段。

具体而言，对于所有下行成员载波，可以是仅有主下行成员载波传输的 DCI 中的公共字段配置为 DAI 命令字段或者 ARI 命令字段，也可以是其他一个或者多个下行成员载波传输的 DCI 中的公共字段配置为 DAI 命令字段或者 ARI 命令字段，也即包含有配置为 DAI 命令字段或者 ARI 命令字段的公共字段的 DCI 可以在一个或者多个下行成员载波上传输，其中该一个下行成员载波可以是主成员载波也可以是非主成员载波。

具体而言，对于一个下行成员载波可以传输一个 DCI，也可以传输多个 DCI。在该下行成员载波仅传输一个 DCI 时，将该 DCI 中的公共字段配置为

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DAI 命令字段或者 ARI 命令字段。在该下行成员载波传输多个 DCI 时，将该多个 DCI 中的一个或者多个 DCI 的公共字段配置为 DAI 命令字段或者 ARI 命令字段。

具体而言，DCI 中可以配置一个或者多个公共字段。

若为了设计简便，当采用绑定反馈模式时，基站可以将所有下行成员载波传输的 DCI 中的公共字段，均配置为 DAI 命令字段；当采用复用反馈模式时，基站可以将所有下行成员载波传输的 DCI 中的公共字段，均配置为 ARI 命令字段。

以图 3 为例，将与下行成员载波-1、下行成员载波-2 和下行成员载波-3 对应的 DCI 中的公共字段，在处于绑定反馈模式时，均设置为 DAI 命令字段，在处于复用反馈模式时，均设置为 ARI 命令字段。其中，上行 ACK/NACK 信息反馈模式可以是小区特定的，即小区中所有用户设备采用相同的上行 ACK/NACK 信息反馈模式；也可以是用户设备特定的，即不同用户设备可以采用不同的上行 ACK/NACK 信息反馈模式。

或者，当采用绑定反馈模式时，基站例如将下行 PCC（Primary Component Carrier，主成员载波）传输的至少一个 DCI 中的公共字段和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段，配置为 DAI 命令字段；当采用复用反馈模式时，基站例如将下行 PCC 传输的至少一个 DCI 中的公共字段和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段，配置为 ARI 命令字段。

对一个处于载波聚合模式的用户设备，可以定义一个下行 PCC 和一个上行 PCC。下行 PCC 可以用于用户设备的无线链路失效监测和系统消息更新，并且配置后不能被去激活。上行 PCC 可以用于用户设备反馈上行控制信息。以图 3 为例，可以将下行成员载波-2 和上行成员载波-2 分别定义为用户设备的下行 PCC 和上行 PCC。

当采用绑定反馈模式时，如果 DAI 命令字段用于指示当前时刻用于携带

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DCI 的 PDCCH 的总数，基站可以只将下行 PCC 传输的部分 DCI 中的公共字段和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段，配置为 DAI 命令字段，其余 DCI 中的公共字段可以配置为一个预设的缺省值或者用作其它目的。当采用复用反馈模式时，一种 ACK/NACK 信息反馈方式是对每个下行成员载波的 PDSCH 传输，分别分配不同的上行 ACK 信道、例如 PUCCH 格式 1a/1b 信道，通过预设方式在选择出来的上行 ACK 信道反馈 ACK/NACK 信息，为描述方便，称为信道选择方式；另一种 ACK/NACK 信息反馈方式是对所有下行成员载波的 PDSCH 传输，分配共同的上行 ACK 信道、例如 PUCCH 格式 2/2a/2b 信道或者新格式 PUCCH 信道，将 ACK/NACK 信息联合编码后在分配的上行 ACK 信道反馈，为描述方便，称为联合编码方式。当 ACK/NACK 信息反馈采用联合编码方式时，由于为所有下行成员载波的 PDSCH 传输分配了共同的上行 ACK 信道，基站可以只将下行 PCC 传输的部分 DCI 中的公共字段和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段，配置为 ARI 命令字段，其余 DCI 中的公共字段可以配置为一个预设的缺省值或者用作其它目的。

步骤 43：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

本实施例通过基于现有的 DAI 命令字段来设计公共字段，该公共字段可以被配置成 DAI 命令字段或者 ARI 命令字段，实现用已有的只能表征一个信息的命令字段表征两个信息，无需新增命令字段，降低比特开销及设计实现复杂度。

图 5 为本发明第三实施例的方法流程示意图，本实施例以 TDD 或者 FDD 系统为例。参见图 5，包括：

步骤 51：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 TPC 命令字段和 ARI 命令字段。

由于 TPC 命令字段是用于控制功率发射的，不论在 TDD 系统还是 FDD

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系统中均会有该 TPC 命令字段。为了与 LTE 系统兼容，载波聚合 LTE-A 系统中可以利用该已有的 TPC 命令字段，将该 TPC 命令字段设置为公共字段，不仅可以表征 TPC 命令字段，也可以表征 ARI 命令字段。这样就可以在 DCI 中需要包含 ARI 命令字段时，无需在 DCI 中新增字段。

步骤 52：基站将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

具体地，对一个用户设备，当配置了 N_{DL} 个下行成员载波传输的 PDSCH 对应的 ACK/NACK 信息在一个上行成员载波上反馈时，在上行成员载波的系统关联下行成员载波上可能同时传输 n 个 PDCCH，其中 $1 \le n \le N_{DL}$，且这 n 个 PDCCH 分别携带了调度 n 个下行成员载波 PDSCH 传输的 DCI 信息。n 取值大于 1 的情况可能是由于以下两种因素导致：N_{DL} 个下行成员载波中有该上行成员载波的至少两个系统关联下行成员载波，PDCCH 跨载波调度其他载波的 PDSCH 传输。在这 n 个 PDCCH 携带的 DCI 信息中，分别各有一个公共字段。

在步骤 52 中，基站将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，其中系统关联下行成员载波传输的至少一个 DCI 具体可以是，与下行 PCC 的 PDSCH 传输对应的 DCI 和/或下行 PCC 传输的至少一个 DCI。

在步骤 52 中，基站将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段，其中将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段具体可以为，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段，例如当 ACK/NACK 信息反馈采用信道选择方式或联合编码方式时；或者将非系统关联下行成员载波传输的一个预先指定的 DCI 中的公共字段配置成 ARI 命令字段，例如当 ACK/NACK 信息反馈采用联合编码方式时，一个预先指定的 DCI

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具体可以是与激活的下行成员载波中非下行 PCC 的 PDSCH 传输对应的第一个或最后一个在非系统关联下行成员载波传输的 DCI。在本步骤中，非系统关联下行成员载波传输的至少一个 DCI，可以是非系统关联下行成员载波中的一个载波上传输的一个或者多个 DCI，也可以是多个载波上传输的一个或者多个 DCI。

以图 3 为例，将与下行成员载波-2 对应的 DCI 中的公共字段，配置成 TPC 命令字段；将与下行成员载波-1 和下行成员载波-3 对应的 DCI 中的公共字段，均设置为 ARI 命令字段；或者将与下行成员载波-2 对应的 DCI 中的公共字段配置成 TPC 命令字段，并将预先指定的 DCI 中的公共字段配置成 ARI 命令字段，其中与下行成员载波-3 对应的 DCI 为预先制定的 DCI。

步骤 53：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

本实施例中，基站为用户设备分配 ACK 信道资源可以采用如下方式：在一个上行成员载波中，为其系统关联下行成员载波上传输的 PDCCH 分别预留了用做隐式映射的上行 ACK 信道资源。因而，对于在系统关联下行成员载波上发送相应 PDCCH 的 PDSCH 传输，对应分配的上行 ACK 信道资源可以通过相应 PDCCH 来隐式映射获取；对于在非系统关联下行成员载波上发送相应 PDCCH 的 PDSCH 传输，对应分配的上行 ACK 信道无法通过相应 PDCCH 来隐式映射获取，可以通过显示信令通知的方式获取。此时，对每个下行成员载波的 PDSCH 传输，如果其相应的 PDCCH 可以在非系统关联下行成员载波上发送，基站就通过高层信令为其分配一组上行 ACK 信道资源。通过高层信令所分配的上行 ACK 信道资源组，对不同成员载波的 PDSCH 传输可以不同、也可以相同。对于在系统关联下行成员载波上发送的 PDCCH，其携带的 DCI 信息公共字段可以全部配置成 TPC 命令字段；对于在非系统关联下行成员载波上发送的 PDCCH，其携带的公共字段可以全部配置成 ARI 命令字段。

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此外，如附图 5a 所示，本实施例还可以包括：

步骤 51：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 TPC 命令字段和 ARI 命令字段。

步骤 54：基站将下行 PCC 传输的至少一个 DCI 和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段，配置成 ARI 命令字段；将剩余 DCI 中的公共字段中的至少一个配置成 TPC 命令字段。

具体地，当 ACK/NACK 信息反馈采用联合编码方式时，由于为所有下行成员载波 PDSCH 传输分配了共同的上行 ACK 信道，基站可以只将下行 PCC 传输的至少一个 DCI 中的公共字段和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段，配置为 ARI 命令字段；将剩余 DCI 中的公共字段中的至少一个配置为 TPC 命令字段；其余 DCI 中的公共字段可以配置为一个预设的缺省值或者用作其它目的。

以图 3 为例，下行成员载波-2 是下行 PCC，下行成员载波-3 是非下行 PCC，此时可以将与下行成员载波-2 对应的 DCI 中的公共字段配置成 ARI 命令字段，将与下行成员载波-3 对应的 DCI 中的公共字段配置成 TPC 命令字，将与下行成员载波-1 对应的 DCI 中的公共字段配置为预设的缺省值。

步骤 53：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

也即本实施例以及第四、第五实施例中，均可以将系统关联下行成员载波（例如下行主成员载波）传输的至少一个 DCI 中的公共字段配置为 DAI 和/或 ARI 命令字段，而将非系统关联下行成员载波（例如下行非主成员载波）传输的至少一个 DCI 中的公共字段配置为 TPC 命令字段。其他情况下，可以参照适用。

本实施例通过基于现有的 TPC 命令字段来设计公共字段，该公共字段可以被配置成 TPC 命令字段或者 ARI 命令字段，实现用已有的只能表征一个信息的命令字段表征两个信息，无需新增命令字段，降低比特开销及设计实现

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复杂度。

图 6 为本发明第四实施例的方法流程示意图，本实施例以 FDD 系统为例。参见图 6，包括：

步骤 61：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段。

步骤 62：基站将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段。

所述系统关联下行成员载波传输的至少一个 DCI 具体可以是，与下行 PCC 的 PDSCH 传输对应的 DCI 和/或下行 PCC 传输的至少一个 DCI。所述将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段具体例如可以是，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段；或者将非系统关联下行成员载波传输的一个预先指定的 DCI 中的公共字段配置成 DAI 命令字段。一个预先指定的 DCI 具体例如可以是与激活的下行成员载波中非下行 PCC 的 PDSCH 传输对应的第一个或最后一个在非系统关联下行成员载波传输的 DCI。

具体地，对一个用户设备，当配置了 N_{DL} 个下行成员载波传输的 PDSCH 对应的 ACK/NACK 信息在一个上行成员载波上反馈时，在上行成员载波的系统关联下行成员载波上可能同时传输 n 个 PDCCH，其中 $1 \le n \le N_{DL}$，且这 n 个 PDCCH 分别携带了调度 n 个下行成员载波 PDSCH 传输的 DCI 信息。n 取值大于 1 的情况可能是由于以下两种因素导致：N_{DL} 个下行成员载波中有该上行成员载波的至少两个系统关联下行成员载波，PDCCH 跨载波调度其他载波的 PDSCH 传输。在这 n 个 PDCCH 携带的 DCI 中，分别各有一个公共字段。

以图 3 为例，将下行成员载波-2 对应的 DCI 中的公共字段，配置成 TPC 命令字段，将下行成员载波-1 和下行成员载波-3 对应的 DCI 中的公共字段，均设置为 DAI 命令字段。

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步骤 63：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

本实施例中，基站为用户设备分配ACK信道资源可以采用如下方式：在一个上行成员载波中，为其系统关联下行成员载波上传输的PDCCH分别预留了用做隐式映射的上行ACK信道资源。因而，对于在系统关联下行成员载波上发送相应PDCCH的PDSCH传输，对应分配的上行ACK信道资源可以通过相应PDCCH来隐式映射获取。对于在系统关联下行成员载波上传输的n个PDCCH，其携带的公共字段可以都解释成TPC命令字段；也可以只从中选择一个PDCCH、例如第一个PDCCH或调度预先指定的系统关联下行成员载波PDSCH传输的PDCCH，其携带的公共命令字段能够配置成TPC命令字段，剩余$n-1$个PDCCH携带的公共字段则配置成DAI命令字段。

如前所述，DAI命令字段用于指示携带DCI的PDCCH的数目，主要是为上行ACK/NACK信息处于绑定反馈模式时使用的。对于绑定反馈模式，与多个PDSCH传输对应的上行ACK/NACK信息通过逻辑与操作一起反馈，只需要一个上行ACK信道分配即可。因而对于在非系统关联下行成员载波上发送相应PDCCH的PDSCH传输，可以不分配上行ACK信道资源，这时候只需要DAI命令字段用于指示当前时刻用于携带DCI的PDCCH的总数即可。以图3所示配置为例，假设调度每个下行成员载波PDSCH传输的相应PDCCH都在本载波发送，那么此时为用户设备通过在下行成员载波-2上发送的PDCCH隐式映射来分配上行ACK信道，为下行成员载波-1、下行成员载波-3上的PDSCH传输不分配上行ACK信道。如果用户设备成功接收了下行成员载波-2上发送的PDCCH，同时错误接收了下行成员载波-1、下行成员载波-3上发送的PDCCH，因为这时用户设备接收到的PDCCH中的公共命令字段不是DAI命令字段，无法发现有PDCCH丢失，造成上行ACK/NACK信息反馈的错误。配置绑定反馈模式的用户设备信道条件通常较差，因而可以强制PDCCH占用的控制信道单元资源数目总是大于一个，这一点可以通过在系统关联下行成员载波总是发

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送大于一个PDCCH、或者系统关联下行成员载波发送的PDCCH占用大于一个控制信道单元的资源来保证。在从PDCCH隐式映射上行ACK信道的过程中，每个控制信道单元都能够映射出一个上行ACK信道。在PDCCH占用的控制信道单元资源数目大于一个时，通过在系统关联下行成员载波发送的PDCCH能够隐式映射出的上行ACK信道数目也大于一个。这时可以从中选择出两个上行ACK信道、例如PDCCH占用的前面两个控制信道单元映射出的两个上行ACK信道，分别记为$ACK0$和$ACK1$。为了避免没有接收到含有能配置成DAI命令字段的公共字段的PDCCH时可能造成的上行ACK/NACK信息反馈错误，可以在成功接收到的PDCCH中的公共命令字段都不能配置成DAI命令字段时选择$ACK0$来反馈上行ACK/NACK信息，在成功接收到的PDCCH中有公共命令字段配置成DAI命令字段时选择$ACK1$来反馈上行ACK/NACK信息。

但是，对于配置绑定模式的用户设备，强制 PDCCH 占用的控制信道单元资源数目总是大于一个可能造成不必要的 PDCCH 资源浪费。对于在非系统关联下行成员载波上发送相应 PDCCH 的 PDSCH 传输，可以通过显示信令通知的方式分配上行 ACK 信道资源。此时可以直接通过高层信令对一个用户设备分配一个上行 ACK 信道资源；或者通过高层信令分配一组上行 ACK 信道资源，在用户设备处于绑定反馈模式时从中选出一个缺省的上行 ACK 信道资源、例如第一个上行 ACK 信道资源。当通过高层信令分配一组上行 ACK 信道资源时，可以采用与复用反馈模式下通过高层信令分配一组上行 ACK 信道资源的方式，以保持一个简单的系统设计。此外，在从一组配置的上行 ACK 信道资源中选出一个缺省的上行 ACK 信道资源时，不同的用户设备可以选择不同的缺省上行 ACK 信道，例如 UE-1 在绑定反馈模式时缺省选择高层信令配置的第一个上行 ACK 信道资源、UE-2 在绑定反馈模式时缺省选择高层信令配置的最后一个上行 ACK 信道资源。记隐式分配的上行 ACK 信道为ACK_{imp}，显示分配的上行 ACK 信道为ACK_{exp}。为了避免没有接收到含有能配置成 DAI 命令字段的公共字段的 PDCCH 时可能造成的上行 ACK/NACK 信

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息反馈错误，可以在成功接收到的 PDCCH 中的公共命令字段都不能配置成 DAI 命令字段时选择 ACK_{imp} 来反馈上行 ACK/NACK 信息，在成功接收到的 PDCCH 中有公共命令字段配置成 DAI 命令字段时选择 ACK_{exp} 来反馈上行 ACK/NACK 信息。

本实施例中，公共字段可以被配置为：TPC 命令字段和 DAI 命令字段，UE 可以确定分配的第一 ACK/NACK 信道；并在正确接收到第一 DCI 时，通过确定的第一 ACK/NACK 信道反馈 ACK/NACK 信息，其中第一 DCI 为公共字段被配置为 DAI 命令字段的 DCI，且第一 ACK/NACK 信道专用于在正确接收到第一 DCI 时反馈 ACK/NACK 信息。该第一 ACK/NACK 信道可以是隐式规则确定的，也可以是高层信令通知的。其中根据高层信令通知确定第一 ACK/NACK 信道时，可以是高层信令通知一组 ACK/NACK 信道，用户设备从中选择一个或者多个；也可以是用户设备使用高层信令通知的所有 ACK/NACK 信道。

本实施例中，公共字段可以被配置为：TPC 命令字段和 DAI 命令字段，UE 可以确定分配的第二 ACK/NACK 信道；并在未正确接收到第一 DCI 时，通过确定的第二 ACK/NACK 信道反馈 ACK/NACK 信息，其中第二 ACK/NACK 信道专用于在未正确接收到第一 DCI 时反馈 ACK/NACK 信息。该第二 ACK/NACK 信道可以是隐式规则确定的，也可以是高层信令通知的。其中根据高层信令通知确定第二 ACK/NACK 信道时，可以是高层信令通知一组 ACK/NACK 信道，用户设备从中选择一个或者多个；也可以是用户设备使用高层信令通知的所有 ACK/NACK 信道。

本实施例通过基于现有的 TPC 命令字段来设计公共字段，该公共字段可以被配置成 TPC 命令字段或者 DAI 命令字段，实现用已有的只能表征一个信息的命令字段表征两个信息，无需新增命令字段，降低比特开销及设计实现复杂度。

图 7 为本发明第五实施例的方法流程示意图，本实施例以 FDD 系统为例。

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参见图 7，包括：

步骤 71：基站在 DCI 中设置公共字段，所述公共字段能够被配置成 TPC 命令字段、DAI 命令字段和 ARI 命令字段。

步骤 72：基站将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段；或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

所述系统关联下行成员载波传输的至少一个 DCI 具体可以是，与下行 PCC 的 PDSCH 传输对应的 DCI 和/或下行 PCC 传输的至少一个 DCI。当 ACK/NACK 信息的反馈模式为绑定反馈模式时，所述将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段具体例如可以是，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段；或者将非系统关联下行成员载波传输的一个预先指定的 DCI 中的公共字段配置成 DAI 命令字段。当 ACK/NACK 信息的反馈模式为复用反馈模式时，所述将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段具体例如可以是，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段；或者将非系统关联下行成员载波传输的一个预先指定的 DCI 中的公共字段配置成 ARI 命令字段。一个预先指定的 DCI 具体可以是与激活的下行成员载波中非下行 PCC 的 PDSCH 传输对应的第一个或最后一个在非系统关联下行成员载波传输的 DCI。

具体地，对一个用户设备，当配置了 N_{DL} 个下行成员载波传输的 PDSCH 对应的 ACK/NACK 信息在一个上行成员载波上反馈时，在上行成员载波的系统关联下行成员载波上可能同时传输 n 个 PDCCH，其中 $1 \le n \le N_{DL}$，且这 n 个 PDCCH 分别携带了调度 n 个下行成员载波 PDSCH 传输的 DCI 信息。n 取

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值大于 1 的情况可能是由于以下两种因素导致：N_{DL} 个下行成员载波中有该上行成员载波的至少两个系统关联下行成员载波，PDCCH 跨载波调度其他载波的 PDSCH 传输。在这 n 个 PDCCH 携带的 DCI 信息中，分别各有一个公共字段。

以图 3 为例，将下行成员载波-2 对应的公共字段，配置成 TPC 命令字段；在绑定反馈模式下，将下行成员载波-1 和下行成员载波-3 的公共字段均设置为 DAI 命令字段，在复用反馈模式下，将下行成员载波-1 和下行成员载波-3 的公共字段均设置为 ARI 命令字段。

步骤 73：基站将上述 DCI 发送给用户设备，以便用户设备根据该 DCI 反馈 ACK/NACK 信息。

本实施例中，基站为用户设备分配 ACK 信道资源可以采用如下方式：当 ACK/NACK 信息的反馈模式为复用反馈模式时，可以参见图 5 所示的实施例进行分配，当 ACK/NACK 信息的反馈模式为绑定反馈模式时，可以参见图 6 所示的实施例进行分配。

本实施例中，公共字段可以被配置为：TPC 命令字段和 DAI 命令字段以及 ARI 命令字段，当 ACK/NACK 信息的反馈模式为绑定反馈模式时，UE 可以确定分配的第一 ACK/NACK 信道；并在正确接收到第一 DCI 时，通过确定的第一 ACK/NACK 信道反馈 ACK/NACK 信息，其中第一 DCI 为公共字段被配置为 DAI 命令字段的 DCI，且第一 ACK/NACK 信道专用于在正确接收到第一 DCI 时反馈 ACK/NACK 信息。该第一 ACK/NACK 信道可以是隐式规则确定的，也可以是高层信令通知的。其中根据高层信令通知确定第一 ACK/NACK 信道时，可以是高层信令通知一组 ACK/NACK 信道，用户设备从中选择一个或者多个；也可以是用户设备使用高层信令通知的所有 ACK/NACK 信道。

本实施例中，公共字段可以被配置为：TPC 命令字段和 DAI 命令字段以及 ARI 命令字段，当 ACK/NACK 信息的反馈模式为绑定反馈模式时，UE 可

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以确定分配的第二 ACK/NACK 信道；并在未正确接收到第一 DCI 时，通过确定的第二 ACK/NACK 信道反馈 ACK/NACK 信息，其中第二 ACK/NACK 信道专用于在未正确接收到第一 DCI 时反馈 ACK/NACK 信息。该第二 ACK/NACK 信道可以是隐式规则确定的，也可以是高层信令通知的。其中根据高层信令通知确定第二 ACK/NACK 信道时，可以是高层信令通知一组 ACK/NACK 信道，用户设备从中选择一个或者多个；也可以是用户设备使用高层信令通知的所有 ACK/NACK 信道。

本实施例通过基于现有的 TPC 命令字段来设计公共字段，该公共字段可以被配置成 TPC 命令字段或者 DAI 命令字段或者 TPC 命令字段，实现用已有的只能表征一个信息的命令字段表征三个信息，无需新增命令字段，降低比特开销及设计实现复杂度。

注意，在本发明第一实施例到第五实施例中，对下行成员载波数据传输，根据 DCI 中的公共字段来控制对应 ACK/NACK 信息的反馈。对于在下行成员载波半静态调度的数据传输，初传没有 DCI 进行控制，对应 ACK/NACK 信息反馈可以重用 LTE 系统的机制，不属于本发明讨论范围。对于 LTE-A 系统，上行 ACK/NACK 信息反馈可能引入一些多天线技术，例如发射分集或者空分复用，这时候可能对一个下行成员载波数据传输需要分配两个或更多的上行 ACK 信道。以一个下行成员载波数据传输需要分配两个上行 ACK 信道为例，可以根据分配的第一个 ACK 信道加上一个固定的偏置得到分配的第二个 ACK 信道；或者，对于 PDCCH 隐式映射分配上行 ACK 信道的情况，通过每个 PDCCH 至少占用两个控制信道单元资源来实现，对于显示信令通知分配上行 ACK 信道的情况，可以高层信令直接配置一组上行 ACK 信道资源对，DCI 中的 ARI 命令字段指示当前具体分配的上行 ACK 信道资源对。这也不是本发明的关注点，在此不再赘述。

图 8 为本发明第六实施例的基站的结构示意图，包括配置模块 81 和发送模块 82，配置模块 81 用于将 DCI 预设的公共字段配置为，所述公共字段能

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够被配置成的至少两种 ACK/NACK 反馈相关的命令字段中的至少一种 ACK/NACK 反馈相关的命令字段；发送模块 82 用于将所述 DCI 发送给用户设备，以便所述用户设备根据所述 DCI 反馈 ACK/NACK 信息。

进一步地，本实施例还可以包括设置模块，所述设置模块用于在所述 DCI 中设置所述公共字段。

其中，可以是，所述公共字段能够被配置成 DAI 命令字段和 ARI 命令字段；此时，所述配置模块 81 包括第一单元或第二单元；所述第一单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将至少一个公共字段配置成 DAI 命令字段，例如，将所有公共字段均配置成 DAI 命令字段，或者至少将下行 PCC 传输的至少一个 DCI 中的公共字段和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段配置为 DAI 命令字段；所述第二单元用于当 ACK/NACK 信息的反馈模式为复用反馈模式时，将至少一个公共字段配置成 ARI 命令字段，例如，将所有公共字段均配置成 ARI 命令字段，或者至少将下行 PCC 传输的至少一个 DCI 中的公共字段和/或与下行 PCC 的 PDSCH 传输对应的 DCI 中的公共字段配置为 ARI 命令字段。

也可以是，所述公共字段能够被配置成 TPC 命令字段和 ARI 命令字段；此时，所述配置模块 81 包括第三单元和第四单元；所述第三单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，具体的例如，将与下行 PCC 的 PDSCH 传输对应的 DCI 和/或下行 PCC 传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第四单元用于将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段，具体的例如，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段，或者将非系统关联下行成员载波传输的一个预先指定的 DCI 中的公共字段配置成 ARI 命令字段。

或者所述第三单元用于将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第四单元用于将系统关联下行成员

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载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

也可以是，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段；此时，所述配置模块 81 包括第五单元和第六单元；所述第五单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，具体的例如，将与下行 PCC 的 PDSCH 传输对应的 DCI 和/或下行 PCC 传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第六单元用于将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段，具体的例如，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段，或者将非系统关联下行成员载波传输的一个预先指定的 DCI 中的公共字段配置成 DAI 命令字段。

或者所述第五单元用于将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第六单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段。

也可以是，所述公共字段能够被配置成 TPC 命令字段和 DAI 命令字段及 ARI 命令字段；此时，所述配置模块 81 包括第七单元和第八单元；所述第七单元用于将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段，具体的例如，将与下行 PCC 的 PDSCH 传输对应的 DCI 和/或下行 PCC 传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第八单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段，具体的例如，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 DAI 命令字段，或者将非系统关联下行成员载波传输的一个预先指定的 DCI 中的公共字段配置成 DAI 命令字段；或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段，具体的例如，将非系统关联下行成员载波传输的 DCI 中的公共字段均配置成 ARI 命令字段，或者将非系统关联下行成员载

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波传输的一个预先指定的 DCI 中的公共字段配置成 ARI 命令字段。

或者，所述第七单元用于将非系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 TPC 命令字段；所述第八单元用于当 ACK/NACK 信息的反馈模式为绑定反馈模式时，将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 DAI 命令字段，或者，当 ACK/NACK 信息的反馈模式为复用反馈模式时，将系统关联下行成员载波传输的至少一个 DCI 中的公共字段配置成 ARI 命令字段。

上述模块具体执行的功能可以参见方法实施例，不再赘述。本实施例提供的基站例如可以执行上述方法实施例提供的方法。

本实施例通过在 DCI 中设置公共字段，在不同的场景下，该公共字段可以被配置成不同的命令字段，因此，可以在效果上使得该公共字段相当于其可以被配置成的命令字段的总和，实现用较少的比特数表明较多的命令字段，降低比特开销及设计和实现的复杂度，实现 LTE-A 系统的 DCI 信息的比特数尽量与 LTE 系统的一致，实现对 LTE 系统的兼容性，使得 LTE 系统的绝大部分设计都将在 LTE-A 系统中得到继承。

图 9 为本发明第七实施例的用户设备的结构示意图，包括接收模块 91 和反馈模块 92，接收模块 91 用于接收基站发送的下行成员载波传输的 DCI；反馈模块 92 用于根据所述 DCI 预设的公共字段中配置的 ACK/NACK 反馈相关的命令字段反馈 ACK/NACK 信息，所述公共字段能够被配置成至少两种 ACK/NACK 反馈相关的命令字段。

其中，公共字段能够被配置成的至少两种 ACK/NACK 反馈相关的命令字段可以是： DAI 命令字段和 ARI 命令字段；或者， TPC 命令字段和 ARI 命令字段；或者，TPC 命令字段和 DAI 命令字段；或者，TPC 命令字段和 DAI 命令字段及 ARI 命令字段。

本实施例中，在公共字段可以配置为：TPC 命令字段和 DAI 命令字段、或者 TPC 命令字段和 DAI 命令字段以及 ARI 命令字段，且 ACK/NACK 信息

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的反馈模式为绑定反馈模式时，用户设备进一步还可以包括确定模块 93。确定模块 93 用于确定分配的第一 ACK/NACK 信道；并且反馈模块 92 具体用于在正确接收到第一 DCI 时，通过确定模块 93 确定的第一 ACK/NACK 信道反馈 ACK/NACK 信息。本实施例中，第一 DCI 为公共字段被配置为 DAI 命令字段的 DCI；第一 ACK/NACK 信道专用于在正确接收到第一 DCI 时反馈 ACK/NACK 信息。

本实施例中，确定模块 93 进一步还可以用于确定第二 ACK/NACK 信道。反馈模块 92 具体用于在未正确接收到第一 DCI 时，通过确定模块 93 确定的第二 ACK/NACK 信道反馈 ACK/NACK 信息。本实施例中，第二 ACK/NACK 信道专用于在未正确接收到第一 DCI 时反馈 ACK/NACK 信息。

上述模块具体执行的功能可以参见方法实施例，不再赘述。本实施例提供的用户设备例如可以执行上述方法实施例提供的方法。

本实施例通过在 DCI 中设置公共字段，在不同的场景下，该公共字段可以被配置成不同的命令字段，因此，可以在效果上使得该公共字段相当于其可以被配置成的命令字段的总和，实现用较少的比特数表明较多的命令字段，降低比特开销及设计和实现的复杂度，实现 LTE-A 系统的 DCI 信息的比特数尽量与 LTE 系统的一致，实现对 LTE 系统的兼容性，使得 LTE 系统的绝大部分设计都将在 LTE-A 系统中得到继承。

本领域普通技术人员可以理解：实现上述方法实施例的全部或部分步骤可以通过程序指令相关的硬件来完成，前述的程序可以存储于一计算机可读取存储介质中，该程序在执行时，执行包括上述方法实施例的步骤；而前述的存储介质包括：ROM、RAM、磁碟或者光盘等各种可以存储程序代码的介质。

可以理解的是，附图中或实施例中所示仅仅是示意性的，表示逻辑结构，其中所述作为分离部件显示的模块可能是或者可能不是物理上分开的，作为模块显示的部件可能是或者可能不是物理单元，即可以位于一个地方，或者

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分布到几个网络实体上。

最后应说明的是：以上实施例仅用以说明本发明的技术方案，而非对其限制；尽管参照前述实施例对本发明进行了详细的说明，本领域的普通技术人员应当理解：其依然可以对前述各实施例所记载的技术方案进行修改，或者对其中部分技术特征进行等同替换；而这些修改或者替换，并不使相应技术方案的本质脱离本发明各实施例技术方案的精神和范围。

Samsung Exhibit 1002, Page 141

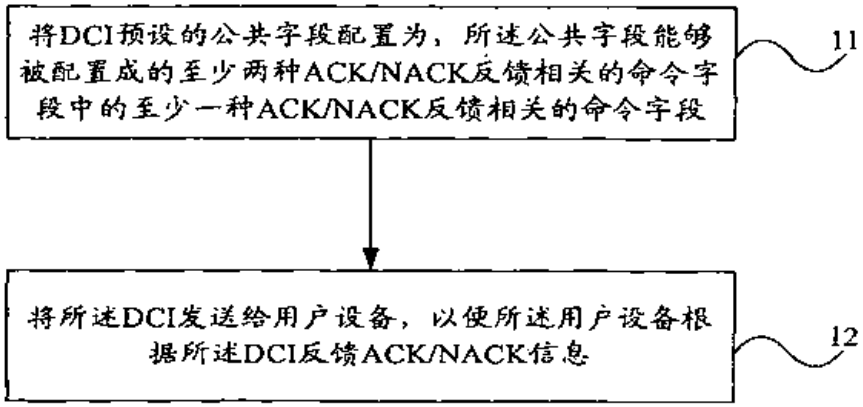


图 1

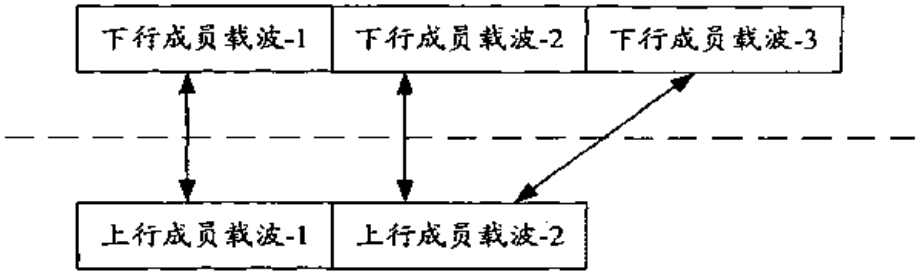


图 2

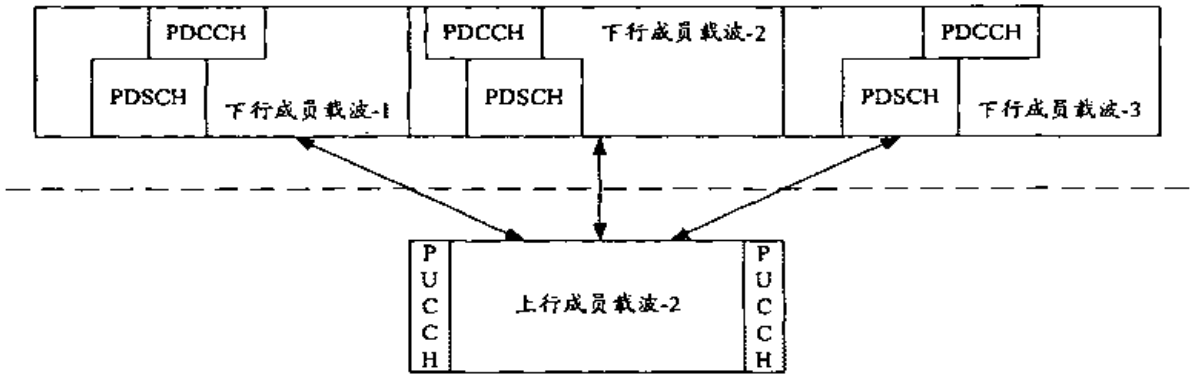


图 3

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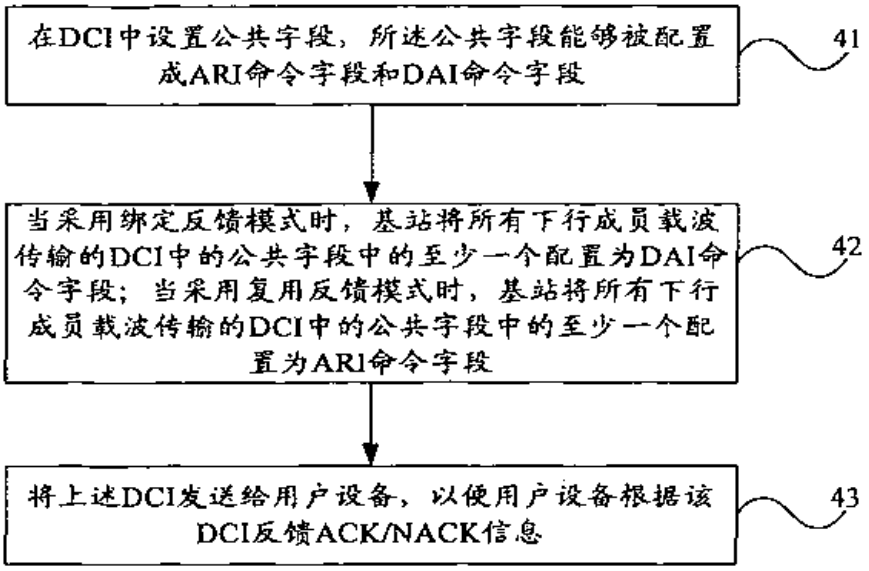


图 4

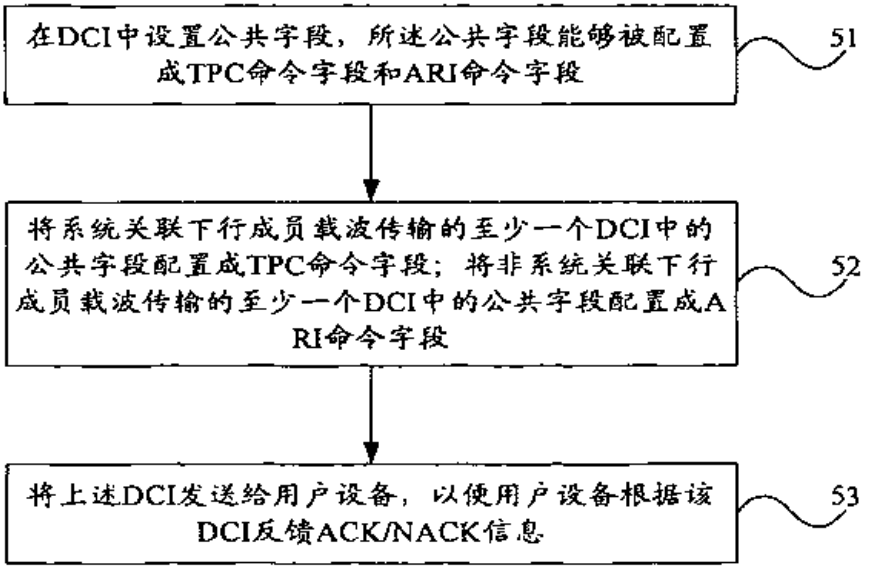


图 5

Samsung Exhibit 1002, Page 143

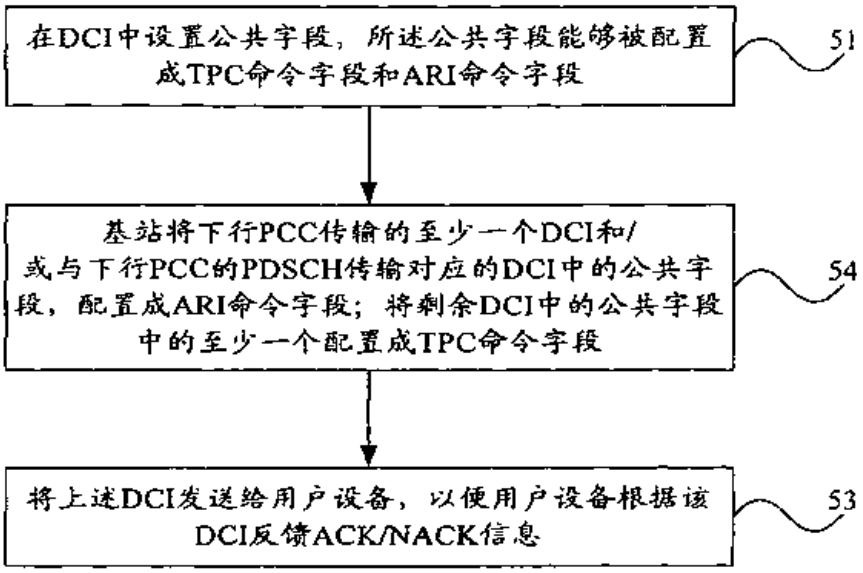


图 5a

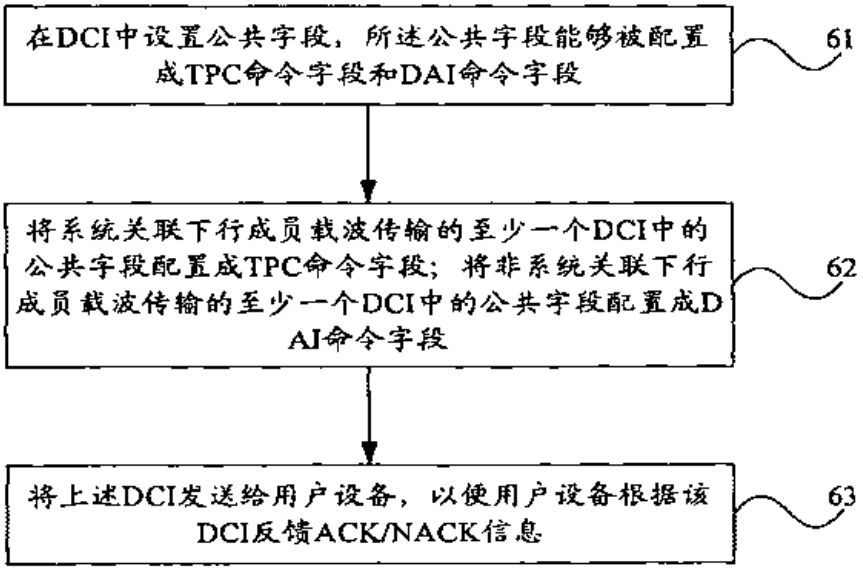


图 6

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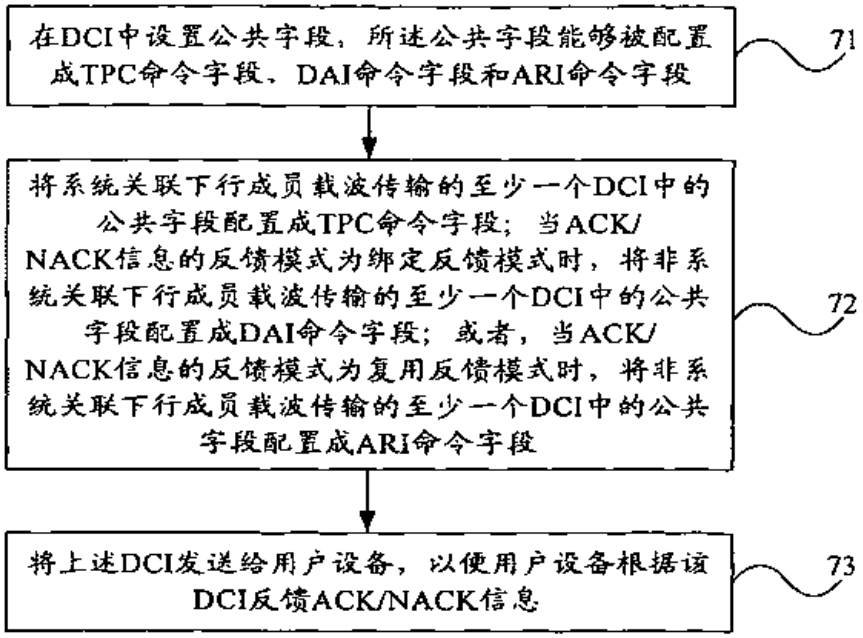


图 7

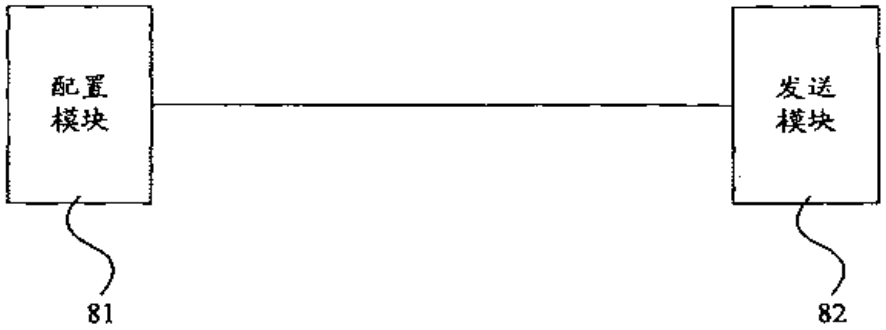


图 8

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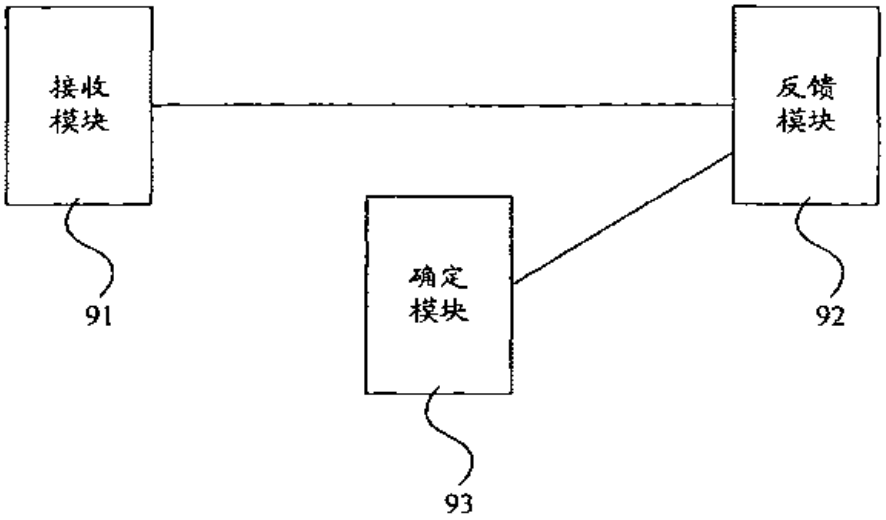


图 9

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OPAP
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PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Chen, *et al.*	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Art Unit:	2472
Filed:	June 2, 2012	Examiner:	TBD
For:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		

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Respectfully submitted,

Claudette Hoffmann
Legal Assistant

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Ste. 1000
Dallas, Texas 75252
Tel: 972-732-1001
Fax: 972-732-9218

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PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Chen, *et al.*	Docket No.:	HW 82713780US09
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TRANSMITTAL OF CERTIFIED COPY OF PRIORITY DOCUMENT

Dear Sir:

Attached please find a certified copy of the foreign application from which priority is claimed for this case:

Country: China
Application Number: 200910251390.9
Filing Date: December 3, 2009

Country: China
Application Number: 201010137731.2
Filing Date: March 24, 2010

Respectfully submitted,

8/14/2012
Date

Ira S. Matsil
Attorney for Applicant
Reg. No. 35,272

Slater & Matsil, L.L.P.
17950 Preston Road, Suite 1000
Dallas, Texas 75252
(972) 732-1001 - Tel
(972) 732-9218 - Fax

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09

CONFIRMATION NO. 5823

74365
Slater & Matsil, L.L.P.
17950 Preston Road, Suite 1000
Dallas, TX 75252

PUBLICATION NOTICE

OC000000056650703

Title: Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation

Publication No.US-2012-0236812-A1
Publication Date:09/20/2012

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The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 2

Complete if Known	
Application Number	13/487,172
Filing Date	June 2, 2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	TBD
Attorney Docket Number	HW 82713780US09

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM DD YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US 7,570,970 B2	08-04-2009	Duan, et al.	
	2	US 2012/0155316 A1	06-21-2012	Li, et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[6]
	3	CN 101594211 A	12-02-2009	ZTE Corp		
	4	CN 101998509 A	03-30-2011	Huawei Tech Co Ltd.		

Examiner Signature		Date Considered	

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Sheet 2 of 2

Complete if Known	
Application Number	13/487,172
Filing Date	June 2, 2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	TBD
Attorney Docket Number	HW 82713780US09

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	5	Extended Search Report received in European Patent Application No. 10834239.5, mailed July 27, 2012. 5 pages.	
	6	International Search Report received in Patent Cooperation Treaty Application No. PCT/CN2010/079423, mailed March 10, 2011, 3 pages.	
	7	Written Opinion of the International Searching Authority received in Patent Cooperation Treaty Application No. PCT/CN2010/079423, mailed March 10, 2011, 5 pages.	
	8	CMCC, "UL ACK/NACK and CQI Feedback in Carrier Aggregation," 3GPP TSG RAN WG1 Meeting #58, R1-093269, Shenzhen, China, August 24-28, 2009, 2 pages.	
	9	ERICSSON, "Details of ACK/NAK Bundling for TDD," TSG-RAN WG1 #53, R1-082002, Kansas City, MO, May 5-9, 2008. 6 pages.	
	10	ERICSSON, et al., "PUCCH Transmission for Carrier Aggregation," 3GPP TSG RAN WG1 Meeting #58bis, R1-094273, Miyazaki, Japan, October 12-16, 2009, 3 pages.	
	11	NOKIA, et al., "DAI Design for TDD Configuration #5 (9:1) in ACK/NACK Bundling," R1-082615 (revised from R1-82601), 3GPP TSG RAN WG1 Meeting #53bis, Warzaw, Poland, June 30-July 4, 2008. 7 pages.	
	12	3rd GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and Channel Coding (Release 8)," 3GPP TS 36.212, v8.7.0, May 2009, 60 pages.	
	13	3rd GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Layer Procedures (Release 8)," 3GPP TS 36.213, v8.8.0, September 2009, 77 pages.	

Examiner Signature		Date Considered	

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This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Bibliographic data: CN101594211 (A) — 2009-12-02

Method for sending correct/wrong response message in multicarrier system with big bandwidth

Inventor(s):	CHUNLI LIANG [CN]; YUQIANG ZHANG [CN]; SHUQIANG XIA [CN] +
Applicant(s):	ZTE CORP [CN] +

Classification:	- international:	***H04L1/16; H04L1/18; H04W72/14***
	- European:	H04L1/00A9F1; H04L1/16F; H04W72/04F
Application number:	CN20091150608 20090619	
Priority number (s):	CN20091150608 20090619	
Also published as:	WO2010145373 (A1)	

Abstract of CN101594211 (A)

The invention discloses a method for sending a correct/wrong response message, which is suitable for a correct/wrong response of a terminal in a multicarrier system with big bandwidth, and comprises that: according to carrier aggregation allocation information in the multicarrier system, each downlink component carrier allocated to the terminal is detected, and a correct/wrong response message HARQ_ACK(i) of each downlink component carrier is obtained; and the terminal selects an available physical uplink control channel N[PUCCH] according to a combined state [HARQ_ACK(0), HARQ_ACK(1), ellipsis, HARQ_ACK(M-1)] of correct/wrong response messages of downlink component carriers, and adopts a format 1b of the physical uplink control channel PUCCH to send 2-bit correct/wrong response message information recorded as b(0)b(1), wherein M is the number of the downlink component carriers allocated to the terminal; and the available physical uplink control channel is one of M physical uplink control channels corresponding to the M downlink component carriers, namely N[PUCCH, i], wherein i=0, 1, ellipsis, M-1.

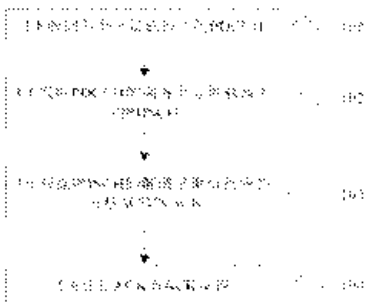


图 1 FIG. 1

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[12] 发明专利申请公布说明书

[21] 申请号 200910150608.1

[51] Int. Cl.
H04L 1/16 (2009.01)
H04L 1/18 (2006.01)
H04W 72/14 (2009.01)

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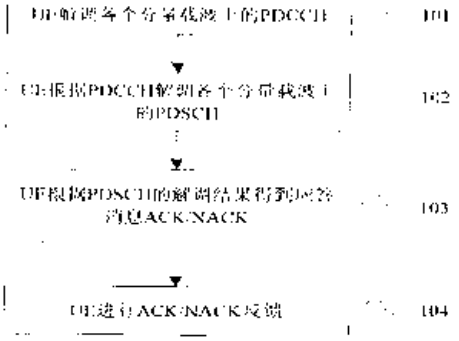
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[71] 申请人 中兴通讯股份有限公司
地址 518057 广东省深圳市南山区高新技术产业园科技南路中兴通讯大厦法律部
[72] 发明人 梁春丽 张禹强 夏树强
[74] 专利代理机构 北京安信方达知识产权代理有限公司
代理人 龙 洪 霍育栋
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大带宽的多载波系统中发送正确/错误应答消息的方法

[57] 摘要

一种发送正确/错误应答消息的方法，适于大带宽的多载波系统中的终端进行正确/错误应答，包括：根据多载波系统中的载波聚合配置信息，检测配置给终端的每个下行分量载波，得到每个下行分量载波的正确/错误应答消息 HARQ_ACK(i)；终端根据下行分量载波的正确/错误应答消息的组合状态{HARQ_ACK(0)，HARQ_ACK(1)，...，HARQ_ACK(M－1)}，选择一个可用的物理上行控制信道 $n_{PUCCH}^{(1)}$，采用物理上行控制信道 PUCCH 的格式 1b 来发送 2 个比特的正确/错误应答消息信息，记为 b(0)b(1)；其中，M 为配置给终端的下行分量载波的个数，所述可用的物理上行控制信道为与 M 个下行分量载波对应的 M 个物理上行控制信道之一，即 $n_{PUCCH}^{(1)} \in n_{PUCCH,i}^{(1)}$，i＝0，1，...，M－1。



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1、一种发送正确/错误应答消息的方法，适于大带宽的多载波系统中的终端进行正确/错误应答，其特征在于，包括：

根据多载波系统中的载波聚合配置信息，检测配置给终端的每个下行分量载波，得到每个下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$；

终端根据下行分量载波的正确/错误应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), ..., HARQ_ACK(M-1)\}$，选择一个可用的物理上行控制信道 $n_{PUCCH}^{(1)}$，采用物理上行控制信道 PUCCH 的格式 1b 来发送 2 个比特的正确/错误应答消息信息，记为 b(0)b(1)；

其中，M 为配置给终端的下行分量载波的个数，所述可用的物理上行控制信道为与 M 个下行分量载波对应的 M 个物理上行控制信道之一，即 $n_{PUCCH}^{(1)} \in n_{PUCCH,i}^{(1)}$，$i = 0, 1, ..., M-1$。

2、如权利要求 1 所述的方法，其特征在于，

所述终端检测配置给终端的每个下行分量载波时，

首先，对各个下行分量载波的物理下行控制信道 PDCCH 进行检测；

然后，根据解调出来的物理下行控制信道 PDCCH 信息，对各个分量载波上的物理下行共享信道 PDSCH 进行解调，从而得到每个下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$。

3、如权利要求 2 所述的方法，其特征在于，

所述终端得到的每个下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$ 为以下三种状态之一：

ACK，表示终端正确接收到分量载波 i 上的物理下行共享信道 PDSCH；

NACK，表示终端未正确接收到分量载波 i 上的物理下行共享信道 PDSCH；

DTX，表示终端未正确接收到分量载波 i 上的物理下行控制信道 PDCCH 而无法正确解调出物理下行共享信道 PDSCH 或基站在当前子帧在下行分量

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载波 i 上没有给终端调度物理下行共享信道 PDSCH。

4、如权利要求 2 所述的方法，其特征在于，

若所述大带宽的多载波系统为频分双工 FDD 系统，所述终端获取下行分量载波 i 的正确/错误应答消息 $HARQ_ACK(i)$ 的方式为：

当终端检测到该下行分量载波 i 包含两个码字流时，将该下行分量载波 i 对应的应答消息 $HARQ_ACK(i)$ 确定为：所述两个码字流的正确/错误应答消息进行逻辑与操作之后所得到的应答消息；

当终端检测到该下行分量载波 i 只有一个码字流时，将该下行分量载波 i 对应的应答消息 $HARQ_ACK(i)$ 确定为：该一个码字流的正确/错误应答消息；

当终端检测到该下行分量载波 i 上没有给终端发送数据时，将该下行分量载波 i 对应的应答消息 $HARQ_ACK(i)$ 确定为：NACK 或 DTX。

5、如权利要求 2 所述的方法，其特征在于，

若所述大带宽的多载波系统为时分双工 TDD 系统，所述终端获取下行分量载波 i 的正确/错误应答消息 $HARQ_ACK(i)$ 的方式为：

当该下行分量载波 i 对应的上行分量载波的上行子帧需反馈多个下行子帧的正确/错误应答消息时，终端对该下行分量载波的每个码字流对应的多个下行子帧的正确/错误应答消息进行逻辑与操作，得到子帧间绑定后的正确/错误应答消息，该过程称为“子帧间绑定”；

因而，若终端检测到该下行分量载波 i 包含两个码字流时，终端对进行了所述“子帧间绑定”操作而得到的正确/错误应答消息再进行所述两个码字流的逻辑与操作即“码字流间绑定”操作，从而得到该下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$；

因而，若终端检测到该下行分量载波 i 包含只一个码字流时，终端确定进行了所述“子帧间绑定”操作而得到的正确/错误应答消息即为该下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$；

其中，在进行所述“子帧间绑定”操作中，若该下行分量载波 i 的下行子帧中未给该终端发送数据时，假定其正确/错误应答消息为 ACK；

当该下行分量载波 i 上没有给终端发送数据时，则终端确定该该下行分

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量载波 i 对应的正确/错误应答消息的反馈状态为 NACK 或 DTX。

6、如权利要求 1 所述的方法，其特征在于，

所述终端选择出的一个可用的物理上行控制信道 $n_{PUCCH}^{(1)}$，是终端可通过信令方式得到、或者通过根据正确接收到的物理下行控制信道与物理上行控制信道索引之间的隐含得到；该物理上行控制信道 PUCCH 对应的下行分量载波的正确/错误应答消息必须为非 DTX 状态，即为 ACK 状态或 NACK 状态。

7、如权利要求 1 所述的方法，其特征在于，

所述终端获取的 M 个下行分量载波的正确/错误应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots, HARQ_ACK(M-1)\}$ 与所述终端选择出的可用的物理上行控制信道 $n_{PUCCH}^{(1)}$ 以及所采用的发送格式之间具有预设的映射关系；

所述终端根据该预设的映射关系确定该可用的物理上行控制信道 $n_{PUCCH}^{(1)}$；

所述发送格式为物理上行控制信道 PUCCH 的格式 1b 上发送的 2 比特 b(0)b(1)。

8、如权利要求 7 所述的方法，其特征在于，所述预设的映射关系与 M 的取值有关；当 M=1 时，表示所述系统并未采用载波聚合技术，则终端采用与现有长期演进 LTE 系统一致的上行正确/应答消息的反馈方法。

9、如权利要求 7 所述的方法，其特征在于，所述预设的映射关系与 M 的取值有关；当 M= 2/3/4/5 时，所述的预设的映射关系满足以下设计原则：

原则 1：当 $\{HARQ_ACK(0), HARQ-ACK(1), \ldots, HARQ-ACK(M-1)\}$ 中 ACK 状态的个数 N 大于零而小于 M 时，则合并非 ACK 状态的其他分量载波上的 NACK 和 DTX 状态；

原则 2：当 $\{HARQ-ACK(0), HARQ-ACK(1), \ldots, HARQ-ACK(M-1)\}$ 中 ACK 状态的个数为 0 时，选择一个能够正确解调物理下行控制信道 PDCCH 的分量载波所对应的物理上行控制信道 PUCCH 来进行反馈，即该物理上行控制信道 PUCCH 对应的分量载波的正确/错误应答消息的反馈状态必须为 NACK，再合并其他分量载波上的 NACK 和 DTX 状态；

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原则 3：当所有下行分量载波上的正确/错误应答消息的反馈状态都为 DTX 时，终端不向基站发送任何信号；

原则 4：当下行分量载波的个数 M=4 时，按照 N 的个数，对按照所述原则 1 得到的状态进行进一步的合并，将 N=3 和 N=2 的部分状态合并；当下行分量载波的个数 M=5 时，按照 N 的个数，对按照所述原则 1 得到的状态进行进一步的合并，将 N=1 和 N=2 的部分状态合并，将 N=2 的余下的部分状态与 N=3 的部分状态合并，将 N=3 的余下部分状态与 N=4 的状态合并；当下行分量载波的个数 M=5，并且 N=0 时，若 $\{HARQ-ACK(0), HARQ-ACK(1), \ldots, HARQ-ACK(M-1)\}$ 中有 4 个分量载波的正确/错误应答消息为 DTX 状态时，终端不向基站发送任何信号。

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大带宽的多载波系统中发送正确/错误应答消息的方法

技术领域

本发明涉及数字通信领域，特别是涉及一种大带宽下的多载波系统中发送正确/错误应答消息的方法。

背景技术

数字通信系统的飞速发展对数据通信的可靠性提出了更高的要求，然而，在恶劣的信道下，尤其是在高数据速率或高速移动环境中，多径干扰及多普勒频移等严重地影响着系统性能。因此，有效的差错控制技术，尤其是混合自动请求重传（Hybrid Automatic Repeat Request，HARQ）技术就成为通信领域致力研究的热点。

在 HARQ 方式中，发端发送的码不仅能够检错，而且还具有一定的纠错能力。接收端译码器收到码字后，首先检验错误情况，如果在码的纠错能力以内，则自动进行纠错；如果错误很多，超过了码的纠错能力，但能检测错误出来，则接收端通过反馈信道给发端发送一个判决信号，要求发端重发相应的码字信息。在 OFDM（Orthogonal Frequency Division Multiplexing，正交频分复用）系统中，通过正确应答消息/错误应答消息（ACK/NACK: Acknowledgement/Negative Acknowledgement）控制信令来表示传输正确或错误，并以此判断是否需要重传。

在长期演进系统（LTE: Long Term Evolution）的下行 HARQ 中，物理下行共享信道（PDSCH: Physical Downlink Shared Channel）的 ACK/NACK 应答消息，当终端（UE: User Equipment）没有物理上行共享信道（PUSCH: Physical Uplink Shared Channel）时，是在物理上行控制信道（PUCCH: Physical Uplink Control Channel）上发送的。当 PDSCH 只包含一个传输块时，终端要反馈 1 比特的 ACK/NACK 应答消息，当 PDSCH 包含两个传输块时，终端要反馈 2 比特的 ACK/NACK 应答消息。LTE 定义了多种 PUCCH 格式

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（format），包括 PUCCH format 1/1a/1b 和 format 2/2a/2b，其中 format 1a 和 1b 分别用来反馈 1 比特的 ACK/NACK 应答消息和 2 比特的 ACK/NACK 应答消息。

在 FDD（频分双工）系统中，由于上下行子帧是一一对应的，因此，一个上行子帧只反馈一个下行子帧相应 PDSCH 的 ACK/NACK 应答信息，根据反馈的比特数，选择 PUCCH format 1a 或 1b 发送即可。

而在 TDD（时分双工）系统中，由于上下行子帧的比例关系是可配置的，因此，当出现下行子帧数大于上行子帧数时，就有一个上行子帧需要反馈多个下行子帧相应的 PDSCH 的 ACK/NACK 应答消息的情况。当前 LTE 定义了两种反馈模式：绑定模式（bundling）和复用模式（Multiplexing）。

对于绑定模式，终端 UE 将对检测到的各个子帧相应码字流的 ACK/NACK 应答消息进行绑定操作（bundling，也称逻辑“与”操作，只有当全部 ACK/NACK 应答消息为 ACK 时，绑定后为 ACK，否则为 NACK），得到相应的 1 比特（对应 1 个码字流的情况）或 2 比特（对应 2 个码字流的情况）信息，然后在与最后一个检测到的下行子帧的物理下行控制信道 PDCCH 对应的物理上行控制信道 PUCCH 上，采用 format 1a 或 1b 来发送绑定后的比特信息。

对于复用模式，终端 UE 根据上下行的比例关系，确定该上行子帧需要反馈 ACK/NACK 应答消息的个数 M（也就是 ACK/NACK 应答消息需要在该上行子帧反馈的下行子帧数，也称为反馈窗）；然后分别对反馈窗内各个子帧的码字流的 ACK/NACK 应答消息进行绑定操作，得到 M 个绑定后的反馈状态；然后根据预设的反馈状态与可用 PUCCH 信道以及 b(0)b(1)的关系，选择一个可用的物理上行控制信道 PUCCH，采用 format 1b 来发送 b(0)b(1)。这种方式也称为信道选择。

在先进国际移动通信（International Mobile Telecommunications-Advanced，简称为 IMT-Advanced）系统中，能够实现数据的高速传输，并具有较大的系统容量：在低速移动、热点覆盖的情况下，IMT-Advanced 系统的峰值速率可以达到 1Gbit/s；在高速移动、广域覆盖的情况下，IMT-Advanced 系统的峰值速率可以达到 100Mbit/s。

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为了满足先进国际电信联盟（International Telecommunication Union-Advanced，简称为ITU-Advanced）的要求，作为LTE的演进标准的高级长期演进（Long Term Evolution Advanced，简称为LTE-A）系统需要支持更大的系统带宽（最高可达100MHz），并需要后向兼容LTE现有的标准。在现有的LTE系统的基础上，可以将LTE系统的带宽进行合并来获得更大的带宽，这种技术称为载波聚合（Carrier Aggregation，简称为CA）技术，该技术能够提高IMT-Advance系统的频谱利用率、缓解频谱资源紧缺，进而优化频谱资源的利用。

引入载波聚合后，当前关于下行分量载波与物理下行共享信道PDSCH传输块以及混合自动请求重传HARQ进程关系的讨论中，一个基本工作假定是：当没有采用空分复用时，一个下行分量载波对应一个PDSCH传输块以及一个HARQ进程，也就是说，UE需要为每个分量载波的一个PDSCH传输块反馈1比特的ACK/NACK应答信息。

在采用了频谱聚合技术后的LTE-A系统中，上行带宽和下行带宽就可以包括多个分量载波。当基站在多个下行分量载波上都有调度给某UE的PDSCH时，且当UE在当前子帧没有PUSCH要发送时，终端需要在PUCCH上反馈这多个下行分量载波的PDSCH传输的ACK/NACK应答消息。一种直接的方法就是在与多个下行分量载波对应的多个PUCCH信道上，采用跟LTE相同的方式，分别反馈多个ACK/NACK应答消息。这种方法比较简单，能够很好的保持与LTE的兼容性，但是由于上行有多个PUCCH信道同时传输，破坏了上行单载波特性，当UE功率受限时，将会影响ACK/NACK的检测性能，或者导致上行覆盖性能下降。对此，不同公司提出了很多方法，如对多个下行载波的ACK/NACK应答消息进行绑定操作（也就是逻辑“与”运算）后在单个PUCCH信道上反馈。由于各个载波的信道相差可能会比较大，因此，对多个下行载波的ACK/NACK应答消息捆绑反馈的方法使得吞吐量下降问题比较严重。

此外，还有一种基于TDD系统的信道选择的方法，该方法的核心思想就是利用不同的PUCCH信道和该信道上不同的调制符号来表示所有载波的不同反馈状态。该方法由于仅在一个PUCCH信道上反馈，因此不存在破坏

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单载波特性的问题，同时避免了捆绑方法带来的吞吐量下降问题，因此该方法受到多个公司的支持。但是该方法的一个主要缺点是，如果直接借用 TDD 系统中的映射方法，基站最多同时只能给 UE 调度 4 个下行分量载波，而考虑到目前关于载波聚合的系统带宽问题上最多能够支持 100MHz，因此载波聚合后有 5 个分量载波的情况。而在当前 LTE-A 的载波聚合关于需要优先考虑的典型应用场景中，最多能够支持 5 个分量载波的聚合，因此，当基站给 UE 调度了 5 个下行分量载波时，需要设计新的映射规则。

因而，在大带宽的多载波系统中，需要一种在该系统中在物理上行控制信道上发送正确/错误应答消息的方法，解决大带宽下多个下行分量载波情况下如何进行正确/错误应答消息的发送问题。

发明内容

本发明所要解决的技术问题在于，提供一种在大带宽下的多载波系统中的物理上行控制信道上发送正确/错误应答消息的方法，用于实现大带宽下多个下行分量载波的情况时对正确/错误应答消息的正确发送。

为了解决上述问题，本发明提出了一种发送正确/错误应答消息的方法，适于大带宽的多载波系统中的终端进行正确/错误应答，包括：

根据多载波系统中的载波聚合配置信息，检测配置给终端的每个下行分量载波，得到每个下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$；

终端根据下行分量载波的正确/错误应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), ..., HARQ_ACK(M-1)\}$，选择一个可用的物理上行控制信道 $n_{PUCCH}^{(1)}$，采用物理上行控制信道 PUCCH 的格式 1b 来发送 2 个比特的正确/错误应答消息信息，记为 b(0)b(1)；

其中，M 为配置给终端的下行分量载波的个数，所述可用的物理上行控制信道为与 M 个下行分量载波对应的 M 个物理上行控制信道之一，即 $n_{PUCCH}^{(1)} \in n_{PUCCH,i}^{(1)}$，$i = 0,1,....M-1$。

此外，所述终端检测配置给终端的每个下行分量载波时，

首先，对各个下行分量载波的物理下行控制信道 PDCCH 进行检测；

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然后，根据解调出来的物理下行控制信道 PDCCH 信息、对各个分量载波上的物理下行共享信道 PDSCH 进行解调，从而得到每个下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$。

此外，所述终端得到的每个下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$ 为以下三种状态之一：

ACK，表示终端正确接收到分量载波 i 上的物理下行共享信道 PDSCH；

NACK，表示终端未正确接收到分量载波 i 上的物理下行共享信道 PDSCH；

DTX，表示终端未正确接收到分量载波 i 上的物理下行控制信道 PDCCH 而无法正确解调出物理下行共享信道 PDSCH 或基站在当前子帧在下行分量载波 i 上没有给终端调度物理下行共享信道 PDSCH。

此外、若所述大带宽的多载波系统为频分双工 FDD 系统，所述终端获取下行分量载波 i 的正确/错误应答消息 $HARQ_ACK(i)$ 的方式为：

当终端检测到该下行分量载波 i 包含两个码字流时，将该下行分量载波 i 对应的应答消息 $HARQ_ACK(i)$ 确定为：所述两个码字流的正确/错误应答消息进行逻辑与操作之后所得到的应答消息；

当终端检测到该下行分量载波 i 只有一个码字流时，将该下行分量载波 i 对应的应答消息 $HARQ_ACK(i)$ 确定为：该一个码字流的正确/错误应答消息；

当终端检测到该下行分量载波 i 上没有给终端发送数据时，将该下行分量载波 i 对应的应答消息 $HARQ_ACK(i)$ 确定为：NACK 或 DTX。

此外，若所述大带宽的多载波系统为时分双工 TDD 系统，所述终端获取下行分量载波 i 的正确/错误应答消息 $HARQ_ACK(i)$ 的方式为：

当该下行分量载波 i 对应的上行分量载波的上行子帧需反馈多个下行子帧的正确/错误应答消息时，终端对该下行分量载波的每个码字流对应的多个下行子帧的正确/错误应答消息进行逻辑与操作，得到子帧间绑定后的正确/错误应答消息，该过程称为“子帧间绑定”；

因而，若终端检测到该下行分量载波 i 包含两个码字流时，终端对进行了所述“子帧间绑定”操作而得到的正确/错误应答消息再进行所述两个码

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字流的逻辑与操作即“码字流间绑定”操作，从而得到该下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$；

因而，若终端检测到该下行分量载波 i 包含只一个码字流时，终端确定进行了所述“子帧间绑定”操作而得到的正确/错误应答消息即为该下行分量载波的正确/错误应答消息 $HARQ_ACK(i)$；

其中，在进行所述“子帧间绑定”操作中，若该下行分量载波 i 的下行子帧中未给该终端发送数据时，假定其正确/错误应答消息为 ACK;

当该下行分量载波 i 上没有给终端发送数据时，则终端确定该该下行分量载波 i 对应的正确/错误应答消息的反馈状态为 NACK 或 DTX。

此外，所述终端选择出的一个可用的物理上行控制信道 $n_{PUCCH}^{(1)}$，是终端可通过信令方式得到、或者通过根据正确接收到的物理下行控制信道与物理上行控制信道索引之间的隐含得到；该物理上行控制信道 PUCCH 对应的下行分量载波的正确/错误应答消息必须为非 DTX 状态，即为 ACK 状态或 NACK 状态。

此外，所述终端获取的 M 个下行分量载波的正确/错误应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots, HARQ_ACK(M-1)\}$ 与所述终端选择出的可用的物理上行控制信道 $n_{PUCCH}^{(1)}$ 以及所采用的发送格式之间具有预设的映射关系；

所述终端根据该预设的映射关系确定该可用的物理上行控制信道 $n_{PUCCH}^{(1)}$；

所述发送格式为物理上行控制信道 PUCCH 的格式 1b 上发送的 2 比特 b(0)b(1)。

此外，所述预设的映射关系与 M 的取值有关；当 M=1 时，表示所述系统并未采用载波聚合技术，则终端采用与现有长期演进 LTE 系统一致的上行正确/应答消息的反馈方法。

此外，所述预设的映射关系与 M 的取值有关；当 M= 2/3/4/5 时，所述的预设的映射关系满足以下设计原则：

原则 1：当 $\{HARQ-ACK(0), HARQ-ACK(1), \ldots, HARQ-ACK(M-1)\}$ 中 ACK 状态的个数 N 大于零而小于 M 时，则合并非 ACK 状态的其他分量载波上的 NACK

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和 DTX 状态；

原则 2：当 $\{HARQ-ACK(0),HARQ-ACK(1),...,HARQ-ACK(M-1)\}$ 中 ACK 状态的个数为 0 时，选择一个能够正确解调物理下行控制信道 PDCCH 的分量载波所对应的物理上行控制信道 PUCCH 来进行反馈，即该物理上行控制信道 PUCCH 对应的分量载波的正确/错误应答消息的反馈状态必须为 NACK，再合并其他分量载波上的 NACK 和 DTX 状态；

原则 3：当所有下行分量载波上的正确/错误应答消息的反馈状态都为 DTX 时，终端不向基站发送任何信号；

原则 4：当下行分量载波的个数 M=4 时，按照 N 的个数，对按照所述原则 1 得到的状态进行进一步的合并，将 N=3 和 N=2 的部分状态合并；当下行分量载波的个数 M=5 时，按照 N 的个数，对按照所述原则 1 得到的状态进行进一步的合并，将 N=1 和 N=2 的部分状态合并，将 N=2 的余下的部分状态与 N=3 的部分状态合并，将 N=3 的余下部分状态与 N=4 的状态合并；当下行分量载波的个数 M=5，并且 N=0 时，若 $\{HARQ-ACK(0),HARQ-ACK(1),...,HARQ-ACK(M-1)\}$ 中有 4 个分量载波的正确/错误应答消息为 DTX 状态时，终端不向基站发送任何信号。

采用本发明的正确/错误应答消息发送方法，终端在兼容现有 LTE 的反馈方式的基础上，还能够反馈所接收到的下行分量载波上的反馈信息，因而不会引起系统吞吐量性能的下降。同时，终端能够采用一个 PUCCH 信道反馈各个下行分量载波的反馈信息，因而保持了上行的单载波性，这对于覆盖受限的终端 UE 尤为重要。另外，由于采用了本发明的预设映射关系，还解决了当前 LTE-A 定义的载波聚合的所有典型应用场景中上行 ACK/NACK 应答消息的反馈问题，具有充分的容错兼容性。

附图说明

图 1 是终端发送 ACK/NACK 应答消息的处理流程图；

图 2 是在 FDD 系统中终端得到各个下行分量载波的 ACK/NACK 应答

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消息的示意图；

图 3 是在 TDD 系统中终端得到各个下行分量载波的 ACK/NACK 应答消息的示意图；

图 4 是采用 M=2/3/4/5 时预设映射关系设计原则的具体设计流程示意图；

图 5~图 8 是在 M=5/4/3/2 时，下行分量载波的 ACK/NACK 应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots, HARQ_ACK(M-1)\}$ 与选择的可用 PUCCH 信道以及 PUCCH 格式 1b 中 2 比特信息 b(0)b(1)的预设映射关系的具体实施例示意表图。

具体实施方式

为使本发明的目的、技术方案和优点更加清楚，以下结合附图对本发明作进一步地详细说明。

在采用了载波聚合技术的系统中，当基站在 M 个下行分量载波上都有调度给某 UE 的 PDSCH 时，且当 UE 在当前子帧没有 PUSCH 要发送时，终端需要在 PUCCH 上反馈这 M 个下行分量载波的 PDSCH 传输的 ACK/NACK 应答消息。针对采用载波聚合技术的大带宽的多载波系统，目前尚无较佳的正确/错误应答消息的反馈方法的问题，本发明提供了一种相应的发送正确/错误应答消息的方法。

本发明旨在给出 UE 采用基于信道选择的方法进行 ACK/NACK 反馈时，M 个下行分量载波的 ACK/NACK 应答消息的状态组合与选择的 PUCCH 信道以及该信道上携带的 2 比特信息 b(0)b(1)之间的映射关系，以及采用所述映射关系进行 ACK/NACK 应答消息反馈的方法。

为了便于描述，假设下行分量载波 i 上的 ACK/NACK 应答消息表示为 $HARQ_ACK(i)$，其中 $i = 0,1,\ldots,M-1$，M 为某时刻基站配置给 UE 的下行分量载波的个数，$HARQ_ACK(i) \in \{ACK, NACK, DTX\}$；其中：

ACK 表示 UE 正确接收到分量载波 i 上的 PDSCH，

NACK 表示 UE 没有正确接收到分量载波 i 上的 PDSCH，

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DTX 表示 UE 没有正确接收到分量载波 i 上的 PDCCH 因而无法正确解调出 PDSCH 或基站在当前子帧在下行分量载波 i 上没有给 UE 调度 PDSCH。

终端 UE 根据在分量载波 i 上的物理下行控制信道 PDCCH 得到其对应的可用 PUCCH 信道的信道索引为 $n_{PUCCH,i}^{(1)}$，UE 需要反馈的 M 个下行分量载波的 ACK/NACK 应答消息的组合状态可表示为 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots, HARQ_ACK(M-1)\}$；PUCCH 格式 1b 上发送的两比特信息记为 b(0)b(1);

本发明中发送 ACK/NACK 应答消息的主要思想包括：终端 UE 根据载波聚合配置信息，检测配置给它的每个下行分量载波，得到每个下行分量载波的 ACK/NACK 应答消息 $HARQ_ACK(i)$；根据 M 个下行分量载波的 ACK/NACK 应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots, HARQ_ACK(M-1)\}$，选择一个可用的 PUCCH 信道 $n_{PUCCH}^{(1)}$，采用 PUCCH 格式 1b 来发送 2 比特信息 b(0)b(1)，所述的可用的 PUCCH 信道为 $n_{PUCCH}^{(1)} \in n_{PUCCH,i}^{(1)}$，$i = 0, 1, \ldots, M-1$。

图 1 给出了采用本发明 UE 发送 ACK/NACK 应答消息的处理流程：

步骤 101，UE 首先对各个下行分量载波的 PDCCH 进行检测。

步骤 102，UE 根据解调出来的 PDCCH 信息，对各个分量载波上的 PDSCH 进行解调。

步骤 103，UE 根据 PDSCH 的解调结果，得到各个下行分量载波的 ACK/NACK 应答消息；

步骤 104，UE 根据在步骤 103 得到的 M 个下行分量载波的 ACK/NACK 应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots, HARQ_ACK(M-1)\}$，采用本发明所述的预设映射关系，选择一个 PUCCH 信道，采用 PUCCH 格式 1b 来发送相应的 2 比特信息 b(0)b(1)。

所述步骤 103 中，对 FDD 系统和 TDD 系统的终端而言，相应终端 UE 得到某下行分量载波的 ACK/NACK 应答消息 $HARQ_ACK(i)$ 的方式是不同的。

对于 FDD 系统：

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当 UE 检测到某下行分量载波包含两个码字流时，其对应的应答消息为两个码字流的 ACK/NACK 进行逻辑与操作后得到的应答消息；

当 UE 检测得到某下行分量载只有一个码字流时，其对应的应答消息为该码字流的 ACK/NACK 的应答消息；

当某个分量载波上没有给 UE 发送数据时，其对应的反馈状态为 NACK 或 DTX。

图 2 给出了图 1 的步骤 103 中，FDD 系统中 UE 得到各个下行分量载波的 ACK/NACK 应答消息的示意图。具体如下所述：

对于分量载波#0，由于 UE 在该分量载波上检测到 2 个码字流，因此，UE 需要对该分量载波上 2 个码字流的 ACK/NACK 应答消息进行逻辑与操作，得到绑定后的一个应答消息，这里记为 HARQ-ACK(0)；

对于分量载波#1，由于 UE 在该分量载波上只检测到 1 个码字流，，因此，该分量载波上对应的反馈状态为其上码字流#0 的 ACK/NACK 应答消息，记为 HARQ-ACK(1)；

对于分量载波#2，由于 UE 在该分量载波上检测到 2 个码字流，因此，UE 需要对该分量载波上 2 个码字流的 ACK/NACK 应答消息进行逻辑与操作，得到绑定后的一个应答消息，这里记为 HARQ-ACK(2)；

对于分量载波#3，由于 UE 在该分量载波上检测到 2 个码字流，因此，UE 需要对该分量载波上 2 个码字流的 ACK/NACK 应答消息进行逻辑与操作，得到绑定后的一个应答消息，这里记为 HARQ-ACK(3)；

对于分量载波#4，由于 UE 在该分量载波上检测到 2 个码字流，因此，UE 需要对该分量载波上 2 个码字流的 ACK/NACK 应答消息进行逻辑与操作，得到绑定后的一个应答消息，这里记为 HARQ-ACK(4)。

对于 TDD 系统：

当某下行分量载波对应的上行分量载波的上行子帧需要反馈多个下行子帧的 ACK/NACK 应答消息时，UE 需要对该下行分量载波每个码字流对

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应的多个下行子帧的 ACK/NACK 应答消息进行逻辑与操作，得到子帧间绑定后的 ACK/NACK 应答消息；这一过程称为“子帧间绑定”；

- 当 UE 检测到某下行分量载波包含 2 个码字流时，UE 需要在上述的“子帧间绑定”操作后得到的 ACK/NACK 应答消息再进行“码字流间绑定”操作，从而得到该下行分量载波的 ACK/NACK 应答消息 $HARQ_ACK(i)$；
- 当 UE 检测得到某下行分量载只有一个码字流时，其对应应答消息为该码字流“子帧间绑定”操作后得到的 ACK/NACK 的应答消息
- 在“子帧间绑定”操作当中，如果某下行子帧中没有给该 UE 发送数据时，假定其 ACK/NACK 应答消息为 ACK；

当某个分量载波上没有给 UE 发送数据时，其对应的反馈状态为 NACK 或 DTX。

图 3 给出了图 1 的步骤 103 中，TDD 系统中 UE 得到各个下行分量载波的 ACK/NACK 应答消息的示意图。具体如下所述：这里假定一个上行子帧需要反馈 4 个下行子帧 ACK/NACK 应答消息：

对于分量载波#0，由于 UE 在该分量载波上检测到 2 个码字流，因此，UE 需要对该分量载波上 2 个码字流对应下行子帧的 ACK/NACK 应答消息先进行“子帧间绑定”操作，然后再进行“码字流间绑定”操作，最后得到绑定后的一个应答消息，这里记为 HARQ-ACK(0)；在进行“子帧间绑定”操作时、对于码字流#1，由于在下行子帧#1 没有给 UE 发送数据，因此，在进行“子帧间绑定”操作时，该下行子帧的应答消息假设为 ACK；

对于分量载波#1，由于 UE 在该分量载波上只检测到 1 个码字流，UE 需要对该分量载波上码字流#0 对应下行子帧的 ACK/NACK 应答消息进行“子帧间绑定”操作，从而得到绑定后的一个应答消息，这里记为 HARQ-ACK(1)；

对于分量载波#2，由于 UE 在该分量载波上检测到 2 个码字流，因此，

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UE 需要对该分量载波上 2 个码字流对应下行子帧的 ACK/NACK 应答消息先进行“子帧间绑定”操作，然后再进行“码字流间绑定”操作，最后得到绑定后的一个应答消息，这里记为 HARQ-ACK(2)；在进行“子帧间绑定”操作时，对于码字流#1，由于在下行子帧#2 没有给 UE 发送数据，因此，在进行“子帧间绑定”操作时，该下行子帧的应答消息假设为 ACK；

对于分量载波#3，由于 UE 在该分量载波上检测到 2 个码字流，因此，UE 需要对该分量载波上 2 个码字流对应下行子帧的 ACK/NACK 应答消息先进行“子帧间绑定”操作，然后再进行“码字流间绑定”操作，最后得到绑定后的一个应答消息，这里记为 HARQ-ACK(3)；

对于分量载波#4，由于 UE 在该分量载波上没有检测到分配给它的数据，因此，分量载波#4 对应的 ACK/NACK 应答消息 HARQ-ACK(4)为 NACK 或 DTX。

图 1 的所述步骤 104 中，可用的 PUCCH 信道是 UE 能够获得的，具体来说是可以根据正确接收到的物理下行控制信道与 PUCCH 信道索引之间的隐含得到或通过信令的方式得到，也就是说与该 PUCCH 信道对应的下行分量载波的 ACK/NACK 应答消息必须为非 DTX 状态。

图 1 的所述步骤 104 中，选择的 PUCCH 信道以及 PUCCH 格式 1b 上发送的 2 比特 b(0)b(1)与 M 个下行分量载波的 ACK/NACK 应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots, HARQ_ACK(M-1)\}$ 有预设的映射关系；所述的预设关系与 M 的取值有关，具体来说，

当 M=1 时（没有采用载波聚合技术），上行 ACK/NACK 应答消息的反馈方法与现有 LTE 系统的一致。

当 M= 2/3/4/5 时，其设计满足以下设计原则：

原则 1：当 $\{HARQ-ACK(0), HARQ-ACK(1), \ldots, HARQ-ACK(M-1)\}$ 中 ACK 的个数为 N（0<N<M）时，则不区分其余(M-N)个分量载波上的 NACK 和 DTX 状态，也就是合并其他分量载波上的 NACK 和 DTX 状态；

原则 2：当 $\{HARQ-ACK(0), HARQ-ACK(1), \ldots, HARQ-ACK(M-1)\}$ 中 ACK 的个数为 0

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时，也就是UE没有正确接收到任一个下行分量载波的数据时，将选择能够正确解调PDCCH的分量载波所对应的PUCCH信道来进行反馈，也就是选择的PUCCH信道对应的分量载波的ACK/NACK反馈状态必须为NACK，然后不区分其他分量载波上的NACK和DTX状态，也就是合并其他分量载波上的NACK和DTX状态；

原则3：当所有下行分量载波上的反馈状态都为DTX时，UE不向基站发送任何信号；

原则4：当下行分量载波的个数M=4/5时，由于可用的PUCCH信道与b(0)b(1)的组合所能表达的状态数少于$\{HARQ-ACK(0),HARQ-ACK(1),\ldots,HARQ-ACK(M-1)\}$可能的状态组合数，因此，存在状态合并（指不同的$\{HARQ-ACK(0),HARQ-ACK(1),\ldots,HARQ-ACK(M-1)\}$状态组合采用相同的PUCCH信道和b(0)b(1)组合来表示）的情况：

- 对于M=4时，按照N的个数，对所述原则1中得到的状态进行进一步的合并，具体来说，将N=3和N=2的部分状态合并；
- 对于M=5时，按照N的个数，对所述原则1中得到的状态进行进一步的合并，具体来说，将N=1和N=2的部分状态合并，将N=2的余下的部分状态与N=3的部分状态合并，将N=3的余下部分状态与N=4的状态合并；
- 对于M=5且N=0时，当$\{HARQ-ACK(0),HARQ-ACK(1),\ldots,HARQ-ACK(M-1)\}$中有4个分量载波的应答消息为DTX时，UE也不向基站发送任何信号。

图4给出了采用上述M=2/3/4/5时预设映射关系设计原则的具体设计流程示意图，具体描述如下：

统计$\{HARQ_ACK(0),HARQ_ACK(1),\ldots,HARQ_ACK(M-1)\}$中应答消息为ACK的个数，记为N；

当N=0时，采用上述的原则1进行信道选择和状态合并；

当N>0时，采用上述的原则2进行信道选择和状态合并；

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最后，对于 M=4/5 的情况，采用原则 4 进行进一步的状态合并。

根据以上设计原则，本发明的预设映射关系具有以下特点：

当 M=2 时，采用原则 1 和原则 2 进行状态合并后，$(HARQ_ACK(0), HARQ_ACK(1))$ 的状态数为 5 个，而可用 PUCCH 信道与 b(0)b(1)的组合数为 2*4=8 个，因此，对于 M=2 的情况，PUCCH 与 b(0)b(1)的组合状态数完全能够表示 $(HARQ_ACK(0), HARQ_ACK(1))$ 的可能组合状态数，因而不需要进行原则 4 的状态合并；

当 M=3 时，采用原则 1 和原则 2 进行状态合并后，$(HARQ_ACK(0), HARQ_ACK(1), HARQ_ACK(2))$ 的状态数为 10 个，而可用 PUCCH 信道与 b(0)b(1)的组合数为 3*4=12 个，因此，对于 M=3 的情况，PUCCH 与 b(0)b(1)的组合状态数完全能够表示 $(HARQ_ACK(0), HARQ_ACK(1), HARQ_ACK(2))$ 的可能组合状态数，因而不需要进行原则 4 的状态合并；

当 M=4 时，采用原则 1 和原则 2 进行状态合并后，$(HARQ_ACK(0), HARQ_ACK(1), HARQ_ACK(2), HARQ_ACK(3))$ 的状态数为 19 个，而可用 PUCCH 信道与 b(0)b(1)的组合数为 4*4=16 个，因此，对于 M=4 的情况，PUCCH 与 b(0)b(1)的组合状态数不能表示 $(HARQ_ACK(0), HARQ_ACK(1), HARQ_ACK(2), HARQ_ACK(3))$ 的全部可能组合状态数，因而需要进行原则 4 的状态合并，对 N=3 和 N=2 的部分状态进行合并；

当 M=5 时，采用原则 1 和原则 2 进行状态合并后，$(HARQ_ACK(0), HARQ_ACK(1), HARQ_ACK(2), HARQ_ACK(3), HARQ_ACK(4))$ 的状态数为 36 个，而可用 PUCCH 信道与 b(0)b(1)的组合数为 5*4=20 个，因此，对于 M=4 的情况，PUCCH 与 b(0)b(1)的组合状态数不能表示 $(HARQ_ACK(0), HARQ_ACK(1), HARQ_ACK(2), HARQ_ACK(3), HARQ_ACK(4))$ 的全部可能组合状态数，因而需要进行原则 4 的状态合并，将 N=1 和 N=2 的部分状态合并，将 N=2 的余下的部分状态与 N=3 的部分状态合并，将 N=3 的余下部分状态与 N=4 的状态合并，这样，对于 N>0 的情况，共需要表示 16 种不同的状态，由于可用 PUCCH 信道与 b(0)b(1)的组合数为 20，而根据原则 2 进行状态合并后共有 5 种情况，剩下的 4 种情况不能完全表示这 5 种情况，因而当 $(HARQ_ACK(0), HARQ_ACK(1), HARQ_ACK(2), HARQ_ACK(3), HARQ_ACK(4))$ 中有 4 个分量载波的

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应答消息为 DTX，1 个分量载波的应答消息为 NACK 时，UE 也不向基站发送任何信号。

图 5~图 8 给出了本发明 M=5/4/3/2 时，下行分量载波的 ACK/NACK 应答消息的组合状态 $\{HARQ_ACK(0), HARQ_ACK(1), \ldots HARQ_ACK(M-1)\}$ 与选择的可用 PUCCH 信道以及 PUCCH 格式 1b 中 2 比特信息 b(0)b(1)的预设映射关系的实施例。图 5~图 8 中的 N/A 表示 UE 不向基站发送任何信号。

采用本发明的发送方法，UE 能够反馈所接收到的下行分量载波上的反馈信息，因而不会引起系统吞吐量性能的下降。同时，UE 能够采用一个 PUCCH 信道反馈各个下行分量载波的反馈信息，因而保持了上行的单载波性，这对于覆盖受限的 UE 尤为重要。另外，采用本发明的预设映射关系，解决了当前 LTE-A 定义的载波聚合的所有典型应用场景中上行 ACK/NACK 应答消息的反馈问题。

以上所述仅为本发明的实施例而已，并不用于限制本发明，对于本领域的技术人员来说，本发明可以有各种更改和变化。凡在本发明的精神和原则之内，所作的任何修改、等同替换、改进等，均应包含在本发明的权利要求范围之内。

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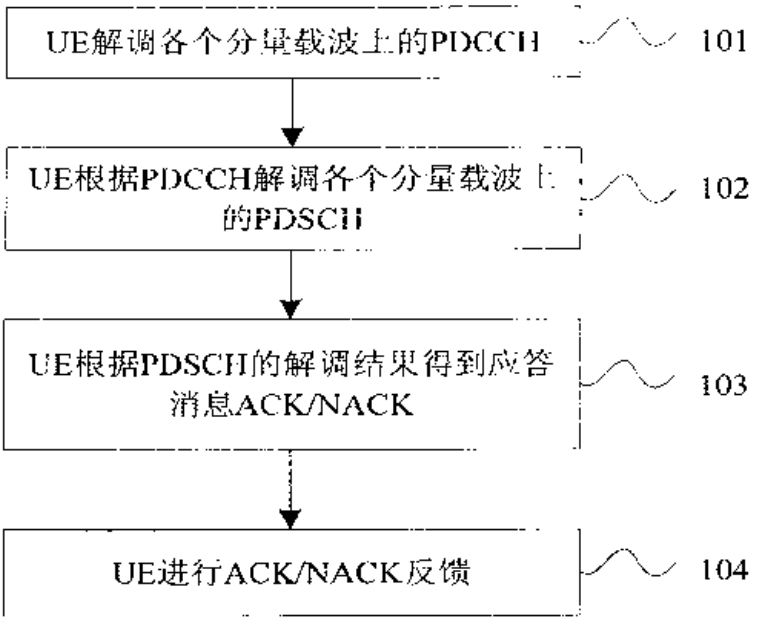


图1

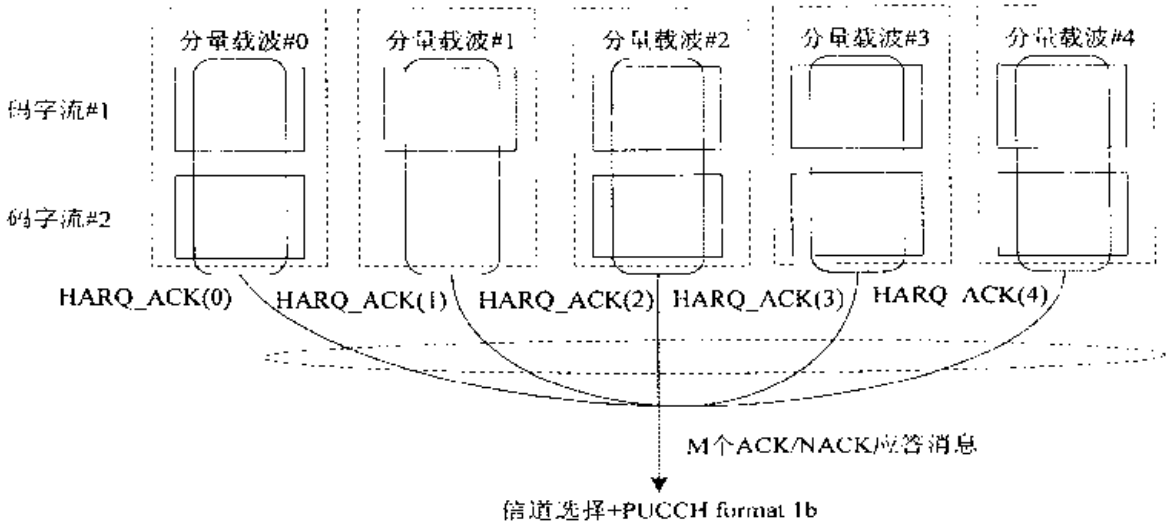


图2

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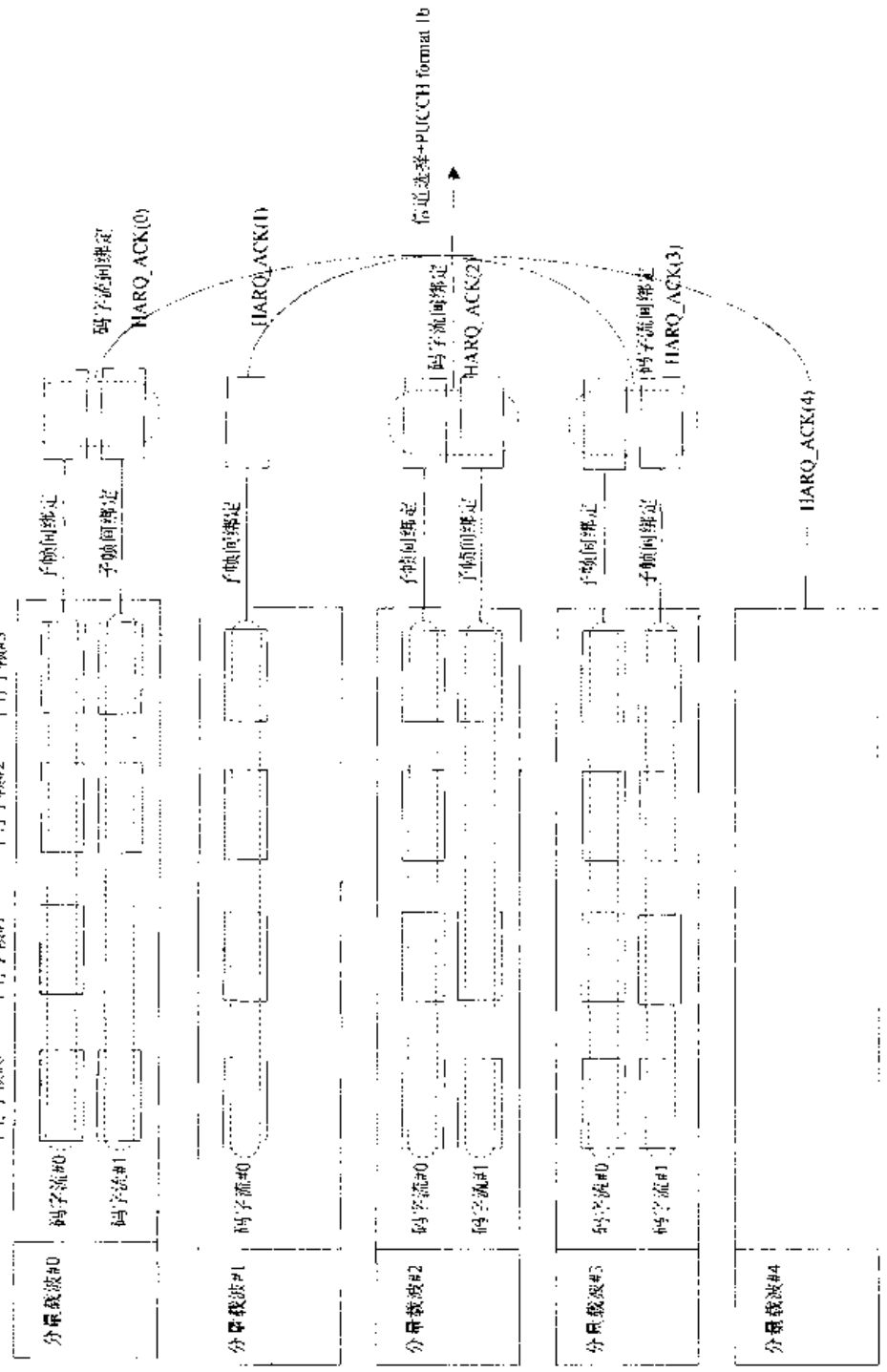


图3

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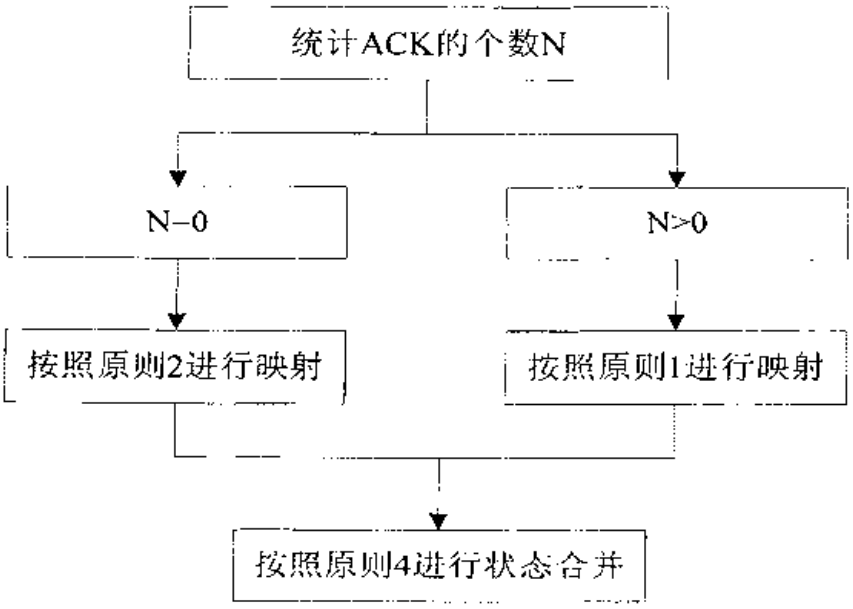


图4

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HARQ_ACK(0).HARQ_ACKK(1),HARQ_ACKK(2). HHARQ_ACK(3).HARQ_ACK(4)					$n^{(1)}_{PUCCH}$	b(0)b(1)
ACK	ACK	ACK	ACK	ACK	$n^{(1)}_{PUCCH,4}$	0,0
ACK	ACK	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1,1
ACK	ACK	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1,1
ACK	ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	1,1
ACK	ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	1,1
NACK/DTX	ACK	ACK	ACK	ACK	$n^{(1)}_{PUCCH,2}$	1,1
NACK/DTX	ACK	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1,1
ACK	NACK/DTX	ACK	ACK	ACK	$n^{(1)}_{PUCCH,3}$	1,1
NACK/DTX	NACK/DTX	ACK	ACK	ACK	$n^{(1)}_{PUCCH,3}$	1,1
ACK	ACK	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,4}$	1,1
ACK	NACK/DTX	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,4}$	1,1
ACK	ACK	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1,0
ACK	NACK/DTX	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1,0
NACK/DTX	ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	1,0
NACK/DTX	ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	1,0
ACK	NACK/DTX	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1,0
ACK	NACK/DTX	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1,0
NACK/DTX	ACK	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,3}$	1,0
NACK/DTX	ACK	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	1,0
NACK/DTX	ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,4}$	1,0
NACK/DTX	ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,4}$	1,0
ACK	NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	0,1
ACK	NACK/DTX	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,0}$	0,1
NACK/DTX	ACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0,1
ACK	ACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0,1
NACK/DTX	NACK/DTX	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	0,1
NACK/DTX	ACK	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	0,1
NACK/DTX	NACK/DTX	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	0,1

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NACK/DTX	NACK/DTX	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	0,1
NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,4}$	0,1
NACK/DTX	NACK/DTX	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,4}$	0,1
NACK	NACK/DTX	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	0,0
DTX	NACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0,0
DTX	DTX	NACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,2}$	0,0
DTX	DTX	DTX	NACK	NACK/DTX	$n^{(1)}_{PUCCH,3}$	0,0
DTX	DTX	DTX	DTX	NACK	N/A	N/A
DTX	DTX	DTX	DTX	DTX	N/A	N/A

图5

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HARQ_ACK(0),HARQ_ACKK(1),HARQ_ACKK(2),HARQ ACK(3),				$n^{(1)}_{PUCCH}$	b(0)b(1)
ACK	ACK	ACK	ACK	$n^{(1)}_{PUCCH,1}$	1,1
ACK	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,1}$	1,0
ACK	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	1,0
ACK	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,2}$	0,1
NACK/DTX	ACK	ACK	ACK	$n^{(1)}_{PUCCH,3}$	0,1
ACK	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0,1
ACK	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,2}$	0,1
ACK	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,0}$	0,1
NACK/DTX	ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,2}$	1,0
NACK/DTX	ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,3}$	1,0
NACK/DTX	NACK/DTX	ACK	ACK	$n^{(1)}_{PUCCH,3}$	0,1
ACK	NACK/DTX	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1,1
NACK/DTX	ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0,1
NACK/DTX	NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,2}$	0,0
NACK/DTX	NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,3}$	0,0
NACK	DTX	DTX	DTX	$n^{(1)}_{PUCCH,0}$	1,0
NACK/DTX	NACK	DTX	DTX	$n^{(1)}_{PUCCH,1}$	0,0
NACK/DTX	NACK/DTX	NACK	DTX	$n^{(1)}_{PUCCH,2}$	1,1
NACK/DTX	NACK/DTX	NACK/DTX	NACK	$n^{(1)}_{PUCCH,3}$	1,1
DTX	DTX	DTX	DTX	N/A	N/A

图6

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HARQ_ACK(0),HARQ_ACKK(1),HARQ ACKK(2)			$n^{(1)}_{PUCCH}$	b(0)b(1)
ACK	ACK	ACK	$n^{(1)}_{PUCCH,2}$	1,1
ACK	ACK	NACK/DTX	$n^{(1)}_{PUCCH,1}$	1,1
ACK	NACK/DTX	ACK	$n^{(1)}_{PUCCH,0}$	1,0
NACK/DTX	ACK	ACK ACK	$n^{(1)}_{PUCCH,2}$	1,0
ACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	0,1
NACK/DTX	ACK	NACK/DTX	$n^{(1)}_{PUCCH,1}$	0,0
NACK/DTX	NACK/DTX	ACK	$n^{(1)}_{PUCCH,2}$	0,0
NACK	NACK/DTX	NACK/DTX	$n^{(1)}_{PUCCH,0}$	1,0
DTX	NACK	NACK/DTX	$n^{(1)}_{PUCCH,1}$	1,0
DTX	DTX	NACK	$n^{(1)}_{PUCCH,2}$	0,1
DTX	DTX	DTX	N/A	N/A

图7

HARQ_ACK(0),HARQ_ACKK(1)		$n^{(1)}_{PUCCH}$	b(0)b(1)
ACK	ACK	$n^{(1)}_{PUCCH,1}$	1,1
ACK	NACK/DTX	$n^{(1)}_{PUCCH,0}$	0,1
NACK/DTX	ACK	$n^{(1)}_{PUCCH,1}$	0,0
NACK	DTX	$n^{(1)}_{PUCCH,0}$	1,0
NACK/DTX	NACK	$n^{(1)}_{PUCCH,1}$	1,0
DTX	DTX	N/A	N/A

图8

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Espacenet

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Method and device for determining searching space and candidate control channel resources

Inventor(s):	CHAOJUN LI; LIXIA XUE; BINGYU QU; LEI GUAN; ZHENG YU ±
Applicant(s):	HUAWEI TECH CO LTD ±
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Abstract of CN101998509 (A)

The invention provides a method and a device for determining searching space and candidate control channel resources. The method for determining searching space comprises: determining the downlink control information bit number of each kind of control channels the user equipment (UE) needs to monitor currently; according to the mapping relationship between a data channel-carrying unit carrier and a control channel carrying unit carrier, which are used by the UE currently, determining the temporary searching space corresponding to each kind of control channels the UE needs to monitor; and when the downlink control information bit number of one or more kinds of control channels of the same control channel element (CCE) aggregation grade, which are needed to be monitored by the UE, is the same as that of a control channel selected, determining the actual searching space corresponding to the selected control channel as all or part of CCEs in the total temporary searching space corresponding to all or part of control channels having the same downlink control information bit number. When the scheme is used, the probability of the blocking of the physical downlink control channel (PDCCH) in a carrier aggregation system is lowered.

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(71) 申请人 华为技术有限公司
地址 518129 广东省深圳市龙岗区坂田华为总部办公楼

(72) 发明人 全超君 薛丽霞 曲秉玉 官磊 余政

(74) 专利代理机构 深圳市深佳知识产权代理事务所（普通合伙） 44285
代理人 彭愿洁 李文红

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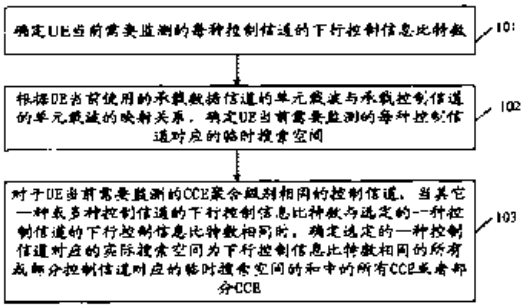
权利要求书 7 页 说明书 25 页 附图 8 页

(54) 发明名称

确定搜索空间、候选控制信道资源的方法及装置

(57) 摘要

本发明提供确定搜索空间、候选控制信道资源的方法及装置，其中确定搜索空间的方法包括：确定 UE 当前需要监测的每种控制信道的下行控制信息比特数；根据 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定 UE 需要监测的每种控制信道对应的临时搜索空间；对于 UE 当前需要监测的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有或者部分 CCE。使用该方案，在载波聚合系统中能减少 PDCCH 调度碰撞的概率。



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1. 一种确定搜索空间的方法，其特征在于，包括：

确定用户设备 UE 当前需要监测的每种控制信道的下行控制信息比特数；

根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间；

对于 UE 当前需要监测的控制信道单元 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE；

其中，所述其它一种或多种控制信道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

2. 根据权利要求 1 所述的方法，其特征在于，

对于 UE 当前需要监测的 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际搜索空间为所述选定的一种控制信道对应的临时搜索空间。

3. 根据权利要求 1 所述的方法，其特征在于，

确定 UE 当前需要监测的每种控制信道的下行控制信息比特数具体为：

根据下行控制信息比特数配置规则以及所述 UE 当前需要监测的每种控制信道承载的 DCI 的格式，确定 UE 当前需要监测的每种控制信道的下行控制信息比特数，其中，所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则。

4. 根据权利要求 3 所述的方法，其特征在于，

所述下行控制信息比特数配置规则包括以下规则中的至少一种：

同一频域资源分配方式对应的 DCI 格式的下行控制信息比特数相同；

频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同；

在当前配置的不同资源条件下，若同一种 DCI 格式的下行控制信息比特数的差值小于预设数值，所述 DCI 格式的下行控制信息比特数配置成唯一值。

5. 根据权利要求 1 所述的方法，其特征在于，

在根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间之前，该方法还包括：

UE 获取标准预先定义的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

或者，

UE 接收基站发送的第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系；

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所述 UE 根据所述第一映射关系指示信息和当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系，确定所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。

6. 根据权利要求 5 所述的方法，其特征在于，

所述标准预先定义的承载数据信道的单元载波与承载控制信道的单元载波的映射关系为 $I_{PDCCH}(k) = (floor(c \times k + \delta)) \bmod N_{PDCCH}$，

其中，k 为承载数据信道的单元载波在第一载波集合中的序号，$I_{PDCCH}(k)$ 为承载控制信道的单元载波在第一载波集合中的序号；N_{PDCCH} 表示第一载波集合中单元载波的个数；δ 为整数；c 为整数或分数。

7. 根据权利要求 1 所述的方法，其特征在于，

在根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间之前，该方法还包括：

UE 接收基站发送的第二映射关系指示信息，所述第二映射关系指示信息用于指示在标准预先定义的映射规则下所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

所述映射规则包括如下规则中至少一种：

当承载数据信道的单元载波能承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；

当与承载数据信道的上行单元载波相配对的下行单元载波能承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；

不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；

不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；

不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上。

8. 一种确定候选控制信道资源的方法，其特征在于，包括：

确定 UE 当前可被配置的每种控制信道的下行控制信息比特数；

根据所述 UE 当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道对应的临时候选控制信道资源；

对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE；

其中，所述其它一种或多种控制信道为 UE 当前可被配置的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数

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相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

9. 根据权利要求 8 所述的方法，其特征在于，

对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述选定的一种控制信道对应的临时候选控制信道资源。

10. 根据权利要求 8 所述的方法，其特征在于，

确定 UE 当前可被配置的每种控制信道的下行控制信息比特数具体为：

根据下行控制信息比特数配置规则以及所述 UE 当前可被配置的每种控制信道承载的 DCI 的格式，确定 UE 当前可被配置的每种控制信道的下行控制信息比特数，其中，所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则。

11. 根据权利要求 10 所述的方法，其特征在于，

所述下行控制信息比特数配置规则包括以下规则中的至少一种：

同一频域资源分配方式对应的 DCI 格式的下行控制信息比特数相同；

频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同；

在当前配置的不同资源条件下，若同一种 DCI 格式的下行控制信息比特数的差值小于预设数值，所述 DCI 格式的下行控制信息比特数配置成唯一值。

12. 根据权利要求 8 所述的方法，其特征在于，

在根据所述 UE 当前可被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道所对应的临时候选控制信道资源之前，该方法还包括：

基站获取标准预先定义的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

或者，

基站在当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中选择一种映射关系，向 UE 发送第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系。

13. 根据权利要求 12 所述的方法，其特征在于，

所述标准预先定义的承载数据信道的单元载波与承载控制信道的单元载波的映射关系为 $I_{PUCCH,CC}(k) = (Floor(c \times k + \delta)) \bmod N_{PUCCH,CC}$，

其中，k 为承载数据信道的单元载波在第一载波集合中的序号，$I_{PUCCH,CC}(k)$ 为承载控制信道的单元载波在第一载波集合中的序号；$N_{PUCCH,CC}$ 表示第一载波集合中单元载波的个数；δ 为整数；c 为整数或分数。

14. 根据权利要求 8 所述的方法，其特征在于，

在根据所述 UE 当前可被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道所对应的临时候选控制信道资源

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之前，该方法还包括：

基站根据标准预先定义的映射规则，确定当前可配置的映射关系种类，并选择一种映射关系，向 UE 发送第一映射关系指示信息，所述第一映射关系指示信息用于指示在标准预先定义的映射规则下所述 UE 当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

所述映射规则包括如下规则中至少一种：当承载数据信道的单元载波能承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；

当与承载数据信道的上行单元载波相配对的下行单元载波能承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；

不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；

不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；

不同级别上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上。

15. 一种用户设备，其特征在于，包括：

控制信息比特数确定单元，用于确定 UE 当前需要监测的每种控制信道的下行控制信息比特数；

临时搜索空间确定单元，用于根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间；

实际搜索空间确定单元，用于对于 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE；其中，所述其它一种或多种控制信道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

16. 根据权利要求 15 所述的用户设备，其特征在于，

所述实际搜索空间确定单元，还用于对于 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际搜索空间为所述选定的一种控制信道对应的临时搜索空间。

17. 根据权利要求 15 所述的用户设备，其特征在于，

该用户设备还包括：控制信息比特数配置规则保存单元，用于保存下行控制信息比特

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数配置规则，其中，所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则；

所述控制信息比特数确定单元，用于根据所述下行控制信息比特数配置规则以及所述 UE 当前需要监测的每种控制信道承载的 DCI 的格式，确定 UE 当前需要监测的每种控制信道的下行控制信息比特数。

18. 根据权利要求 15 所述的用户设备，其特征在于，

该用户设备还包括：第一保存单元，用于保存所述用户设备使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

所述临时搜索空间确定单元，用于根据所述第一保存单元所保存的用户设备使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间。

19. 根据权利要求 15 所述的用户设备，其特征在于，该用户设备还包括：

第二保存单元，用于保存用户设备当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系；

第一接收单元，用于接收基站发送的第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在所述用户设备当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系；

第一映射关系确定单元，用于根据所述第二保存单元所保存的多种映射关系和第一映射关系指示信息，确定所述用户设备当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

所述临时搜索空间确定单元，用于根据所述第一映射关系确定单元所确定的用户设备当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间。

20. 根据权利要求 15 所述的用户设备，其特征在于，该用户设备还包括：

第二保存单元，用于保存标准预先定义的映射规则，所述映射规则包括如下规则中至少一种：

当承载数据信道的单元载波能承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；当与承载数据信道的上行单元载波相配对的下行单元载波能承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；

第二接收单元，用于接收基站发送的第二映射关系指示信息，所述第二映射关系指示信息用于指示在标准预先定义的映射规则下所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

第二映射关系确定单元，用于根据所述第二保存单元所保存的映射规则，确定所述映射规则下可用的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系，根据所述多种映射关系和第二映射关系指示信息，确定所述用户设备当前使用的承载数据信

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道的单元载波与承载控制信道的单元载波的映射关系；

所述临时搜索空间确定单元，用于根据所述第二映射关系确定单元所确定的用户设备当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间。

21. 一种基站，其特征在于，包括：

控制信息比特数确定单元，用于确定 UE 当前可被配置的每种控制信道的下行控制信息比特数；

临时候选控制信道资源确定单元，用于根据所述 UE 当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道所对应的临时候选控制信道资源；

实际候选控制信道资源确定单元，用于当对于 CCE 聚合级别相同的控制信道，其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE；其中，所述其它一种或多种控制信道为 UE 当前可被配置的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

22. 根据权利要求 21 所述的基站，其特征在于，

所述实际候选控制信道资源确定单元，还用于对于 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述选定的一种控制信道对应的临时候选控制信道资源。

23. 根据权利要求 21 所述的基站，其特征在于，

控制信息比特数配置规则保存单元，用于保存下行控制信息比特数配置规则，其中，所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则；

所述控制信息比特数确定单元，用于根据所述下行控制信息比特数配置规则以及所述 UE 当前可被配置的每种控制信道承载的 DCI 的格式，确定 UE 当前可被配置的每种控制信道的下行控制信息比特数。

24. 根据权利要求 21 所述的基站，其特征在于，该基站还包括：

第一保存单元，用于保存所述用户设备被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

所述临时候选控制信道资源确定单元，用于根据所述第一保存单元所保存的用户设备被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道对应的临时候选控制信道资源。

25. 根据权利要求 21 所述的基站，其特征在于，该基站还包括：

第二保存单元，用于保存用户设备当前可被配置的承载数据信道的单元载波与承载控

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制信道的单元载波的多种映射关系；

第一选择单元，用于在所述多种映射关系中选择一种映射关系；

所述临时候选控制信道资源确定单元，用于根据所述第一选择单元所选择的用户设备当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述UE当前可被配置的每种控制信道对应的临时候选控制信道资源。

26. 根据权利要求25所述的基站，其特征在于，该基站还包括：

第一发送单元，用于向用户设备发送第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在所述第一保存单元所保存的多种映射关系中所选择的一种映射关系。

27. 根据权利要求21所述的基站，其特征在于，该基站还包括：

第二保存单元，用于保存标准预先定义的映射规则，所述映射规则包括如下规则中至少一种：

当承载数据信道的单元载波能承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；当与承载数据信道的上行单元载波相配对的下行单元载波能承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；

第二选择单元，用于在所述映射规则下所述用户设备可被配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中选择一种映射关系；

所述临时候选控制信道资源确定单元，用于根据所述第二选择单元所选择的用户设备当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述UE当前可被配置的每种控制信道对应的临时候选控制信道资源。

28. 根据权利要求27所述的基站，其特征在于，该基站还包括：

第二发送单元，用于向所述用户设备发送第二映射关系指示信息，所述第二映射关系指示信息用于指示在第二保存单元所保存的映射规则下所述用户设备当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。

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确定搜索空间、候选控制信道资源的方法及装置

技术领域

[0001] 本发明涉及通信技术领域，特别涉及一种搜索空间、候选控制信道资源的确定方法及装置。

背景技术

[0002] 在长期演进 (Long Term Evolution,LTE) 系统中，用户设备 (User Equipment,UE) 接收或发送业务数据之前，需要获知演进基站 (Evolved NodeB, eNB) 配置给该用户设备的下行控制信息 (Downlink Control Information, DCI)，该 DCI 通过物理层下行控制信道 (Physical Downlink Control channel,PDCCH) 承载。一个 PDCCH 由 1、2、4 或者 8 个连续控制信道单元 (Control Channel Element,CCE) 聚合而成，每一个聚合级别 (aggregation level) 对应一个搜索空间 (参见表一)，聚合级表示一个 PDCCH 由几个 CCE 聚合，搜索空间即为 UE 待检测的 PDCCH 集合。其中，搜索空间可分为公共搜索空间 (Common search space) 和用户设备特定搜索空间 (UE specific search space)。

[0003]

搜索空间			待检测的PDCCH个数
类型	聚合级	CCE个数	
用户设备特定搜索空间	1	6	6
	2	12	6
	4	8	2
	8	16	2
公共搜索空间	4	16	4
	8	16	2

[0004] 表一

[0005] 现有技术具有如下缺点：

[0006] 在载波聚合 (carrier aggregation, CA) 系统中，用户设备可以同时使用承载数据信道的多个单元载波 (component carrier,CC)，每个承载数据信道的单元载波的数据调度或功控都配置相应的一个 DCI 来进行指示，不同的 DCI 承载在不同的 PDCCH 上，当这些 PDCCH 承载于一个承载控制信道的单元载波或较少的几个承载控制信道的单元载波上时，由于现有技术定义的搜索空间大小有限，所以发生 PDCCH 调度碰撞 (blocking) 的概率很大。

发明内容

[0007] 本发明实施例提供一种确定搜索空间的方法及装置，和确定候选控制信道资源的

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方法及装置，在载波聚合系统中，能够减少 PDCCH 调度碰撞出现的概率。

[0008] 有鉴于此，本发明实施例提供：

[0009] 一种确定搜索空间的方法，包括：

[0010] 确定用户设备 UE 当前需要监测的每种控制信道的下行控制信息比特数；

[0011] 根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间；

[0012] 对于 UE 当前需要监测的控制信道单元 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE；

[0013] 其中，所述其它一种或多种控制信道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0014] 一种确定候选控制信道资源的方法，包括：

[0015] 确定 UE 当前可被配置的每种控制信道的下行控制信息比特数；

[0016] 根据所述 UE 当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道对应的临时候选控制信道资源；

[0017] 对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE；

[0018] 其中，所述其它一种或多种控制信道为 UE 当前可被配置的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0019] 一种用户设备，包括：

[0020] 控制信息比特数确定单元，用于确定 UE 当前需要监测的每种控制信道的下行控制信息比特数；

[0021] 临时搜索空间确定单元，用于根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间；

[0022] 实际搜索空间确定单元，用于对于 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE；其中，所述其它一种或多种控制信

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道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0023] 一种基站，包括：

[0024] 控制信息比特数确定单元，用于确定 UE 当前可被配置的每种控制信道的下行控制信息比特数；

[0025] 临时候选控制信道资源确定单元，用于根据所述 UE 当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道所对应的临时候选控制信道资源；

[0026] 实际候选控制信道资源确定单元，用于当对于 CCE 聚合级别相同的控制信道，其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE；其中，所述其它一种或多种控制信道为 UE 当前可被配置的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0027] 本发明一实施例中，UE 当前需要监测的控制信道对应的临时搜索空间是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同；对于 UE 当前需要监测的控制信道单元 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE，而且不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同，所以经过合并后扩大了控制信道对应的搜索空间，从而在载波聚合系统中，减少了控制信道对应的实际搜索空间中控制信道调度碰撞出现的概率，而且 UE 侧控制信道盲译码次数没有增加。

[0028] 本发明另一实施例中，UE 当前可被配置的控制信道对应的临时候选控制信道资源是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的临时候选控制信道资源可能不同；对于 UE 当前可被配置的控制信道单元 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE，而且不同承载数据信道的单元载波对应的控制信道的临时候选控制信道资源可能不同，所以

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经过合并后扩大了控制信道对应的候选控制信道资源，从而在载波聚合系统中，减少了控制信道对应的实际候选控制信道资源中控制信道调度碰撞出现的概率。

附图说明

[0029] 为了更清楚地说明本发明实施例的技术方案，下面将对实施例中所需要使用的附图作简单地介绍，显而易见地，下面描述中的附图仅仅是本发明的一些实施例，对于本领域普通技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。

[0030] 图 1 是本发明实施例一提供的一种搜索空间确定方法流程图；

[0031] 图 2 是本发明实施例二提供的一种监测控制信道的方法流程图；

[0032] 图 3 是本发明实施例提供的承载数据信道的单元载波与序号的对应关系示意图；

[0033] 图 4 是本发明实施例提供的根据函数关系得到的承载数据信道的单元载波与承载控制信道的单元载波的映射关系示意图；

[0034] 图 5 是本发明实施例提供的承载数据信道的单元载波的临时搜索空间及 DCI 格式示意图；

[0035] 图 6 是本发明实施例提供的搜索空间扩充示意图；

[0036] 图 7 是本发明实施例三提供的一种候选控制信道资源确定方法流程图；

[0037] 图 8 是本发明实施例四提供的一种下行控制信息发送方法；

[0038] 图 9A 是本发明实施例五提供的一种用户设备结构图；

[0039] 图 9B 是本发明实施例五提供的另一种用户设备结构图；

[0040] 图 9C 是本发明实施例五提供的又一种用户设备结构图；

[0041] 图 10A 是本发明实施例六提供的一种基站结构图；

[0042] 图 10B 是本发明实施例六提供的另一种基站结构图；

[0043] 图 10C 是本发明实施例六提供的又一种基站结构图。

具体实施方式

[0044] 为了使本发明实施例更加清楚明白，如下先对系统中承载控制信道的单元载波上的搜索空间与 DCI 格式的应用作简单说明：

[0045] 系统采用物理下行共享信道 (Physical Downlink Shared Channel，PDSCH) 传输下行数据，下行数据是从基站发送给 UE 的；系统采用物理上行共享信道 (Physical Uplink Shared Channel，PUSCH) 传输上行数据，上行数据是由 UE 发给基站的。UE 在接收下行数据或发射上行数据前，需要知道基站配置给 UE 的调度信息 (scheduling information)，如时频资源分配，调制编码方式等。另外，基站也需要通知 UE 上行传输相关的功控命令 (power control commands) 信息。这些调度信息和功控命令信息属于下行控制信息 (DCI)。下行控制信息的格式称为 DCI 格式，基站当前可给 UE 配置的 DCI 格式或 UE 当前需要监测的 DCI 格式是根据当前的传输模式而定的。每个 DCI 格式中必须包括的下行控制信息比特是预定义的，本发明称为原始下行控制信息比特，相对应地，每个 DCI 格式中必须含有的下行控制信息比特的数目，本发明称为原始下行控制信息比特数。基站从候选控制信道资源中选择一个控制信道，并将下行控制信息通过所选择的控制信道发送给 UE，以便 UE 能根据该下行控制信息接收下行数据或者发送上行数据。UE 根据当前需要监测的每种控制信道的下行控

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制信息比特数（即下行控制信息负载大小），在对应的搜索空间中盲译码该搜索空间包括的所有控制信道，搜索出 CRC 校验正确的下行控制信息。

[0046] 其中，本发明中所述的控制信道即 PDCCH，控制信道的下行控制信息比特数是指该控制信道所承载的 DCI 的信息比特数，不同载波带宽，不同 DCI 格式或者不同发射天线数对应的 DCI 的信息比特数可能不同，以下特征用于区分控制信道的种类：

[0047] 1）由不同数量 CCE 聚合而成的控制信道属于不同的控制信道；一个控制信道由 m 个连续的 CCE 聚合而成，m 为正整数，例如 m 为 1，2，4 或者 8，本发明不对 m 的取值做限制；

[0048] 2）对应不同 DCI 格式的控制信道属于不同的控制信道；一个控制信道承载的 DCI 的格式可以是标准定义的 DCI 格式；

[0049] 3）不同的承载数据信道的单元载波对应不同的控制信道；

[0050] UE 当前需要监测的控制信道或者基站当前可配置的控制信道可能包括由不同数量 CCE 聚合而成的控制信道，也可能包括对应不同 DCI 格式的控制信道，还可能包括对应不同承载数据信道的单元载波的控制信道。例如，当前 UE 需要监测（即基站可配置）的承载数据信道的单元载波有 2 个（CC1 和 CC2），CC1 的传输模式为下行单天线传输，对应的 DCI 格式为 DCI 格式 1 和 DCI 格式 1A，CC2 的传输模式为闭环空分复用，对应的 DCI 格式为 DCI 格式 2 和 DCI 格式 1A，假设现在支持 CCE 聚合级别为 4 和 8，则 UE 当前需要监测（即基站可给 UE 配置）的控制信道有 8 种：1）CC1 对应的，CCE 聚合级别为 4，DCI 格式 1 对应的控制信道；2）CC1 对应的，CCE 聚合级别为 8，DCI 格式 1 对应的控制信道；3）CC1 对应的，CCE 聚合级别为 4，DCI 格式 1A 对应的控制信道；4）CC1 对应的，CCE 聚合级别为 8，DCI 格式 1A 对应的控制信道；5）CC2 对应的，CCE 聚合级别为 4，DCI 格式 2 对应的控制信道；6）CC2 对应的，CCE 聚合级别为 8，DCI 格式 2 对应的控制信道；7）CC2 对应的，CCE 聚合级别为 4，DCI 格式 1A 对应的控制信道；8）CC2 对应的，CCE 聚合级别为 8，DCI 格式 1A 对应的控制信道。

[0051] 其中，本发明中所述的候选控制信道资源即基站可以给 UE 配置的候选控制信道集合，是根据 CCE 定义的一段逻辑资源，其包括：候选控制信道资源的起始 CCE 序号，CCE 个数及其他的表征候选控制信道资源的参数，本发明不做限制。需要说明的是，每一种控制信道对应一个候选控制信道集合。其中，搜索空间是根据 CCE 定义的一段逻辑资源，是需要监测的控制信道的集合，其包括：搜索空间的起始 CCE 序号，CCE 个数及其他的表征搜索空间的参数，本发明不做限制。需要说明的是，每一种控制信道对应一个搜索空间。对于每一控制信道，候选控制信道资源不能大于搜索空间，即基站可配置的候选控制信道集合和 UE 需要监测的控制信道集合相等，或者基站可配置的候选控制信道集合是 UE 需要监测的控制信道集合的一个子集。搜索空间可分为公共搜索空间（Common search space）和用户设备特定搜索空间（UE specific search space）。本发明中的搜索空间指的是用户设备特定搜索空间。对于公共搜索空间的确定可以采用本发明的发法，也可以不采用本发明的方法，本发明不做限制。

[0052] 实施例一：

[0053] 参阅图 1，本发明实施例一提供一种搜索空间确定方法，该方法包括：

[0054] 101、确定 UE 当前需要监测的每种控制信道的下行控制信息比特数。

[0055] 其中，UE 当前需要监测的每种控制信道的下行控制信息比特数可以是根据下行控制信息比特数配置规则以及所述 UE 当前需要监测的每种控制信道承载的 DCI 的格式确定

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的，其中，下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则，该多个 DCI 格式的原始下行控制信息比特数可能不相同，该规则规定了哪些情况下这些 DCI 格式的下行控制信息比特数应该配置成相同，具体可以通过添加冗余信息比特或者额外的有用信息比特来配置这些 DCI 格式的下行控制信息比特数相同。

[0056] 其中，所述下行控制信息比特数配置规则包括以下规则中的至少一种：

[0057] 同一频域资源分配方式对应的 DCI 格式的下行控制信息比特数相同；

[0058] 频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同；

[0059] 在当前配置的不同资源条件下，若同一种 DCI 格式的下行控制信息比特数的差值小于预设数值，所述 DCI 格式的下行控制信息比特数配置成唯一值。

[0060] 102、根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间。

[0061] 其中，承载控制信道的单元载波为第一载波集合中的单元载波，所述第一载波集合即用于传输控制信道的单元载波的集合；所述承载数据信道的单元载波为第二载波集合中的单元载波，所述第二载波集合为下行单元载波集合和/或上行单元载波集合，用户设备可能在下行单元载波集合内的任一个或任几个下行单元载波上接收 PDSCH，用户设备可能在上行单元载波集合内的任一个或任几个上行单元载波上发送 PUSCH。

[0062] 其中，UE 当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系可以为一一对应关系或者多对一关系。

[0063] 具体的，当 UE 当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系为一一对应时，对于时分双工（Time Division Duplex，TDD），所述承载数据信道的单元载波和其映射到的承载控制信道的单元载波是同一单元载波；对于频分双工（Frequency Division Duplex，FDD），当承载数据信道的单元载波为承载上行数据信道的单元载波时，所述承载上行数据信道的单元载波和其映射到的承载控制信道的单元载波是同一单元载波对中的单元载波；当承载数据信道的单元载波为承载下行数据信道的单元载波时，所述承载下行数据信道的单元载波和其映射到的承载控制信道的单元载波是同一单元载波，其中，一个下行单元载波和与其配对的一个上行单元载波称为一个单元载波对，具体可以是根据定义好的双工间距（即上下行单元载波的载频间距）进行配对，本发明不对配对方法做限制。

[0064] 具体地，当 UE 当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系为多对一映射关系时，对于时分双工（Time Division Duplex，TDD），所述承载数据信道的单元载波和其映射到的承载控制信道的单元载波可以是同一单元载波，也可以不是同一单元载波；对于频分双工（Frequency Division Duplex，FDD），当承载数据信道的单元载波为承载上行数据信道的单元载波时，所述承载上行数据信道的单元载波和其映射到的承载控制信道的单元载波可以是同一单元载波对中的单元载波，也可以不是同一单元载波对中的单元载波；当承载数据信道的单元载波为承载下行数据信道的单元载波时，所述承载下行数据信道的单元载波和其映射到的承载控制信道的单元载波可以是同一单元载波，也可以不是同一单元载波。

[0065] 该步骤中 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的

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映射关系可以是标准预先定义的，也可以是在该步骤之前，UE 接收基站发送的第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系；UE 根据所述第一映射关系指示信息和当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系，确定所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。其中，该标准预先定义的映射关系是通信标准或协议定义的映射关系。

[0066] 或者在该步骤之前，UE 接收基站发送的第二映射关系指示信息，所述第二映射关系指示信息用于指示在标准预先定义的映射规则下所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。该标准预先定义的映射规则是通信标准或协议定义的映射规则，该映射规则包括如下规则中至少一种：当承载数据信道的单元载波可以承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；当与承载数据信道的上行单元载波相配对的下行单元载波可以承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；或者，不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；或者，不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；或者，不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上。

[0067] 103、对于 UE 当前需要监测的控制信道单元 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE；

[0068] 其中，所述其它一种或多种控制信道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0069] 本发明实施例一中，UE 当前需要监测的控制信道对应的临时搜索空间是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同；对于 UE 当前需要监测的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE，而且不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同，所以经过合并后扩大了控制信道对应的搜索空间，从而在载波聚合系统中，减少了控制信道对应的实际搜索空间中控制信道调度碰撞出现的概率，而且 UE 侧控制信道盲译码次数没有增加。

[0070] 实施例二：

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[0071] 参阅图 2，本发明实施例一提供一种监测控制信道的方法，该实施例主要从 UE 侧描述如何确定搜索空间的，该方法具体包括：

[0072] 201、UE 确定自己当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。

[0073] 具体的，UE 确定自己当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系可以采用如下方式实现：

[0074] 第一种方式：承载数据信道的单元载波与承载控制信道的单元载波的映射关系可以是预先定义的，该预先定义的映射关系是通信标准或协议定义的映射关系，该步骤中 UE 根据标准预先定义的映射关系，确定第二载波集合中的每一个单元载波映射到（即对应到）第一载波集合中的哪一个单元载波。

[0075] 标准预先定义的承载数据信道的单元载波与承载控制信道的单元载波可以为某种函数关系，比如其函数关系包括但不限于如下公式：$I_{PDCCH_C}(k) = (Floor(c \times k + \delta)) \bmod N_{PDCCH_C}$，其中，k 为承载数据信道的单元载波在第二载波集合中的序号，k 为整数，$I_{PDCCH_C}(k)$ 为承载控制信道的单元载波在第一载波集合中的序号，$I_{PDCCH_C}(k)$ 为整数。其中，第一载波集合和 / 或第二载波集合中单元载波的序号可以按照单元载波标识的大小进行编排，或者按照单元载波的载频的高低进行编排，或者按照其他规则进行编排。另外，当第二载波集合是下行单元载波集合和上行单元载波集合之和时，同一单元载波对中的上行和下行单元载波的序号可以相同，例如图 3，先按下行单元载波的标识大小或载频高低进行排列，对于与下行单元载波配对的上行单元载波，其排列的位置与所述下行单元载波相同，对于不与任意下行单元载波配对的上行单元载波，则按其单元载波标识或载频放置到所述排列中，然后按照排列顺序给单元载波编排序号，本发明不对序号的编排作限制。其中，mod 表示取模运算，N_{PDCCH_C} 表示第一载波集合中单元载波的个数；δ 为整数，表征一种偏移量，即序号为 0 的承载数据信道的单元载波映射到的承载控制信道的单元载波的序号，根据不同的场景需求，可以设置不同偏移量，例如，当序号为 0 的承载数据信道的单元载波和序号为 1 的承载控制信道的单元载波为同一个单元载波时，为了使承载数据信道的单元载波与承载控制信道的单元载波一一对应，可以设置 δ = 1，c 为整数或者分数，例如，当 c = 1 时表示第二单元载波集合中的单元载波轮流映射到第一单元载波集合中的单元载波上，当 c = 1/2 且 $N_{PDCCH_C} = 2$ 时表示第二单元载波集合中的单元载波以每 2 个单元载波或单元载波对为一组轮流映射到第一单元载波集合中的单元载波上。Floor 表示向下取整，例如 Floor(0.5) = 0，当 δ 和 c 都为整数时，可以没有 Floor()，即 $I_{PDCCH_C}(k) = (c \times k - \delta) \bmod N_{PDCCH_C}$，δ 和 c 可以是标准预定义的固定值，也可以是标准定义的 UE 特定值，即不同的 UE 采用不同的值。例如，$c = \sum_{i=0}^{N} C(n_s, n_{RNTI}) \cdot 2^i$，其中 C(k) 表示某种伪随机序列，其初始值与 n_{RNTI} 有关，n_{RNTI} 为 RNTI 值，即 UE 标识，n_s 为当前时隙号，N 为整数，这样不同时刻，承载数据信道的单元载波可以随机地映射到承载控制信道的单元载波上，δ 类似。

[0076] 如图 4 所示，设置承载数据信道的单元载波 a 的序号为 0，承载数据信道的单元载波 b 的序号为 1，承载数据信道的单元载波 c 的序号为 2，承载数据信道的单元载波 d 的序号为 3；设置承载控制信道的单元载波 a 的序号为 0，承载控制信道的单元载波 b 的序号为 1，则 $N_{PDCCH_C} = 2$；另外，设置 δ = 0，c = 1，因此，当 k = 0 时，计算得到 $I_{PDCCH_C}(k) = 0$，则表示承载数据信道的单元载波 a 映射到承载控制信道的单元载波 a；序号 k = 1 时，计算得

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到 $I_{PDCCH,CC}(k) = 1$，则表示承载数据信道的单元载波 b 映射到承载控制信道的单元载波 b；序号 k = 2 时，计算得到 $I_{PDCCH,CC}(k) = 1$，承载数据信道的单元载波 c 映射到承载控制信道的单元载波 a，序号 k = 3 时，计算得到 $I_{PDCCH,CC}(k) = 1$，承载数据信道的载波 d 映射到承载控制信道的载波 b。

[0077] 第二种方式：UE 接收基站发送的半静态或者动态的通知消息，通知消息中携带第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系。该 UE 根据第一映射关系指示信息和当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系，确定 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。假定可供选择的映射关系为 N 种，则表示采用哪种映射关系的比特数至少为 $\log_2 N$ 个。例如，图 4 中，每个承载数据信道的单元载波有 2 种选择，可以映射到承载控制信道的单元载波 a 或承载控制信道的单元载波 b，共有 4 个承载数据信道的单元载波，因此，可供选择的映射关系有 $2^4 = 16$ 种，至少需要 4 比特表示当前采用的映射关系。

[0078] 另外，根据第一种方式中提供的映射关系，不同的参数对应着不同的映射关系，UE 接收基站发送的半静态或者动态的通知消息，获知基站当前配置的参数。例如，δ 的值域范围为 {0，1，2，3}，至少需要 2 比特来通知 δ 的具体数值。

[0079] 其中，动态的通知消息即动态信令，其发送频率高，可以按照子帧级的时间间隔发送动态信令；半静态的通知消息即半静态信令，其发送频率较低，可以是周期发送的。

[0080] 第三种方式：标准预先定义一种或多种承载数据信道的单元载波与承载控制信道的单元载波的映射规则，该标准预先定义的映射规则是通信标准或协议定义的映射规则。

[0081] 该映射规则可以包括但不限于以下规则：1）当承载数据信道的单元载波可以承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一载波；当与承载数据信道的上行单元载波相配对的下行单元载波可以承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；2）不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；其中，单元载波带宽等级的划分，可以按照每一种单元载波带宽作为一个等级，或者每一类单元载波带宽作为一个等级，例如，带宽差别 5MHz 以下的单元载波属于同一个单元载波带宽等级，比如 1.4MHz，3MHz，5MHz 属于同一个单元载波带宽等级；3）不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；4）对于非连续载波聚合，不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上。

[0082] UE 接收基站发送的第二映射关系指示信息，该第二映射关系指示信息用于指示在标准预先定义的映射规则下所述 UE 能使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，该 UE 能使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系是基站在标准预先定义的映射规则下存在的多种映射关系中所选择的一种映射关系。

[0083] 例如，图 4 中，有 2 个承载数据信道的单元载波与承载控制信道的单元载波相对应，根据映射规则 1），这 2 个承载数据信道的单元载波则和其相对应的承载控制信道的单

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元载波相映射，那么当前仅有 2 个承载数据信道的单元载波需要通知其映射关系，即当前需要通知的可被配置的映射关系仅为 $2^2 - 4$ 种（而第一种方式中，图 1 有 16 种映射关系），在该步骤中，UE 接收基站发送的第二映射关系的指示信息，该指示信息表示的是基站所选择的一种映射关系。

[0084] 例如，图 4 中，承载数据信道的单元载波 a 和 b 的带宽为 20MHz，而单元载波 c 和 d 的带宽为 10MHz，根据映射规则 2），承载数据信道的单元载波 a 和 / 或 b 不能和单元载波 c 和 / 或 d 映射到同一个承载控制信道的单元载波，那么当前可被配置的映射关系仅为 2 种，即承载数据信道的单元载波 a 和 b 映射到承载控制信道的单元载波 a，承载数据信道的单元载波 c 和 d 映射到承载控制信道的单元载波 b，或者，承载数据信道的单元载波 a 和 b 映射到承载控制信道的单元载波 b，承载数据信道的单元载波 c 和 d 映射到承载控制信道的单元载波 a，在该步骤中，UE 接收基站发送的第二映射关系的指示信息，该指示信息表示的是基站所选择的一种映射关系。

[0085] 可见，预定义映射规则结合信令通知的方法可以节省信令开销，对于映射规则 3）和 4），也可以采用与信令通知结合的方法，在此不再赘述。

[0086] 202、UE 根据下行控制信息比特数配置规则及传输模式、单元载波带宽、发射天线数，每种 DCI 格式的原始下行控制信息比特配置内容等信息，确定 UE 当前需要监测的每种控制信道的下行控制信息比特数。

[0087] 第一步：根据当前可使用的每个承载数据信道的单元载波的传输模式，确定该 UE 当前可使用的每个承载数据信道的单元载波对应的 DCI 格式，从而确定出该 UE 当前可使用的每个承载数据信道的单元载波对应的控制信道承载的 DCI 的格式，即该 UE 当前需要监测的每种控制信道承载的 DCI 的格式；

[0088] 第二步：根据每个承载数据信道的单元载波的单元载波带宽，发射天线数以及每种 DCI 格式的原始下行控制信息比特配置内容确定每个承载数据信道的单元载波对应的 DCI 格式的原始下行控制信息比特数，从而确定出该 UE 当前需要监测的每种控制信道对应的 DCI 格式的原始下行控制信息比特数；

[0089] 第三步：根据下行控制信息比特数配置规则以及该 UE 当前需要监测的每种控制信道对应的 DCI 格式的原始下行控制信息比特数，确定 UE 当前需要监测的每种控制信道的下行控制信息比特数。

[0090] 所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则。该规则可以是标准预先定义的，即该标准预先定义的下行控制信息比特数配置规则是通信标准或协议定义的规则；或者在该步骤之前，UE 接收基站发送的携带下行控制信息比特数配置规则的消息。

[0091] 下行控制信息比特数的配置规则可以包括如下规则中至少一种：

[0092] 1）、传输模式相同的承载数据信道的上行单元载波和承载数据信道的下行单元载波所对应的 DCI 格式的下行控制信息比特数相同。

[0093] 所述相同的比特数可以是传输模式相同的承载数据信道的上行单元载波和承载数据信道的下行单元载波对应的 DCI 格式的原始控制信息比特数中的最大值。

[0094] 需要说明的是，每种传输模式可以对应 1 种或 2 种 DCI 格式，如果对应 2 种 DCI 格式，其中有一个 DCI 格式是所有下行单元载波的或上行单元载波的传输模式都支持的，例

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如，下行单天线传输模式支持 DCI 格式 1 和 DCI 格式 1A，其中，DCI 格式 1A 是所有下行传输模式都支持的，所述的这两种传输模式对应的 DCI 格式不包括所述下行或上行传输模式都支持的 DCI 格式。

[0095] 例如，下行单元载波的闭环空分复用传输对应 DCI 格式 2 和 DCI 格式 1A，上行单元载波的闭环空分复用传输对应 DCI 格式 02 和 DCI 格式 0，因为下行单元载波和上行单元载波都采用相同的传输模式，所以 DCI 格式 2 和 DCI 格式 02 的下行控制信息比特数相同。

[0096] 在该步骤之前，UE 会接收到基站发送的通知 UE 的传输模式的消息，该步骤中 UE 可以根据自己的传输模式，确定上当前需要监测的每个 DCI 格式，当上行单元载波的传输模式和下行单元载波的传输模式相同时，则这两种传输模式对应的 DCI 格式的下行控制信息比特数相同。

[0097] 2)、若多种 DCI 格式的原始下行控制信息比特数在相同的单元载波带宽或相同的单元载波带宽等级条件下的彼此差值小于预设数值，则这多种 DCI 格式的下行控制信息比特数相同。所述相同的比特数可以是所述多种 DCI 格式的原始控制信息比特数中的最大值。

[0098] 比如，LTE A 系统中下行大时延 CDD 对应的 DCI 格式为 DCI 格式 2A 和 DCI 格式 1A，下行闭环空分复用对应的 DCI 格式为 DCI 格式 2 和 DCI 格式 1A，在相同单元载波带宽下，如果 DCI 格式 2A 和 DCI 格式 2 的原始下行控制信息比特数相差 0 ～ 1 比特，其差值小于预设数值（假设预设数值为 1 比特），因此，DCI 格式 2A 和 DCI 格式 2 的下行控制信息比特数相同。

[0099] 3)、若多种 DCI 格式的原始下行控制信息比特数在当前的资源配置条件下的彼此差值小于预设数值，则这多种 DCI 格式的下行控制信息比特数相同。所述的当前的资源配置条件可以包括但不限于以下条件：单元载波带宽，天线个数等。所述相同的比特数可以是所述多种 DCI 格式的原始控制信息比特数中的最大值。

[0100] 比如 LTE-A 系统中，UE 当前能使用的 2 个下行单元载波的带宽分别为 20MHz 和 5MHz，带宽为 20MHz 的单元载波的传输模式为下行单天线传输，对应的 DCI 格式为 DCI 格式 1 和 DCI 格式 1A，带宽为 5MHz 的单元载波的传输模式为下行闭环空分复用，对应的 DCI 格式为 DCI 格式 2 和 DCI 格式 1A，其中，如果 20MHz 带宽对应的 DCI 格式 1 和带宽为 5MHz 的 DCI 格式 2 的原始下行控制信息比特数相差 0 ～ 3 比特，小于预设数值 4bit，则带宽为 20MHz 对应的 DCI 格式 1 和带宽为 5MHz 对应的 DCI 格式 2 的下行控制信息比特数相同。

[0101] 4)、同一频域资源分配方式对应的 DCI 格式的下行控制信息比特数相同。

[0102] 同一频域资源分配方式对应的 DCI 格式的下行控制信息应具有相同的比特数，该相同的比特数可以是同一频域资源分配方式对应的所有 DCI 格式的原始控制信息比特数中的最大值。

[0103] 其中，系统的频域资源分配方式包括两种：连续频域资源分配方式和非连续频域资源分配方式。

[0104] 该步骤中 UE 可以根据自己当前需要监测的每个 DCI 格式对应的频域资源分配方式确定当前需要监测的每个 DCI 格式的信息比特数：同一种频域资源分配方式所对应的 DCI 格式的信息比特数相同。

[0105] 5)、可指示的最多传输块 (Transport Block，TB) 个数相同的 DCI 格式的下行控制

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信息比特数相同。

[0106] 其中，传输块即码字（codeword），每种 DCI 格式可指示的最多传输块个数是固定的，每个传输块需要的比特指示信息也是固定的，例如，下行的每个传输块需要 8 比特进行指示，上行的每个传输块需要 5 比特进行指示。

[0107] 可指示的最多传输块个数相同的 DCI 格式应具有相同的比特数，该相同的比特数可以是可指示的最多传输块个数相同的所有 DCI 格式的原始控制信息比特数中的最大值。

[0108] 有些 DCI 格式对应的下行控制信息最多只能调度一个传输块，则这些 DCI 格式的下行控制信息比特数应该相同；有些 DCI 格式对应的下行控制信息最多只能调度两个传输块，则这些 DCI 格式的下行控制信息比特数应该相同。

[0109] 该步骤中 UE 可以根据自己当前需要监测的每个 DCI 格式的下行控制信息可指示的最多传输块个数确定当前需要监测的每个 DCI 格式的信息比特数；可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0110] 6）、频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0111] 频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式应具有相同的比特数，该相同的比特数可以是满足该条件的所有 DCI 格式的原始控制信息比特数中的最大值。

[0112] 该步骤中 UE 可以根据自己当前需要监测的每个 DCI 格式采用的频域资源分配方式和每个 DCI 格式的下行控制信息可指示的最多传输块个数确定当前需要监测的每个 DCI 格式的信息比特数；频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0113] 7）、在相同的单元载波带宽或相同的单元载波带宽等级条件下，相同频域资源分配方式相同和 / 或可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0114] 该相同的比特数可以是满足该条件的所有 DCI 格式的原始控制信息比特数中的最大值。

[0115] 8）、某种特定资源配置条件下，同一种 DCI 格式的信息比特数在当前时刻仅配置成唯一值。

[0116] 所述的唯一值必须按照最大的信息比特数进行配置，例如按照当前支持的最大单元载波带宽（DCI 格式的信息比特数会随着带宽的增加而变大）和 / 或当前支持的最大天线数（DCI 格式的信息比特数会随着天线数的增加而变大）等配置信息比特数；

[0117] 所述的某种特定资源配置条件可以包括但不限于以下条件：

[0118] 该 DCI 格式采用的是连续频域资源分配方式，例如，DCI 格式 1A 采用的是连续频域资源分配，则无论当前配置的单元载波带宽是多少，DCI 格式的信息比特数在当前时刻仅配置成唯一值（按照当前支持的最大单元载波带宽进行配置）；

[0119] 该 DCI 格式在当前配置的不同条件下的原始下行控制信息比特数的差值小于预设数值，例如，UE 当前能使用的 2 个下行单元载波的带宽分别为 20MHz 和 5MHz，且都支持 DCI 格式 1B，如果 20MHz 带宽对应的 DCI 格式 1B 和带宽为 5MHz 的 DCI 格式 1B 的下行控制信息比特数相差 3 比特（小于预设数值 4bit），则 DCI 格式 1B 在当前时刻仅配置成唯一值（按照 20MHz 带宽进行配置）。

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[0120] 9)、同一种 DCI3 格式的信息比特数在当前时刻仅配置成唯一值。

[0121] 所述的唯一值必须按照最大的信息比特数进行配置，例如按照当前支持的最大单元载波带宽（DCI 格式的信息比特数会随着带宽的增加而变大）和 / 或当前支持的最大天线数（DCI 格式的信息比特数会随着天线数的增加而变大）等配置信息比特数。

[0122] 203、UE 根据预定义的临时搜索空间计算方法、以及承载控制信道的单元载波与承载数据信道的单元载波之间的映射关系，确定 UE 当前需要监测的每种控制信道对应的临时搜索空间。

[0123] 为了方便理解，先对承载控制信道的单元载波的临时搜索空间作简单说明：系统中每个承载数据信道的单元载波对应一个临时搜索空间，一个或者多个承载数据信道的单元载波可以联合到同一个承载控制信道的单元载波，因此，每个承载控制信道的单元载波上可以有多个临时搜索空间。根据预定义的搜索空间计算方法计算出的多个临时搜索空间可能相同，也可能不相同。

[0124] 1）确定每个承载数据信道的单元载波对应的临时搜索空间；

[0125] 由于搜索空间是 UE 需要监测的 PDCCH 的集合，PDCCH 是由 CCE 聚合而成，因此要确定每个承载数据信道的单元载波对应的临时搜索空间，需要确定组成临时搜索空间$S_{k,d,n}^{(L)}$的 CCE，其中，L 为聚合级别，k 为当前子帧号，d 为承载控制信道的单元载波的标识或序号，n 为承载数据信道的单元载波的标识或序号。该步骤中单元载波标识 / 序号 d 表示的承载控制信道的单元载波和单元载波标识 / 序号 n 表示的承载数据信道的单元载波具有步骤 201 所确定的映射关系。

[0126] 例如，组成临时搜索空间$S_{k,d,n}^{(L)}$的 CCE 的公式为：

[0127]

$$L\left\{\left(Y_k + m\right)\bmod \left\lfloor N_{CCE,k,d} / L \right\rfloor\right\} + i$$

[0128] 其中，$i = 0, \cdots, L-1$，$m = 0, \cdots, M^{(L)}-1$。$M^{(L)}$ 为聚合级别为 L 时，待检测的 PDCCH 个数。$N_{CCE,k,d}$ 为单元载波标识或序号为 d 的承载控制信道的单元载波在第 k 个子帧时使用的 CCE 总数。

[0129] 其中，$Y_k = (A \cdot Y_{k-1}) \bmod D$。其中 $Y_{-1} = F(n_{RNTI}, n) \neq 0$ 或按照现有技术 $Y_{-1} = n_{RNTI} \neq 0$，F(k) 表示某种函数，A = 39827，D = 65537，$k = \lfloor n_s/2 \rfloor$，$n_s$ 为一个无线帧的时序（slot）序号，n_{RNTI} 为 RNTI 值。

[0130] 需要说明的是，当考虑单元载波的属性时，$M^{(L)}$ 也可以随着不同单元载波的属性，而设置不同。例如，当某一承载数据信道的单元载波为主载波时，其对应的临时搜索空间的 $M^{(L)}$ 值可以不同于非主载波对应的临时搜索空间，或者，当某一承载控制信道的单元载波为主载波时，其上的所有临时搜索空间的 $M^{(L)}$ 值可以不同于非主载波对应的临时搜索空间。这里所指的主载波为为处于连接状态的用户设备需要持续的监测的单元载波，或者，UE 接收寻呼信息（paging）和系统广播信息的单元载波，本发明不对主载波的特征进行限制。具体地，例如，考虑主载波上发送的信息较为重要，进而希望降低主载波对应的搜索空间的控制信道调度碰撞概率，因此当某一承载数据信道的单元载波为主载波时，其对应的临时搜索空间的 $M^{(L)}$ 值可以大于非主载波对应的临时搜索空间。

[0131] 2)、根据 UE 的承载数据信道的单元载波所对应的控制信道，及承载数据信道的单

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元载波对应的临时搜索空间，确定 UE 当前需要监测的每种控制信道对应的临时搜索空间。如图 5 所示，承载数据信道的单元载波 a 对应的控制信道 A，控制信道 B 和控制信道 C 的临时搜索空间为 SS0；承载数据信道的单元载波 c 对应的控制信道 D，控制信道 E 和控制信道 F 的临时搜索空间为 SS2；承载数据信道的单元载波 b 对应的控制信道 G，控制信道 H 和控制信道 I 的临时搜索空间为 SS1；承载数据信道的单元载波 d 对应的控制信道 J 和控制信道 K 的临时搜索空间为 SS3。此处仅是举例，每个承载数据信道的单元载波对应的控制信道可以不止 2 种或 3 种。

[0132] 204、对于 UE 当前需要监测的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE。其中，所述其它一种或多种控制信道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0133] 为了描述清楚，分别对构成实际搜索空间的 2 维要素进行描述：

[0134] 第一维构成要素：实际搜索空间是所有和还是部分和，即实际搜索空间是由全部控制信道对应的临时搜索空间构成的，还是由部分控制信道对应的临时搜索空间构成的。其中，所有和是指所述选定的一种控制信道对应的实际搜索空间为所述下行控制信息比特数相同的所有控制信道对应的临时搜索空间的和，部分和是指所述选定的一种控制信道对应的实际搜索空间为所述下行控制信息比特数相同的部分控制信道对应的临时搜索空间的和。出现部分和的原因可能是其中某个或某几个单元载波的属性导致。例如当某一承载数据信道的单元载波为主载波时，考虑主载波上发送的信息较为重要，进而希望降低主载波对应的搜索空间的控制信道调度碰撞概率，因此其对应的临时搜索空间不适合共享给其它承载数据信道的单元载波。例如，为了 UE 能尽可能的省电或者降低盲译码次数，从 UE 的不连续接收角度出发，希望监测的实际搜索空间尽量集中在较少的承载控制信道的单元载波上，因此某些承载控制信道的单元载波上的临时搜索空间可以不参与和并，具体地，例如，考虑主载波在连接状态是总要监测的，参与和并的临时搜索空间可以只是主载波上的临时搜索空间，这样，当非主载波上一段时间内没有数据信道发送时，可以进入休眠状态，如有需要，可以通过主载波上的动态信令激活。需要说明的是，本发明不对导致部分和的原因做限制。例如图 6 所示，假设承载数据信道的单元载波 b 是主载波，控制信道 A，D 和 G 都是 UE 当前需要监测的同一 CCE 聚合级别的下行控制信息比特数相同的控制信道，其中，控制信道 A 的实际搜索空间扩大到了 SS0，SS1 和 SS2，这属于所有和的构成方式；其中，考虑降低主载波对应的搜索空间的控制信道调度碰撞概率，控制信道 D 的实际搜索空间只扩大到 SS0 和 SS2，这属于部分和的构成方式；其中，考虑参与和并的临时搜索空间只是主载波上的临时搜索空间，控制信道 G 的实际搜索空间为 SS1，这属于部分和的构成方式。

[0135] 第二维构成要素：实际搜索空间是临时搜索空间和中的所有 CCE，还是临时搜索空间和中的一部分 CCE。其中，和中的所有 CCE 是指所述选定的一种控制信道对应的实际搜

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索空间为所述下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，即每个参与构成实际搜索空间的临时搜索空间是完整的，包括该临时搜索空间的所有 CCE，其中，和中的一部分 CCE 是指所述选定的一种控制信道对应的实际搜索空间为所述下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE，即对于某个或某几个或全部参与构成实际搜索空间的临时搜索空间，只有该临时搜索空间的一部分 CCE 参与和并。出现实际搜索空间是临时搜索空间和中的一部分 CCE 的原因是当实际搜索空间是临时搜索空间和中的所有 CCE，由于构成的实际搜索空间过大，为了降低 UE 端的盲译码次数，需要缩小实际搜索空间。例如，当前盲译码次数超过 UE 的最大盲译码次数或者标准定义的最大盲译码次数，这样实际搜索空间可以根据最大盲译码次数进行缩小，另外，实际搜索空间也可以根据系统确定的某个缩小比例（可以是基站通知，或者标准定义的）进行缩小，每个临时搜索空间的缩小比例可以相同也可以不相同。本发明不对导致实际搜索空间是临时搜索空间和中的一部分 CCE 的原因做限制。例如图 6 所示，假设控制信道 B，E，H 和 K 都是 UE 当前需要监测的同一 CCE 聚合级别的下行控制信息比特数相同的控制信道，其中，控制信道 B 的实际搜索空间扩大到了 SS0，SS1，SS2 和 SS3，其中 SS0，SS1，SS2 和 SS3 包括的所有 CCE 都参与实际搜索空间的构成，这属于实际搜索空间是临时搜索空间和中的所有 CCE 的构成方式；其中，控制信道 E 的实际搜索空间扩大为 SS0_p，SS1_p，SS2_p 和 SS3_p，SS0_p 为 SS0 的一部分，假设 SS0 包括 12 个 CCE，SS0_p 包括的 CCE 是 SS0 包括的前 2/3 的 CCE，即前 8 个 CCE，SS1_p，SS2_p 和 SS3_p 相同操作，这属于实际搜索空间是临时搜索空间和中的一部分 CCE 的构成方式；其中，控制信道 H 的实际搜索空间扩大为 SS0_p，SS2_p 和 SS3_p，SS0_p 为 SS0 的一部分，假设 SS0 包括 12 个 CCE，SS0_p 包括的 CCE 是 SS0 包括的前 5/6 的 CCE，即前 10 个 CCE，SS2_p 和 SS3_p 相同操作，这属于实际搜索空间是临时搜索空间和中的一部分 CCE 的构成方式；其中，控制信道 K 的实际搜索空间扩大为 SS0_p 和 SS3_p，SS0_p 和 SS3_p 分别为 SS0 和 SS3 的一部分，假设 SS0 和 SS3 都包括 12 个 CCE，SS0_p 包括的 CCE 是 SS0 包括的前 1/2 的 CCE，即前 6 个 CCE，SS3_p 包括的 CCE 是 SS0 包括的前 5/6 的 CCE，即前 10 个 CCE，这属于实际搜索空间是临时搜索空间和中的一部分 CCE 的构成方式。

[0136] 另外，所述选定的一种控制信道对应的实际搜索空间也可以为所述下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和的扩充，出现进一步扩充的原因主要是为了进一步减小 PDCCH 调度碰撞的概率。例如图 6 所示，假设控制信道 C 和 I 都是 UE 当前需要监测的同一 CCE 聚合级别的下行控制信息比特数相同的控制信道，其中，控制信道 C 的实际搜索空间扩大为 SS0，SS1 和 SS_b，SS_b 为扩充的搜索空间，即扩充的 CCE，例如扩充 4 个 CCE；其中，控制信道 I 的实际搜索空间扩大为 SS0 和 SS1。

[0137] 对于 UE 当前需要监测的 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际搜索空间为所述选定的一种控制信道对应的临时搜索空间。所述其它控制信道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的所有控制信道；对于不同下行控制信息比特数的控制信道的搜索空间不进行合并，是为了不增加控制信道的盲译码次数。例如，如图 6 所示，对于 UE 当前需要监测的同一 CCE 聚合级别的控制信道，控制信道 F 和其它控制信道的下行控制信息比特数不相同，

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所以控制信道 1 的实际搜索空间为 SS2。控制信道 J 类似。

[0138] 需要说明的是，下行控制信息比特数配置规则是定义那些应配置成相同的下行控制信息比特数的 DCI 格式应该符合什么样的条件，对于某个 UE 使用的多个 DCI 格式，可能有部分满足条件能配置成相同的下行控制信息比特数，也可能某个 DCI 格式不能满足条件，则此时对应该 DCI 格式的控制信道对应的实际搜索空间就是该控制信道对应的临时搜索空间。

[0139] 需要说明的是，图 6 相关的例子都是基于图 5 的例子进行阐述的。

[0140] 205、UE 根据当前需要监测的每种控制信道对应的实际搜索空间以及当前需要监测的每种控制信道的下行控制信息比特数，对每种控制信道对应的实际搜索空间中的 PDCCH 进行盲译码，搜索出 CRC 校验正确的下行控制信息。

[0141] 当多个下行控制信息比特数相同的控制信道对应的实际搜索空间相同时，基站需要给每种控制信道承载的 DCI 添加标识单元载波的信息头，即载波标识 (Carrier Identify，CI) 比特，或者需要给每个 DCI 添加不同的扰码，UE 根据每个 DCI 的载波标识比特或者不同的扰码，区分搜索出来的 DCI 指示的是哪一个承载数据信道的单元载波。

[0142] 本发明实施例一中，UE 当前需要监测的控制信道对应的临时搜索空间是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同；对于 UE 当前需要监测的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为所述下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE，而且不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同，所以经过合并后扩大了控制信道对应的搜索空间，从而在载波聚合系统中，减少了控制信道对应的实际搜索空间中控制信道调度碰撞出现的概率，而且 UE 侧控制信道盲译码次数没有增加。

[0143] 实施例二：

[0144] 参阅图 7，本发明实施例提供一种候选控制信道资源确定方法，该方法包括：

[0145] 701、确定 UE 当前可被配置的每种控制信道的下行控制信息比特数。

[0146] 其中，UE 当前可被配置的每种控制信道的下行控制信息比特数可以是根据下行控制信息比特数配置规则以及所述 UE 当前可被配置的每种控制信道承载的 DCI 的格式确定的，其中，下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则，该多个 DCI 格式的原始下行控制信息比特数可能不相同，该规则规定了哪些情况下这些 DCI 格式的下行控制信息比特数应该配置成相同，具体可以通过添加冗余信息比特或者额外的有用信息比特来配置这些 DCI 格式的下行控制信息比特数相同。

[0147] 其中，所述下行控制信息比特数配置规则包括以下规则中的至少一种：

[0148] 同一频域资源分配方式对应的 DCI 格式的下行控制信息比特数相同；

[0149] 频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同；

[0150] 在当前配置的不同资源条件下，若同一种 DCI 格式的下行控制信息比特数的差值

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小于预设数值，所述 DCI 格式的下行控制信息比特数配置成唯一值。

[0151] 702、根据所述 UE 当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道所对应的临时候选控制信道资源。

[0152] 其中，承载控制信道的单元载波为第一载波集合中的单元载波，所述承载数据信道的单元载波为第二载波集合中的单元载波，对第一载波集合、第二载波集合及相关描述见实施例一中的步骤 102。

[0153] 其中，UE 当前可被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系可以为 一对应关系或者多对一关系，相关描述见实施例一中的步骤 102。

[0154] 该步骤中 UE 当前可被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系可以是标准预先定义的。或者，在该步骤之前基站在当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中选择一种映射关系，为了使 UE 和基站采用同一种映射关系，基站向 UE 发送第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在当前 UE 可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系。其中，该标准预先定义的映射关系是通信标准或协议定义的映射关系。

[0155] 或者，在该步骤之前，基站根据标准预先定义的映射规则，确定当前可配置的映射关系种类，并选择一种映射关系。其中，标准预先定义的映射规则是通信标准或协议定义的映射规则，为了保证 UE 和基站采用相同的映射关系，基站向 UE 发送第二映射关系指示信息，所述第二映射关系指示信息用于指示在标准预先定义的映射规则下所述 UE 当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；

[0156] 所述映射规则包括如下规则中至少一种：当承载数据信道的单元载波能承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；

[0157] 当与承载数据信道的上行单元载波相配对的下行单元载波能承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；

[0158] 不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；

[0159] 不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；

[0160] 不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上。

[0161] 703、对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE。其中，所述其它一种或多种控制信道为 UE 当前可被配置的 CCE 聚合级别相同的控制信道中除

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了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0162] 本发明实施例二中，所述UE当前可被配置的控制信道对应的临时候选控制信道资源是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的临时候选控制信道资源可能不同；对于UE当前可被配置的CCE聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分CCE，而且不同承载数据信道的单元载波对应的控制信道的临时候选控制信道资源可能不同，所以经过合并后扩大了控制信道对应的候选控制信道资源，从而在载波聚合系统中，减少了控制信道对应的实际候选控制信道资源中控制信道调度碰撞出现的概率。

[0163] 实施例四：

[0164] 参阅图8，本发明实施例四提供一种下行控制信息发送方法，该方法主要从基站侧描述如何确定控制信道对应的候选控制信道资源，该方法具体包括：

[0165] 801、基站确定UE当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。

[0166] 具体的：基站确定UE当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系可以采用如下方式实现：

[0167] 第一种方式：承载数据信道的单元载波与承载控制信道的单元载波的映射关系可以是标准预先定义的，该步骤中基站根据标准预先定义的映射关系，确定在第二载波集合中的每一个单元载波映射到（即对应到）第一载波集合中的哪一个单元载波。其中，该标准预先定义的映射关系是通信标准或协议定义的映射关系。其中，可以预先定义承载数据信道的单元载波与承载控制信道的单元载波为某种函数关系，见实施例二中步骤201下的相关描述，在此不再赘述。

[0168] 第二种方式：当前UE可配置的映射关系有多种，比如N种映射关系，基站选择一种，为了保证UE与基站采用的同一种映射关系，基站会通过半静态信令或者动态信令向UE发送第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在当前UE可配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系。

[0169] 第三种方式：标准预先定义一种或多种承载数据信道的单元载波与承载控制信道的单元载波的映射规则，其映射规则可以是上述实施例二所描述的四种映射规则，基站根据标准预先定义的映射规则，确定当前可配置的映射关系种类，基站会选择一种映射关系，为了保证UE与基站采用的是同一种映射关系，该步骤中基站会给UE发送第二映射关系指示信息，该第二映射关系指示信息用于指示在预定义的映射规则下所述UE使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系。其中，标准预先定义的映射规则是通信标准或协议定义的映射规则。

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[0170] 802、基站根据下行控制信息比特数配置规则及传输模式、单元载波带宽、发射天线数，每种 DCI 格式的原始下行控制信息比特配置内容等信息，确定 UE 当前可被配置的每种控制信道的下行控制信息比特数，还可以将传输模式、单元载波带宽、发射天线数等信息通知给 UE，以便 UE 根据这些信息获知自己需要监测的每种控制信道的下行控制信息比特数。

[0171] 具体确定 UE 当前可被配置的每种控制信道的下行控制信息比特数的步骤与实施例一 202 中描述的一个步骤相似，在此不再赘述。

[0172] 其中，所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相互间的规则。该规则可以是标准预先定义的，即该标准预先定义的下行控制信息比特数配置规则是通信标准或协议定义的规则；或者，基站将当前使用的下行控制信息比特数的配置规则通知 UE。

[0173] 下行控制信息比特数的配置规则可以包括如下规则中至少一种：

[0174] 1)、传输模式相同的承载数据信道的上行单元载波和承载数据信道的下行单元载波所对应的 DCI 格式的下行控制信息比特数相同。

[0175] 当基站当前配置的上行单元载波的传输模式和下行单元载波的传输模式相同时，则该上行单元载波和下行单元载波对应的 DCI 格式的下行控制信息比特数相同。

[0176] 2)、若多种 DCI 格式的原始下行控制信息比特数在在相同的单元载波带宽或相同的单元载波带宽等级条件下的彼此差值小于预设数值，则这多种 DCI 格式的下行控制信息比特数相同。

[0177] 3)、若多种 DCI 格式的原始下行控制信息比特数在当前的资源配置条件下的彼此差值小于预设数值，则这多种 DCI 格式的下行控制信息比特数相同。所述的当前的资源配置条件可以包括但不限于以下条件：单元载波带宽，天线个数等。

[0178] 4)、同一频域资源分配方式对应的 DCI 格式的下行控制信息比特数相同。

[0179] 该步骤中基站根据 UE 当前可被配置的每个 DCI 格式对应的频域资源分配方式确定当前可被配置的每个 DCI 格式的信息比特数；同一种频域资源分配方式所对应的 DCI 格式的信息比特数相同。

[0180] 5)、可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0181] 该步骤中基站根据 UE 当前可被配置的每个 DCI 格式的下行控制信息可指示的最多传输块个数确定当前可被配置的每个 DCI 格式的信息比特数；可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0182] 6)、频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0183] 该步骤中基站根据当前可被配置的每个 DCI 格式采用的频域资源分配方式和每个 DCI 格式的下行控制信息可指示的最多传输块个数确定当前可被配置的每个 DCI 格式的信息比特数；频域资源分配方式相同且可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0184] 7)、在相同的单元载波带宽或相同的单元载波带宽等级条件下，相同频域资源分配方式相同和 / 或可指示的最多传输块个数相同的 DCI 格式的下行控制信息比特数相同。

[0185] 8)、某种特定资源配置条件下，同一种 DCI 格式的信息比特数在当前时刻仅配置

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成唯一值。

[0186] 所述的唯一值必须按照最大的信息比特数进行配置；

[0187] 所述的某种特定资源配置条件可以包括但不限于以下条件：该 DCI 格式采用的是连续频域资源分配方式；该 DCI 格式在当前配置的不同条件下的原始下行控制信息比特数的差值小于预设数值。

[0188] 9)、同一种 DCI 格式的信息比特数在当前时刻仅配置成唯一值。

[0189] 803、基站根据预定义的临时候选控制信道资源计算方法，以及承载控制信道的单元载波与承载数据信道的单元载波之间的映射关系，确定 UE 当前可被配置的每种控制信道对应的临时候选控制信道资源。

[0190] 该步骤的临时候选控制信道资源确定方式与实施例一中的步骤 203 临时搜索空间确定的实现方式相似，在此不再赘述。

[0191] 804、对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE。其中，所述其它一种或多种控制信道为 UE 当前可被配置的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0192] 为了描述清楚，分别对构成实际候选控制信道资源的 2 维要素进行描述：

[0193] 第一维构成要素：实际候选控制信道资源是所有和还是部分和，即实际候选控制信道资源是由全部控制信道对应的临时候选控制信道资源构成的，还是由部分控制信道对应的临时候选控制信道资源构成的。其中，所有和是指所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的所有控制信道对应的临时候选控制信道资源的和，部分和是指所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的部分控制信道对应的临时候选控制信道资源的和。出现部分和的原因可能是其中某个或某几个单元载波的属性导致。

[0194] 第二维构成要素：实际候选控制信道资源是临时候选控制信道资源和中的所有 CCE，还是临时候选控制信道资源和中的一部分 CCE。其中，和中的所有 CCE 是指所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，即每个参与构成实际候选控制信道资源的临时候选控制信道资源是完整的，包括该临时候选控制信道资源的所有 CCE，其中，和中的一部分 CCE 是指所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE，即对于某个或某几个或全部参与构成实际候选控制信道资源的临时候选控制信道资源，只有该临时候选控制信道资源的一部分 CCE 参与和并。出现实际候选控制信道资源是临时候选控制信道资源和中的一部分 CCE 的原因是当实际候选控制信道资源是临时候选控制信道资源和中的所有 CCE，由于构成的实际候选控制信道资源过大，为了降低

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UE 端的盲译码次数，需要缩小实际候选控制信道资源。

[0195] 另外，所述选定的一种控制信道对应的实际候选控制信道资源也可以为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和的扩充，出现进一步扩充的原因主要是为了进一步减小 PDCCH 调度碰撞的概率。

[0196] 对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述选定的一种控制信道对应的临时候选控制信道资源。所述其它控制信道为 UE 当前可被配置的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的所有控制信道。对于不同下行控制信息比特数的控制信道的候选控制信道资源不进行合并，是为了不增加控制信道的盲译码次数。

[0197] 805、基站根据所确定的 UE 当前可被配置的每种控制信道的下行控制信息比特数，构造每种控制信道承载的 DCI，并将 DCI 承载于实际候选控制信道资源中的控制信道上发送给 UE。

[0198] 基站构造每种控制信道承载的 DCI 时，当步骤 802 确定的控制信道的下行控制信息数比该控制信道的原始下行控制信息比特数多时，可在多的比特位上添加有用信息比特或者冗余信息比特。

[0199] 当多种下行控制信息比特数相同的控制信道对应的实际候选控制信道资源相同时，需要给每种控制信道承载的 DCI 添加载波标识比特，或者需要添加不同的扰码，便于 UE 区分搜索出来的 DCI 指示的是哪一个承载数据信道的单元载波。

[0200] 本发明实施例四中，所述 UE 当前可被配置的控制信道对应的临时候选控制信道资源是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的临时候选控制信道资源也能不同；对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE，而且不同承载数据信道的单元载波对应的控制信道的临时候选控制信道资源可能不同，所以经过合并后扩大了控制信道对应的候选控制信道资源，从而在载波聚合系统中，减少了控制信道对应的实际候选控制信道资源中控制信道调度碰撞出现的概率。

[0201] 实施例五：

[0202] 参阅图 9A、9B 和 / 或 9C，本发明实施例五提供一种用户设备，包括：

[0203] 控制信息比特数确定单元 901，用于确定 UE 当前需要监测的每种控制信道的下行控制信息比特数；

[0204] 临时搜索空间确定单元 902，用于根据所述 UE 当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间；

[0205] 实际搜索空间确定单元 903，用于对于 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所

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述选定的一种控制信道对应的实际搜索空间为所述下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有 CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分 CCE；其中，所述其它一种或多种控制信道为 UE 当前需要监测的 CCE 聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0206] 其中，实际搜索空间确定单元 903 还用于对于 CCE 聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际搜索空间为所述选定的一种控制信道对应的临时搜索空间。

[0207] 优选的，该用户设备还包括：控制信息比特数配置规则保存单元 904，用于保存下行控制信息比特数配置规则，其中，所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则；控制信息比特数确定单元 901，用于根据所述下行控制信息比特数配置规则以及所述 UE 当前需要监测的每种控制信道承载的 DCI 的格式，确定 UE 当前需要监测的每种控制信道的下行控制信息比特数。

[0208] 优选的，如图 9A 所示，该用户设备还包括：第一保存单元 905，用于保存所述用户设备使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；此时临时搜索空间确定单元 902，用于根据第一保存单元 905 所保存的用户设备能使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间。

[0209] 或者，如图 9B 所示，该用户设备还包括：第二保存单元 906，用于保存用户设备当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系；第一接收单元 907，用于接收基站发送的第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在所述用户设备当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系；第一映射关系确定单元 908，用于根据第二保存单元 906 所保存的多种映射关系和第一映射关系指示信息，确定所述用户设备当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；此时临时搜索空间确定单元 902，用于根据第一映射关系确定单元 908 所确定的用户设备当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前需要监测的每种控制信道对应的临时搜索空间。

[0210] 或者，如图 9C 所示，该用户设备还包括：第二保存单元 909，用于保存映射规则，所述映射规则包括如下规则中至少一种：当承载数据信道的单元载波能承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；当与承载数据信道的上行单元载波相配对的下行单元载波能承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的

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单元载波上；第二接收单元910，用于接收基站发送的第二映射关系指示信息，所述第二映射关系指示信息用于指示在标准预先定义的映射规则下所述UE当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；第二映射关系确定单元911，用于根据所述第二保存单元909所保存的映射规则，确定所述映射规则下可用的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系，根据所述多种映射关系和第二映射关系指示信息，确定所述用户设备当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；此时所述临时搜索空间确定单元902，用于根据第二映射关系确定单元911所确定的用户设备当前使用的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述UE当前需要监测的每种控制信道对应的临时搜索空间。

[0211] 本发明实施例中，UE当前需要监测的控制信道对应的临时搜索空间是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同；对于UE当前需要监测的CCE聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际搜索空间为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的所有CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时搜索空间的和中的一部分CCE，而且不同承载数据信道的单元载波对应的控制信道的临时搜索空间可能不同，所以经过合并后扩大了控制信道对应的搜索空间，从而在载波聚合系统中，减少了控制信道对应的实际搜索空间中控制信道频度碰撞出现的概率，而且UE侧控制信道盲译码次数没有增加。

[0212] 实施例六：

[0213] 参阅图10A、10B和/或10C，本发明实施六提供一种基站，包括：

[0214] 控制信息比特数确定单元1001，用于确定UE当前可被配置的每种控制信道的下行控制信息比特数；

[0215] 临时候选控制信道资源确定单元1002，用于根据所述UE当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述UE当前可被配置的每种控制信道所对应的临时候选控制信道资源；

[0216] 实际候选控制信道资源确定单元1003，用于当对于CCE聚合级别相同的控制信道，其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有CCE，或者为下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分CCE。其中，所述其它一种或多种控制信道为UE当前可被配置的CCE聚合级别相同的控制信道中除了所述选定的一种控制信道以外的一种或多种控制信道；所述下行控制信息比特数相同的所有或部分控制信道为所述其它一种或多种控制信道以及选定的一种控制信道组成的控制信道集合中的所有或部分控制信道。

[0217] 其中，实际候选控制信道资源确定单元1003，还用于对于CCE聚合级别相同的控制信道，当其它控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数都不相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述选定

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的一种控制信道对应的临时候选控制信道资源。

[0218] 优选的，该基站还包括：控制信息比特数配置规则保存单元 1004，用于保存下行控制信息比特数配置规则，其中，所述下行控制信息比特数配置规则是指规定多个 DCI 格式的下行控制信息比特数相同的规则。控制信息比特数确定单元 1001，用于根据下行控制信息比特数配置规则以及所述 UE 当前可被配置的每种控制信道承载的 DCI 的格式，确定 UE 当前可被配置的每种控制信道的下行控制信息比特数。

[0219] 优选的，如图 10A 所示，该基站还包括：第一保存单元 1005，用于保存所述用户设备被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；此时临时候选控制信道资源确定单元 1002，用于根据所述第一保存单元所保存的用户设备可被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道对应的临时候选控制信道资源。

[0220] 优选的，如图 10B 所示，该基站还包括：第二保存单元 1006，用于保存用户设备当前可被配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系；第一选择单元 1007，用于在所述多种映射关系中选择一种映射关系；第一发送单元 1008，用于向用户设备发送第一映射关系指示信息，所述第一映射关系指示信息用于指示基站在所述用户设备当前能使用的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中所选择的一种映射关系；此时临时候选控制信道资源确定单元 1002，用于根据所述第一选择单元 1006 所选择的用户设备当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道对应的临时候选控制信道资源。

[0221] 或者，如图 10C 所示，该基站还包括：第二保存单元 1009，用于保存映射规则，所述映射规则包括如下规则中至少一种：当承载数据信道的单元载波能承载控制信道时，则所述承载数据信道的单元载波与其映射到的承载控制信道的单元载波为同一单元载波；当与承载数据信道的上行单元载波相配对的下行单元载波能承载控制信道时，则所述承载数据信道的上行单元载波与其映射到的承载控制信道的单元载波为同一单元载波对中的单元载波；不同单元载波带宽等级的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波；不同传输模式的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；不同频段上的承载数据信道的单元载波不能映射到同一个承载控制信道的单元载波上；第二选择单元 1010，用于在所述映射规则下所述用户设备可被配置的承载数据信道的单元载波与承载控制信道的单元载波的多种映射关系中选择一种映射关系；第二发送单元 1011，用于向所述用户设备发送第二映射关系指示信息，所述第二映射关系指示信息用于指示在标准预先定义的映射规则下所述用户设备当前可被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系；此时临时候选控制信道资源确定单元 1002，用于根据所述第二选择单元所选择的用户设备当前被配置的承载数据信道的单元载波与承载控制信道的单元载波的映射关系，确定所述 UE 当前可被配置的每种控制信道对应的临时候选控制信道资源。

[0222] 本发明实施例六提供的基站设备中，UE 当前可被配置的控制信道对应的临时候选控制信道资源是根据承载数据信道的单元载波与承载控制信道的单元载波的映射关系确定的，因而不同承载数据信道的单元载波对应的控制信道的备时候选控制信道资源可能不

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同；对于 UE 当前可被配置的 CCE 聚合级别相同的控制信道，当其它一种或多种控制信道的下行控制信息比特数与选定的一种控制信道的下行控制信息比特数相同时，确定所述选定的一种控制信道对应的实际候选控制信道资源为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的所有 CCE，或者为所述下行控制信息比特数相同的所有或部分控制信道对应的临时候选控制信道资源的和中的一部分 CCE，而且不同承载数据信道的单元载波对应的控制信道的临时候选控制信道资源可能不同，所以经过合并后扩大了控制信道对应的候选控制信道资源，从而在载波聚合系统中，减少了控制信道对应的实际候选控制信道资源中控制信道调度碰撞出现的概率。

[0223] 本领域普通技术人员可以理解实现上述实施例方法中的全部或部分步骤是可以通过程序来指令相关的硬件完成，所述的程序可以存储于一种计算机可读存储介质中，例如只读存储器，磁盘或光盘等。

[0224] 以上对本发明实施例所提供的确定搜索空间或候选控制信道资源的方法及装置进行了详细介绍，本文中应用了具体个例对本发明的原理及实施方式进行了阐述，以上实施例的说明只是用于帮助理解本发明的方法及其核心思想；同时，对于本领域的一般技术人员，依据本发明的思想，在具体实施方式及应用范围上均会有改变之处，综上所述，本说明书内容不应理解为对本发明的限制。

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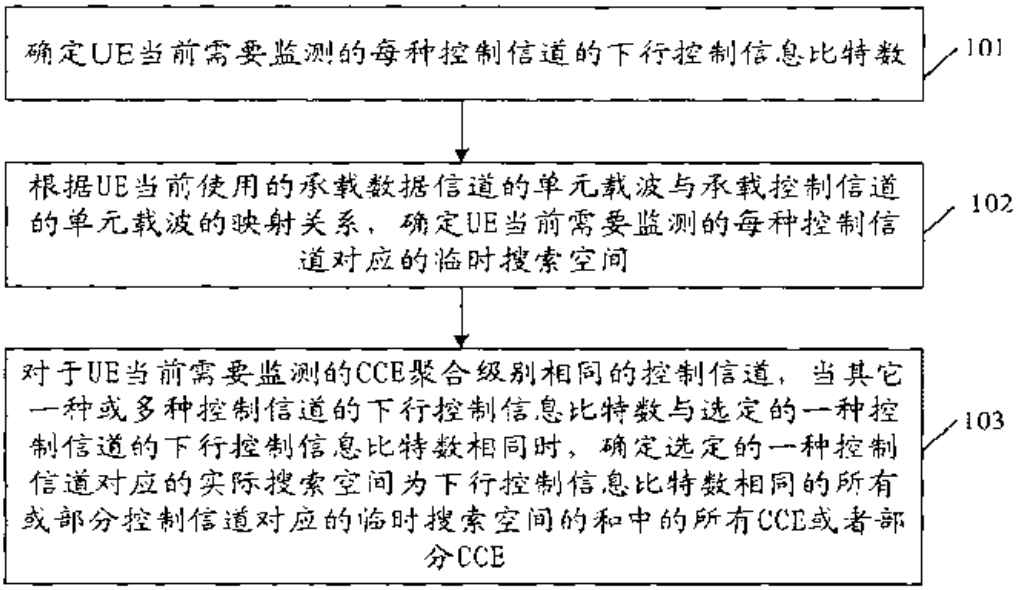


图 1

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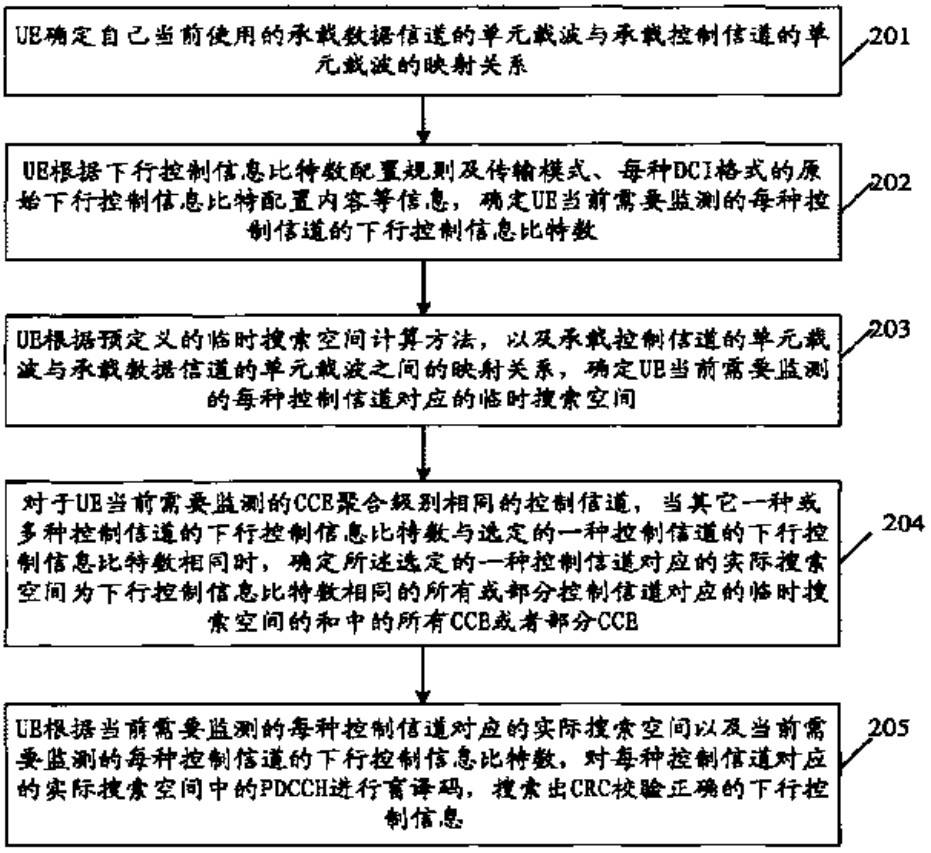


图 2

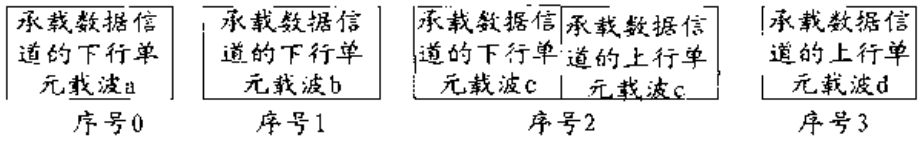


图 3

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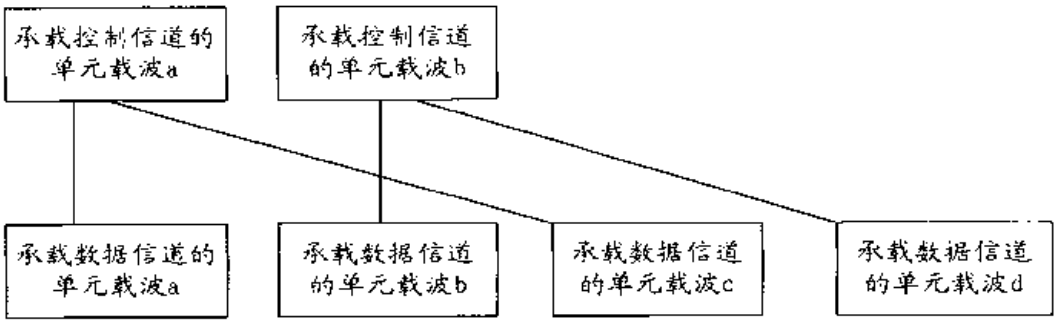


图 4

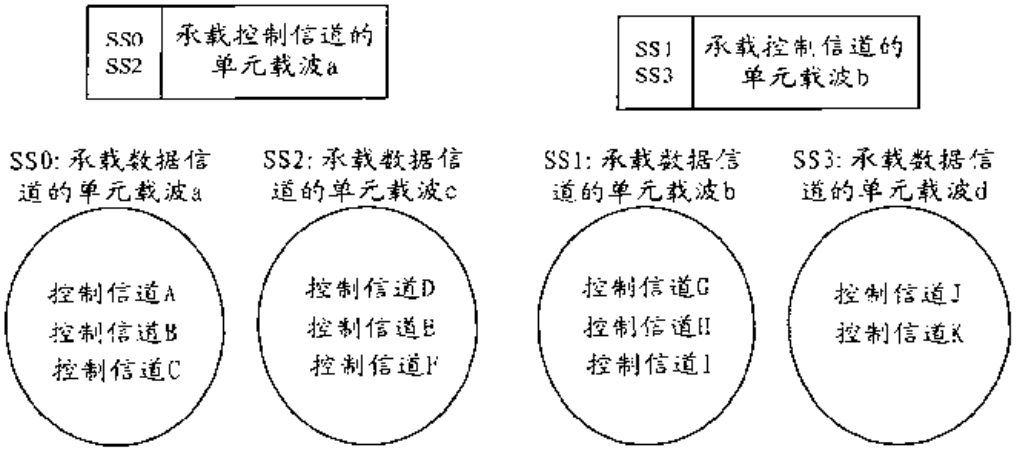


图 5

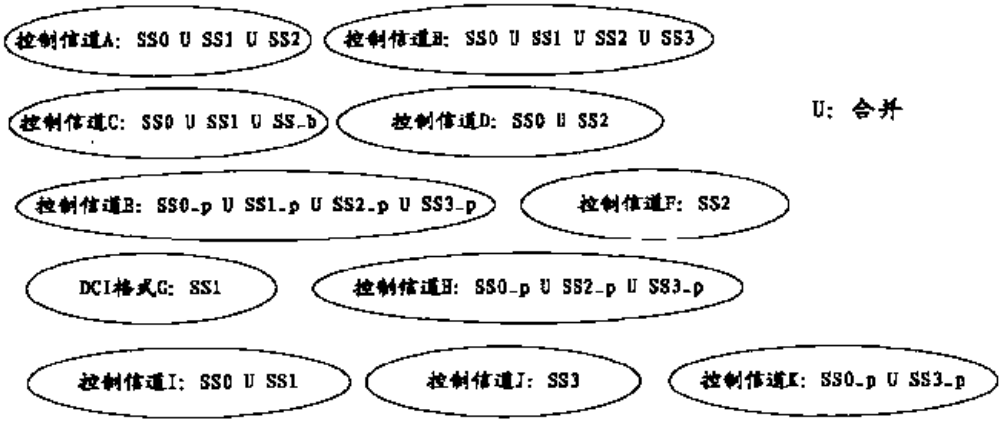


图 6

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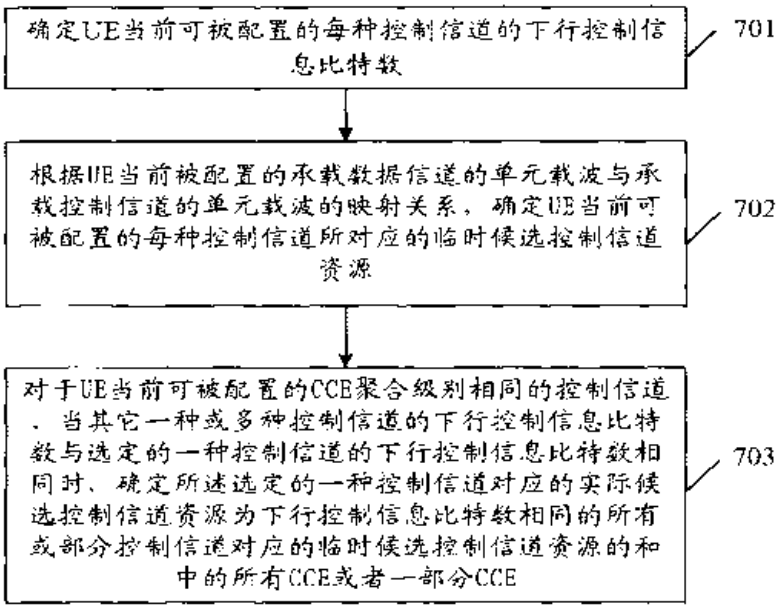


图 7

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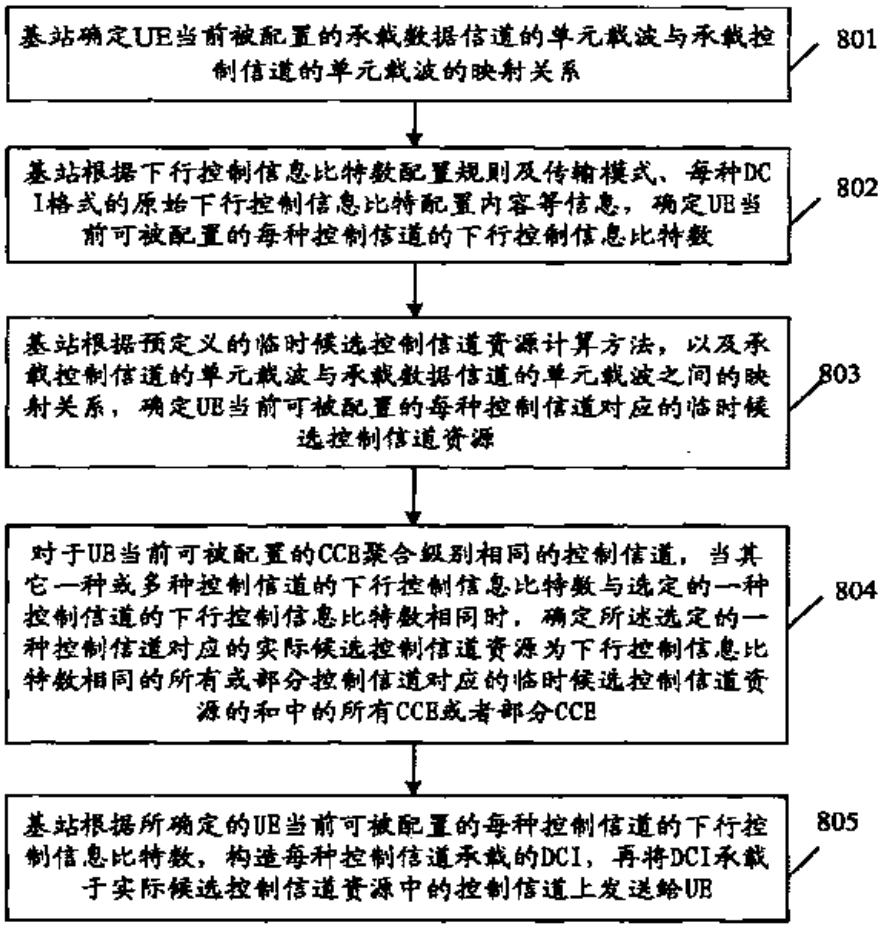


图 8

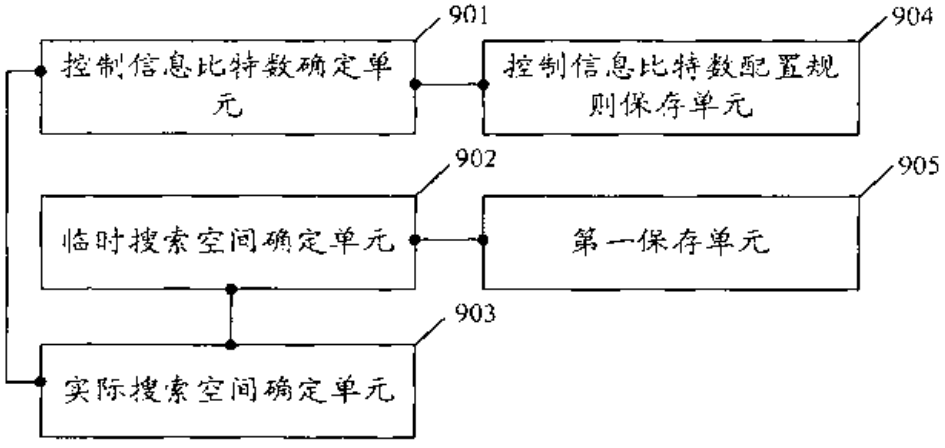


图 9A

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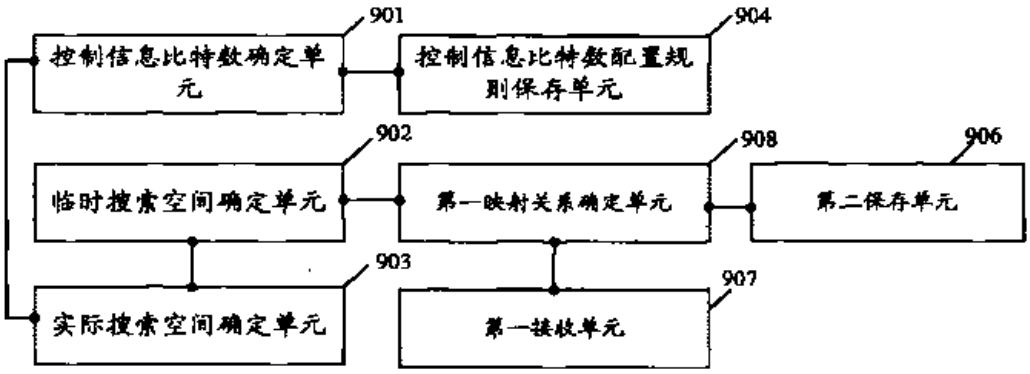


图 9B

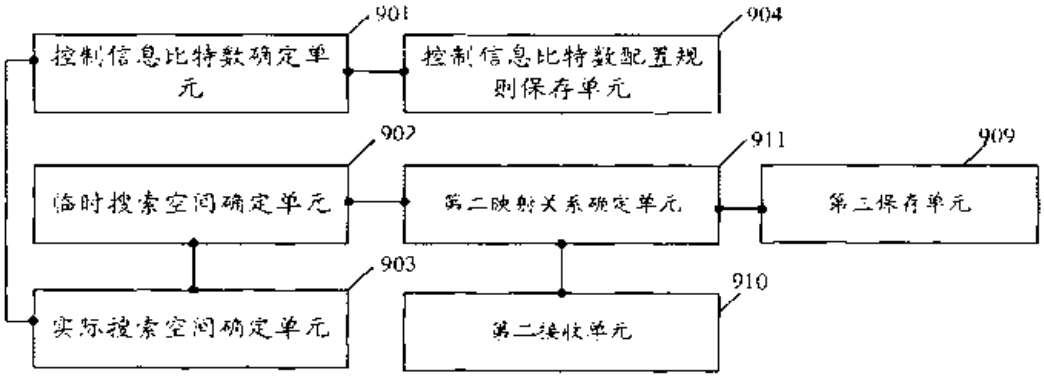


图 9C

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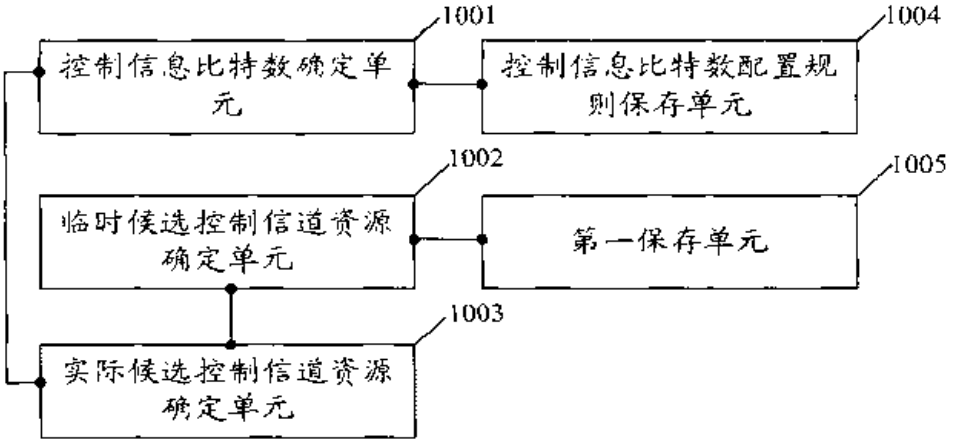


图 10A

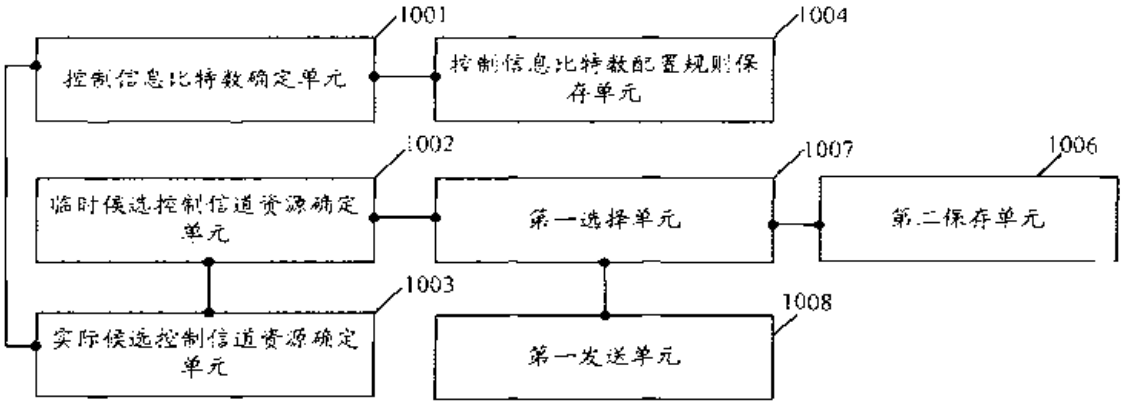


图 10B

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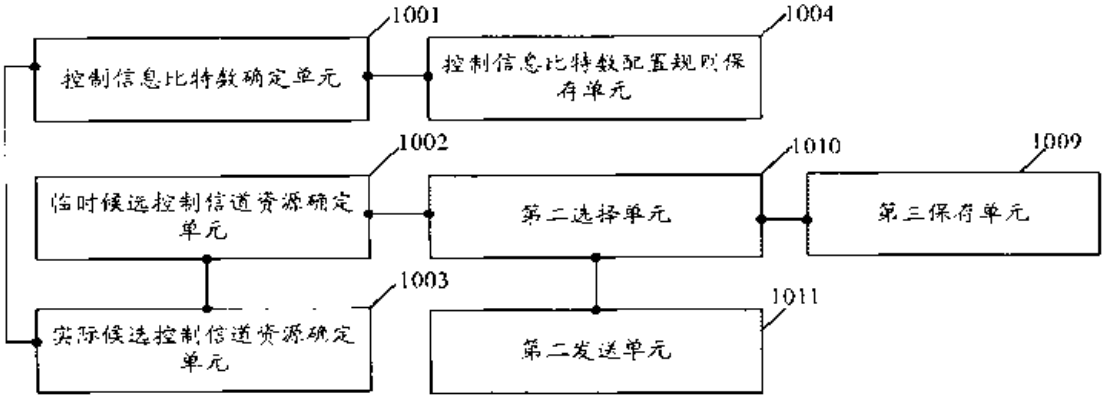


图 10C

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below
827137801PCT3		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority date *(day/month/year)*
PCT/CN2010/079423	03 Dec. 2010(03.12.2010)	03 Dec. 2009(03.12.2009)

Applicant

HUAWEI TECHNOLOGIES CO., LTD. et al.

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a))

c. ☐ With regard to any **nucleotide and /or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. The figure of the **drawings** to be published with the abstract is Figure No. 1

☒ as suggested by the applicant

☐ as selected by this Authority, because the applicant failed to suggest a figure

☐ as selected by this Authority, because this figure better characterizes the invention

b. ☐ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2010/079423

A. CLASSIFICATION OF SUBJECT MATTER

H04L 1/18 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04L, H04Q, H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

VEN; CNABS; CNKI:

ACK/NACK, acknowledgement, DCI, downlink control information, carrier aggregation, LTE-A, LTE-advanced, 4G

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"DAI Design for TDD configuration #5 (9:1) in ACK/NACK Bundling", 3GPP TSG RAN WG1 Meeting #53bis, R1-082615 (revised from R1-826011, Warzaw, Poland, 04 Jul. 2008 (04.07.2008)	1-3,13,18,19,24
A	See the whole document	4-12,14-17,20-23
A	"Details of ACK/NAK bundling for TDD", TSG-RAN WG1 #53, R1-082002, Kansas City, MO, USA, 09 May 2008 (09.05.2008) See the whole document	1-24
A	"UL ACK/NACK and CQI feedback in Carrier Aggregation", 3GPP TSG RAN WG1 meeting #58, R1-093269, Shenzhen, China, 28 Aug. 2009 (28.08.2009) See the whole document	1-24
A	CN101594211A (ZTE CORPORATION) 02 Dec. 2009 (02.12.2009) See the whole document	1-24

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 Mar. 2011 (01.03.2011)	**10 Mar. 2011 (10.03.2011)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer WEN,Rui Telephone No. (86-10)6241 2083

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2010/079123

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN101594211A	02.12.2009	WO2010145373A1	23.12.2010

Form PCT/ISA/210 (patent family annex) (July 2009)

PATENT COOPERATION TREATY From the

INTERNATIONAL SEARCHING AUTHORITY

To:

518129

B1-3A Intellectual Property Dept.Huawei Administration Building,Bantian, Longgang,Shenzhen,Guangdong,China

HUAWEI TECHNOLOGIES CO.,LTD.

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43 *bis*.1)

Date of mailing (*day/month/year*)	10 Mar. 2011 (10.03.2011)
Applicant's or agent's file reference: 82713780PCT3	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/CN2010/079423	03 Dec. 2010(03.12.2010)	03 Dec. 2009(03.12.2009)

International Patent Classification (IPC) or both national classification and IPC

H04L 1/18 (2006.01) i

Applicant

HUAWEI TECHNOLOGIES CO.,LTD. et al.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No.II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No.VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No.VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/CN	Date of completion of this opinion	Authorized officer
The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	03 Mar. 2011 (03.03.2011)	WEN,Rui Telephone No. (86-10)6241 2083

Form PCT/ISA/237(cover sheet) (July 2009)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CN2010/079423

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application **in the** language in which it was filed.
   ☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account **the rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rule 43bis.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed **in** the international application ,this opinion has been established on the basis of :

   a. a sequence listing filed or furnished

      ☐ on paper
      ☐ in electronic form

   b. time of filing or furnishing

      ☐ contained in the applicant as filed
      ☐ filed together with the application in electronic form
      ☐ furnished subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/CN2010/079423

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement:

Novelty (N)	Claims	1-24	YES
	Claims	None	NO
Inventive step (IS)	Claims	4-12,14-17,20-23	YES
	Claims	1-3,13,18,19,24	NO
Industrial applicability (IA)	Claims	1-24	YES
	Claims	None	NO

2. Citations and explanations

(1) The document cited in the search report has been taken into consideration here:
D1: DAI Design for TDD configuration #5 (9:1) in ACK/NACK Bundling, 3GPP TSG RAN WG1 Meeting #53bis, R1-082615 (revised from R1-82601) (04.07.2008)

(2) Claim 1 claims a method for providing feedback on Acknowledgement/Negative-acknowledgement (ACK/NACK) message during the carrier aggregation, and D1 is considered as the most relevant prior art, which discloses a scheme of DAI design for TDD configurations in ACK/NACK bundling. D1 includes: a 2-bit Downlink Assignment Index (DAI) field is added to DCI (corresponding to "configuring the predefined common field of the Downlink Control Information (DCI) to be at least one type of ACK/NACK feedback related command field in the at least two types of ACK/NACK feedback related command fields which the common field can be configured to be"); DCI is sent to the UE and the UE provides feedback on ACK/NACK message based on the DAI field of DCI (implicitly disclosed) (See the whole document of D1). It is obvious that not all the technical features in claim 1 are disclosed by D1.Thus, claim 1 has the novelty under PCT Article 33(2). Further, claims 2-12 have the novelty under PCT Article 33 (2).
(3) The difference between claim 1 and D1 is that: the carrier aggregation technique is adopted. Thus, the problem to be solved by the invention claimed by claim 1 is: providing feedback on ACK/NACK during adopting the carrier aggregation. However, it is obvious for the person skilled in the art to achieve the invention of claim 1 by applying the technique scheme of D1 into the system adopting the carrier aggregation technique. Thus, the invention of claim 1 does not have the inventive step under PCT Article 33 (3).
(4) Claim 2 further specifies the method of claim 1. However, the additional technical feature in claim 2 is disclosed by D1 (see the part of "Introduction" in D1). At the same time, it is obvious for the person skilled in the art to achieve the invention of claim 2 on the basis of D1. Thus, claim 2 does not have the inventive step under PCT Article 33 (3).
(5) Claim 3 further specifies the system of claim 1 or 2. However the additional technical features (defining the specific rules for setting common field) of claim 3 are well known to the person skilled in the art. At the same time, the invention of claim 3 is obvious to the person skilled in the art on the basis of the combination of D1 and the common sense. Thus, claim 3 does not have the inventive step under PCT Article 33 (3).
(6) Claim 4 further specifies the method of claim 1. However, the additional technical features (the specific ACK/NACK feedback related command fields) in claim 4 are not disclosed by D1. At the same time, it is not obvious for the person skilled in the art to achieve the invention of claim 4 on the basis of the combination of D1 and other common means. Thus, the invention of claim 4 has the inventive step under PCT Article 33 (3). Further, claims 5-8 citing claim 4 have the inventive steps under PCT Article 33 (3).
(7) Claim 5 further specifies the method of claim 1 or 2. However, the additional technical features (the common fields of at least one of DCIs which are transmitted by a main member carrier is configured as TPC command field) in claim 5 are not disclosed by D1. At the same time, it is not obvious for the person skilled in the art to achieve the invention of claim 5 on the basis of the combination of D1 and other common means. Thus, the invention of claim 5 has the inventive step under PCT Article 33 (3). Further, claims 6-7 citing claim 5 have the inventive steps under PCT Article 33 (3).

(The following see the supplemental Box 1)

Supplemental Box I

In case **the space in any of the preceding boxes is not sufficient.**

Continuation of : Box No. V

(8) Claim 8 further specifies the method of claim 1 or 2. However, the additional technical features (the specific configurations for the common fields of DCI) in claim 8 are not disclosed by D1. At the same time, it is not obvious for the person skilled in the art to achieve the invention of claim 8 on the basis of the combination of D1 and other common means. Thus, the invention of claim 8 has the inventive step under PCT Article 33 (3).
(9) Claims 9-11 further specify the method of claim 1. However, the additional technical features (the specific ACK/NACK feedback related command fields) in claims 9-11 are not disclosed by D1. At the same time, it is not obvious for the person skilled in the art to achieve the invention of claim 9, 10 or 11 on the basis of the combination of D1 and other common means. Thus, the inventions of claims 9-11 have the inventive steps under PCT Article 33 (3). Further, claim 12 citing claim 9, 10 or 11 has the inventive step under PCT Article 33 (3).
(10) Claim 13 claims a method for providing feedback on Acknowledgement/Negative-acknowledgement (ACK/NACK) message during the carrier aggregation, and D1 is considered as the most relevant prior art, which discloses a scheme of DAI design for TDD configurations in ACK/NACK bundling. D1 includes: a 2-bit Downlink Assignment Index (DAI) field is added to DCI (corresponding to "the common field can be configured to be at least one type of ACK/NACK feedback related command field in the at least two types of ACK/NACK feedback related command fields"); the base station sends DCI to the UE and the UE provides feedback on ACK/NACK message based on the DAI field of DCI (implicitly disclsed) (See the whole document of D1). It is obvious that not all the technical features in claim 13 are disclosed by D1.Thus, claim 13 has the novelty under PCT Article 33(2). Further, claims 14-17 have the novelty under PCT Article 33 (2).
(11) The difference between claim 13 and D1 is that: the carrier aggregation technique is adopted. Thus, the problem to be solved by the invention claimed by claim 13 is: providing feedback on ACK/NACK during adopting the carrier aggregation. However, it is obvious for the person skilled in the art to achieve the invention of claim 13 by applying the technique scheme of D1 into the system adopting the carrier aggregation technique. Thus, the invention of claim 13 does not have the inventive step under PCT Article 33 (3).
(12) Claim 14 further specifies the method of claim 13. However, the additional technical features (the specific ACK/NACK feedback related command fields) in claim 14 are not disclosed by D1. At the same time, it is not obvious for the person skilled in the art to achieve the invention of claim 14 on the basis of the combination of D1 and other common means. Thus, the invention of claim 14 has the inventive step under PCT Article 33 (3). Further, claims 15-17 citing claim 14 have the inventive steps under PCT Article 33 (3).
(13) Claim 18 claims a base station, and D1 is considered as the most relevant prior art, which discloses a scheme of DAI design for TDD configurations in ACK/NACK bundling. D1 includes: a 2-bit Downlink Assignment Index (DAI) field is added to DCI (corresponding to "configuration module"); DCI is sent to the UE and the UE provides feedback on ACK/NACK message based on the DAI field of DCI (corresponding to "sending module") (implicitly disclsed) (See the whole document of D1). It is obvious that not all the technical features in claim 18 are disclosed by D1.Thus, claim 18 has the novelty under PCT Article 33(2). Further, claims 19-23 have the novelty under PCT Article 33 (2).
(14) The difference between claim 18 and D1 is that: the carrier aggregation technique is adopted. Thus, the problem to be solved by the invention claimed by claim 18 is: providing feedback on ACK/NACK during adopting the carrier aggregation. However, it is obvious for the person skilled in the art to achieve the invention of claim 18 by applying the technique scheme of D1 into the system adopting the carrier aggregation technique. Thus, the invention of claim 18 does not have the inventive step under PCT Article 33 (3).
(15) Claim 19 further specifies the base station of claim 18. However, the additional technical feature in claim 19 is disclosed by D1 (see the part of "Introduction" in D1). At the same time, it is obvious for the person skilled in the art to achieve the invention of claim 19 on the basis of D1. Thus, claim 19 does not have the inventive step under PCT Article 33 (3).
(16) Claims 20-23 further specify the base station of claim 18 or 19. However, the additional technical features (the specific ACK/NACK feedback related command fields and the corresponding configurations) in claims 20-23 are not disclosed by D1. At the same time, it is not obvious for the person skilled in the art to achieve the invention of claim 20, 21, 22 or 23 on the basis of the combination of D1 and other common means. Thus, the inventions of claims 20-23 has the inventive steps under PCT Article 33 (3).

(The following see the supplemental Box II)

Supplemental Box II

In case **the space in any of the preceding boxes is not sufficient.**

Continuation of : Supplemental Box I

(17) Claim 24 claims a user equipment, and D1 is considered as the most relevant prior art, which discloses a scheme of DAI design for TDD configurations in ACK/NACK bundling. D1 includes: a 2-bit Downlink Assignment Index (DAI) field is added to DCI (corresponding to "the common field can be configured to be at least one type of ACK/NACK feedback related command field in the at least two types of ACK/NACK feedback related command fields"); DCI is sent to the UE and the UE provides feedback on ACK/NACK message based on the DAI field of DCI (corresponding to "sending module") (implicitly disclsed) (corresponding to the "receiving module" and the "feedback module") (See the whole document of D1). It is obvious that not all the technical features in claim 24 are disclosed by D1.Thus, claim 24 has the novelty under PCT Article 33(2).

(18) The difference between claim 24 and D1 is that: the carrier aggregation technique is adopted. Thus, the problem to be solved by the invention claimed by claim 24 is: providing feedback on ACK/NACK during adopting the carrier aggregation. However, it is obvious for the person skilled in the art to achieve the invention of claim 24 by applying the technique scheme of D1 into the system adopting the carrier aggregation technique. Thus, the invention of claim 24 does not have the inventive step under PCT Article 33 (3).

(19) The inventions of claims 1-24 could be made and used in industry. Thus they comply with the criteria set by PCT Article 33 (4).

Electronic Acknowledgement Receipt	
EFS ID:	14079158
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Denise Wilson
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	25-OCT-2012
Filing Date:	02-JUN-2012
Time Stamp:	17:37:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDS-cover.pdf	17730	no	1
Warnings:					
Information:					

2	Information Disclosure Statement (IDS) Form (SB08)	IDS-form.pdf	108540	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	FOR-CN101594211A.pdf	1404548	no	29
Warnings:					
Information:					
4	Foreign Reference	FOR-CN101998509A.pdf	3134873	no	42
Warnings:					
Information:					
5	Non Patent Literature	NPL-EP-sr.pdf	168169	no	5
Warnings:					
Information:					
6	Non Patent Literature	NPL-PCT-isr.pdf	114971	no	3
Warnings:					
Information:					
7	Non Patent Literature	NPL-PCT-wo.pdf	303015	no	5
Warnings:					
Information:					
8	Non Patent Literature	NPL-R1-093269.pdf	33496	no	2
Warnings:					
Information:					
9	Non Patent Literature	NPL-R1-082002.pdf	296317	no	6
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					

10	Non Patent Literature	NPL-R1-094273.pdf	46302	no	3
Warnings:					
Information:					
11	Non Patent Literature	NPL-R1-082615.pdf	107455	no	7
Warnings:					
Information:					
12	Non Patent Literature	NPL-3GPP-36-212.pdf	603710	no	60
Warnings:					
Information:					
13	Non Patent Literature	NPL-3GPP-36-213.pdf	2753483	no	77
Warnings:					
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		Total Files Size (in bytes):	9092609		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Chen, et al.	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Examiner:	TBD
Filed:	June 2, 2012	Art Unit:	2472
For:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Applicants wish to bring to the attention of the Patent and Trademark Office the information noted on the enclosed forms PTO/SB/08a and PTO/SB/08b that may be considered material to the examination of the above-identified application. Applicants enclose a copy of the foreign patents and non-patent literature references. By this submission, Applicants are not asserting or acknowledging that the cited references are prior art under 35 U.S.C. § 102.

No fee is due at this time, as this Information Disclosure Statement is being filed pursuant to 37 C.F.R. § 1.97(b)(3), before the mailing of a first Office Action on the merits.

In the event a fee is deemed due, please charge any such fees, or credit any overpayment, to Deposit Acct. No. 50-1065 of the below-mentioned firm.

Respectfully submitted,

October 25, 2012
Date

/Ira S Matsil/
Ira S. Matsil
Attorney for Applicants
Reg. No. 35,272

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Suite 1000
Dallas, TX 75252
(972) 732-1001 (phone)
(972) 732-9218 (fax)

PTO/SB/08b (01-08)
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

	Complete if Known
Application Number	13/487,172
Filing Date	06-02-2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	TBD
Attorney Docket Number	HW 82713780US09

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	1	First Chinese Office Action of Chinese Application No. 201010137731.2 mailed August 27, 2012, 7 pages	X

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Acknowledgement Receipt	
EFS ID:	14391306
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	05-DEC-2012
Filing Date:	02-JUN-2012
Time Stamp:	15:46:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		82713780US09_IDS.pdf	102447	yes	2

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	1	
	Information Disclosure Statement (IDS) Form (SB08)		2	2	
Warnings:					
Information:					
2	Non Patent Literature	ChineseOfficeAction_PTO.pdf	1701886	no	7
Warnings:					
Information:					
		Total Files Size (in bytes):	1804333		

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New Applications Under 35 U.S.C. 111
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New International Application Filed with the USPTO as a Receiving Office
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Chen, *et al.*	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Art Unit:	2472
Filed:	June 2, 2012	Examiner:	TBD
For:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

The Applicants wish to bring to the attention of the Patent and Trademark Office the information noted on the enclosed forms PTO/SB/08b that may be considered material to the examination of the above-identified application. Applicants have included a copy of the non-patent literature. By this submission, Applicant is not asserting or acknowledging that the cited references are prior art under 35 U.S.C. § 102.

No fee is due at this time, as this Information Disclosure Statement is being filed pursuant to 37 C.F.R. § 1.97(b)(3), before the mailing of a first Office Action on the merits. In the event a fee is deemed due, please charge any such fees, or credit any overpayment, to Deposit Acct. No. 50-1065 of the below-mentioned firm.

Respectfully submitted,

12/4/2012
Date

Ira S. Matsil
Attorney for Applicants
Reg. No. 35,272

Slater & Matsil, L.L.P.
17950 Preston Rd., Suite 1000
Dallas, TX 75252
(972) 732-1001 (phone)
(972) 732-9218 (fax)

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	13/487,172
Filing Date	6/2/2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	Kizou, Hassan
Attorney Docket Number	HW 82713780US09

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number: Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	US- 2009/0197630 A1	8/6/2009	Ahn, et al.	
	2	US- 2012/0140726 A1	6/7/2012	Moon, et al.	
	3	US- 2012/0224553 A1	9/6/2012	Kim, et al.	
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document: Country Code[3] Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	13/487,172
Filing Date	6/2/2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	Kizou, Hassan
Attorney Docket Number	HW 82713780US09

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	4	ERICSSON, "Details of ACK/NAK bundling for TDD," TSG-RAN WG1 #53, R1-082002, Kansas City, MO, May 5-9, 2008, 6 pages.	
	5	United States Office Action received in Application No. 13/725,413, mailed May 15, 2013, 17 pages.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

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If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	15887767
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	28-MAY-2013
Filing Date:	02-JUN-2012
Time Stamp:	18:55:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		HW82713780_IDS_pto.PDF	178547	yes	3

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	1	
	Information Disclosure Statement (IDS) Form (SB08)		2	3	
Warnings:					
Information:					
2	Non Patent Literature	R1-082002 pto.PDF	88582	no	6
Warnings:					
Information:					
3	Non Patent Literature	OA1 pto.PDF	693486	no	17
Warnings:					
Information:					
		Total Files Size (in bytes):	960615		

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New Applications Under 35 U.S.C. 111
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New International Application Filed with the USPTO as a Receiving Office
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Chen, *et al.*	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Art Unit:	2472
Filed:	June 2, 2012	Examiner:	Kizou, Hassan
For:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

The Applicant wishes to bring to the attention of the Patent and Trademark Office the information noted on the enclosed forms PTO/SB/08a and 08b that may be considered material to the examination of the above-identified application. Applicant has included copies of the non-patent literature. By this submission, Applicant is not asserting or acknowledging that the cited references are prior art under 35 U.S.C. § 102.

No fee is due at this time, as this Information Disclosure Statement is being filed pursuant to 37 C.F.R. § 1.97(b)(3), before the mailing of a first Office Action on the merits. In the event a fee is deemed due, please charge any such fees, or credit any overpayment, to Deposit Acct. No. 50-1065 of the below-mentioned firm.

Respectfully submitted,

5/28/2013
Date

Ira S. Matsil
Attorney for Applicant
Reg. No. 35,272

Slater & Matsil, L.L.P.
17950 Preston Rd., Suite 1000
Dallas, TX 75252
(972) 732-1001 (phone)
(972) 732-9218 (fax)

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	13/487,172
Filing Date	6/2/2012
First Named Inventor	Xiaobo Chen
Art Unit	2472
Examiner Name	Kizou, Hassan
Attorney Docket Number	HW 82713780US09

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	1	Second Office Action of Chinese Application No. 201010137731.2 mailed May 2, 2013, 12 pages. (Partial Translation)	✓

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

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Electronic Acknowledgement Receipt	
EFS ID:	16215503
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	02-JUL-2013
Filing Date:	02-JUN-2012
Time Stamp:	12:43:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		41T5851.PDF	100346	yes	2

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	1	
	Information Disclosure Statement (IDS) Form (SB08)		2	2	
Warnings:					
Information:					
2	Non Patent Literature	41T5518.PDF	1884326	no	12
Warnings:					
Information:					
		Total Files Size (in bytes):	1984672		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor:	Xiaobo Chen	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Conf. No.:	5823
Art Unit:	2472	Examiner:	Kizou, Hassan
Filed:	June 2, 2012		
Title:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Applicant wishes to bring to the attention of the U.S. Patent and Trademark Office the information noted on the enclosed form, which may be considered material to the examination of the above-identified application. Applicant makes no assertion that a prior art search has been made or that any of the cited references are prior art under 35 U.S.C. § 102.

In accordance with 37 C.F.R. § 1.97(e)(1), Applicant hereby states that each item of information contained in this statement was first cited in a communication from a foreign patent office in a counterpart application not more than three months prior to the filing of this statement. As such, no fee is due at this time because this statement is being filed before the mailing of a final rejection or a notice of allowance. In the event a fee is deemed due, please charge any such fees, or credit any overpayment, to Deposit Acct. No. 50-1065.

Respectfully submitted,

7/2/2013
Date

//
Ira S. Matsil
Attorney for Applicant
Reg. No. 35,272

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Ste. 1000
Dallas, Texas 75252
Tel.: 972-732-1001

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012 OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Sulaiman Nooristany
Attorney Docket Number	HW 82713780US09

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13487172
	Filing Date	2012-06-02
	First Named Inventor	Xiaobo Chen
	Art Unit	2478
	Examiner Name	Sulaiman Nooristany
	Attorney Docket Number	HW 82713780US09

	1	Australian Patent Examination Report received in Application No. 2010327189, Applicant: Huawei Technologies Co., Ltd., issued August 9, 2013, 3 pages.	☐
	2		☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13487172
	Filing Date	2012-06-02
	First Named Inventor	Xiaobo Chen
	Art Unit	2478
	Examiner Name	Sulaiman Nooristany
	Attorney Docket Number	HW 82713780US09

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

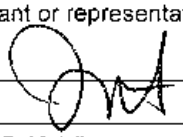
☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature		Date (YYYY-MM-DD)	9/18/2013
Name/Print	Ira S. Matsil	Registration Number	35,272

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	16897672
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Donna Turner
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	19-SEP-2013
Filing Date:	02-JUN-2012
Time Stamp:	11:58:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	HW_82713780US09_IDS.pdf	243671	no	4
Warnings:					
Information:					

This is not an USPTO supplied IDS fillable form					
2	Non Patent Literature	HW_82713780US09_AOA.pdf	335226 [illegible]	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	578897		

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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Nooristany, Sulaiman
Attorney Docket Number	HW 82713780US09

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2009041785	WO	A2	2009-04-02	LG Electronics Inc.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13487172
	Filing Date	2012-06-02
	First Named Inventor	Xiaobo Chen
	Art Unit	2478
	Examiner Name	Nooristany, Sulaiman
	Attorney Docket Number	HW 82713780US09

	1	3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 8), 3GPP TS 36.213, V8.6.0, March 2009, 77 pages.	☐
	2	Extended European Search Report received in Application No. 13185753.4-1860 mailed October 29, 2013, 6 pages.	☐

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(71) Applicant (*for all designated States except US*): **LG ELECTRONICS INC.** [KR/KR]; 20, Yeouido-dong, Yeongdeungpo-gu, Seoul 150-721 (KR).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **CHUNG, Jae Hoon** [KR/KR]; LG R & D Complex, 533, Hogye 1 dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-749 (KR). **KIM, Su Yeon** [KR/KR]; LG R & D Complex, 533, Hogye 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-749 (KR). **KIM, Jong Min** [KR/KR]; LG R & D Complex, 533, Hogye 1-dong, Dongan-gu, Anyang-si, Gyeonggki-do 431-749 (KR). **SUNG, Doo Hyun** [KR/KR]; LG R & D Complex, 533, Hogye 1 dong, Dongan gu, Anyang si, Gyeonggi-do 431-749 (KR).

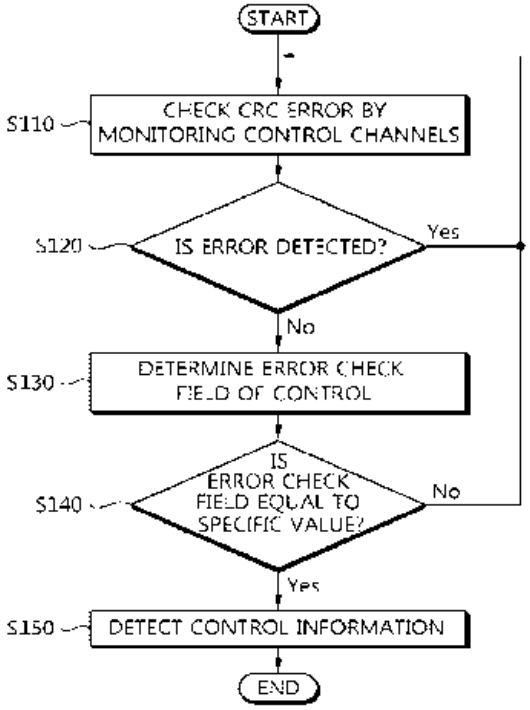
(74) Agent: **YANG, Moon-Ock**; S & IP Patent & Law Firm, 10F, Songam Bldg., 642-10, Yeoksam-dong, Gangnam gu, Seoul 135 080 (KR).

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[Continued on next page]

(54) Title: METHOD FOR DETECTING CONTROL INFORMATION IN WIRELESS COMMUNICATION SYSTEM

[Fig. 14]



(57) Abstract: A method for detecting control information in a wireless communication system is provided. The method includes checking a cyclic redundancy check (CRC) error by monitoring control channels, determining whether a value of an error check field is equal to a specific value, and, if the value of the error check field is equal to the specific value, detecting the control information on the control channel.

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Description

METHOD FOR DETECTING CONTROL INFORMATION IN WIRELESS COMMUNICATION SYSTEM

Technical Field

[1] The present invention relates to wireless communications, and more particularly, to a method for detecting control information in a wireless communication system.

Background Art

[2] In a wireless communication system, a base station (BS) generally provides services to a plurality of user equipments (UEs). The BS schedules user data for the plurality of UEs, and transmits control information together with the user data. The control information contains scheduling information for the user data. A channel for carrying the control information is generally referred to as a control channel. A channel for carrying the user data is generally referred to as a data channel. The UE monitors the control channel to search control information of the UE, and processes data of the UE by using the control information.

[3] In order for the UE to receive the user data allocated to the UE, the control information for the user data on the control channel must be received. In general, a plurality of pieces of control information of the plurality of UEs are multiplexed within one transmission interval in an assigned bandwidth. That is, to provide a service to the plurality of UEs, the BS multiplexes the plurality of pieces of control information of the plurality of UEs and transmits the control information on a plurality of control channels. Each UE searchs its own control channel among the plurality of control channels.

[4] Blind detection is one of schemes for detecting specific control information among a plurality of pieces of multiplexed control information. The blind detection implies attempting by the UE to recover a control channel by combining a plurality of pieces of information in a state where information required to recover the control channel does not exist. That is, in a state where the UE neither knows whether a plurality of pieces of control information received from the BS is control information of the UE nor knows in which location the control information of the UE exists, the UE decodes all pieces of provided control information until the control information of the UE is detected. The UE may use its unique information to determine whether the received control information is control information of the UE. For example, when the BS multiplexes control information of each UE, the BS may transmit a unique identifier of each UE by masking the identifier onto a cyclic redundancy check (CRC). The CRC is a code used in error detection. The UE demasks its unique identifier to the CRC of the

received control information, and thereafter can determine whether the received control information is control information of the UE by performing CRC checking.

[5] However, when the UE monitors the control channel through CRC error detection, even if the control channel is a control channel of another UE, the CRC error may not be detected and thus a decoding result may be erroneously informed that decoding is successful. In case of semi-persistent scheduling (SPS), incorrect CRC error detection becomes more problematic. This is because, in the SPS, the UE receives control information for allocating radio resources and thereafter transmits or receives data by using the radio resources allocated using the control information during an SPS interval. This results in waste of limited radio resources and deterioration in reliability of wireless communication. Accordingly, there is a need for a method for detecting control information with an increased accuracy.

Disclosure of Invention

Technical Problem

[6] The present invention provides a method for detecting control information in a wireless communication system.

Technical Solution

[7] In one aspect, a method for detecting control information in a wireless communication system is provided. The method includes checking a cyclic redundancy check (CRC) error by monitoring control channels, determining whether a value of an error check field is equal to a specific value, where the error check field is a field among fields included in the control information on a control channel, the control channel in which the CRC error is not detected, and, if the value of the error check field is equal to the specific value, detecting the control information on the control channel, the control channel in which the CRC error is not detected.

[8] In another aspect, a user equipment is provided. The user equipment includes a radio frequency (RF) unit for transmitting and receiving a radio signal and a processor coupled with the RF unit and configured to check a CRC error by monitoring control channels, determine whether a value of an error check field is equal to a specific value, where the error check field is a field among fields included in the control information on a control channel, the control channel in which the CRC error is not detected, and, if the value of the error check field is equal to the specific value, detect the control information on the control channel, the control channel in which the CRC error is not detected.

[9] In still another aspect, a method for transmitting control information in a wireless communication system is provided. The method includes generating the control information comprising an error check field having a specific value and transmitting the

control information on a control channel by appending a CRC to the control information, wherein a successful reception of the control information is determined according to the specific value of the error check field and the CRC.

[10]

Advantageous Effects

[11] A method for detecting control information can be provided with an increased accuracy in a wireless communication system. A specific value of an error check field can be used as a virtual cyclic redundancy check (CRC). A user equipment can increase an accuracy of CRC error checking by using the virtual CRC when detecting the control information. That is, the control information can be accurately detected while effectively utilizing radio resources. Therefore, an overall system performance can be increased.

Brief Description of the Drawings

[12] FIG. 1 is a block diagram showing a wireless communication system.

[13] FIG. 2 is a block diagram showing functional split between an evolved universal terrestrial radio access network (E-UTRAN) and an evolved packet core (EPC).

[14] FIG. 3 is a block diagram showing constitutional elements of a user equipment.

[15] FIG. 4 is a diagram showing a radio protocol architecture for a user plane.

[16] FIG. 5 is a diagram showing a radio protocol architecture for a control plane.

[17] FIG. 6 shows mapping between downlink logical channels and downlink transport channels.

[18] FIG. 7 shows mapping between downlink transport channels and downlink physical channels.

[19] FIG. 8 shows a structure of a radio frame.

[20] FIG. 9 shows an example of a resource grid for one downlink slot.

[21] FIG. 10 shows a structure of a subframe.

[22] FIG. 11 is a flowchart showing a physical downlink control channel (PDCCH) configuration.

[23] FIG. 12 is a flowchart showing PDCCH processing.

[24] FIG. 13 shows an example of a method for utilizing an unused information field among a plurality of information fields constituting a downlink control information (DCI) format.

[25] FIG. 14 is a flowchart showing a method for detecting control information according to an embodiment of the present invention.

[26] FIG. 15 is a flow diagram showing downlink data transmission using a dynamic scheduling scheme.

[27] FIG. 16 is a flow diagram showing uplink data transmission using a dynamic

scheduling scheme.

[28] FIG. 17 shows an example of a traffic model in a voice over Internet protocol (VoIP).

[29] FIG. 18 is a flow diagram showing downlink data transmission using a semi-persistent scheduling scheme.

[30] FIG. 19 is a flow diagram showing uplink data transmission using a semi-persistent scheduling scheme.

[31]

Mode for the Invention

[32] FIG. 1 is a block diagram showing a wireless communication system. The wireless communication system may have a network structure of an evolved-universal mobile telecommunications system (E-UMTS). The E-UMTS may be referred to as a long-term evolution (LTE) system. The wireless communication system can be widely deployed to provide a variety of communication services, such as voices, packet data, etc.

[33] Referring to FIG. 1, an evolved-UMTS terrestrial radio access network (E-UTRAN) includes at least one base station (BS) 20 which provides a control plane and a user plane.

[34] A user equipment (UE) 10 may be fixed or mobile, and may be referred to as another terminology, such as a mobile station (MS), a user terminal (UT), a subscriber station (SS), a wireless device, etc. The BS 20 is generally a fixed station that communicates with the UE 10 and may be referred to as another terminology, such as an evolved node-B (eNB), a base transceiver system (BTS), an access point, etc. The BS 20 can provide services to one or more cells. The cell is an area where the BS 20 provides communication services. Interfaces for transmitting user traffic or control traffic may be used between the BSs 20. Hereinafter, a downlink is defined as a communication link from the BS 20 to the UE 10, and an uplink is defined as a communication link from the UE 10 to the BS 20.

[35] The BSs 20 are interconnected by means of an X2 interface. The BSs 20 are also connected by means of an S1 interface to an evolved packet core (EPC), more specifically, to a mobility management entity (MME)/serving gateway (S-GW) 30. The S1 interface supports a many-to-many relation between the BS 20 and the MME/S-GW 30.

[36] The wireless communication system may be not only a multiple input multiple output (MIMO) system or a multiple input single output (MISO) system but also a single input single output (SISO) system or a single input multiple output (SIMO) system. A MIMO scheme uses multiple transmit (Tx) antennas and multiple receive (Rx) antennas to improve data Tx/Rx efficiency and spectral efficiency. Examples of the

MIMO scheme include spatial diversity, spatial multiplexing, beamforming, etc.

[37] FIG. 2 is a block diagram showing functional split between the E-UTRAN and the EPC. Slashed boxes depict radio protocol layers and white boxes depict the functional entities of the control plane.

[38] Referring to FIG. 2, the BS performs the following functions: (1) functions for radio resource management (RRM) such as radio bearer control, radio admission control, connection mobility control, and dynamic allocation of resources to the UE. (2) Internet protocol (IP) header compression and encryption of user data streams. (3) routing of user plane data to the S-GW. (4) scheduling and transmission of paging messages. (5) scheduling and transmission of broadcast information and (6) measurement and measurement reporting configuration for mobility and scheduling.

[39] The MME performs the following functions: (1) non-access stratum (NAS) signaling. (2) NAS signaling security. (3) idle mode UE reachability. (4) tracking area list management. (5) roaming and (6) authentication.

[40] The S-GW performs the following functions: (1) mobility anchoring and (2) lawful interception. A PDN gateway (P-GW) performs the following functions: (1) UE Internet protocol (IP) allocation and (2) packet filtering.

[41] FIG. 3 is a block diagram showing constitutional elements of the UE. A UE 50 includes a processor 51, a memory 52, a radio frequency (RF) unit 53, a display unit 54, and a user interface unit 55. Layers of the radio interface protocol are implemented in the processor 51. The processor 51 provides the control plane and the user plane. The function of each layer can be implemented in the processor 51. The memory 52 is coupled to the processor 51 and stores an operating system, applications, and general files. The display unit 54 displays a variety of information of the UE and may use a well-known element such as a liquid crystal display (LCD), an organic light emitting diode (OLED), etc. The user interface unit 55 can be configured with a combination of well-known user interfaces such as a keypad, a touch screen, etc. The RF unit 53 is coupled to the processor 51 and transmits and/or receives radio signals.

[42] Layers of a radio interface protocol between the UE and the network can be classified into L1 layer (a first layer), L2 layer (a second layer), and L3 layer (a third layer) based on the lower three layers of the open system interconnection (OSI) model that is well-known in the communication system. A physical layer, or simply a PHY layer, belongs to the first layer and provides an information transfer service through a physical channel. A radio resource control (RRC) layer belongs to the third layer and serves to control radio resources between the UE and the network. The UE and the network exchange RRC messages via the RRC layer.

[43] FIG. 4 is a diagram showing a radio protocol architecture for the user plane. FIG. 5 is a diagram showing a radio protocol architecture for the control plane. They illustrate

the architecture of a radio interface protocol between the UE and the E-UTRAN. The user plane is a protocol stack for user data transmission. The control plane is a protocol stack for control signal transmission.

[44] Referring to FIGs. 4 and 5, a PHY layer belongs to the first layer and provides an upper layer with an information transfer service through a physical channel. The PHY layer is coupled with a medium access control (MAC) layer, i.e., an upper layer of the PHY layer, through a transport channel. Data is transferred between the MAC layer and the PHY layer through the transport channel. Between different PHY layers (i.e., a PHY layer of a transmitter and a PHY layer of a receiver), data is transferred through the physical channel.

[45] The MAC layer belongs to the second layer and provides services to a radio link control (RLC) layer, i.e., an upper layer of the MAC layer, through a logical channel. The RLC layer in the second layer supports reliable data transfer. There are three operating modes in the RLC layer, that is, a transparent mode (TM), an unacknowledged mode (UM), and an acknowledged mode (AM) according to a data transfer method. An AM RLC provides bidirectional data transmission services and supports retransmission when the transfer of the RLC protocol data unit (PDU) fails.

[46] A packet data convergence protocol (PDCP) layer belongs to the second layer and performs a header compression function for reducing an IP packet header size.

[47] A radio resource control (RRC) layer belongs to the third layer and is defined only in the control plane. The RRC layer serves to control the logical channel, the transport channel, and the physical channel in association with configuration, reconfiguration and release of radio bearers (RBs). An RB is a service provided by the second layer for data transmission between the UE and the E-UTRAN. When an RRC connection is established between an RRC layer of the UE and an RRC layer of the network, it is called that the UE is in an RRC connected mode. When the RRC connection is not established yet, it is called that the UE is in an RRC idle mode.

[48] A non-access stratum (NAS) layer belongs to an upper layer of the RRC layer and serves to perform session management, mobility management, or the like.

[49] FIG. 6 shows mapping between downlink logical channels and downlink transport channels. This may be found in section 6.1.3.2 of the 3GPP TS 36.300 V8.3.0 (2007-12) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 8).

[50] Referring to FIG. 6, a paging control channel (PCCH) is mapped to a paging channel (PCH). A broadcast control channel (BCCH) is mapped to a broadcast channel (BCH) or a downlink shared channel (DL-SCH). A common control channel (CCCH), a dedicated control channel (DCCH), a dedicated traffic channel (DTCH), a multicast

control channel (MCCH), and a multicast traffic channel (MTCH) are mapped to the DL-SCH. The MCCH and MTCH are also mapped to a multicast channel (MCH).

[51] A type of each logical channel is defined according to a type of information to be transmitted. A logical channel is classified into two groups, i.e., a control channel and a traffic channel.

[52] The control channel is used for the transfer of control plane information. The BCCH is a downlink channel for broadcasting system control information. The PCCH is a downlink channel for transmitting paging information and is used when a network does not know the location of a UE. The CCCH is a channel for transmitting control information between the UE and the network and is used when there is no RRC connection established between the UE and the network. The MCCH is a point-to-multipoint downlink channel used for transmitting multimedia broadcast multicast service (MBMS) control information. The MCCH is used by UEs that receive an MBMS. The DCCH is a point-to-point uni-directional channel for transmitting dedicated control information between the UE and the network, and is used by UEs having an RRC connection.

[53] The traffic channel is used for the transfer of user plane information. The DTCH is a point-to-point channel used for the transfer of user information. The DTCH can exist in both uplink and downlink. The MTCH is a point-to-multipoint downlink channel for transmitting traffic data and is used by the UEs that receive the MBMS.

[54] The transport channel is classified according to a type and characteristic of data transmission through a radio interface. The BCH is broadcast in the entire coverage area of the cell and has a fixed, pre-defined transport format. The DL-SCH is characterized by support for hybrid automatic repeat request (HARQ), support for dynamic link adaptation by varying modulation, coding, and Tx power, possibility to be broadcast in the entire cell, and possibility to use beamforming, support for both dynamic and semi-static resource allocation, support for UE discontinuous reception (DRX) to enable UE power saving, and support for MBMS transmission. The PCH is characterized by support for DRX to enable UE power saving and support for broadcast in the entire coverage area of the cell. The MCH is characterized by support for broadcast in the entire coverage area of the cell and support for an MBMS single frequency network (MBSFN).

[55] FIG. 7 shows mapping between downlink transport channels and downlink physical channels. This may be found in section 5.3.1 of the 3GPP TS 36.300 V8.3.0 (2007-12).

[56] Referring to FIG. 7, a BCH is mapped to a physical broadcast channel (PBCH). An MCH is mapped to a physical multicast channel (PMCH). A PCH and a DL-SCH are mapped to a physical downlink shared channel (PDSCH). The PBCH carries a BCH transport block. The PMCH carries the MCH. The PDSCH carries the DL-SCH and

the PCH.

[57] There are several downlink physical control channels used in a PHY layer. A physical downlink control channel (PDCCH) informs a UE of resource allocation of the PCH and DL-SCH, and also informs the UE of HARQ information related to the DL-SCH. The PDCCH may carry an uplink scheduling grant which informs the UE of resource allocation for uplink transmission. A physical control format indicator channel (PCFICH) informs the UE of the number of orthogonal frequency division multiplexing (OFDM) symbols used for the transfer of PDCCHs in a subframe. The PCFICH is transmitted in every subframe. A physical hybrid ARQ indicator channel (PHICH) carries HARQ acknowledgement (ACK)/negative-acknowledgement (NACK) signals in response to uplink transmission.

[58] FIG. 8 shows a structure of a radio frame.

[59] Referring to FIG. 8, the radio frame includes 10 subframes. One subframe includes two slots. A time for transmitting one subframe is defined as a transmission time interval (TTI). For example, one subframe may have a length of 1ms, and one slot may have a length of 0.5ms.

[60] The radio frame of FIG. 8 is shown for exemplary purposes only. Thus, the number of subframes included in the radio frame or the number of slots included in the subframe or the number of OFDM symbols included in the slot may change variously.

[61] FIG. 9 shows an example of a resource grid for one downlink slot.

[62] Referring to FIG. 9, the downlink slot includes a plurality of OFDM symbols in a time domain. Although it is described herein that one downlink slot includes 7 OFDM symbols and one resource block includes 12 subcarriers in a frequency domain, this is for exemplary purposes only, and thus the number of OFDM symbols and the number of subcarriers are not limited thereto.

[63] Elements on the resource grid are referred to as resource elements. One resource block includes 12×7 resource elements. The number of resource blocks included in the downlink slot NDL depends on a downlink transmission bandwidth determined in a cell.

[64] FIG. 10 shows a structure of a subframe.

[65] Referring to FIG. 10, the subframe includes two consecutive slots. A maximum of three OFDM symbols located in a front portion of a 1st slot within the subframe correspond to a control region to be assigned with a PDCCH. The remaining OFDM symbols correspond to a data region to be assigned with a PDSCH. In addition to the PDCCH, control channels such as a PCFICH, a PHICH, etc., can be assigned to the control region. The UE can read data information transmitted through the PDSCH by decoding control information transmitted through the PDCCH. Although the control region includes three OFDM symbols herein, this is for exemplary purposes only. The

number of OFDM symbols included in the control region of the subframe can be known by the PCFICH.

[66] The control region consists of a plurality of control channel elements (CCEs) that is a logical CCE sequence. Hereinafter, the CCE sequence denotes an aggregation of all CCEs constituting the control region in one subframe. The CCE corresponds to a plurality of resource element groups. For example, the CCE may correspond to 9 resource element groups. The resource element group is used to define mapping of a control channel onto a resource element. For example, one resource element group may consist of four resource elements.

[67] A plurality of PDCCHs may be transmitted in the control region. The PDCCH carries control information such as scheduling allocation. The PDCCH is transmitted on an aggregation of one or several consecutive CCEs. A PDCCH format and the number of available PDCCH bits are determined according to the number of CCEs constituting the CCE aggregation. Hereinafter, the number of CCEs used for PDCCH transmission is referred to as a CCE aggregation level. The CCE aggregation level is a CCE unit for searching for the PDCCH. A size of the CCE aggregation level is defined by the number of contiguous CCEs. For example, the CCE aggregation level may be an element of {1, 2, 4, 8}.

[68] Table 1 below shows examples of the PDCCH format and the number of available PDCCH bits according to the CCE aggregation level.

[69] [Table 1]

[70]

PDCCH format	CCE aggregation level	Number of resource element groups	Number of PDCCH bits
0	1	9	72
1	2	18	144
2	4	36	288
3	8	72	576

[71] Control information transmitted through the PDCCH is referred to as downlink control information (hereinafter, DCI). The DCI transmits uplink scheduling information, downlink scheduling information, system information, uplink power control command, control information for paging, control information indicating random access channel (RACH) response, etc. Further, the DCI may transmit control information indicating activation of semi-persistent scheduling (SPS). The DCI may also transmit control information indicating deactivation of SPS. The SPS may be used for uplink or downlink voice over Internet protocol (VoIP) transmission.

[72] Examples of a DCI format include a format 0 for scheduling of a physical uplink shared channel (PUSCH), a format 1 for scheduling of one physical downlink shared channel (PDSCH) codeword, a format 1A for compact scheduling of the one PDSCH codeword, a format 1B for scheduling of single codeword rank-1 transmission in a

spatial multiplexing mode, a format 1C for very compact scheduling of a downlink shared channel (DL-SCH), a format 1D for scheduling of a PDSCH in a multi-user spatial multiplexing mode, a format 2 for scheduling of the PDSCH in a closed-loop spatial multiplexing mode, a format 2A for scheduling of the PDSCH in an open-loop spatial multiplexing mode, and formats 3 and 3A for transmission of a transmission power control (TPC) command for an uplink channel.

[73] FIG. 11 is a flowchart showing a PDCCH configuration.

[74] Referring to FIG. 11, a BS generates control information according to a DCI format. The BS can select one DCI format from a plurality of DCI formats (DCI format 1, 2,...,N) according to the control information to be transmitted to a UE.

[75] In step S110, a cyclic redundancy check (CRC) is attached to detect an error from control information generated according to each DCI format. A unique identifier (i.e., a radio network temporary identifier (RNTI)) is masked on the CRC according to a usage or an owner of the PDCCH. If the PDCCH is for a specific UE, a unique identifier of the UE (e.g., cell-RNTI (C-RNTI)) can be masked on the CRC. That is, the CRC can be scrambled together with the unique identifier of the UE. Examples of the RNTI for the specific UE include a temporary C-RNTI, a semi-persistent C-RNTI, etc. The temporary C-RNTI is a temporary identifier of the UE and can be used during a random access procedure. The semi-persistent C-RNTI can be used to indicate SPS activation.

[76] If the PDCCH is for a paging message transmitted through a PCH, a paging identifier (e.g., paging-RNTI (P-RNTI)) can be masked on the CRC. If the PDCCH is for system information transmitted through the DL-SCH, a system information identifier (e.g., system information-RNTI (SI-RNTI)) can be masked on the CRC. If the PDCCH is for indicating a random access response that is a response for transmission of a random access preamble of the UE, a random access-RNTI (RA-RNTI) can be masked on the CRC. Table 2 below shows examples of identifiers masked on the PDCCH.

[77] [Table 2]

[78]

Type	Identifier	Description
UE-specific	C-RNTI, temporary C-RNTI, semi-persistent C-RNTI	used for a unique UE identification
	P-RNTI	used for paging message
Common	SI-RNTI	used for system information
	RA-RNTI	used for random access response

[79] When using a C-RNTI, a temporary C-RNTI, or a semi-persistent C-RNTI, the PDCCH carries control information for a corresponding specific UE. When using other RNTIs, the PDCCH carries common control information to be received by all UEs in a cell.

[80] In step S120, channel coding is performed on the CRC-attached control information to generate coded data. In step S130, rate matching is performed according to a CCE aggregation level assigned to the PDCCH format.

[81] In step S140, the coded data is modulated to generate modulation symbols. The modulation symbols constituting one PDCCH may have one of CCE aggregation levels 1, 2, 4, and 8. In step S150, the modulation symbols are mapped to physical resource elements (REs) (i.e., CCE to RE mapping).

[82] FIG. 12 is a flowchart showing PDCCH processing.

[83] Referring to FIG. 12, in step S210, a UE demaps a CCE from physical RE (i.e., CCE to RE demapping). In step S220, the UE demodulates respective CCE aggregation levels since the UE does not know which CCE aggregation level is used to receive the PDCCH. In step S230, the UE performs rate dematching to the demodulated data. Since the UE does not know a DCI format of control information to be received by the UE, the UE performs the rate dematching for the respective DCI formats. In step S240, the UE performs channel decoding to the rate-dematched data according to a code rate, and detects an error by performing CRC checking. If no error is detected, it is regarded that the UE detects its own PDCCH. Otherwise, if the error is detected, the UE continuously performs blind decoding on another CCE aggregation level or another DCI format. In step S250, upon detecting its own PDCCH, the UE removes the CRC from the decoded data and thus obtains the control information for the UE.

[84] A plurality of multiplexed PDCCHs for a plurality of UEs can be transmitted within a control region of one subframe. The UE monitors the PDCCHs. The monitoring is an operation in which the UE attempts to decode respective PDCCHs according to monitored DCI formats. The BS does not provide information indicating a location of a corresponding PDCCH to the UE in the control region assigned within the subframe. The UE finds its own PDCCH by monitoring a set of PDCCH candidates within the subframe. This is called blind decoding (or blind detection). Through the blind decoding, the UE simultaneously performs identification of a PDCCH transmitted to the UE and performs decoding of the control information transmitted through the PDCCH. For example, it is regarded that the UE detects its own PDCCH if a CRC error is not detected by demasking its own C-RNTI from the PDCCH.

[85] The number of DCI formats to be transmitted through the PDCCH is limited to effectively reduce an overhead of the blind decoding. The number of DCI formats is less than the number of different types of control information to be transmitted using the PDCCH. The DCI format includes a plurality of different information fields. A type of information field constituting the DCI format, the number of information fields, the number of bits of each information field, and the like are different according to the DCI format. In addition, a size of control information conforming to the DCI format

differs according to the DCI format. A variety of control information is transmitted through the PDCCH by using one of the limited number of DCI formats. That is, an arbitrary DCI format can be used to transmit two or more pieces of control information with different types. Accordingly, when the control information is specified by assigning specific values to a plurality of information fields constituting a DCI format, some of the plurality of information fields may be unnecessary. That is, specific values may not be defined in some of the plurality of information fields constituting the DCI format. Some information fields constituting the DCI format may be reserved fields and thus may be reserved in a state of having arbitrary values. The information fields are reserved for the purpose of size adaptation so that a plurality of different types of control information can conform to one DCI format. However, if the reserved fields exist when the control information is transmitted, the BS ineffectively consumes transmission energy and transmission power to transmit the reserved fields which are not used in any functions. Therefore, when the control information is generated conforming to the DCI format, there is a need for a method capable of utilizing unused information fields among the plurality of information fields constituting the DCI format.

[86] FIG. 13 shows an example of a method for utilizing an unused information field among a plurality of information fields constituting a DCI format.

[87] Referring to FIG. 13, different types of control information A, B, and C are grouped to use one DCI format. The control information A, B, and C conforms to one DCI format. The DCI format consists of a plurality of different information fields. The control information A is specified by assigning specific values to all information fields of the DCI format. The control information B or C is specified by assigning specific value to some information fields of the DCI format. The control information A has a greatest information bit size in the group. This is because all information fields of the DCI format are configured to be used meaningfully in the control information A. The information bit size of the control information A is a reference information bit size. Null information is appended to the control information B or C to fit the same size as the reference information bit size. Accordingly, the control information A, B, and C in the group is fixed to the same information bit size.

[88] As such, the different types of control information are grouped to conform to one DCI format which is arbitrarily determined. Each piece of control information is specified by mapping a specific value to an information field constituting the DCI format. Arbitrary pieces of control information included in the group can be specified by assigning specific values to all information fields of the DCI format. On the other hand, other control information included in the group can be specified by assigning specific values to some information fields of the DCI format. That is, other information

fields of the DCI format are not necessary when the other control information is specified. A total size of information fields used to specify the control information can be defined as an information bit size. An information bit size of the former control information is the largest. An information bit size of the latter control information is relatively small.

[89] The reference information bit size is defined as an information bit size when control information is specified by assigning specific values to all information fields of the DCI format. The reference information bit size denotes a total size of information fields constituting the DCI format and/or a size of the DCI format itself. In a case where other control information included in the group has an information bit size less than the reference information bit size, the null information is appended to fit the same size as the reference information bit size. That is, when specific control information is specified by assigning values to some information fields among all information fields defined in the DCI format, remaining information fields in which values are not assigned are used as the null information. The information fields used as the null information can be referred to as an error check field.

[90] The null information is appended so that control information conforming to the DCI format has the same size as the reference information bit size of that DCI format. When the control information is generated according to the DCI format, a part of unused information fields can be used as the null information. The null information has a specific value. For example, all bits of the information field used as the null information may be all set to either bits of '0' or bits of '1'. Alternatively, the field used as the null information may be set to binary code stream values known to the UE. Such a binary code stream can be named as a binary scramble code stream. The binary stream may be generated according to a method for generating a binary bit stream known to both the BS and the UE and for generating a Gold sequence or an m-sequence generated by the BS and the UE by using the same input parameter.

[91] The information field used as the null information may be predetermined between the BS and the UE or may be reported by the BS to the UE. For example, the BS may report information regarding the information filed used as the null information to the UE by using RRC signaling or system information.

[92] When the UE monitors PDCCHs by performing CRC error detection, the UE may erroneously recognize another UE's PDCCH as its own PDCCH, or when demasking is performed with an RNTI different from an actual RNTI, the UE may erroneously recognize that no CRC error is detected and thus decoding is successful. This is called a false positive error. To reduce the false positive error, the null information can be utilized as a virtual CRC or a probe for additional error check.

[93] FIG. 14 is a flowchart showing a method for detecting control information according

to an embodiment of the present invention.

[94] Referring to FIG. 14, a UE checks a CRC error by monitoring control channels (step S310). The control channels may be PDCCHs. If the CRC error is detected, the UE continuously monitors the control channels (step S320). If no CRC error is detected, the UE determines whether a value of an error check field is equal to a specific value (step S330). The error check field is one of fields included in control information on a control channel in which the CRC error is not detected. The error check field is information field used as null information among a plurality of information fields constituting the control information.

[95] If the value of the error check field is not equal to the specific value, the UE continuously monitors the control channels (step S340). Otherwise, if the value of the error check field is equal to the specific value, the UE detects the control information on the control channel, in which no CRC error is detected, as its own control information (step S350). That is, only when the null information is decoded to a specific value known to the UE, the control information transmitted through a corresponding PDCCH is received as the control information of the UE.

[96] Hereinafter, a method for transmitting control information using null information will be described in detail. It is assumed that control information is transmitted to indicate semi-persistent scheduling (SPS) activation by using a DCI format of a PDCCH defined for other usages. That is, the control information indicating SPS activation and other types of control information use one DCI format. SPS can be used for uplink or downlink VoIP transmission.

[97] A radio resource scheduling scheme includes a dynamic scheduling scheme, a persistent scheduling scheme, and an SPS scheme. The dynamic scheduling scheme is a scheme in which scheduling information is requested by using a control signal whenever data is transmitted or received. The persistent scheduling scheme is a scheme in which predetermined information is used so that scheduling information is not requested by using the control signal whenever data is transmitted or received. The SPS scheme is a scheme in which scheduling information is not requested during an SPS interval by using the control signal whenever data is transmitted or received. The SPS interval can start upon receiving the control information indicating SPS activation. The SPS interval can end upon receiving control information indicating SPS deactivation. Alternatively, the SPS interval can be determined through RRC signaling.

[98] FIG. 15 is a flow diagram showing downlink data transmission using the dynamic scheduling scheme. A BS transmits a downlink (DL) grant to a UE through a PDCCH whenever downlink data is transmitted through a PDSCH. The UE receives the downlink data transmitted through the PDSCH by using the DL grant received through the PDCCH. Advantageously, the BS can properly schedule radio resources according

to a downlink channel condition.

[99] FIG. 16 is a flow diagram showing uplink data transmission using the dynamic scheduling scheme. A BS allocates radio resources to a UE according to an uplink (UL) grant before uplink data is transmitted through a PUSCH. The UL grant is transmitted through a PDCCH.

[100] A Voice over IP (VoIP) service provides voice data over an Internet protocol (IP) network. Conventionally, the voice data has been provided in a circuit switched (CS) domain. In the VoIP service, however, the voice data is provided in a packet switched (PS) domain. In CS-based voice services, the voice data is transmitted while maintaining a connection in an end-to-end manner. On the other hand, in the VoIP service, since the voice data can be transmitted in a connection-less manner, a network resource can be very effectively used.

[101] With the development of a wireless communication technique, an amount of user data is rapidly increased. Thus, for effective use of a limited network resource, the conventional CS-based services have recently been replaced with PS-based services. The VoIP service is being developed in the same vein, and it is expected that all voice services are provided over the VoIP in most of wireless communication systems in the future.

[102] A real-time transport protocol (RTP) is developed to effectively provide the PS-based voice services. Further, an RTP control protocol (RTCP) is also developed to control the RTP. In the RTP, time stamp information is carried in every packet, and thus a jitter problem can be solved. Further, an RTP packet loss is reported through the RTCP, and thus a frame error rate (FER) can be reduced through rate control. In addition to the RTP/RTCP, with the development of a session initiation protocol (SIP) and a session description protocol (SDP), a virtual connection can be maintained in an end-to-end manner. Therefore, the delay problem can be mostly solved.

[103] FIG. 17 shows an example of a traffic model in a VoIP.

[104] Referring to FIG. 17, two types of voice packets are generated in the VoIP, that is, a packet generated in a talk spurt and a packet generated in a silence period. For example, if an adaptive multi-rate (AMR) of 12.2 kbps is assumed, an RTP packet is generated in the talk spurt with a period of 20ms, and has a size of 35 to 49 bytes. In the silence period, the RTP packet is generated with a period of 160ms, and has a size of 10 to 24 bytes.

[105] When a packet is generated with a constant period in a voice service such as a VoIP service, a size of the generated packet is relatively small and constant. Therefore, the VoIP generally uses the persistent scheduling scheme or the SPS scheme. When using the persistent scheduling scheme, radio resources are persistently allocated by predicting the scheduling scheme in a radio bearer configuration process, and thus

packets can be transmitted and received in the absence of a control signal including scheduling information. When data is transmitted or received using the persistent scheduling scheme, a channel condition is not considered at a time point when the data is transmitted or received since a predetermined radio resource is used without providing scheduling information. As a result, a transfer error rate may be increased along with changes in the channel condition. The VoIP is suitable to use the SPS scheme when the talk spurt is used as an SPS interval.

[106] FIG. 18 is a flow diagram showing downlink data transmission using the SPS scheme. A BS transmits control information indicating SPS activation of resource allocation information to a UE through a PDCCH. During an SPS interval, the UE can receive VoIP data from the BS through a PDSCH by using the resource allocation information.

[107] FIG. 19 is a flow diagram showing uplink data transmission using the SPS scheme. A BS transmits control information indicating SPS activation of resource allocation information to a UE through a PDCCH. During an SPS interval, the UE can transmit VoIP data to the BS through a PUSCH by using the resource allocation information.

[108] First, a method for transmitting control information indicating SPS activation by using the DCI format 0 will be described. Control information indicating PUSCH scheduling and the control information indicating SPS activation can be transmitted by using the DCI format 0. The SPS activation can be used for uplink VoIP transmission.

[109] Table 3 below shows examples of control information transmitted using the DCI format 0.

[110] [Table 3]

[111]

~1	Flag for format0/format1a differentiation	1
~2	Hopping flag	1
~3	Resource block assignment and hopping resource allocation	$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$
~4	Modulation and coding scheme and redundancy version	5
~5	New data indicator	1
~6	TPC command for scheduled PUSCH	2
~7	Cyclic shift for DM RS	3
~8	UL index	2
~9	CQI request	1

[112] The DCI format 0 includes a plurality of information fields. The information fields are (1) a flag field, (2) a hopping flag field, (3) a resource block assignment and hopping resource allocation field, (4) a modulation and coding scheme (MCS) and redundancy version field, (5) a new data indicator field, (6) a TPC command field, (7) a cyclic shift field, (8) a UL index field, and (9) a channel quality indicator (CQI) request field. A bit size of each information field is for exemplary purposes only, and thus the bit size is not limited thereto.

[113] The flag field is an information field for differentiating the format 0 from the format

1A. The resource block assignment and hopping resource allocation field may have a bit size that varies according to a hopping PUSCH or a non-hopping PUSCH. The resource block assignment and hopping resource allocation field for the non-hopping PUSCH provides

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$$

bits to allocate resrouces of a first slot in an uplink subframe. Herein,

N_{RB}^{UL}

denotes the number of resource blocks included in an uplink slot, and depends on an uplink Tx bandwidth determined in a cell. The resource block assignment and hopping resource allocation field for the hopping PUSCH provides

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil - N_{UL_hop}$$

bits to allocate resources of the first slot in the uplink subframe.

[114] If the number of information bits of the format 0 is less than the number of information bits of the format 1A, '0' is appended to the format 0 until a payload size becomes equal to a payload size of the format 1A.

[115] The control information for PUSCH scheduling is expressed using all of the aforementioned fields. Accordingly, control information having a reference information bit size conforms to the DCI format 0 for PUSCH scheduling.

[116] If the control information for SPS activation is transmitted using the DCI format 0, the null information appended to fit the reference information bit size of the DCI format 0 can be used for virtual CRC check together with bits of '0' padded to conform to the payload size of the format 1A.

[117] Hereinafter, examples of the information field that can be used as the null information when the control information for SPS activation is transmitted using the DCI format 0 will be described.

[118] (1) 1st Embodiment

[119] If it is assumed that a UE performs only PUCCH-based feedback without performing aperiodic PUSCH feedback for downlink VoIP transmission, the CQI request field can be used as the null information.

[120] Table 4 below shows the 1st embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[121] [Table 4]

[122]

	Information field	bits
:	:	:
1	CQI request Set the activation of uplink semi-persistent scheduling, this information bit is set to zero.	

[123] If the control information is for uplink SPS activation, a value of the CQI request field is set to '0'. Remaining fields of the DCI format 0 other than the CQI request field are the same as shown in Table 3 above. It is assumed that the UE performs only PUCCH-based feedback without performing aperiodic PUSCH feedback for downlink VoIP transmission.

[124] (2) 2nd Embodiment

[125] It is assumed that control information indicating SPS activation for uplink VoIP packet transmission does not require additional closed-loop power control, and determines Tx power of VoIP transmission on the basis of open-loop type or hybrid type power control. When the TPC command field for a scheduled PUSCH is not used by considering assignment of a semi-static resource block, the TPC command field can be used as the null information.

[126] Table 5 below shows the 2nd embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[127] [Table 5]

[128]

	Information Field	bit(s)
:	:	:
'0'	TPC command for scheduled PUSCH - For the set action of uplink semi-persistent scheduling, this information bits is set to all zeros.	2
:	:	:

[129] If the control information is for uplink SPS activation, values of the TPC command field are all set to '0'. Remaining fields of the DCI format 0 other than the TPC command field are the same as shown in Table 3 above.

[130] (3) 3rd Embodiment

[131] The control information indicating SPS activation for uplink VoIP packet transmission may not implicitly use the new data indicator field for specific information delivery. In this case, the new data indicator field can be used as the null information.

[132] Table 6 below shows the 3rd embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[133] [Table 6]

[134]

	Information Field	bit(s)
:	:	:
'0'	New data indicator - For the activation of uplink semi-persistent scheduling, this information bit is set to zero.	1
:	:	:

[135] If the control information is for uplink SPS activation, a value of the new data indicator field is set to '0'. Remaining fields of the DCI format 0 other than the new data indicator field are the same as shown in Table 3 above.

[136] (4) 4th Embodiment

[137] The control information indicating SPS activation for uplink VoIP packet transmission can use additional signaling without indicating an MCS or redundancy version in the MCS and redundancy version field. When the additional signaling is used without indicating the MCS in the MCS and redundancy version field, 3 bits out of 5 bits of the MCS and redundancy version field can be used for the null information. When the additional signaling is used without indicating the redundancy version in the redundancy version filed, 2 bits out of the 5 bits can be used for the null information. When the additional signaling is used both for the MCS and the redundancy version, the 5 bits can be all used for the null information.

[138] Table 7 below shows the 4th embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[139] [Table 7]

[140]

Information Field	bits
Modulation and coding scheme and redundancy version - for the activation of uplink semi-persistent scheduling, if information bits among 5 bits is set to all zeros, 2, 3 or 5.	5

[141] If the control information is for uplink SPS activation, 2, 3, or 5 bits out of the 5 bits of the MCS and redundancy version field are set to '0'. Remaining fields of the DCI format 0 other than the MCS and redundancy version field are the same as shown in Table 3 above.

[142] (5) 5th Embodiment

[143] The control information indicating SPS activation for uplink VoIP packet transmission may not additionally indicate the cyclic shift field for a demodulation reference symbol (DM-RS). In this case, the cyclic shift field is used for the null information.

[144] Table 8 below shows the 5th embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[145] [Table 8]

[146]

Information Field	bits
Cyclic shift for DM RS - for the activation of uplink semi-persistent scheduling, this information bits is set to all zeros.	3

[147] If the control information is for uplink SPS activation, values of the cyclic shift field are all set to '0'. Remaining fields of the DCI format 0 other than the TPC command field are the same as shown in Table 3 above.

[148] (6) 6th Embodiment

[149] The control information indicating SPS activation for uplink VoIP packet transmission may allow the VoIP to limit a bandwidth that can be allocated over the entire system bandwidth. In this case, the resource block assignment and hopping resource allocation field can be used as the null information. Among the

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$$

bits, M bits can be used for the null information. Herein, M is a natural number in the range of 1 to

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil - 1$$

.

[150] Table 9 below shows the 5th embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[151] [Table 9]

[152]

Information Field	Bit(s)
.	
Resource block assignment and hopping resource allocation For non-hopping PUSCH with resource allocation type 0: For non-hopping PUSCH with resource allocation type 1: For hopping PUSCH:	$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$
.	

[153] If the control information is for uplink SPS activation, the M bits out of the

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$$

bits are set to '0'. Herein, M is a natural number in the range of 1 to

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil - 1$$

. Remaining fields of the DCI format 0 other than the resource block assignment and hopping resource allocation field are the same as shown in Table 3 above.

[154] (7) 7th Embodiment

[155] A combination of a plurality of information fields of the DCI format 0 is used as the null information. Arbitrary information fields can be combined to be used as the null information. The entire information fields can be used as the null information. The information fields used as the null information in the 1st to 6th embodiments can be used in the combination of the plurality of information fields. For example, when the additional signaling is used for the MCS or the redundancy version as described in the 4th embodiment, the 2, 3, or 5 bits out of the 5 bits of the MCS and redundancy version field can be used in a combination of the plurality of information fields. When using a frequency division duplex (FDD) system, bits of the uplink index field can be used as the null information by appending them to the information fields used as the

null information in the 1st to 6th embodiments.

[156] (8) 8th Embodiment

[157] The 8th embodiment is a detailed embodiment of the 7th embodiment. If the control information for SPS activation is transmitted using the DCI format 0, a combination of the resource block assignment and hopping resource allocation field, the MCS and redundancy version field, the TPC command field, the cyclic shift field, and the CQI request field can be used as the null information.

[158] Table 10 below shows the 8th embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[159] [Table 10]

[160]

	Information Field	Bit(s)
	-	-
1-1	Resource block assignment and hopping resource allocation For the activation of uplink semi-persistent scheduling RIV=1 : $\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$ bits otherwise $\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) - \log_2(N_{SB}^{UL}(N_{SB}^{UL}+1)/2) \rceil$ bits	$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$
1-2	Modulation and coding scheme and redundancy version - For the activation of uplink semi-persistent scheduling: N information bits among 5 bits are set to all zeros	4
1-3	New data indicator	1
1-4	TPC command for scheduled PUSCH For the activation of uplink semi-persistent scheduling: this information field is set to all zeros.	2
1-5	Cyclic shift for DM RS For the activation of uplink semi-persistent scheduling: this information field is set to all zeros.	3
1-6	UL index (TDD)	2
1-7	CQI request For the activation of uplink semi-persistent scheduling: this information field is set to zero	1

[161] Herein, M of the resource block assignment and hopping resource allocation may be specifically set to '2', and N of the MCS and redundancy version field may be specifically set to '1'.

[162] (9) 9th Embodiment

[163] The 9th embodiment is a detailed embodiment of the 7th embodiment. If the control information for SPS activation is transmitted using the DCI format 0, a combination of the resource block assignment and hopping resource allocation field, the MCS and redundancy version field, the new data indicator field, the TPC command field, the cyclic shift field, and the CQI request field can be used as the null information. This is a case where the new data indicator field is added to the combination of the information fields of the 8th embodiment so as to be used as the null information.

[164] Table 11 below shows the 9th embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[165] [Table 11]

[166]

	Information Field	Digital
-		
(a)	Resource block assignment and hopping resource allocation - For the activation of uplink semi-persistent scheduling: [illegible] Information bits were [illegible] bits is set to all zeros.	[illegible]
(b)	Modulation and coding scheme and redundancy version - For the activation of uplink semi-persistent scheduling, 5 information bits among which is set to all zeros	5
(c)	New data indicator - For the activation of uplink semi-persistent scheduling, this information bit is set to zero.	1
(d)	DM RS cyclic shift for DM RS - For the activation of uplink semi-persistent scheduling, this information bits is set to all zeros. Cyclic shift for DM RS - For the activation of uplink semi-persistent scheduling, this information bits is set to all zeros.	3 3
(e)	UL index (TDD)	2
(f)	CQI request - For the activation of uplink semi-persistent scheduling, this information bit is set to zero.	1

[167] Herein, M of the resource block assignment and hopping resource allocation may be specifically set to '2', and N of the MCS and redundancy version field may be specifically set to '1'.

[168] (10) 10th Embodiment

[169] The 10th embodiment is a detailed embodiment of the 7th embodiment. If the control information for SPS activation is transmitted using the DCI format 0, according to a relation between the resource block assignment and hopping resource allocation field and the MCS and redundancy version field, the null information can be used for the two fields. The two fields can be related by additional indication of RRC. In addition to the two fields, a combination of the TPC command field, the cyclic shift field, and the CQI request field can be used as the null information.

[170] Table 12 below shows the 10th embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[171] [Table 12]

[172]

	Resource block assignment and hopping resource allocation	$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$
	Modulation and coding scheme and redundancy version - For the activation of uplink semi-persistent scheduling, this information bits from transmitter have been used for indicating the resource allocation and Modulation and coding scheme and redundancy version, if set to all zeros	
	New data indicator	1
	TPC command for scheduled PUSCH - For the activation of uplink semi-persistent scheduling, this information bits is set to all zeros	2
	Cyclic shift for DM RS - For the activation of uplink semi-persistent scheduling, this information bits is set to all zeros	3
	UL index (TDD) - For the activation of uplink semi-persistent scheduling, this information bits is set to zeros	2
	CQI request - For the activation of uplink semi-persistent scheduling, this information bit is set to zeros	1

[173] Herein, R may be 1, 2,..., or may be

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$$

+4 bits. Alternatively, R may be specifically set to '3' or '4'.

[174] (11) 11th Embodiment

[175] The 11th embodiment is a detailed embodiment of the 7th embodiment. If the control information for SPS activation is transmitted using the DCI format 0, the new data indicator field is added to the combination of the information fields of the 10th embodiment so as to be used as the null information.

[176] Table 13 below shows the 11th embodiment of the control information transmitted using the DCI format 0 for PUSCH scheduling and SPS activation.

[177] [Table 13]

[178]

	Resource block assignment and hopping resource allocation	$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$
	Modulation and coding scheme and redundancy version - For the activation of uplink semi-persistent scheduling, this information bits from transmitter have been used for indicating the resource allocation and hopping, resource allocation and Modulation and coding scheme and redundancy version, if set to all zeros	
	New data indicator - For the activation of uplink semi-persistent scheduling, this information bit is set to zeros	1
	TPC command for scheduled PUSCH - For the activation of uplink semi-persistent scheduling, this information bits is set to all zeros	2
	Cyclic shift for DM RS - For the activation of uplink semi-persistent scheduling, this information bits is set to all zeros	3
	UL index (TDD) CQI request - For the activation of uplink semi-persistent scheduling, this information bit is set to zeros	2 1

[179] Herein, R may be 1, 2,.... or may be

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$$

+4 bits. Alternatively, R may be specifically set to '3' or '4'.

[180] Now, a method for transmitting the control information indicating SPS activation by using the DCI format 1A will be described. The DCI format 1A can be used to transmit control information for compact scheduling of one PDSCH codeword and the control information indicating SPS activation. The SPS activation can be used for uplink VoIP transmission.

[181] Table 14 below shows examples of the control information transmitted using the DCI format 1A.

[182] [Table 14]

[183]

1	Flag for format0/format1A differentiation	1
2	Localized/Distributed VRB assignment flag	1
3	Resource block assignment	$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$
4	Modulation and coding scheme	5
5	HARQ process number	3 bits
6	New data indicator	1
7	Redundancy version	2
8	TPC command for scheduled PUSCH	2
9	Downlink Assignment Index (DAI)	2

[184] The DCI format 1A includes a plurality of information fields. The information fields are (1) a flag field, (2) a localized/distributed virtual resource block (VRB) assignment flag field, (3) a resource block assignment field, (4) a modulation and coding scheme (MCS) field, (5) a hybrid automatic repeat request (HARQ) process number field, (6) a new data indicator field, (7) a redundancy version field, (8) a TPC command field, and (9) a downlink assignment index field. A bit size of each information field is for exemplary purposes only, and thus the bit size is not limited thereto.

[185] The flag field is an information field for differentiating the format 0 from the format 1A. If a CRC of the DCI format 1A is scrambled with an RA-RNTI, P-RNTI, or SI-RNTI, a bit of the flag field indicates a column

N_{PRB}^{1A}

of a transport block size (TBS) table. If the flag field is '0',

N_{PRB}^{1A}

is 20. If the flag field is '1',

N_{PRB}^{1A}

is '3'. Otherwise, the flag field indicates the DCI format.

[186] The resource block assignment field may have a bit size that varies according to a localized VRB or a distributed VRB. The resource block assignment field for the localized VRB provides

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$$

bits for resource assignment. Herein,

N_{RB}^{DL}

denotes the number of resource blocks included in a downlink slot, and depends on a downlink Tx bandwidth determined in a cell. The resource block assignment field for the distributed VRB varies according to whether

N_{RB}^{DL}

is less than 50 or whether

N_{RB}^{DL}

is greater than or equal to 50.

[187] If

N_{RB}^{DL}

is less than 50 or if the CRC of the DCI format 1A is scrambled with the RA-RNTI, P-RNTI, or SI-RNTI,

$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$

bits are provided for resource assignment. If

N_{RB}^{DL}

is greater than or equal to 50,

$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil - 1$

bits are provided for resource assignment.

[188] If the CRC of the DCI format 1A is scrambled with the RA-RNTI, P-RNTI, or SI-RNTI, the new data indicator field indicates a gap value. For example, if the new data indicator field is '0', Ngap is Ngap,1. If the new data indicator field is '1', Ngap is Ngap.2. Otherwise, the new data indicator field indicates new data.

[189] Control information indicating channel assignment on the PDSCH can is expressed using all of the aforementioned fields. Accordingly, control information having a reference information size conforms to the DCI format 1A used to assign channels for the PDSCH.

[190] Hereinafter, examples of the information field that can be used as the null information when the control information for SPS activation is transmitted using the DCI format 1A will be described.

[191] (12) 12th Embodiment

[192] Control information indicating SPS activation for downlink VoIP packet transmission does not have to report an HARQ process number for downlink VoIP transmission. In this case, the HARQ process number field can be used as the null information. For example, if it is assumed that a UE performs only PUCCH-based

feedback without performing aperiodic PUSCH feedback for downlink VoIP transmission, the HARQ process number field can be used as the null information.

[193] Table 15 below shows the 12th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[194] [Table 15]

[195]

	Information Field	bits
:	:	:
(2)	HARQ process number For the activation of downlink semi-persistent scheduling, this information bits is set to all zero.	3 or 4
:	:	:

[196] If the control information is for downlink SPS activation, the HARQ process number field is set to '0'. Remaining fields of the DCI format 1A other than the HARQ process number field are the same as shown in Table 14 above.

[197] (13) 13th Embodiment

[198] It is assumed that control information indicating SPS activation for downlink VoIP packet transmission does not require additional closed-loop power control, and determines Tx power of PUCCH transmission on the basis of open-loop type or hybrid type power control. When the TPC command field is not used by considering assignment of a semi-static resource block, the TPC command field can be used as the null information.

[199] Table 16 below shows the 13th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[200] [Table 16]

[201]

	Information Field	bits
:	:	:
(8)	TPC command for scheduled PUSCH For the activation of downlink semi-persistent scheduling, this information bit is set to all zero.	2
:	:	:

[202] If the control information is for downlink SPS activation, values of the TPC command fields are all set to '0'. Remaining fields of the DCI format 1A other than the TPC command field are the same as shown in Table 14 above.

[203] (14) 14th Embodiment

[204] The control information indicating SPS activation for downlink VoIP packet may not implicitly use the new data indicator field for specific information delivery. In this case, the new data indicator field can be used as the null information.

[205] Table 17 below shows the 14th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[206] [Table 17]

[207]

	Information Field	bit(s)
:	:	:
1st	New data indicator - For the activation of downlink semi-persistent scheduling, this information bit is set to zero.	1
:	:	:

[208] If the control information is for downlink SPS activation, a value of the new data indicator field is set to '0'. Remaining fields of the DCI format 1A other than the new data indicator field are the same as shown in Table 14 above.

[209] (15) 15th Embodiment

[210] The control information indicating SPS activation for downlink VoIP packet may not implicitly use the redundancy version field for specific information delivery. In this case, the redundancy version field can be used as the null information.

[211] Table 18 below shows the 14th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[212] [Table 18]

[213]

	Information Field	bit(s)
:	:	:
4th	Redundancy version. For the activation of downlink semi-persistent scheduling, this information bits is set to all zero.	2
:	:	:

[214] If the control information is for downlink SPS activation, values of the redundancy version field are all set to '0'. Remaining fields of the DCI format 1A other than the redundancy version field are the same as shown in Table 14 above.

[215] (16) 16th Embodiment

[216] The control information indicating SPS activation for downlink VoIP packet can use additional signaling without indicating an MCS in the MCS field. Alternatively, some of all possible cases of modulation schemes and coding rates may be used. In this case, Q bits out of the 5 bits of the MCS field can be used as the null information. Herein, Q is a natural number in the range of 1 to 5.

[217] Table 19 below shows the 16th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[218] [Table 19]

[219]

	Information Field	bit(s)
:	:	:
3rd	Modulation and coding scheme For the activation of downlink semi-persistent scheduling, Q information bits among 5 bits is set to all zero.	5
:	:	:

[220] If the control information is for downlink SPS activation, the Q bits out of the 5 bits of the MCS field are set to '0'. Herein, Q is a natural number in the range of 1 to 5.

Remaining fields of the DCI format 1A other than the MCS field are the same as shown in Table 14 above.

|221| (17) 17th Embodiment

|222| The control information indicating SPS activation for downlink VoIP packet may allow the VoIP to limit a bandwidth that can be allocated over the entire system bandwidth. In this case, the resource block assignment field can be used as the null information. Among

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$$

bits, P bits can be used for the null information. Herein, P is a natural number in the range of 1 to

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil - 1$$

.

|223| Table 20 below shows the 17th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

|224| [Table 20]

|225|

:	:	
(17)	- Resource block assignment - For the activation of downlink semi-persistent scheduling - P information bits are used for the null information in DCI format 1A	$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$
:		

|226| If the control information is for downlink SPS activation, the P bits out of the

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$$

bits are set to '0'. Herein, P is a natural number in the range of 1 to

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil - 1$$

. Remaining fields of the DCI format 1A other than the resource block assignment field are the same as shown in Table 14 above.

|227| (18) 18th Embodiment

|228| A combination of a plurality of information fields of the DCI format 1A is used as the null information. Arbitrary information fields can be combined to be used as the null information. The entire information fields can be used as the null information. The information fields used as the null information in the 12th to 17th embodiments can be used in the combination of the plurality of information fields. For example, when the additional signaling is used for the MCS as described in the 16th embodiment, the Q bits out of the 5 bits of the MCS field can be used in a combination of the plurality of information fields. Herein, Q is a natural number in the range of 1 to 5. In addition, as in the 17th embodiment, the P bits out of the

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$$

bits of the resource block assignment field can be used in a combination of the information fields. Herein, P is a natural number in the range of 1 to

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil - 1$$

. When using the FDD system, bits of the downlink index field can be used as the null information by appending them to the information fields used as the null information in the 12th to 17th embodiments.

[229] (19) 19th Embodiment

[230] The 19th embodiment is a detailed embodiment of the 18th embodiment. If the control information for SPS activation is transmitted using the DCI format 1A, a combination of the resource block assignment field, the MCS field, and the redundancy version field is used as the null information.

[231] Table 21 below shows the 19th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[232] [Table 21]

[233]

Information field	Number of bits
Flag for format0/format1a differentiation	1
Localized/Distributed VRB assignment flag	1
Resource block assignment For the first slot of downlink semi-persistent scheduling, For subframes other than the first subframe of downlink semi-persistent scheduling, bits are set to all zeros.	$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$ $\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil - P$
Modulation and coding scheme For the first slot of downlink semi-persistent scheduling, Otherwise, for the corresponding PDCCH, all zeros.	5
HARQ process number	3 (FDD) 4 (TDD)
New data indicator	1
Redundancy version For the first slot of downlink semi-persistent scheduling, Otherwise, for the corresponding PDCCH, all zeros.	2
TPC command for scheduled PUCCH	2
Downlink Assignment Index (DAI)	2

[234] (20) 20th Embodiment

[235] The 20th embodiment is a detailed embodiment of the 18th embodiment. If the control information for SPS activation is transmitted using the DCI format 1A, a combination of the resource block assignment field, the MCS field, the new data indicator field, and the redundancy version is used as the null information. This is a case where the new data indicator field is added to the combination of the information fields of the 19th embodiment so as to be used as the null information.

[236] Table 22 below shows the 20th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[237] [Table 22]

[238]

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1
[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1
[illegible]	[illegible]	3
[illegible]	[illegible]	2
[illegible]	[illegible]	2

[239] (21) 21st Embodiment

[240] The 21st embodiment is a detailed embodiment of the 18th embodiment. If the control information for SPS activation is transmitted using the DCI format 1A, a combination of the resource block assignment field, the MCS field, the HARQ process number field, and the redundancy version field is used as the null information. This is a case where the HARQ process number field is added to the combination of the information fields of the 19th embodiment so as to be used as the null information.

[241] [Table 23]

[242]

[illegible]	[illegible]	1
[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1
[illegible]	[illegible]	3
[illegible]	[illegible]	2
[illegible]	[illegible]	2

[243] (22) 22nd Embodiment

[244] The 22nd embodiment is a detailed embodiment of the 18th embodiment. If the control information for SPS activation is transmitted using the DCI format 1A, a combination of the resource block assignment field, the MCS field, the HARQ process number field, the new data indicator field, and the redundancy version field is used as the null information. This is a case where the new data indicator field is added to the combination of the information fields of the 21st embodiment so as to be used as the null information.

[245] [Table 24]

[246]

C1	Flag for format 0/format 1A differentiation	1
C2	Localized/Distributed VRB assignment flag	1
C3	Resource block assignment For non-activation of downlink semi-persistent scheduling - PUSCH hopping bits - NUL hopping bits - Resource block assignment bits For activation of downlink semi-persistent scheduling - Information bits among 3 bits is set to all "zeros"	$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$
C4	Modulation and coding scheme - For the activation of downlink semi-persistent scheduling, this information bits among 5 bits is set to all "zeros"	5
C5	HARQ process number For the activation of downlink semi-persistent scheduling, this information bits is set to all zeros	3 bits
C6	New data indicator For the activation of downlink semi-persistent scheduling, this information bits is set to all zeros	1
C7	Redundancy version For the activation of downlink semi-persistent scheduling, this information bits is set to all zeros	2
C8	TPC command for scheduled PUCCH	2
C9	Downlink Assignment Index (DAI)	2

[247] (23) 23rd Embodiment

[248] The 23rd embodiment is a detailed embodiment of the 18th embodiment. If the control information for SPS activation is transmitted using the DCI format 1A, according to a relation between the resource block assignment field and the MCS field, the null information can be used for the two fields. The two fields can be related by additional indication of RRC. In addition to the two fields, the redundancy version field can be further combined to be used as the null information.

[249] Table 25 below shows the 23rd embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[250] [Table 25]

[251]

C1	Flag for format 0/format 1A differentiation	1
C2	Localized/Distributed VRB assignment flag	1
C3	Resource block assignment	$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$
C4	Modulation and coding scheme - For the activation of downlink semi-persistent scheduling, this information bits from Resource block assignment field, Modulation and coding scheme field are set to all "zeros"	5
C5	HARQ process number	3 bits
C6	New data indicator	1
C7	Redundancy version For the activation of downlink semi-persistent scheduling, this information bits is set to all zeros	2
C8	TPC command for scheduled PUCCH	2
C9	Downlink Assignment Index (DAI)	2

[252] Herein, S may be 1, 2,..., or may be

$$\lceil \log_2(N_{RB}^{UL}(N_{RB}^{UL}+1)/2) \rceil$$

+4 bits.

[253] (24) 24th Embodiment

[254] The 24th embodiment is a detailed embodiment of the 18th embodiment. If the

control information for SPS activation is transmitted using the DCI format 1A, according to a relation between the resource block assignment field and the MCS field, the null information can be used for the two fields. The two fields can be related by additional indication of RRC. In addition to the two fields, a combination of the new data indicator field and the redundancy version field can be used as the null information. This is a case where the new data indicator field is added to the combination of the information fields of the 23rd embodiment so as to be used as the null information.

[255] Table 26 below shows the 24th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[256] [Table 26]

[257]

	Information Field	bit(s)
[illegible]	[illegible]	1
[illegible]	[illegible]	1
[illegible]	[illegible]	$\left\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \right\rceil$
[illegible]	[illegible]	5
[illegible]	[illegible]	[illegible]
[illegible]	New data indicator - For the activation of downlink semi-persistent scheduling, this information bit is set to zero. Redundancy version - For the activation of downlink semi-persistent scheduling, this information bits are set to '00'	1 2
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2

[258] Herein, S may be 1, 2..... or may be

$\left\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \right\rceil$

+4 bits.

[259] (25) 25th Embodiment

[260] The 25th embodiment is a detailed embodiment of the 18th embodiment. If the control information for SPS activation is transmitted using the DCI format 1A, according to a relation between the resource block assignment field and the MCS field, the null information can be used for the two fields. The two fields can be related by additional indication of RRC. In addition to the two fields, a combination of the HARQ process number field and the redundancy version field can be used as the null information. This is a case where the HARQ process number field is added to the combination of the information fields of the 23rd embodiment so as to be used as the null information.

[261] Table 27 below shows the 25th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[262] [Table 27]

[263]

	Information Field	Bit(s)
910	Flag for format0/format1A differentiation	1
920	Localized/Distributed VRB assignment flag	1
930	Resource block assignment	$\lceil \log_2(N_{DL}^{RB}(N_{DL}^{RB}+1)/2) \rceil$
940	Modulation and coding scheme For the activation of downlink semi-persistent scheduling, this information field from the resource block assignment and Modulation and coding scheme field are all zeros.	5
950	HARQ process number For the activation of downlink semi-persistent scheduling, this information field is set to all zeros.	3 or 4
960	New data indicator For the activation of downlink semi-persistent scheduling, this information field is set to all zeros.	1
970	Redundancy version For the activation of downlink semi-persistent scheduling, this information field is set to all zeros.	2
980	TPC command for scheduled PUSCH	2
990	Downlink Assignment Index (DAI)	2

[264] Herein, S may be 1, 2..... or may be

$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$

+4 bits.

[265] (26) 26th Embodiment

[266] The 26th embodiment is a detailed embodiment of the 18th embodiment. If the control information for SPS activation is transmitted using the DCI format 1A, according to a relation between the resource block assignment field and the MCS field, the null information can be used for the two fields. The two fields can be related by additional indication of RRC. In addition to the two fields, a combination of the HARQ process number field, the new data indicator field, and the redundancy version field can be used as the null information. This is a case where the new data indicator field is added to the combination of the information fields of the 25th embodiment so as to be used as the null information.

[267] Table 28 below shows the 26th embodiment of the control information transmitted using the DCI format 1A for PDSCH channel assignment and SPS activation.

[268] [Table 28]

[269]

	Information Field	Bit(s)
910	Flag for format0/format1A differentiation	1
920	Localized/Distributed VRB assignment flag	1
930	Resource block assignment	$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$
940	Modulation and coding scheme For the activation of downlink semi-persistent scheduling, this information field from the resource block assignment and Modulation and coding scheme field are all zeros.	5
950	HARQ process number For the activation of downlink semi-persistent scheduling, this information field is set to all zeros.	3 or 4
960	New data indicator For the activation of downlink semi-persistent scheduling, this information field is set to all zeros.	1
970	Redundancy version For the activation of downlink semi-persistent scheduling, this information field is set to all zeros.	2
980	TPC command for scheduled PUSCH	2
990	Downlink assignment index (DAI)	2

|270| Herein, S may be 1, 2,..., or may be

$$\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2) \rceil$$

+4 bits.

|271| (27) 27th Embodiment

|272| The DCI format 1 can be used to transmit control information for channel assignment on a PDSCH based on general resource allocation and control information indicating SPS activation for downlink VoIP packet transmission. In a method of the 12th to 26th embodiments, the information fields defined in the DCI format 1A are used as the null information in a condition where control information indicating channel assignment on a PDSCH based on specific resource allocation and control information indicating SPS activation for downlink VoIP packet transmission are transmitted using the DCI format 1A. The method of the 12th to 26th embodiments can be equally applied to a case where the control information indicating SPS activation is transmitted using the DCI format 1. Information fields defined in the DCI format 1 may also be used as the null information.

|273| (28) 28th Embodiment

|274| The DCI format 2 can be used to transmit control information for PDSCH scheduling for a UE which is set to a spatial multiplexing mode and control information for SPS activation for downlink VoIP packet transmission. The method of the 12th to 26th embodiments can be equally applied to a case where the control information for SPS activation is transmitted using the DCI format 2. Information fields defined in the DCI format 2 may also be used as the null information.

|275| The DCI format 2 includes a HARQ swap flag field. The HARQ swap flag field can also be used as the null information by being appended to the information fields used as the null information in the DCI format 2. All possible combinations of the HARQ swap flag field and other information fields can also be used as the null information.

|276| As described above, a method for detecting control information can provided with an increased accuracy in a wireless communication system. A specific value of an error check field can be used as a virtual CRC. A user equipment can increase an accuracy of CRC error checking by using the virtual CRC when detecting the control information. That is, the control information can be accurately detected while effectively utilizing radio resources. Therefore, an overall system performance can be increased.

|277| All functions described above may be performed by a processor such as a microprocessor, a controller, a microcontroller, and an application specific integrated circuit (ASIC) according to software or program code for performing the functions. The program code may be designed, developed, and implemented on the basis of the descriptions of the present invention, and this is well known to those skilled in the art.

|278| While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The exemplary embodiments should be considered in descriptive sense only and not for purposes of limitation. Therefore, the scope of the invention is defined not by the detailed description of the invention but by the appended claims, and all differences within the scope will be construed as being included in the present invention.

|279|

|280|

Claims

[1] A method for detecting control information in a wireless communication system, the method comprising:
checking a cyclic redundancy check (CRC) error by monitoring control channels;
determining whether a value of an error check field is equal to a specific value, where the error check field is a field among fields included in the control information on a control channel, the control channel in which the CRC error is not detected; and
if the value of the error check field is equal to the specific value, detecting the control information on the control channel, the control channel in which the CRC error is not detected.

[2] The method of claim 1, wherein the control channel is a physical downlink control channel (PDCCH).

[3] The method of claim 1, wherein a semi-persistent cell-radio network temporary identifier (C-RNTI) is masked on the CRC to indicate activation of semi-persistent scheduling.

[4] The method of claim 3, wherein the monitoring of the control channels is checking the CRC error after demasking the semi-persistent C-RNTI to the CRC.

[5] The method of claim 1, wherein the control information indicates activation of semi-persistent scheduling of resource assignment information for a voice over Internet protocol (VoIP).

[6] The method of claim 5, further comprising receiving VoIP data on a physical downlink shared channel (PDSCH) during a specific time interval by using the resource allocation information.

[7] The method of claim 5, further comprising transmitting VoIP data on a physical uplink shared channel (PUSCH) during a specific time interval by using the resource allocation information.

[8] The method of claim 1, wherein the control information indicates deactivation of semi-persistent scheduling.

[9] A user equipment comprising:
a radio frequency (RF) unit for transmitting and receiving a radio signal; and
a processor coupled with the RF unit and configured to
check a CRC error by monitoring control channels, determine whether a value of an error check field is equal to a specific value, where the error check field is a field among fields included in the control information on a control channel, the control channel in which the CRC error is not detected, and, if the value of the error check field is equal to the specific value, detect the control information on

the control channel, the control channel in which the CRC error is not detected.

[10] The user equipment of claim 9, wherein a semi-persistent C-RNTI is masked on a CRC to indicate activation of semi-persistent scheduling.

[11] The user equipment of claim 9, wherein the monitoring of the control channels is checking the CRC error after demasking the semi-persistent C-RNTI to the CRC.

[12] The user equipment of claim 9, wherein the control information indicates activation of semi-persistent scheduling of resource assignment information for a VoIP.

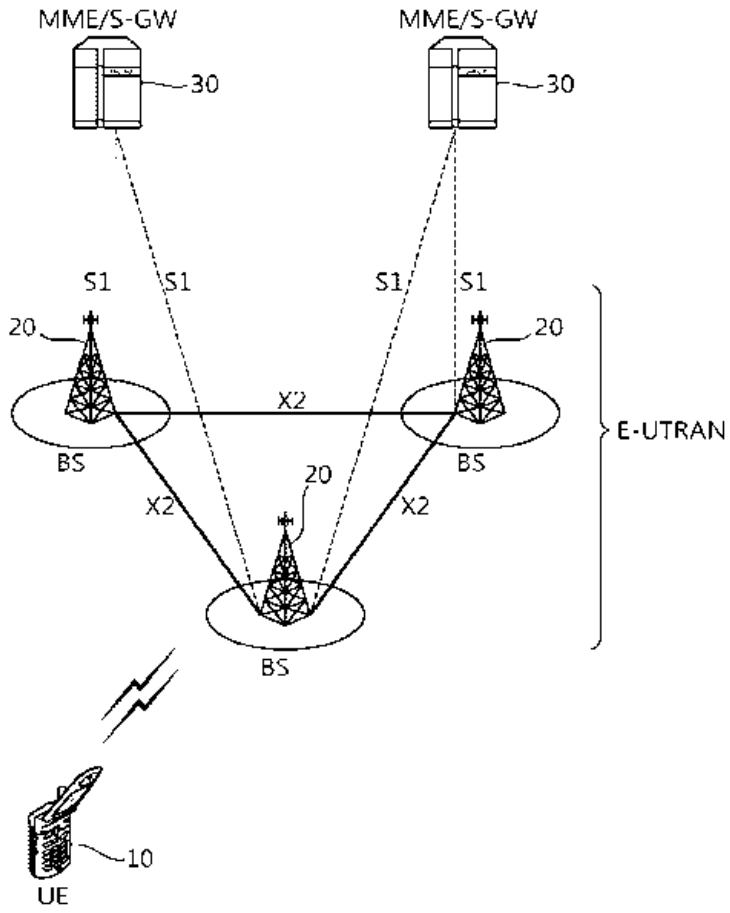
[13] A method for transmitting control information in a wireless communication system, the method comprising:

generating the control information comprising an error check field having a specific value; and

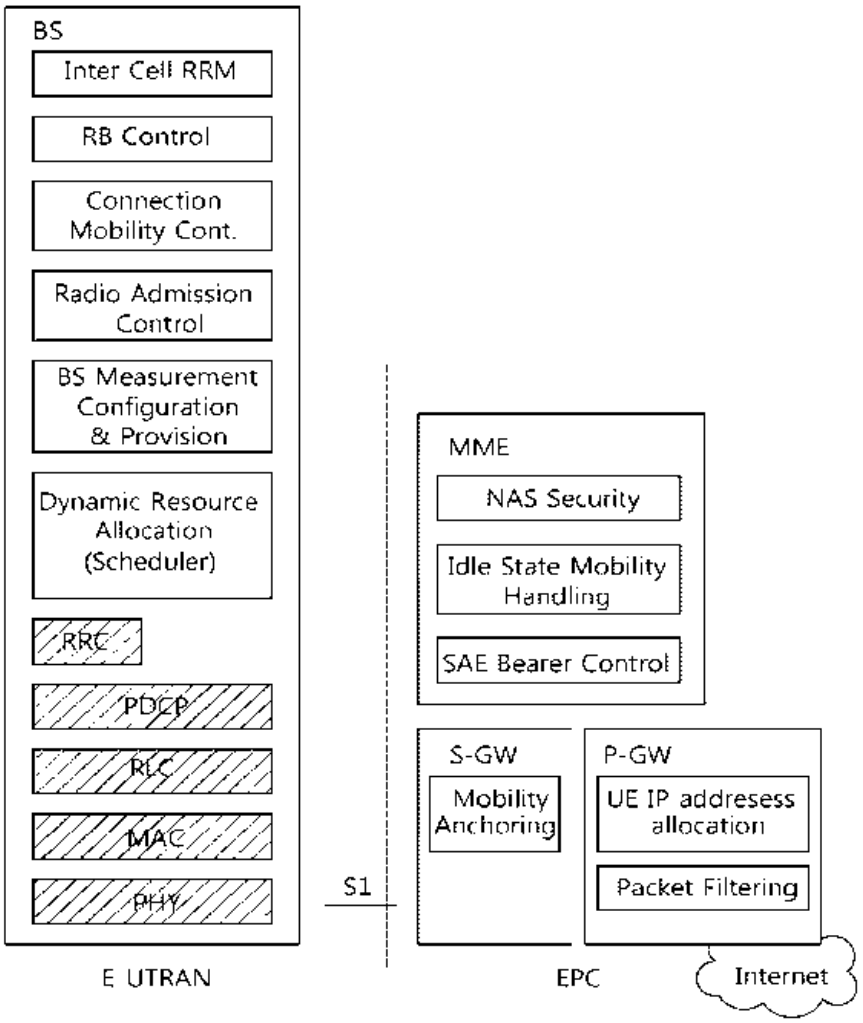
transmitting the control information on a control channel by appending a CRC to the control information,

wherein a successful reception of the control information is determined according to the specific value of the error check field and the CRC.

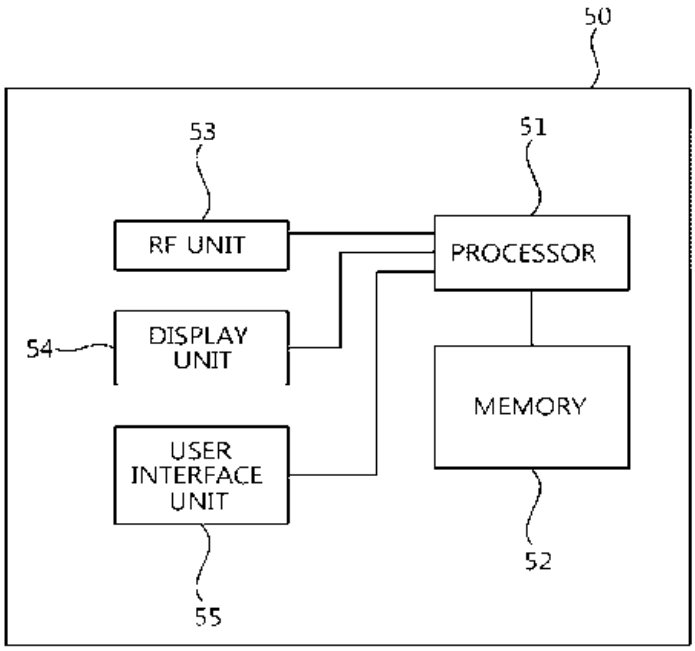
[Fig. 1]


MME/S-GW
MME/S-GW
30
30
S1
S1
S1
S1
20
20
X2
BS
BS
E-UTRAN
20
X2
X2
BS
10
UE

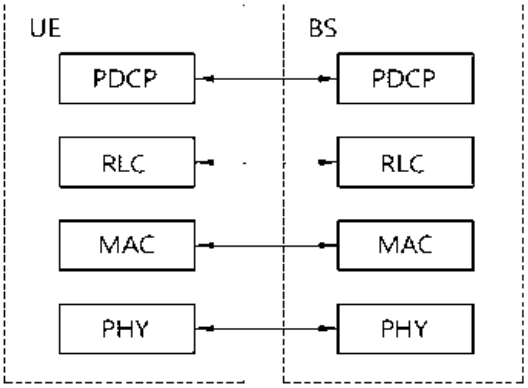
[Fig. 2]


BS
Inter Cell RRM
RB Control
Connection Mobility Cont.
Radio Admission Control
BS Measurement Configuration & Provision
Dynamic Resource Allocation (Scheduler)
RRC
PDCP
RLC
MAC
PHY
S1
MME
NAS Security
Idle State Mobility Handling
SAE Bearer Control
S-GW
Mobility Anchoring
P-GW
UE IP addresess allocation
Packet Filtering
Internet
E UTRAN
EPC

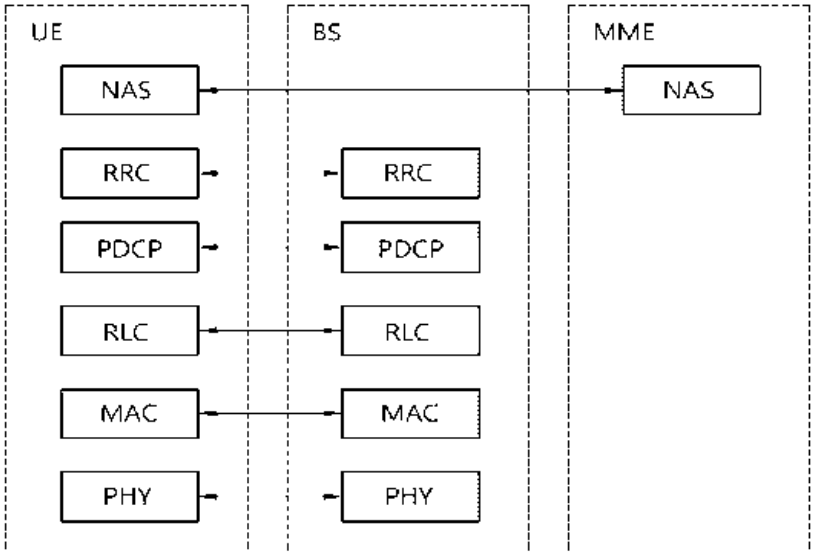
[Fig. 3]


50
53
51
RF UNIT
PROCESSOR
54
DISPLAY UNIT
MEMORY
USER INTERFACE UNIT
52
55

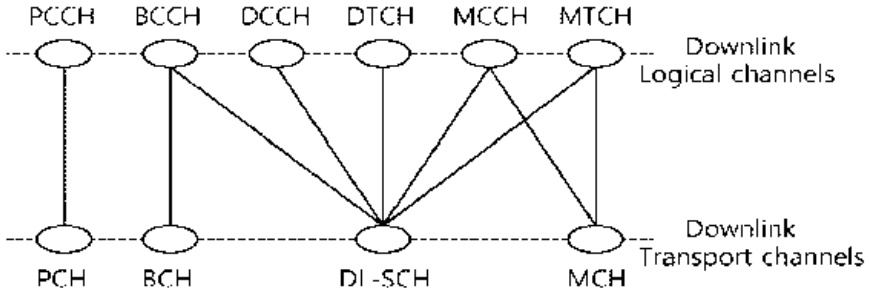
[Fig. 4]


UE
BS
PDCP
PDCP
RLC
RLC
MAC
MAC
PHY
PHY

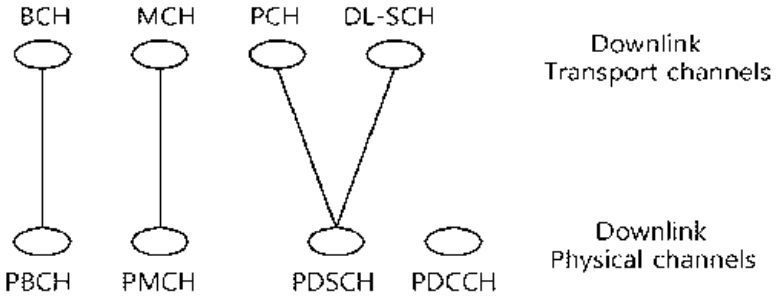
[Fig. 5]



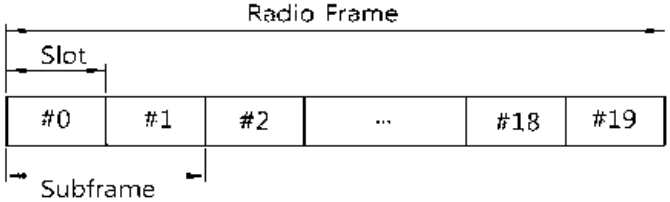
[Fig. 6]



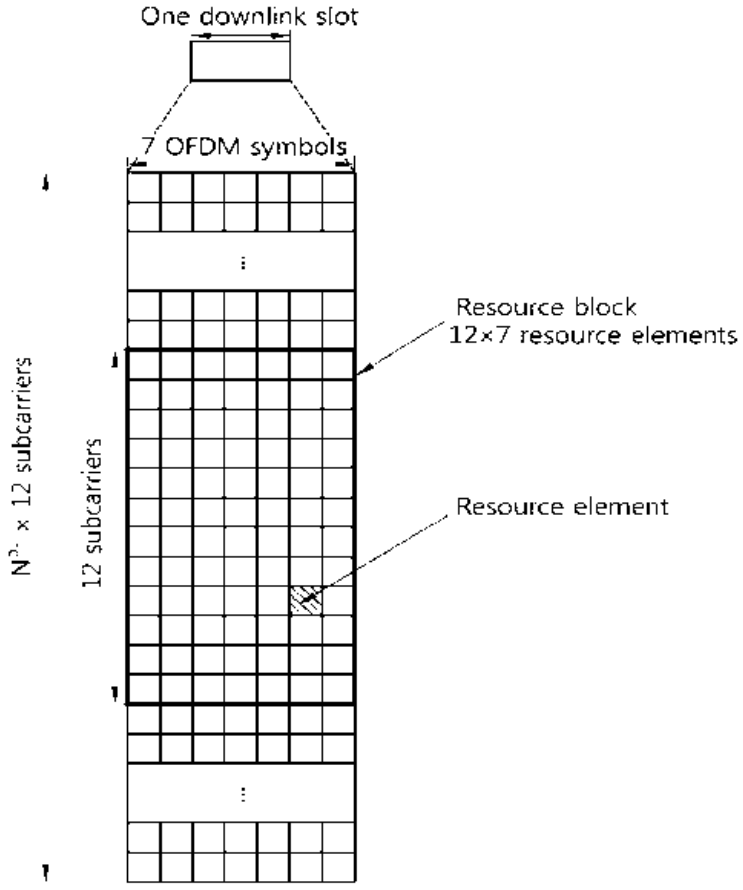
[Fig. 7]



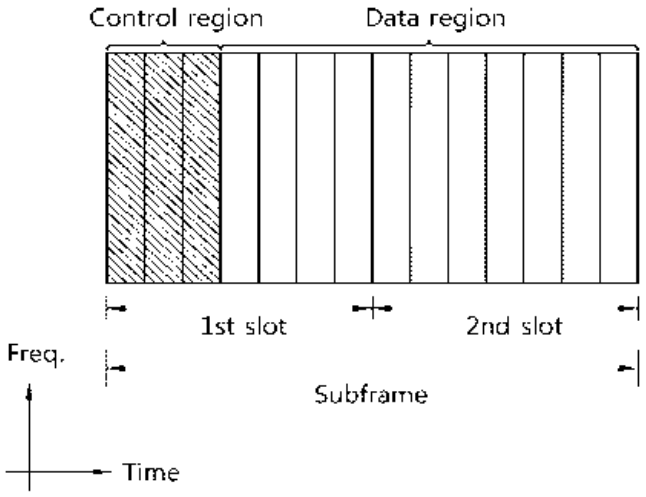
[Fig. 8]



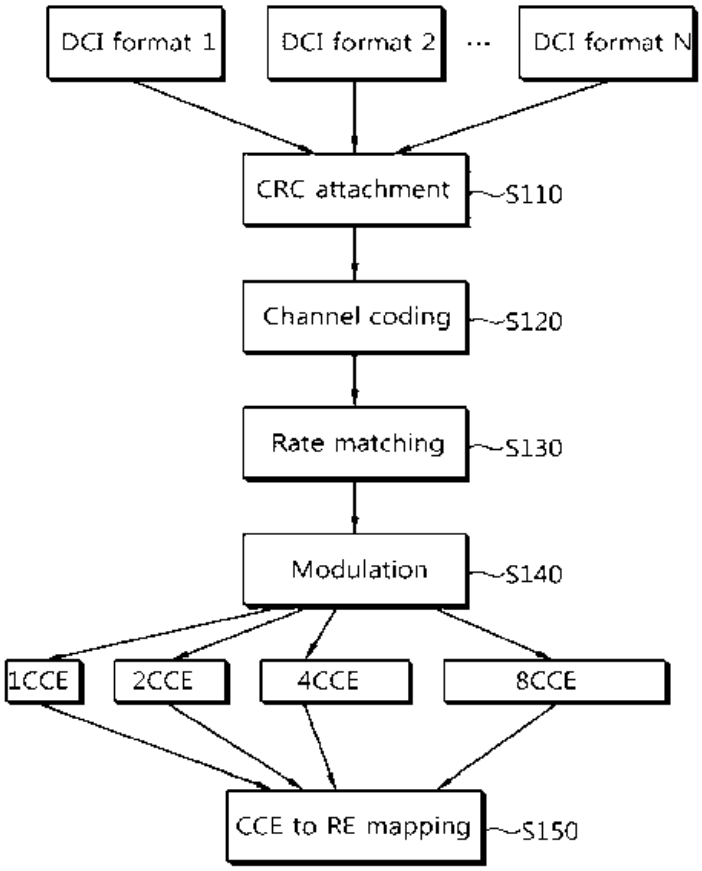
[Fig. 9]


One downlink slot
7 OFDM symbols
Resource block
12×7 resource elements
Resource element
N^{DL}_{RB} x 12 subcarriers
12 subcarriers

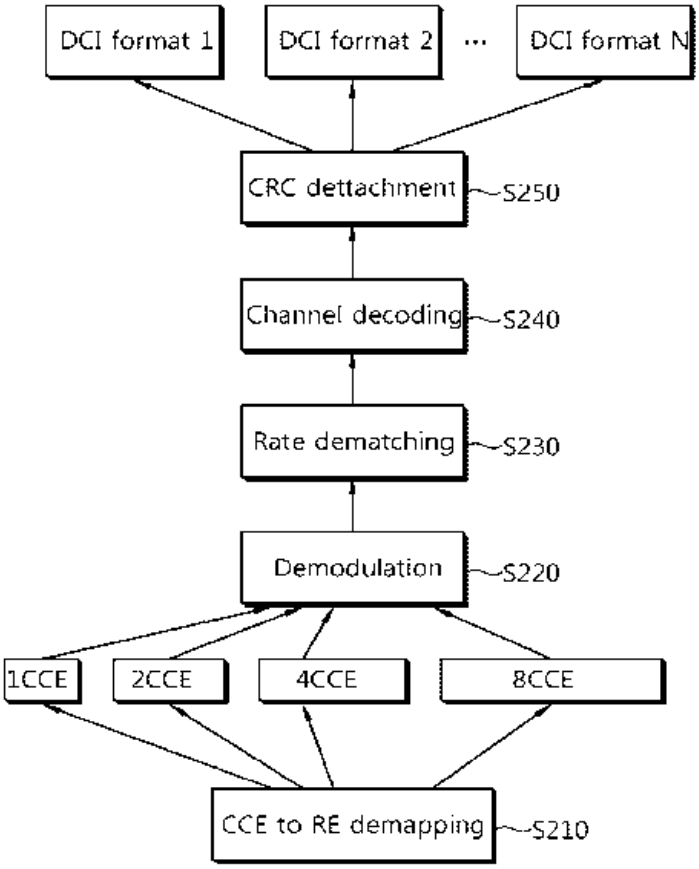
[Fig. 10]


Control region
Data region
1st slot
2nd slot
Subframe
Freq.
Time

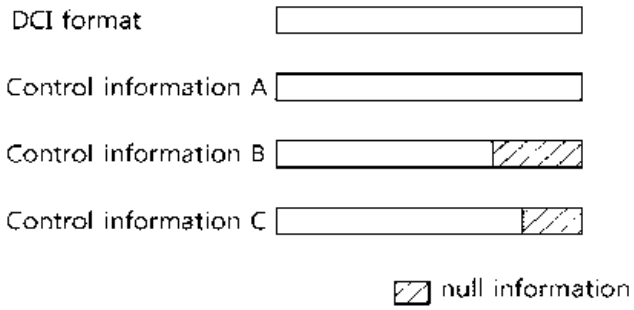
[Fig. 11]


DCI format 1
DCI format 2
...
DCI format N
CRC attachment
S110
Channel coding
S120
Rate matching
S130
Modulation
S140
1CCE
2CCE
4CCE
8CCE
CCE to RE mapping
S150

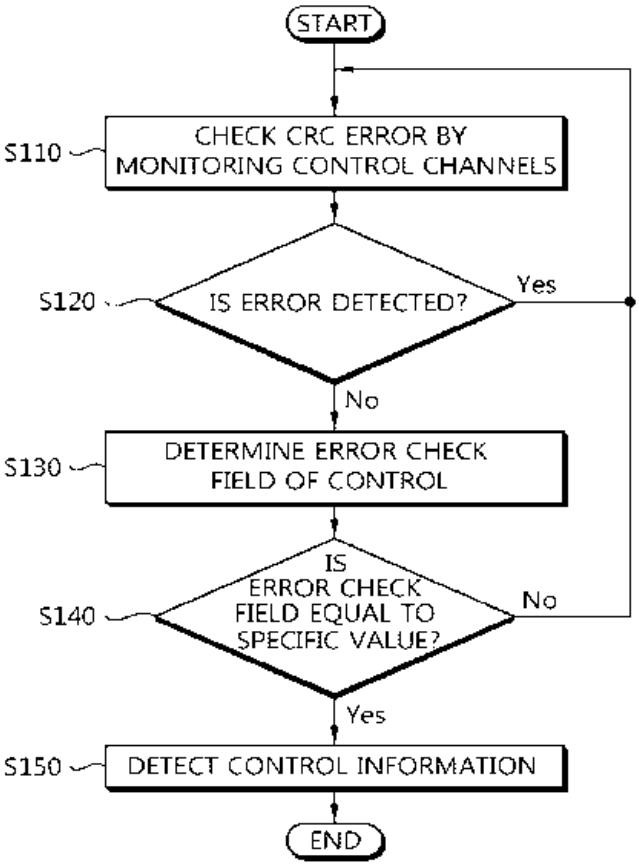
[Fig. 12]


DCI format 1
DCI format 2
...
DCI format N
CRC dettachment
S250
Channel decoding
S240
Rate dematching
S230
Demodulation
S220
1CCE
2CCE
4CCE
8CCE
CCE to RE demapping
S210

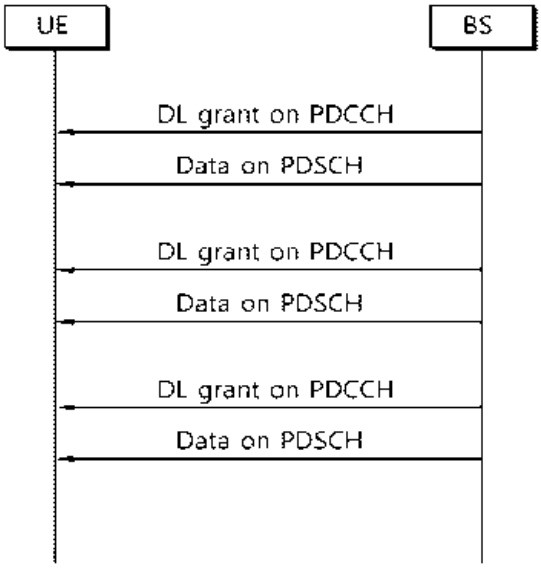
[Fig. 13]


DCI format
Control information A
Control information B
Control information C
null information

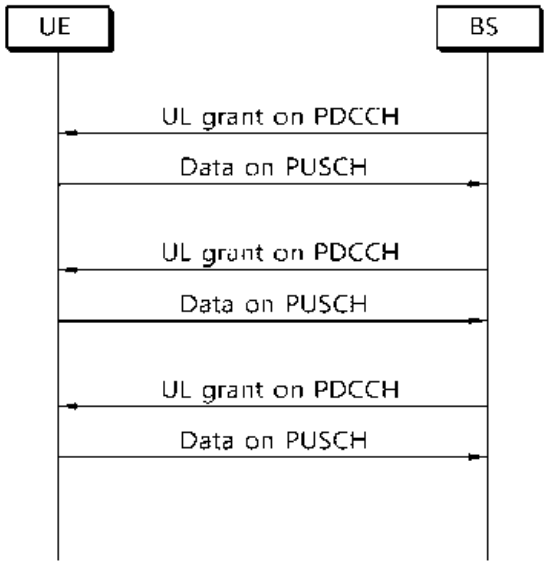
[Fig. 14]


START
S110
CHECK CRC ERROR BY MONITORING CONTROL CHANNELS
S120
IS ERROR DETECTED?
Yes
No
S130
DETERMINE ERROR CHECK FIELD OF CONTROL
S140
IS ERROR CHECK FIELD EQUAL TO SPECIFIC VALUE?
No
Yes
S150
DETECT CONTROL INFORMATION
END

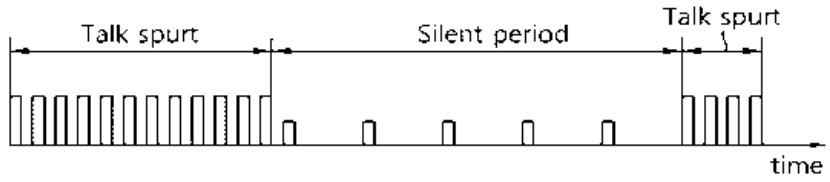
[Fig. 15]


UE
BS
DL grant on PDCCH
Data on PDSCH
DL grant on PDCCH
Data on PDSCH
DL grant on PDCCH
Data on PDSCH

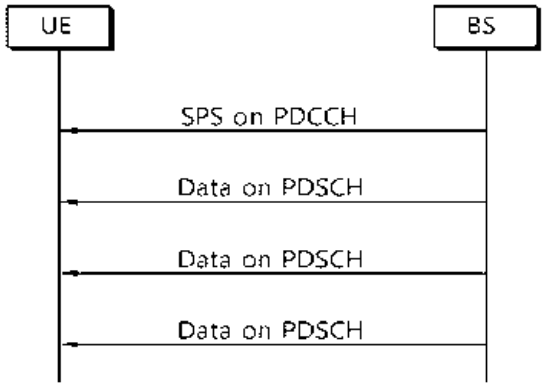
[Fig. 16]



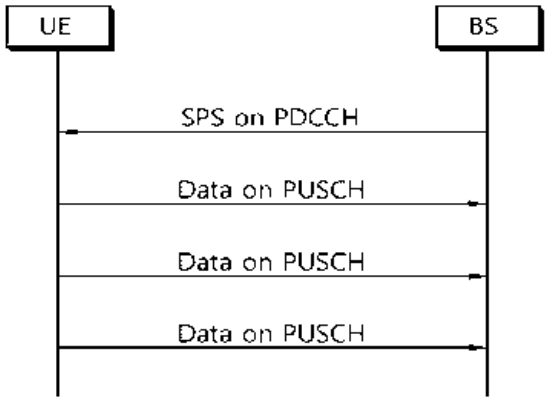
[Fig. 17]



[Fig. 18]



[Fig. 19]



Electronic Acknowledgement Receipt	
EFS ID:	17403086
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	14-NOV-2013
Filing Date:	02-JUN-2012
Time Stamp:	14:54:34
Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS_pto.PDF	252509	no	4
Warnings:					
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09	5823

74368 7590 11/19/2013
Slater & Matsil, L.L.P.
17950 Preston Road, Suite 1000
Dallas, TX 75252

EXAMINER	
NOORISTANY, SULAIMAN	
ART UNIT	**PAPER NUMBER**
2478	

NOTIFICATION DATE	DELIVERY MODE
11/19/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@slater-matsil.com

Office Action Summary	Application No. 13/487,172	Applicant(s) CHEN ET AL.	
	Examiner SULAIMAN NOORISTANY	Art Unit 2478	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *2 June 2012*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *17-36* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *17-36* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *6/2/212* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☒ All b)☐ Some * c)☐ None of the:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/25/2012, 12/5/2012, 5/28/2013, 7/2/2013, 9/19/2013*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

4) ☐ Other. _____.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 17, 28, 32, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Details of ACK/ NACK bundling for TDD" by Ericsson, hereafter referred as Ericsson in view of Moon (US 2012/0140726)

Regarding claim 17, Ericsson teaches wherein a method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising (see section 1 "Introduction" line 2-3 "ACK/NACKs from several DL subframes are combined or bundled"), the method comprising:

configuring a common field preset in Downlink Control Information (DCI) as at least one type of command field related to ACK/NACK feedback (see section 4 "Discussion" see

paragraph beginning with "As described in [2]:"Bits can be added to the downlink control information").

However, Ericsson doesn't teach where Moon (US 2012/0140726) teaches a transmission power control field in Downlink Control Information (DCI) (see para 0038 "The DCI includes ...uplink transmission power control command") wherein the common field can be configured as the at least two types of command fields related to ACK/NACK feedback (see para 0039 "transmit power control command"; "see para 005 "The type 2 resource allocation field includes a resource indication value (RIV)"): and sending the DCI to a user equipment (see para 0039 "DCI to be transmitted"), so that the user equipment feeds back the ACK/NACK information according to the DCI (see para 0031 "Control information transmitted from the user equipment to the base station… through the uplink includes downlink/uplink ACK/NACK signals.") Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of DCI in transmit power control in the system of Ericsson. The motivation is to establish communication.

Regarding claim 28, Ericsson teaches a method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation (ACK/NACK) information for carrier aggregation (see section 1 "Introduction" line 2-3 "ACK/NACKs from several DL subframes are combined or bundled").. the method comprising:
receiving downlink control information (DCI) that is sent by a base station and
transmitted by a downlink component carrier (see page 4 section 4. Discussion para 3 line 2 DCI is signaled on the PDCCH).

However, Ericsson doesn't teach where Moon teaches feeding back ACK/NACK information according to a command field which is related to ACK/NACK feedback and configured in a common field preset in the DCI. wherein the common field can be configured as at least two types of command fields related to ACK/NACK feedback (see para 0039 "transmit power control command"; "see para 005 "The type 2 resource allocation field includes a resource indication value (RIV)"). (see para 0031 "Control information transmitted from the user equipment to the base station... through the uplink includes downlink/uplink ACK/NACK signals.") Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of DCI in transmit power control in the system of Ericsson. The motivation is to establish communication.

Claims 18-21 rejected under 35 U.S.C. 103(a) as being unpatentable over "Details of ACK/ NACK bundling for TDD" by Ericsson, hereafter referred as Ericsson in view of Moon (US 2012/0140726) and further in view of Kim (20120224553).

Regarding claim 18. The method according to claim 17, wherein configuring the common field comprises configuring common field preset in the DCI as at least one type of command field related to ACK/NACK feedback according to an acknowledgement information feedback mode and/or a downlink component carrier type (Ericsson: see page 4 section 4, Discussion para 3 line 2 DCI is signaled on the PDCCH) (Kim: see para 0022). Thus it would have been obvious to a

person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson. The motivation is to transmit TPC.

Regarding claim 19. The method according to claim 17, wherein the at least two types of command fields related to ACK/NACK feedback are: a downlink assignment index (DAI) command field and an ACK resource indication (ARI) command field (Ericsson: see page 4 section 4, Discussion para 3 line 2 DCI is signaled on the PDCCH):

a transmission power control (TPC) command field and an ARI command field: a TPC command field and a DAI command field; or a TPC command field, a DAI command field, and an ARI command field (Ericsson: see section 3; section 4, Discussion para 3 line 2 DCI is signaled on the PDCCH) (Kim: see para 0022). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson. The motivation is to transmit TPC.

Regarding claim 20. Ericsson doesn't teach where Kim 20120224553 teaches wherein configuring the TPC command field comprises configuring the TPC command field in at least one piece of DCI transmitted by a downlink primary component carrier as the TPC command (see para 0022). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson. The motivation is to transmit TPC.

Regarding claim 21. Ericsson doesn't teach where Kim wherein the at least one piece of DCI transmitted by the downlink primary component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of the downlink primary component carrier (see para 0015 "transmitting a downlink control information (DCI)message including the TPC information to each user equipment (UE) through a physical downlink control channel (PDCCH)"). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the downlink primary component carrier in the system of Ericsson. The motivation is to transmit TPC information.

Claims 22-23, 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Details of ACK/ NACK bundling for TDD" by Ericsson, hereafter referred as Ericsson in view of Moon (US 2012/0140726) and further in view of Ahn (US 20090197630)

Regarding claim 22, Ericsson doesn't teach where Ahn (20090197630) teaches wherein configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a downlink non-primary component carrier as an ACK resource indication (ARI) command field and/or a DAI command field (para 0079). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson . The motivation is to transmit TPC.

Regarding claim 23. Ericsson doesn't teach where Ahn (20090197630) teaches wherein the common field can be configured as a transmission power control (TPC) command field and an ACK resource indication (ARI) command field. and wherein configuring the common field further comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command field (para 0079). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson . The motivation is to transmit TPC.

Regarding claim 25, Ericsson doesn't teach where Ahn (20090197630) teaches wherein the common field can be configured as a transmission power control (TPC) command field and an ACK resource indication (ARI) command field. and wherein configuring the common field further comprises configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as an ARI command field (para 0079). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson . The motivation is to transmit TPC.

Regarding claim 26. Ericsson doesn't teach where Ahn (20090197630) teaches wherein the common field can be configured as a TPC command field and a DAI command field and

configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a DAI command field (para 0079). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson . The motivation is to transmit TPC.

Regarding claim 27, Ericsson doesn't teach where Ahn (20090197630) teaches wherein the common field can be configured as a TPC command field and a DAI command field and configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as a TPC command field and configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a DAI command field (para 0079). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the implementation of TPC command field in DCI in the system of Ericsson . The motivation is to transmit TPC.

Claims 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Details of ACK/ NACK bundling for TDD" by Ericsson, hereafter referred as Ericsson in view of Moon (US 2012/0140726) and further in view of Ahn (US 20090197630) and Kim.

Regarding claim 24. Ericsson doesn't teach where Kim teaches wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier and/or at least one piece of DCI transmitted by the downlink PCC (see para 0012). Thus it would have been obvious to a person with ordinary skills in the art at the time of invention to combine the PDSCH in the system of Ericsson . The motivation is use PDSCH for transmission.

Claims 29-36 are rejected for the same reasons as state above.

Remark:

Examiner stressed that the claims are too broad and require detail or specialization of the steps as recited in the claims. Alone and as claimed, the limitations are too open.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sulaiman Nooristany whose telephone number is (571) 270-1929. The examiner can normally be reached on M-F from 9 to 5. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Derrick Ferris can be reached on (571) 272-3123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained

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/Sulaiman Nooristany/

Primary Examiner, Art Unit 2478

Notice of References Cited	Application/Control No. 13/487,172	Applicant(s)/Patent Under Reexamination CHEN ET AL.	
	Examiner SULAIMAN NOORISTANY	Art Unit 2478	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2012/0140726	06-2012	Moon et al.	370/329
*	B	US-2009/0197630	08-2009	AHN et al.	455/522
*	C	US-2012/0224553	09-2012	Kim et al.	370/329
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

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*		Include as applicable: Author. Title Date. Publisher. Edition or Volume. Pertinent Pages)
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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Sheet 1 of 1

	Complete if Known
Application Number	13/487,172
Filing Date	06-02-2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	TBD
Attorney Docket Number	HW 82713780US09

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	1	First Chinese Office Action of Chinese Application No. 201010137731.2 mailed August 27, 2012, 7 pages	X

Examiner Signature	/Sulaiman Nooristany/	Date Considered	11/13/2013

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Sheet 1 of 2

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Application Number	13/487,172
Filing Date	6/2/2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	Kizou, Hassan
Attorney Docket Number	HW 82713780US09

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	US- 2009/0197630 A1	8/6/2009	Ahn, et al.	
	2	US- 2012/0140726 A1	6/7/2012	Moon, et al.	
	3	US- 2012/0224553 A1	9/6/2012	Kim, et al.	
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Sheet 2 of 2

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Application Number	13/487,172
Filing Date	6/2/2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	Kizou, Hassan
Attorney Docket Number	HW 82713780US09

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Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	4	ERICSSON, "Details of ACK/NAK bundling for TDD," TSG-RAN WG1 #53, R1-082002, Kansas City, MO, May 5-9, 2008, 6 pages.	
	5	United States Office Action received in Application No. 13/725,413, mailed May 15, 2013, 17 pages.	

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1480775	(chen or Li).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:21
L2	7	(chen or Li).in. and ((ACK/NACK) same feedback same (DAI or TPC or DCI)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:26
L3	72	370/329.ccls. and ((ACK/NACK) same feedback same (DAI or TPC or DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:29
L4	4	370/329.ccls. and ((ACK/NACK) same feedback same (DAI same TPC same DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:29
L5	4	((ACK/NACK) same feedback same (DAI same TPC same DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:30
L6	8	((ACK/NACK) same (DAI same TPC same DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:30
L7	0	(system near link same downlink same (DAI same TPC same DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:31
L8	0	(system near link same downlink same (DAI and TPC and DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:31
L9	783	(DCI with pdsch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:32
L10	250	(DCI with pdsch with downlink with transmission)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:32
L11	53	(DCI with pdsch with downlink with transmission same tpc)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:32
L12	2	(DCI with pdsch with downlink with transmission same tpc same DAI)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:33

L13	1	2012/0140726	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:33
L14	2	"20120140726"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:33
L15	2	"20120224553"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:34
L16	3	"20090197630"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:34

EAST Search History (Interference)

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Sheet 1 of 1

Complete if Known	
Application Number	13/487,172
Filing Date	6/2/2012
First Named Inventor	Xiaobo Chen
Art Unit	2472
Examiner Name	Kizou, Hassan
Attorney Docket Number	HW 82713780US09

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	1	Second Office Action of Chinese Application No. 201010137731.2 mailed May 2, 2013, 12 pages. (Partial Translation)	✓

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Sheet 1 of 2

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Application Number	13/487,172
Filing Date	June 2, 2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	TBD
Attorney Docket Number	HW 82713780US09

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number - Kind Code[2] (if known)	Publication Date MM DD YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US 7,570,970 B2	08-04-2009	Duan, et al.	
	2	US 2012/0155316 A1	06-21-2012	Li, et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[6]
	3	CN 101594211 A	12-02-2009	ZTE Corp		
	4	CN 101998509 A	03-30-2011	Huawei Tech Co Ltd.		

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Sheet 2 of 2

	Complete if Known
Application Number	13/487,172
Filing Date	June 2, 2012
First Named Inventor	Chen, et al.
Art Unit	2472
Examiner Name	TBD
Attorney Docket Number	HW 82713780US09

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	5	Extended Search Report received in European Patent Application No. 10834239.5, mailed July 27, 2012. 5 pages.	
	6	International Search Report received in Patent Cooperation Treaty Application No. PCT/CN2010/079423, mailed March 10, 2011, 3 pages.	
	7	Written Opinion of the International Searching Authority received in Patent Cooperation Treaty Application No. PCT/CN2010/079423, mailed March 10, 2011, 5 pages.	
	8	CMCC, "UL ACK/NACK and CQI Feedback in Carrier Aggregation," 3GPP TSG RAN WG1 Meeting #58, R1-093269, Shenzhen, China, August 24-28, 2009, 2 pages.	
	9	ERICSSON, "Details of ACK/NAK Bundling for TDD," TSG-RAN WG1 #53, R1-082002, Kansas City, MO, May 5-9, 2008. 6 pages.	
	10	ERICSSON, et al., "PUCCH Transmission for Carrier Aggregation," 3GPP TSG RAN WG1 Meeting #58bis, R1-094273, Miyazaki, Japan, October 12-16, 2009, 3 pages.	
	11	NOKIA, et al., "DAI Design for TDD Configuration #5 (9:1) in ACK/NACK Bundling," R1-082615 (revised from R1-82601), 3GPP TSG RAN WG1 Meeting #53bis, Warzaw, Poland, June 30-July 4, 2008. 7 pages.	
	12	3rd GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and Channel Coding (Release 8)," 3GPP TS 36.212, v8.7.0, May 2009, 60 pages.	
	13	3rd GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Layer Procedures (Release 8)," 3GPP TS 36.213, v8.8.0, September 2009, 77 pages.	

Examiner Signature	/Sulaiman Nooristany/	Date Considered	11/13/2013

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Sulaiman Nooristany
Attorney Docket Number	HW 82713780US09

U.S.PATENTS

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	First Named Inventor	Xiaobo Chen
	Art Unit	2478
	Examiner Name	Sulaiman Nooristany
	Attorney Docket Number	HW 82713780US09

	1	Australian Patent Examination Report received in Application No. 2010327189, Applicant: Huawei Technologies Co., Ltd., issued August 9, 2013, 3 pages.	☐
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CONFIRMATION NO. 5823

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/487,172	06/02/2012 RULE	370	2478	HW 82713780US09

APPLICANTS

INVENTORS

Xiaobo Chen, Shenzhen, CHINA;
Chaojun Li, Shenzhen, CHINA;

**** CONTINUING DATA ****************************

This application is a CON of PCT/CN2010/079423 12/03/2010

**** FOREIGN APPLICATIONS ***************************

CHINA 200910251390.9 12/03/2009
CHINA 201010137731.2 03/24/2010

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06/12/2012

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /SUBAIMAN NOORISTANY/ Examiner's Signature ☐ Met after Allowance Initials	CHINA	6	20	4

ADDRESS

Slater & Matsil, L.L.P.
17950 Preston Road, Suite 1000
Dallas, TX 75252
UNITED STATES

TITLE

Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
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Final	Original	11/13/2013								
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SEARCH NOTES		
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	2	2010521942	JP	A	2010-06-24	LG Electronics Inc.		☐
	3	2010539847	JP	A	2010-12-16	LG Electronics Inc.		☐

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	1	Japanese Office Action for Application No. 2012-541313, mailed 11/12/2013, 5 pages.	☐
	2	Huawei, "UL ACK/NACK Feedback Related DCI Design for Carrier Aggregation," 3GPP TSG RAN WG1 Meeting #60bis, R1-101943, Beijing, China, April 12-16, 2010, 4 pages.	☐
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	Art Unit	2478
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(71) Applicant *(for all designated States except US)*: **LG ELECTRONICS INC.** [KR/KR]; 20, Yeouido-dong, Yeongdeungpo-gu, Seoul 150-721 (KR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **AHN, Joon Kui** [KR/KR]; LG R&D Complex, 533, Hogye 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-749 (KR). **LEE, Dae Won** [KR/KR]; LG R&D Complex, 533, Hogye 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-749 (KR). **YUN, Young Woo** [KR/KR]; LG R&D Complex, 533, Hogye 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-749 (KR). **KIM, Ki Jun** [KR/KR]; LG R&D Complex, 533, Hogye 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-749 (KR).

(74) Agent: **YANG, Moon Oek**; S&IP Patent & Law Firm, 10F, Songam Bldg., #642-10, Yeoksam-dong, Gangnam-gu, Seoul 135-080 (KR).

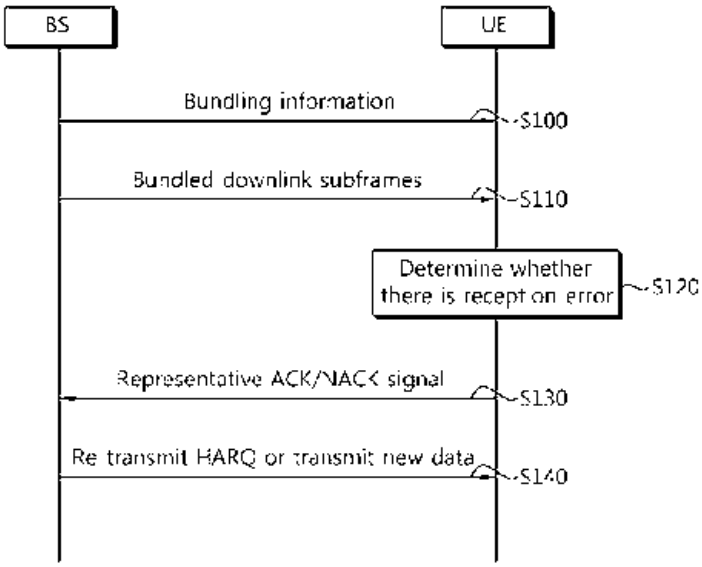
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[Continued on next page]

(54) Title: METHOD FOR EFFECTIVELY TRANSMITTING CONTROL SIGNAL IN WIRELESS COMMUNICATION SYSTEM

[Fig. 9]



(57) Abstract: A method of performing HARQ performed by a user equipment (UE) is provided. The method includes receiving a bundling indicator which indicates the number of bundled downlink subframes, determining whether at least one bundled downlink subframe is missed by comparing the bundling indicator with the number of detected bundled downlink subframes, generating a representative ACK/NACK signal when no bundled downlink subframe is missed, and transmitting the representative ACK/NACK signal on an uplink channel. Recovery capability is maximized and the packet loss is reduced in such a situation that less number of ACK/NACK signals are fed back than that of downlink packets.

WO 2009/116760 A2

OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Description

METHOD FOR EFFECTIVELY TRANSMITTING CONTROL SIGNAL IN WIRELESS COMMUNICATION SYSTEM

Technical Field

[1] The present invention relates to wireless communication, and more particularly, to a method for effectively transmitting control signal in wireless communication system.

Background Art

[2] Next-generation mobile communication systems are being standardized for the purpose of efficient connection with wired and wireless communication networks and integrated service although communication systems of previous generations provide simple wireless communication services. As high-speed large-capacity communication systems capable of processing and transmitting information of various types such as video data and radio data as well as audio data are required, development of a technique capable of transmitting a large quantity of data, which corresponds to the capacity of a wired communication network, through a wireless communication network is needed. Accordingly, an appropriate error detection scheme which can minimize information loss and increase system transmission efficiency to improve system performance becomes an essential element.

[3] Automatic Repeat request (ARQ) transmits positive acknowledgement (ACK) signal to a transmitter when a receiver properly receives data and transmits a negative acknowledgement (NACK) signal to the transmitter when the receiver does not properly receive the data. In Hybrid Automatic Repeat request (HARQ), an ACK/NACK signal transmitted by a data receiver is represented by a small number of bits, in general.

[4] To improve data transmission efficiency in data processing, HARQ corresponding to a combination of ARQ and channel coding of a physical layer has been proposed. HARQ not only re-transmits data that is not received by a transmitter but also store data that is not received by a receiver. When the receiver receives re-transmitted data, the received data is added to the previously stored data to improve a performance gain.

[5] Since the receiver uses additional feedback radio resources to feed back an ACK/NACK signal to the transmitter in HARQ, efficient use of limited feedback radio resources is very important.

[6] Hereinafter, a downlink represents a communication link from a base station to a user equipment (UE) and an uplink represents a communication link from the UE to the base station. The downlink is also referred to as a forward link and the uplink is also referred to as a reverse link. A transmitter may be a part of the base station and a receiver may be a part of the UE in the downlink. The transmitter may be a part of the

UE and the receiver may be a part of the base station in the uplink.

[7] A method of discriminating radio resources used for downlink transmission from radio resources such as frequency, time and code domains used for uplink transmission is required. This method is referred to as duplex. The uplink and the downlink can be discriminated from each other in the frequency, time and code domains as does in a multiple access scheme for identifying different users. The duplex is classified into frequency division duplexing (FDD) which discriminates the uplink and the downlink from each other according to frequency and time division duplexing (TDD) which discriminates the uplink and the downlink from each other according to time.

[8] The uplink is discriminated from the downlink in the frequency domain in FDD, and thus transmission of data between a base station and a UE can be continuously performed in the time domain in each link. While FDD is suitable for symmetric service such as voice communication because it symmetrically allocates frequencies having the same level to the uplink and the downlink, TDD is suitable for asymmetric service such as Internet service and thus researches on the TDD have been actively carried out recently.

[9] TDD is suitable for the asymmetric service because it can allocate time having different lengths to the uplink and the downlink. Furthermore, uplink data and downlink data are transmitted and received in the same frequency band in TDD, and thus uplink and downlink channel states correspond to each other. Accordingly, TDD is suitable for array antenna technology because a channel state can be immediately estimated when a signal is received. TDD uses the entire frequency band as the uplink or the downlink, discriminates the uplink from the downlink in the time domain, uses the frequency band as the uplink for a predetermined time and uses the frequency band as the downlink for a predetermined time, and thus transmission and reception of data between a base station and a UE cannot be simultaneously performed.

[10] When a base station transmits downlink data in a TDD system, a UE transmits ACK/NACK signals with respect to the downlink data to the uplink after a predetermined lapse of time. If the time used for downlink transmission is longer than the time used for uplink transmission, the number of ACK/NACK signals to be transmitted to the uplink may be restricted. That is, a single UE should transmit ACK/NACK signals by using a number of ACK/NACK resources smaller than N for received N downlink packets. Accordingly, there is a need for an ACK/NACK signal transmitting method capable of minimizing packet loss and maximizing recovery capability even when a number of ACK/NACK signals smaller than the number of downlink packets are fed back.

Disclosure of Invention

Technical Problem

[11] The present invention provides a method of effectively transmitting an ACK/NACK signal in wireless communication system.

Technical Solution

[12] According to an aspect of the present invention, a method of performing HARQ performed by a user equipment (UE) is provided. The method includes receiving a bundling indicator which indicates the number of bundled downlink subframes, each subframe of the bundled downlink subframes being used to transmit one or plural codewords, determining whether at least one bundled downlink subframe is missed by comparing the bundling indicator with the number of detected bundled downlink subframes, generating a representative ACK/NACK signal when no bundled downlink subframe is missed, wherein the representative ACK/NACK signal is an ACK signal if all codewords in the detected bundled downlink subframes are successfully received, otherwise the representative ACK/NACK signal is a NACK signal, and transmitting the representative ACK/NACK signal on an uplink channel.

[13] According to another aspect of the present invention, a method of transmitting a control signal performed by a UE is provided. The method includes receiving a bundling indicator which indicates the number of bundled downlink subframes within M (M>1) downlink subframes, incrementing a counter when a bundled downlink subframe is detected, generating a representative NACK signal if the bundling indicator is not equal to the counter, wherein the representative NACK signal represents unsuccessful reception for all codewords in the bundled downlink subframes, and transmitting the representative NACK signal on an uplink shared channel in an uplink subframe.

[14] According to yet another aspect of the present invention, a method of transmitting a control signal performed by a UE is provided. The method includes receiving codewords in bundled downlink subframes, incrementing a counter when a bundled downlink subframe is detected, generating a representative ACK/NACK signal, wherein the representative ACK/NACK signal is a NACK signal when at least one bundled downlink subframe is missed or when at least one codeword is not successfully received, otherwise the representative ACK/NACK signal is an ACK signal when all of the bundled downlink subframes are detected and all of the codewords are successfully received, and transmitting the representative ACK/NACK signal and the counter on an uplink shared channel in an uplink subframe.

[15] According to yet another aspect of the present invention, a method of performing HARQ performed by a UE is provided. The method includes receiving bundled downlink subframes, each subframe of the bundled downlink subframes being used to

transmit one or plural codewords, generating a representative ACK/NACK signal wherein the representative ACK/NACK signal is an ACK signal if all codewords in the bundled downlink subframes are successfully received, and the representative ACK/NACK signal is a NACK signal if at least one codeword in the bundled downlink subframes is not successfully received, and transmitting the representative ACK/NACK signal on an uplink channel, wherein an uplink resource for the uplink channel carrying the representative ACK/NACK signal is associated with the last detected bundled downlink subframe and/or the downlink resource used for the scheduling of the last detected bundled downlink subframe.

[16] According to yet another aspect of the present invention, an apparatus for transmitting an ACK/NACK signal using HARQ is provided. The apparatus includes a receiving unit for receiving a bundling indicator which indicates the number of bundled downlink subframes, each subframe of the bundled downlink subframes being used to transmit one or plural codewords, a determining unit for determining whether at least one bundled downlink subframe is missed by comparing the bundling indicator with the number of detected bundled downlink subframes, a generating unit for generating a representative ACK/NACK signal when no bundled downlink subframe is missed, wherein the representative ACK/NACK signal is an ACK signal if all codewords in the detected bundled downlink subframes are successfully received, otherwise the representative ACK/NACK signal is a NACK signal, and a transmitting unit for transmitting the representative ACK/NACK signal on an uplink channel.

[17]

Advantageous Effects

[18] Recovery capability is maximized and the packet loss is reduced in such a situation that less number of ACK/NACK signals are fed back than that of downlink packets.

Brief Description of Drawings

[19] FIG. 1 shows a wireless communication system.

[20] FIG. 2 is a block diagram of a UE

[21] FIG. 3 illustrates an example of a structure of a radio frame.

[22] FIG. 4 illustrates another example of a structure of a radio frame, that is, TDD radio frame.

[23] FIG. 5 illustrates the structure of the downlink subframe.

[24] FIG. 6 illustrates the structure of the uplink subframe.

[25] FIG. 7 illustrates transmission of an ACK/NACK signal in a PUCCH.

[26] FIG. 8 illustrates a method of performing HARQ through ACK/NACK bundling according to an embodiment of the present invention.

[27] FIG. 9 is a flow diagram showing a method of performing HARQ in TDD system

according to an embodiment of the present invention.

[28] FIG. 10 illustrates a method of mapping a representative ACK/NACK signal to a radio resource according to an embodiment of the present invention.

[29] FIG. 11 illustrates a method of transmitting an ACK/NACK signal in a TDD system according to an embodiment of the present invention.

[30] FIG. 12 is a flowchart illustrating a method of transmitting an ACK/NACK signal in a TDD system according to another embodiment of the present invention.

Mode for the Invention

[31] The present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. The invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the concept of the invention to those skilled in the art. In the drawings, the thickness of layers and regions are exaggerated for clarity. Like reference numerals in the drawings denote like elements.

[32] FIG. 1 shows a wireless communication system. The wireless communication system can be widely deployed to provide a variety of communication services, such as voices, packet data, etc.

[33] Referring to FIG. 1, the wireless communication system includes a base station (BS) 10 and at least one user equipment (UE) 20. The BS 10 is generally a fixed station that communicates with the UE 20 and may be referred to as another terminology, such as a node-B, a base transceiver system (BTS), an access point, etc. There are one or more cells within the coverage of the BS 10. The UE 20 may be fixed or mobile, and may be referred to as another terminology, such as a mobile station (MS), a user terminal (UT), a subscriber station (SS), a wireless device, etc.

[34] A downlink represents a communication link from the BS 10 to the UE 20, and an uplink represents a communication link from the UE 20 to the BS 10. In downlink, a transmitter may be a part of the BS 10, and a receiver may be a part of the UE 20. In uplink, the transmitter may be a part of the UE 20, and the receiver may be a part of the BS 10.

[35] Different multiple access schemes may be used for downlink and uplink transmissions. For example, orthogonal frequency division multiple access (OFDMA) is used for downlink, and single carrier-frequency division multiple access (SC-FDMA) is used for uplink.

[36] There is no limit in the multiple access scheme used in the wireless communication system. The multiple access scheme may be based on code division multiple access

(CDMA), time division multiple access (TDMA), frequency division multiple access (FDMA), SC-FDMA, OFDMA, or other well-known modulation schemes. In these modulation schemes, signals received from multi-users are demodulated to increase capacity of the communication system.

[37] The layers of the radio interface protocol can be classified into a first layer (L1), a second layer (L2), and a third layer (L3) based on the open system interconnection (OSI) model that is well-known in a communication system. Compared with the OSI model, a physical (PHY) layer corresponds to the first layer L1, the medium access control (MAC) layer and the radio link control (RLC) layer correspond to the second layer L2, and the radio resource control (RRC) layer corresponds to the third layer L3. The physical layer provides an information transfer service using a physical channel, the MAC layer is connected with the physical layer through transport channel, and the radio RRC layer serves to control radio resources between the UE and the network.

[38] Examples of a downlink transport channel include a broadcast channel (BCH) for transmitting system information and a downlink-shared channel (DL-SCH) for transmitting user traffic or control messages. The user traffic of downlink multicast or broadcast services or the control messages can be transmitted on the DL-SCH or an additional downlink multicast channel (DL-MCH). The downlink transport channel is mapped to a downlink physical channel.

[39] Examples of the downlink physical channel include a physical downlink shared channel (PDSCH) mapped to the DL-SCH, and a physical downlink control channel (PDCCH) for transmitting a control signal.

[40] Examples of an uplink transport channel include a random access channel (RACH) for transmitting initial control messages and an uplink-shared channel (UL-SCH) for transmitting user traffic or control messages. The uplink transport channel is mapped to a physical uplink channel. Examples of the physical uplink channel include a physical random access channel (PRACH) mapped to the RACH, a physical uplink shared channel (PUSCH) mapped to the UL-SCH, and a physical uplink control channel (PUCCH) for uplink control messages. The PUSCH is a physical uplink shared channel, and is used when the UE transmits data in uplink.

[41] The PDCCH is a downlink physical control channel and transmits control information for the PUSCH or the PDSCH. An uplink grant that is scheduling information for uplink data transmission and a downlink grant that is scheduling information for downlink data transmission can be transmitted through the PDCCH. Herein, the scheduling information implies control information including radio resource allocation for transmitting downlink data from the BS to the UE or for receiving uplink data from the UE, a modulation and coding scheme (MCS), MIMO information, etc.

[42] FIG. 2 is a block diagram of a UE 50. The UE 50 includes a processor 51, a memory 52, an RF unit 53, a display unit 54, and a user interface unit 54. The processor 51 implements layers of air interface protocol and provides a control plane and a user plane. Functions of the layers are implemented through the processor 51. The memory 52 is connected to the processor 51 and stores a UE driving system, application and general files. The display unit 54 displays information on the UE and may use well-known components such as organic light emitting diodes (OLEDs). The user interface unit 55 may be composed of a combination of well-known user interfaces such as a keypad or a touch screen. The RF unit 53 is connected to the processor and transmits and/or receives radio signals.

[43] FIG. 3 illustrates an example of a structure of a radio frame.

[44] Referring to FIG. 3, the radio frame has ten subframes and each subframe may include two slots. A basic data transmission unit corresponds to a subframe and scheduling of downlink or uplink is performed based on the subframe. A single slot may include a plurality of OFDM symbols in the time domain and at least one subcarrier in the frequency domain. The single slot may include six or seven OFDM symbols.

[45] FIG. 4 illustrates another example of a structure of a radio frame, that is, TDD radio frame.

[46] Referring to FIG. 4, the radio frame includes two half-frames. The half-frames have the same structure. Specifically, each half-frame includes 5 subframes and 3 fields, i.e., a downlink pilot time slot (DwPTS), a guard period (GP), and an uplink pilot time slot (UpPTS). The DwPTS is used for initial cell search, synchronization, or channel estimation in a UE. The UpPTS is used for channel estimation in a BS and uplink transmission synchronization of the UE. The GP is used to remove interference that occurs in uplink due to a multi-path delay of a downlink signal between uplink and downlink.

[47] Table 1 shows an example of a configuration of the radio resource. The configuration of the radio frame indicates a specific rule according to which all subframes are allocated (or reserved) for uplink or downlink.

[48] Table 1

[Table 1]

[Table]

Configuration	Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

[49] In Table 1, 'D' denotes a subframe used for downlink transmission, and 'U' denotes a subframe used for uplink transmission. Further, 'S' denotes a special subframe that is used for a special purpose, such as, frame synchronization or downlink transmission. Hereinafter, a subframe used for downlink transmission is simply referred to as a downlink subframe, and a subframe used for uplink transmission is simply referred to as an uplink subframe. For each configuration, a position and the number of downlink and uplink subframes are different from each other within one radio frame.

[50] A time point at which downlink is switched to uplink, or vice versa, is defined as a switching point. A switch-point periodicity represents a period in which the same switching pattern is repeated between uplink and downlink. The switch-pint periodicity is 5ms or 10ms. For example, in case of the configuration 1, switching occurs in the pattern of D->S->U->U->U from 0th to 4th subframes. In addition, from 5th to 9th subframes, switching occurs in the pattern of D->S->U->U->U in the same pattern as the previous switching. Since one subframe is 1ms, the switch-point periodicity is 5ms. That is, the switch-point periodicity is less than one radio frame length (i.e., 10ms), and switching is repeated one time within the radio frame. For all configurations, 0th and 5th subframes and the DwPTS are used for downlink transmission. A 1st subframe in all configurations and a 6th subframe in configurations 0, 1, 2, and 6 are composed of the DwPTS, the GP, and the UpPTS. A time length of each field varies depending on configurations. The remaining 8 subframes other than the 1st and 6th subframes are composed of 2 slots.

[51] If the switch-point periodicity is 5ms, the UpPTS and 2nd and 7th subframes are reserved for uplink transmission. If the switch-point periodicity is 10ms, the UpPTS and the 2nd subframe are reserved for uplink transmission, and the DwPTS, and 7th

and 9th subframes are reserved for downlink transmission.

[52] The configuration of Table 1 may be system information known by both the BS and the UE. The BS can inform the UE that an uplink-downlink allocation state of the radio frame is modified by transmitting only a configuration index whenever the configuration of the radio frame changes. The configuration is a sort of downlink control information. Similarly to other scheduling information, the configuration may be transmitted on a physical downlink control channel (PDCCH). Alternatively, the configuration may be control information commonly transmitted on a broadcast channel to all UEs existing in a cell. In addition, the configuration may be included in the system information. The number of half-frames included in the radio frame, the number of subframe included in the half-frame, and the combination of the downlink subframe and the uplink subframe in the TDD system are shown for exemplary purposes only.

[53] In Table 1, if 'S' corresponds to downlink subframes, a single radio frame includes 8 downlink subframes and 2 uplink subframes in the case of configuration 2. That is, the ratio of the number of downlink subframes to the number of uplink subframes is 4:1. In this case, the UE must receive data through 4 downlink subframes and transmit ACK/NACK signals through a single uplink subframe. When the number of downlink subframes is greater than the number of uplink subframes as described above, uplink radio resources are insufficient for one-to-one mapping between subframe(s) for downlink data and subframe(s) for ACK/NACK signals . Accordingly, N:1 mapping is carried out between subframe(s) for data and subframe(s) for ACK/NACK signals. In this case, A single ACK/NACK signal is used as an HARQ feedback for transmission of plural PDSCHs for a single UE. This is referred to as ACK/NACK bundling.

[54] FIG. 5 illustrates the structure of the downlink subframe.

[55] Referring to FIG. 5, 3 prior OFDM symbols of the first slot of the downlink subframe correspond to a control region to which a PDCCH is allocated and remaining OFDM symbols correspond to a data region to which a PDSCH is allocated. Control channels other than the PDCCH, such as PCFICH and PHICH, may be allocated to the control region. A UE may decode control information transmitted through the PDCCH to read data information transmitted through the PDSCH. Here, the number of OFDM symbols included in the control region in the subframe is not limited to 3 and can be known through PCFICH.

[56] The control region is composed of a set of control channel elements (CCEs). This CCE set is a set of CCEs constructing the control region in the single subframe. The CCE corresponds to a plurality of resource element groups. For example, the CCE may correspond to 9 resource element groups. The resource element group is used to define mapping of control channels to resource elements. For instance, a single resource element group can be composed of 4 resource elements.

[57] A plurality of multiplexed PDCCHs for a plurality of UEs may be transmitted within the control region. The PDCCH transfers control information such as scheduling allocation. The PDCCH is transmitted on aggregation of a single CCE or several contiguous CCEs. Hereinafter, the number of CCEs used for PDCCH transmission is referred to as a CCE aggregation level. For example, the CCE aggregation level may be elements of {1, 2, 4, 8}. The CCE aggregation level corresponds to the number of CCEs used for PDCCH transmission and is a CCE unit for searching PDCCH. The magnitude of the CCE aggregation level is defined by the number of contiguous CCEs. The CCE aggregation level may differ depending on UE. In FIG. 4, for instance, the CCE aggregation level of the 2nd, 4th and 6th UEs UE2, UE4 and UE6 is 1, the CCE aggregation level of the 3rd and 5th UEs UE3 and UE5 is 2, and the CCE aggregation level of the 1st and 7th UEs UE1 and UE7 is 4.

[58] FIG. 6 illustrates the structure of the uplink subframe.

[59] Referring to FIG. 6, the uplink subframe can be divided into a control region to which a PDCCH that transfers uplink control information in the frequency domain is allocated and a data region to which a PUSCH that transfers user data is allocated.

[60] The PUCCH for the single UE is assigned to a resource block (RB) pair in the subframe and RBs belonging to the RB pair respectively have different subcarriers in two slots. That is, the RB pair allocated to the PUCCH frequency-hops at the slot boundary.

[61] The PUCCH can support multiple formats. That is, the PUCCH can transmit uplink control information having different numbers of bits for subframes according to modulation scheme. The following table represents PUCCH format, modulation scheme and the number of bits, which are supported according to 3GPP TS 36.211 V8.2.0.

[62] Table 2

[Table 2]

[Table]

PUCCH format	Modulation scheme	Number of bits per subframe, M
1	N/A	N/A
1a	BPSK	1
1b	QPSK	2
2	QPSK	20
2a	QPSK+BPSK	21
2b	QPSK+QPSK	22

[63] PUCCH format 1 is used to transmit scheduling request SR, PUCCH format 1a/1b is used to transmit a representative ACK/NACK signal, PUCCH format 2 is used to transmit CQI, and PUCCH format 2a/2b is used to transmit CQI and the representative ACK/NACK signal.

[64] The PUCCH format 1a/1b is used when a representative ACK/NACK signal is transmitted alone in an arbitrary subframe and the PUCCH format 1 is used when SR is transmitted alone. PUCCH formats for transmitting control information have been described above. An allocation scheme and allocation quantity of radio resources used to transmit the control information may differ depending on the PUCCH format.

[65] FIG. 7 illustrates transmission of an ACK/NACK signal in a PUCCH.

[66] Referring to FIG. 7, a reference signal RS is loaded in 3 SC-FDMA symbols among 7 SC-FDMA symbols included in a single slot and a representative ACK/NACK signal is loaded in the remaining four SC-FDMA symbols. The reference signal SC is loaded in 3 contiguous SC-FDMA symbols in the middle of the slot.

[67] To transmit the ACK/NACK signal, a 2-bit representative ACK/NACK signal is QPSK-modulated to generate a single modulation symbol d(0). A modulated sequence m(n) is generated based on the modulation symbol d(0) and the cyclically shifted sequence r(n,a). 'a' is an amount of cyclic shift (CS). It is possible to multiply the cyclically shifted sequence r(n,a) by the modulation symbol to generate a modulated sequence y(n) according to Equation 1.

[68] MathFigure 1

[Math.1]

$$y(n) = d(0)\ r(n,a)$$

[69] The cyclically shifted sequence r(n,a) may have different CS amounts or the same CS amount for the respective SC-FDMA symbols. Although CS amounts 0, 1, 2 and 3 are sequentially set for 4 SC-FDMA symbols in a single slot in this case, this is exemplary.

[70] Furthermore, although the single modulation symbol is generated by QPSK-modulating the 2-bit ACK/NACK signal in the current embodiment, it is also possible to BPSK-modulate a 1-bit ACK/NACK signal to generate a single modulation symbol. The number of bits of the ACK/NACK signal, modulation scheme and the number of modulation symbols are exemplary and do not limit the technical spirit of the present invention.

[71] Furthermore, the modulated sequence can be spread using an orthogonal sequence in order to increase the capacity of a UE. Sequences represented in Table 3 can be used as orthogonal sequences $w_i(k)$ (i is a sequence index, $0 \le k \le K-1$) having a spreading factor of K=4.

[72] Table 3

[Table 3]

[Table]

Sequence index	[w(0), w(1), w(2), w(3)]
0	[+1 +1 +1 +1]
1	[+1 -1 +1 -1]
2	[+1 -1 -1 +1]

[73] Otherwise, sequences represented in Table 4 can be used as orthogonal sequences w-(k) (i is a sequence index, 0≤k≤K-1) having a spreading factor of K=3.

[74] Table 4

[Table 4]

[Table]

Sequence index	[w(0), w(1), w(2), w(3)]
0	[1 1 1]
1	[1 $e^{j2\pi/3}$ $e^{j4\pi/3}$]
2	[1 $e^{j4\pi/3}$ $e^{j2\pi/3}$]

[75] Here, an operation of spreading a sequence modulated through the orthogonal sequence wi(k) having a spreading factor of K=4 for 4 SC-FDMA symbols included in a single slot for a representative ACK/NACK signal is described.

[76] FIG. 8 illustrates a method of performing HARQ through ACK/NACK bundling according to an embodiment of the present invention. FIG. 8 shows that a UE which has received downlink data transmits ACK/NACK signals to uplink in a TDD system in which the number of subframes used for downlink transmission is greater than the number of subframes used for uplink transmission. But the present invention is applied not only to a TDD system but also to a FDD system where ACK/NACK signals for plural downlink subframes are transmitted via a single uplink subframe

[77] Referring to FIG. 8, the UE transmits data corresponding to 3 contiguous downlink subframes or a single ACK/NACK signal corresponding to a PDSCH through a single uplink subframe. That is, the radio of the number of ACK/NACK signals to the data (or PDSCH) is 3:1. When a plurality of subframes are allocated to a specific UE for downlink transmission in the TDD system, ACK/NACK signals are transmitted in con-sideration of data transmitted to the downlink as a single HARQ packet.

[78] Hereinafter, an ACK/NACK signal transmitted through a single uplink subframe according to ACK/NACK bundling is referred to as a representative ACK/NACK signal. And among a plurality of downlink subframes associated with the single uplink subframe, at least one downlink subframe by which data for a certain UE is transmitted

is referred to as bundled downlink subframes. And each of the subframe included in the bundled downlink subframes is referred to as a bundled downlink subframe.

[79] The UE determines the representative ACK/NACK signal as an ACK or NACK signal according to the following method. The UE performs decoding for a codeword that the US received in a bundled downlink subframe, and executes a logic AND operation on ACK signals or NACK signals for bundled downlink subframes to generate at least one representative ACK/NACK signal. That is, the UE transmits an ACK signal only when successively receiving all the codewords received on the bundled downlink subframes and transmits a NACK signal when failing in receiving any one of the codewords. Or, when a plurality of representative ACK/NACK signals is generated, the UE divides codewords, which is transmitted over bundled downlink subframes, into a plurality of codeword groups. So the UE can transmit ACK/NACK signal for each of the codeword group.

[80] This is a principal of determining an ACK or NACK signal in consideration of downlink data composed of a plurality of codewords as single data. Here, a codeword is a unit of data transmitted for every bundled downlink subframe and may be referred to as a transport block.

[81] Hereinafter, a set of codewords corresponding to the basis of decision in generating a representative ACK/NACK signal is referred to as a downlink data packet. Accordingly, it is considered that the UE successively receives the downlink data packet when the representative ACK/NACK signal is an ACK signal and it is considered that the UE fails in receiving the downlink data packet when the representative ACK/NACK signal is a NACK signal.

[82] If a UE fails to decode downlink data packet, it is natural for the UE to transmit a NACK signal to a BS. And the BS retransmits the downlink data packet to the UE. But, if the UE misses scheduling information(or PDCCH) and cannot detect the existence of data of the missed bundled downlink subframe, the UE should perform HARQ only based on the rest of bundled downlink subframe(s) apart from the missed bundled downlink subframe. It doesn't matter when the UE is supposed to transmit a NACK signal, because the BS can retransmit downlink data. But when the UE is supposed to transmit an ACK signal, the data for the missed bundled downlink subframe is lost and cannot be recovered. Therefore, the BS or the UE need to know to which bundled downlink subframe the representative ACK/NACK signal is corresponds.

[83] In FIG. 8, although it is assumed that the UE is the subject that transmits the ACK/NACK signal, the BS can also transmit the ACK/NACK signal in the same manner.

[84] FIG. 9 is a flow diagram showing a method of performing HARQ in TDD system according to an embodiment of the present invention.

[85] Referring to FIG. 9, a BS transmits a bundling indicator to a UE in step S100. The bundling indicator is control information which indicates bundled downlink subframes associated with a single uplink subframe for transmission of a representative ACK/NACK signal. The bundling indicator may be the number of bundled downlink subframe(s), or a transmission order of bundled downlink subframe(s). The bundling indicator is included in scheduling information and can be transmitted through a PDCCH. Otherwise, the bundling indicator can be included in bundled downlink data packets and transmitted. The bundling indicator will be described in more detail later.

[86] The BS transmits to a specific UE a downlink data packet over bundled downlink subframes in step S110. The bundled downlink subframes may be contiguous subframes or discontinuous subframes. The downlink data packet is transmitted through a PDSCH that is a physical channel in every downlink subframe. When the bundling indicator is included in the bundled downlink data packet, the bundling indicator and the bundled downlink data packet can be simultaneously transmitted.

[87] The UE detects the bundled downlink subframe(s) in step S120. The UE determines that there is no missing of bundled downlink subframe when all the bundled downlink subframes indicated by the bundling indicator are successfully received. And the UE determines that there is a missing bundled downlink subframe when failing in receiving any bundled downlink subframe. For instance, if the UE detects only two downlink subframes although the bundling indicator indicates that there are three bundled downlink subframes. The UE determines that a bundled downlink subframe is missed and generates a representative NACK signal to report that the UE failed in detecting one bundled downlink subframe. Of course, the UE determines that there is a reception error when it fails in receiving any one of the two downlink subframes.

[88] The UE transmits the representative ACK/NACK signal to the BS in step S130. The UE transmits the representative ACK/NACK signal through a predetermined uplink subframe. The representative ACK/NACK signal may be transmitted through a PUCCH that is an uplink control channel or a PUSCH that is an uplink data channel. The uplink radio resources used to transmit the representative ACK/NACK signal will be described later in more detail.

[89] The BS re-transmits HARQ when the representative ACK/NACK signal is a NACK signal and transmits new data when the representative ACK/NACK signal is an ACK signal in step S140.

[90] The bundling indicator will now be explained in detail. In an embodiment, the bundling indicator may correspond to the number of bundled downlink subframes. The bundling indicator is 3 in FIG. 8, for example. The bundling indicator may be transmitted through all the bundled downlink subframes or some of the bundled downlink subframes. The UE counts the number of bundled downlink subframes that

the UE detects. Then, the UE compares the bundling indicator with a counter. If the bundling indicator is different from the counter of the UE, the UE transmits a representative NACK signal to the BS or does not perform any operation and operates in a discontinuous transmission (DTX) mode. If the number of downlink subframes actually counted by the UE is 2 while a bundling indicator 3 is received, for instance, it means that UE fails in receiving a single downlink subframe, and thus the UE transmits the representative NACK signal to the BS or does not perform any operation.

[91] In another embodiment, the bundling indicator can indicate a transmission order of bundled downlink subframes or a transmission order of PDSCH with respect to a specific UE. The UE counts the number of downlink subframes detected by itself. For instance, if 4 downlink subframes are associated with a single uplink subframe for a representative ACK/NACK signal, and 3 out of the 4 downlink subframes are bundled downlink subframes for a specific UE. Bundling indicators 1, 2 and 3 can be accumulatively assigned to the three bundled downlink subframes in sequence. The specific UE increases the counter whenever the UE detects a bundled downlink subframe. If the specific UE detects only bundled downlink subframes corresponding to the bundling indicators 1 and 3, for instance. The counter is 1 when the specific UE detects the 1st bundled downlink subframe. The specific UE fails in detecting the 2nd bundled downlink subframe, and thus the counter is still 1. When the specific UE detects the 3rd bundled downlink subframe, the counter is 2 although the bundling indicator is 3. The bundling indicator does not correspond to the counter, and thus it can be known that the specific UE fails in detecting PDCCH of the 2nd bundled downlink subframe corresponding to the bundling indicator 1. In this case, the specific UE may generate a representative NACK signal or do not perform any operation and operate in the DTX mode.

[92] An example that the UE determines that there is a reception error is represented as follows.

[93] MathFigure 2

[Math.2]

$$Bundlingindicator \neq (N_{DAI} - 1) \bmod(a) + 1$$

[94] Here, N_{DAI} denotes the number of bundled downlink subframes successfully detected by the UE and mod(a) represents a modulo operation. When the bundling indicator is ceiling[$\log_2(a)$] bit information, the transmission order starts from 1 when the bundling indicator becomes greater than a maximum transmission order a, and thus the modulo operation is performed. In this manner, the UE can correctly transmit a representative ACK/NACK signal. Here, the bundling indicator can be also referred to as a downlink assignment index (DAI).

[95] The information indicated by the bundling indicator may differ depending on DCI format. For example, when the DCI format is 0, the bundling indicator simply indicates the number of PDSCH transmissions associated with an uplink subframe which transmits a representative ACK/NACK signal for a specific UE. When the DCI format is 1/1A/1B/1D/2/2A, which is for downlink scheduling information, the bundling indicator indicates the accumulative number of PDSCH transmissions for the specific UE, and can be updated every subframe.

[96] Radio resources used for a UE to transmit a representative ACK/NACK signal will now be explained. In ACK/NACK bundling, a single uplink subframe is used to transmit ACK/NACK signals for bundled downlink subframes. Accordingly, radio resources that will transmit the ACK/NACK signals with respect to the plurality of bundled downlink subframes must be allocated to the uplink subframe. If downlink data is transmitted to different UEs through 4 downlink subframes when the ratio of the number of downlink subframes to the number of uplink subframes is 4:1, for example, the UEs should be able to transmit the ACK/NACK signals through the same uplink subframe. Accordingly, a radio resource for ACK/NACK signals, which is four times the radio resource required when the ratio of the number of downlink subframes to the number of uplink subframes is 1:1, must be allocated to each uplink subframe.

[97] On the contrary, when downlink data is transmitted to a single UE through bundled downlink subframes, a radio resource for a representative ACK/NACK signal corresponding to the bundled downlink subframes will not be used by other UEs. Accordingly, the single UE can transmit the representative ACK/NACK signal by using one of radio resources allocated for ACK/NACK signals.

[98] According to the present invention, a UE transmits a representative ACK/NACK signal using a radio resource for ACK/NACK signals and the radio resource for the ACK/NACK signals are assigned for the last bundled downlink subframe in the bundled downlink subframes. This gives a criterion in which a BS determines whether PDSCH of the bundled downlink subframes is successfully transmitted or not. For example, if a UE misses the last bundled downlink subframe(s) in the bundled downlink subframes, the UE shall transmit a representative ACK/NACK signal using a radio resource assigned for the second last bundled downlink subframe. In this case, the BS can find out the last bundled downlink subframe(s) is missed, by the radio resource used to transmit the representative ACK/NACK signal.

[99] FIG. 10 illustrates a method of mapping a representative ACK/NACK signal to a radio resource according to an embodiment of the present invention. Here, the representative ACK/NACK signal is transmitted through a PUCCH.

[100] Referring to FIG. 10, a single uplink subframe is allocated to transmit an ACK/NACK signal for 4 downlink subframes. The specific position of the bundled downlink

subframe(s) corresponding to an uplink subframe for the representative ACK/NACK signal, is defined a table below.

[101] Table 5

[Table 5]

[Table]

Configuration	Subframe n									
	0	1	2	3	4	5	6	7	8	9
0	-	-	6	-	5	-	-	6	-	4
1	-	-	7,6	4	-	-	-	7,6	4	-
2	-	-	8,7,6,4	-	-	-	-	8,7,6,4	-	-
3	-	-	11,7,6	6,5	5,4	-	-	-	-	-
4	-	-	12,11,8,7	7,6,5,4	-	-	-	-	-	-
5	-	-	TBD	-	-	-	-	-	-	-
6	-	-	7	7	5	-	-	7	7	-

[102] In Table 5, the subframe n denotes an uplink subframe index. A bundled downlink subframe corresponding to an nth subframe (uplink subframe) is determined as n-k. That is, the bundled downlink subframe is indicated as a subframe prior to the nth subframe by k. Here, k denotes an indicator which determines the bundled downlink subframe and belongs to a set K including M elements $\{k_0, k_1, ..., k_{M-1}\}$. The position of the bundled downlink subframe is determined by the subframe n and configuration.

[103] For example, if the representative ACK/NACK signal is transmitted through the 2nd subframe (n=2) when a radio frame is determined by configuration 2, the bundling indicator when n=2 corresponds to K={8,7,6,4}. Accordingly, bundled downlink subframes covered by the representative ACK/NACK signal correspond to 4th, 5th, 6th and 8th subframes prior to the 2nd subframe by 8, 7, 6 and 4. This is because the bundled downlink subframes are prior to the uplink subframe which transmits the representative ACK/NACK signal.

[104] Each downlink subframe is composed of a PDCCH and a PDSCH and the PDCCH is segmented into 4 sections. The section can be referred to as a certain region of radio resources(i.e resource block (RB)). This segmentation is exemplary and the interval and number of segmented sections can be varied. A UE decodes the PDCCH through CCE, and then decodes the PDSCH according to downlink grant of the PDCCH. The UE receives data from the PDSCH and a region receiving the data may be composed of resource blocks which are radio resource units.

[105] Radio resources for ACK/NACK signals for a specific PDCCH can be determined by

a resource index. Here, the radio resources mean radio resources of the PUCCH. For example, the 0th downlink subframe uses radio resources corresponding to indexes 1, 2, 3 and 4 in the uplink subframe to transmit ACK/NACK signals and the 1st downlink subframe uses radio resources corresponding to indexes 5, 6, 7 and 8 in the uplink subframe to transmit the ACK/NACK signals. That is, radio resources used to transmit ACK/NACK signals through a single uplink subframe can be classified for the respective downlink subframes. Or to reduce the amount of radio resources for ACK/NACK signal transmission, it can be considered that the ACK/NACK signal resource for a certain downlink subframe can be duplicated with other downlink subframe.

[106] If a specific UE receives a codeword through 0th, 1st and 3rd downlink subframes among the 4 bundled downlink subframes, the specific UE decodes section 3 of PDCCH of the 0th downlink subframe and reads PDSCH indicated by section 3. Further, the specific UE decodes section 6 of PDCCH of the 1st downlink subframe and reads PDSCH indicated by section 6. In addition, the specific UE decodes section 13 of PDCCH of the 3rd downlink subframe and reads PDSCH indicated by section 13.

[107] The specific UE transmits a representative ACK/NACK signal according to whether the UE successfully receives the PDSCH or fails in receiving the PDSCH. Here, the specific UE does not use radio resource indexes 3 and 6 and transmits the representative ACK/NACK signal by using only radio resource index 13 corresponding to the last section 13 which has been received latest by the UE.

[108] A radio resource of a bundled downlink subframe(s) that a UE detects the most recently(or nearest to the uplink subframe n), is used to transmit the representative ACK/NACK signal. The bundled downlink subframe(s) is included in downlink subframe associated with the uplink subframe n.

[109] For example, it is assumed that the representative ACK/NACK signal is transmitted in uplink subframe 2 in configuration 2. Bundled downlink subframes are 4th, 5th, 6th and 8th subframes. If the UE detects the 4th, 5th and 8th subframes, the representative ACK/NACK signal is transmitted using the radio resource according to the last received 8th downlink subframe. This is performed when k=4. That is, when a downlink subframe according to the smallest number of elements which belong to the set K is determined, the radio resource used to transmit the representative ACK/NACK signal is determined according to the downlink subframe.

[110] This is a method of determining radio resources which transmit the representative ACK/NACK signal. A method of determining whether a representative ACK/NACK signal corresponds to an ACK signal or a NACK signal has been described above.

[111] The specific UE cannot read the PDSCH indicated by section 13 if the UE does not detect section 13 of the PDCCH of the 3rd downlink subframe. Accordingly, the

specific UE will transmit the representative ACK/NACK signal according to a radio resource index corresponding to the last received section 6. On the contrary, a BS expects to receive the representative ACK/NACK signal according to radio resource index 13 because the BS transmits downlink data according to section 13. However, the BS receives the representative ACK/NACK signal according to radio resource index 6, and thus the BS can recognize that transmission of downlink data last transmitted according to section 13 failed. Accordingly, the BS can perform HARQ re-transmission even if the representative ACK/NACK signal is an ACK signal.

[112] If the method of selecting radio resource for ACK/NACK signal is combined with the method of detecting bundled downlink subframe with bundling indicator described above, it is possible to discover missed bundled downlink subframe(s) regardless of the position of the missed bundled downlink subframe(s) is in the middle or at the last. For example, it is assumed that the specific UE does not detect section 6 of the PDCCH of the 1st downlink subframe and detects section 13. The bundling indicator in the PDCCH of section 3 is 1, the bundling indicator in the PDCCH of section 6 is 2, and the bundling indicator in the PDCCH of section 13 is 3. The UE fails in detecting section 6, and thus the counter of the UE when the UE detects the PDCCH of section 13 still indicates 2. Here, the UE does not transmit the representative ACK/NACK signal according to the radio resource corresponding to section 13 and operates in the DTX mode. The BS expects to receive the representative ACK/NACK signal according to the radio resource index 13 because the BS has transmitted the downlink data according to section 13. However, the BS does not receive any representative ACK/NACK signal, and thus the BS can perform HARQ re-transmission.

[113] The BS can discern the successful or unsuccessful transmission of bundled downlink subframes, with the radio resource for a representative ACK/NACK signal transmitted from the UE. And the UE can discern whether a bundled downlink subframe(s) is missed by comparing a bundling indicator with the number of detected bundled downlink subframes.

[114] A method of transmitting an ACK/NACK signal by using radio resources used to transmit uplink data will now be explained. When a UE simultaneously transmits the uplink data when transmitting the ACK/NACK signal to an uplink subframe, a radio resource allocated to transmit the ACK/NACK signal may be not a radio resource for transmitting general control information. That is, the UE can transmit the ACK/NACK signal by using a radio resource in the PUSCH without using a radio resource in the PUCCH. Here, the ACK/NACK signal may be multiplexed with general uplink data.

[115] The UE transmits a NACK signal with respect to downlink data that is not recognized or not for the UE as well as downlink data which is judged by the UE whether it is successfully received. A NACK signal formally transmitted for downlink

data is referred to as a dummy NACK signal. When the dummy NACK signal is transmitted, a BS can be aware whether the UE properly receives the downlink data and whether the ACK/NACK signals transmitted from the UE are true.

[116] FIG. 11 illustrates a method of transmitting an ACK/NACK signal in a TDD system according to an embodiment of the present invention.

[117] Referring to FIG. 11, there are 4 downlink subframes #0, #1, #2 and #3 and an plink subframe #n for transmitting ACK/NACK signals corresponding to the 4 downlink subframes #0, #1, #2 and #3. Only the downlink subframe #0 transmits downlink data for a UE A. Accordingly, the UE decodes the downlink subframe #0 and transmits an ACK/NACK signal with respect to the downlink subframe #0 by using a radio resource 'a' of the PUSCH of the uplink subframe #n. Further, the UE transmits 3 NACK signals as ACK/NACK signals with respect to the downlink subframes #1, #2 and #3 by using radio resources 'b', 'c' and 'd' of the PUSCH of the uplink subframe #n. The UE transmits all the ACK/NACK signals with respect to the downlink subframes #1, #2 and #3 even though downlink data for the UE A is not transmitted in the downlink subframes #1, #2 and #3. That is, the UE transmits 4 ACK/NACK signals.

[118] Although the radio resources a, b, c and d are continuous in FIG. 11, radio resources for transmitting ACK/NACK signals can be scattered in the PUSCH. Furthermore, the method of mapping ACK/NACK signals to the radio resources a, b, c and d may be different from a radio resource mapping method for ACK/NACK signals in the PUCCH. Further, an ACK/NACK signal may be independently transmitted or multiplexed with uplink data and transmitted.

[119] The ACK/NACK signal may be transmitted through the PUCCH if required. In this case, a representative ACK/NACK signal is transmitted as described above. The system can freely select whether the representative ACK/NACK signal is transmitted through the PUCCH or a dummy NACK signal is transmitted through the PDSCH. Further, an ACK/NACK signal may be dynamically transmitted while switching to the PUCCH and PUSCH.

[120] To transmit the same amount of ACK/NACK signals with the number of maximum downlink subframes or data for a UE, causes an overhead problem because the amount of feedback increases. Hereinafter, a method for feedback reduction discloses.

[121] FIG. 12 is a flowchart illustrating a method of transmitting an ACK/NACK signal in a TDD system according to another embodiment of the present invention.

[122] Referring to FIG. 12, a BS configures bundled downlink subframes with N_D downlink subframes, and transmits data to a UE over the bundled downlink subframes in step S200. The downlink data is transmitted through PDSCH of the bundled downlink subframes. The UE transmits a representative ACK/NACK signal to the BS in step S210. The method of generating the representative ACK/NACK signal has been

described with reference to FIG. 8. The UE transmits data counting information N_C to the BS in step S220. N_C is the number of bundled downlink subframe(s) that the UE detects. So, $N_D=N_C+N_{missed}$. Here, N_{missed} denotes the amount of bundled downlink subframes that is not detected (or recognized) by the UE.

[123] The number of bits of the data counting information is ceiling[$\log_2(\max(N_D))$], if the data counting information is expressed in an independent information bit stream. The UE must transmit information of ceiling[$\log_2(\max(N_D))$]+2 bits through an uplink subframe, if the representative ACK/NACK signal is 2 bit. Therefore, it is more desirable in signaling overhead aspect to use both the representative ACK/NACK signal and the data counting information, than to transmit $2\times\max(N_D)$-bit ACK/NACK signals. The representative ACK/NACK signal and the data counting information are transmitted through a PUSCH.

[124] The BS determines whether HARQ re-transmission is performed or new data is transmitted according to the representative ACK/NACK signal and the data counting information in step S230. This determination is performed by comparing N_D and N_C by the BS. In an embodiment, when the UE detects all the bundled downlink subframes, $N_{missed}=0$ and $N_C = N_D$. That is, the BS can be aware that no bundled downlink subframes are missed from the data counting information. Therefore, the BS performs HARQ retransmission or new data transmission according to the representative ACK/NACK signal.

[125] In another embodiment, when the UE misses at least one of the bundled downlink subframes, $N_{missed}\neq0$ and $N_C\neq N_D$. Therefore, the BS can be aware that the UE missed Nmissed bundled downlink subframe(s). Then, the BS can perform HARQ re-transmission even if the BS receives a representative ACK signal from the UE.

[126] The aforementioned functions can be executed by processors such as micro-processors, controllers, microcontrollers, application specific integrated circuits (ASICs) and so on according to software or program codes coded to execute the functions. The design, development and implementation of the codes are obvious to those skilled in the art.

[127] While the present invention has been particularly shown an described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

[128]

[129]

[130]

Claims

[1] A method of performing Hybrid Automatic Repeat request (HARQ) performed by a user equipment (UE) in a wireless communication system, the method comprising :
receiving a bundling indicator which indicates the number of bundled downlink subframes, each subframe of the bundled downlink subframes being used to transmit one or plural codewords;
determining whether at least one bundled downlink subframe is missed by comparing the bundling indicator with the number of detected bundled downlink subframes;
generating a representative ACK/NACK signal when no bundled downlink subframe is missed, wherein the representative ACK/NACK signal is an ACK signal if all codewords in the detected bundled downlink subframes are successfully received, otherwise the representative ACK/NACK signal is a NACK signal.; and
transmitting the representative ACK/NACK signal on an uplink channel.

[2] The method of claim 1, wherein the representative ACK/NACK signal is not transmitted if at least one bundled downlink subframe is missed.

[3] The method of claim 2, wherein the uplink channel is Physical Uplink Control Channel (PUCCH).

[4] The method of claim 1, wherein an uplink resource for the uplink channel carrying the representative ACK/NACK signal is associated with the last detected bundled downlink subframe and/or the downlink resource used for the scheduling of the last detected bundled downlink subframe.

[5] The method of claim 1, wherein the bundling indicator is transmitted on a downlink channel, the resource for the uplink channel is associated with the downlink channel for the nearest bundled downlink subframe to the uplink subframe.

[6] The method of claim 1, further comprising :
generating the representative ACK/NACK signal as a NACK signal if at least one bundled downlink subframe is missed.

[7] The method of claim 6, wherein the uplink channel is Physical Uplink Shared Channel (PUSCH).

[8] The method of claim 1, wherein the bundling indicator is an accumulative number of the bundled downlink subframes.

[9] The method of claim 1, wherein the bundling indicator is included in downlink scheduling information.

[10] The method of claim 1, wherein the bundling indicator is included in uplink scheduling information.

[11] A method of transmitting a control signal performed by a UE in a wireless communication system, the method comprising :
receiving a bundling indicator which indicates the number of bundled downlink subframes within M (M>1) downlink subframes;
incrementing a counter when a bundled downlink subframe is detected;
generating a representative NACK signal if the bundling indicator is not equal to the counter, wherein the representative NACK signal represents unsuccessful reception for all codewords in the bundled downlink subframes; and
transmitting the representative NACK signal on an uplink shared channel in an uplink subframe.

[12] The method of claim 11, wherein the bundling indicator is received on a downlink control channel.

[13] The method of claim 11, wherein the bundling indicator is included in the bundled downlink subframes.

[14] The method of claim 11, wherein the positions and the number of the bundled downlink subframes are predetermined with respect to the uplink subframe.

[15] The method of claim 11, wherein the number of the bundled downlink subframes are equal to or bigger than the number of the uplink subframe.

[16] A method of transmitting a control signal performed by a UE in a wireless communication system, the method comprising :
receiving codewords in bundled downlink subframes;
incrementing a counter when a bundled downlink subframe is detected;
generating a representative ACK/NACK signal, wherein the representative ACK/NACK signal is a NACK signal when at least one bundled downlink subframe is missed or when at least one codeword is not successfully received, otherwise the representative ACK/NACK signal is an ACK signal when all of the bundled downlink subframes are detected and all of the codewords are successfully received;
transmitting the representative ACK/NACK signal and the counter on an uplink shared channel in an uplink subframe.

[17] A method of performing HARQ performed by a UE in a wireless communication system, the method comprising :
receiving bundled downlink subframes, each subframe of the bundled downlink subframes being used to transmit one or plural codewords;
generating a representative ACK/NACK signal wherein the representative ACK/NACK signal is an ACK signal if all codewords in detected bundled downlink

subframes are successfully received, or the representative ACK/NACK signal is a NACK signal if at least one codeword in the detected bundled downlink subframes is not successfully received: and

transmitting the representative ACK/NACK signal on an uplink channel, wherein an uplink resource for the uplink channel carrying the representative ACK/NACK signal is associated with the last detected bundled downlink subframe and/or the downlink resource used for the scheduling of the last detected bundled downlink subframe.

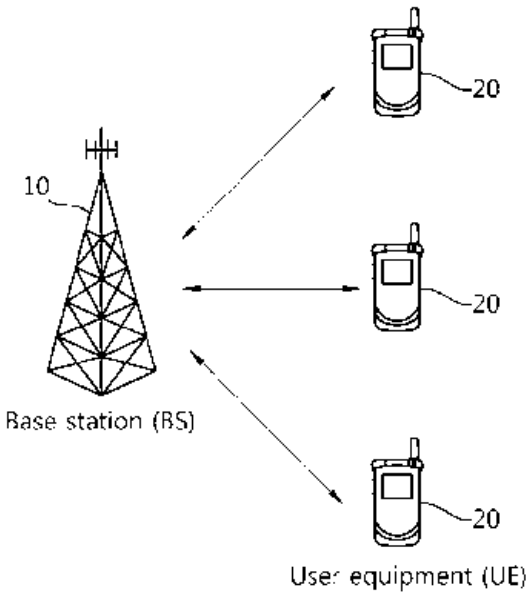
[18] A method of performing HARQ performed by a UE in a wireless communication system, the method comprising :

receiving bundled downlink subframes, each subframe of the bundled downlink subframes being used to transmit one or plural codewords;

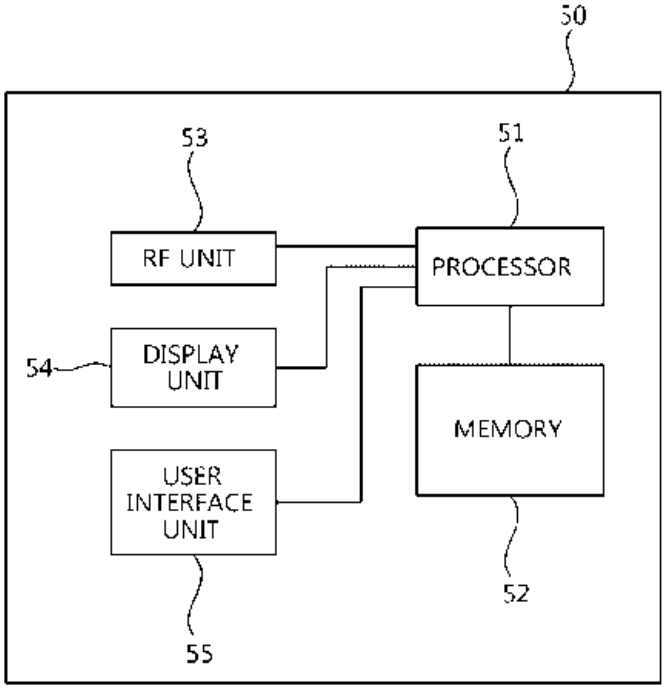
generating a representative ACK/NACK signal wherein the representative ACK/NACK signal is an ACK signal if all codewords in detected bundled downlink subframes are successfully received, or the representative ACK/NACK signal is a NACK signal if at least one codeword in the detected bundled downlink subframes is not successfully received; and

transmitting the representative ACK/NACK signal on an uplink channel, wherein an uplink resource for the uplink channel carrying the representative ACK/NACK signal is associated with the last detected bundled downlink subframe and/or the downlink resource used for the scheduling of the last detected bundled downlink subframe.

[Fig. 1]

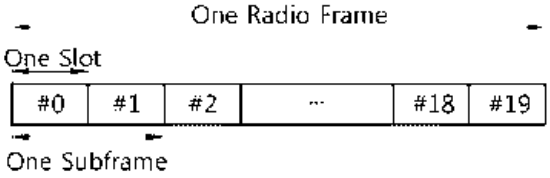

20
10
20
Base station (BS)
20
User equipment (UE)

[Fig. 2]

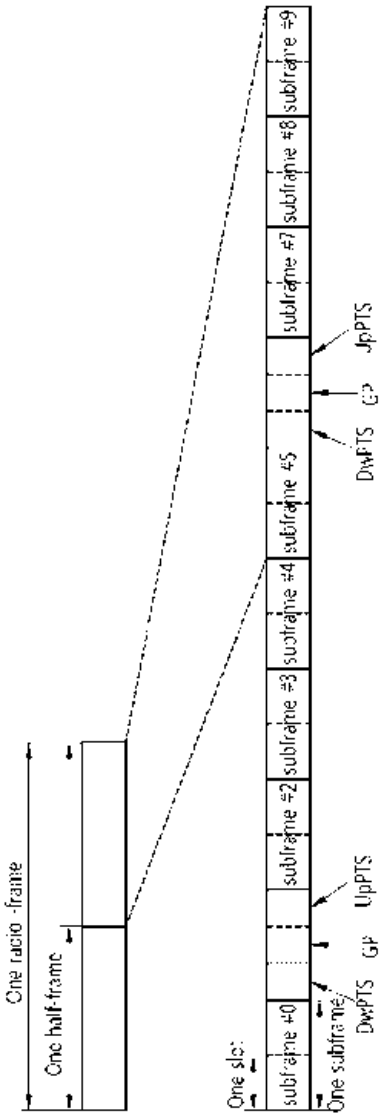

50
53
51
RF UNIT
PROCESSOR
54
DISPLAY UNIT
MEMORY
USER INTERFACE UNIT
52
55

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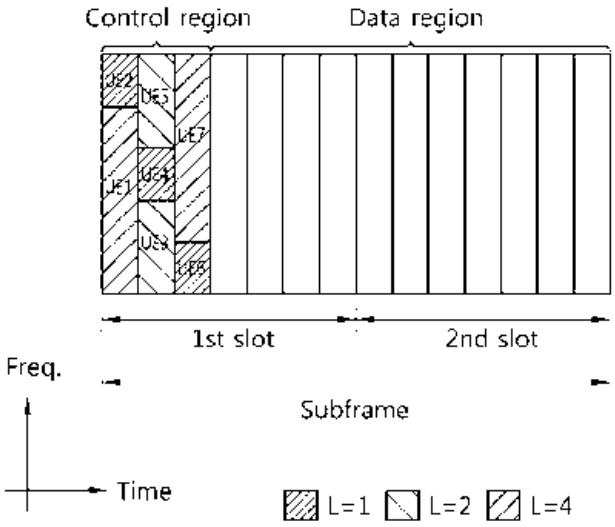
[Fig. 3]



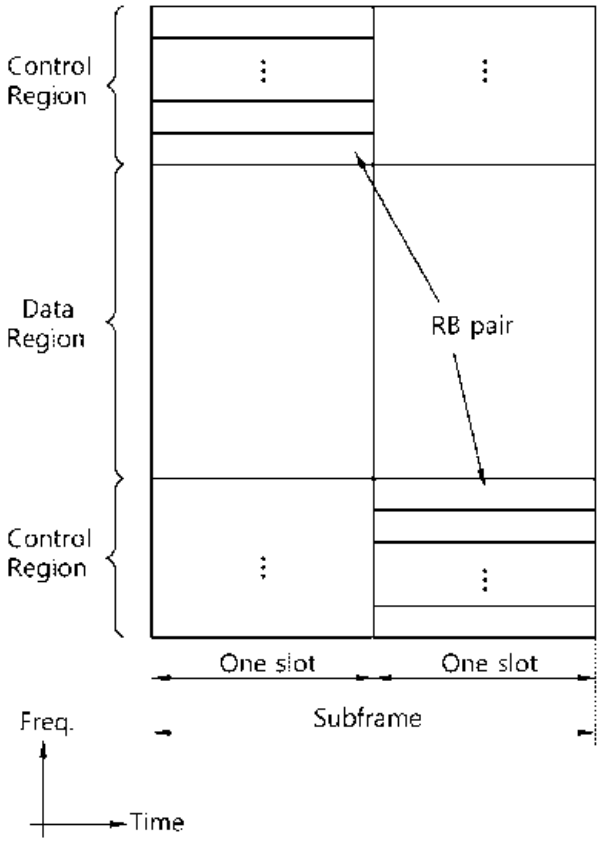
[Fig. 4]



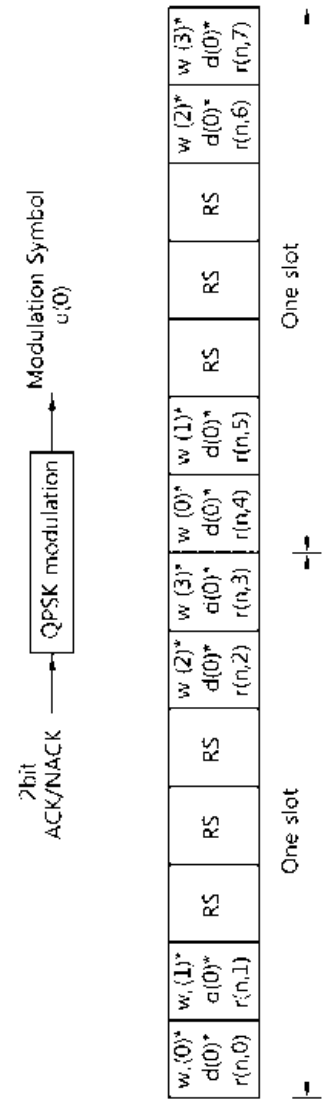
[Fig. 5]


Control region
Data region
UE2
UE3
UE7
UE1
UE4
UE6
UE5
1st slot
2nd slot
Freq.
Subframe
Time
L=1
L=2
L=4

[Fig. 6]

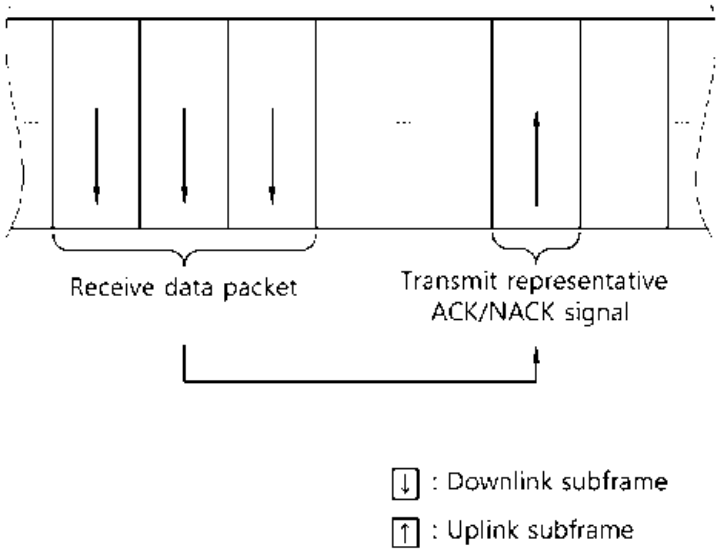

Control Region
Data Region
Control Region
RB pair
One slot
One slot
Subframe
Freq.
Time

[Fig. 7]

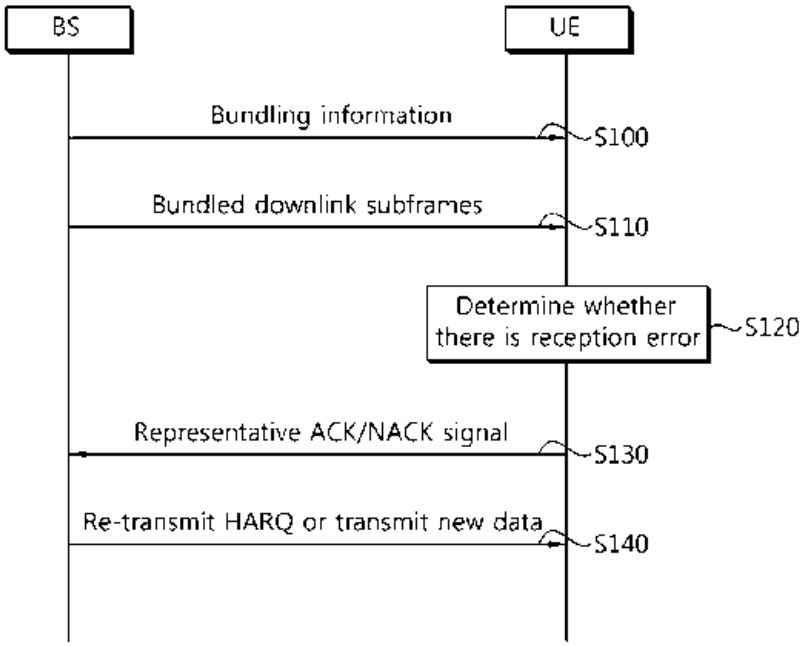


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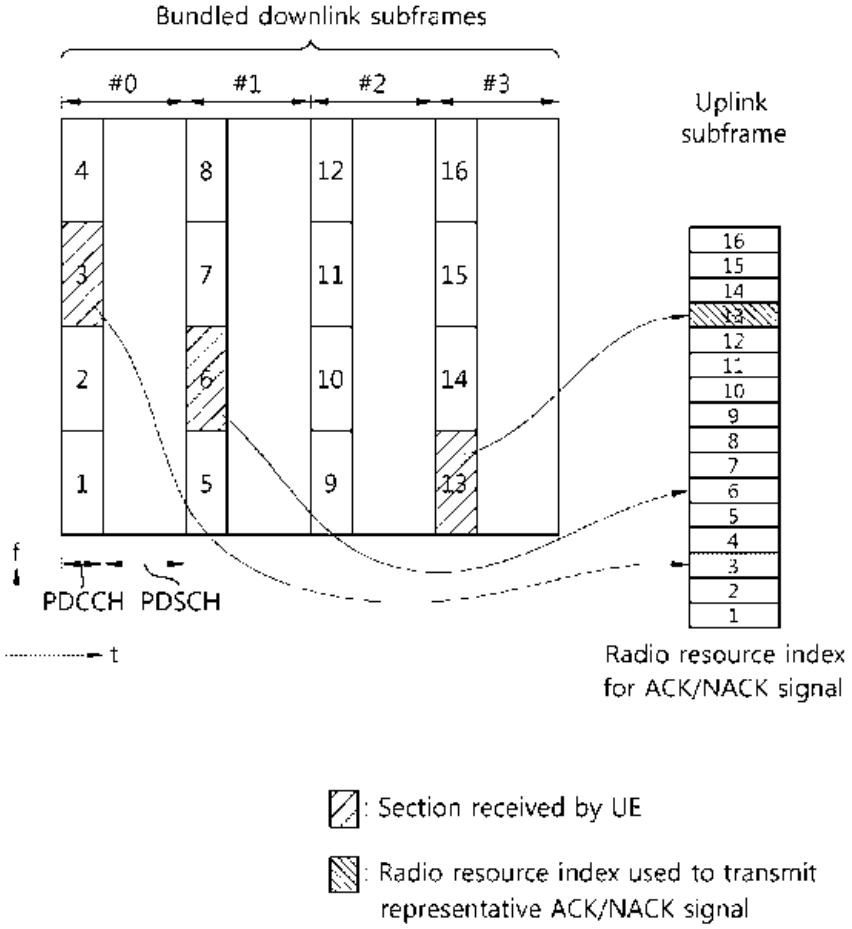
[Fig. 8]


Receive data packet
Transmit representative ACK/NACK signal
: Downlink subframe
: Uplink subframe

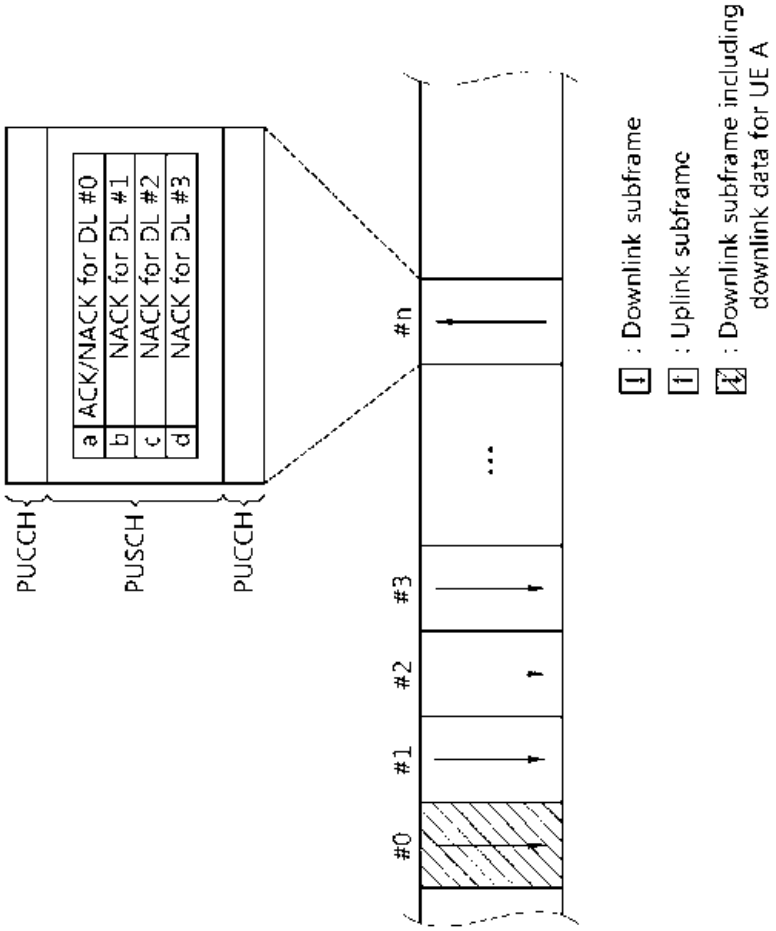
[Fig. 9]


BS
UE
Bundling information
S100
Bundled downlink subframes
S110
Determine whether there is reception error
S120
Representative ACK/NACK signal
S130
Re-transmit HARQ or transmit new data
S140

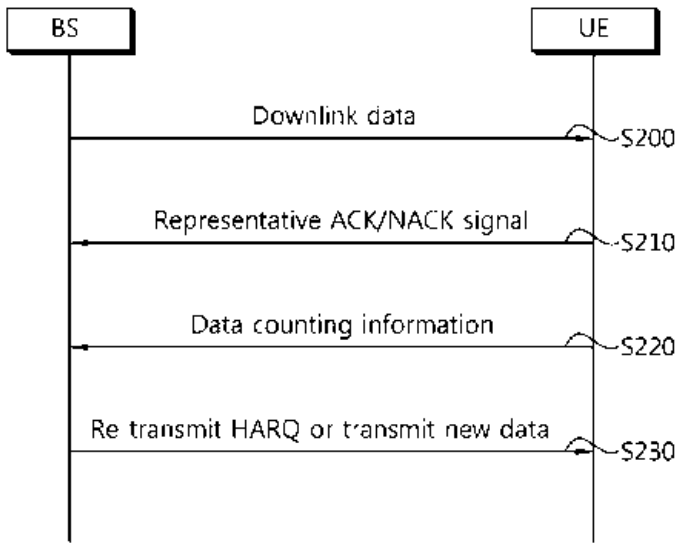
[Fig. 10]


Bundled downlink subframes
#0
#1
#2
#3
Uplink subframe
4
8
12
16
3
7
11
15
2
6
10
14
1
5
9
13
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
f
PDCCH
PDSCH
t
Radio resource index for ACK/NACK signal
: Section received by UE
: Radio resource index used to transmit representative ACK/NACK signal

[Fig. 11]


a ACK/NACK for DL #0
b NACK for DL #1
c NACK for DL #2
d NACK for DL #3
PUCCH
PUSCH
PUCCH
#n
#3
#2
#1
#0
: Downlink subframe
: Uplink subframe
: Downlink subframe including downlink data for UE A

[Fig. 12]


BS
UE
Downlink data
S200
Representative ACK/NACK signal
S210
Data counting information
S220
Re transmit HARQ or transmit new data
S230

Espacenet

Bibliographic data: JP2010539847 (A) — 2010-12-16

METHOD FOR DETECTING CONTROL INFORMATION IN WIRELESS COMMUNICATION SYSTEM

No documents available for this priority number

Inventor(s):

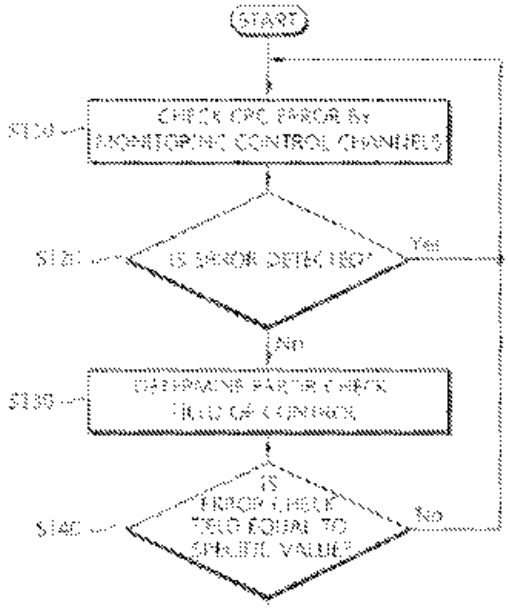
Applicant(s):

Classification:	**- international:**	***H04L1/00; H04W28/04***
	- cooperative:	**H04L1/0061; H04L1/0083**
Application number:	JP20100525771 20080926	
Priority number (s):	WO2008KR05718 20080926 ; US20070976140P 20070928 ; US20080095287P 20080908	
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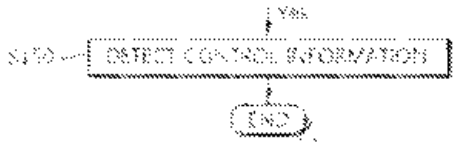
A method for detecting control information in a wireless communication system is provided. The method includes checking a cyclic redundancy check (CRC) error by monitoring control channels, determining whether a value of an error check field is equal to a specific value, and, if the value of the error check field is equal to the specific value, detecting the control information on the control channel.

[Fig. 4]



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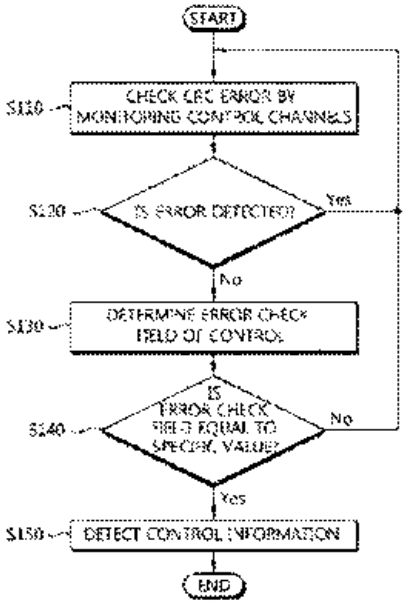
(71)出願人　502032105
エルジー　エレクトロニクス　インコーポレイティド
大韓民国，ソウル　１５０　７２１，ヨンドゥンポーク，ヨイド－ドン，２０
(74)代理人　100078282
弁理士　山本　秀策
(74)代理人　100062409
弁理士　安村　高明
(74)代理人　100113413
弁理士　森下　夏樹

最終頁に続く

(54)【発明の名称】無線通信システムにおける制御情報検出方法

(57)【要約】
【課題】無線通信システムにおける制御情報検出方法を提供する。
【解決手段】前記方法は、制御チャネルをモニタリングして、ＣＲＣ（Ｃｙｃｌｉｃ　Ｒｅｄｕｎｄａｎｃｙ　Ｃｈｅｃｋ）エラーを確認する段階、前記ＣＲＣエラーが検出されない制御チャネル上の制御情報に含まれたフィールドのうちエラー確認フィールドの値が特定値と一致するか否かを確認する段階、及び前記エラー確認フィールドの値が前記特定値と一致する場合、前記ＣＲＣエラーが検出されない前記制御チャネル上の前記制御情報を検出する段階を含む。無線通信システムにおいて正確度を高めることができる制御情報検出方法を提供することができる。
【選択図】図１４

[Fig. 14]



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【特許請求の範囲】
【請求項１】
無線通信システムにおける制御情報検出方法において、
制御チャネルをモニタリングして、ＣＲＣ（Ｃｙｃｌｉｃ　Ｒｅｄｕｎｄａｎｃｙ　Ｃｈｅｃｋ）エラーを確認する段階；
前記ＣＲＣエラーが検出されない制御チャネルＩの制御情報に含まれたフィールドのうちエラー確認フィールドの値が特定値と一致するか否かを確認する段階；及び
前記エラー確認フィールドの値が前記特定値と一致する場合、前記ＣＲＣエラーが検出されない前記制御チャネルＩの前記制御情報を検出する段階；
を含む制御情報検出方法。
【請求項２】
前記制御チャネルは、ＰＤＣＣＨ（Ｐｈｙｓｉｃａｌ　Ｄｏｗｎｌｉｎｋ　Ｃｏｎｔｒｏｌ　Ｃｈａｎｎｅｌ）であることを特徴とする請求項１に記載の制御情報検出方法。
【請求項３】
前記制御チャネルのＣＲＣには半持続的スケジューリング活性化を指示するための半持続的Ｃ－ＲＮＴＩ（Ｃｅｌｌ－Ｒａｄｉｏ　Ｎｅｔｗｏｒｋ　Ｔｅｍｐｏｒａｒｙ　Ｉｄｅｎｔｉｆｉｅｒ）がマスキングされることを特徴とする請求項１に記載の制御情報検出方法。
【請求項４】
前記制御チャネルのモニタリングは、ＣＲＣに前記半持続的Ｃ－ＲＮＴＩをデマスキング（ｄｅｍａｓｋｉｎｇ）した後に前記ＣＲＣエラーを確認することを特徴とする請求項３に記載の制御情報検出方法。
【請求項５】
前記制御情報は、ＶｏＩＰ（Ｖｏｉｃｅ　ｏｖｅｒ　Ｉｎｔｅｒｎｅｔ　Ｐｒｏｔｏｃｏｌ）のためのリソース割当情報の半持続スケジューリング活性化を指示することを特徴とする請求項１に記載の制御情報検出方法。
【請求項６】
前記リソース割当情報を用いて一定期間中ＰＤＳＣＨ（Ｐｈｙｓｉｃａｌ　Ｄｏｗｎｌｉｎｋ　Ｓｈａｒｅｄ　Ｃｈａｎｎｅｌ）上にＶｏＩＰデータを受信する段階をさらに含むことを特徴とする請求項５に記載の制御情報検出方法。
【請求項７】
前記リソース割当情報を用いて一定期間中ＰＵＳＣＨ（Ｐｈｙｓｉｃａｌ　Ｕｐｌｉｎｋ　Ｓｈａｒｅｄ　Ｃｈａｎｎｅｌ）上にＶｏＩＰデータを伝送する段階をさらに含むことを特徴とする請求項５に記載の制御情報検出方法。
【請求項８】
前記制御情報は、半持続スケジューリング活性化の非活性化を指示することを特徴とする請求項１に記載の制御情報検出方法。
【請求項９】
無線信号を受信するＲＦ（Ｒａｄｉｏ　Ｆｒｅｑｕｅｎｃｙ）部；及び
前記ＲＦ部と連結されて、
制御チャネルをモニタリングして、ＣＲＣエラーを確認して、
前記ＣＲＣエラーが検出されない制御チャネルＩの制御情報に含まれたフィールドのうちエラー確認フィールドの値が特定値と一致するか否かを確認して、
前記エラー確認フィールドの値が前記特定値と一致する場合、前記ＣＲＣエラーが検出されない前記制御チャネルＩの前記制御情報を検出するプロセッサを含むことを特徴とする端末。
【請求項１０】
前記制御チャネルのＣＲＣには半持続的スケジューリング活性化を指示するための半持続的Ｃ－ＲＮＴＩがマスキングされることを特徴とする請求項９に記載の端末。
【請求項１１】

前記制御チャネルのモニタリングは、ＣＲＣに前記半持続的Ｃ－ＲＮＴＩをデマスキングした後に前記ＣＲＣエラーを確認することを特徴とする請求項１に記載の端末。
【請求項１２】
前記制御情報は、ＶｏＩＰのためのリソース割当情報の半持続スケジューリング活性化を指示することを特徴とする請求項９に記載の端末。
【請求項１３】
無線通信システムにおける制御情報伝送方法において、
特定値を有するエラー確認フィールドを含む制御情報を生成する段階；及び
前記制御情報にＣＲＣを付加して制御チャネル上に伝送する段階；を含み、
前記エラー確認フィールドの特定値及び前記ＣＲＣに基づいて前記制御情報の成功的受信を確認するようにすることを特徴とする制御情報伝送方法。

【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、無線通信に関し、より詳しくは、無線通信システムにおける制御情報検出方法に関する。
【背景技術】
【０００２】
無線通信システムにおいて、一般的に一つの基地局は、複数の端末にサービスを提供する。基地局は、複数の端末に対する使用者データをスケジューリングし、前記使用者データに対するスケジューリング情報を含めた制御情報（Ｃｏｎｔｒｏｌ　Ｉｎｆｏｒｍａｔｉｏｎ）を使用者データと共に伝送する。一般的に前記制御情報を運ぶチャネルを制御チャネルといい、使用者データを運ぶチャネルをデータチャネルという。端末は、制御チャネルをモニタリングして自分の制御情報を探して、前記制御情報を用いて自分のデータを処理する。
【０００３】
端末が自分に割り当てられた使用者データを受信するためには制御チャネル上の使用者データに対する制御情報を必ず受信しなければならない。然しながら、与えられた帯域幅で複数の端末の制御情報は、一つの伝送間隔（ｔｒａｎｓｍｉｓｓｉｏｎ　ｉｎｔｅｒｖａｌ）内で多重化（ｍｕｌｔｉｐｌｅｘｉｎｇ）されることが一般的である。即ち、基地局は、複数の端末にサービスを提供するために複数の端末に対する制御情報を多重化して複数の制御チャネルを介して伝送する、端末は、複数の制御チャネルのうち自分の制御チャネルを探す。
【０００４】
多重化された制御情報のうちから特定制御情報を検出する技法のうち一つがブラインド検出（ｂｌｉｎｄ　ｄｅｔｅｃｔｉｏｎ）である。ブラインド検出は、端末が制御チャネルの復旧に必要な情報のない状態で複数の組合せの情報を用いて制御チャネルを検出するための試みをすることである。即ち、端末は、基地局から伝送された制御情報が自分の制御情報であるか否か知らなく、自分の制御情報がどの部分に位置するか知らない状態で自分の制御情報をさがす時まで与えられた全ての制御情報をデコーディングする。端末が自分の制御情報であるか否かを判別するためには端末の固有情報を用いることができる。例えば、基地局が各端末の制御情報を多重化させる時、各端末の固有識別子をＣＲＣ（Ｃｙｃｌｉｃ　Ｒｅｄｕｎｄａｎｃｙ　Ｃｈｅｃｋ）にマスキングさせて伝送することができる。ＣＲＣは、エラー検出に使われる符号（ｃｏｄｅ）である。端末は、受信した制御情報のＣＲＣに自分の固有識別子をデマスキングした後、ＣＲＣチェックをして自分の制御情報であるか否かを判断することができる。
【０００５】
然しながら、端末がＣＲＣエラー検出を介する制御チャネルモニタリングの際、他の端末の制御チャネルであるにもかかわらずＣＲＣエラー検出がされなく、正しくデコーディングされたと認識するエラーが発生できる。半持続的スケジューリング（Ｓｅｍｉ－Ｐｅ

ｒｓｉｓｔｅｎｔ Ｓｃｈｅｄｕｌｉｎｇ、ＳＰＳ）の場合、ＣＲＣエラー検出が誤っている場合、一時問題となる。半持続的スケジューリングの場合、端末は、無線リソースを割り当てる制御情報受信の後、半持続的スケジューリング区間中前記制御情報で割り当てられた無線リソースを介してデータを伝送したり、受信するためである。これは設定された無線リソースを無駄にし、無線通信の信頼度を落とす。従って、正確度を高めることができる制御情報検出方法が必要である。

【発明の概要】

【発明が解決しようとする課題】

【０００６】

本発明が解決しようとする技術的課題は、無線通信システムにおける制御情報検出方法を提供することである。

【課題を解決するための手段】

【０００７】

一態様において、無線通信システムにおける制御情報検出方法を提供する。前記方法は、制御チャネルをモニタリングして、ＣＲＣ（Ｃｙｃｌｉｃ Ｒｅｄｕｎｄａｎｃｙ Ｃｈｅｃｋ）エラーを確認する段階、前記ＣＲＣエラーが検出されない制御チャネル上の制御情報に含まれたフィールドのうちエラー確認フィールドの値が特定値と一致するか否かを確認する段階、及び前記エラー確認フィールドの値が前記特定値と一致する場合、前記ＣＲＣエラーが検出されない前記制御チャネル上の前記制御情報を検出する段階を含む。

【０００８】

他の態様において、無線信号を受信するＲＦ（Ｒａｄｉｏ Ｆｒｅｑｕｅｎｃｙ）部、及び前記ＲＦ部と連結されて、制御チャネルをモニタリングして、ＣＲＣエラーを確認して、前記ＣＲＣエラーが検出されない制御チャネル上の制御情報に含まれたフィールドのうちエラー確認フィールドの値が特定値と一致するか否かを確認して、前記エラー確認フィールドの値が前記特定値と一致する場合、前記ＣＲＣエラーが検出されない前記制御チャネル上の前記制御情報を検出するプロセッサを含む端末を提供する。

【０００９】

他の態様において、無線通信システムにおける制御情報伝送方法を提供する。前記方法は、特定値を有するエラー確認フィールドを含む制御情報を生成する段階、及び前記制御情報にＣＲＣを付加して制御チャネル上に伝送する段階を含み、前記エラー確認フィールドの特定値及び前記ＣＲＣに従って前記制御情報の成功的受信を確認するようにする。

【発明の効果】

【００１０】

無線通信システムにおいて正確度を高めることができる制御情報検出方法を提供することができる。エラー確認フィールドの特定値は、仮想（ｖｉｒｔｕａｌ）ＣＲＣとして活用することができる。端末は、制御情報検出の際、仮想ＣＲＣを介してＣＲＣエラーチェックの正確度を高めることができる。即ち、無線リソースを効率的に活用することができ、且つ制御情報の正確な検出が可能になる。従って、全体システム性能が向上されることができる。

【図面の簡単な説明】

【００１１】

【図１】無線通信システムを示すブロック図である。

【図２】Ｅ－ＵＴＲＡＮとＥＰＣとの間の機能分割を示すブロック図である。

【図３】端末の要素を示すブロック図である。

【図４】使用者平面に対する無線プロトコル構造を示すブロック図である。

【図５】制御平面に対する無線プロトコル構造を示すブロック図である。

【図６】ダウンリンク論理チャネルとダウンリンク伝送チャネルとの間のマッピングを示す。

【図７】ダウンリンク伝送チャネルとダウンリンク物理チャネルとの間のマッピングを示す。

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【図８】無線フレームの構造を示す。
【図９】一つのダウンリンクスロットに対するリソースグリッドを示す例示図である。
【図１０】サブフレームの構造を示す。
【図１１】ＰＤＣＣＨの構成を示すフローチャートである。
【図１２】ＰＤＣＣＨ処理を示すフローチャートである。
【図１３】ＤＣＩフォーマットを構成する複数の情報フィールドのうち使われない情報フィールドを活用することができる方法の例を示す。
【図１４】本発明の実施例に係る制御情報検出方法を示す。
【図１５】動的スケジューリング方式を用いたダウンリンクデータ伝送を示す流れ図である。
【図１６】動的スケジューリング方式を用いたアップリンクデータ伝送を示す流れ図である。
【図１７】ＶｏＩＰにおけるトラフィックモデルを示す例示図である。
【図１８】半持続的スケジューリング方式を用いたダウンリンクデータ伝送を示す流れ図である。
【図１９】半持続的スケジューリング方式を用いたアップリンクデータ伝送を示す流れ図である。
【発明を実施するための形態】
【００１２】
図１は、無線通信システムを示すブロック図である。これはＥ－ＵＭＴＳ（Ｅｖｏｌｖｅｄ－Ｕｎｉｖｅｒｓａｌ　Ｍｏｂｉｌｅ　Ｔｅｌｅｃｏｍｍｕｎｉｃａｔｉｏｎｓ　Ｓｙｓｔｅｍ）の網構造であってもよい。Ｅ－ＵＭＴＳシステムは、ＬＴＥ（Ｌｏｎｇ　Ｔｅｒｍ　Ｅｖｏｌｕｔｉｏｎ）システムということもできる。無線通信システムは、音声、パケットデータなどのような多様な通信サービスを提供するために広く配置される。
【００１３】
図１を参照すると、Ｅ－ＵＴＲＡＮ（Ｅｖｏｌｖｅｄ－ＵＭＴＳ　Ｔｅｒｒｅｓｔｒｉａｌ　Ｒａｄｉｏ　Ａｃｃｅｓｓ　Ｎｅｔｗｏｒｋ）は、制御平面（ｃｏｎｔｒｏｌ　ｐｌａｎｅ）及び使用者平面（ｕｓｅｒ　ｐｌａｎｅ）を提供する基地局（２０；Ｂａｓｅ　Ｓｔａｔｉｏｎ、ＢＳ）を含む。
【００１４】
端末（１０；Ｕｓｅｒ　Ｅｑｕｉｐｍｅｎｔ、ＵＥ）は、固定されたり移動性を有することができ、ＭＳ（Ｍｏｂｉｌｅ　ｓｔａｔｉｏｎ）、ＵＴ（Ｕｓｅｒ　Ｔｅｒｍｉｎａｌ）、ＳＳ（Ｓｕｂｓｃｒｉｂｅｒ　Ｓｔａｔｉｏｎ）、無線機器（Ｗｉｒｅｌｅｓｓ　Ｄｅｖｉｃｅ）等、他の用語で呼ばれることができる。基地局（２０）は、一般的に端末（１０）と通信する固定された地点（ｆｉｘｅｄ　ｓｔａｔｉｏｎ）をいい、ｅＮＢ（ｅｖｏｌｖｅｄ－ＮｏｄｅＢ）、ＢＴＳ（Ｂａｓｅ　Ｔｒａｎｓｃｅｉｖｅｒ　Ｓｙｓｔｅｍ）、アクセスポイント（Ａｃｃｅｓｓ　Ｐｏｉｎｔ）等、他の用語で呼ばれることができる。一つの基地局（２０）は、少なくとも一つのセルに対してサービスを提供できる。セルは、基地局（２０）が通信サービスを提供する領域である。基地局（２０）間には使用者トラフィックあるいは制御トラフィック伝送のためのインターフェースが使われてもよい。以下、ダウンリンク（ｄｏｗｎｌｉｎｋ）は、基地局（２０）から端末（１０）への通信を意味して、アップリンク（ｕｐｌｉｎｋ）は、端末（１０）から基地局（２０）への通信を意味する。
【００１５】
基地局（２０）は、Ｘ２インターフェースを介してお互いに連結される。基地局（２０）は、Ｓ１インターフェースを介してＥＰＣ（Ｅｖｏｌｖｅｄ　Ｐａｃｋｅｔ　Ｃｏｒｅ）、より詳しくは、ＭＭＥ（Ｍｏｂｉｌｉｔｙ　Ｍａｎａｇｅｍｅｎｔ　Ｅｎｔｉｔｙ）／Ｓ－ＧＷ（Ｓｅｒｖｉｎｇ　Ｇａｔｅｗａｙ、３０）と連結される。Ｓ１インターフェースは、基地局（２０）とＭＭＥ／Ｓ－ＧＷ（３０）との間に多対多関係（ｍａｎｙ－ｔｏ－ｍａｎｙ－ｒｅｌａｔｉｏｎ）を支援する。

【００１６】
無線通信システムは、ＭＩＭＯ（Ｍｕｌｔｉｐｌｅ Ｉｎｐｕｔ Ｍｕｌｔｉｐｌｅ Ｏｕｔｐｕｔ）システム、ＭＩＳＯ（Ｍｕｌｔｉｐｌｅ Ｉｎｐｕｔ Ｓｉｎｇｌｅ Ｏｕｔｐｕｔ）システムだけでなく、ＳＩＳＯ（Ｓｉｎｇｌｅ Ｉｎｐｕｔ Ｓｉｎｇｌｅ Ｏｕｔｐｕｔ）システムやＳＩＭＯ（Ｓｉｎｇｌｅ Ｉｎｐｕｔ Ｍｕｌｔｉｐｌｅ Ｏｕｔｐｕｔ）システムであってもよい。ＭＩＭＯは、多重送信アンテナ及び多重受信アンテナを使用してデータの送受信効率と、スペクトラム効率（ｓｐｅｃｔｒａｌ ｅｆｆｉｃｉｅｎｃｙ）を向上させる。ＭＩＭＯ技術には空間ダイバーシティ（Ｓｐａｔｉａｌ ｄｉｖｅｒｓｉｔｙ）、空間多重化（Ｓｐａｔｉａｌ ｍｕｌｔｉｐｌｅｘｉｎｇ）及びビームフォーミング（Ｂｅａｍ ｆｏｒｍｉｎｇ）などがある。

【００１７】
図２は、Ｅ－ＵＴＲＡＮとＥＰＣとの間の機能分割（ｆｕｎｃｔｉｏｎａｌ ｓｐｌｉｔ）を示すブロック図である。斜線を引いたボックスは、無線プロトコル階層（ｒａｄｉｏ ｐｒｏｔｏｃｏｌ ｌａｙｅｒ）を示して、空のボックスは、制御平面の機能的個体（ｆｕｎｃｔｉｏｎａｌ ｅｎｔｉｔｙ）を示す。

【００１８】
図２を参照すると、基地局は、次のような機能を遂行する。（１）無線ベアラ制御（Ｒａｄｉｏ Ｂｅａｒｅｒ Ｃｏｎｔｒｏｌ）、無線アドミッション制御（Ｒａｄｉｏ Ａｄｍｉｓｓｉｏｎ Ｃｏｎｔｒｏｌ）、連結移動性制御（Ｃｏｎｎｅｃｔｉｏｎ Ｍｏｂｉｌｉｔｙ Ｃｏｎｔｒｏｌ）、端末への動的リソース割当（Ｄｙｎａｍｉｃ Ｒｅｓｏｕｒｃｅ Ａｌｌｏｃａｔｉｏｎ）のような無線リソース管理（Ｒａｄｉｏ Ｒｅｓｏｕｒｃｅ Ｍａｎａｇｅｍｅｎｔ；ＲＲＭ）機能、（２）ＩＰ（Ｉｎｔｅｒｎｅｔ Ｐｒｏｔｏｃｏｌ）ヘッダ圧縮及び使用者データストリームの暗号化（ｅｎｃｒｙｐｔｉｏｎ）、（３）Ｓ－ＧＷへの使用者平面データのルーティング（ｒｏｕｔｉｎｇ）、（４）ページング（ｐａｇｉｎｇ）メッセージのスケジューリング及び伝送、（５）ブロードキャスト（ｂｒｏａｄｃａｓｔ）情報のスケジューリング及び伝送、（６）移動性及びスケジューリングのための測定と測定報告設定。

【００１９】
ＭＭＥは、次のような機能を遂行する。（１）ＮＡＳ（Ｎｏｎ－Ａｃｃｅｓｓ Ｓｔｒａｔｕｍ）シグナリング、（２）ＮＡＳシグナリング保安（ｓｅｃｕｒｉｔｙ）、（３）アイドルモードＵＥ到達性（Ｉｄｌｅ ｍｏｄｅ ＵＥ Ｒｅａｃｈａｂｉｌｉｔｙ）、（４）トラッキング領域リスト管理（Ｔｒａｃｋｉｎｇ Ａｒｅａ ｌｉｓｔ ｍａｎａｇｅｍｅｎｔ）、（５）ローミング（Ｒｏａｍｉｎｇ）、（６）認証（Ａｕｔｈｅｎｔｉｃａｔｉｏｎ）。

【００２０】
Ｓ－ＧＷは、次のような機能を遂行する。（１）移動性アンカリング（ｍｏｂｉｌｉｔｙ ａｎｃｈｏｒｉｎｇ）、（２）合法的傍聴（ｌａｗｆｕｌ ｉｎｔｅｒｃｅｐｔｉｏｎ）。Ｐ－ＧＷ（ＰＤＮ－Ｇａｔｅｗａｙ）は、次のような機能を遂行する。（１）端末ＩＰ（ｉｎｔｅｒｎｅｔ ｐｒｏｔｏｃｏｌ）割当（ａｌｌｏｃａｔｉｏｎ）、（２）パケットフィルタリング。

【００２１】
図３は、端末の要素を示すブロック図である。端末（５０）は、プロセッサ（ｐｒｏｃｅｓｓｏｒ、５１）、メモリ（ｍｅｍｏｒｙ、５２）、ＲＦ部（ＲＦ（Ｒａｄｉｏ Ｆｒｅｑｕｅｎｃｙ）ｕｎｉｔ、５３）、ディスプレー部（ｄｉｓｐｌａｙ ｕｎｉｔ、５４）、使用者インターフェース部（ｕｓｅｒ ｉｎｔｅｒｆａｃｅ ｕｎｉｔ、５５）を含む。プロセッサ（５１）は、無線インターフェースプロトコルの階層が具現されて、制御平面及び使用者平面を提供する。各階層の機能は、プロセッサ（５１）を介して具現されることができる。メモリ（５２）は、プロセッサ（５１）と連結されて、端末駆動システム、アプリケーション及び一般的なファイルを格納する。ディスプレー部（５４）は、端末の多様な情報をディスプレーして、ＬＣＤ（Ｌｉｑｕｉｄ Ｃｒｙｓｔａｌ Ｄｉｓｐ

fay）、ＯＬＥＤ（Ｏｒｇａｎｉｃ　Ｌｉｇｈｔ　Ｅｍｉｔｔｉｎｇ　Ｄｉｏｄｅｓ）など、よく知られた要素を使用してもよい、使用者インターフェース部（５５）は、キーパッドやタッチスクリーンなど、よく知られた使用者インターフェースの組合せでなることができる。ＲＦ部（５３）は、プロセッサと連結されて、無線信号（ｒａｄｉｏ　ｓｉｇｎａｌ）を送信及び／または受信する。

【００２２】

端末とネットワークとの間の無線インターフェースプロトコル（ｒａｄｉｏ　ｉｎｔｅｒｆａｃｅ　ｐｒｏｔｏｃｏｌ）の階層は、通信システムに広く知られた開放型システム間相互連結（Ｏｐｅｎ　Ｓｙｓｔｅｍ　Ｉｎｔｅｒｃｏｎｎｅｃｔｉｏｎ：ＯＳＩ）モデルの下位３個階層に基づいて第１の階層（Ｌ１）、第２の階層（Ｌ２）、第３の階層（Ｌ３）に区分されることができる。この中から第１の階層に属する物理階層は、物理チャネル（ｐｈｙｓｉｃａｌ　ｃｈａｎｎｅｌ）を用いた情報伝送サービス（ｉｎｆｏｒｍａｔｉｏｎ　ｔｒａｎｓｆｅｒ　ｓｅｒｖｉｃｅ）を提供して、第３の階層に位置する無線リソース制御（ｒａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ；以下、ＲＲＣという）階層は、端末とネットワークとの間に無線リソースを制御する役割を遂行する。このために、ＲＲＣ階層は、端末とネットワークとの間にＲＲＣメッセージをお互いに交換する。

【００２３】

図４は、使用者平面（ｕｓｅｒ　ｐｌａｎｅ）に対する無線プロトコル構造（ｒａｄｉｏ　ｐｒｏｔｏｃｏｌ　ａｒｃｈｉｔｅｃｔｕｒｅ）を示すブロック図である。図５は、制御平面（ｃｏｎｔｒｏｌ　ｐｌａｎｅ）に対する無線プロトコル構造を示すブロック図である。これは端末とＥ－ＵＴＲＡＮとの間の無線インターフェースプロトコルの構造を示す。使用者平面は、使用者データ伝送のためのプロトコルスタック（ｐｒｏｔｏｃｏｌ　ｓｔａｃｋ）であり、制御平面は、制御信号伝送のためのプロトコルスタックである。

【００２４】

図４及び図５を参照すると、第１の階層である物理階層（ＰＨＹ（ｐｈｙｓｉｃａｌ）ｌａｙｅｒ）は、物理チャネル（ｐｈｙｓｉｃａｌ　ｃｈａｎｎｅｌ）を用いて上位階層に情報伝送サービス（ｉｎｆｏｒｍａｔｉｏｎ　ｔｒａｎｓｆｅｒ　ｓｅｒｖｉｃｅ）を提供する。物理階層は、上位にある媒体接続制御（Ｍｅｄｉｕｍ　Ａｃｃｅｓｓ　Ｃｏｎｔｒｏｌ：ＭＡＣ）階層及び伝送チャネル（ｔｒａｎｓｐｏｒｔ　ｃｈａｎｎｅｌ）を介して連結しており、この伝送チャネルを介してＭＡＣ階層と物理階層との間のデータが移動する。そして、相異なる物理階層間、即ち、送信側及び受信側の物理階層間は、物理チャネルを介してデータが移動する。

【００２５】

第２の階層のＭＡＣ階層は、論理チャネル（ｌｏｇｉｃａｌ　ｃｈａｎｎｅｌ）を介して上位階層である無線リンク制御（Ｒａｄｉｏ　Ｌｉｎｋ　Ｃｏｎｔｒｏｌ：ＲＬＣ）階層にサービスを提供する。第２の階層のＲＬＣ階層は、信頼性あるデータの伝送を支援する。ＲＬＣ階層にはデータの伝送方法に応じて透明モード（Ｔｒａｎｓｐａｒｅｎｔ　Ｍｏｄｅ、ＴＭ）、非確認モード（Ｕｎａｃｋｎｏｗｌｅｄｇｅｄ　Ｍｏｄｅ、ＵＭ）、及び確認モード（Ａｃｋｎｏｗｌｅｄｇｅｄ　Ｍｏｄｅ、ＡＭ）の３種類の動作モードが存在する。ＡＭ　ＲＬＣは、両方向データ伝送サービスを提供して、ＲＬＣ　ＰＤＵ（Ｐｒｏｔｏｃｏｌ　Ｄａｔａ　Ｕｎｉｔ）の伝送失敗の際、再伝送を支援する。

【００２６】

第２の階層のＰＤＣＰ（Ｐａｃｋｅｔ　Ｄａｔａ　Ｃｏｎｖｅｒｇｅｎｃｅ　Ｐｒｏｔｏｃｏｌ）階層は、ＩＰパケットヘッダサイズを減らすヘッダ圧縮（ｈｅａｄｅｒ　ｃｏｍｐｒｅｓｓｉｏｎ）機能を遂行する。

【００２７】

第３の階層の無線リソース制御（Ｒａｄｉｏ　Ｒｅｓｏｕｒｃｅ　Ｃｏｎｔｒｏｌ：以下、ＲＲＣ）階層は、制御平面でだけ定義される。ＲＲＣ階層は、無線ベアラ（Ｒａｄｉｏ　Ｂｅａｒｅｒ：以下、ＲＢ）の設定（ｃｏｎｆｉｇｕｒａｔｉｏｎ）、再設定（ｒｅ

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ーｃｏｎｆｉｇｕｒａｔｉｏｎ）、及び解除（ｒｅｌｅａｓｅ）と関連し、論理チャネル、伝送チャネル、及び物理チャネルの制御を割当する。ＲＢは、端末とＥ－ＵＴＲＡＮとの間のデータ伝達のために第２の階層によって提供されるサービスを意味する。端末のＲＲＣとネットワークのＲＲＣとの間にＲＲＣ連結（ＲＲＣ　Ｃｏｎｎｅｃｔｉｏｎ）のある場合、端末は、ＲＲＣ連結モード（ＲＲＣ　Ｃｏｎｎｅｃｔｅｄ　Ｍｏｄｅ）にあるようになり、そうでない場合、ＲＲＣアイドルモード（ＲＲＣ　Ｉｄｌｅ　Ｍｏｄｅ）にあるようになる。

【００２８】

ＲＲＣ階層上位に位置するＮＡＳ（Ｎｏｎ－Ａｃｃｅｓｓ　Ｓｔｒａｔｕｍ）階層は、連結管理（Ｓｅｓｓｉｏｎ　Ｍａｎａｇｅｍｅｎｔ）及び移動性管理（Ｍｏｂｉｌｉｔｙ　Ｍａｎａｇｅｍｅｎｔ）などの機能を遂行する。

【００２９】

図６は、ダウンリンク論理チャネルとダウンリンク伝送チャネルとの間のマッピング（ｍａｐｐｉｎｇ）を示す。これは３ＧＰＰ　ＴＳ　３６．３００　Ｖ８．５．０（２００７－１２）Ｔｅｃｈｎｉｃａｌ　Ｓｐｅｃｉｆｉｃａｔｉｏｎ　Ｇｒｏｕｐ　Ｒａｄｉｏ　Ａｃｃｅｓｓ　Ｎｅｔｗｏｒｋ：Ｅｖｏｌｖｅｄ　Ｕｎｉｖｅｒｓａｌ　Ｔｅｒｒｅｓｔｒｉａｌ　Ｒａｄｉｏ　Ａｃｃｅｓｓ（Ｅ－ＵＴＲＡ）　ａｎｄ　Ｅｖｏｌｖｅｄ　Ｕｎｉｖｅｒｓａｌ　Ｔｅｒｒｅｓｔｒｉａｌ　Ｒａｄｉｏ　Ａｃｃｅｓｓ　Ｎｅｔｗｏｒｋ（Ｅ－ＵＴＲＡＮ）；Ｏｖｅｒａｌｌ　Ｄｅｓｃｒｉｐｔｉｏｎ；Ｓｔａｇｅ２（Ｒｅｌｅａｓｅ８）の６．１．３．２節を参照することができる。

【００３０】

図６を参照すると、ＰＣＣＨ（Ｐａｇｉｎｇ　Ｃｏｎｔｒｏｌ　Ｃｈａｎｎｅｌ）は、ＰＣＨ（Ｐａｇｉｎｇ　Ｃｈａｎｎｅｌ）にマッピングされ、ＢＣＣＨ（Ｂｒｏａｄｃａｓｔ　Ｃｏｎｔｒｏｌ　Ｃｈａｎｎｅｌ）は、ＢＣＨ（Ｂｒｏａｄｃａｓｔ　Ｃｈａｎｎｅｌ）またはＤＬ－ＳＣＨ（Ｄｏｗｎｌｉｎｋ　Ｓｈａｒｅｄ　Ｃｈａｎｎｅｌ）にマッピングされる。ＣＣＣＨ（Ｃｏｍｍｏｎ　Ｃｏｎｔｒｏｌ　Ｃｈａｎｎｅｌ）、ＤＣＣＨ（Ｄｅｄｉｃａｔｅｄ　Ｃｏｎｔｒｏｌ　Ｃｈａｎｎｅｌ）、ＤＴＣＨ（Ｄｅｄｉｃａｔｅｄ　Ｔｒａｆｆｉｃ　Ｃｈａｎｎｅｌ）、ＭＣＣＨ（Ｍｕｌｔｉｃａｓｔ　Ｃｏｎｔｒｏｌ　Ｃｈａｎｎｅｌ）、及びＭＴＣＨ（Ｍｕｌｔｉｃａｓｔ　Ｔｒａｆｆｉｃ　Ｃｈａｎｎｅｌ）は、ＤＬ－ＳＣＨにマッピングされる。ＭＣＣＨ及びＭＴＣＨは、ＭＣＨ（Ｍｕｌｔｉｃａｓｔ　Ｃｈａｎｎｅｌ）にもマッピングされる。

【００３１】

各論理チャネルタイプは、ある種類の情報が伝送されるかに応じて定義される。論理チャネルは、制御チャネル及びトラフィックチャネルの２種類がある。

【００３２】

制御チャネルは、制御平面情報の伝送に使われる。ＢＣＣＨは、システム制御情報をブロードキャスティングするためのダウンリンクチャネルである。ＰＣＣＨは、ページング情報を伝送するダウンリンクチャネルであり、ネットワークが端末の位置を知らない時使用する。ＣＣＣＨは、端末とネットワークとの間の制御情報を伝送するチャネルであり、端末とネットワークとの間にＲＲＣ連結がされていない時使用する。ＭＣＣＨは、ＭＢＭＳ（ｍｕｌｔｉｍｅｄｉａ　ｂｒｏａｄｃａｓｔ　ｍｕｌｔｉｃａｓｔ　ｓｅｒｖｉｃｅ）制御情報の伝送に使われる一対多（ｐｏｉｎｔ－ｔｏ－ｍｕｌｔｉｐｏｉｎｔ）ダウンリンクチャネルであり、ＭＢＭＳを受信する端末に使われる。ＤＣＣＨは、端末とネットワークとの間の専用制御情報を伝送する一対一双方向チャネルであり、ＲＲＣ連結を有する端末によって使われる。

【００３３】

トラフィックチャネルは、使用者平面情報の伝送に使われる。ＤＴＣＨは、使用者情報の伝送のための一対一チャネルであり、アップリンクとダウンリンクの両方に存在する。ＭＴＣＨは、トラフィックデータの伝送のための一対多ダウンリンクチャネルであり、ＭＢＭＳを受信する端末によって使われる。

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【００３４】
伝送チャネルは、無線インターフェースを介するデータの伝送の編成及び特徴に応じて分類される。ＢＣＨは、セルの全領域でブロードキャストされて固定されて予め定義された伝送フォーマットを有する。ＤＬ－ＳＣＨは、ＨＡＲＱ（ｈｙｂｒｉｄ ａｕｔｏｍａｔｉｃ ｒｅｐｅａｔ ｒｅｑｕｅｓｔ）の支援、変調、コーディング、及び伝送パワーの変化による動的リンク適応の支援、ブロードキャストの可能性、ビームフォーミングの可能性、動的、半静的（ｓｅｍｉ－ｓｔａｔｉｃ）リソース割当支援、端末パワー節約のためのＤＲＸ（ｄｉｓｃｏｎｔｉｎｕｏｕｓ ｒｅｃｅｐｔｉｏｎ）支援、及びＭＢＭＳ伝送支援によって特徴される。ＰＣＨは、端末パワー節約のためのＤＲＸ支援、セルの全領域へのブロードキャスト支援によって特徴される。ＭＣＨは、セルの全領域へのブロードキャスト及びＭＢＳＦＮ（ＭＢＭＳ Ｓｉｎｇｌｅ Ｆｒｅｑｕｅｎｃｙ Ｎｅｔｗｏｒｋ）支援によって特徴される。

【００３５】
図７は、ダウンリンク伝送チャネルとダウンリンク物理チャネルとの間のマッピングを示す。これは３ＧＰＰ ＴＳ ３６．３００ Ｖ８．５．０（２００７－１２）の５．３．１節を参照することができる。

【００３６】
図７を参照すると、ＢＣＨは ＰＢＣＨ（ｐｈｙｓｉｃａｌ ｂｒｏａｄｃａｓｔ ｃｈａｎｎｅｌ）にマッピングされ、ＭＣＨは、ＰＭＣＨ（ｐｈｙｓｉｃａｌ ｍｕｌｔｉｃａｓｔ ｃｈａｎｎｅｌ）にマッピングされ、ＰＣＨ及びＤＬ ＳＣＨは、ＰＤＳＣＨ（Ｐｈｙｓｉｃａｌ Ｄｏｗｎｌｉｎｋ Ｓｈａｒｅｄ Ｃｈａｎｎｅｌ）にマッピングされる。ＰＢＣＨは、ＢＣＨ伝送ブロックを運び、ＰＭＣＨは、ＭＣＨを運び、ＰＤＳＣＨは、ＤＬ－ＳＣＨ及びＰＣＨを運ぶ。

【００３７】
物理階層で使われる数個のダウンリンク物理制御チャネルがある。ＰＤＣＣＨ（Ｐｈｙｓｉｃａｌ Ｄｏｗｎｌｉｎｋ Ｃｏｎｔｒｏｌ Ｃｈａｎｎｅｌ）は、端末にＰＣＨとＤＬ－ＳＣＨとのリソース割当、及びＤＬ－ＳＣＨと関連したＨＡＲＱ情報に対して知らせる。ＰＤＣＣＨは、端末にアップリンク伝送のリソース割当を知らせるアップリンクスケジューリンググラントを運ぶことができる。ＰＣＦＩＣＨ（ｐｈｙｓｉｃａｌ ｃｏｎｔｒｏｌ ｆｏｒｍａｔ ｉｎｄｉｃａｔｏｒ ｃｈａｎｎｅｌ）は、端末に、サブフレーム内でＰＤＣＣＨの伝送に使われるＯＦＤＭシンボルの数を知らせる。ＰＣＦＩＣＨは、サブフレームごとに伝送される。ＰＨＩＣＨ（ｐｈｙｓｉｃａｌ Ｈｙｂｒｉｄ ＡＲＱ ｉｎｄｉｃａｔｏｒ ｃｈａｎｎｅｌ）は、アップリンク伝送の応答としてＨＡＲＱ ＡＣＫ／ＮＡＣＫ信号を運ぶ。

【００３８】
図８は、無線フレームの構造を示す。

【００３９】
図８を参照すると、無線フレーム（ｒａｄｉｏ ｆｒａｍｅ）は、１０個のサブフレーム（ｓｕｂｆｒａｍｅ）で構成されて、一つのサブフレームは、２個のスロット（ｓｌｏｔ）で構成される。一つのサブフレームの伝送にかかる時間をＴＴＩ（ｔｒａｎｓｍｉｓｓｉｏｎ ｔｉｍｅ ｉｎｔｅｒｖａｌ）という。例えば、一つのサブフレームの長さは１ｍｓであり、一つのスロットの長さは０．５ｍｓである。

【００４０】
無線フレームの構造は、例示に過ぎず、無線フレームに含まれるサブフレームの数またはサブフレームに含まれるスロットの数、スロットに含まれるＯＦＤＭシンボルの数は多様に変更されることができる。

【００４１】
図９は、一つのダウンリンクスロットに対するリソースグリッド（ｒｅｓｏｕｒｃｅ ｇｒｉｄ）を示す例示図である。

【００４２】

図９を参照すると、ダウンリンクスロットは、時間領域（ｔｉｍｅ　ｄｏｍａｉｎ）で複数のＯＦＤＭ（ｏｒｔｈｏｇｏｎａｌ　ｆｒｅｑｕｅｎｃｙ　ｄｉｖｉｓｉｏｎ　ｍｕｌｔｉｐｌｅｘｉｎｇ）シンボルを含む。ここで、一つのダウンリンクスロットは、７ＯＦＤＭシンボルを含み、一つのリソースブロック（ｒｅｓｏｕｒｃｅ　ｂｌｏｃｋ）は、周波数領域で１２副搬送波を含むことを例示的に記述するが、これに制限されることではない。

【００４３】

リソースグリッドの各要素（ｅｌｅｍｅｎｔ）は、リソース要素（Ｒｅｓｏｕｒｃｅ　Ｅｌｅｍｅｎｔ、ＲＥ）といわれ、一つのリソースブロックは、１２×７リソース要素を含む。ダウンリンクスロットに含まれるリソースブロックの数N^{DL}は、セルで設定されるダウンリンク伝送帯域幅（ｂａｎｄｗｉｄｔｈ）に従属する。

【００４４】

図１０は、サブフレームの構造を示す。

【００４５】

図１０を参照すると、サブフレームは、２個の連続的な（ｃｏｎｓｅｃｕｔｉｖｅ）スロットを含む。サブフレーム内の最初のスロットの前部の最大３ＯＦＤＭシンボルがＰＤＣＣＨが割り当てられる制御領域（ｃｏｎｔｒｏｌ　ｒｅｇｉｏｎ）であり、残りのＯＦＤＭシンボルはＰＤＳＣＨが割り当てられるデータ領域（ｄａｔａ　ｒｅｇｉｏｎ）である。制御領域にはＰＤＣＣＨの以外にもＰＣＦＩＣＨ、ＰＨＩＣＨなどの制御チャネルが割り当てられることができる。端末は、ＰＤＣＣＨを介して伝送される制御情報をデコーディングしてＰＤＳＣＨを介して伝送されるデータ情報を読み取ることができる。ここで、制御領域が３ＯＦＤＭシンボルを含むことは例示にすぎない。サブフレーム内の制御領域が含むＯＦＤＭシンボルの数は、ＰＣＦＩＣＨを介して分かる。

【００４６】

制御領域は、複数のＣＣＥ（ｃｏｎｔｒｏｌ　ｃｈａｎｎｅｌ　ｅｌｅｍｅｎｔｓ）である論理的なＣＣＥ列で構成される。以下、ＣＣＥ列は一つのサブフレーム内で制御領域を構成する全体ＣＣＥの集合である。ＣＣＥは、複数のリソース要素グループ（ｒｅｓｏｕｒｃｅ　ｅｌｅｍｅｎｔ　ｇｒｏｕｐ）に対応される。例えば、ＣＣＥは、９リソース要素グループに対応されることができる。リソース要素グループは、リソース要素上に制御チャネルをマッピングすることを定義するために使われる。例えば、一つのリソース要素グループは、４個のリソース要素で構成されることができる。

【００４７】

複数のＰＤＣＣＨは制御領域内で伝送されてもよい。ＰＤＣＣＨは、スケジューリング割当などのような制御情報（ｃｏｎｔｒｏｌ　ｉｎｆｏｒｍａｔｉｏｎ）を運ぶ。ＰＤＣＣＨは、一つまたは複数の連続的なＣＣＥ（ｃｏｎｔｒｏｌ　ｃｈａｎｎｅｌ　ｅｌｅｍｅｎｔｓ）の集団（ａｇｇｒｅｇａｔｉｏｎ）上に伝送される。ＣＣＥ集団を構成するＣＣＥの数（Ｎｕｍｂｅｒ　ｏｆ　ＣＣＥｓ）に応じてＰＤＣＣＨのフォーマット及び可能なＰＤＣＣＨのビットの数が決定される。以下、ＰＤＣＣＨ伝送のために使われるＣＣＥの数をＣＣＥ集団レベル（ａｇｇｒｅｇａｔｉｏｎ　ｌｅｖｅｌ）という。また、ＣＣＥ集団レベルは、ＰＤＣＣＨを検索するためのＣＣＥ単位である。ＣＣＥ集団レベルの大きさは隣接するＣＣＥの数によって定義される。例えば、ＣＣＥ集団レベルは｛１，２，４，８｝の元素であってもよい。

【００４８】

次の表は、ＣＣＥ集団レベルにともなうＰＤＣＣＨのフォーマット、可能なＰＤＣＣＨのビット数の例を示す。

【００４９】

【表１】

【表１】

PDCCH format	CCE aggregation level	Number of resource element groups	Number of PDCCH bits
0	1	9	72
1	2	18	144
2	4	36	288
3	8	72	576

【００５０】

ＰＤＣＣＨを介して伝送される制御情報をダウンリンク制御情報（ｄｏｗｎｌｉｎｋ ｃｏｎｔｒｏｌ ｉｎｆｏｒｍａｔｉｏｎ、以下、ＤＣＩという。ＤＣＩは、アップリンクスケジューリング情報、ダウンリンクスケジューリング情報、システム情報（ｓｙｓｔｅｍ ｉｎｆｏｒｍａｔｉｏｎ）、アップリンクパワー制御命令（ｐｏｗｅｒ ｃｏｎｔｒｏｌ ｃｏｍｍａｎｄ）、ページングのための制御情報、ランダムアクセス応答（ＲＡＣＨ ｒｅｓｐｏｎｓｅ）を指示するための制御情報などを伝送する。また、ＤＣＩは、半持続的スケジューリング（Ｓｅｍｉ－Ｐｅｒｓｉｓｔｅｎｔ Ｓｃｈｅｄｕｌｉｎｇ、ＳＰＳ）活性化（ａｃｔｉｖａｔｉｏｎ）を指示するための制御情報を伝送することができる。ＤＣＩは、半持続的スケジューリング非活性化を指示するための制御情報を伝送することもできる。半持続的スケジューリングは、アップリンクまたはダウンリンクのＶｏＩＰ（Ｖｏｉｃｅｏｖｅｒ Ｉｎｔｅｒｎｅｔ Ｐｒｏｔｏｃｏｌ）伝送のために使われることもできる。

【００５１】

ＤＣＩフォーマットとしては、ＰＵＳＣＨ（Ｐｈｙｓｉｃａｌ Ｕｐｌｉｎｋ Ｓｈａｒｅｄ Ｃｈａｎｎｅｌ）スケジューリングのためのフォーマット０、一つのＰＤＳＣＨ（Ｐｈｙｓｉｃａｌ Ｄｏｗｎｌｉｎｋ Ｓｈａｒｅｄ Ｃｈａｎｎｅｌ）コードワードのスケジューリングのためのフォーマット１、一つのＰＤＳＣＨコードワードの簡単な（ｃｏｍｐａｃｔ）スケジューリングのためのフォーマット１Ａ、空間多重化モードで単一コードワードのランク－１伝送に対するスケジューリングのためのフォーマット１Ｂ、ＤＬ－ＳＣＨ（Ｄｏｗｎｌｉｎｋ Ｓｈａｒｅｄ Ｃｈａｎｎｅｌ）の非常に簡単なスケジューリングのためのフォーマット１Ｃ、多重使用者空間多重化モードでＰＤＳＣＨスケジューリングのためのフォーマット１Ｄ、閉ループ（Ｃｌｏｓｅｄ－ｌｏｏｐ）空間多重化モードでＰＤＳＣＨスケジューリングのためのフォーマット２、開ループ（Ｏｐｅｎ－ｌｏｏｐ）空間多重化モードでＰＤＳＣＨスケジューリングのためのフォーマット２Ａ、アップリンクチャネルのためのＴＰＣ（Ｔｒａｎｓｍｉｓｓｉｏｎ Ｐｏｗｅｒ Ｃｏｎｔｒｏｌ）命令の伝送のためのフォーマット３及び３Ａがある。

【００５２】

図１１は、ＰＤＣＣＨの構成を示すフローチャートである。

【００５３】

図１１を参照すると、基地局は、ＤＣＩフォーマットに応じて制御情報を生成する。基地局は、端末に送られる制御情報に応じて複数のＤＣＩフォーマット（ＤＣＩ ｆｏｒｍａｔ １，２，…，Ｎ）のうち一つのＤＣＩフォーマットを選択することができる。

【００５４】

段階Ｓ１１０において、各々のＤＣＩフォーマットに応じて生成された制御情報にエラー検出（ｅｒｒｏｒ ｄｅｔｅｃｔｉｏｎ）のためＣＲＣ（Ｃｙｃｌｉｃ Ｒｅｄｕｎｄａｎｃｙ Ｃｈｅｃｋ）を付加する。ＣＲＣには、ＰＤＣＣＨの所有者（ｏｗｎｅｒ）や用途に応じて識別子（これをＲＮＴＩ（Ｒａｄｉｏ Ｎｅｔｗｏｒｋ Ｔｅｍｐｏｒａｒｙ Ｉｄｅｎｔｉｆｉｅｒ）という）がマスキングされる。特定端末のためのＰＤＣＣＨであれば、端末の固有識別子、例えば、Ｃ－ＲＮＴＩ（Ｃｅｌｌ－ＲＮＴＩ）がＣＲＣにマスキングされることができる。即ち、ＣＲＣは、端末の固有識別子と共にスクランブルされることができる。特定端末のためのＲＮＴＩとしては、臨時（ｔｅｍｐｏｒａｒｙ）

C－RNTI、半持続的（semi-persistent）C－RNTIなどもある。臨時C－RNTIは、端末の臨時識別子であり、ランダムアクセス過程中に使われることができる。半持続的C－RNTIは、半持続的スケジューリング活性化を指示するために使われることができる。

【0055】

または、PCHを介して伝送されるページングメッセージのためのPDCCHであれば、ページング識別子、例えば、P－RNTI（Paging－RNTI）がCRCにマスキングされることができる。DL－SCHを介して伝送されるシステム情報（system information）のためのPDCCHであれば、システム情報識別子、例えば、SI－RNTI（System Information－RNTI）がCRCにマスキングされることができる。端末のランダムアクセスプリアンブルの伝送に対する応答であるランダムアクセス応答を指示するためのPDCCHであれば、RA－RNTI（Random Access－RNTI）がCRCにマスキングされることができる。次の表は、PDCCHにマスキングされる識別子の例を示す。

【0056】

【表2】

【表2】

タイプ(Type)	識別子(Identifier)	説明
端末-特定的 (UE-specific)	C-RNTI, tempucary C-RNTI, semi-persistent C-RNTI	端末の識別に使用
共用 (Common)	P-RNTI	ページングメッセージに使用
	SI-RNTI	システム情報に使用
	RA-RNTI	ランダムアクセス応答に使用

【0057】

C－RNTI、臨時C－RNTIまたは半持続的C－RNTIが使われるとき、PDCCHは該当する特定端末のための制御情報を運び、他のRNTIが使われるとき、PDCCHは、セル内の全ての端末が受信する共用制御情報を運ぶ。

【0058】

段階S120において、CRCが付加された制御情報にチャネルコーディングを遂行して符号化されたデータ（coded data）を生成する。段階S130において、PDCCHフォーマットに割り当てられたCCE集団レベルにともなう伝送率マッチング（rate matching）を遂行する。

【0059】

段階S140において、符号化されたデータを変調して変調シンボルを生成する。一つのPDCCHを構成する変調シンボルは、CCE集団レベルが1，2，4，8のうち一つであってもよい。段階S150において、変調シンボルを物理的なリソース要素（RE）にマッピング（CCE to RE mapping）する。

【0060】

図12は、PDCCH処理を示すフローチャートである。

【0061】

図12を参照すると、段階S210において、端末は、物理的なリソース要素をCCEにデマッピング（CCE to RE demapping）する。段階S220において、端末は、自分がどのCCE集団レベルにPDCCHを受信しなければならないか知らないため、各々のCCE集団レベルに対して復調（Demodulation）する。段階S230において、端末は、復調されたデータに伝送率デマッチング（rate dematching）を遂行する。端末は、自分があるDCIフォーマットを有する制御情報を受信しなければならないか知らないため、各々のDCIフォーマットに対して伝送率デマッチングを遂行する。段階S240において、伝送率デマッチングされたデータにコードレートに応じてチャネルデコーディングを遂行して、CRCをチェックしてエラー発生如何を検出する。エラーが発生しなければ、端末は、自分のPDCCHを検出したこと

である。もし、エラーが発生すれば，端末は、他のＣＣＥ集団レベルや、他のＤＣＩフォーマットに対してブラインドデコーディングを進行し続ける、段階Ｓ２５９において、自分のＰＤＣＣＨを検出した端末は、デコーディングされたデータにＣＲＣを除去して、端末に必要な制御情報を獲得する。

【００６２】

複数の端末に対する多重化された複数のＰＤＣＣＨが一つのサブフレームの制御領域内で伝送されることができる、端末は、ＰＤＣＣＨをモニタリング（ｍｏｎｉｔｏｒｉｎｇ）する。ここで、モニタリングとは、端末がモニタリングされるＤＣＩフォーマットに応じてＰＤＣＣＨの各々のデコーディングを試みることをいう。サブフレーム内で割り当てられた制御領域において，基地局は、端末に該当するＰＤＣＣＨがどこにあるかに関する情報を提供しない。端末は、サブフレーム内でＰＤＣＣＨ候補（ｃａｎｄｉｄａｔｅ）の集合をモニタリングして自分のＰＤＣＣＨを探す。これをブラインドデコーディング（ｂｌｉｎｄ　ｄｅｃｏｄｉｎｇ）またはブラインド検出（ｂｌｉｎｄ　ｄｅｔｅｃｔｉｏｎ）という。ブラインドデコーディングを介して、端末は、自分に伝送されたＰＤＣＣＨの識別（ｉｄｅｎｔｉｆｉｃａｔｉｏｎ）と該当ＰＤＣＣＨを介して伝送される制御情報のデコーディングとを同時に遂行する。例えば、該当するＰＤＣＣＨから自分のＣ－ＲＮＴＩをデマスキングしてＣＲＣエラーが検出されないと、端末は，自分のＰＤＣＣＨを検出することである。

【００６３】

ブラインドデコーディングのオーバーヘッド（ｏｖｅｒｈｅａｄ）を効果的に減少させるためにＰＤＣＣＨを介して伝送されるＤＣＩフォーマットの個数を限定されるように定義するようになる，ＰＤＣＣＨを用いて伝送される制御的な制御情報の種類よりＤＣＩフォーマットの個数がさらに小さくなる。ＤＣＩフォーマットは、複数の相異なる情報フィールドを含む。ＤＣＩフォーマットに応じて前記ＤＣＩフォーマットを構成する情報フィールドの種類、情報フィールドの個数，各情報フィールドのビットの数などが変えられる，また、ＤＣＩフォーマットに応じて前記ＤＣＩフォーマットに合う制御情報のサイズが変えられるようになる。多様な制御情報は，各々、限定された個数のＤＣＩフォーマットのうち一つのＤＣＩフォーマットを使用してＰＤＣＣＨ伝送が行われるようになる，即ち、任意のＤＣＩフォーマットは、二つ以上の異なる種類の制御情報伝送に使われることができる。これに伴い，制御情報は、ＤＣＩフォーマットの情報フィールドの値が特定の値として具体化される時、複数の情報フィールドのうち一部情報フィールドは必要ない場合がある，即ち、ＤＣＩフォーマットを構成する複数の情報フィールドのうち一部情報フィールドに具体的な値が定義されないことである。ＤＣＩフォーマットを構成する一部情報フィールドは、予備フィールド（ｒｅｓｅｒｖｅｄ　ｆｉｅｌｄ）になって任意値（ａｒｂｉｔｒａｒｙ　ｖａｌｕｅ）を有する状態で保留される（ｒｅｓｅｒｖｅｄ）。複数種類の異質的制御情報を一つのＤＣＩフォーマットにサイズ適応（ｓｉｚｅ　ａｄａｐｔａｔｉｏｎ）させるためである。然しながら、このように、制御情報伝送に予備フィールドが存在する場合、何らの機能に用いることができない無意味な予備フィールド伝送のために、基地局は，伝送エネルギー，伝送パワーを非効率的に消耗するようになる。従って，ＤＣＩフォーマットに合せて制御情報を生成する時、ＤＣＩフォーマットを構成する複数の情報フィールドのうち使われない情報フィールドを活用することができる方法が必要である。

【００６４】

図１３は、ＤＣＩフォーマットを構成する複数の情報フィールドのうち使われない情報フィールドを活用することができる方法の例を示す。

【００６５】

図１３を参照すると、相異なる種類の制御情報である制御情報Ａ，Ｂ，Ｃは、グループ化（ｇｒｏｕｐｉｎｇ）されて一つのＤＣＩフォーマットを使用する。相異なる種類の制御情報Ａ、Ｂ、Ｃ（Ｃｏｎｔｒｏｌ　Ｉｎｆｏｒｍａｔｉｏｎ　Ａ，Ｂ，Ｃ）は、一つのＤＣＩフォーマットに合う。ＤＣＩフォーマットは，複数の相異なる情報フィールドで構

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成される。制御情報A（Control information A）は、該当DCIフォーマットの全ての情報フィールドに特定値が付与されて具体化される。制御情報BまたはC（Control information B or C）は、該当DCIフォーマットの一部情報フィールドに特定値が付与されて具体化される。グループ内で制御情報Aの情報ビットサイズが最も大きい。制御情報Aは、該当DCIフォーマットの全ての情報フィールドを意味のあるように構成する場合であるためである。制御情報Aの情報ビットサイズが基準情報ビットサイズとなる。制御情報BまたはCは、基準情報ビットサイズと同じサイズを有するためにダミー情報（dummy information）を追加する。これによって、グループ内の制御情報は、全て同じ情報ビットサイズで固定されるる。

【００６６】

このように、複数種類の異質的な制御情報は、グループ化されて任意に指定された一つのDCIフォーマットに合う。個別制御情報は、該当DCIフォーマットを構成する情報フィールドに特定の値をマッピングすることによって具体化される。グループ内の任意の制御情報は、該当DCIフォーマットの全ての情報フィールドに特定値を付与して具体化されることができる。一方、グループ内の他の制御情報は、該当DCIフォーマットの一部情報フィールドに特定値を付与して具体化されることができる。即ち、該当DCIフォーマットの他の情報フィールドは、制御情報の具体化の際、必要でない。このとき、制御情報の具体化において用いられる情報フィールドの全体サイズを情報ビットサイズとして定義することができる。前者の制御情報の情報ビットサイズが最も大きく、後者の制御情報の情報ビットサイズは相対的に小さい。

【００６７】

制御情報がDCIフォーマットの全ての情報フィールドに特定値を付与して具体化される場合の情報ビットサイズを基準情報ビットサイズとする。基準情報ビットサイズは、DCIフォーマットを構成する情報フィールドの全体サイズ及び／またはDCIフォーマット自体のサイズを意味する。グループ内の他の制御情報が基準情報ビットサイズより小さい情報ビットサイズを有する場合、基準情報ビットサイズと同じになるようにナル情報を追加する。これはDCIフォーマットで指定される全ての情報フィールドのうち一部情報フィールドに対して値を指定することによって特定制御情報を具体化する場合、値が指定されない残りの情報フィールドをナル情報として使用することである。ナル情報として使われる情報フィールドをエラー確認フィールドと呼ぶこともできる。

【００６８】

ナル情報は、DCIフォーマットに合う制御情報が基準情報ビットサイズと同じになるように追加される情報である。DCIフォーマットに従って制御情報を生成する時，使用しない一部情報フィールドをナル情報として使用することができる。ナル情報は、特定値を有する。例えば、ナル情報として使われる情報フィールドを全部‘０’ビットまたは全部‘１’ビットの値に指定することができる。または、ナル情報として使われるフィールドを基地局と端末が予め知っている二進符号列の値に指定することができる。このような二進符号列を二進スクランブル符号列として名称化することができる。このような符号列生成の例として、基地局と端末の両方が知っている二進ビット列、基地局と端末が同じ入力パラメータを介して生成するm－シーケンスまたはゴールド（gold）シーケンス生成方式に従って導出されることができる。

【００６９】

ナル情報として使われる情報フィールドは、基地局と端末との間に予め設定されたり、基地局が端末にナル情報として使われる情報フィールドに対する情報を知らせることもできる。例えば、基地局は、端末にRRCシグナリングやシステム情報を介してナル情報として使われる情報フィールドに対する情報を知らせることができる。

【００７０】

端末は、CRCエラー検出を含むPDCCHをモニタリングの際、他の端末のPDCCHを自分のものであると認識したり，実際RNTIとは異なるRNTIでデマスキン

グの際、ＣＲＣエラーが検出されなく、正しくデコーディングされたと認識するエラーが発生する場合がある。これをフォールスポジティブエラー（ｆａｌｓｅ　ｐｏｓｉｔｉｖｅ　ｅｒｒｏｒ）という。フォールスポジティブエラーの発生確率を低くするために、ナル情報を仮想（ｖｉｒｔｕａｌ）ＣＲＣまたは付加的なエラーチェックのためのプローブ（ｐｒｏｂｅ）として活用することができる。

【００７１】

図１４は、本発明の実施例に係る制御情報検出方法を示す。

【００７２】

図１４を参照すると、端末は、制御チャネルをモニタリングして、ＣＲＣエラーを確認する（Ｓ３１０）。制御チャネルは、ＰＤＣＣＨであってもよい。ＣＲＣエラーが検出されれば、端末は、制御チャネルのモニタリングを遂行し続ける（Ｓ３２０）。ＣＲＣエラーが検出されないと、端末は、ＣＲＣエラーが検出されない制御チャネルｉの制御情報に含まれたフィールドのうちエラー確認フィールドの値が特定値と一致するか否かを確認する（Ｓ３３０）。エラー確認フィールドは、制御情報を構成する複数の情報フィールドのうちナル情報として扱われる情報フィールドである。

【００７３】

エラー確認フィールドの値が特定値と一致しないと、端末は、制御チャネルのモニタリングを遂行し続ける（Ｓ３４０）。エラー確認フィールドの値が特定値と一致すれば、端末は、ＣＲＣエラーが検出されない制御チャネルｉの制御情報を自分の制御情報として検出する（Ｓ３５０）。即ち、ナル情報は、端末の知っている指定された特定値にデコーディングされた場合にのみ該当ＰＤＣＣＨを介して伝送された制御情報を端末の制御情報として受信する。

【００７４】

以下、ナル情報を使用する制御情報伝送方法を具体例として記述する。他の用途のために定義されたＰＤＣＣＨのＤＣＩフォーマットを用いて半持続的スケジューリング（ＳＰＳ）活性化（ａｃｔｉｖａｔｉｏｎ）を指示する制御情報が伝送される場合を仮定する。即ち、半持続的スケジューリング活性化を指示する制御情報と他の種類の制御情報とが、一つのＤＣＩフォーマットを使用する場合である。半持続的スケジューリングは、アップリンクＶｏＩＰまたはダウンリンクＶｏＩＰ伝送のために使われることができる。

【００７５】

無線リソーススケジューリング（Ｒｅｓｏｕｒｃｅ　Ｓｃｈｅｄｕｌｉｎｇ）方式としては、動的スケジューリング（Ｄｙｎａｍｉｃ　Ｓｃｈｅｄｕｌｉｎｇ）方式、持続的スケジューリング（Ｐｅｒｓｉｓｔｅｎｔ　Ｓｃｈｅｄｕｌｉｎｇ）方式、半持続的スケジューリング（ＳＰＳ）方式などがある。動的スケジューリング方式は、データを送信または受信する時ごとに、制御信号を介するスケジューリング情報が要求される方式である。持続的スケジューリング方式は、予め設定された情報を用いて、データの送信または受信する時ごとに制御信号を介するスケジューリング情報が要求されない方式である。半持続的スケジューリング方式は、半持続的スケジューリングＩＫ間（ｓｅｍｉ－ｐｅｒｓｉｓｔｅｎｔ　ｓｃｈｅｄｕｌｉｎｇ　ｉｎｔｅｒｖａｌ）の間に、データの送信または受信する時ごとに制御信号を介するスケジューリング情報が要求されない方式である。半持続的スケジューリングＩＫ間は、半持続的スケジューリング活性化を指示する制御情報の受信によって開始されて、半持続的スケジューリング非活性化を指示する制御情報の受信によって終了されることができる。または、半持続的スケジューリングＩＫ間は、ＲＲＣシグナリングを介して設定されることもできる。

【００７６】

図１５は、動的スケジューリング方式を用いたダウンリンクデータ伝送を示す流れ図である。基地局（ｂａｓｅ　ｓｔａｔｉｏｎ、ＢＳ）は、ＰＤＳＣＨを介してダウンリンクデータを伝送する時ごとに、端末（ｕｓｅｒ　ｅｑｕｉｐｍｅｎｔ、ＵＥ）にＰＤＣＣＨを介してダウンリンクグラント（ＤＬ　ｇｒａｎｔ）を伝送する。端末は、ＰＤＣＣＨを介して受信したダウンリンクグラントを用いてＰＤＳＣＨを介して伝送されるダウンリン

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クデータを受信する。基地局は，ダウンリンクチャネル状態（ｃｈａｎｎｅｌ　ｃｏｎｄｉｔｉｏｎ）に応じて適切に無線リソースをスケジューリングできる利点がある。

【００７７】

図１６は、動的スケジューリング方式を用いたアップリンクデータ伝送を示す流れ図である。端末は，ＰＵＳＣＨを介するアップリンクデータを伝送する前、基地局からアップリンクグラント（ＵＬ　Ｇｒａｎｔ）を介して無線リソースの割当を受ける。アップリンクグラントは，ＰＤＣＣＨを介して伝送される。

【００７８】

ＶｏＩＰ（Ｖｏｉｃｅ　ｏｖｅｒ　ＩＰ）は、ＩＰ（Ｉｎｔｅｒｎｅｔ　Ｐｒｏｔｏｃｏｌ）を介して音声データを伝送するサービスであって、従来ＣＳ（Ｃｉｒｃｕｉｔ　Ｓｗｉｔｃｈｅｄ）領域（ｄｏｍａｉｎ）で提供した音声データをＰＳ（Ｐａｃｋｅｔ　Ｓｗｉｔｃｈｅｄ）領域で提供する方法である。ＣＳ基盤音声サービスにおいては、エンドツーエンド（ｅｎｄ－ｔｏ－ｅｎｄ）に連結を維持して音声データを伝送し、一方、ＶｏＩＰでは連結を維持しないまま（ｃｏｎｎｅｃｔｉｏｎ－ｌｅｓｓ）音声データを伝送するため、ネットワークリソースを相当効率的に使用することができる長所がある。

【００７９】

無線通信技術が発展することによって使用者データも相当早く増加しており、制限されたネットワークリソースの効率的利用のために、最近、既存のＣＳ基盤サービスがＰＳ基盤サービスに置き換えられている。また、ＶｏＩＰも、同一脈絡に開発されており，今後大部分の無線通信システムでは全ての音声サービスがＶｏＩＰを介して提供されること予想される。

【００８０】

ＰＳ基盤音声サービスを効果的に提供するためにＲＴＰ（Ｒｅａｌ－ｔｉｍｅ　Ｔｒａｎｓｐｏｒｔ　Ｐｒｏｔｏｃｏｌ）が開発され、また、ＲＴＰを制御するためのプロトコルであるＲＴＣＰ（ＲＴＰ　Ｃｏｎｔｒｏｌ　Ｐｒｏｔｏｃｏｌ）も開発された。ＲＴＰは、パケットごとに時間スタンプ（ｔｉｍｅ　ｓｔａｍｐ）情報を載せているためジッタ（ｊｉｔｔｅｒ）問題を解決することができて、ＲＴＣＰを介してＲＴＰパケットの損失（ｌｏｓｓ）を報告することによって、伝送率制御（ｒａｔｅ　ｃｏｎｔｒｏｌ）を介してＦＥＲ（Ｆｒａｍｅ　Ｅｒｒｏｒ　ｒａｔｅ）を減らすことができる。ＲＴＰ／ＲＴＣＰの以外にもＳＩＰ（Ｓｅｓｓｉｏｎ　Ｉｎｉｔｉａｔｉｏｎ　Ｐｒｏｔｏｃｏｌ）及びＳＤＰ（Ｓｅｓｓｉｏｎ　Ｄｅｓｃｒｉｐｔｉｏｎ　Ｐｒｏｔｏｃｏｌ）なども開発されてエンドツーエンドに仮想連結（ｖｉｒｔｕａｌ　ｃｏｎｎｅｃｔｉｏｎ）を維持するようにして遅延問題も相当部分解消することができる。

【００８１】

図１７は、ＶｏＩＰにおけるトラフィックモデルを示す例示図である。

【００８２】

図１７を参考すると、ＶｏＩＰにおいて発生する音声パケットの種類は、対話区間（Ｔａｌｋ　ｓｐｕｒｔ）で発生するパケットと沈黙区間（Ｓｉｌｅｎｃｅ　Ｐｅｒｉｏｄ）で発生するパケットとに分けられる。例えば，１２．２ｋｂｐｓ　ＡＭＲ（Ａｄａｐｔｉｖｅ　Ｍｕｌｔｉ－Ｒａｔｅ）を仮定すれば、対話区間ではＲＴＰパケットが２０ｍｓの周期に発生して、３５～４９バイトの大きさを有する。そして、沈黙区間でＲＴＰパケットが１６０ｍｓ周期に発生して、１０～２４バイトの大きさを有する。

【００８３】

ＶｏＩＰのような音声サービスでは一定の周期にパケットが生成されれば、生成されるパケットの大きさが比較的小さく一定である。従って、ＶｏＩＰは、一般的に持続的スケジューリング方式または半持続的スケジューリング方式を使用する。持続的スケジューリング方式の場合，無線ベアラ（Ｒａｄｉｏ　Ｂｅａｒｅｒ）設定過程でこれを予め予測して無線リソースを持続的に割り当てて、これに伴いスケジューリング情報を含む制御信号がなくてもパケットを送信または受信する。持続的スケジューリング方式によってデータを送信または受信する時、スケジューリング情報が提供されなく、予め設定された無線リ

ソースを用いるため、データを送信または受信する時点におけるチャネル状態が予測されなくてチャネル状態が変えられた場合に伝送エラーが生まることがある。VoIPは、対話区間が半持続的スケジューリング区間として使用されるとき、半持続的スケジューリング方式の使用に適する。

【００８４】

図１８は、半持続的スケジューリング方式を用いたダウンリンクデータ伝送を示す流れ図である。基地局は、端末にＰＤＣＣＨを介してリソース割当情報の半持続的スケジューリング活性化を指示する制御情報を伝送する。半持続的スケジューリング区間中、端末は、基地局からリソース割当情報を用いてＰＤＳＣＨを介してＶｏＩＰデータを受信することができる。

【００８５】

図１９は、半持続的スケジューリング方式を用いたアップリンクデータ伝送を示す流れ図である。基地局は、端末にＰＤＣＣＨを介してリソース割当情報の半持続的スケジューリング活性化を指示する制御情報を伝送する。半持続的スケジューリング区間中、端末は、基地局にリソース割当情報を用いてＰＵＳＣＨを介してＶｏＩＰデータを伝送することができる。

【００８６】

まず、半持続的スケジューリング活性化を指示する制御情報をＤＣＩフォーマット０を介して伝送する方法を説明する。ＤＣＩフォーマット０を介してＰＵＳＣＨのスケジューリングのための制御情報と半持続的スケジューリング活性化を指示する制御情報とを伝送することができる。半持続的スケジューリング活性化は、アップリンクＶｏＩＰ伝送のために使われることができる。

【００８７】

次の表は、ＤＣＩフォーマット０が伝送する制御情報の例を示す。

【００８８】

【表３】

【表３】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Hopping Flag	1
(3)	Resource block assignment and hopping resource allocation	$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme and redundancy version	5
(5)	New data Indicator	1
(6)	TPC command for scheduled PUSCH	2
(7)	Cyclic shift for DM RS	3
(8)	UL index (TDD)	2
(9)	CQI request	1

【００８９】

ＤＣＩフォーマット０は、複数の情報フィールドを含む。情報フィールドには、（１）フラッグ（Ｆｌａｇ）フィールド、（２）ホッピングフラッグ（Ｈｏｐｐｉｎｇ ｆｌａｇ）フィールド、（３）リソースブロック割当及びホッピングリソース割当（Ｒｅｓｏｕｒｃｅ ｂｌｏｃｋ ａｓｓｉｇｎｍｅｎｔ ａｎｄ ｈｏｐｐｉｎｇ ｒｅｓｏｕｒｅ ａｌｏｃａｔｉｏｎ）フィールド、（４）ＭＣＳ（Ｍｏｄｕｌａｔｉｏｎ ａｎｄ Ｃｏｄｉｎｇ Ｓｃｈｅｍｅ）及びリダンダンシバージョン（Ｒｅｄｕｎｄａｎｃｙ ｖｅｒｓｉｏｎ）フィールド、（５）新しいデータインジケータ（Ｎｅｗｄａｔａ ｉｎｄｉｃａｔｏｒ）フィールド、（６）ＴＰＣ命令（ＴＰＣ ｃｏｍｍａｎｄ）フィールド、（７）サイクリックシフト（Ｃｙｃｌｉｃ ｓｈｉｆｔ）フィールド、（８）アップリンクインデックス（ＵＬ ｉｎｄｅｘ）フィールド、（９）ＣＱＩ要請（ｒｅｑｕｅｓｔ

）フィールドで構成される。各情報フィールドのビットの大きさは例示に過ぎず、フィールドのビットの大きさを制限することではない。

【００９０】

フラグフィールドは、フォーマット０及びフォーマット１Ａの区別のための情報フィールドである。リソースブロック割当及びホッピングリソース割当フィールドは、ホッピングＰＵＳＣＨまたは非ホッピング（ｎｏｎ－ｈｏｐｐｉｎｇ）ＰＵＳＣＨに応じてフィールドのビットの大きさが変えられる。非ホッピングＰＵＳＣＨのためのリソースブロック割当及びホッピングリソース割当フィールドは、

【数１】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$$

ビットをアップリンクサブフレーム内の最初のスロットのリソース割当に提供する。ここで、

【数２】

$$N_{RB}^{UL}$$

は、アップリンクスロットに含まれるリソースブロックの数であり、セルで設定されるアップリンク伝送帯域幅に依存する。ホッピングＰＵＳＣＨのためのリソースブロック割当及びホッピングリソース割当フィールドは、

【数３】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil - N_{UL_hop}$$

ビットをアップリンクサブフレーム内の最初のスロットのリソース割当に提供する。

【００９１】

ＰＤＳＣＨに対するチャネル割当の制御情報は、前述の全てのフィールドを使用して表現される。これに伴い、ＰＤＳＣＨに対するチャネル割当のためのＤＣＩフォーマット１Ａは、基準情報サイズ（ｒｅｆｅｒｅｎｃｅ　ｉｎｆｏｒｍａｔｉｏｎ　ｓｉｚｅ）を有する制御情報になる。

【００９２】

フォーマット０の情報ビットの数がフォーマット１Ａの情報ビットの数より少ない場合、ペイロードの大きさがフォーマット１Ａのペイロードの大きさと同一になる時までフォーマット０に‘０’を付加する（ａｐｐｅｎｄ）。

【００９３】

ＰＵＳＣＨのスケジューリングのための制御情報は、前述の全てのフィールドを使用して表現される。これに伴い、ＰＵＳＣＨのスケジューリングのためのＤＣＩフォーマット０は、基準情報ビットサイズ（ｒｅｆｅｒｅｎｃｅ　ｉｎｆｏｒｍａｔｉｏｎ　ｂｉｔ　ｓｉｚｅ）を有する制御情報になる。

【００９４】

半持続的スケジューリング活性化のための制御情報をＤＣＩフォーマット０を介して伝送する場合、ＤＣＩフォーマット０の基準情報ビットサイズに合せるためのナル情報は、フォーマット１Ａとのペイロードの大きさを合うためにパッディングされる‘０’ビットと共に仮想（ｖｉｒｔｕａｌ）ＣＲＣチェックのために使われることができる。

【００９５】

以下、半持続的スケジューリング活性化のための制御情報をＤＣＩフォーマット０を介して伝送する場合、ナル情報として使用することができる情報フィールドの例を説明する。

【００９６】

（１）第１の実施例

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ダウンリンクＶｏＩＰ伝送に対する非周期的（ａｐｅｒｉｏｄｉｃ）ＰＵＳＣＨフィードバック（ｆｅｅｄｂａｃｋ）なしに端末がＰＵＣＣＨ基盤フィードバックのみを遂行する状況を考慮する場合，ＣＱＩ要請フィールドをナル情報として使用することができる。

【００９７】

次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第１の実施例を示す。

【００９８】

【表４】

【表４】

	情報フィールド	Bit(s)
:	:	:
(9)	**CQI request** －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1

【００９９】

アップリンク半持続的スケジューリング活性化のための制御情報の場合、ＣＱＩ要請フィールドを‘０’の値に指定する。ＣＱＩ要請フィールドを除いたＤＣＩフォーマット０の残りのフィールドは、表３で説明した通りである。端末は、ダウンリンクＶｏＩＰ伝送に対する非周期的ＰＵＳＣＨフィードバックなしにＰＵＣＣＨ基盤フィードバックのみを遂行すると仮定する。

【０１００】

（２）第２の実施例

アップリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、閉途の閉ループ（ｃｌｏｓｅｄ－ｌｏｏｐ）電力制御が必要なく、開ループ（ｏｐｅｎ－ｌｏｏｐ）系列またはハイブリット系列の電力制御に基づいてＶｏＩＰ伝送の送信電力を決定すると設定する。半静的（ｓｅｍｉ－ｓｔａｔｉｃ）リソースブロック割当状況まで勘案してスケジュールされたＰＵＳＣＨのためのＴＰＣ命令フィールドを使用しない時、ＴＰＣ命令フィールドをナル情報として使用することができる。

【０１０１】

次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第２の実施例を示す。

【０１０２】

【表５】

【表５】

	情報フィールド	Bit(s)
:	:	:
(6)	**TPC command for scheduled PUSCH** －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
.	.	.

【０１０３】

アップリンク半持続的スケジューリング活性化のための制御情報の場合、ＴＰＣ命令フィールドの値を全部‘０’に指定する。ＴＰＣ命令フィールドを除いたＤＣＩフォーマット０の残りのフィールドは、表３で説明した通りである。

【０１０４】

（３）第３の実施例

アップリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、新しいデータインジケータフィールドを特定の情報伝送に暗示的（ｉｍｐｌｉｃｉｔ）に用いなくてもよい。この場合，新しいデータインジケータフィールドをナル情報として使用することができる。

【０１０５】
次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第３の実施例を示す。
【０１０６】
【表６】
【表６】

	情報フィールド	Bit(s)
:	:	:
(5)	New data indicator －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1
:	:	:

。
【０１０７】
アップリンク半持続的スケジューリング活性化のための制御情報の場合、新しいデータインジケータフィールドの値を‘０’に指定する。新しいデータインジケータフィールドを除いたＤＣＩフォーマット０の残りのフィールドは、表３で説明した通りである。
【０１０８】
（４）第４の実施例
アップリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、ＭＣＳまたはリダンダンシバージョンをＭＣＳ及びリダンダンシバージョンフィールドで指示せずに別途のシグナリングを用いることができる。ＭＣＳをＭＣＳ及びリダンダンシバージョンフィールドで指示せずに別途のシグナリングを用いる場合、５ビットのうち３ビットをナル情報として使用することができる。リダンダンシバージョンをリダンダンシバージョンフィールドで指示せずに別途のシグナリングを用いる場合、５ビットのうち２ビットをナル情報として使用することができる。ＭＣＳ及びリダンダンシバージョンの両方とも別途のシグナリングを用いる場合、５ビットを全部ナル情報として使用することができる。
【０１０９】
次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第４の実施例を示す。
【０１１０】
【表７】
【表７】

	情報フィールド	Bit(s)
:	:	:
(4)	Modulation and coding scheme and redundancy version －アップリンク半持続的スケジューリングの活性化のために、５ビットのうちN情報ビットが０にセッティング(N=2, 3, or 5)	5
:	:	:

【０１１１】
アップリンク半持続的スケジューリング活性化のための制御情報の場合、ＭＣＳ及びリダンダンシバージョンフィールドの５ビットのうち２、３または５ビットを‘０’に指定する。ＭＣＳ及びリダンダンシバージョンフィールドを除いたＤＣＩフォーマット０の残りのフィールドは、表３で説明した通りである。
【０１１２】
（５）第５の実施例
アップリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、ＤＭＲＳのためのサイクリックシフトフィールドを別途に指示しなくてもよい。この場合、サイクリックシフトフィールドをナル情報として使用する。

【０１１２】
次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第５の実施例を示す。
【０１１４】
【表８】
【表８】

	情報フィールド	Bit(s)
:	:	:
(7)	**Cyclic shift for DM RS** －アップリンク半持続的スケジューリングの活性化のために，情報ビットが０にセッティング	3
:	:	:

【０１１５】
アップリンク半持続的スケジューリング活性化のための制御情報の場合、サイクリックシフトフィールドの値を全部‘０’に指定する。ＴＰＣ命令フィールドを除いたＤＣＩフォーマット０の残りのフィールドは、表３で説明した通りである。
【０１１６】
（６）第６の実施例
アップリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、ＶｏＩＰが全体システム帯域幅（ｂａｎｄｗｉｄｔｈ）上で割り当てられることができる帯域幅を限定してもよい。この場合、リソースブロック割当及びホッピングリソース割当フィールドをナル情報として使用することができる。

【数４】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$$

ビットのうちＭビットをナル情報として使用することができる。ここで、Ｍは、１～

【数５】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil-1$$

の自然数である。
【０１１７】
次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第６の実施例を示す。
【０１１８】
【表９】
【表９】

	情報フィールド	Bit(s)
:	:	:
(3)	**Resource block assignment and hopping resource allocation** －アップリンク半持続的スケジューリングの活性化のために、$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$ビットのうちM情報ビットが０にセッティング	$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
:	:	:

【０１１９】
アップリンク半持続的スケジューリング活性化のための制御情報の場合、リソースブロック割当及びホッピングリソース割当フィールドの

【数６】

$$\left\lceil \log_2\left(N_{BB}^{UL}\left(N_{SB}^{UL}+1\right)/2\right)\right\rceil$$

ビットのうちＭビットを‘０’に指定する。ここで，Ｍは、１～

【数７】

$$\left\lceil \log_2\left(N_{BB}^{UL}\left(N_{SB}^{UL}+1\right)/2\right)\right\rceil-1$$

の自然数である。リソースブロック割当及びホッピングリソース割当フィールドを除いたＤＣＩフォーマット０の残りのフィールドは，表３で説明した通りである。

【０１２０】

（７）第７の実施例

ＤＣＩフォーマット０上の情報フィールドのうち複数の情報フィールドの組合せをナル情報として使用する。任意の情報フィールドを組合せてナル情報として使用することができる。全情報フィールドをナル情報として使用することもできる。第１ないし第６の実施例でナル情報として使われる各々の情報フィールドが複数の情報フィールドの組合せに使われることができる。例えば、第４の実施例で説明したように、ＭＣＳまたはリダンダンシバージョンを別途のシグナリングを用いる場合、ＭＣＳ及びリダンダンシバージョンフィールドの５ビットのうち２、３または５ビットを複数の情報フィールドの組合せに活用することができる。ＦＤＤシステムの場合、第１ないし第６の実施例でナル情報として使われる各々の情報フィールドに付加してアップリンクインデックスフィールドのビットをナル情報として使用することができる。

【０１２１】

（８）第８の実施例

第８の実施例は、第７の実施例の具体的な実施例である。ＤＣＩフォーマット０を介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当及びホッピングリソース割当フィールド、ＭＣＳ及びリダンダンシバージョンフィールド、ＴＰＣ命令フィールド、サイクリックシフトフィールド、及びＣＱＩ要請フィールドの組合せをナル情報として使用することができる。

【０１２２】

次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第８の実施例を示す。

【０１２３】

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【表１０】

【表１９】

	情報フィールド	Bit(s)
:	:	:
(3)	Resource block assignment and hopping resource allocation ーアップリンク半持続的スケジューリングの活性化のために、$\lceil \log_2 \left(N_{RB}^{UL} \left(N_{RB}^{UL}+1 \right)/2 \right) \rceil$ ビットのうちM情報ビットが０にセッティング	$\lceil \log_2 \left(N_{RB}^{UL} \left(N_{RB}^{UL}+1 \right)/2 \right) \rceil$
(4)	Modulation and coding scheme and redundancy version ーアップリンク半持続的スケジューリングの活性化のために、５ビットのうちN情報ビットが０にセッティング(N=2, 3, or 5)	5
(5)	New data indicator	1
(6)	TPC command for scheduled PUSCH	2
(7)	Cyclic shift for DM RS ーアップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3
(8)	UL index (TDD)	2
(9)	CQI request ーアップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1

【０１２４】

ここで、リソースブロック割当及びホッピングリソース割当フィールドのMを２、ＭＣＳ及びリダンダンシバージョンフィールドのＮを１のように具体的に設定してもよい。

【０１２５】

（９）第９の実施例

第９の実施例は、第７の実施例の具体的な実施例である。ＤＣＩフォーマット０を介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当及びホッピングリソース割当フィールド、ＭＣＳ及びリダンダンシバージョンフィールド、新しいデータインジケータフィールド、ＴＰＣ命令フィールド、サイクリックシフトフィールド、及びＣＱＩ要請フィールドの組合せをナル情報として使用することができる。第８の実施例の情報フィールド組合せに新しいデータインジケータフィールドが追加されてナル情報として使われる場合である。

【０１２６】

次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第９の実施例を示す。

【０１２７】

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【表１１】

【表１１】

	情報フィールド	Bit(s)
1	2	3
(3)	Resource block assignment and hopping resource allocation －アップリンク半持続的スケジューリングの活性化のために、$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$ビットのうちM情報ビットが０にセッティング	$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme and redundancy version －アップリンク半持続的スケジューリングの活性化のために、５ビットのうちN情報ビットが０にセッティング(N=2, 3, or 5)	5
(5)	New data indicator －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1
(6)	TPC command for scheduled PUSCH －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(7)	Cyclic shift for DM RS －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3
(8)	UL index (TDD)	2
(9)	CQI request －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1

【０１２８】

ここで、リソースブロック割当及びホッピングリソース割当フィールドのMを２、ＭＣＳ及びリダンダンシバージョンフィールドのＮを１のように具体的に設定してもよい。

【０１２９】

（１０）第１０の実施例

第１０の実施例は、第７の実施例の具体的な実施例である。ＤＣＩフォーマットｏを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当及びホッピングリソース割当フィールドと、ＭＣＳ及びリダンダンシバージョンフィールドとの関係に応じて、前記二つのフィールドに対してナル情報を使用することができる。ＲＲＣにおける別途指示によって二つのフィールドを連係することができる。前記二つのフィールド外に、ＴＰＣ命令フィールド、サイクリックシフトフィールド、及びＣＱＩ要請フィールドの組合せをナル情報として使用することができる。

【０１３０】

次の表は、ＰＵＳＣＨのスケジューリング及び半持続的スケジューリング活性化のためのＤＣＩフォーマットｏが伝送する制御情報の第１０の実施例を示す。

【０１３１】

【表１２】

【Ｔａｂｌｅ１２】

	情報フィールド	Bit(s)
:	:	:
(3)	Resource block assignment and hopping resource allocation	$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme and redundancy version －アップリンク半持続的スケジューリングの活性化のために、"Resource block assignment and hopping resource allocation"及び"Modulation and coding scheme and redundancy version"のうちＲ情報ビットが０にセッティング	5
(5)	New data indicator	1
(6)	TPC command for scheduled PUSCH －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(7)	Cyclic shift for DM RS －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3
(8)	UL index (TDD)	2
(9)	CQI request －アップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1

【０１３２】

ここで、Ｒは、１，２，…、または

【数８】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil+4$$

ビットであってもよい。または、Ｒを３または４のように具体的に設定してもよい。

【０１３３】

（３１）第１１の実施例

第１１の実施例は、第７の実施例の具体的な実施例である。ＤＣＩフォーマット０を介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、第１０の実施例の情報フィールド組合せに新しいデータインジケータフィールドが追加されてナル情報として使われる場合である。

【０１３４】

次の表は、ＰＵＳＣＨのスケジューリング及び半永久的スケジューリング活性化のためのＤＣＩフォーマット０が伝送する制御情報の第１１の実施例を示す。

【０１３５】

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【表１３】

【表１３】

	情報フィールド	Bit(s)
:	:	:
(3)	**Resource block assignment and hopping resource allocation**	$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
(4)	**Modulation and coding scheme and redundancy version** ーアップリンク半持続的スケジューリングの活性化のために、"**Resource block assignment and hopping resource allocation**"及び"**Modulation and coding scheme and redundancy version**"のうちR情報ビットが０にセッティング	5
(5)	**New data indicator** ーアップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1
(6)	**TPC command for scheduled PUSCH** ーアップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(7)	**Cyclic shift for DM RS** ーアップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3
(8)	**UL index (TDD)**	2
(9)	**CQI request** ーアップリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1

【０１３６】

ここで、Ｒは、１、２、一、または

【数９】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil+4$$

ビットであってもよい、または、Ｒを３または４のように具体的に設定してもよい。

【０１３７】

次に、半持続的スケジューリング活性化を指示する制御情報をＤＣＩフォーマット１Ａを介して伝送する方法を説明する。ＤＣＩフォーマット１Ａを介して一つのＰＤＳＣＨコードワードの簡単な（ｃｏｍｐａｃｔ）スケジューリングのための制御情報と半持続的スケジューリング活性化を指示する制御情報とを伝送することができる。半持続的スケジューリング活性化は、アップリンクＶｏＩＰ伝送のために使われることができる。

【０１３８】

次の表は、ＤＣＩフォーマット１Ａが伝送する制御情報の例を示す。

【０１３９】

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【表１４】

【Ｔａｂｌｅ１４】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme	5
(5)	HARQ process number	3 or 4
(6)	New data indicator	1
(7)	Redundancy version	2
(8)	TPC command for scheduled PUCCH	2
(9)	Downlink Assignment Index (TDD)	2

【０１４０】

ＤＣＩフォーマット１Ａは、複数の情報フィールドを含む。情報フィールドには、（１）フラッグ（Ｆｌａｇ）フィールド、（２）地域化された（ｌｏｃａｌｉｚｅｄ）／分散された（ｄｉｓｔｒｉｂｕｔｅｄ）ＶＲＢ（Ｖｉｒｔｕａｌ　Ｒｅｓｏｕｒｃｅ　Ｂｌｏｃｋ）割当フラッグフィールド、（３）リソースブロック割当フィールド、（４）ＭＣＳ（Ｍｏｄｕｌａｔｉｏｎ　ａｎｄ　Ｃｏｄｉｎｇ　Ｓｃｈｅｍｅ）フィールド、（５）ＨＡＲＱ（Ｈｙｂｒｉｄ　Ａｕｔｏｍａｔｉｃ　Ｒｅｐｅａｔ　ＲｅＱｕｅｓｔ）プロセス番号フィールド、（６）新しいデータインジケータ（Ｎｅｗ　ｄａｔａ　ｉｎｄｉｃａｔｏｒ）フィールド、（７）リダンダンシバージョン（Ｒｅｄｕｎｄａｎｃｙ　ｖｅｒｓｉｏｎ）フィールド、（８）ＴＰＣ命令（ＴＰＣ　ｃｏｍｍａｎｄ）フィールド、（９）ダウンリンク割当インデックスフィールドで構成される。各情報フィールドのビットの大きさは、例示に過ぎず、フィールドのビットの大きさを制限することではない。

【０１４１】

フラッグフィールドは、フォーマット０及びフォーマット１Ａの識別のための情報フィールドである。もし、ＤＣＩフォーマット１ＡのＣＲＣがＲＡ－ＲＮＴＩ、Ｐ－ＲＮＴＩまたはＳＩ－ＲＮＴＩでスクランブルされた場合、フラッグフィールドのビットは、ＴＢＳ（Ｔｒａｎｓｐｏｒｔ　Ｂｌｏｃｋ　Ｓｉｚｅ）テーブルのコラム

【数１０】

$N_{PRB}^{L_1}$

を指示する。フラッグフィールドが‘０’であれば、

【数１１】

$N_{PRB}^{L_1}$

は２であり、フラッグフィールドが‘１’であれば、

【数１２】

$N_{PRB}^{L_1}$

はスケーラブルである。その他、フラックフィールドは、ＤＣＩフォーマットを指示する。

【０１４２】

リソースブロック割当フィールドは、地域化されたＶＲＢまたは分散されたＶＲＢに応じてフィールドのビットの大きさが変えられることができる。地域化されたＶＲＢのためのリソースブロック割当フィールドは、

【数１３】

$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$

ビットをリソース割当に提供する。ここで、

【数１４】

$N_{RB_1}^{DL}$

は、ダウンリンクスロットに含まれるリソースブロックの数であり、セルで設定されるダウンリンク伝送帯域幅に従属する。分散されたＶＲＢのためのリソースブロック割当フィールドは、

【数１５】

N_{RB}^{DL}

が５０未満である場合及び

【数１６】

N_{RB}^{DL}

が５０以上である場合に応じて変えられる。

【数１７】

N_{RB}^{DL}

が５０未満、或いはＤＣＩフォーマット１ＡのＣＲＣがＲＡ－ＲＮＴＩ、Ｐ－ＲＮＴＩまたはＳＩ－ＲＮＴＩでスクランブルされた場合、

【数１８】

$$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$$

ビットをリソース割当に提供する。

【数１９】

N_{RB}^{DL}

が５０以上である場合、

【数２０】

$$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil-1$$

ビットをリソース割当に提供する。

【０１４３】

もし、ＤＣＩフォーマット１ＡのＣＲＣがＲＡ－ＲＮＴＩ、Ｐ－ＲＮＴＩまたはＳＩ－ＲＮＴＩでスクランブルされた場合、新しいデータインジケータフィールドは、ギャップ値（ｇａｐ　ｖａｌｕｅ）を指示する。例えば、新しいデータインジケータフィールドが‘０’であれば、Ｎｇａｐ，１はＮｇａｐ，２であり、‘１’であれば、Ｎｇａｐ，１はＮｇａｐ，１である。その他、新しいデータインジケータフィールドは、新しいデータを指示する。

【０１４４】

ＰＤＳＣＨに対するチャネル割当の制御情報は、前述の全てのフィールドを使用して表現される。これに伴い、ＰＤＳＣＨに対するチャネル割当のためのＤＣＩフォーマット１Ａは、基準情報サイズ（ｒｅｆｅｒｅｎｃｅ　ｉｎｆｏｒｍａｔｉｏｎ　ｓｉｚｅ）を有する制御情報になる。

【０１４５】

以下、半持続的スケジューリング活性化のための制御情報をＤＣＩフォーマット１Ａを介して伝送する場合、ナル情報として使用することができる情報フィールドの例を説明する。

【０１４６】
（１２）第１２の実施例
ダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、ダウンリンクＶｏＩＰ伝送に対するＨＡＲＱプロセスナンバを知らせる必要がない。この場合、ＨＡＲＱプロセスナンバフィールドをナル情報として使用することができる。例えば、ダウンリンクＶｏＩＰ伝送に対する非周期的（ａｐｅｒｉｏｄｉｃ）ＰＵＳＣＨフィードバック（Ｆｅｅｄｂａｃｋ）なしに端末がＰＵＣＣＨ基盤フィードバックのみを運行すると仮定する時、ＨＡＲＱプロセスナンバフィールドをナル情報として使用することができる。
【０１４７】
次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１２の実施例を示す。
【０１４８】
【表１５】
【表１５】

	情報フィールド	Bit(s)
：	：	：
(5)	HARQ process number －ダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3 or 4
：	：	：

【０１４９】
ダウンリンク半持続的スケジューリング活性化のための制御情報の場合、ＨＡＲＱプロセスナンバフィールドを‘０’の値に指定する。ＨＡＲＱプロセスナンバフィールドを除いたＤＣＩフォーマット１Ａの残りのフィールドは、表１４で説明した通りである。
【０１５０】
（１３）第１３の実施例
ダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、別途の閉ループ電力制御が必要なく、開ループ系列またはハイブリッド系列の電力制御に基づいてＰＵＣＣＨ伝送の送信電力を決定すると仮定する。半静的リソースブロック割当状況までを考慮してＴＰＣ命令フィールドを使用しない時、ＴＰＣ命令フィールドをナル情報として使用することができる。
【０１５１】
次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１３の実施例を示す。
【０１５２】
【表１６】
【表１６】

	情報フィールド	Bit(s)
：	：	：
(8)	TPC command for scheduled PUSCH －ダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
：	：	：

【０１５３】
ダウンリンク半持続的スケジューリング活性化のための制御情報の場合、ＴＰＣ命令フィールドの値を全部‘０’に指定する。ＴＰＣ命令フィールドを除いたＤＣＩフォーマット１Ａの残りのフィールドは、表１４で説明した通りである。
【０１５４】
（１４）第１４の実施例

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ダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、新しいデータインジケータフィールドを特定の情報伝達に潜在的に用いなくてもよい。この場合、新しいデータインジケータフィールドをナル情報として使用することができる。

【０１５５】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１４の実施例を示す。

【０１５６】

【表１７】

【表１７】

	情報フィールド	Bit(s)
：	：	：
(6)	New data indicator －ダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1
：	：	：

【０１５７】

ダウンリンク半持続的スケジューリング活性化のための制御情報の場合、新しいデータインジケータフィールドの値を‘０’に指定する。新しいデータインジケータフィールドを除いたＤＣＩフォーマット１Ａの残りのフィールドは、表１４で説明した通りである。

【０１５８】

（１５）第１５の実施例

ダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、リダンダンシバージョンフィールドを特定の情報伝達に潜在的に用いなくてもよい。この場合、リダンダンシバージョンフィールドをナル情報として使用することができる。

【０１５９】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１４の実施例を示す。

【０１６０】

【表１８】

【表１８】

	情報フィールド	Bit(s)
：	：	：
(7)	Redundancy version －ダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
：	：	：

【０１６１】

ダウンリンク半持続的スケジューリング活性化のための制御情報の場合、リダンダンシバージョンフィールドの値を全部‘０’に指定する。リダンダンシバージョンフィールドを除いたＤＣＩフォーマット１Ａの残りのフィールドは、表１４で説明した通りである。

【０１６２】

（１６）第１６の実施例

ダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、ＭＣＳをＭＣＳフィールドで指示せずに割当のシグナリングを用いることができる。また、変調方式及びコーディングレートの全ての場合に対して一部場合のみを使用してもよい。この場合、ＭＣＳフィールドの５ビットのうちＱビットをナル情報として使用することができる。ここで、Ｑは、１～５の自然数である。

【０１６３】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１６の実施例を示す。

【０１６４】

【表１９】

【表１９】

	情報フィールド	Bit(s)
:	:	:
(4)	**Modulation and coding scheme** －ダウンリンク半持続的スケジューリングの活性化のために、５ビットのうちＱ情報ビットがＱにセッティング	5
:	:	:

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【０１６５】

ダウンリンク半持続的スケジューリング活性化のための制御情報の場合、ＭＣＳフィールドの５ビットのうちＱビットを‘０’に指定する。ここで、ここで、Ｑは、１～５の自然数である。ＭＣＳフィールドを除いたＤＣＩフォーマット１Ａの残りのフィールドは、表１４で説明した通りである。

【０１６６】

（１７）第１７の実施例

ダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化に対する制御情報は、ＶｏＩＰが全体システム帯域幅上で割り当てられることができる帯域幅を限定してもよい。この場合、リソースブロック割当フィールドをナル情報として使用することができる。

【数２１】

$$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$$

ビットのうちＰビットをナル情報として使用することができる。ここで、Ｐは、１～

【数２２】

$$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil-1$$

の自然数である。

【０１６７】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１７の実施例を示す。

【０１６８】

【表２０】

【表２０】

	情報フィールド	Bit(s)
:	:	:
(3)	**Resource block assignment** －ダウンリンク半持続的スケジューリングの活性化のために、$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$ ビットのうちＰ情報ビットが０にセッティング	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$
:	:	:

【０１６９】

ダウンリンク半持続的スケジューリング活性化のための制御情報の場合、リソースブロック割当フィールドの

【数２３】

$$\left\lceil \log_2\left(N_{BB}^{DL}\left(N_{SB}^{DL}+1\right)/2\right)\right\rceil$$

ビットのうちＰビットを‘０’に指定する。ここで，Ｐは、１～

【数２４】

$$\left\lceil \log_2\left(N_{SB}^{DL}\left(N_{BB}^{DL}+1\right)/2\right)\right\rceil-1$$

の自然数である。リソースブロック割当フィールドを除いたＤＣＩフォーマット０の残りのフィールドは、表１４で説明した通りである。

【０１７０】

（１８）第１８の実施例

ＤＣＩフォーマット１Ａの情報フィールドのうち複数の情報フィールドの組合せをナル情報として使用する。任意の情報フィールドを組合せてナル情報として使用することができる。全体情報フィールドをナル情報として使用することもできる。第１２ないし第１７の実施例において、ナル情報として使われる各々の情報フィールドが複数の情報フィールドの組合せに使われる。例えば，第１６の実施例で説明したように、ＭＣＳを制約のシグナリングを用いる場合、ＭＣＳフィールドの５ビットのうちＱビットを複数の情報フィールドの組合せに使用することができる，ここで，Ｑは、１～５の自然数である。また、第１７の実施例で説明したように、リソースブロック割当フィールド

【数２５】

$$\left\lceil \log_2\left(N_{SB}^{DL}\left(N_{BB}^{DL}+1\right)/2\right)\right\rceil$$

ビットのうちＰビットを情報フィールドの組合せに使用することができる。ここで、Ｐは１～

【数２６】

$$\left\lceil \log_2\left(N_{BB}^{DL}\left(N_{SB}^{DL}+1\right)/2\right)\right\rceil-1$$

の自然数である。ＦＤＤシステムの場合、第１２ないし第１７の実施例においてナル情報として使われる各々の情報フィールドに付加してダウンリンクインデックスフィールドのビットをナル情報として使用することができる。

【０１７１】

（１９）第１９の実施例

第１９の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールド、ＭＣＳフィールド、及びリダンダンシバージョンフィールドの組合せをナル情報として使用する。

【０１７２】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１９の実施例を示す。

【０１７３】

【表２１】

【表２１】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment ーダウンリンク半持続的スケジューリングの活性化のために、$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$ ビットのうちP情報ビットが０にセッティング	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme ーダウンリンク半持続的スケジューリングの活性化のために、５ビットのうちQ情報ビットが０にセッティング	5
(5)	HARQ process number	3 or 4
(6)	New data indicator	1
(7)	Redundancy version ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(8)	TPC command for scheduled PUCCH	2
(9)	Downlink Assignment Index (TDD)	2

【０１７４】

（２０）第２０の実施例

第２０の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールド、ＭＣＳフィールド、新しいデータインジケータフィールド、及びリダンダンシバージョンフィールドの組合せをナル情報として使用する。第１９の実施例の情報フィールド組合せに新しいデータインジケータフィールドが追加されてナル情報として使われる場合である。

【０１７５】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第１９の実施例を示す。

【０１７６】

【表２２】

【表２２】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment ーダウンリンク半持続的スケジューリングの活性化のために、$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$ビットのうちＰ情報ビットが０にセッティング	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme ーダウンリンク半持続的スケジューリングの活性化のために、５ビットのうちＱ情報ビットが０にセッティング	5
(5)	HARQ process number	3 or 4
(6)	New data indicator ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1
(7)	Redundancy version ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(8)	TPC command for scheduled PUCCH	2
(9)	Downlink Assignment Index (TDD)	2

【０１７７】

（２１）第２１の実施例

第２１の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールド、ＭＣＳフィールド、ＨＡＲＱプロセス番号フィールド、及びリダンダンシバージョンフィールドの組合せをナル情報として使用する。第１９の実施例の情報フィールド組合せにＨＡＲＱプロセス番号フィールドが追加されてナル情報として使われる場合である。

【０１７８】

【表２３】

【表２３】

情報フィールド	Bit(s)
(1) Flag for format0/format1A differentiation	1
(2) Localized/Distributed VRB assignment flag	1
(3) Resource block assignment ーダウンリンク半持続的スケジューリングの活性化のために、$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$ ビットのうちP情報ビットが０にセッティング	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$
(4) Modulation and coding scheme ーダウンリンク半持続的スケジューリングの活性化のために、５ビットのうちQ情報ビットが０にセッティング	5
(5) HARQ process number ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3 or 4
(6) New data indicator	1
(7) Redundancy version ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(8) TPC command for scheduled PUCCH	2
(9) Downlink Assignment Index (TDD)	2

【０１７９】

（２２）第２２の実施例

第２２の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールド、ＭＣＳフィールド、ＨＡＲＱプロセス番号フィールド、新しいデータインジケータフィールド、及びリダンダンシバージョンフィールドの組合せをナル情報として使用する、第２１の実施例の情報フィールドの組合せに新しいデータインジケータフィールドが追加されてナル情報として使われる場合である。

【０１８０】

【表２４】

【Ｔａｂｌｅ４】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment －ダウンリンク半持続的スケジューリングの活性化のために、$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$ビットのうちＰ情報ビットが０にセッティング	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme －ダウンリンク半持続的スケジューリングの活性化のために、５ビットのうちＱ情報ビットが０にセッティング	5
(5)	HARQ process number －ダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3 or 4
(6)	New data indicator －ダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1
(7)	Redundancy version －ダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(8)	TPC command for scheduled PUCCH	2
(9)	Downlink Assignment Index (TDD)	2

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【０１８１】

（２３）第２３の実施例

第２３の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールドとＭＣＳフィールドとの関係において、前記２つのフィールドに対してヌル情報を使用することができる。ＲＲＣにおける別途指示によって２つのフィールドを連係することができる。前記２つのフィールド外に、リダンダンシバージョンフィールドの組合せをヌル情報として使用することができる。

【０１８２】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第２３の実施例を示す。

【０１８３】

【表２５】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment	$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme ーダウンリンク半持続的スケジューリングの活性化のために、"Resource block assignment"及び"Modulation and coding scheme"のうちＳ情報ビットが０にセッティング	5
(5)	HARQ process number	3 or 4
(6)	New data indicator	1
(7)	Redundancy version ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(8)	TPC command for scheduled PUCCH	2
(9)	Dowalink Assignment Index (TDD)	2

、

【０１８４】

ここで、Ｓは、１、２、一、または

【数２７】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil+4$$

ビットであってもよい。

【０１８５】

（２４）第２４の実施例

第２４の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールドとＭＣＳフィールドとの関係に応じて、前記二つのフィールドに対してヌル情報を使用することができる。ＲＲＣにおける明示的指示によって二つのフィールドを連係することができる。前記二つのフィールド外に、新しいデータインジケータフィールド及びリダンダンシバージョンフィールドの組合せをヌル情報として使用することができる。第２３の実施例の情報フィールド組合せに新しいデータインジケータフィールドが追加されてヌル情報として使われる場合である。

【０１８６】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第２４の実施例を示す。

【０１８７】

【表２６】

【表２６】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme ーダウンリンク半持続的スケジューリングの活性化のために、"Resource block assignment"及び"Modulation and coding scheme"のうちS情報ビットが0にセッティング	5
(5)	HARQ process number	3 or 4
(6)	New data indicator ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが0にセッティング	1
(7)	Redundancy version ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが0にセッティング	2
(8)	TPC command for scheduled PUCCH	2
(9)	Downlink Assignment Index (TDD)	2

【０１８８】

ここで、Ｓは、１、２、一、または

【数２８】

$$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil+4$$

ビットであってもよい。

【０１８９】

（２５）第２５の実施例

第２５の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールドとＭＣＳフィールドとの関係に比して、前記２つのフィールドに対してヌル情報を使用することができる。ＲＲＣにおける明示的指示によって２つのフィールドを連係することができる。前記２つのフィールド外に、ＨＡＲＱプロセス番号フィールド及びリダンダンシバージョンフィールドの組合せをヌル情報として使用することができる。第２３の実施例の情報フィールド組合せにＨＡＲＱプロセス番号フィールドが追加されてヌル情報として使われる場合である。

【０１９０】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第２５の実施例を示す。

【０１９１】

【表２７】

【表２７】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment	$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme ーダウンリンク半持続的スケジューリングの活性化のために、"Resource block assignment"及び"Modulation and coding scheme"のうちＳ情報ビットが０にセッティング	5
(5)	HARQ process number ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3 or 4
(6)	New data indicator	1
(7)	Redundancy version ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(8)	TPC command for scheduled PUCCH	2
(9)	Downlink Assignment Index (TDD)	2

【０１９２】

ここで、Ｓは、１、２、一、または

【数２９】

$$\left\lceil \log_2\left(N_{RB}^{UL}\left(N_{RB}^{UL}+1\right)/2\right)\right\rceil+4$$

ビットであってもよい。

【０１９３】

（２６）第２６の実施例

第２６の実施例は、第１８の実施例の具体的な実施例である。ＤＣＩフォーマット１Ａを介して半持続的スケジューリング活性化に対する制御情報を伝送する場合、リソースブロック割当フィールドとＭＣＳフィールドとの関係に比して、前記２つのフィールドに対してナル情報を使用することができる。ＲＲＣにおける別途指示によって２つのフィールドを連係することができる。前記２つのフィールド外に、ＨＡＲＱプロセス番号フィールド、新しいデータインジケータフィールド及びリダンダンシバージョンフィールドの組合せをナル情報として使用することができる。第２５の実施例の情報フィールド組合せに新しいデータチウッインジケータフィールドが追加されてナル情報として使われる場合である。

【０１９４】

次の表は、ＰＤＳＣＨに対するチャネル割当及び半持続的スケジューリング活性化のためのＤＣＩフォーマット１Ａが伝送する制御情報の第２６の実施例をぶす。

【０１９５】

【表２８】

【表２８】

	情報フィールド	Bit(s)
(1)	Flag for format0/format1A differentiation	1
(2)	Localized/Distributed VRB assignment flag	1
(3)	Resource block assignment	$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil$
(4)	Modulation and coding scheme ーダウンリンク半持続的スケジューリングの活性化のために、"Resource block assignment"及び"Modulation and coding scheme"のうちＳ情報ビットが０にセッティング	5
(5)	HARQ process number ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	3 or 4
(6)	New data indicator ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	1
(7)	Redundancy version ーダウンリンク半持続的スケジューリングの活性化のために、情報ビットが０にセッティング	2
(8)	TPC command for scheduled PUCCH	2
(9)	Downlink Assignment Index (TDD)	2

【０１９６】

ここで、Ｓは、１，２，…，または

【数３０】

$$\left\lceil \log_2\left(N_{RB}^{DL}\left(N_{RB}^{DL}+1\right)/2\right)\right\rceil+4$$

ビットであってもよい。

【０１９７】

（２７）第２７の実施例

ＤＣＩフォーマット１は，一般的なリソース割当に基づいくＰＤＳＣＨに対するチャネル割当の制御情報及びダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化のための制御情報の伝送に使われることができる。第１２ないし第２６の実施例は、特定のリソース割当に基づくＰＤＳＣＨに対するチャネル割当の制御情報と，ダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化のための制御情報とが、ＤＣＩフォーマット１Ａの伝送される状況でＤＣＩフォーマット１Ａ内の情報フィールドをナル情報として使用する方法である。第１２ないし第２６の実施例における方法は、半持続的スケジューリング活性化のための制御情報がＤＣＩフォーマット１を介して伝送される場合にも同一に適用されることができる。ＤＣＩフォーマット１内の情報フィールドもナル情報として使われることができる。

【０１９８】

（２８）第２８の実施例

ＤＣＩフォーマット２は、空間多重化モード（ｓｐａｔｉａｌ　ｍｕｌｔｉｐｌｅｘｉｎｇ　ｍｏｄｅ）に設定された端末のためのＰＤＳＣＨスケジューリングのための制御情報、及びダウンリンクＶｏＩＰパケット伝送のための半持続的スケジューリング活性化のための制御情報の伝送に使われることができる。第１２ないし第２６の実施例における方法は，第１２ないし第２６の実施例における方法は，半持続的スケジューリング活性化のための制御情報がＤＣＩフォーマット２を介して伝送される場合にも同一に適用されることができる。ＤＣＩフォーマット２内の情報フィールドもナル情報として使われることが

Samsung Exhibit 1002, Page 412

できる。

【０１０９】

ＤＣＩフォーマット２にはＨＡＲＱ交換（ｓｗａｐ）フラッグフィールドがある，ＤＣＩフォーマット２内のナル情報として使われる情報フィールドに付加してＨＡＲＱ交換フラッグフィールドもナル情報として使用することができる。ＨＡＲＱ交換フラッグフィールド及び他の情報フィールドの全ての組合せに対してナル情報として使用することができる。

【０２００】

このように、無線通信システムにおいて正確度を高めることができる制御情報検出方法を提供することができる。エラー確認フィールドの特定領は、仮想（ｖｉｒｔｕａｌ）ＣＲＣとして活用することができる。端末は、制御情報検出の際、仮想ＣＲＣを介してＣＲＣエラーチェックの正確度を高めることができる。即ち、無線リソースを効率的に活用することができ，且つ制御情報の正確な検出が可能になる。従って、全体システム性能が向上されることができる。

【０２０１】

前述した全ての機能は，前記機能を遂行するようにコーディングされたソフトウェアやプログラムコードなどにともなうマイクロプロセッサ、制御器、マイクロ制御器、ＡＳＩＣ（Ａｐｐｌｉｃａｔｉｏｎ Ｓｐｅｃｉｆｉｃ Ｉｎｔｅｇｒａｔｅｄ Ｃｉｒｃｕｉｔ）などのようなプロセッサによって遂行されることができる，前記コードの設計，開発及び具現は、本発明の説明に基づいて当業者に自明である。

【０２０２】

以上、本発明に対して実施例を参照して説明したが、該当技術分野の通常の知識を有する者は、本発明の技術的思想及び領域から外れない範囲内で本発明を多様に修正及び変更させて実施することができることを理解することができる。従って，前述した実施例に限定されることではなく、本発明は，特許請求の範囲内の全ての実施例を含む。

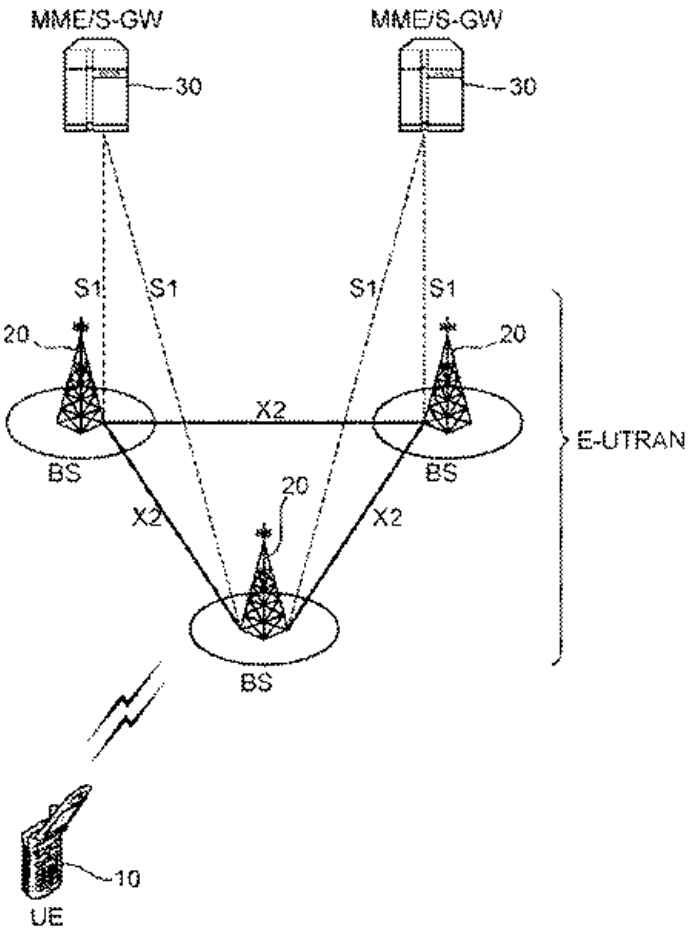
【符号の説明】

【０２０３】

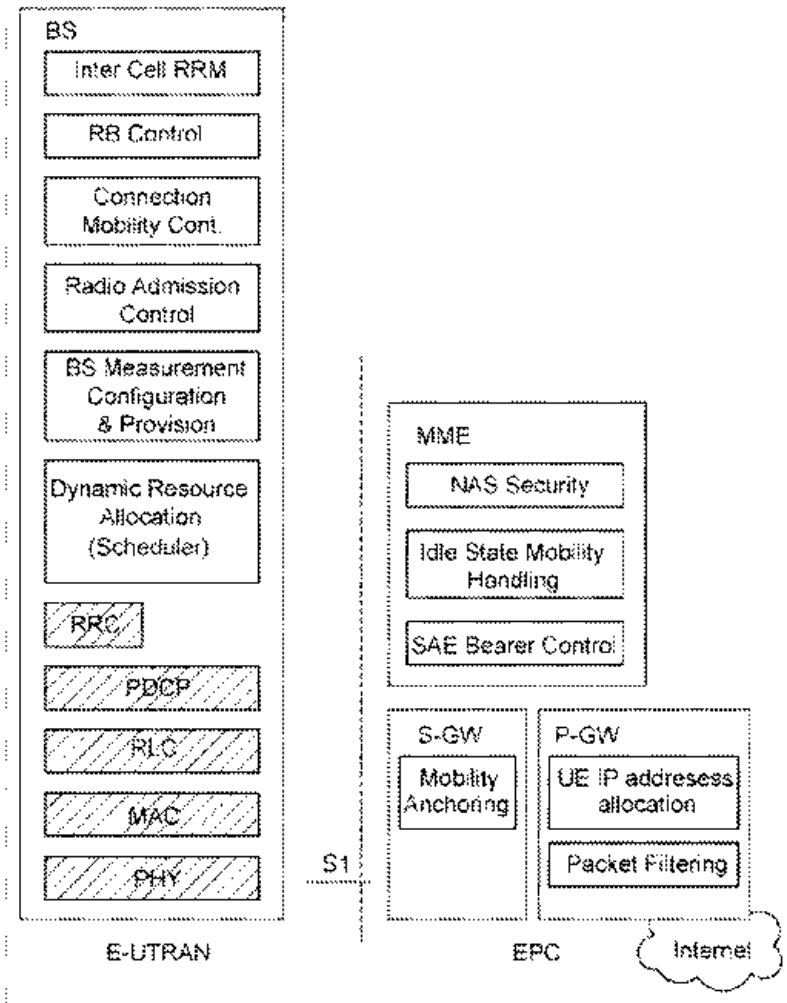
１０　端末
２０　基地局
５０　端末
５１　プロセッサ
５２　メモリ
５３　ＲＦ部
５４　ディスプレー部
５５　使用者インターフェース部

【図１】

【図１】

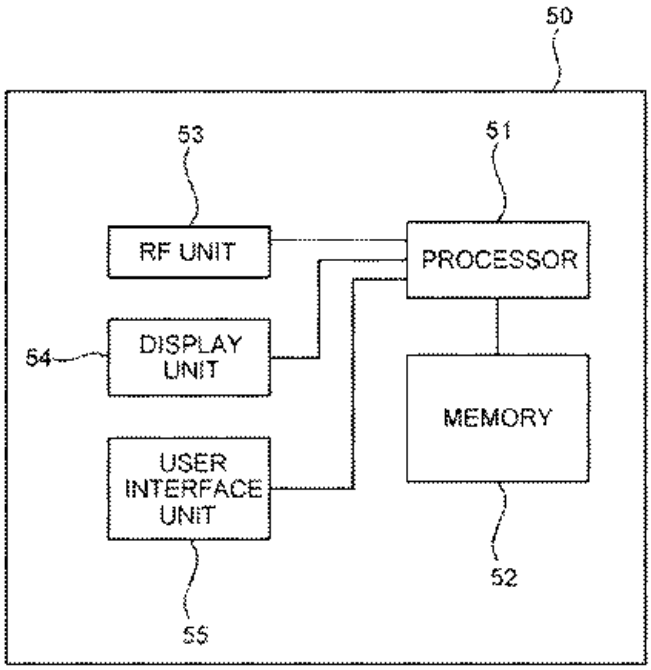

MME/S-GW
MME/S-GW
30
30
S1
S1
S1
S1
20
20
X2
BS
BS
E-UTRAN
20
X2
X2
BS
10
UE

【図２】


BS
Inter Cell RRM
RB Control
Connection Mobility Cont.
Radio Admission Control
BS Measurement Configuration & Provision
Dynamic Resource Allocation (Scheduler)
RRC
PDCP
RLC
MAC
PHY
E-UTRAN
S1
MME
NAS Security
Idle State Mobility Handling
SAE Bearer Control
S-GW
Mobility Anchoring
P-GW
UE IP addresess allocation
Packet Filtering
EPC
Internet

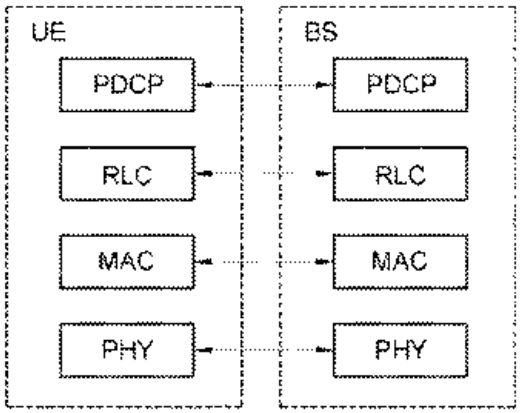
【図３】

【図３】


50
53
51
RF UNIT
PROCESSOR
54
DISPLAY UNIT
MEMORY
USER INTERFACE UNIT
52
55

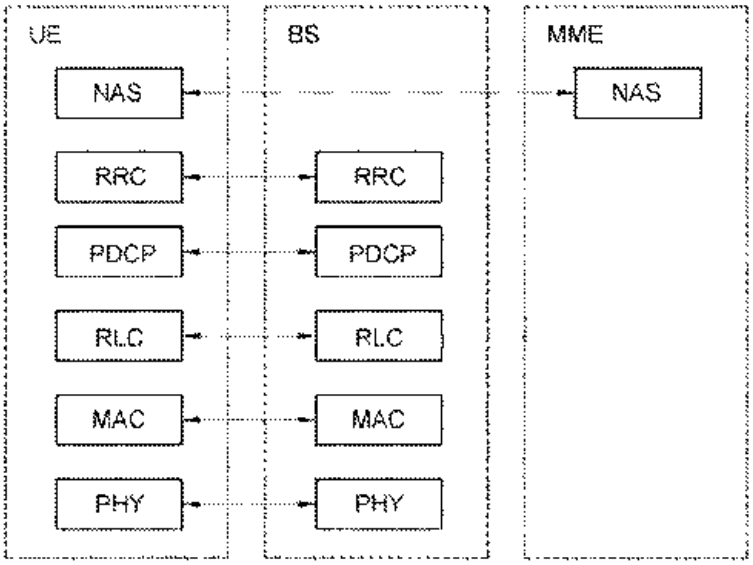
【図４】

【図４】


UE
BS
PDCP
PDCP
RLC
RLC
MAC
MAC
PHY
PHY

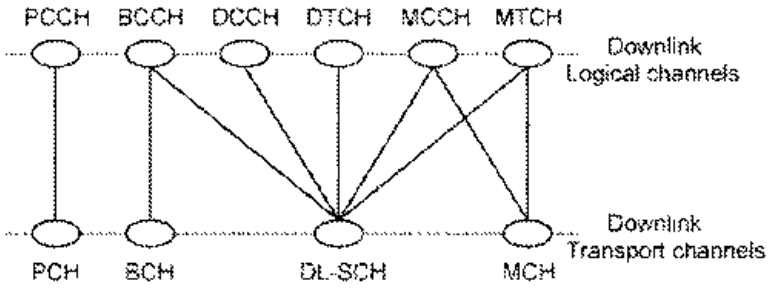
【図５】

【図５】



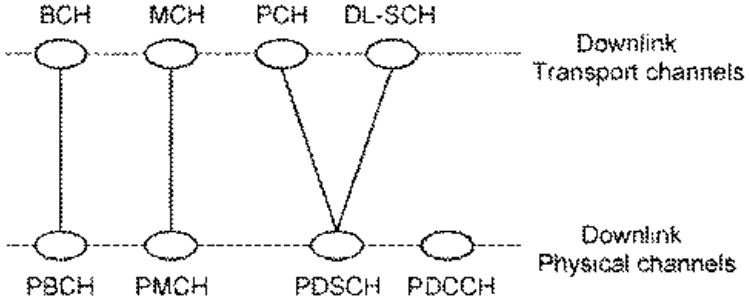
【図６】

【図６】

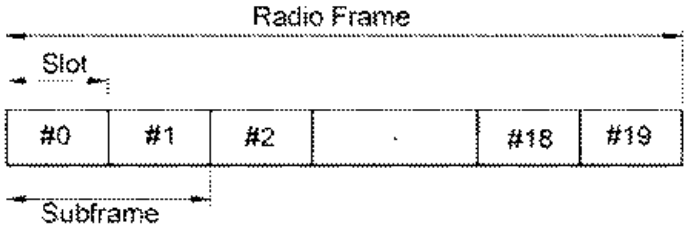


【図７】

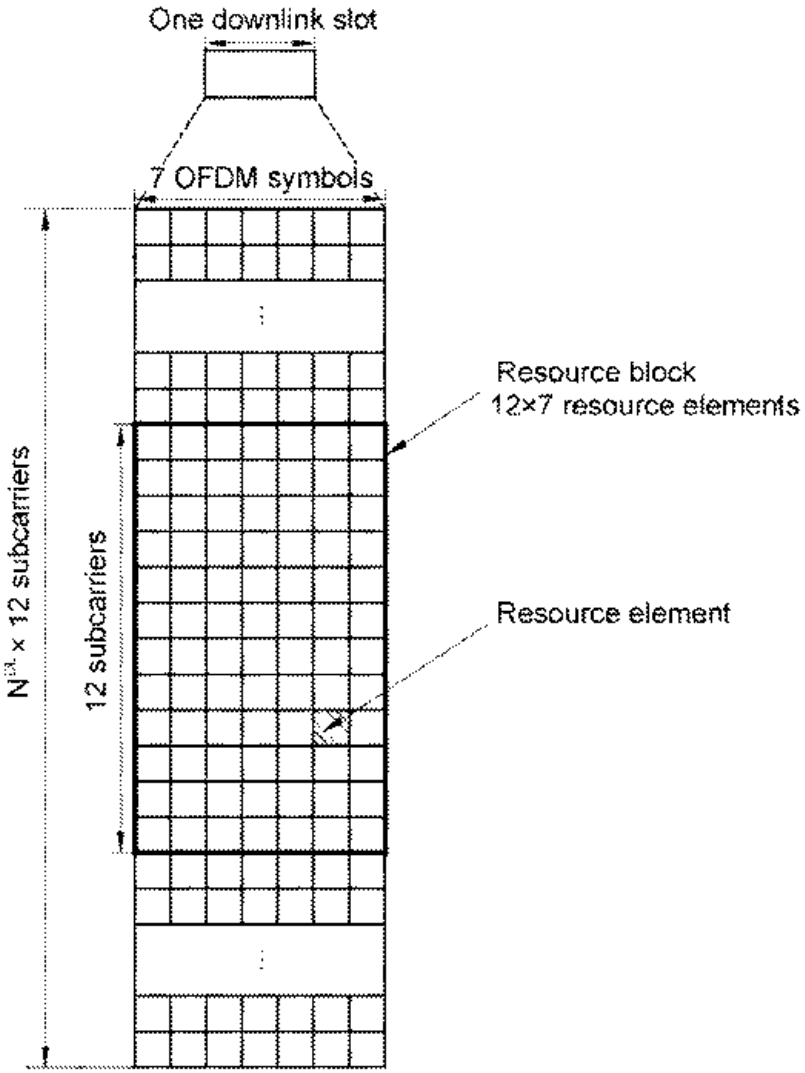
【図７】



【図８】

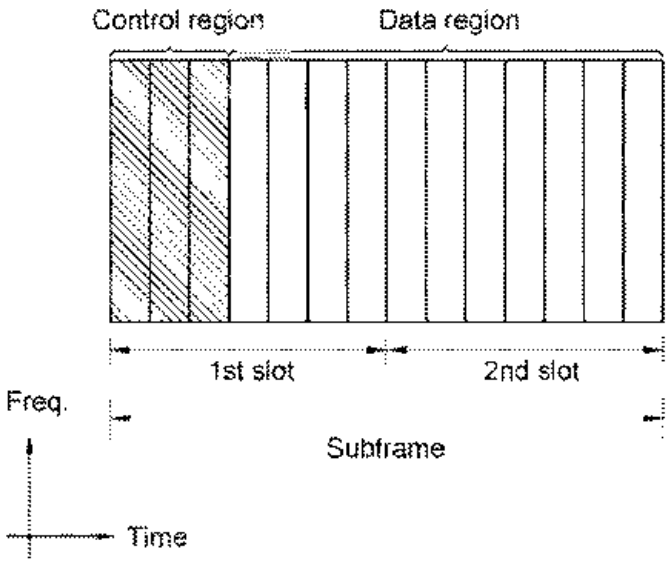

Radio Frame
Slot
#0
#1
#2
#18
#19
Subframe

【図９】


One downlink slot
7 OFDM symbols
Resource block
12×7 resource elements
Resource element
N^{DL}_{RB} × 12 subcarriers
12 subcarriers

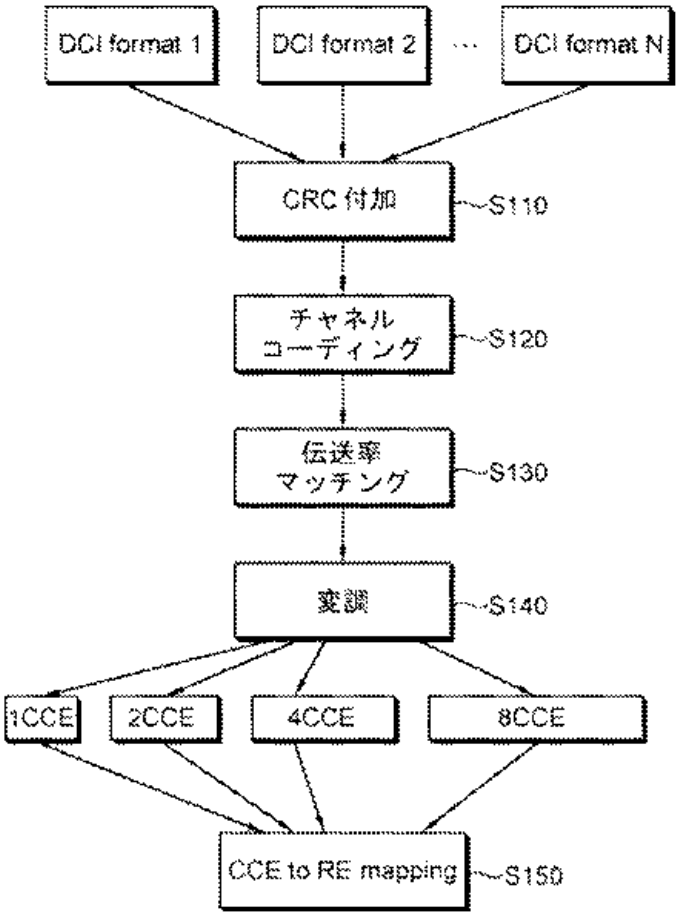
【図１０】

【図１０】



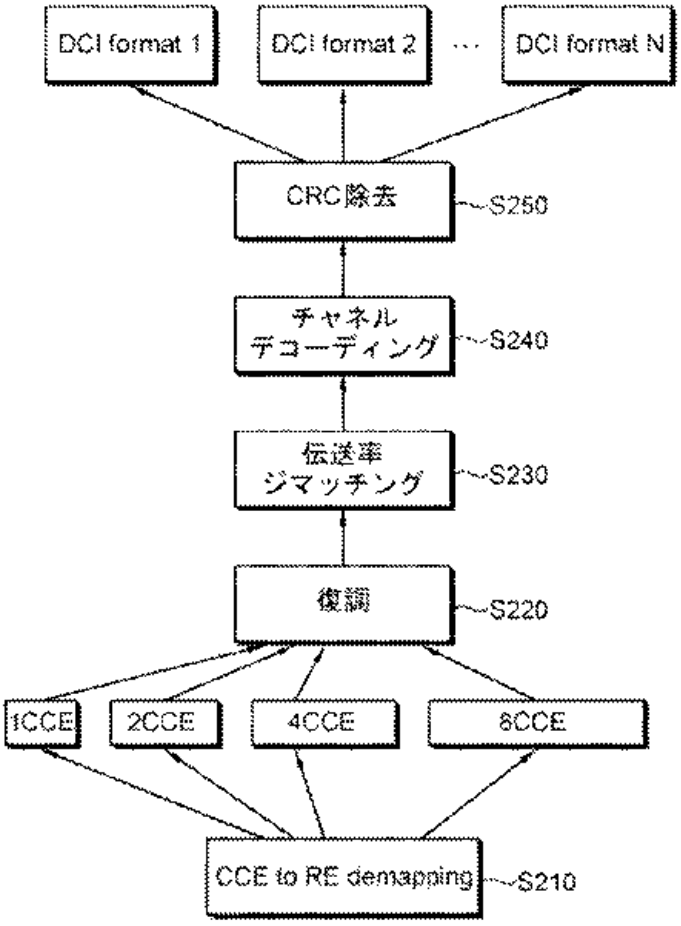
【図１１】

【図１１】



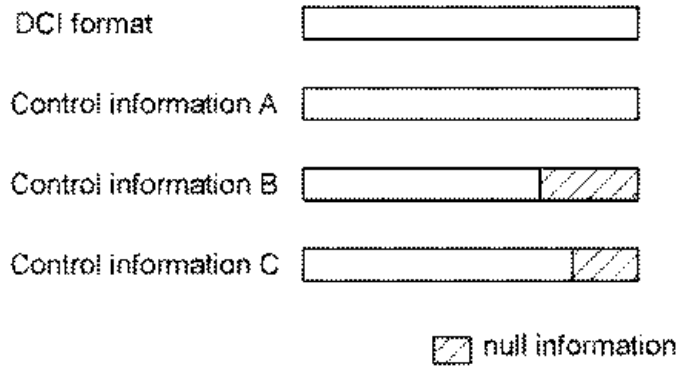
【図１２】

【図１３】



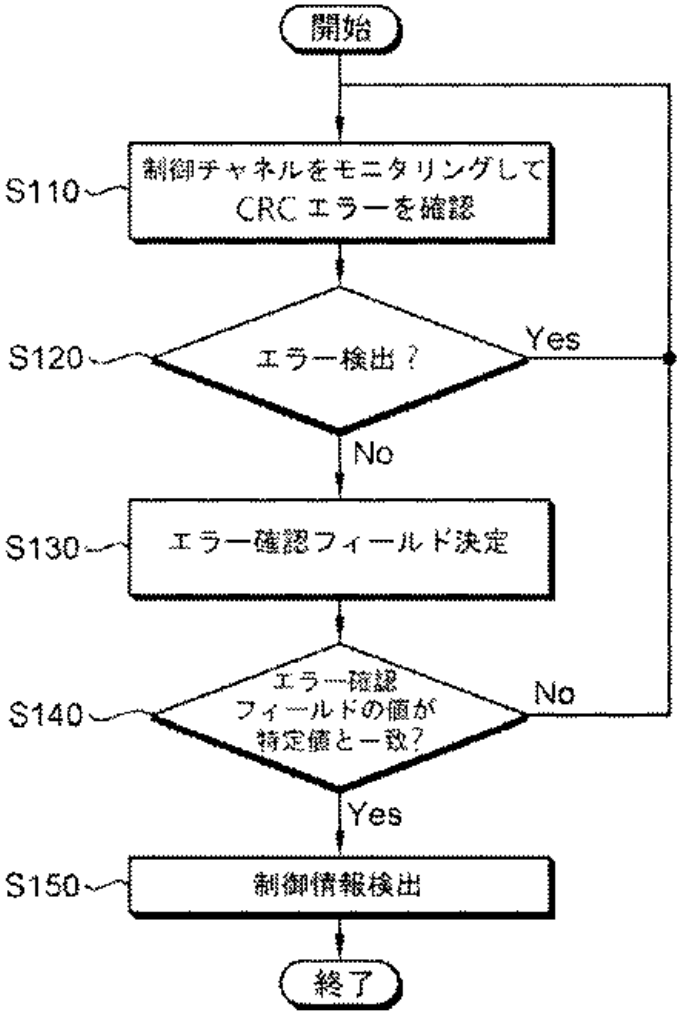
【図１４】

【図１５】



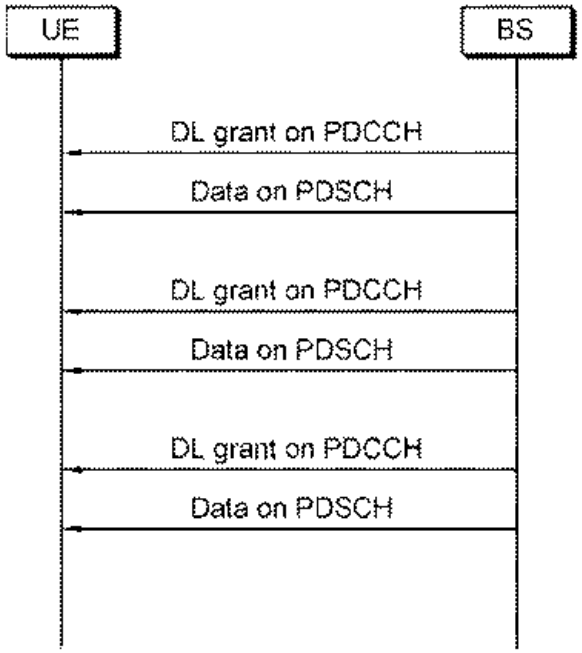
【図１１】

【図１４】


開始
S110
制御チャネルをモニタリングして
CRC エラーを確認
S120
エラー検出？
Yes
No
S130
エラー確認フィールド決定
S140
エラー確認
フィールドの値が
特定値と一致？
No
Yes
S150
制御情報検出
終了

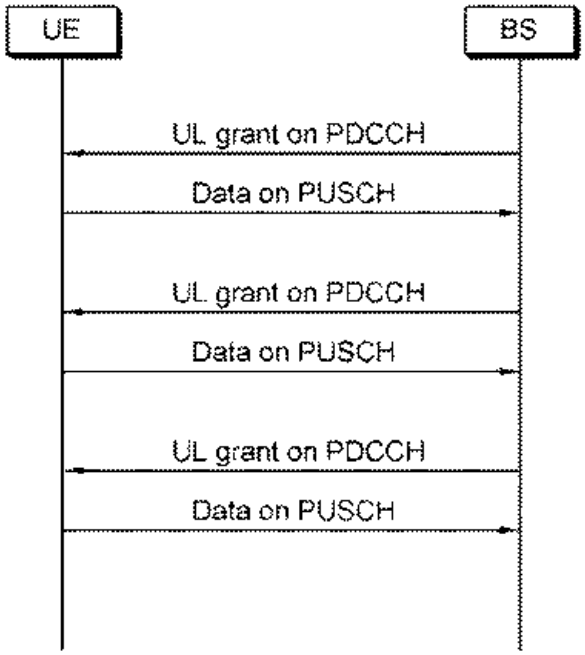
【図５】

【図５】


UE
BS
DL grant on PDCCH
Data on PDSCH
DL grant on PDCCH
Data on PDSCH
DL grant on PDCCH
Data on PDSCH

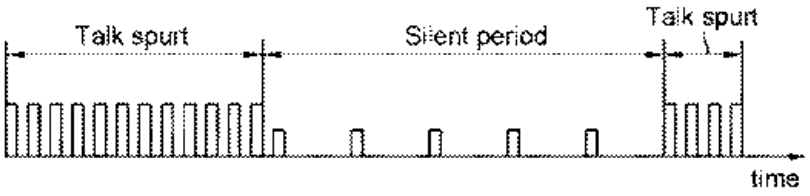
【図６】

【図６】


UE
BS
UL grant on PDCCH
Data on PUSCH
UL grant on PDCCH
Data on PUSCH
UL grant on PDCCH
Data on PUSCH

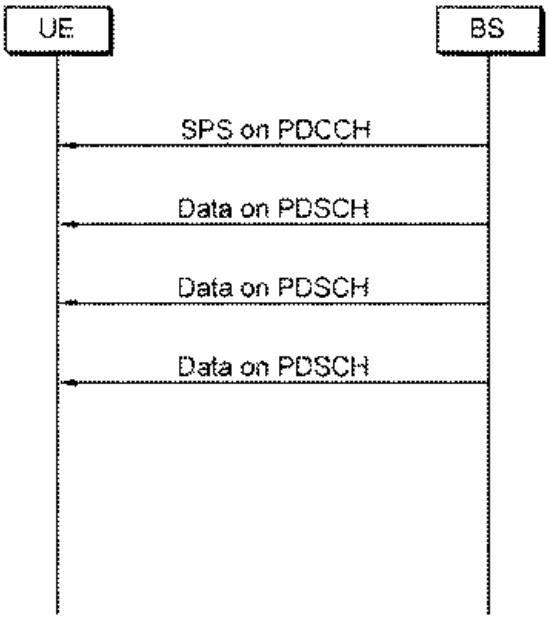
【図１７】

【図１７】



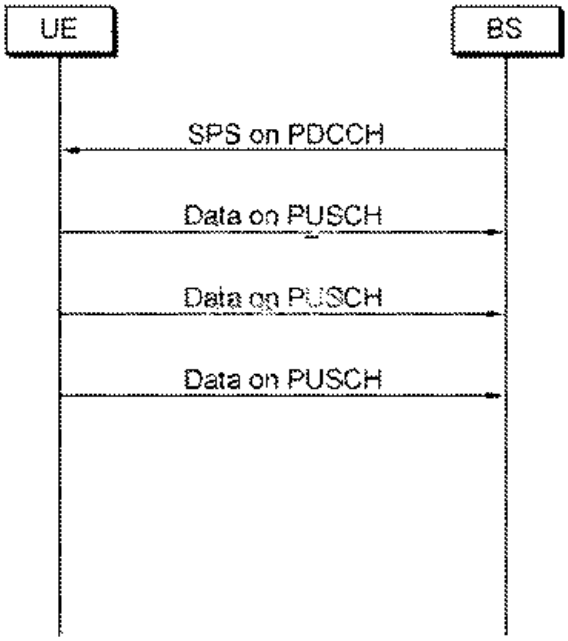
【図１８】

【図１８】



【図１０】

【図１０】



【国際調査報告】

INTERNATIONAL SEARCH REPORT

International application No
PCT/KR2008/005718

A. CLASSIFICATION OF SUBJECT MATTER

H04B 7/26(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04H, H03M, H04B, H04L, H04N, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EKIPASS(KIPO internal), IEEE xplore "Keyword: error, detecting and control."

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7162675 B2 (ARNAB DAS et al.) 09 January 2007 See the abstract, claim 7	1-13
A	US 7134064 B2 (SUNG HENK KIM.) 07 November 2006 See the abstract, claims 4-6.	1-13
A	US 2004/0198314 A1(YOUN SUN KIM et al.) 07 October 2004 See the abstract, claims 4-5.	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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(72)発明者　チャン，　チェ　ホン
大韓民国　４３１－７４９　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アール　アンド　ディー　コンプレックス
(72)発明者　キム，　ソ　ヨン
大韓民国　４３１－７４９　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アール　アンド　ディー　コンプレックス
(72)発明者　キム，　ジョン　ミン
大韓民国　４３１－７４９　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アール　アンド　ディー　コンプレックス
(72)発明者　サン，　ド　ヒュン
大韓民国　４３１－７４９　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アール　アンド　ディー　コンプレックス
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Method for effectively transmitting control signal in wireless communication system

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Inventor(s):

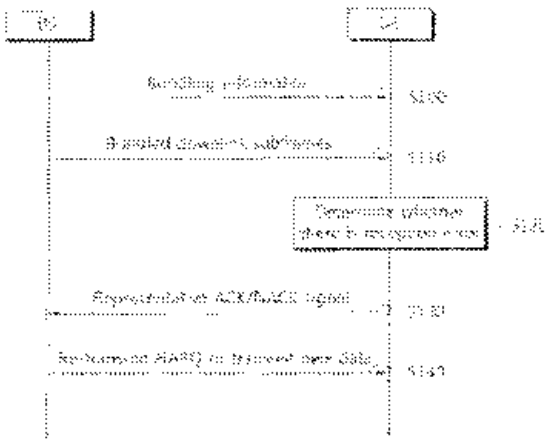
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Abstract of corresponding document: EP2104263 (A1)

A method of performing HARQ performed by a user equipment (UE) is provided. The method includes receiving a bundling indicator which indicates the number of bundled downlink subframes, determining whether at least one bundled downlink subframe is missed by comparing the bundling indicator with the number of detected bundled downlink subframes, generating a representative ACK/NACK signal when no bundled downlink subframe is missed, and transmitting the representative ACK/NACK signal on an uplink channel. Recovery capability is maximized and the packet loss is reduced in such a situation that less number of ACK/NACK signals are fed back than that of downlink packets.

FIG. 9



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(71)出願人　502032105
エルジー　エレクトロニクス　インコーポレイティド
大韓民国，ソウル　１５０　７２１，ヨンドゥンポーク，ヨイド－ドン，２０
(74)代理人　100078282
弁理士　山本　秀策
(74)代理人　100062409
弁理士　安村　高明
(74)代理人　100113413
弁理士　森下　夏樹

最終頁に続く

(54)【発明の名称】無線通信システムで制御信号の効率的な伝送方法

(57)【要約】
【課題】無線通信システムで端末がＨＡＲＱを遂行する方法を提供する。
【解決手段】前記方法は、バンドルされた複数のダウンリンクサブフレームの数を指示するバンドル指示子を受信すること、ここで前記バンドルされた複数のダウンリンクサブフレームの各サブフレームは一つまたは複数の符号語の伝送に使われ、前記バンドル指示子と検出されるバンドルされた複数のダウンリンクサブフレームの数とを比較することによって，少なくとも一つのバンドルされたダウンリンクサブフレームが脱失されたかを判断すること；どんなバンドルされたダウンリンクサブフレームも脱失されない場合，代表ＡＣＫ／ＮＡＣＫ信号を生成すること，及び前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネルに伝送することを含む。前記代表ＡＣＫ／ＮＡＣＫ信号は，前記検出されるバンドルされたダウンリンクサブフレーム内の全ての符号語が成功裏に受信される場合，ＡＣＫ信号である。
【選択図】図９

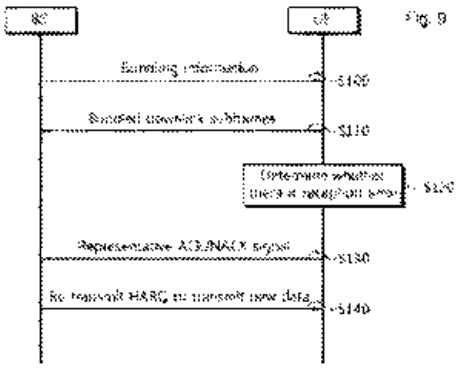


Fig. 9

【特許請求の範囲】
【請求項１】
無線通信システムにおいて，ハイブリッド自動反復要求（ＨＡＲＱ）を実行する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は，
バンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信することであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、ことと、
前記バンドル指示子と、検出されたバンドルされたダウンリンクサブフレームの数とを比較することによって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われているかどうかを判定することと、
バンドルされたダウンリンクサブフレームが失われていない場合には、代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、前記検出されたバンドルされたダウンリンクサブフレーム内のすべての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号であり、それ以外の場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号である、ことと、
前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネルに送信することと
を含む、方法。
【請求項２】
前記代表ＡＣＫ／ＮＡＣＫ信号は、少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合には、送信されない、請求項１に記載の方法。
【請求項３】
前記アップリンクチャネルは、物理アップリンク制御チャネル（ＰＵＣＣＨ）である、請求項２に記載の方法。
【請求項４】
前記代表ＡＣＫ／ＮＡＣＫ信号を搬送する前記アップリンクチャネルのためのアップリンクリソースは、最後に検出されたバンドルされたダウンリンクサブフレームおよび／または前記最後に検出されたバンドルされたダウンリンクサブフレームのスケジューリングのために使用されるダウンリンクリソースに関連する、請求項１に記載の方法。
【請求項５】
前記バンドル指示子は、ダウンリンクチャネルに送信され、前記アップリンクチャネルのためのリソースは、前記アップリンクサブフレームに最も近い前記バンドルされたダウンリンクサブフレームに対するダウンリンクチャネルに関連する、請求項１に記載の方法。
【請求項６】
少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合には、前記代表ＡＣＫ／ＮＡＣＫ信号をＮＡＣＫ信号として生成することをさらに含む，請求項１に記載の方法。
【請求項７】
前記アップリンクチャネルは、物理アップリンク共用チャネル（ＰＵＳＣＨ）である、請求項６に記載の方法。
【請求項８】
前記バンドル指示子は、前記バンドルされたダウンリンクサブフレームの累積的な数である、請求項１に記載の方法。
【請求項９】
前記バンドル指示子は、ダウンリンクスケジューリング情報に含まれている、請求項１に記載の方法。
【請求項１０】
前記バンドル指示子は、アップリンクスケジューリング情報に含まれている、請求項１に記載の方法。

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【請求項１１】
無線通信システムにおいて、制御信号を送信する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
Ｍ（Ｍ＞１）個のダウンリンクサブフレームにおいてバンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信することと、
バンドルされたダウンリンクサブフレームが検出された場合には、カウンタを増加させることと、
前記バンドル指示子が前記カウンタに等しくない場合には、代表ＮＡＣＫ信号を生成することであって、前記代表ＮＡＣＫ信号は、前記バンドルされたダウンリンクサブフレームにおける全ての符号語の受信が不成功であったことを表す、ことと、
アップリンクサブフレーム内のアップリンク共用チャネル上に前記代表ＮＡＣＫ信号を送信することと
を含む、方法。
【請求項１２】
前記バンドル指示子は、ダウンリンク制御チャネル上で受信される、請求項１１に記載の方法。
【請求項１３】
前記バンドル指示子は、前記バンドルされたダウンリンクサブフレームに含まれている、請求項１１に記載の方法。
【請求項１４】
前記バンドルされたダウンリンクサブフレームの位置および数は、前記アップリンクサブフレームに対して予め決められている、請求項１３に記載の方法。
【請求項１５】
前記バンドルされたダウンリンクサブフレームの数は、前記アップリンクサブフレームの数に等しいか、または、前記アップリンクサブフレームの数よりも大きい、請求項１１に記載の方法。
【請求項１６】
無線通信システムにおいて制御信号を送信する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームにおける符号語を受信することと、
バンドルされたダウンリンクサブフレームが検出された場合に、カウンタを増加させることと、
代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合、または、少なくとも１つの符号語の受信が不成功であった場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号であり、そうでない場合において、前記バンドルされたダウンリンクサブフレームの全てが検出され、かつ、前記符号語の全ての受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号である、ことと、
アップリンクサブフレーム内のアップリンク共用チャネル上に、前記代表ＡＣＫ／ＮＡＣＫ信号と前記カウンタとを送信することと
を含む、方法。
【請求項１７】
無線通信システムにおいて、ＨＡＲＱを実行する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームを受信することであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を運ぶために使用される、ことと、

代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、検出されたバンドルされたダウンリンクサブフレームにおける全ての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号であり、前記検出されたバンドルされたダウンリンクサブフレームにおける少なくとも１つの符号語の受信が不成功であった場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号である、ことと、
アップリンクチャネル上に前記代表ＡＣＫ／ＮＡＣＫ信号を送信することと
を含み、
前記代表ＡＣＫ／ＮＡＣＫ信号を搬送する前記アップリンクチャネルのためのアップリンクリソースは、前記最後に検出されたバンドルされたダウンリンクサブフレームおよび／または前記最後に検出されたバンドルされたダウンリンクサブフレームの前記スケジューリングのために使用されるダウンリンクリソースに関連する、方法。
【請求項１８】
無線通信システムにおいて、ＨＡＲＱを用いてＡＣＫ／ＮＡＣＫ信号を送信する装置であって、
前記装置は、
バンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信する受信ユニットであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、受信ユニットと、
前記バンドル指示子と、検出されたバンドルされたダウンリンクサブフレームの数とを比較することによって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われたかどうかを判定する判定ユニットと、
バンドルされたダウンリンクサブフレームが失われていない場合には、代表ＡＣＫ／ＮＡＣＫ信号を生成する生成ユニットであって、前記検出されたバンドルされたダウンリンクサブフレーム内の全ての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号であり、それ以外の場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号である、生成ユニットと
前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネル上に送信する送信ユニットと
を含む、装置。

【発明の詳細な説明】
【技術分野】
【０００１】

本発明は、無線通信に関し、より詳しくは、無線通信システムで制御信号の効率的な伝送方法に関する。
【背景技術】
【０００２】
次世代移動通信システムは、以前世代の移動通信システムのように単純な無線通信サービスに留まらず、有線通信ネットワークと無線通信ネットワークとの効率的連動及び統合サービスを目標として標準化されている。このように、音声中心のサービスを超えて映像、無線データなどの多様な情報を処理して伝送することができる高速大容量通信システムが要求されることによって、無線通信ネットワークに有線通信ネットワークの容量（ｃａｐａｃｉｔｙ）に匹敵する大容量データを伝送することができる技術開発が要求されている。従って、情報損失の減少を最小化して、システム伝送効率を高めることによってシステム性能を向上させることができる適切なエラー検出方式が必須な要素となった。
【０００３】
自動反復要請（Ａｕｔｏｍａｔｉｃ　Ｒｅｐｅａｔｅ　Ｑｕｅｓｔ：以下、ＡＲＱ）方式は、受信機がデータを正しく受信した場合、送信機に受信成功信号（Ａｃｋｎｏｗｌｅｄｇｅｍｅｎｔ：以下、ＡＣＫ）を伝送して、一方、受信機がデータを正しく受信できなかった場合、送信機に再伝送要求信号（Ｎｏｔ　Ａｃｋｎｏｗｌｅｄｇｅｍｅｎｔ：以下、ＮＡＣＫ）を伝送する方式である。ハイブリッド自動反復要求（ＨＡＲＱ）方式にお

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いて、データ受信機が伝送するＡＣＫ／ＮＡＣＫ信号は一般的に少ない数のビットに表現される。

【０００４】

最近、データ処理時、伝送効率を向上させるために既存のＡＲＱ方式に、物理階層のチャネルコーディング（Ｃｈａｎｎｅｌ　Ｃｏｄｉｎｇ）を結合した技術であるＨＡＲＱ（Ｈｙｂｒｉｄ－ＡＲＱ）が提案されている。ＨＡＲＱでは、送信機は受信失敗したデータを再伝送して、受信機は受信失敗したデータを捨てないで格納する。受信機が再伝送されたデータを受信すると、前記再伝送されたデータを以前に格納しておいたデータに結合して性能利得を高める。

【０００５】

ＨＡＲＱ方式では受信機がＡＣＫ／ＮＡＣＫ信号を送信機にフィードバック（ｆｅｅｄｂａｃｋ）するための別途のフィードバック無線リソース（ｆｅｅｄｂａｃｋ　ｒａｄｉｏ　ｓｏｕｒｃｅ）を用いる点で、限定されたフィードバック無線リソースの効率的な使用が相当重要な論点として登場している。

【０００６】

以下、ダウンリンク（ｄｏｗｎｌｉｎｋ）は基地局から端末への通信を意味して、アップリンク（ｕｐｌｉｎｋ）は端末から基地局への通信を意味する。ダウンリンクは、正方向リンク（ｆｏｒｗａｒｄ　ｌｉｎｋ）ともいい、アップリンクは逆方向リンク（ｒｅｖｅｒｓｅ　ｌｉｎｋ）ともいう。ダウンリンクにおいて、送信機は基地局の一部分であり、受信機は端末の一部分である。アップリンクにおいて、送信機は端末の一部分であり、受信機は基地局の一部分である。

【０００７】

ダウンリンク伝送に使われる無線リソースと、アップリンク伝送に使われる周波数、時間及びコード領域のような無線リソースが重ならないように区分する方式が必要であり、このような方式をデュプレックス（ｄｕｐｌｅｘ）という。お互いに異なる使用者を区分するための多重接続技術（ｍｕｌｔｉｐｌｅ　ａｃｃｅｓｓ　ｓｃｈｅｍｅ）と同様に、アップリンクとダウンリンクの区分は、周波数、時間及びコード領域で可能である。デュプレックス方式は、大きくにアップリンクとダウンリンクを周波数に区分するＦＤＤ（Ｆｒｅｑｕｅｎｃｙ　Ｄｉｖｉｓｉｏｎ　Ｄｕｐｌｅｘｉｎｇ）方式と、アップリンクとダウンリンクを時間に区分するＴＤＤ（Ｔｉｍｅ　Ｄｉｖｉｓｉｏｎ　Ｄｕｐｌｅｘｉｎｇ）方式に分けられる。

【０００８】

ＦＤＤ方式では周波数領域でアップリンクとダウンリンクが区分されるため、基地局と端末間のデータの伝送が各リンクにおいて時間領域から連続的に行われることができる。ＦＤＤ方式は、アップリンクとダウンリンクに同じ大きさの周波数を対称的に割り当てており、音声通話のような対称型サービス（ｓｙｍｍｅｔｒｉｃ　ｓｅｒｖｉｃｅ）に適切であるため広く使われたが、最近、インターネットサービスのような非対称型サービス（ａｓｙｍｍｅｔｒｉｃ　ｓｅｒｖｉｃｅ）にはＴＤＤ方式が適し、これに対する研究が活発に進行している。

【０００９】

ＴＤＤ方式は、アップリンクおよびダウンリンクに相違する比率の時間スロットを割り当てることができるため、非対称型サービスに適するという利点がある。ＴＤＤ方式のもう他の長所では、アップリンクとダウンリンクが同一周波数領域で送受信されるため、アップリンクとダウンリンクのチャネル状態がほぼ一致する。従って、信号を受信すると正確にチャネル状態を推定することができてアレイアンテナ（Ａｒｒａｙ　Ａｎｔｅｎｎａ）技術等に適する。ＴＤＤ方式は、全体周波数領域をアップリンクまたはダウンリンクとして使用し、時間領域でアップリンクとダウンリンクを区分しているため、一定時間はアップリンクとして使用して、もう他の一定時間はダウンリンクとして使用するため、基地局と端末間にデータ送受信が同時に行われることができない。

【００１０】

基地局がダウンリンクデータを伝送すると、端末は一定時間が経過した後にダウンリンクデータに対するＡＣＫ／ＮＡＣＫ信号をアップリンクに伝送する。もし、ダウンリンク伝送に使われる時間がアップリンク伝送に使われる時間より大きい場合、ＡＣＫ／ＮＡＣＫ信号を伝送することができる最小割当てであることがある。即ち、一つの端末がダウンリンクに受信したＮ個のパケットに対してＮより小さい数のＡＣＫ／ＮＡＣＫリソースを用いてＡＣＫ／ＮＡＣＫ信号を伝送しなければならない状況が発生する。ダウンリンクパケットの数より少ない数のＡＣＫ／ＮＡＣＫ信号がフィードバックされる状況でも、パケットの損失を最小化して後退性能を極大化することができるＡＣＫ／ＮＡＣＫ信号の伝送方法が要求される。

【発明の概要】

【発明が解決しようとする課題】

【００１１】

本発明の技術的課題は、無線通信システムでＡＣＫ／ＮＡＣＫ信号を効率的に伝送する方法を提供することである。

【課題を解決するための手段】

【００１２】

本発明の一態様によると、無線通信システムで端末がＨＡＲＱを遂行する方法が提供される。前記方法は、バンドルされた複数のダウンリンクサブフレームの数を指示するバンドル指示子を受信すること、ここで前記バンドルされた複数のダウンリンクサブフレームの各サブフレームは一つまたは複数の符号語の伝送に使われ、前記バンドル指示子と検出されるバンドルされた複数のダウンリンクサブフレームの数を比較することによって少なくとも一つのバンドルされたダウンリンクサブフレームが紛失されたかを判断すること；どんなバンドルされたダウンリンクサブフレームも紛失されない場合、代表ＡＣＫ／ＮＡＣＫ信号を生成すること、及び前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネルに伝送することを含む。前記代表ＡＣＫ／ＮＡＣＫ信号は、前記検出されるバンドルされたダウンリンクサブフレーム内の全ての符号語が成功的に受信される場合ＡＣＫ信号であり、以外の場合にはＮＡＣＫ信号である。

【００１３】

本発明の他の態様によると、無線通信システムで端末が制御信号を伝送する方法が提供される。前記方法は、Ｍ個の複数のダウンリンクサブフレーム内のバンドルされたダウンリンクサブフレームの数を指示するバンドル指示子を受信すること、バンドルされたダウンリンクサブフレームが検出される場合、カウンタ（ｃｏｕｎｔｅｒ）を増加させること；前記バンドル指示子が前記カウンタと同じでない場合、代表ＮＡＣＫ信号を生成すること、及びアップリンクサブフレームのアップリンク共用チャネルを介して前記代表ＮＡＣＫ信号を伝送することを含む。前記代表ＮＡＣＫ信号を前記バンドルされた複数のダウンリンクサブフレーム内の全ての符号語に対する非成功的な受信を表す。

【００１４】

本発明のもう他の態様によると、無線通信システムで端末が制御信号を伝送する方法が提供される。前記方法は、バンドルされたダウンリンクサブフレーム内の符号語を受信すること、バンドルされたダウンリンクサブフレームが検出される時、カウンタを増加させること、代表ＡＣＫ／ＮＡＣＫ信号を生成すること、及び前記代表ＡＣＫ／ＮＡＣＫ信号及び前記カウンタをアップリンクサブフレーム内のアップリンク共用チャネル上に伝送することを含む。前記代表ＡＣＫ／ＮＡＣＫ信号は、少なくとも一つのバンドルされたダウンリンクサブフレームが紛失される、或いは少なくとも一つの符号語が成功的に受信されない場合、ＮＡＣＫ信号である。そして、前記代表ＡＣＫ／ＮＡＣＫ信号は、前記バンドルされた複数のダウンリンクサブフレームが全て検出され、前記符号語が全て成功的に受信される場合ＡＣＫ信号である。

【００１５】

本発明のもう他の態様によると、無線通信システムで端末がＨＡＲＱを遂行する方法が提供される。前記方法は、バンドルされた複数のダウンリンクサブフレームを受信するこ

と、ここで前記バンドルされた複数のダウンリンクサブフレームの各サブフレームは一つまたは複数の符号語の伝送に使われる－、代表ＡＣＫ／ＮＡＣＫ信号を生成すること、及び前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネル上に伝送することを含む。前記代表ＡＣＫ／ＮＡＣＫ信号は、前記バンドルされた複数のダウンリンクサブフレーム内の全ての符号語が成功的に受信される場合にＡＣＫ信号であり、前記バンドルされた複数のダウンリンクサブフレーム内で少なくとも一つの符号語も成功的に受信されない場合、ＮＡＣＫ信号である。前記代表ＡＣＫ／ＮＡＣＫ信号を運搬する前記アップリンクチャネルのためのアップリンクリソースは、最後に検出されるバンドルされたダウンリンクサブフレーム及び／または前記最後に検出されるバンドルされたダウンリンクサブフレームのスケジューリングのために使われるダウンリンクリソースと関連する。

【００１６】

本発明のもう他の態様によると、無線通信システムでＨＡＲＱを用いてＡＣＫ／ＮＡＣＫ信号を伝送する装置が提供される。前記装置は、バンドルされた複数のダウンリンクサブフレームの数を表示するバンドル指示子を受信する受信部、ここで前記バンドルされた複数のダウンリンクサブフレームの各サブフレームは一つまたは複数の符号語の伝送に使われる－、前記バンドル指示子と検出されるバンドルされた複数のダウンリンクサブフレームの数とを比較することによって、少なくとも一つのバンドルされたダウンリンクサブフレームが紛失されたかを判断する判断部；どんなバンドルされたダウンリンクサブフレームも紛失されない場合、代表ＡＣＫ／ＮＡＣＫ信号を生成する生成部、及び前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネルに伝送する伝送部を含む。前記代表ＡＣＫ／ＮＡＣＫ信号は、前記検出されるバンドルされたダウンリンクサブフレーム内の全ての符号語が成功的に受信される場合ＡＣＫ信号であり、以外の場合にはＮＡＣＫ信号である。

【発明の効果】

【００１７】

ダウンリンクパケットの数より少ない数のＡＣＫ／ＮＡＣＫ信号がフィードバックされる状況でも、パケットの損失が最小化して後退性能を極大化することができる。

【図面の簡単な説明】

【００１８】

【図１】無線通信システムを示したブロック図である

【図２】端末の要素を示したブロック図である。

【図３】無線フレーム構造の一例である。

【図４】無線フレーム構造の他の例である。

【図５】ダウンリンクサブフレームの構造の一例である。

【図６】アップリンクサブフレームの構造の一例である。

【図７】ＰＵＣＣＨにおけるＡＣＫ／ＮＡＣＫ信号の伝送を示す。

【図８】本発明の一例にともなうＡＣＫ／ＮＡＣＫバンドル（ＡＣＫ／ＮＡＣＫ　ｂｕｎｄｌｉｎｇ）によりＨＡＲＱを遂行する方法を説明する。

【図９】本発明の一例にともなうＴＤＤシステムにおけるＨＡＲＱ遂行方法を示す流れ図である。

【図１０】本発明の一例にともなう代表ＡＣＫ／ＮＡＣＫ信号を無線リソースにマッピングする方法を説明する図面である。

【図１１】本発明の一例にともなうＴＤＤシステムでＡＣＫ／ＮＡＣＫ信号の伝送方法を説明する説明図である。

【図１２】本発明の他の例にともなうＴＤＤシステムでＡＣＫ／ＮＡＣＫ信号の伝送方法を説明する流れ図である。

【発明を実施するための形態】

【００１９】

以下の技術は、ＣＤＭＡ（ｃｏｄｅ　ｄｉｖｉｓｉｏｎ　ｍｕｌｔｉｐｌ　ａａｃｃｅｓｓ）、ＦＤＭＡ（ｆｒｅｑｕｅｎｃｙ　ｄｉｖｉｓｉｏｎ　ｍｕｌｔｉｐｌｅ　ａｃｃｅｓｓ）、ＴＤＭＡ（ｔｉｍｅ　ｄｉｖｉｓｉｏｎ　ｍｕｌｔｉｐｌｅ　ａｃｃｅｓｓ）

、ＯＦＤＭＡ（ｏｒｔｈｏｇｏｎａｌ ｆｒｅｑｕｅｎｃｙ ｄｉｖｉｓｉｏｎ ｍｕｌｔｉｐｌｅ ａｃｃｅｓｓ）、ＳＣ－ＦＤＭＡ（ｓｉｎｇｌｅ ｃａｒｒｉｅｒ ｆｒｅｑｕｅｎｃｙ ｄｉｖｉｓｉｏｎ ｍｕｌｔｉｐｌｅ ａｃｃｅｓｓ）などのような多様な無線通信システムに使われることができる。ＣＤＭＡは、ＵＴＲＡ（Ｕｎｉｖｅｒｓａｌ Ｔｅｒｒｅｓｔｒｉａｌ Ｒａｄｉｏ Ａｃｃｅｓｓ）やＣＤＭＡ２０００のような無線技術（ｒａｄｉｏ ｔｅｃｈｎｏｌｏｇｙ）により具現されることができる。ＴＤＭＡは、ＧＳＭ（Ｇｌｏｂａｌ Ｓｙｓｔｅｍ ｆｏｒ Ｍｏｂｉｌｅ ｃｏｍｍｕｎｉｃａｔｉｏｎｓ）／ＧＰＲＳ（Ｇｅｎｅｒａｌ Ｐａｃｋｅｔ Ｒａｄｉｏ Ｓｅｒｖｉｃｅ）／ＥＤＧＥ（Ｅｎｈａｎｃｅｄ Ｄａｔａ Ｒａｔｅｓ ｆｏｒ ＧＳＭ Ｅｖｏｌｕｔｉｏｎ）のような無線技術により具現されることができる。ＯＦＤＭＡは、ＩＥＥＥ８０２．１１（Ｗｉ－Ｆｉ）、ＩＥＥＥ８０２．１６（ＷｉＭＡＸ）、ＩＥＥＥ８０２－２０、Ｅ－ＵＴＲＡ（Ｅｖｏｌｖｅｄ ＵＴＲＡ）などのような無線技術により具現されることができる。ＵＴＲＡは、ＵＭＴＳ（Ｕｎｉｖｅｒｓａｌ Ｍｏｂｉｌｅ Ｔｅｌｅｃｏｍｍｕｎｉｃａｔｉｏｎｓ Ｓｙｓｔｅｍ）の一部である。３ＧＰＰ（３ｒｄ Ｇｅｎｅｒａｔｉｏｎ Ｐａｒｔｎｅｒｓｈｉｐ Ｐｒｏｊｅｃｔ）ＬＴＥ（ｌｏｎｇ ｔｅｒｍ ｅｖｏｌｕｔｉｏｎ）は、Ｅ－ＵＴＲＡ（Ｅｖｏｌｖｅｄ－ＵＭＴＳ Ｔｅｒｒｅｓｔｒｉａｌ Ｒａｄｉｏ Ａｃｃｅｓｓ）を使用するＥ－ＵＭＴＳ（Ｅｖｏｌｖｅｄ ＵＭＴＳ）の一部であって、ダウンリンクでＯＦＤＭＡを採用し、アップリンクでＳＣ－ＦＤＭＡを採用する。ＬＴＥ－Ａ（Ａｄｖａｎｃｅｄ）は３ＧＰＰ ＬＴＥの進化である。

【００２０】

図１は、無線通信システムを示したブロック図である。無線通信システムは、音声、パケットデータなどのような多様な通信サービスを提供するために広く配設される。

【００２１】

図１を参照すると、無線通信システムは、基地局（１０；Ｂａｓｅ Ｓｔａｔｉｏｎ、ＢＳ）及び端末（２０；Ｕｓｅｒ Ｅｑｕｉｐｍｅｎｔ、ＵＥ）を含む。基地局（１０）は、一般的に端末（２０）と通信する固定された地点（ｆｉｘｅｄ ｓｔａｔｉｏｎ）をいい、ノードＢ（Ｎｏｄｅ－Ｂ）、ＢＴＳ（Ｂａｓｅ Ｔｒａｎｓｃｅｉｖｅｒ Ｓｙｓｔｅｍ）、アクセスポイント（Ａｃｃｅｓｓ Ｐｏｉｎｔ）等、他の用語とも呼ばれることができる。一つの基地局（１０）には一つ以上のセルが存在することができる。端末（２０）は、固定されるか、或いは移動性を有することができ、ＭＳ（Ｍｏｂｉｌｅ Ｓｔａｔｉｏｎ）、ＵＴ（Ｕｓｅｒ Ｔｅｒｍｉｎａｌ）、ＳＳ（Ｓｕｂｓｃｒｉｂｅｒ Ｓｔａｔｉｏｎ）、無線機器（ｗｉｒｅｌｅｓｓ ｄｅｖｉｃｅ）等、他の用語とも呼ばれることができる。

【００２２】

無線通信システムは、アップリンク及び／またはダウンリンクＨＡＲＱを支援することができる。また、リンク適応（Ｌｉｎｋ ａｄａｐｔａｔｉｏｎ）のためにＣＱＩ（ｃｈａｎｎｅｌ ｑｕａｌｉｔｙ ｉｎｄｉｃａｔｏｒ）を使用することができる。ダウンリンクとアップリンク伝送のための多重接続方式はお互いに異なってもよい。例えば、ダウンリンクはＯＦＤＭＡ（Ｏｒｔｈｏｇｏｎａｌ Ｆｒｅｑｕｅｎｃｙ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ）を使用して、アップリンクはＳＣ－ＦＤＭＡ（Ｓｉｎｇｌｅ Ｃａｒｒｉｅｒ－Ｆｒｅｑｕｅｎｃｙ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ）を使用することができる。

【００２３】

無線通信システムに適用される多重接続方式には制限がない。ＣＤＭＡ（Ｃｏｄｅ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ）、ＴＤＭＡ（Ｔｉｍｅ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ）、ＦＤＭＡ（Ｆｒｅｑｕｅｎｃｙ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ）、ＳＣ－ＦＤＭＡ（Ｓｉｎｇｌｅ－Ｃａｒｒｉｅｒ ＦＤＭＡ）、ＯＦＤＭＡ（ＯｒｔｈｏｇｏｎａｌＦｒｅｑｕｅｎｃｙ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅ Ａｃｃｅｓｓ）または公知された他の変調技術等のような多重接続技法に基づいてもよい。これらの変調技法は通信システムの多重使用者から受

信された信号を復調して通信システムの容量を増加させる。

【００２４】

端末とネットワーク間の無線インターフェースプロトコル（ｒａｄｉｏ　ｉｎｔｅｒｆａｃｅ　ｐｒｏｔｏｃｏｌ）の階層は、通信システムで広く知られた開放型システム間相互接続（Ｏｐｅｎ　Ｓｙｓｔｅｍ　Ｉｎｔｅｒｃｏｎｎｅｃｔｉｏｎ：ＯＳＩ）モデルの下位３個の階層に基づいて第１階層（Ｌ１）、第２階層（Ｌ２）、第３階層（Ｌ３）に区分されることができる。このうち、第１階層に属する物理階層は物理チャネル（ｐｈｙｓｉｃａｌ　ｃｈａｎｎｅｌ）を用いた情報伝送サービス（ｉｎｆｏｒｍａｔｉｏｎ　ｔｒａｎｓｆｅｒ　ｓｅｒｖｉｃｅ）を提供して、第３階層に位置する無線リソース制御（ｒａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ；以下、ＲＲＣという）階層は端末とネットワーク間に無線リソースを制御する役割を遂行する。このためにＲＲＣ階層は端末とネットワーク間にＲＲＣメッセージをお互いに交換する。

【００２５】

物理階層で使われるいくつかのダウンリンク物理制御チャネルがある。ＰＤＣＣＨ（ｐｈｙｓｉｃａｌ　ｄｏｗｎｌｉｎｋ　ｃｏｎｔｒｏｌ　ｃｈａｎｎｅｌ）は、端末にＰＣＨとＤＬ－ＳＣＨのリソース割当及びＤＬ－ＳＣＨと関連したＨＡＲＱ情報に対して知らせる。ＰＤＣＣＨは、端末にダウンリンク伝送のリソース割当を知らせるダウンリンクグラント（ｄｏｗｎｌｉｎｋ　ｇｒａｎｔ）及びアップリンク伝送のリソース割当を知らせるアップリンクグラント（ｕｐｌｉｎｋ　ｇｒａｎｔ）を伝送することができる。ＰＣＦＩＣＨ（ｐｈｙｓｉｃａｌ　ｃｏｎｔｒｏｌ　Ｆｏｒｍａｔ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）は、端末にサブフレーム内でＰＤＣＣＨの伝送に使われるＯＦＤＭシンボルの数を知らせる。ＰＣＦＩＣＨは、サブフレームごとに伝送される。ＰＨＩＣＨ（ｐｈｙｓｉｃａｌ　Ｈｙｂｒｉｄ　ＡＲＱ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）は、アップリンク伝送の応答としてＨＡＲＱ　ＡＣＫ／ＮＡＣＫ信号を伝送する。

【００２６】

図２は、端末の要素を示したブロック図である。端末（５０）は、プロセッサ（ｐｒｏｃｅｓｓｏｒ、５１）、メモリ（ｍｅｍｏｒｙ、５２）、ＲＦ部（ＲＦ　ｕｎｉｔ、５３）、ディスプレー部（ｄｉｓｐｌａｙ　ｕｎｉｔ、５４）、使用者インターフェース部（ｕｓｅｒ　ｉｎｔｅｒｆａｃｅ　ｕｎｉｔ、５５）を含む。プロセッサ（５１）は、無線インターフェースプロトコルの階層が具現され、制御平面と使用者平面を提供する。各階層の機能はプロセッサ（５１）を介して具現されることができる。メモリ（５２）は、プロセッサ（５１）と連結して、端末駆動システム、アプリケーション及び一般的なファイルを格納する。ディスプレー部（５４）は、端末の多様な情報をディスプレーして、ＬＣＤ（Ｌｉｑｕｉｄ　Ｃｒｙｓｔａｌ　Ｄｉｓｐｌａｙ）、ＯＬＥＤ（Ｏｒｇａｎｉｃ　Ｌｉｇｈｔ　Ｅｍｉｔｔｉｎｇ　Ｄｉｏｄｅｓ）等、よく知られた要素を使用することができる。使用者インターフェース部（５５）は、キーパッドやタッチスクリーンなど、よく知られた使用者インターフェースの組合せでなることができる。ＲＦ部（５３）は、プロセッサと連結して、無線信号（ｒａｄｉｏ　ｓｉｇｎａｌ）を送信及び／または受信する。

【００２７】

図３は、無線フレーム構造の一例である。

【００２８】

図３を参照すると、無線フレーム（ｒａｄｉｏ　ｆｒａｍｅ）は、１０個のサブフレーム（ｓｕｂｆｒａｍｅ）で構成され、一つのサブフレームは２個のスロット（ｓｌｏｔ）を含むことができる。データ伝送の基本単位はサブフレーム単位になり、サブフレーム単位にダウンリンクまたはアップリンクのスケジューリングが行われる。一つのスロットは、時間領域で複数のＯＦＤＭシンボルと周波数領域で少なくとも一つの副搬送波を含むことができる。一つのスロットは７または６ＯＦＤＭシンボルを含むことができる。

【００２９】

図４は、無線フレーム構造の他の例である。これはＦＤＤ無線フレーム構造である。

【００３０】
図４を参照すると、無線フレーム（ｒａｄｉｏ　ｆｒａｍｅ）は、２つのハーフフレーム（ｈａｌｆ－ｆｒａｍｅ）を含む。各ハーフフレームの構造は同一である。ハーフフレームは、５個のサブフレーム（ｓｕｂｆｒａｍｅ）と３個のフィールド（ｆｉｅｌｄ）ＤｗＰＴＳ（Ｄｏｗｎｌｉｎｋ　Ｐｉｌｏｔ　Ｔｉｍｅ　Ｓｌｏｔ：ＤｗＰＴＳ）、保護区間（Ｇｕａｒｄ　Ｐｅｒｉｏｄ）及びＵｐＰＴＳ（Ｕｐｌｉｎｋ　Ｐｉｌｏｔ　Ｔｉｍｅ　Ｓｌｏｔ）を含む。ＤｗＰＴＳは、端末における初期セル探索、同期化またはチャネル推定に使われる。ＵｐＰＴＳは、基地局におけるチャネル推定と端末のアップリンク伝送同期を合せるとき使われる。保護区間は、アップリンクとダウンリンクとの間にダウンリンク信号の多重経路の遅延によりアップリンクで生じる干渉を除去するための区間である。

【００３１】
表１は、無線フレームの設定情報（ｃｏｎｆｉｇｕｒａｔｉｏｎ）の一例を表す。無線フレームの設定情報は、一つの無線フレーム内の全てのサブフレームにアップリンクとダウンリンクが如何なる規則により割当（または予約）されるかを表す情報である。

【００３２】

【表１】

【表１】

Configuration	Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

表１を参照すると、‘Ｄ’はサブフレームがダウンリンク伝送のために使われることを表して、‘Ｕ’はサブフレームがアップリンク伝送のために使われることを表す。‘Ｓ’はサブフレームが特別な用途に使われることを表し、フレーム同期（ｓｙｎｃ）を合わせる、或いはダウンリンク伝送のために使われることを表す。以下、ダウンリンク伝送のために使われるサブフレームを簡単にダウンリンクサブフレームといい、アップリンク伝送のために使われるサブフレームを簡単にアップリンクサブフレームという。各設定ごとに一つの無線フレーム内のダウンリンクサブフレームとアップリンクサブフレームの配置（ｐｏｓｉｔｉｏｎ）及び個数が相違する。

【００３３】
ダウンリンクからアップリンクに変更される時点またはアップリンクからダウンリンクに切り替える時点を切り替え時点（ｓｗｉｔｃｈｉｎｇ　ｐｏｉｎｔ）という。切り替え時点の周期性（Ｓｗｉｔｃｈ－ｐｏｉｎｔ　ｐｅｒｉｏｄｉｃｉｔｙ）は、アップリンクサブフレームとダウンリンクサブフレームが切り替える様相が同一に繰り返される周期を意味して、５ｍｓまたは１０ｍｓである。例えば、設定０から見ると、０番目から４番目サブフレームまでＤ－＞Ｓ－＞Ｕ－＞Ｕ－＞Ｕに切り替え、５番目から９番目サブフレームまで以前と同一にＤ－＞Ｓ－＞Ｕ－＞Ｕ－＞Ｕに切り替える。一つのサブフレームが１ｍｓであるため、切り替え時点の周期性は５ｍｓである。勿論、切り替え時点の周期性は一つの無線フレーム長さ（１０ｍｓ）より少なく、無線フレーム内で切り替える様相が１回繰り返される。

【００３４】
全ての設定において、０番目、５番目サブフレーム、及びＤｗＰＴＳはダウンリンク伝送のために使われる。全ての設定の１番目サブフレームと設定０、１、２、及び６の６番目サブフレームはＤｗＰＴＳ、保護区間、及びＵｐＰＴＳで構成される。各フィールドの時間長さは設定に従って異なる。前記１番目及び６番目サブフレームを除外した残りの８個のサブフレームは２個のスロットで構成される。

【００３５】

切り替え時点の周期が毎５ｍｓである場合、ＵｐＰＴＳと２番目及び７番目サブフレームはアップリンク伝送に予約される。一方、切り替え時点の周期が毎１０ｍｓである場合、ＵｐＰＴＳと２番目サブフレームはアップリンク伝送に予約され、ＤｗＰＴＳ、７番目及び９番目サブフレームはダウンリンク伝送に予約される。

【００３６】

前記表１の設定情報は、基地局と端末が全て知っているシステム情報であってもよい。基地局は、無線フレームの設定情報が変わる時ごとに設定情報のインデックスだけを伝送することによって、無線フレームのアップリンク－ダウンリンク割当状態の変更を端末に知らせることができる。前記設定情報は、一種のダウンリンク制御情報であって、他のスケジューリング情報と同様に、ダウンリンク制御チャネルであるＰＤＣＣＨ（Ｐｈｙｓｉｃａｌ Ｄｏｗｎｌｉｎｋ Ｃｏｎｔｒｏｌ ＣＨａｎｎｅｌ）を介して伝送されることができる。または、前記設定情報は、放送情報であって、ブロードキャストチャネル（ｂｒｏａｄｃａｓｔ ｃｈａｎｎｅｌ）を介してセル内の全ての端末に共通に伝送される制御情報であってもよい。または前記設定情報はシステム情報に含まれた情報であってもよい。

【００３７】

前記表１で、‘Ｓ’が全てダウンリンクサブフレームとすると、設定情報２の場合、一つの無線フレームは、８個のダウンリンクサブフレームと２個のアップリンクサブフレームを含む。即ち、ダウンリンクサブフレームとアップリンクサブフレームの比率が４：１である。この場合、端末は、４個のダウンリンクサブフレームを介してデータを受信して、１個のアップリンクサブフレームを介してＡＣＫ／ＮＡＣＫ信号を伝送しなければならない。このようにダウンリンクサブフレームの数がアップリンクサブフレームの数より大きい場合、データが伝送されるサブフレームとＡＣＫ／ＮＡＣＫ信号が伝送されるサブフレームとを１：１に対応させるにはアップリンク無線リソースが足りない。従って、データが伝送されるサブフレームとＡＣＫ／ＮＡＣＫ信号が伝送されるサブフレームとの間にＮ：１マッピングをさせるが、この場合、一端末に対する複数のＰＤＳＣＨ（Ｐｈｙｓｉｃａｌ Ｄｏｗｎｌｉｎｋ Ｓｈａｒｅｄ ＣＨａｎｎｅｌ）伝送に対するＨＡＲＱフィードバックとして単一ＡＣＫ／ＮＡＣＫ信号が使われてもよい。このようなモード（ｍｏｄｅ）をＡＣＫ／ＮＡＣＫハンドル（ｂｕｎｄｌｉｎｇ）であるともいう。

【００３８】

図５は、ダウンリンクサブフレーム構造の一例である。

【００３９】

図５を参照すると、ダウンリンクサブフレーム内の最初のスロットの最前の最大３ＯＦＤＭシンボルはＰＤＣＣＨの割り当てられる制御領域（ｃｏｎｔｒｏｌ ｒｅｇｉｏｎ）であり、残りのＯＦＤＭシンボルはＰＤＳＣＨの割り当てられるデータ領域（ｄａｔａ ｒｅｇｉｏｎ）になる。制御領域にはＰＤＣＣＨの以外にもＰＣＦＩＣＨ、ＰＨＩＣＨなどの制御チャネルが割り当てられてもよい。端末はＰＤＣＣＨを介して伝送される制御情報をデコーディングしてＰＤＳＣＨを介して伝送されるデータ情報を読むことができる。ここで、制御領域が３ＯＦＤＭシンボルを含むことは例示にすぎない、サブフレーム内の制御領域が含むＯＦＤＭシンボルの数はＰＣＦＩＣＨを介して分かる。

【００４０】

制御領域は、複数のＣＣＥ（ｃｏｎｔｒｏｌ ｃｈａｎｎｅｌ ｅｌｅｍｅｎｔｓ）であるＣＣＥ集合で構成される。以下、ＣＣＥ集合は一つのサブフレーム内で制御領域を構成する全体ＣＣＥの集合である。ＣＣＥは複数のリソース要素グループ（ｒｅｓｏｕｒｃｅ ｅｌｅｍｅｎｔ ｇｒｏｕｐ）に対応される。例えば、ＣＣＥは９リソース要素グループに対応されることができる。リソース要素グループはリソース要素に制御チャネルをマッピングすることを定義するために使われる。例えば、一つのリソース要素グループは４個のリソース要素で構成されることができる。

【００４１】

複数の端末に対する多重化された複数のＰＤＣＣＨが制御領域内で伝送されることがで

きる。ＰＤＣＣＨはスケジューリング割当などのような制御情報（ｃｏｎｔｒｏｌ　ｉｎｆｏｒｍａｔｉｏｎ）を伝送する。ＰＤＣＣＨは一つまたは多数の連続的なＣＣＥ（ｃｏｎｔｒｏｌ　ｃｈａｎｎｅｌ　ｅｌｅｍｅｎｔｓ）の集団（ａｇｇｒｅｇａｔｉｏｎ）上に伝送される、以下、ＰＤＣＣＨ伝送のために使われるＣＣＥの数（Ｎｕｍｂｅｒ　ｏｆ　ＣＣＥｓ）をＣＣＥ集団レベル（ａｇｇｒｅｇａｔｉｏｎ　ｌｅｖｅｌ）という。例えば、ＣＣＥ集団レベルは１，２，４，８の元素であってもよい。ＣＣＥ集団レベルはＰＤＣＣＨ伝送のために使われるＣＣＥの数であり、ＰＤＣＣＨを検索するためのＣＣＥ単位である。ＣＣＥ集団レベルの大きさは隣接するＣＣＥの数により定義される。端末毎にＣＣＥ集団レベルが異なることができる。例えば、図６では第２、第３及び第６端末（ＵＥ２、ＵＥ４、ＵＥ６）のＣＣＥ集団レベル（Ｌ）は１である。第３及び第５端末（ＵＥ３，ＵＥ５）のＣＣＥ集団レベル（Ｌ）は２であり、第１及び第７端末（ＵＥ１、ＵＥ７）のＣＣＥ集団レベル（Ｌ）は４である。

【００４２】

図６は、アップリンクサブフレームの構造の一例である。

【００４３】

図６を参照すると、アップリンクサブフレームは、周波数領域でアップリンク制御情報を伝送する物理アップリンク制御チャネル（ＰＵＣＣＨ）が割り当てられる制御領域（Ｃｏｎｔｒｏｌ　Ｒｅｇｉｏｎ）と使用者データを伝送するＰＵＳＣＨが割り当てられるデータ領域（Ｄａｔａ　Ｒｅｇｉｏｎ）に分けることができる。

【００４４】

一つの端末に対するＰＵＣＣＨは、サブフレームでＲＢ対（ｒｅｓｏｕｒｃｅ　ｂｌｏｃｋ　ｐａｉｒ）に割り当てられ、ＲＢ対に属するＲＢは、２スロットの各々でお互いに異なる副搬送波を占める。これをＰＵＣＣＨに割り当てられるＲＢ対がスロット境界（ｓｌｏｔ　ｂｏｕｎｄａｒｙ）で周波数跳躍（ｆｒｅｑｕｅｎｃｙ　ｈｏｐｐｉｎｇ）されるという。

【００４５】

ＰＵＣＣＨは多重フォーマットを支援することができる、即ち、変調方式（ｍｏｄｕｌａｔｉｏｎ　ｓｃｈｅｍｅ）に従ってサブフレーム当たりお互いに異なるビット数を有するアップリンク制御情報を伝送することができる。次の表は、３ＧＰＰ　ＴＳ　３６．２１１　Ｖ８．２．０に従ってを支援されるＰＵＣＣＨフォーマット、変調方式及びビット数を表す。

【００４６】

【表２】

PUCCH format	Modulation scheme	Number of bits per subframe, M_{bit}
1	N/A	N/A
1a	BPSK	1
1b	QPSK	2
2	QPSK	20
2a	QPSK+BPSK	21
2b	QPSK+QPSK	22

ＰＵＣＣＨフォーマット１はＳＲ（ｓｃｈｅｄｕｌｉｎｇ　ｒｅｑｕｅｓｔ）の伝送に使われて、ＰＵＣＣＨフォーマット１ａ／１ｂは代表ＡＣＫ／ＮＡＣＫ信号の伝送に使われて、ＰＵＣＣＨフォーマット２はＣＱＩの伝送に使われて、ＰＵＣＣＨフォーマット２ａ／２ｂはＣＱＩ及び代表ＡＣＫ／ＮＡＣＫ信号の伝送に使われる。

【００４７】

任意のサブフレームで代表ＡＣＫ／ＮＡＣＫ信号が単独に伝送される場合にはＰＵＣＣ

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Hフォーマット1a／1bを使われて、SRが単独に伝送される場合にはPUCCHフォーマット1を使用する。前記では各種制御情報を伝送するPUCCH上のフォーマットに関して記述した。PUCCHのフォーマットに従って、制御情報の伝送に使われる無線リソースの割当方式及び割当量が変わることができる。

【0048】

図7は、PUCCHにおけるACK／NACK信号の伝送を示す。

【0049】

図7を参照すると、一つのスロットに含まれる7SC－FDMAシンボルのうち3SC－FDMAシンボルにはRS（reference signal）が載せ、残りの4SC－FDMAシンボルにはACK／NACK信号が載せる。RSはスロットの中間の3個の連続する（contiguous）SC－FDMAシンボルに載せる。

【0050】

ACK NACK信号を伝送するために2ビットのACK／NACK信号をQPSK（Quadrature Phase Shift Keying）変調させて一つの変調シンボルd（0）に生成する。変調シンボルd（0）と循環シフト（cyclic shift）されたシーケンスr（n、a）に基づいて変調されたシーケンス（modulated sequence）m（n）を生成する。循環シフトされたシーケンスr（n、a）に変調シンボルをかけて次のような変調されたシーケンスy（n）を生成することができる。

【0051】

【数1】

【式1】

$$y(n) = d(0)\, r(n,a)$$

循環シフトされたシーケンスr（n、a）のCS（cyclic shift）量aは各SC－FDMAシンボルごとに変わってもよく、同一であってもよい。ここでは、一つのスロット内に15SC－FDMAシンボルに対してCS量aを順次的に0、1、2、3、4、5、6、7に置いているか、これは例示にすぎない。

【0052】

ここでは、2ビットのACK／NACK信号をQPSK変調を介して一つの変調シンボルを生成することを例示しているが、1ビットのACK／NACK信号をBPSK（Binary Phase Shift Keying）変調を介して一つの変調シンボルを生成することもできる。ACK／NACK信号のビット数、変調方式、変調シンボルの数は例示に過ぎず、本発明の技術的思想を制限するのではない。

【0053】

また、端末容量を増加させるために、変調されたシーケンスは直交シーケンスを用いて広がることができる。拡散係数（spreading factor）K＝4である直交シーケンスw（k）（iはシーケンスインデックス、0≦k≦K－1）であり、次のようなシーケンスを使用することができる。

【0054】

【式3】

【表3】

Sequence index	{w(0), w(1), w(2), w(3)}
0	[+1 +1 +1 +1]
1	[+1 −1 +1 −1]
2	[+1 −1 −1 +1]

または、拡散係数K＝3である直交シーケンスw（k）（iはシーケンスインデックス、0≦k≦K－1）であり、次のようなシーケンスを使用することができる。

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【００３５】
【表４】
【表４】

Sequence index	[w(0), w(1), w(2)]
0	[1 1 1]
1	$\left[1 \quad e^{j2\pi/3} \quad e^{j4\pi/3}\right]$
2	$\left[1 \quad e^{j4\pi/3} \quad e^{j2\pi/3}\right]$

ここでは、代表ＡＣＫ／ＮＡＣＫ信号のための一つのスロット内の４ＳＣ－ＦＤＭＡシンボルに対して拡散係数Ｋ＝４である直交シーケンスｗ（ｋ）を介して変調されたシーケンスを拡散させるのを示している。
【００３６】
図８は、本発明の一例にともなうＡＣＫ／ＮＡＣＫバンドル（ＡＣＫ／ＮＡＣＫ ｂｕｎｄｌｉｎｇ）によりＨＡＲＱを遂行する方法を説明する。これはダウンリンク伝送に使われるサブフレームの個数がアップリンク伝送に使われるサブフレームの個数より大きいＴＤＤシステムでダウンリンクにデータを受信した端末がＡＣＫ／ＮＡＣＫ信号をアップリンクに伝送することを示す。然しながら、本発明はＴＤＤシステムでないシステムでも１個のアップリンクサブフレーム上に、複数のダウンリンクサブフレームに対するＡＣＫ／ＮＡＣＫ信号を伝送する場合に適用可能である。
【００３７】
図８を参照すると、端末が通話する３個のダウンリンクサブフレーム上に受信するデータまたはＰＤＳＣＨに対応する一つのＡＣＫ／ＮＡＣＫ信号を１個のアップリンクサブフレーム上に伝送する。即ち、データ（またはＰＤＳＣＨ）に対するＡＣＫ，ＮＡＣＫ信号の比率が３：１である。ＴＤＤシステムで特定端末に多数のサブフレームがダウンリンク伝送に割り当てられる場合には前記ダウンリンクに伝送されるデータを一つのＨＡＲＱ（Ｈｙｂｒｉｄ ＡＲＱ）パケット（ｐａｃｋｅｔ）と見なしてＡＣＫ／ＮＡＣＫ信号を伝送する。
【００３８】
以下、ＡＣＫ／ＮＡＣＫバンドルにより一つのアップリンクサブフレームにより伝送されるＡＣＫ／ＮＡＣＫ信号を代表ＡＣＫ／ＮＡＣＫ（ｒｅｐｒｅｓｅｎｔｉｔｉｖｅ ＡＣＫ／ＮＡＣＫ）信号といい、前記一つのアップリンクサブフレームと関連した複数のダウンリンクサブフレームのうち、任意の端末のためのデータが伝送されるものなくとも一つ以上のダウンリンクサブフレームを結合上バンドルされた複数のダウンリンクサブフレーム（ｂｕｎｄｌｅｄ ｄｏｗｎｌｉｎｋ ｓｕｂｆｒａｍｅｓ）という。また、バンドルされた複数のダウンリンクサブフレームに属する各々のサブフレームをバンドルされたダウンリンクサブフレーム（ｂｕｎｄｌｅｄ ｄｏｗｎｌｉｎｋ ｓｕｂｆｒａｍｅ）という。
【００３９】
端末が代表ＡＣＫ／ＮＡＣＫ信号をＡＣＫまたはＮＡＣＫに決定する方法は、次の通りである。端末は、一つのバンドルされたダウンリンクサブフレームを介して受信した符号語（ｃｏｄｅｗｏｒｄ）単位に復号化（ｄｅｃｏｄｉｎｇ）を遂行して、その結果、得られる複数のＡＣＫ信号またはＮＡＣＫ信号に論理的ＡＮＤ演算して、少なくとも一つの代表ＡＣＫ／ＮＡＣＫ信号を生成する。即ち、端末はバンドルされたダウンリンクサブフレーム上に受信される符号語を全て成功的に受信する場合に限ってＡＣＫ信号を伝送して、一つの符号語でも受信に失敗するとＮＡＣＫ信号を伝送する。或いは、複数の代表ＡＣＫ／ＮＡＣＫ信号を生成する場合にはバンドルされたダウンリンクサブフレーム上に受信さ

れる符号語を複数の符号語集合に分けて各符号語集合に対して下記のようにＡＣＫ／ＮＡＣＫ信号を伝送する。多数の符号語が合わせられたダウンリンクデータを単一データとして見てＡＣＫまたはＮＡＣＫを決定する原理である。ここで、符号語は、バンドルされたダウンリンクサブフレームごとに伝送されるデータの単位として、伝送ブロック（ｔｒａｎｓｐｏｒｔ　ｂｌｏｃｋ）とも呼ばれることができる。

【００６０】

以下、代表ＡＣＫ／ＮＡＣＫ信号の生成において判断の基礎となる符号語の集合をダウンリンクデータパケットという。従って、代表ＡＣＫ／ＮＡＣＫ信号がＡＣＫ信号であると、端末がダウンリンクデータパケットを成功的に受信したことを意味して、代表ＡＣＫ／ＮＡＣＫ信号がＮＡＣＫ信号であると、端末がダウンリンクデータパケットの受信に失敗したことを意味する。

【００６１】

もし、端末がダウンリンクデータパケットのデコーディングに失敗したならば、ＮＡＣＫ信号を伝送することは自然であり、これに伴い基地局はダウンリンクデータパケットを再伝送するとよい。然しながら、端末がスケジューリング情報（あるいはＰＤＣＣＨ）をのかして特定バンドルされたダウンリンクサブフレームを介して伝送されるデータの存在自体を検出できない場合、前記特定バンドルされたダウンリンクサブフレームを除外した残りのバンドルされたダウンリンクサブフレーム（単数又は複数）だけに基づいてＡＣＫ信号またはＮＡＣＫ信号の伝送を判断しなければならない。もちろん、端末がＮＡＣＫ信号を伝送する場合は、基地局がダウンリンクデータを再伝送することができるため問題がない。然しながら、端末がＡＣＫ信号を伝送する場合は、前記特定ダウンリンクサブフレームのデータが損失されて復旧できない問題が発生するおそれがある。従って、基地局または端末は、代表ＡＣＫ、ＮＡＣＫ信号が具体的にどのバンドルされたダウンリンクサブフレームに対応するかを知る必要がある。

【００６２】

図８ではＡＣＫ／ＮＡＣＫ信号を伝送する主体を端末と仮定しているが、基地局も同じ方式にＡＣＫ／ＮＡＣＫ信号を伝送することができることはもちろんである。

【００６３】

図９は、本発明の一例にとるなうＴＤＤシステムにおけるＨＡＲＱ遂行方法を表す流れ図である。

【００６４】

図９を参照すると、基地局はバンドル指示子（ｂｕｎｄｌｉｎｇ　ｉｎｄｉｃａｔｏｒ）を端末に伝送する（Ｓ１００）。バンドル指示子は、代表ＡＣＫ／ＮＡＣＫ信号の伝送のために一つのアップリンクサブフレームと関連する（ａｓｓｏｃｉａｔｅｄ）バンドルされたダウンリンクサブフレームを指示する制御情報である。バンドル指示子は、バンドルされたダウンリンクサブフレーム（単数又は複数）の個数であってもよく、バンドルされたダウンリンクサブフレーム（単数又は複数）の伝送順序であってもよい。バンドル指示子はスケジューリング情報に含まれ、ＰＤＣＣＨを介して伝送されることができる。またはバンドル指示子はダウンリンクデータパケットに含まれて伝送されることもできる。バンドル指示子に関する具体的な内容は後述される。

【００６５】

基地局は、任意の端末にバンドルされたダウンリンクサブフレーム上にダウンリンクデータパケットを伝送する（Ｓ１１０）。バンドルされた複数のダウンリンクサブフレームは、連続的（ｃｏｎｔｉｇｕｏｕｓ）サブフレームらである場合もあってもよく、不連続的なサブフレームらであってもよい。ダウンリンクデータパケットは、物理チャネルであるＰＤＳＣＨ（Ｐｈｙｓｉｃａｌ　Ｄｏｗｎｌｉｎｋ　Ｓｈａｒｅｄ　ＣＨａｎｎｅｌ）を介してダウンリンクサブフレーム毎に伝送される。バンドル指示子がダウンリンクデータパケットに含まれる場合、バンドル指示子は各ＰＤＳＣＨに含まれて伝送される。端末はバンドルされたダウンリンクサブフレーム（単数又は複数）を検出（ｄｅｔｅｃｔ）する（Ｓ１２０）。端末は、バンドル指示子が指示するバンドルされたダウンリンクサブフ

レーム（単数または複数）を全て成功的に検出してデータ復号化に成功した場合、受信エラーがないと判断して、一つのバンドルされたダウンリンクサブフレームでも紛失（ｍｉｓｓｅｄ）されると、受信エラーがあると判断する。例えば、バンドル指示子により指示される３個のバンドルされたダウンリンクサブフレームのうち、端末が２個のバンドルされたダウンリンクサブフレームだけを検出したと仮定する。たとえ、２個のバンドルされたダウンリンクサブフレームを正常に検出して復号化したとしても、残りの１個のバンドルされたダウンリンクサブフレームの検出に失敗したため、端末はバンドルされたダウンリンクサブフレームが紛失されたと判断して代表ＮＡＣＫ信号を生成する。もちろん、前記２個のバンドルされたダウンリンクサブフレームのうち一つでも検出に失敗する場合にも端末が検出エラーであると判断することは自明である。

【００６６】

端末は代表ＡＣＫ／ＮＡＣＫ信号を基地局に伝送する（Ｓ１３０）。端末は予め決められたアップリンクサブフレーム上に代表ＡＣＫ／ＮＡＣＫ信号を伝送する。代表ＡＣＫ／ＮＡＣＫ信号は、アップリンク制御チャネルであるＰＵＣＣＨ（Ｐｈｙｓｉｃａｌ　Ｕｐｌｉｎｋ　Ｃｏｎｔｒｏｌ　ＣＨａｎｎｅｌ）に伝送されることもでき、アップリンクデータチャネルであるＰＵＳＣＨ（ＰｈｙｓｉｃａｌＵｐｌｉｎｋ　Ｓｈａｒｅｄ　ＣＨａｎｎｅｌ）に伝送されることもできる。代表ＡＣＫ／ＮＡＣＫ信号の伝送のために使われるアップリンク無線リソースに関する具体的な内容は後述する。

【００６７】

基地局は、前記代表ＡＣＫ／ＮＡＣＫ信号がＮＡＣＫ信号である場合、ＨＡＲＱ再伝送を遂行して、前記代表ＡＣＫ／ＮＡＣＫ信号がＡＣＫ信号である場合、新規データ伝送を遂行する（Ｓ１４０）。

【００６８】

以下、バンドル指示子に関して詳述する。一例として、バンドル指示子はバンドルされたダウンリンクサブフレームの個数であってもよい。例えば、図８でバンドル指示子は３である。バンドル指示子はバンドルされたダウンリンクサブフレームを介して伝送されてもよく、一部を介して伝送されてもよい。端末は、自分の検出（ｄｅｔｅｃｔ）するバンドルされたダウンリンクサブフレームの個数をカウント（ｃｏｕｎｔ）する。以後、端末は、バンドル指示子と自分のカウントした数であるカウンタ（ｃｏｕｎｔｅｒ）を比較する。もし、バンドル指示子と端末のカウンタが等なると、端末は代表ＮＡＣＫ信号を基地局に伝送する、或いは毎らの動作をせずに、そのままＤＴＸ（ｄｉｓｃｏｎｔｉｎｕｅｏｕｓ　ｔｒａｎｓｍｉｓｓｉｏｎ）モードに動作することができる。例えば、バンドル指示子３を受信したとき、端末が実際にカウントした総ダウンリンクサブフレームの個数が２であるとすると、１個のダウンリンクサブフレームの受信に失敗したことであるため、端末は代表ＮＡＣＫ信号を基地局に伝送する、或いは何らの動作を取らない。

【００６９】

他の例として、バンドル指示子は、特定端末に対するバンドルされたダウンリンクサブフレームあるいはＰＤＳＣＨの伝送順序を指示することができる。端末は、自分の検出するバンドルされたダウンリンクサブフレームの個数をカウントする。例えば、４個のダウンリンクサブフレームが、一つのアップリンクサブフレームと代表ＡＣＫ／ＮＡＣＫ信号に対して関連されており、このうち３個が特定端末に対してバンドルされたダウンリンクサブフレームを形成すると仮定する。この場合、３個のバンドルされたダウンリンクサブフレームの伝送順序に応じて１、２、３のように順次的にバンドル指示子が各バンドルされたダウンリンクサブフレームに累積的に（ａｃｃｕｍｕｌａｔｉｖｅｌｙ）付けられることができる。前記特定端末はバンドルされたダウンリンクサブフレームを成功的に検出する時ごとにカウンタを増加させる。例えば、前記特定端末がバンドル指示子１、３に対応するバンドルされたダウンリンクサブフレームだけを検出すると仮定する。１番目バンドルされたダウンリンクサブフレームを検出すると、カウンタは１となる。前記特定端末が２番目バンドルされたダウンリンクサブフレームの検出に失敗するため、カウンタは依然として１に維持される。前記特定端末が３番目バンドルされたダウンリンクサブフレーム

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を検出すると、バンドル指示子は３であるが、カウンタは２となる。バンドル指示子とカウンタの値が同じではないため、前記特定端末は、バンドル指示子１に対応するバンドルされたダウンリンクサブフレームのＰＤＣＣＨの検出に失敗したことが分かる。この場合、前記特定端末は、バンドルされたダウンリンクサブフレームに対して代表ＮＡＣＫ信号を生成するか、或いは何らの動作をせずに、そのままＤＴＸ（ｄｉｓｃｏｎｔｉｎｕｏｕｓ ｔｒａｎｓｍｉｓｓｉｏｎ）モードに動作することができる。

【００７０】

このように、端末がバンドルされたダウンリンクサブフレームの検出エラーであると判断する例を図式化すると、次の通りである。

【００７１】

（式２）

バンドル指示子＝（Ｎｕｍ＋ｉ）ｍｏｄ（ａ）－１

ここで、Ｎｕｍは、端末が検出に成功したバンドルされたダウンリンクサブフレームの個数であり、ｍｏｄ（ａ）はモジュロ（ｍｏｄｕｌｏ）演算である。バンドル指示子が、ｃｅｉｌｉｎｇ｛ｌｏｇ２（ａ）｝ビット情報である時、バンドル指示子が最大伝送順序ａ以上になると、再び伝送順序は１から始まるため、モジュロ演算を取る。このような方法により端末は代表ＡＣＫ／ＮＡＣＫ信号を正確に伝送することができる。ここで、バンドル指示子は、ダウンリンク割当インデックス（ｄｏｗｎｌｉｎｋａｓｓｉｇｎｍｅｎｔｉｎｄｅｘ：ＤＡＩ）の値とも呼ばれることができる。

【００７２】

バンドル指示子は、ＤＣＩフォーマットに従ってその意味が変わることができる。例えば、アップリンクスケジューリング情報のためのＤＣＩフォーマット０である場合、バンドル指示子は、代表ＡＣＫ／ＮＡＣＫ信号を伝送するアップリンクサブフレームに対応される特定端末に対するバンドルされた複数のダウンリンクサブフレームの個数あるいはそのバンドルされた複数のダウンリンクサブフレームに属するＰＤＳＣＨ伝送の単純な個数を表す。ダウンリンクスケジューリング情報のためのＤＣＩフォーマット１／１Ａ／１Ｂ／１Ｄ／２／２Ａである場合、バンドル指示子は、バンドルされたダウンリンクサブフレームを介して特定端末に伝送されたサブフレームあるいはＰＤＳＣＨの順序、即ち、特定端末に対するサブフレームあるいはＰＤＳＣＨ伝送の累積的な回数（ａｃｃｕｍｕｌａｔｉｖｅ ｎｕｍｂｅｒ）を示して、バンドル指示子はサブフレーム別に更新されることができる。

【００７３】

以下、端末が代表ＡＣＫ／ＮＡＣＫ信号の伝送に使用する無線リソースに関して説明する。ＡＣＫ／ＮＡＣＫバンドル方式では、バンドルされたダウンリンクサブフレームに対するＡＣＫ／ＮＡＣＫ信号が一つのアップリンクサブフレームを介して伝送される、従って、該当アップリンクサブフレームにはバンドルされたダウンリンクサブフレームに対するＡＣＫ／ＮＡＣＫ信号を伝送する無線リソースが割り当てられなければならない。例えば、４個のダウンリンクサブフレームに対して一つのアップリンクサブフレームにＡＣＫ／ＮＡＣＫを伝送しなければならない場合、もし、４個のダウンリンクサブフレームを介して互いに異なる端末にダウンリンクデータが伝送される場合には、各端末は、同じである１個のアップリンクサブフレームを介してＡＣＫ／ＮＡＣＫ信号を伝送することができなければならない。従って、ダウンリンクサブフレームとアップリンクサブフレームの比率が１：１である時に比べて４倍のＡＣＫ／ＮＡＣＫ信号用無線リソースが各アップリンクサブフレームに割り当てられなければならない。

【００７４】

一方、バンドルされた複数のダウンリンクサブフレームを介して一つの端末にダウンリンクデータが伝送される場合、前記バンドルされた複数のダウンリンクサブフレームに対応するＡＣＫ／ＮＡＣＫ割り当リソースは他の端末によって使われない。従って、端末はＡＣＫ／ＮＡＣＫ信号用に割り当てられた多数の無線リソースのうちいずれか一つの無線リソースを用いて代表ＡＣＫ／ＮＡＣＫ信号を伝送することができる。

【００７５】

本発明では，バンドルされた複数のダウンリンクサブフレーム内で端末が基地局のデータ伝送を検出した最後のバンドルされたダウンリンクサブフレームに関して割り当てられるＡＣＫ／ＮＡＣＫ信号用無線リソースを用いて代表ＡＣＫ／ＮＡＣＫ信号を伝送することによって、基地局がバンドルされたダウンリンクサブフレームのＰＤＳＣＨが端末に無事に伝送されたかを判断することができる基準になるようにする。例えば、端末がバンドルされた複数のダウンリンクサブフレームのうち最後の一つあるいは最後の複数のバンドルされたダウンリンクサブフレームをのがした場合（即ち、検出できない場合）、端末は、前記最後のバンドルされたダウンリンクサブフレーム（単数又は複数）の直前のダウンリンクサブフレームに関するＡＣＫ／ＮＡＣＫ信号用無線リソースを用いて代表ＡＣＫ／ＮＡＣＫ信号を伝送する。この場合、基地局は前記代表ＡＣＫ／ＮＡＣＫ信号の無線リソースから端末が前記最後のバンドルされたダウンリンクサブフレーム（単数又は複数）をのがしたことがわかる。これに関して図１０において詳細に説明する。

【００７６】

図１０は、本発明の一例にともなう代表ＡＣＫ／ＮＡＣＫ信号を無線リソースにマッピングする方法を説明する図面である。これは代表ＡＣＫ／ＮＡＣＫ信号がＰＵＣＣＨ上に伝送される場合である。

【００７７】

図１０を参照すると、４個のダウンリンクサブフレーム当たり１個のアップリンクサブフレームがＡＣＫ／ＮＡＣＫ信号の伝送のために割り当てられる。代表ＡＣＫ／ＮＡＣＫ信号が伝送されるアップリンクサブフレームに対応するバンドルされたダウンリンクサブフレームの可能な具体的な位置は、次の表で求められることができる。

【００７８】

【表５】

【表5】

Configuration	Subframe n									
	0	1	2	3	4	5	6	7	8	9
0	-	-	6	-	5	-	-	6	-	4
1	-	-	7,6	4	-	-	-	7,6	4	-
2	-	-	8,7,6,4	-	-	-	-	8,7,6,4	-	-
3	-	-	11,7,6	6,5	5,4	-	-	-	-	-
4	-	-	12,11,8,7	7,6,5,4	-	-	-	-	-	-
5	-	-	TBD	-	-	-	-	-	-	-
6	-	-	7	7	5	-	-	7	7	-

前記表でサブフレームｎ（ｓｕｂｆｒａｍｅ　ｎ）はアップリンクサブフレームであるインデックスを表す。ｎ番目サブフレーム（アップリンクサブフレーム）に対応するバンドルされたダウンリンクサブフレームはｎ－ｋに決定される。即ち、バンドルされたダウンリンクサブフレームはｎ番目サブフレームよりｋだけ相対的に先のサブフレームになることができる、ここで，ｋはバンドルされたダウンリンクサブフレームを決定する指示子であって、各個の要素｛ｋ０，ｋ１，・・・，ｋＭ－１｝ｉの集合Ｋに属する。バンドルされたダウンリンクサブフレームの具体的な位置はサブフレームｎと設定情報により決定される。

【００７９】

例えば、無線フレームが設定情報２（ｃｏｎｆｉｇｕｒａｔｉｏｎ２）により決められた場合において，２番目サブフレーム（ｎ＝２）上に代表ＡＣＫ／ＮＡＣＫ信号を伝送すると仮定する。ｎ＝２における指示子はＫ＝｛８，７，６，４｝である、従って、前記代表ＡＣＫ／ＮＡＣＫ信号がカバー（ｃｏｖｅｒ）するバンドルされたダウンリンクサブフレームになることができるサブフレームらは、２番目サブフレームより相対的に８、７、６、４だけ先のサブフレームである４、５、６、８番目サブフレームである。これはダウンリンクサブフレームは、それに対応する代表ＡＣＫ／ＮＡＣＫ信号が伝送されるアップリンクサブフレームより時間的に早いためである。

【００８０】

各ダウンリンクサブフレームはＰＤＣＣＨとＰＤＳＣＨで構成され、各ＰＤＣＣＨは４個の区間に区分される。この区間は無線リソースの一定領域、例えばリソースブロック（

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ｒｅｓｏｕｒｃｅ　ｂｌｏｃｋ（ＲＢ）と呼ばれることができる。このような区分は例示に過ぎず、ＰＤＣＣＨの区分された領域と区分の個数は多様に変形されることができる。端末はＣＣＥを介してＰＤＣＣＨをデコーディングした後、ＰＤＣＣＨのダウンリンクグラントに従ってＰＤＳＣＨをデコーディングする。端末はＰＤＳＣＨでデータを受信して、このデータを受信する領域は無線リソース単位であるＲＢ（Ｒｅｓｏｕｒｃｅ　Ｂｌｏｃｋ）単位で構成されることができる。

【００８１】

特定ＰＤＣＣＨに対するＡＣＫ／ＮＡＣＫ信号用無線リソースはリソースインデックスにより決定されることができる。無線リソースとは、ＰＵＣＣＨの無線リソースを意味する。例えば、０番目ダウンリンクサブフレームは、アップリンクサブフレームにおけるインデックス１、２、３、４に該当する無線リソースをＡＣＫ／ＮＡＣＫ信号の伝送のために使用して、１番目ダウンリンクサブフレームは、アップリンクサブフレームにおけるインデックス５、６、７、８に該当する無線リソースをＡＣＫ／ＮＡＣＫ信号の伝送のために使用する。このように、ＡＣＫ／ＮＡＣＫ信号を一つのアップリンクサブフレームの伝送に使われる無線リソースは各ダウンリンクサブフレーム毎に区分されることができる。或いは、ＡＣＫ／ＮＡＣＫ信号伝送に使われる無線リソースの量を減めるために各ダウンリンクサブフレームに対応するＡＣＫ／ＮＡＣＫリソースは複数の複数のダウンリンクサブフレームの間に重なることができる。

【００８２】

前記４個のダウンリンクサブフレームのうち、特定端末が符号語を０、１、３番目ダウンリンクサブフレームを介して受信すると仮定する。前記特定端末は０番目ダウンリンクサブフレームのＰＤＣＣＨの区間３をデコーディングし、区間３が指示するＰＤＳＣＨを読む。前記特定端末は、また、１番目ダウンリンクサブフレームのＰＤＣＣＨの区間６をデコーディングし、区間６が指示するＰＤＳＣＨを読む。そして、前記特定端末は、また、３番目ダウンリンクサブフレームのＰＤＣＣＨの区間１３をデコーディングし、区間１３が指示するＰＤＳＣＨを読む。

【００８３】

前記特定端末は、ＰＤＳＣＨの受信成功または失敗如何に従って代表ＡＣＫ／ＮＡＣＫ信号を伝送する。このとき、前記特定端末は、無線リソースインデックス３および６は用いなく、前記特定端末が最も最近に受信した最後の区間１３に対応する無線リソースインデックス１３だけを用いて代表ＡＣＫ／ＮＡＣＫ信号を伝送する。

【００８４】

アップリンクサブフレームｎに対応される、バンドルされたダウンリンクサブフレームになることができる複数のダウンリンクサブフレームのうち端末が最も最近に検出したイまたはアップリンクサブフレームｎから時間的に最も近い）ダウンリンクサブフレームにともなう無線リソースか、代表ＡＣＫ／ＮＡＣＫ信号の伝送に使われる。例えば、設定情報２において、アップリンクサブフレーム２で代表ＡＣＫ／ＮＡＣＫ信号が伝送されると仮定する。

【００８５】

バンドルされたダウンリンクサブフレームは４、５、６、８番目サブフレームであり、このうち、端末が４、５、８番目ダウンリンクサブフレームを受信したならば、最も最近に受信した８番目ダウンリンクサブフレームにともなう無線リソースを用いて代表ＡＣＫ／ＮＡＣＫ信号を伝送する。これはＫ＝４である場合である。即ち、集合Ｋに属する要素のうち最も小さい数によるダウンリンクサブフレームが決定されると、代表ＡＣＫ／ＮＡＣＫ信号の伝送のための無線リソースもこれに伴い決定される。これは代表ＡＣＫ／ＮＡＣＫ信号を伝送する無線リソースを決定する方法であって、代表ＡＣＫ／ＮＡＣＫ信号がＡＣＫ信号であるかまたはＮＡＣＫ信号であるかを決定する方法は、前記図８の以下で説明した通りである。

【００８６】

もし、前記特定端末が３番目ダウンリンクサブフレームのＰＤＣＣＨの区間１３を検出

できなければ、区間１３におけるＰＤＳＣＨを読むことができない。従って、前記特定端末は、自分が最後に受信した区間６に対応される無線リソースインデックスにより代表ＡＣＫ／ＮＡＣＫ信号を伝送する。一方、基地局は区間１３に従ってダウンリンクデータを伝送したため、無線リソースインデックス１３にともなう代表ＡＣＫ／ＮＡＣＫ信号の受信を期待する。ところが、基地局は、無線リソースインデックス６にともなう代表ＡＣＫ／ＮＡＣＫ信号を受信するため、自分が区間１３に従って最後に伝送したダウンリンクデータの伝送が失敗したことが分かる。従って、基地局は代表ＡＣＫ／ＮＡＣＫ信号がＡＣＫ信号であるとしても、ＨＡＲＱ再伝送を遂行することができる。

【００８７】

このようにＡＣＫ／ＮＡＣＫ信号用無線リソースを選定する方法が式２にともなうバンドル指示子を用いたバンドルされたダウンリンクサブフレームのエラー検出方法、即ち、バンドル指示子が各端末に対するバンドルされたダウンリンクサブフレームの伝送個数を指示する方法と結合される場合、紛失される（ｍｉｓｓｅｄ）バンドルされたダウンリンクサブフレームの位置が最後であれ、中間であれエラーを検出することができる。例えば、前記特定端末が１番目ダウンリンクサブフレームのＰＤＣＣＨの区間６を検出することができず、区間１３は検出したと仮定する。区間３のＰＤＣＣＨにおけるバンドル指示子は１であり、区間６のＰＤＣＣＨにおけるバンドル指示子は２であり、区間１３のＰＤＣＣＨにおけるバンドル指示子は３である。端末は区間６の検出に失敗するため、区間１３のＰＤＣＣＨを検出した時の自分のカウンタは相変らず２を指す。このとき、端末は、区間１３に対応する無線リソースによって代表ＡＣＫ／ＮＡＣＫ信号を伝送せず、ＤＴＸモードに動作する。基地局は区間１３によってダウンリンクデータを伝送したため、無線リソースインデックス１３にともなう代表ＡＣＫ／ＮＡＣＫ信号の受信を期待する。ところが、基地局は何らの代表ＡＣＫ／ＮＡＣＫ信号を受信しないため、ＨＡＲＱ再伝送を遂行することができる。

【００８８】

整理すると、基地局は、代表ＡＣＫ／ＮＡＣＫ信号の伝送される無線リソースが予想される無線リソースと一致するかを判断することによって、バンドルされたダウンリンクサブフレーム内の最後の一つあるいは最後の複数のダウンリンクサブフレームの検出失敗を判断することができる。また、端末は、基地局が伝送したバンドル指示子と自分の検出したバンドルされた複数のダウンリンクサブフレームを比較することによってバンドルされたダウンリンクサブフレームの検出失敗を判断することができる。

【００８９】

以下、アップリンクデータの伝送に使われる無線リソースを用いてＡＣＫ／ＮＡＣＫ信号を伝送する方法に関して開示する。端末がアップリンクサブフレームにＡＣＫ／ＮＡＣＫ信号を伝送する時点にアップリンクデータも共に伝送する場合、ＡＣＫ／ＮＡＣＫ信号の伝送のために割り当てられる無線リソースは、一般的な制御情報の伝送のための無線リソースでないこともある。即ち、端末はＰＵＣＣＨにおける無線リソースでない、ＰＵＳＣＨにおける無線リソースを用いてＡＣＫ／ＮＡＣＫ信号を伝送することができる。ここで、ＡＣＫ、ＮＡＣＫ信号は一般的なアップリンクデータと多重化されてもよい。アップリンクデータに使われる無線リソースは、アップリンク制御情報に使われる無線リソースに比べて多いため、ＰＵＳＣＨにＡＣＫ／ＮＡＣＫが伝送される場合には一層多くの情報を送ることができるためである。

【００９０】

本発明で、端末は、自分が受信成功可否を判断したダウンリンクデータだけでなく、自分が認識することができない、或いは自分に伝送されたデータがないダウンリンクサブフレームに対するＮＡＣＫ信号も伝送する。ダウンリンクデータに対して形式ＥＮＡＣＫ信号を伝送する必要がある時、このようなＮＡＣＫ信号をダミーＮＡＣＫ信号（ｄｕｍｍｙ　ＮＡＣＫ）という。ダミーＮＡＣＫ信号を伝送すると、基地局は、端末がダウンリンクデータを正しく受信したかが分かり、端末が伝送したＡＣＫ／ＮＡＣＫ信号が真であるかも分かる。

【００９１】
図１１は、本発明の一例にともなうＴＤＤシステムでＡＣＫ／ＮＡＣＫ信号の伝送方法を説明する説明図である。
【００９２】
図１１を参照すると、４個のダウンリンクサブフレーム＃０、＃１、＃２、＃３と前記４個のダウンリンクサブフレームに対応するＡＣＫ／ＮＡＣＫ信号を伝送するアップリンクサブフレーム＃ｎがある。ダウンリンクサブフレーム＃０だけが端末Ａのためのダウンリンクデータを伝送する。従って、端末はダウンリンクサブフレーム＃０をデコーディングし、これに関するＡＣＫ／ＮＡＣＫ信号をアップリンクサブフレーム＃ｎのＰＵＳＣＨの無線リソースａを用いて伝送する。そして、ダウンリンクサブフレーム＃１、＃２、＃３に対するＡＣＫ／ＮＡＣＫ信号を全てＮＡＣＫ信号として３個のＮＡＣＫ信号をアップリンクサブフレーム＃ｎのＰＵＳＣＨの無線リソースｂ、ｃ、ｄを用いて伝送する。たとえ、ダウンリンクサブフレーム＃１、＃２、＃３では端末Ａのためのダウンリンクデータが伝送されないとしても、端末はこれに対するＡＣＫ／ＮＡＣＫ信号を全て伝送する。即ち、端末Ａは総４個のＡＣＫ／ＮＡＣＫ信号を伝送するものである。無線リソースａ、ｂ、ｃ、ｄを連続して表記したが、これは例示に過ぎず、ＡＣＫ／ＮＡＣＫ信号の伝送される無線リソースはＰＵＳＣＨ内で散在して存在することができる。また、無線リソースａ、ｂ、ｃ、ｄにＡＣＫ／ＮＡＣＫ信号のマッピングされる方式は、ＰＵＣＣＨでＡＣＫ／ＮＡＣＫ信号のための無線リソースのマッピング方式と差があることがある。さらに、ＡＣＫ／ＮＡＣＫ信号は独立的に伝送される、或いはアップリンクデータと重畳されて伝送されることができる。
【００９３】
一方、必要に応じてＡＣＫ／ＮＡＣＫ信号はＰＵＣＣＨによっても伝送されることができる。この場合には前述の方法のように代表ＡＣＫ／ＮＡＣＫ信号を伝送するようになる。ＰＵＣＣＨを介して代表ＡＣＫ／ＮＡＣＫ信号を伝送するか、またはＰＵＳＣＨを介してダミーＮＡＣＫ信号を伝送するか否かはシステムにより自由に選択されることができる。また、これらの両者間にスイッチング（ｓｗｉｔｃｈｉｎｇ）されて動的にＡＣＫ／ＮＡＣＫ信号が伝送されることもある。
【００９４】
上記の通り、端末が自分の受信可能な最大ダウンリンクサブフレームの数あるいはデータの数だけのＡＣＫ／ＮＡＣＫ信号を伝送する方法は、データの数が増えるほどフィードバックしなければならないオーバーヘッドが増加する問題がある。従って、以下でフィードバックオーバーヘッドを減らすことができる方法に関して説明する。
【００９５】
図１２は、本発明の他の例にともなうＴＤＤシステムでＡＣＫ／ＮＡＣＫ信号の伝送方法を説明する流れ図である。
【００９６】
図１２を参照すると、基地局はＮｍ個のダウンリンクサブフレームでバンドルされた複数のダウンリンクサブフレームを構成して、前記バンドルされた複数のダウンリンクサブフレームを介してデータを端末に伝送する（Ｓ２００）。ダウンリンクデータは前記バンドルされた複数のダウンリンクサブフレームのＰＤＳＣＨに伝送される。前記ダウンリンクデータを受信した端末は代表ＡＣＫ／ＮＡＣＫ信号を伝送する（Ｓ２１０）。代表ＡＣＫ／ＮＡＣＫ信号の生成方法は図８で説明した通りである。このように、端末は、データカウンティング情報（ｄａｔａ ｃｏｕｎｔｉｎｇ ｉｎｆｏｒｍａｔｉｏｎ）Ｎｄを基地局に伝送する（Ｓ２２０）。データカウンティング情報Ｎｄは、前記Ｎｍ個のバンドルされた複数のダウンリンクサブフレームのうち該当端末が検出したバンドルされたダウンリンクサブフレームの個数であり、Ｎｄ＝Ｎ１＋Ｎ２＋．．．．＋Ｎｋが成立する。ここで、Ｎ１、Ｎ２、．．．．、Ｎｋは前記端末が検出できないバンドルされたダウンリンクサブフレームの個数である。
【００９７】

もし、前記データカウンティング情報を独立的な情報ビット列に表現すると、前記データカウンティング情報を伝送するときに必要なビット数は$ceiling[log_2(max(N_s))]$である。もし、ある端末が伝送しなければならない代表ＡＣＫ／ＮＡＣＫ信号のビット数が２であれば、端末は$ceiling[log_2(max(N_s))]+2$ビットの情報をアップリンクサブフレームにより伝送しなければならない。従って、伝送しなければならない最大ＡＣＫ／ＮＡＣＫビット数である$2\times max(N_s)$個のＡＣＫ／ＮＡＣＫを常に伝送することより前記代表ＡＣＫ／ＮＡＣＫ信号とカウンティング情報を伝送することがレイテンシオーバーヘード側面で望ましい。前記代表ＡＣＫ／ＮＡＣＫ信号と前記データカウンティング情報はＰＵＳＣＨを介して伝送される。

【００９８】

基地局は、前記代表ＡＣＫ／ＮＡＣＫ信号と前記データカウンティング情報からＨＡＲＱ再伝送を遂行するか、新規データの伝送を遂行するかを決定する（Ｓ２３０）。このような決定は前記基地局がN_sとN_rを比較することによって行われる。一例として、端末がバンドルされた複数のダウンリンクサブフレームを全て検出すると、$N_{s,1}=N_{s,2}=\cdots=N_{s,M}=0$であるため、$N_s=N_r$である。即ち、基地局はバンドルされた複数のダウンリンクサブフレームが全て端末により成功的に検出されたことが分かる。従って、基地局は、前記代表ＡＣＫ／ＮＡＣＫ信号に従ってＨＡＲＱ再伝送または新規データの伝送を遂行する。

【００９９】

他の例として、端末が一つのダウンリンクサブフレームでものがせば$N_{s,1}=\cdots=N_{s,M-1}=0$であるため、$N_s=N_r$である。従って、基地局は、端末が$N_{missed}$個のバンドルされたダウンリンクサブフレームをのがしたことが分かる。このとき、基地局は、たとえ代表ＡＣＫ信号を端末から受信しても、ＨＡＲＱ再伝送を遂行することができる。

【０１００】

本発明は、ハードウェア、ソフトウェアまたはこれらの組合せによい具現されることができる。ハードウェア具現において、上述した機能を遂行するためにデザインされたＡＳＩＣ（application specific integrated circuit）、ＤＳＰ（digital signal processing）、ＰＬＤ（programmable logic device）、ＦＰＧＡ（field programmable gate array）、プロセッサ、制御機、マイクロプロセッサ、他の電子ユニットまたはこれらの組合せにより具現されることができる。ソフトウェア具現において、上述した機能を遂行するモジュルにより具現されることができる。ソフトウェアは、メモリユニットに格納されることができ、プロセッサにより実行される。メモリユニットやプロセッサは当業者によく知られた多様な手段を採用することができる。

【０１０１】

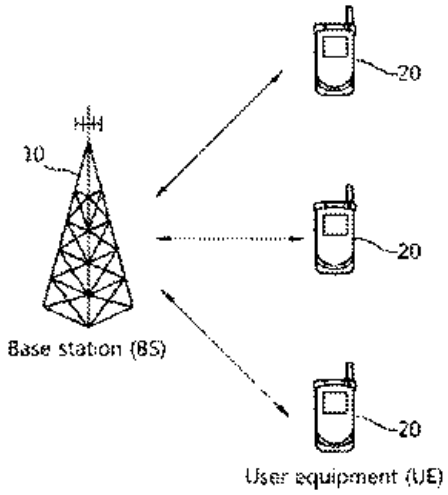
以上、本発明に対して実施例を参照して説明したが、該当技術分野の通常の知識を有した者は、本発明の技術的思想及び領域から外れない範囲内で本発明を多様に修正及び変更させて実施可能であることを理解することができる。従って、上述した実施例に限定されることではなく、本発明は特許請求範囲の範囲内の全ての実施例を含む。

【符号の説明】

【０１０２】

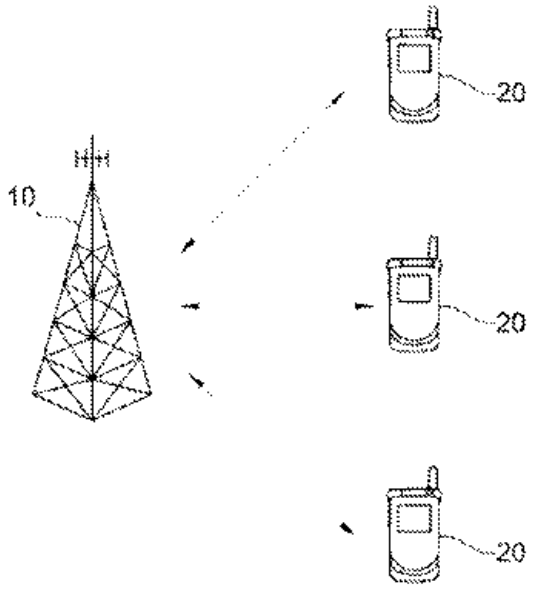
１０　基地局
２０、５０　端末
５１　プロセッサ
５２　メモリ
５３　ＲＦ部
５４　ディスプレー部
５５　使用者インターフェース部

[Fig. 1]

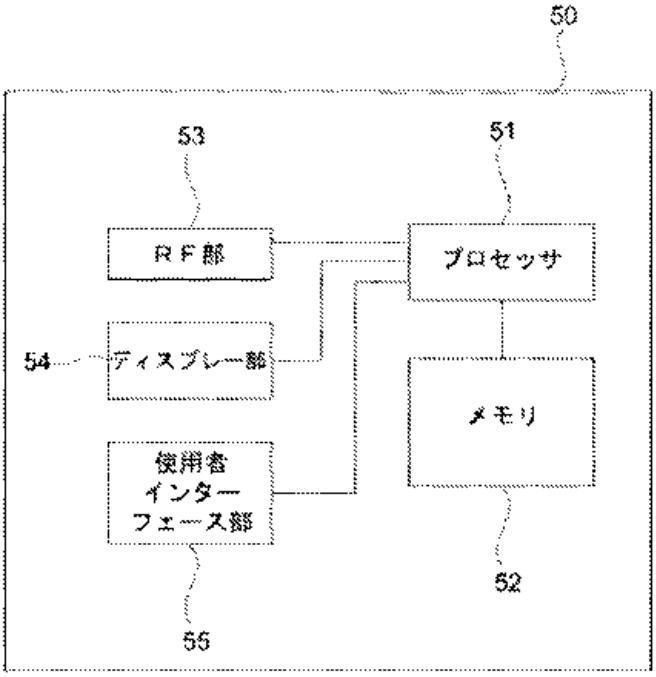


【図１】

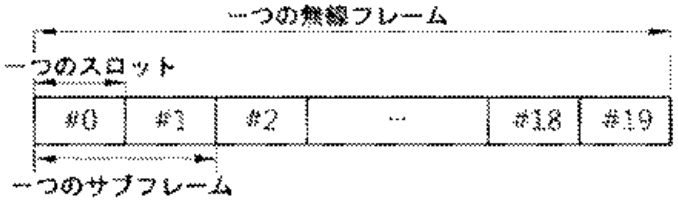
【図１】



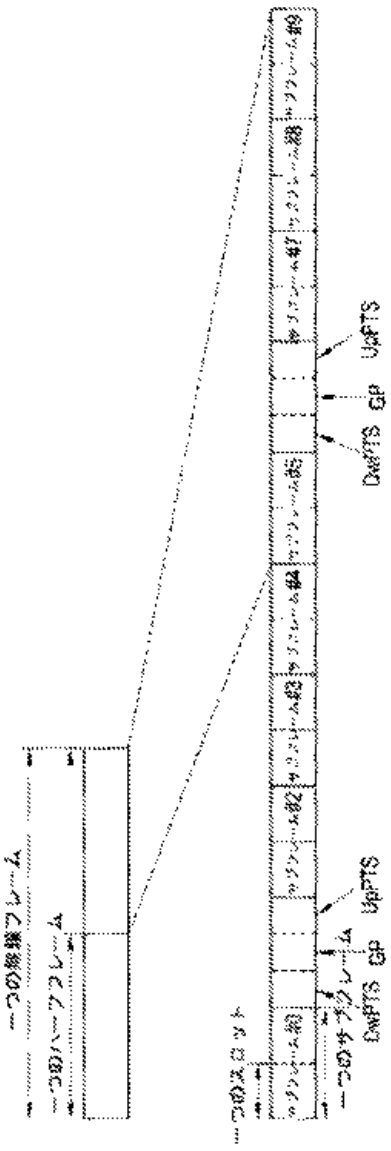
【図２】


50
53
51
ＲＦ部
プロセッサ
54
ディスプレー部
メモリ
使用者
インター
フェース部
52
55

【図３】

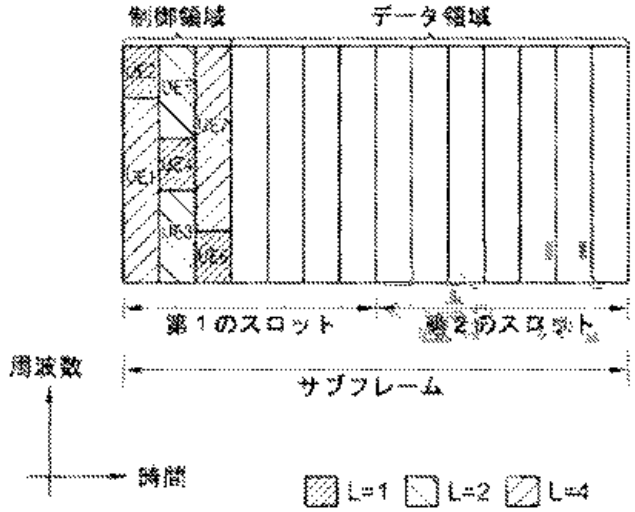

一つの無線フレーム
一つのスロット
#0
#1
#2
…
#18
#19
一つのサブフレーム

【図４】


#0
#1
#2
#3
#4
#5
#6
DwPTS
GP
UpPTS
DwPTS
GP
UpPTS
ダウンリンクサブフレーム
アップリンクサブフレーム
ダウンリンクサブフレーム

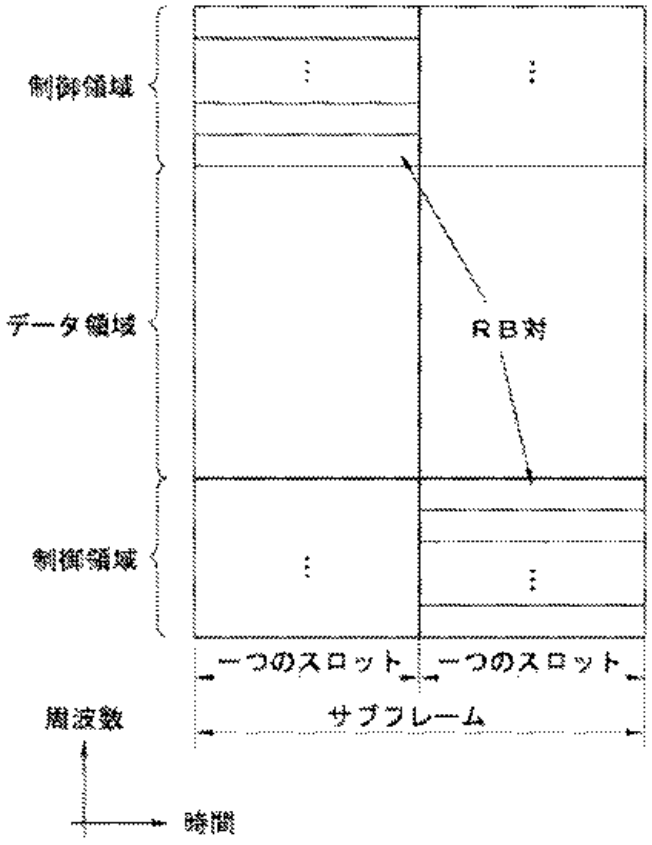
【図５】

【図５】


制御領域
データ領域
第１のスロット
第２のスロット
周波数
サブフレーム
時間
L=1
L=2
L=4

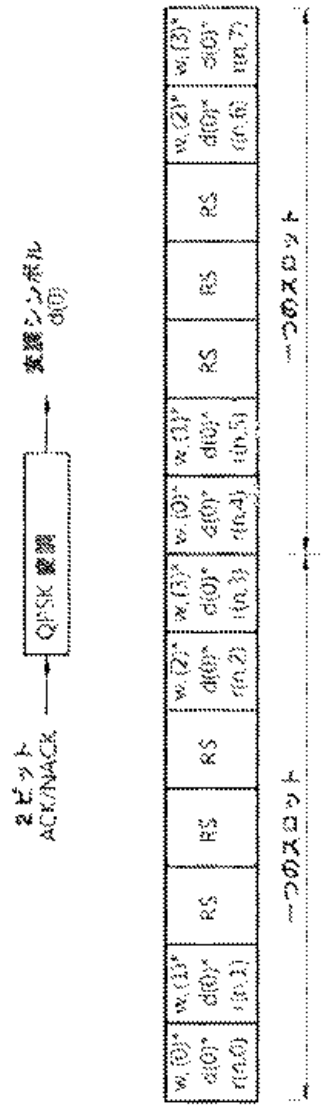
【図６】

【図６】


制御領域
データ領域
制御領域
ＲＢ対
一つのスロット
一つのスロット
周波数
サブフレーム
時間

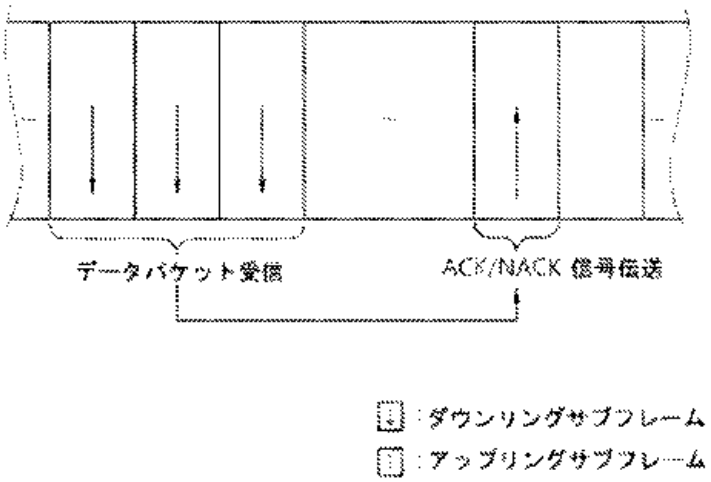
【図７】

【図７】


2ビット
ACK/NACK
QPSK 変調
変調シンボル
d(0)
RS
RS
RS
RS
RS
RS
w(0)* d(0)* r(n,0)
w(1)* d(0)* r(n,1)
w(2)* d(0)* r(n,2)
w(0)* d(0)* r(n,3)
w(1)* d(0)* r(n,4)
w(2)* d(0)* r(n,5)
w(0)* d(0)* r(n,6)
w(1)* d(0)* r(n,7)
一つのスロット
一つのスロット

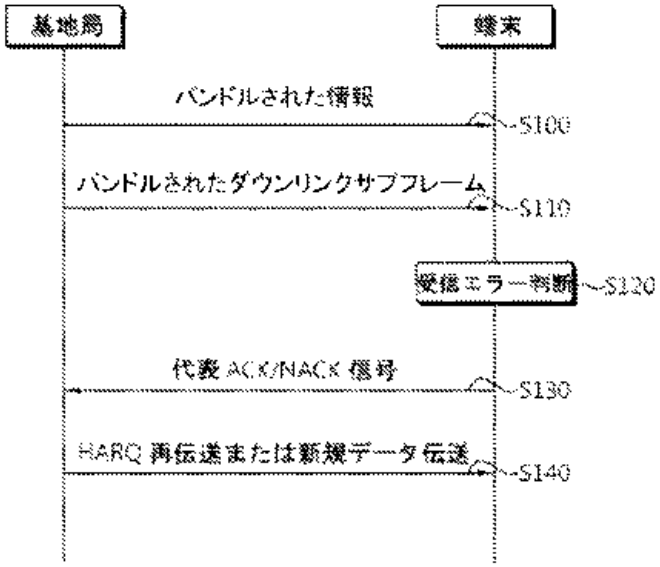
【図８】

【図８】


データパケット受信
ACK/NACK 信号伝送
：ダウンリングサブフレーム
：アップリングサブフレーム

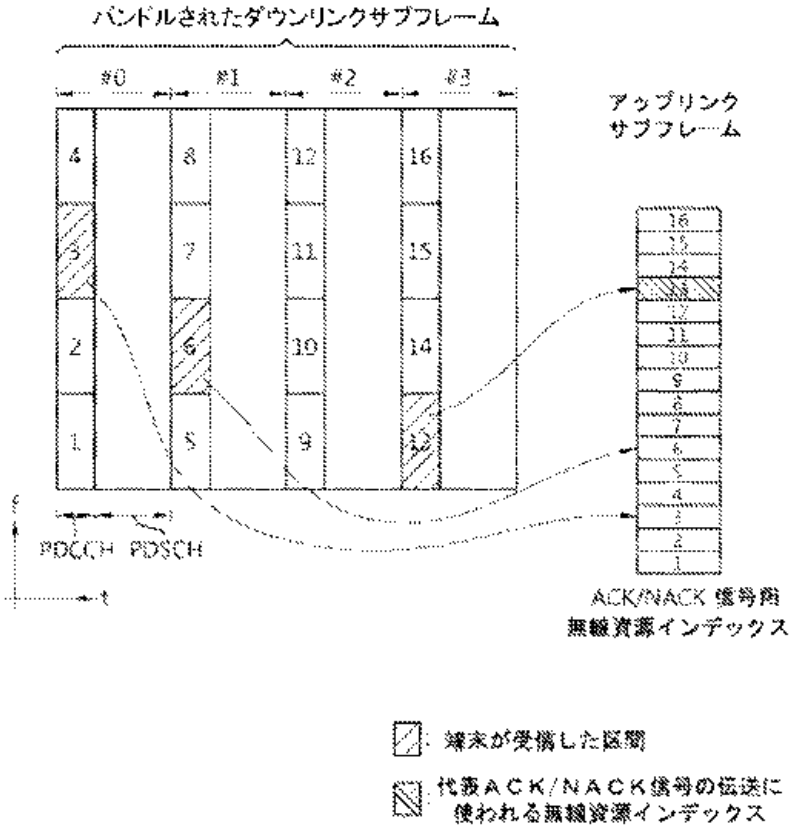
【図９】

【図９】


基地局
端末
バンドルされた情報
S100
バンドルされたダウンリンクサブフレーム
S110
受信エラー判断
S120
代表 ACK/NACK 信号
S130
HARQ 再伝送または新規データ伝送
S140

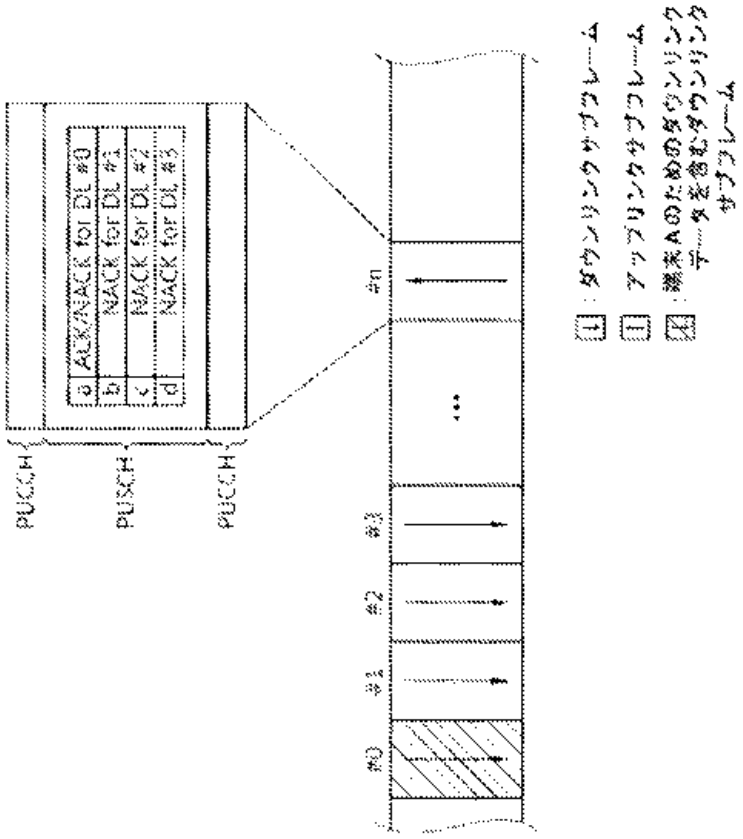
【図１６】

【図１０】


バンドルされたダウンリンクサブフレーム
#0
#1
#2
#3
アップリンク
サブフレーム
PDCCH
PDSCH
t
ACK/NACK 信号用
無線資源インデックス
端末が受信した区間
代表ＡＣＫ/ＮＡＣＫ信号の伝送に
使われる無線資源インデックス

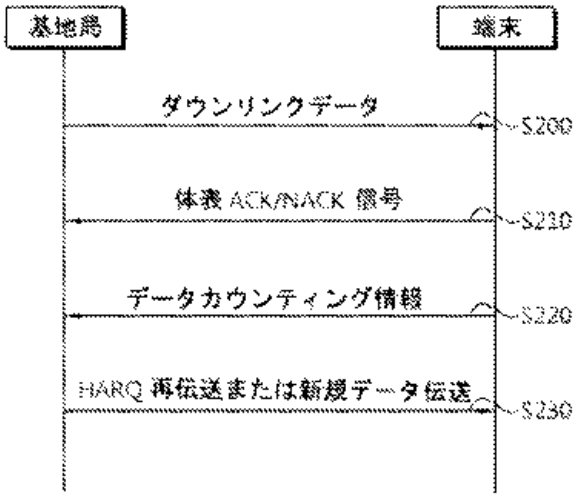
【図１１】

【図１１】



【図１２】

【図１２】



【手続補正書】

【提出日】平成21年8月12日(2009.8.12)

【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】００１６
【補正方法】変更
【補正の内容】
【００１６】
本発明のもう他の態様によると、無線通信システムでＨＡＲＱを用いてＡＣＫ／ＮＡＣＫ信号を伝送する装置が提供される。前記装置は、バンドルされた複数のダウンリンクサブフレームの数を指示するバンドル指示子を受信する受信部、ここで前記バンドルされた複数のダウンリンクサブフレームの各サブフレームは一つまたは複数の符号語の伝送に使われる、前記バンドル指示子と検出されるバンドルされた複数のダウンリンクサブフレームの数とを比較することによって、少なくとも一つのバンドルされたダウンリンクサブフレームが紛失されたかを判断する判断部；どんなバンドルされたダウンリンクサブフレームも紛失されない場合、代表ＡＣＫ／ＮＡＣＫ信号を生成する生成部、及び前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネルに伝送する伝送部を含む。前記代表ＡＣＫ／ＮＡＣＫ信号は、前記検出されるバンドルされたダウンリンクサブフレーム内の全ての符号語が成功的に受信される場合ＡＣＫ信号であり、以外の場合にはＮＡＣＫ信号である。
（項目１）
無線通信システムにおいて、ハイブリッド自動反復要求（ＨＡＲＱ）を実行する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信することであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、ことと、
前記バンドル指示子と、検出されたバンドルされたダウンリンクサブフレームの数とを比較することによって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われているかどうかを判定することと、
バンドルされたダウンリンクサブフレームが失われていない場合には、代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、前記検出されたバンドルされたダウンリンクサブフレーム内のすべての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号であり、それ以外の場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号である、ことと、
前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネル上に送信することと
を含む、方法。
（項目２）
前記代表ＡＣＫ／ＮＡＣＫ信号は、少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合には、送信されない、項目１に記載の方法。
（項目３）
前記アップリンクチャネルは、物理アップリンク制御チャネル（ＰＵＣＣＨ）である、項目２に記載の方法。
（項目４）
前記代表ＡＣＫ／ＮＡＣＫ信号を搬送する前記アップリンクチャネルのためのアップリンクリソースは、最後に検出されたバンドルされたダウンリンクサブフレームおよび／または前記最後に検出されたバンドルされたダウンリンクサブフレームのスケジューリングのために使用されるダウンリンクリソースに関連する、項目１に記載の方法。
（項目５）
前記バンドル指示子は、ダウンリンクチャネル上に送信され、前記アップリンクチャネルのためのリソースは、前記アップリンクサブフレームに最も近い前記バンドルされたダウンリンクサブフレームに対するダウンリンクチャネルに関連する、項目１に記載の方法。

（項目６）
少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合には、前記代表ＡＣＫ／ＮＡＣＫ信号をＮＡＣＫ信号として生成することをさらに含む、項目１に記載の方法。
（項目７）
前記アップリンクチャネルは、物理アップリンク共用チャネル（ＰＵＳＣＨ）である、項目６に記載の方法。
（項目８）
前記バンドル指示子は、前記バンドルされたダウンリンクサブフレームの累積的な数である、項目１に記載の方法。
（項目９）
前記バンドル指示子は、ダウンリンクスケジューリング情報に含まれている、項目１に記載の方法。
（項目１０）
前記バンドル指示子は、アップリンクスケジューリング情報に含まれている、項目１に記載の方法。
（項目１１）
無線通信システムにおいて、制御信号を送信する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
Ｍ（Ｍ＞１）個のダウンリンクサブフレームにおいてバンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信することと、
バンドルされたダウンリンクサブフレームが検出された場合には、カウンタを増加させることと、
前記バンドル指示子が前記カウンタに等しくない場合には、代表ＮＡＣＫ信号を生成することであって、前記代表ＮＡＣＫ信号は、前記バンドルされたダウンリンクサブフレームにおける全ての符号語の受信が不成功であったことを表す、ことと、
アップリンクサブフレーム内のアップリンク共用チャネル上に前記代表ＮＡＣＫ信号を送信することと
を含む、方法。
（項目１２）
前記バンドル指示子は、ダウンリンク制御チャネル上で受信される、項目１１に記載の方法。
（項目１３）
前記バンドル指示子は、前記バンドルされたダウンリンクサブフレームに含まれている、項目１１に記載の方法。
（項目１４）
前記バンドルされたダウンリンクサブフレームの位置および数は、前記アップリンクサブフレームに対して予め決められている、項目１１に記載の方法。
（項目１５）
前記バンドルされたダウンリンクサブフレームの数は、前記アップリンクサブフレームの数に等しいか、または、前記アップリンクサブフレームの数よりも大きい、項目１１に記載の方法。
（項目１６）
無線通信システムにおいて制御信号を送信するある方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームにおける符号語を受信することと、
バンドルされたダウンリンクサブフレームが検出された場合に、カウンタを増加させることと、

代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合、または、少なくとも１つの符号語の受信が不成功であった場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号であり、そうでない場合において、前記バンドルされたダウンリンクサブフレームの全てが検出され、かつ、前記符号語の全ての受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号である、ことと、
アップリンクサブフレーム内のアップリンク共用チャネル上に、前記代表ＡＣＫ／ＮＡＣＫ信号と前記カウンタとを送信することと
を含む、方法。
（項目１７）
無線通信システムにおいて、ＨＡＲＱを実行する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームを受信することであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、ことと、
代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、検出されたバンドルされたダウンリンクサブフレームにおける全ての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号であり、前記検出されたバンドルされたダウンリンクサブフレームにおける少なくとも１つの符号語の受信が不成功であった場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号である、ことと、
アップリンクチャネル上に前記代表ＡＣＫ／ＮＡＣＫ信号を送信することと
を含み、
前記代表ＡＣＫ／ＮＡＣＫ信号を搬送する前記アップリンクチャネルのためのアップリンクリソースは、前記最後に検出されたバンドルされたダウンリンクサブフレームおよび／または前記最後に検出されたバンドルされたダウンリンクサブフレームの前記スケジューリングのために使用されるダウンリンクリソースに関連する、方法。
（項目１８）
無線通信システムにおいて、ＨＡＲＱを用いてＡＣＫ／ＮＡＣＫ信号を送信する装置であって、
前記装置は、
バンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信する受信ユニットであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、受信ユニットと、
前記バンドル指示子と、検出されたバンドルされたダウンリンクサブフレームの数とを比較することによって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われたかどうかを判定する判定ユニットと、
バンドルされたダウンリンクサブフレームが失われていない場合には、代表ＡＣＫ／ＮＡＣＫ信号を生成する生成ユニットであって、前記検出されたバンドルされたダウンリンクサブフレーム内の全ての符号語の受信が成功した場合には、前記代表ＡＣＫ　ＮＡＣＫ信号はＡＣＫ信号であり、それ以外の場合には、前記代表ＡＣＫ　ＮＡＣＫ信号はＮＡＣＫ信号である、生成ユニットと
前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネル上に送信する送信ユニットと
を含む、装置。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００３３
【補正方法】変更
【補正の内容】

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【００３２】
ダウンリンクからアップリンクに変更される時点またはアップリンクからダウンリンクに切り替える時点を切り替え時点（ｓｗｉｔｃｈｉｎｇ　ｐｏｉｎｔ）という，切り替え時点の周期性（Ｓｗｉｔｃｈ－ｐｏｉｎｔ　ｐｅｒｉｏｄｉｃｉｔｙ）は、アップリンクサブフレームとダウンリンクサブフレームが切り替える様相が同一に繰り返される周期を意味して、５ｍｓまたは１０ｍｓである。例えば，設定０から見ると、０番目から４番目サブフレームまでＤ－＞Ｓ－＞Ｕ－＞Ｕ－＞Ｕに切り替え、５番目から９番目サブフレームまで以前と同一にＤ－＞Ｓ－＞Ｕ－＞Ｕ－＞Ｕに切り替える。一つのサブフレームが１ｍｓであるため、切り替え時点の周期性は５ｍｓである。即ち、切り替え時点の周期性は一つの無線フレーム長さ（１０ｍｓ）より少なく、無線フレーム内で切り替える様相が１回繰り返される。

【手続補正3】
【補正対象書類名】特許請求の範囲
【補正対象項目名】全文
【補正方法】変更
【補正の内容】
【特許請求の範囲】
【請求項１】
無線通信システムにおいて、ハイブリット自動反復要求（ＨＡＲＱ）を実行する方法であって、前記方法は，ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信することであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、ことと、
前記バンドル指示子と、検出されたバンドルされたダウンリンクサブフレームの数とを比較することによって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われているかどうかを判定することと、
バンドルされたダウンリンクサブフレームが失われていない場合には，代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、前記検出されたバンドルされたダウンリンクサブフレーム内のすべての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号である、ことと、
前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネル上に送信することと
を含む、方法。
【請求項２】
前記代表ＡＣＫ／ＮＡＣＫ信号は、少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合には，送信されない、請求項１に記載の方法。
【請求項３】
前記アップリンクチャネルは、物理アップリンク制御チャネル（ＰＵＣＣＨ）である，請求項２に記載の方法。
【請求項４】
前記代表ＡＣＫ／ＮＡＣＫ信号を搬送する前記アップリンクチャネルのためのアップリンクリソースは、最後に検出されたバンドルされたダウンリンクサブフレームに関連する、請求項１に記載の方法。
【請求項５】
前記バンドル指示子は、ダウンリンクチャネル上に送信され、前記アップリンクチャネルのためのリソースは、前記アップリンクサブフレームに最も近い前記バンドルされたダウンリンクサブフレームに対するダウンリンクチャネルに関連する、請求項１に記載の方法。
【請求項６】

少なくとも１つのバンドルされたダウンリンクサブフレームが失われた場合には、前記代表ＡＣＫ／ＮＡＣＫ信号をＮＡＣＫ信号として生成することをさらに含む、請求項１に記載の方法。
【請求項７】
前記アップリンクチャネルは、物理アップリンク共用チャネル（ＰＵＳＣＨ）である、請求項６に記載の方法。
【請求項８】
前記バンドル指示子は、前記バンドルされたダウンリンクサブフレームの累積的な数である、請求項１に記載の方法。
【請求項９】
前記バンドル指示子は、ダウンリンクスケジューリング情報に含まれている、請求項１に記載の方法。
【請求項１０】
前記バンドル指示子は、アップリンクスケジューリング情報に含まれている、請求項１に記載の方法。
【請求項１１】
無線通信システムにおいて、制御信号を送信する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
Ｍ個のダウンリンクサブフレームにおいてバンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信することと、
バンドルされたダウンリンクサブフレームが検出された場合には、カウンタを増加させることと、
前記バンドル指示子が前記カウンタに等しくない場合には、代表ＮＡＣＫ信号を生成することであって、前記代表ＮＡＣＫ信号は、前記バンドルされたダウンリンクサブフレームにおける全ての符号語の受信が不成功であったことを表す、ことと、
アップリンクサブフレーム内のアップリンク共用チャネル上に前記代表ＮＡＣＫ信号を送信することと
を含む、方法。
【請求項１２】
前記バンドル指示子は、ダウンリンク制御チャネル上で受信される、請求項１１に記載の方法。
【請求項１３】
前記バンドル指示子は、前記バンドルされたダウンリンクサブフレームに含まれている、請求項１１に記載の方法。
【請求項１４】
前記バンドルされたダウンリンクサブフレームの位置および数は、前記アップリンクサブフレームに対して予め決められている、請求項１１に記載の方法。
【請求項１５】
前記バンドルされたダウンリンクサブフレームの数は、前記アップリンクサブフレームの数に等しいか、または、前記アップリンクサブフレームの数よりも大きい、請求項１１に記載の方法。
【請求項１６】
無線通信システムにおいて制御信号を送信する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームにおける符号語を受信することと、
バンドルされたダウンリンクサブフレームが検出された場合に、カウンタを増加させることと、
代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、少なくとも１つのバンドルされた

ダウンリンクサブフレームが失われた場合、または、少なくとも１つの符号語の受信が不成功であった場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号であり、そうでない場合において、前記バンドルされたダウンリンクサブフレームの全てが検出され、かつ、前記符号語の全ての受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号である、ことと、
アップリンクサブフレーム内のアップリンク共用チャネル上に、前記代表ＡＣＫ／ＮＡＣＫ信号と前記カウンタとを送信することと
を含む、方法。
【請求項１７】
無線通信システムにおいて、ＨＡＲＱを実行する方法であって、前記方法は、ユーザ機器（ＵＥ）によって実行され、
前記方法は、
バンドルされたダウンリンクサブフレームを受信することであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、ことと、
代表ＡＣＫ／ＮＡＣＫ信号を生成することであって、検出されたバンドルされたダウンリンクサブフレームにおける全ての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号であり、前記検出されたバンドルされたダウンリンクサブフレームにおける少なくとも１つの符号語の受信が不成功であった場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号である、ことと、
アップリンクチャネル上に前記代表ＡＣＫ／ＮＡＣＫ信号を送信することと
を含み、
前記代表ＡＣＫ／ＮＡＣＫ信号を搬送する前記アップリンクチャネルのためのアップリンクリソースは、前記最後に検出されたバンドルされたダウンリンクサブフレームに関連する、方法。
【請求項１８】
無線通信システムにおいて、ＨＡＲＱを用いてＡＣＫ／ＮＡＣＫ信号を送信する装置であって、
前記装置は、
バンドルされたダウンリンクサブフレームの数を示すバンドル指示子を受信する受信ユニットであって、前記バンドルされたダウンリンクサブフレームの各サブフレームは、１つまたは複数の符号語を送信するために使用される、受信ユニットと、
前記バンドル指示子と、検出されたバンドルされたダウンリンクサブフレームの数とを比較することによって、少なくとも１つのバンドルされたダウンリンクサブフレームが失われたかどうかを判定する判定ユニットと、
バンドルされたダウンリンクサブフレームが失われていない場合には、代表ＡＣＫ／ＮＡＣＫ信号を生成する生成ユニットであって、前記検出されたバンドルされたダウンリンクサブフレーム内の全ての符号語の受信が成功した場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＡＣＫ信号であり、それ以外の場合には、前記代表ＡＣＫ／ＮＡＣＫ信号はＮＡＣＫ信号である、生成ユニットと
前記代表ＡＣＫ／ＮＡＣＫ信号をアップリンクチャネル上に送信する送信ユニットと
を含む、装置。

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【国際調査報告】

INTERNATIONAL SEARCH REPORT

International application No
PCT/KR2009/001287

A. CLASSIFICATION OF SUBJECT MATTER

H04L 1/18(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 H04L 1/18, H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility Models since 1975
Japanese Utility Models and applications for Utility Models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

KOMPASS(KIPO internal) "HARQ, ACK, NACK, substitute, bundle"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
A	WO 2007-129972 A1 (SAMSUNG ELECTRONICS CO., LTD.) 15 November 2007 See abstract, page 15, line 18 - page 21, line 6, claim 1.	1-18
A	KR 10-2007-0105287 A (SAMSUNG ELECTRONICS CO., LTD.) 30 October 2007 See claims 1-4; figures 3, 4	1-18
A	JP 2005-136597 A (MATSUSHITA ELECTRIC IND CO., LTD.) 26 May 2005 See abstract, claim 1.	1-18

☐ Further documents are listed in the continuation of Box C.　　☒ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
23 OCTOBER 2009 (23.10.2009)	**26 OCTOBER 2009 (26.10.2009)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer JANG Ho Keun Telephone No. 82-42-481-5187

Form PCT/ISA/210 (second sheet) (July 2008)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2009/001287

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007-129872 A1	15.11.2007	EP 1855411 A2	14.11.2007
		KR 10-2007-0108613 A	15.11.2007
		US 2007-0260120 A1	27.12.2007
KR 10-2007-0105287 A	30.10.2007	EP 1852964 A1	07.11.2007
		KR 10-2007-0106480 A	12.11.2007
		US 2008-0002688 A1	03.01.2008
		WO 2007-123377 A1	01.11.2007
JP 2005-136807 A	26.05.2005	None	

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(特許庁注：以下のものは登録商標)
１．ＧＳＭ
(72)発明者　アン，　ヂョン　キ
大韓民国　４３１－７４９，　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アールアンドディー　コンプレックス
(72)発明者　リー，　デ　ウォン
大韓民国　４３１－７４９，　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アールアンドディー　コンプレックス
(72)発明者　ユン，　ヤン　ウー
大韓民国　４３１－７４９，　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アールアンドディー　コンプレックス
(72)発明者　キム，　キ　チョン
大韓民国　４３１－７４９，　キョンキード，　アニャンーシ，　ドンガンーク，　ホゲ　１ードン，　５３３，　エルジー　アールアンドディー　コンプレックス
Ｆターム(参考) 5K067 AA21 BB04 BB21 DD27 DD51 EE02 EE10 FF02 FF23 HH28

Electronic Acknowledgement Receipt	
EFS ID:	17688513
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Sherry Colgrove
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	17-DEC-2013
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Time Stamp:	18:45:44
Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	HW82713780US09_IDS.PDF	693364	no	4
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2	Foreign Reference	FR_WO2009116760A2.pdf	6111665	no	33
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3	Non Patent Literature	NPL-JPOA1.pdf	2384860	no	5
Warnings:					
Information:					
4	Non Patent Literature	NPL-R1-101943.pdf	824052	no	4
Warnings:					
Information:					
5	Foreign Reference	FR_JP2010-539847A.pdf	12212919	no	57
Warnings:					
Information:					
6	Foreign Reference	FR_JPA2010-521942.pdf	8011999	no	41
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		Total Files Size (in bytes):	30238859		

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor:	Chen	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Conf. No.:	5823
Art Unit:	2478	Examiner:	Sulaiman Nooristany
Filed:	6/2/2012		
Title:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Dear Sir:

The following amendments and remarks are presented in response to the Examiner's Office Action dated November 19, 2013. In view of this amendment, Applicant respectfully requests reconsideration or further examination.

Please amend the above-referenced application as follows.

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In the Claims:

1-16. (Cancelled)

17. (Currently Amended) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

configuring a common field preset in Downlink Control Information (DCI) as one command ~~at least one type of command field related to ACK/NACK feedback~~ according to a type of a downlink component carrier transmitting the DCI, wherein ~~the common field can be configured as the at least two types of command fields related to ACK/NACK feedback~~ the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command; and

sending the DCI to a user equipment, ~~so that the user equipment feeds back the ACK/NACK information according to the DCI~~.

18-22. (Cancelled)

23. (Currently Amended) The method according to claim 17, ~~wherein the common field can be configured as a transmission power control (TPC) command field and an ACK resource indication (ARI) command field, and~~ wherein configuring the common field ~~further~~ comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command ~~field~~ and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command ~~field~~.

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24. (Currently Amended) The method according to claim 23, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises:

DCI corresponding to physical downlink shared channel (PDSCH) ~~,PDSCH,~~ transmission of a downlink primary component carrier; and/or

at least one piece of DCI transmitted by the downlink primary component carrier (PCC).

25-27. (Cancelled)

28. (Currently Amended) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

receiving downlink control information (DCI) which is sent by a base station and transmitted by a downlink component carrier; and

feeding back ACK/NACK information according to a command ~~field which is related to ACK/NACK feedback and configured in~~ indicated by a common field preset in the DCI, wherein the common field ~~can be~~ is configured as ~~at least two types of command fields related to ACK/NACK feedback~~ one command according to a type of a downlink component carrier transmitting the DCI, and the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command.

29. (Cancelled).

30. (Currently Amended) The method according to claim 28 ~~claim 29~~, wherein ~~the common field can be configured as a transmission power control (TPC) command field and an ARI command field;~~

if the received DCI is at least one piece of DCI transmitted by a system-linked downlink

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component carrier, ~~the~~ a command field in the DCI is configured as the TPC command ~~field~~; and

if the received DCI is at least one piece of DCI transmitted by a non-system-linked downlink component carrier, the command field in the DCI is configured as the ARI command ~~field~~.

31. (Cancelled)

32. (Currently Amended) A base station, comprising:

a configuring module, configured to configure a common field preset in a downlink control information (DCI) as ~~at least one type of command field related to Acknowledgement/Negative acknowledgement (ACK/NACK) feedback~~ one command according to a type of a downlink component carrier transmitting the DCI, wherein ~~the common field can be configured as the at least two types of command fields related to ACK/NACK feedback~~ the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command; and

a sending module, configured to send the DCI to a user equipment ~~so that the user equipment feeds back ACK/NACK information according to the DCI~~.

33. (Currently Amended) The base station according to claim 32, wherein ~~the common field can be configured as a transmission power control (TPC) command field and an ACK resource indication (ARI) command field:~~

~~wherein~~ the configuring module comprises a third unit and a fourth unit;

wherein the third unit is configured to configure the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as the TPC command ~~field~~; and

wherein the fourth unit is configured to configure the common field in at least one piece

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of DCI transmitted by a non-system-linked downlink component carrier as the ARI command-~~field~~.

34. (Currently Amended) A user equipment, comprising:

a receiving module, configured to receive downlink control information (DCI) that is sent by a base station and transmitted by a downlink component carrier; and

a feedback module, configured to feed back Acknowledgement/Negative-acknowledgement (ACK/NACK) feedback information according to a command ~~field that is related to ACK/NACK feedback and configured in~~ indicated by a common field preset in the DCI, wherein the common field ~~can be~~ is configured as ~~at least one type of command field related to ACK/NACK feedback of at least two types of command fields related to ACK/NACK feedback~~ one command according to a type of a downlink component carrier transmitting the DCI, and the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command.

35. (Currently Amended) The user equipment according to claim 34, wherein the receiving module is configured to receive at least one piece of DCI transmitted by a system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a system-linked downlink component carrier is configured as a TPC command-~~field~~; and is configured to receive at least one piece of DCI transmitted by a non-system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a non-system-linked downlink component carrier is configured as an ARI command-~~field~~.

36. (Cancelled).

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37. (New) The method according to claim 23, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to PDSCH transmission of the downlink PCC.

38. (New) The method according to claim 23, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises the at least one piece of DCI transmitted by the downlink PCC.

39. (New) The method according to claim 30, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier.

40. (New) The method according to claim 30, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises at least one piece of DCI transmitted by a downlink primary component carrier.

41. (New) The base station according to claim 33, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier.

42. (New) The method according to claim 30, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises at least one piece of DCI transmitted by a downlink primary component carrier.

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43. (New) The user equipment according to claim 35, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier.

44. (New) The user equipment according to claim 35, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises at least one piece of DCI transmitted by a downlink primary component carrier.

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REMARKS

Claims 17, 23, 24, 28, 30, 32-35, and 37-44 are pending, with claims 17, 28, 32, and 34 being independent. Claims 1-16, 18-22, 25-27, 29, 31, and 36 have been cancelled. Claims 17, 23, 24, 28, 30, and 32-35 have been amended. Claims 37-44 have been added. No new subject matter has been added. Applicant respectfully requests reconsideration and allowance in view of the following remarks.

Prior Art Rejections

Independent claims 17, 28, 32 and 34 were each rejected under 35 U.S.C. 103(a) as being unpatentable over "Details of ACK/NACK bundling for TDD" ("Ericsson") in view of U.S. Patent Publication No. 2012/0140726 ("Moon"). In addition, claims 18-21 were rejected as being obvious over Ericsson in view of Moon and further in view of U.S. Patent Publication No. 20120224553 ("Kim"), claims 22-23, 25-27 were rejected as being obvious over Ericsson in view of Moon and further in view of U.S. Patent Publication No. 20090197630 ("Ahn"), and claim 24 was rejected as being obvious over Ericsson in view of Moon and further in view of Ahn and Kim. Applicant respectfully traverses these rejections.

Amended independent claim 17 recites "configuring a common field preset in Downlink Control Information (DCI) as one command according to a type of a downlink component carrier transmitting the DCI, wherein the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command; and sending the DCI to a user equipment." Applicant respectfully submits that the prior art does not teach or suggest the limitations of claim 17, as amended.

Applicant respectfully submits that Ericsson at least does not teach or suggest the features of "configuring a common field preset in Downlink Control Information (DCI) as one command

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according to a type of a downlink component carrier transmitting the DCI, wherein the common filed is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command."

Ericsson discloses details of ACK/NACK bundling for TDD. Specially, the last paragraph of section 5 discloses that "to consider use of the two bit UL index of DCI format 0 for the TDD configurations 1-5 to signal the number of dynamically assigned DL subframes within the bundle." For TDD configuration 0, the two bit UL index of DCI format 0 is used to signal UL index, while for TDD configuration 1-5, the two bit UL index of DCI is used to signal the number of dynamically assigned DL subframes within the bundle (i.e. this is actually the function of DAI). So Ericsson teaches the use of the two bit UL index of DCI format 0 as either UL index or DAI according to the TDD configuration. Therefore, Ericsson does not disclose that the common field in the DCI may be used to indicate one of a TPC command and an ARI command according to the types of a downlink component carriers transmitting the DCI. Therefore. Ericsson does not disclose the features.

Moon discloses a method for allocating a relay backhaul resource in a wireless communication system. Specially, Paragraph 39 of Moon discloses that "the DCI formats 3 and 3A represent uplink transmit power control (TPC) command for random user equipment groups." Moon only discusses the DCI formats 3 and 3A represent uplink transmit power control (TPC) command. Moon does not disclose or teach that "the common filed is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command."

Therefore, as such, Applicant respectfully submits that the proposed combination of Ericsson and Moon does not render claim 17 obvious.

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Independent claims 28, 32 and 34 recite apparatus and methods elements similar to those described above with respect to claim 17. As such, these claims are patentably distinct over the cited art of record for at least those reasons stated above with regard to claim 17.

The remaining claims depend from one of the independent claims and add further limitations. It is respectfully submitted that these claims are allowable over the references of record in view of their dependence on an allowable claim as well as the additional limitations.

Conclusion

Applicant has made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Applicant's attorney at the number listed below so that such issues may be resolved as expeditiously as possible. The Commissioner is hereby authorized to charge any fees that are due, or credit any overpayment, to Deposit Account No. 50-1065.

Respectfully submitted,

February 19, 2014
Date

/Ira S Matsil/
Ira S. Matsil
Attorney for Applicant
Reg. No. 35,272

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Ste. 1000
Dallas, Texas 75252
Tel.: 972-732-1001
Fax: 972-732-9218
docketing@slater-matsil.com

Samsung Exhibit 1002, Page 481

Electronic Acknowledgement Receipt

EFS ID:	18245017
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	19-FEB-2014
Filing Date:	02-JUN-2012
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Application Type:	Utility under 35 USC 111(a)

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1		AMEND.pdf	47725	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	10
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New International Application Filed with the USPTO as a Receiving Office
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/487,172	Filing Date 06/02/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)		
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)
☒ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	380
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	x $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	x $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s)			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	380

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)		
AMENDMENT	02/19/2014	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

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LIE
/GWENDOLYN MYERS/

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Slater & Matsil, L.L.P.
IPR Department
17950 Preston Road, Suite 1000
IPR department
Dallas, TX 75252

EXAMINER
NOORISTANY, SULAIMAN

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DATE MAILED: 05/02/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09	5823

TITLE OF INVENTION: METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/NACK INFORMATION FOR CARRIER AGGREGATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEES DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	08/04/2014

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

Samsung Exhibit 1002, Page 485

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

74368 7506 05/02/2014

Slater & Matsil, L.L.P.
IPR Department
17950 Preston Road, Suite 1000
IPR department
Dallas, TX 75252

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09	5823

TITLE OF INVENTION: METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/NACK INFORMATION FOR CARRIER AGGREGATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEES DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	08/04/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
NOORISTANY, SULAIMAN	2478	370-329000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number (enclose an extra copy of this form)

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature Date

Typed or printed name Registration No

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Samsung Exhibit 1002, Page 486

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09	5823

74365 75% 05/02/2014

Slater & Matsil, L.L.P.
IPR Department
17950 Preston Road, Suite 1000
IPR department
Dallas, TX 75252

EXAMINER	
NOORISTANY, SULAIMAN	

ART UNIT	PAPER NUMBER
2478	

DATE MAILED: 05/02/2014

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/487,172	Applicant(s) CHEN ET AL.	
	Examiner SULAIMAN NOORISTANY	Art Unit 2478	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *4/24/14*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *17, 24, 26, 30, 32-35, 37-44*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   Certified copies:
   a) ☐ All b) ☐ Some * c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 12/17/13, 11/14/13
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date *4/24/14* .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/SULAIMAN NOORISTANY/
Primary Examiner, Art Unit 2478

The present application is being examined under the pre-AIA first to invent provisions.

Examiner Amendment

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Ira S. Matsil (Reg. #35,272) on 4/24/2014.

Claims Are Amended As Follows:

1-16. (Cancelled)

17. (currently amended) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

configuring a common field preset in Downlink Control Information (DCI) as one command according to a type of a downlink component carrier transmitting the DCI, wherein the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command; and

sending the DCI to a user equipment;

wherein configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC

command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command.

18-22. (Cancelled)

23. (deleted)

24. (currently amended) The method according to claim [[23]] 17, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises:

DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier; and/or

at least one piece of DCI transmitted by the downlink primary component carrier (PCC).

25-27. (Cancelled)

28. (currently amended) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

receiving downlink control information (DCI) which is sent by a base station and transmitted by a downlink component carrier: and

feeding back ACK/NACK information according to a command indicated by a common field preset in the DCI, wherein the common field is configured as one command according to a type of a downlink component carrier transmitting the DCI, and the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command, wherein the common field is configured by configuring the common field in at least

one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command.

29. (Cancelled).

30. (currently amended) The method according to claim 28, wherein if the received DCI is at least one piece of DCI transmitted by a system-linked downlink component carrier, a common ~~command~~ field in the DCI is configured as the TPC command: and

if the received DCI is at least one piece of DCI transmitted by a non-system-linked downlink component carrier, the common ~~command~~ field in the DCI is configured as the ARI command.

31. (Cancelled)

32. (currently amended) A base station, comprising:

a configuring module, configured to configure a common field preset in a downlink control information (DCI) as one command according to a type of a downlink component carrier transmitting the DCI, wherein the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command, wherein the common field is configured by configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier

as an ARI command; and

a sending module, configured to send the DCI to a user equipment.

33. The base station according to claim 32, wherein the configuring module comprises a third unit and a fourth unit;

wherein the third unit is configured to configure the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as the TPC command; and

wherein the fourth unit is configured to configure the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as the ARI command.

34. (currently amended) A user equipment, comprising:

a receiving module, configured to receive downlink control information (DCI) that is sent by a base station and transmitted by a downlink component carrier; and

a feedback module, configured to feed-back Acknowledgement/Negative-acknowledgement (ACK/NACK) feedback information according to a command indicated by a common field preset in the DCI, wherein the common field is configured as one command according to a type of a downlink component carrier transmitting the DCI, and the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command, wherein the common field is configured by configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command.

35. (currently amended) The user equipment according to claim 34, wherein the receiving module is configured ~~to receive at least one piece of DCI transmitted by a system-linked downlink component carrier, wherein the common field in the at least one piece of DCI transmitted by a system-linked downlink component carrier is configured as a TPC command; and is configured~~ to receive the at least one piece of DCI transmitted by a non-system-linked downlink component carrier~~, wherein the common field in the at least one piece of DCI transmitted by a non-system-linked downlink component carrier is configured as an ARI command~~.

36. (Cancelled).

37. (currently amended) The method according to claim [[23]] 17, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to PDSCH transmission of the downlink PCC.

38. (currently amended) The method according to claim [[23]] 17, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises the at least one piece of DCI transmitted by the downlink PCC.

Allowable Subject Matter

Claims **17, 24, 28, 30, 32-35, 37-44** are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

None of the prior art of the record explicitly teaches or fairly suggests all of the claimed limitation, especially the limitation wherein configuring a common field preset in Downlink Control Information (DCI) as one command according to a type of a downlink component carrier transmitting the DCI, wherein the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command: and sending the DCI to a user equipment: wherein configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sulaiman Nooristany whose telephone number is (571) 270-1929. The examiner can normally be reached on M-F from 9 to 5. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Derrick Ferris, can be reached on (571) 272-3123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/SULAIMAN NOORISTANY/

Primary Examiner, Art Unit 2478

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	13/487,172	CHEN ET AL.	
	Examiner	Art Unit	
	SULAIMAN NOORISTANY	2478	

All participants (applicant, applicant's representative, PTO personnel):

(1) *SULAIMAN NOORISTANY*. (3)_____.

(2) *Ira S. Matsil (Reg. #35,272)*. (4)_____.

Date of Interview: *4/24/14*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: _____.

Identification of prior art discussed: _____.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant agreed that the examiner's amendment, authorized by Mr. Matsil, would place the application in condition for allowance.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/SULAIMAN NOORISTANY/ Primary Examiner, Art Unit 2478	

Notice of References Cited	Application/Control No. 13/487,172	Applicant(s)/Patent Under Reexamination CHEN ET AL.	
	Examiner SULAIMAN NOORISTANY	Art Unit 2478	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2012/0140726	06-2012	Moon et al.	370/329
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Nooristany, Sulaiman
Attorney Docket Number	HW 82713780US09

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2009041785	WO	A2	2009-04-02	LG Electronics Inc.		☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.N./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Nooristany, Sulaiman
Attorney Docket Number	HW 82713780US09

	1	3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (Release 8), 3GPP TS 36.213, V8.6.0, March 2009, 77 pages.	☐
	2	Extended European Search Report received in Application No. 13185753.4-1860 mailed October 29, 2013, 6 pages.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Sulaiman Nooristany/	Date Considered	04/24/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.N./

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1480775	(chen or Li).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:21
S2	7	(chen or Li).in. and ((ACK/NACK) same feedback same (DAI or TPC or DCI)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:26
S3	72	370/329.ccls. and ((ACK/NACK) same feedback same (DAI or TPC or DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:29
S4	4	370/329.ccls. and ((ACK/NACK) same feedback same (DAI same TPC same DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:29
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S8	0	(system near link same downlink same (DAI and TPC and DCI))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:31
S9	783	(DCI with pdsch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:32
S10	250	(DCI with pdsch with downlink with transmission)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:32

S11	53	(DCI with pdsch with downlink with transmission same tpc)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:32
S12	2	(DCI with pdsch with downlink with transmission same tpc same DAI)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:33
S13	1	2012/0140726	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:33
S14	2	"20120140726"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:33
S15	2	"20120224553"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:34
S16	3	"20090197630"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/13 16:34
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S21	16	(ACK/NACK) same DCI near6 downlink same TPC near command	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:16
S22	0	S21 and TCP near command	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:18

S23	16	S21 and TPC near command	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:18
S24	6	S23 and ACK near6 ARI	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:18
S25	13580	(ACK/NACK)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:27
S26	2606	S25 and (DAI or TPC or DCI)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:27
S27	18	S26 and DCI near command	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:27
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S29	838	S26 and TPC near command	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:28
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S36	589	S29 and PDSCH	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:29
S37	11	S36 and DCI near6 (user or client) near (terminal or station or mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:30
S38	8	S36 and (transmit$4 or send$4 or rely$3) same DCI near6 (user or client) near (terminal or station or mobile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:31
S39	12	ARI near command	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:36
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S51	0	non-system adj link$2 adj down$lnik	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/23 11:39
S55	2	"13273678"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/24 09:54

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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S53	0	(chen or Li).in. and (transmit$4 or send$4 or rely$3) same DCI near6 (user or client) near (terminal or station or mobile).clm.	USPAT; UPAD	OR	ON	2014/04/23 11:41
S54	0	(chen or Li).in. and (system adj linkS2 adj downlink).clm.	USPAT; UPAD	OR	ON	2014/04/23 11:41

4/ 24/ 2014 2:52:51 PM
C:\ Users\ snooristany\ Documents\ EAST\ Workspaces\ 13487172.wsp

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

CPC		
Symbol	Type	Version

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	16	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	04/24/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	329	H	0	4	W	72 04 (2009.01.01)						

CROSS REFERENCE(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	16	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	04/24/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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	8	2	24	8	40										
	9		25	12	41										
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	12	5	28	16	44										
	13		29												
	14	6	30												
	15		31												
	16	10	32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 16	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478 (Primary Examiner)	04/24/2014 (Date)	O.G. Print Claim(s) 17	O.G. Print Figure 5

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	329	11/13/2013	SN

SEARCH NOTES		
Search Notes	Date	Examiner
Tech Search in EAST w370, Google, Inventor Search, US PGPUB, USPAT, FPRS, JPO, DERWENT	11/13/2013	SN
Tech Search in EAST w370, Google, Inventor Search, US PGPUB, USPAT, FPRS, JPO, DERWENT	4/24/2014	SN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
Pg_Pub	see search history	4/24/2014	SN

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/13/2013	04/24/2014							
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13	34	✓	=							
14	35	✓	=							
	36	✓	-							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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CLAIM		DATE								
Final	Original	11/13/2013	04/24/2014							
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8	40		=							
12	41		=							
9	42		=							
15	43		=							
16	44		=							

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Sulaiman Nooristany
Attorney Docket Number	HW 82713780US09

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2009116760	WO	A2	2009-09-24	LG Electronics Inc.		☐
	2	2010521942	JP	A	2010-06-24	LG Electronics Inc.		☐
	3	2010539847	JP	A	2010-12-16	LG Electronics Inc.		☐

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.N./

Receipt date: 12/17/2013

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13487172 13487172 - GAU: 2478
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Sulaiman Nooristany
Attorney Docket Number	HW 82713780US09

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Japanese Office Action for Application No. 2012-541313, mailed 11/12/2013, 5 pages.	☐
	2	Huawei, "UL ACK/NACK Feedback Related DCI Design for Carrier Aggregation," 3GPP TSG RAN WG1 Meeting #60bis, R1-101943, Beijing, China, April 12-16, 2010, 4 pages.	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Sulaiman Nooristany/	Date Considered	04/24/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.N./

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor:	Chen	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Conf. No.:	5823
Art Unit:	2478	Examiner:	Sulaiman Nooristany
Filed:	6/2/2012		
Title:	Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. § 1.312

Dear Sir:

This amendment is filed after the Notice of Allowance dated May 2, 2014. Please amend the application as follows.

In the Claims:

1-16. (Cancelled)

17. (Previously Presented) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

configuring a common field preset in Downlink Control Information (DCI) as one command according to a type of a downlink component carrier transmitting the DCI, wherein the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command; and

sending the DCI to a user equipment;

wherein configuring the common field comprises configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command.

18-23. (Cancelled)

24. (Previously Presented) The method according to claim 17, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises:

DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier; and/or

at least one piece of DCI transmitted by the downlink primary component carrier (PCC).

25-27. (Cancelled)

Samsung Exhibit 1002, Page 515

28. (Previously Presented) A method for feeding back Acknowledgement/Negative-acknowledgement (ACK/NACK) information for carrier aggregation, the method comprising:

receiving downlink control information (DCI) which is sent by a base station and transmitted by a downlink component carrier; and

feeding back ACK/NACK information according to a command indicated by a common field preset in the DCI, wherein the common field is configured as one command according to a type of a downlink component carrier transmitting the DCI, and the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command, wherein the common field is configured by configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command.

29-31. (Cancelled)

32. (Previously Presented) A base station, comprising:

a configuring module, configured to configure a common field preset in a downlink control information (DCI) as one command according to a type of a downlink component carrier transmitting the DCI, wherein the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command; wherein the common field is configured by configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier

Samsung Exhibit 1002, Page 516

as an ARI command; and

a sending module, configured to send the DCI to a user equipment.

33. (Cancelled)

34. (Previously Presented) A user equipment, comprising:

a receiving module, configured to receive downlink control information (DCI) that is sent by a base station and transmitted by a downlink component carrier; and

a feedback module, configured to feed-back Acknowledgement/Negative-acknowledgement (ACK/NACK) feedback information according to a command indicated by a common field preset in the DCI, wherein the common field is configured as one command according to a type of a downlink component carrier transmitting the DCI, and the common field is indicative of one of a transmission power control (TPC) command and an ACK resource indication (ARI) command, wherein the common field is configured by configuring the common field in at least one piece of DCI transmitted by a system-linked downlink component carrier as a TPC command and configuring the common field in at least one piece of DCI transmitted by a non-system-linked downlink component carrier as an ARI command.

35-38. (Cancelled)

39. (Currently Amended) The method according to claim [[30]] 28, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier.

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40. (Currently Amended) The method according to claim [[30]] 28, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises at least one piece of DCI transmitted by a downlink primary component carrier.

41. (Currently Amended) The base station according to claim [[33]] 32, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier.

42. (Currently Amended) The ~~method~~ base station according to claim [[30]] 32, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises at least one piece of DCI transmitted by a downlink primary component carrier.

43. (Currently Amended) The user equipment according to claim [[35]] 34, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises DCI corresponding to physical downlink shared channel (PDSCH) transmission of a downlink primary component carrier.

44. (Currently Amended) The user equipment according to claim [[35]] 34, wherein the at least one piece of DCI transmitted by a system-linked downlink component carrier comprises at least one piece of DCI transmitted by a downlink primary component carrier.

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REMARKS

Applicant notes with appreciation that a Notice of Allowance was mailed on May 2, 2014, in which claims 17, 24, 28, 30, 32-35 and 37-44 were allowed. Applicant noticed that some further, albeit minor, adjustments to the allowed claims 30, 33, 35 and 37-44 are needed. Therefore, with this Amendment, claims 30, 33, 35 and 37-38 are cancelled, and claims 39-44 amended to correct dependencies.

No new subject matter has been added by this amendment and the change does not alter the finding of patentability. Accordingly, Applicants respectfully request that this amendment be considered and entered and that the application move forward into issuance as soon as possible after the issue fee has been paid.

Respectfully submitted,

June 11, 2014
Date

/Ira S Matsil/
Ira S. Matsil
Attorney for Applicant
Reg. No. 35,272

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Ste. 1000
Dallas, Texas 75252
Tel.: 972-732-1001
Fax: 972-732-9218
docketing@slater-matsil.com

Samsung Exhibit 1002, Page 519

Electronic Acknowledgement Receipt	
EFS ID:	19302116
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/ NACK INFORMATION FOR CARRIER AGGREGATION
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	13-JUN-2014
Filing Date:	02-JUN-2012
Time Stamp:	15:45:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		312Amendment.pdf	32026	yes	6

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	6
Warnings:			
Information:			
	Total Files Size (in bytes):	32026	

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Chen	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Art Unit:	2478
Filed:	June 2, 2012	Examiner:	Nooristany, Sulaiman

For: Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF REFERENCES

Dear Sir:

Applicants respectfully request that the reference listed below and filed herewith be placed in the file pursuant to 37 CFR 1.97(i).

United States Office Action received in Application No. 13/725,413 mailed June 25, 2014, 10 pages.

US 2012/0236812 A1

To Applicants' best knowledge, the references cited in the IDS filed herewith are not material to the patentability of the above-identified application.

Respectfully submitted,

7/17/2014
Date

//
Ira S. Matsil
Attorney for Applicants
Reg. No. 35,272

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Suite 1000
Dallas, TX 75252
(972) 732-1001 (phone)
(972) 732-9218 (fax)

Electronic Acknowledgement Receipt

EFS ID:	19611599
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/ NACK INFORMATION FOR CARRIER AGGREGATION
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	17-JUL-2014
Filing Date:	02-JUN-2012
Time Stamp:	16:43:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS.PDF	33275	no	1
Warnings:					
Information:					

This is not an USPTO supplied IDS fillable form					
2	Non Patent Literature	NPL.PDF	862375	no	10
Warnings:					
Information:					
			Total Files Size (in bytes):	895650	

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New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO.
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09	5823

74368 7590 07/23/2014

Slater & Matsil, L.L.P.
17950 Preston Road, Suite 1000
Dallas, TX 75252

EXAMINER	
NOORISTANY, SULAIMAN	
ART UNIT	**PAPER NUMBER**
2478	

NOTIFICATION DATE	DELIVERY MODE
07/23/2014	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@slater-matsil.com

Response to Rule 312 Communication	Application No.	Applicant(s)
	13/487,172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☒ The amendment filed on *13 June 2014* under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/SULAIMAN NOORISTANY/
Primary Examiner, Art Unit 2478

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Chen	Docket No.:	HW 82713780US09
Serial No.:	13/487,172	Art Unit:	2478
Filed:	June 2, 2012	Examiner:	Nooristany, Sulaiman

For: Method, Base Station, and User Equipment for Feeding Back ACK/NACK Information for Carrier Aggregation

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF REFERENCES

Dear Sir:

Applicants respectfully request that the reference listed below and filed herewith be placed in the file pursuant to 37 CFR 1.97(i).

United States Office Action received in Application No. 13/725,413 mailed June 25, 2014, 10 pages.

US 2012/0236812 A1

To Applicants' best knowledge, the references cited in the IDS filed herewith are not material to the patentability of the above-identified application.

Respectfully submitted,

7/17/2014
Date

//
Ira S. Matsil
Attorney for Applicants
Reg. No. 35,272

SLATER & MATSIL, L.L.P.
17950 Preston Rd., Suite 1000
Dallas, TX 75252
(972) 732-1001 (phone)
(972) 732-9218 (fax)

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.N./

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Sulaiman Nooristany
Attorney Docket Number	HW 82713780US09

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100103899	A1	2010-04-29	Kwak, et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2005124991	RU	A	2007-02-10	Samsung Electronics Co., Ltd.	Equivalent to US 20100103899 A1	☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13487172
	Filing Date	2012-06-02
	First Named Inventor	Xiaobo Chen
	Art Unit	2478
	Examiner Name	Sulaiman Nooristany
	Attorney Docket Number	HW 82713780US09

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13487172
	Filing Date	2012-06-02
	First Named Inventor	Xiaobo Chen
	Art Unit	2478
	Examiner Name	Sulaiman Nooristany
	Attorney Docket Number	HW 82713780US09

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Ira S Matsil/	Date (YYYY-MM-DD)	2014-08-04
Name/Print	Ira S. Matsil	Registration Number	35,272

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Espacenet

Bibliographic data: RU2005124991 (A) — 2007-02-10

METHOD AND DEVICE FOR TRANSFERRING USER EQUIPMENT STATUS INFORMATION SIGNALS FOR PACKET TRANSFER OF REVERSE COMMUNICATION LINE IN THE REGION OF PROGRAMMABLE TOKEN PASSING

Inventor(s): KVAK JONG-DZUN, ; LI DZU-KHO, ; LI KOOK-KHEUJ, ; CHO DZOON-JANG, ; KHEO JUN-KHIOUNG, ; KIM JANG-BUM

Applicant(s): SAMSUNG EHLEKTRONIKS KO., LTD

Classification: - international: ***H04B7/00; H04W72/02; H04W76/04;*** *H04W28/04; H04W36/18; H04W52/32; H04W52/36; H04W52/40; H04W8/20*

- cooperative: **H04L1/16; H04L1/1864; H04L1/1887; H04L1/1893;** H04L2001/0092; H04W28/04; H04W36/18; H04W52/32; H04W52/362; H04W52/40; H04W8/20

Application number: RU20050124991 20050805

Priority number(s): KR20040062265 20040807 ; KR20040092154 20041111

Also published as: RU2308818 (C2) EP1624629 (A2) EP1624629 (A3) EP1624629 (B1) US2010103899 (A1) more

Abstract of RU2308818 (C2)

FIELD: communications engineering. ^ SUBSTANCE: method and device are claimed for transferring user equipment (UE) status information, where user equipment is connected to one servicing unit B and to at least one non-servicing unit B, in mobile communication system, which contain transport channel data generation, aforementioned data containing user equipment status information; transfer of transport channels data into servicing unit B and at least into one non-servicing unit B; receipt of response signal for transport channel data from servicing unit B; and repeated transmission of transport channel data if response signal received from servicing unit B is the non-confirming signal (NACK), and finishing of repeated transport channel data transmission, if response signal received from servicing unit B, is the confirmation

Samsung Exhibit 1002, Page 532

signal (ACK). ^ EFFECT: increased regulation characteristics of UE equipment and stability of the whole system. ^ 6 cl, 12 dwg

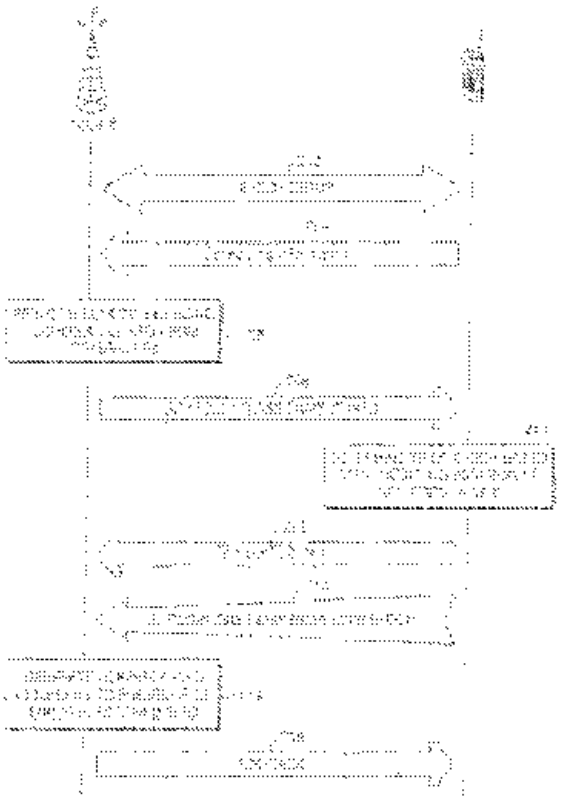


FIG.4

Samsung Exhibit 1002, Page 533

РОССИЙСКАЯ ФЕДЕРАЦИЯ

(19) **RU** (11) **2005 124 991** (13) **A**

(51) МПК
H04B 7/00 (2006.01)

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ,
ПАТЕНТАМ И ТОВАРНЫМ ЗНАКАМ

(12) ЗАЯВКА НА ИЗОБРЕТЕНИЕ

(21), (22) Заявка: 2005124991/09, 05.08.2005

(30) Конвенционный приоритет:
07.08.2004 KR 10-2004-62265
11.11.2004 KR 10-2004-92154

(43) Дата публикации заявки: 10.02.2007 Бюл. № 4

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129010, Москва, ул. Б. Спасская, 25, стр.3,
ООО "Юридическая фирма Городисский и
Партнеры", пат.пов. Ю.Д.Кузнецову

(71) Заявитель(и):
САМСУНГ ЭЛЕКТРОНИКС КО., ЛТД. (KR)

(72) Автор(ы):
КВАК Йонг-Дзун (KR),
ЛИ Дзу-Хо (KR),
ЛИ Коок-Хеуй (KR),
ЧО Дзоон-Янг (KR),
ХЕО Юн-Хиоунг (KR),
КИМ Янг-Бум (KR)

RU 2005124991 A

(54) СПОСОБ И УСТРОЙСТВО ДЛЯ ПЕРЕДАЧИ СИГНАЛОВ ИНФОРМАЦИИ СТАТУСА АБОНЕНТСКОЙ АППАРАТУРЫ ДЛЯ ПАКЕТНОЙ ПЕРЕДАЧИ ОБРАТНОЙ ЛИНИИ СВЯЗИ В РЕГИОНЕ ПРОГРАММИРУЕМОЙ ЭСТАФЕТНОЙ ПЕРЕДАЧИ

(57) Формула изобретения

1. Способ для передачи информации статуса абонентской аппаратуры (UE) посредством UE аппаратуры, связанной с одним обслуживающим узлом B и, по меньшей мере, с одним не обслуживающим узлом B в системе мобильной связи, поддерживающей службу сервиса пакетных данных обратной линии связи, способ содержит шаги

генерации данных транспортных каналов, содержащих информацию статуса UE аппаратуры;

передачи данных транспортных каналов в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B;

приема сигнала отклика для данных транспортных каналов из обслуживающего узла B;

повторной передачи данных транспортных каналов, если сигнал отклика, принятый из обслуживающего узла B, является сигналом не подтверждения (NACK), и

завершения повторной передачи данных транспортных каналов, если сигнал отклика, принятый из обслуживающего узла B, является сигналом подтверждения (ACK).

2. Способ по п.1, в котором информация статуса UE аппаратуры содержит, по меньшей мере, что-то одно, либо информацию мощности передачи, когда передается информация статуса UE аппаратуры, либо информацию о величине данных обратной линии связи.

3. Способ по п.1, в котором шаг генерации данных транспортных каналов содержит шаги

генерации данных транспортных каналов, содержащих заголовок и полезную нагрузку;

определения того, передавать ли информацию статуса UE аппаратуры; и

вставки информации статуса UE аппаратуры в данные транспортных каналов, если определяется, что нужно передавать информацию статуса UE аппаратуры.

4. Способ по п.1, в котором шаг повторной передачи содержит шаг передачи данных транспортных каналов в пределах заданного максимального числа повторных передач, используя заданный коэффициент усиления канала, в котором, по меньшей мере, одна величина из максимального числа повторных передач и коэффициента усиления канала устанавливается согласно тому, содержат ли данные транспортных каналов информацию

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статуса UE аппаратуры.

5. Способ по п.4, который также содержит шаг установки максимального числа повторных передач для данных транспортных каналов, равным первому значению, если данные транспортных каналов не содержат информацию статуса UE аппаратуры, и установки максимального числа повторных передач для данных транспортных каналов, равным второму значению, которое больше первого значения, если данные транспортных каналов содержат информацию статуса UE аппаратуры.

6. Способ по п.5, который также содержит шаг передачи новых данных транспортных каналов, содержащих информацию статуса UE аппаратуры и следующие пакетные данные, в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B, если сигнал ACK для данных транспортных каналов не принимается из обслуживающего узла B до тех пор, пока число повторных передач данных транспортных каналов, содержащих информацию статуса UE аппаратуры, не достигнет второго значения.

7. Способ по п.4, который также содержит шаг установки коэффициента усиления канала данных транспортных каналов, равным первому значению, если данные транспортных каналов не содержат информацию статуса UE аппаратуры, и установки коэффициента усиления канала данных транспортных каналов, равным второму значению, которое больше первого значения, если данные транспортных каналов содержат информацию статуса UE аппаратуры.

8. Способ для передачи информации статуса абонентской аппаратуры (UE) UE аппаратурой, связанной с одним обслуживающим узлом B и, по меньшей мере, с одним не обслуживающим узлом B, в системе мобильной связи, поддерживающей службу сервиса пакетных данных обратной линии связи, способ содержит шаги

генерации данных транспортных каналов, содержащих информацию статуса UE аппаратуры;

передачи данных транспортных каналов в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B;

приема сигнала отклика для данных транспортных каналов из обслуживающего узла B;

передачи данных транспортных каналов, содержащих информацию статуса UE аппаратуры и новые пакетные данные, в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B, если сигнал отклика, принятый из обслуживающего узла B, содержит сигнал не подтверждения (NACK), и сигнал отклика, принятый из, по меньшей мере, одного не обслуживающего узла B, содержит сигнал подтверждения (ACK); и

завершения передачи данных транспортных каналов, если сигнал отклика, принятый из обслуживающего узла B, является сигналом подтверждения (ACK).

9. Способ по п.8, который также содержит шаг передачи новых данных транспортных каналов, содержащих информацию статуса UE аппаратуры и пакетные данные, в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B, если сигнал отклика, принятый из обслуживающего узла B, и сигнал отклика, принятый, по меньшей мере, из одного не обслуживающего узла B, содержит сигналы NACK.

10. Способ по п.8, в котором информация статуса UE аппаратуры содержит, по меньшей мере, что-то одно, либо информацию мощности передачи, когда передается информация статуса UE аппаратуры, либо информацию о величине данных обратной линии связи.

11. Способ по п.8, в котором шаг генерации данных транспортных каналов содержит шаги

генерации данных транспортных каналов, имеющих заголовок и полезную нагрузку;

определения того, передавать ли информацию статуса UE аппаратуры; и

вставки информации статуса UE аппаратуры в данные транспортных каналов, если определяется, что нужно передавать информацию статуса UE аппаратуры.

12. Устройство абонентской аппаратуры (UE) для передачи информации статуса абонентской аппаратуры (UE) в один обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B в системе мобильной связи, поддерживающей службу сервиса пакетных данных обратной линии связи, устройство содержит

генератор для генерации данных транспортных каналов, содержащих информацию статуса UE аппаратуры;

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передатчик для передачи данных транспортных каналов в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B; и

приемник для приема сигнала отклика для данных транспортных каналов из обслуживающего узла B,

при этом передатчик избирательно повторно передает информацию статуса UE аппаратуры согласно сигналу отклика, принятому из обслуживающего узла B, без рассмотрения сигнала отклика, принятого, по меньшей мере, из одного не обслуживающего узла B, если данные транспортных каналов содержат информацию статуса UE аппаратуры.

13. Устройство по п.12, в котором информация статуса UE аппаратуры содержит, по меньшей мере, что-то одно, либо информацию мощности передачи, когда передается информация статуса UE аппаратуры, либо информацию о величине данных обратной линии связи.

14. Устройство по п.12, в котором генератор вставляет информацию статуса UE аппаратуры в данные транспортных каналов согласно сигналу управления, указывающему, передавать ли информацию статуса UE аппаратуры.

15. Устройство по п.12, в котором передатчик передает данные транспортных каналов в пределах заданного максимального числа повторных передач, используя заданный коэффициент усиления канала, в котором, по меньшей мере, одна величина из максимального числа повторных передач и коэффициента усиления канала устанавливается согласно тому, содержат ли данные транспортных каналов информацию статуса UE аппаратуры.

16. Устройство по п.15, в котором максимальное число повторных передач для данных транспортных каналов устанавливается равным первому значению, если данные транспортных каналов не содержат информацию статуса UE аппаратуры, и максимальное число повторных передач для данных транспортных каналов устанавливается равным второму значению, которое больше первого значения, если данные транспортных каналов содержат информацию статуса UE аппаратуры.

17. Устройство по п.16, в котором передатчик передает новые данные транспортных каналов, содержащие информацию статуса UE аппаратуры и следующие пакетные данные в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B, если сигнал ACK для данных транспортных каналов не принимается из обслуживающего узла B, до тех пор, пока число повторных передач данных транспортных каналов, содержащих информацию статуса UE аппаратуры, не достигнет второго значения.

18. Устройство по п.15, в котором коэффициент усиления канала данных транспортных каналов устанавливается равным первому значению, если данные транспортных каналов не содержат информацию статуса UE аппаратуры, и коэффициент усиления канала данных транспортных каналов устанавливается равным второму значению, которое больше первого значения, если данные транспортных каналов содержат информацию статуса UE аппаратуры.

19. Устройство по п.12, в котором передатчик обеспечивает

передачу данных транспортных каналов, содержащих информацию статуса UE аппаратуры и новые пакетные данные, в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B, если сигнал отклика, принятый из обслуживающего узла B, является сигналом NACK, и сигнал отклика, принятый из, по меньшей мере, одного не обслуживающего узла B является сигналом ACK; и

завершение передачи данных транспортных каналов, если сигнал отклика, принятый из обслуживающего узла B, является сигналом ACK.

20. Устройство по п.19, в котором передатчик обеспечивает передачу данных транспортных каналов, содержащих информацию статуса UE аппаратуры и пакетные данные, в обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B, если сигнал отклика, принятый из обслуживающего узла B, и сигнал отклика, принятый, по меньшей мере, из одного не обслуживающего узла B, являются сигналами NACK.

21. Способ для передачи пакетных данных обратной линии связи абонентской аппаратурой (UE), связанной с одним обслуживающим узлом B и, по меньшей мере, с одним не обслуживающим узлом B в системе мобильной связи, поддерживающей службу

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сервиса пакетных данных обратной линии связи, способ содержит шаги

генерации данных первого канала управления, показывающих транспортный формат данных транспортных каналов, имеющих пакетные данные для службы сервиса пакетных данных, и данных второго канала управления, содержащих информацию статуса UE аппаратуры;

определения первой мощности передачи для данных первого канала управления согласно командам управления мощностью, принятым из обслуживающего узла B и, по меньшей мере, одного не обслуживающего узла B;

установки заданного значения смещения мощности для данных второго канала управления;

определения второй мощности передачи для данных второго канала управления путем прибавления значения смещения мощности к первой мощности передачи; и

применения коэффициентов усиления для первой мощности передачи и второй мощности передачи к данным первого канала управления и данным второго канала управления, и передачи данных первого канала управления с примененным коэффициентом усиления и данных второго канала управления после мультиплексирования.

22. Способ по п.21, в котором значение смещения мощности содержит заданное фиксированное значение или значение, определенное контроллером радиосети, и затем передается.

23. Способ по п.21, в котором шаг установки значения смещения мощности содержит шаги

определения объединенной команды управления мощностью, путем объединения команд управления мощностью, принятых из обслуживающего узла B, и, по меньшей мере, одного не обслуживающего узла B;

увеличения значения смещения мощности со значения смещения мощности предыдущего временного интервала на заданное значение, если объединенная команда управления мощностью отличается от команды управления мощностью, принятой из обслуживающего узла B; и

установки значения смещения мощности равным значению смещения мощности предыдущего временного интервала, если объединенная команда управления мощностью идентична команде управления мощностью, принятой из обслуживающего узла B.

24. Способ по п.23, в котором шаг установки значения смещения мощности также содержит шаги

определения того, достигло ли значение смещения мощности заданного предельного значения, если объединенная команда управления мощностью отличается от команды управления мощностью, принятой из обслуживающего узла B; и

анализа команды управления мощностью, принятой из обслуживающего узла B, если значение смещения мощности достигло предельного значения;

поддержания значения смещения мощности на предельном значении, если команда управления мощностью, принятая из обслуживающего узла B, содержит команду "ВВЕРХ"; и

инициализации значения смещения мощности, если команда управления мощностью, принятая из обслуживающего узла B, содержит команду "ВНИЗ".

25. Способ по п.21, в котором данные второго канала управления передаются повторно, по меньшей мере, дважды.

26. Устройство абонентской аппаратуры (UE) для передачи пакетных данных обратной линии связи в один обслуживающий узел B и, по меньшей мере, в один не обслуживающий узел B в системе мобильной связи, поддерживающей службу сервиса пакетных данных обратной линии связи, устройство содержит

генератор первого канала управления для генерации данных первого канала управления, показывающих транспортный формат данных транспортных каналов, имеющих пакетные данные для службы сервиса пакетных данных;

генератор второго канала управления для генерации данных второго канала управления, содержащих информацию статуса UE аппаратуры; и

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мультиплексор для умножения данных первого канала управления на коэффициент усиления первой мощности для первой мощности передачи, для умножения данных второго канала управления на коэффициент усиления для второй мощности передачи, и для передачи данных первого канала управления, умноженных на коэффициент усиления мощности, и данных второго канала управления после мультиплексирования;

в котором вторая мощность передачи определяется путем прибавления заданного смещения мощности для данных второго канала управления к первой мощности передачи.

27. Устройство UE аппаратуры по п.26, в котором значение смещения мощности содержит заданное фиксированное значение или значение, определенное контроллером радиосети, и затем передается.

28. Устройство UE аппаратуры по п.26, в котором значение смещения мощности увеличивается со значения смещения мощности предыдущего временного интервала на заданное значение, если объединенная команда управления мощностью, определенная объединенными командами управления мощностью, принятыми из обслуживающего узла B и, по меньшей мере, одного не обслуживающего узла B, отличается от команды управления мощностью, принятой из обслуживающего узла B, при этом значение смещения мощности устанавливается равным значению смещения мощности предыдущего временного интервала, если объединенная команда управления мощностью идентична команде управления мощностью, принятой из обслуживающего узла B.

29. Устройство UE аппаратуры по п.28, в котором значение смещения мощности поддерживается на заданном предельном значении, если увеличенное значение смещения мощности достигло предельного значения и команда управления мощностью, принятая из обслуживающего узла B, содержит команду "ВВЕРХ", и в котором значение смещения мощности инициализируется, если увеличенное значение смещения мощности достигло предельного значения и команда управления мощностью, принятая из обслуживающего узла B, содержит команду "ВНИЗ".

30. Устройство UE аппаратуры по п.26, в котором данные второго канала управления передаются повторно, по меньшей мере, дважды.

31. Способ для передачи пакетных данных из абонентской аппаратуры (UE) в службе одним обслуживающим узлом B и, по меньшей мере, одним не обслуживающим узлом B в системе мобильной связи, поддерживающей службу сервиса пакетных данных обратной линии связи, способ содержит шаги

приема данных транспортных каналов для службы сервиса пакетных данных обратной линии связи лучшим обслуживающим узлом B и, по меньшей мере, одним не обслуживающим узлом B;

определения того, содержат ли данные транспортного канала информацию статуса UE аппаратуры для службы сервиса пакетных данных для UE аппаратуры,

если данные транспортного канала содержат информацию статуса UE аппаратуры, то передачи лучшим обслуживающим узлом B сигнала не подтверждения (NACK) или сигнала подтверждения (ACK) согласно тому, имеется ли ошибка в данных транспортного канала, и если данные транспортного канала содержат информацию статуса UE аппаратуры и не содержат пакетных данных, то игнорирование, по меньшей мере, одним не обслуживающим узлом B того, есть ли ошибка в данных транспортного канала.

32. Способ по п.31, в котором информация статуса UE аппаратуры содержит, по меньшей мере, что-то одно, либо информацию мощности передачи, когда передается информация статуса UE аппаратуры, либо информацию о величине данных обратной линии связи.

33. Способ по п.31, который также содержит шаг

установки максимального числа повторных передач для данных транспортных каналов, равным первому значению, если данные транспортных каналов не содержат информацию статуса UE аппаратуры, и установки максимального числа повторных передач для данных транспортных каналов, равным второму значению, которое больше первого значения, если данные транспортных каналов содержат информацию статуса UE аппаратуры.

34. Способ по п.31, который также содержит шаг установки коэффициента усиления канала данных транспортных каналов, равным первому значению, если данные

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транспортных каналов не содержат информацию статуса UE аппаратуры, и установки коэффициента усиления канала данных транспортных каналов, равным второму значению, которое больше первого значения, если данные транспортных каналов содержат информацию статуса UE аппаратуры.

RU 2005124991 A

RU 2005124991 A

Electronic Patent Application Fee Transmittal	
Application Number:	13487172
Filing Date:	02-Jun-2012
Title of Invention:	METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/ NACK INFORMATION FOR CARRIER AGGREGATION
First Named Inventor/Applicant Name:	Xiaobo Chen
Filer:	Ira Stuart Matsil/Shandy Sarchet
Attorney Docket Number:	HW 82713780US09

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960
Publ. Fee- Early, Voluntary, or Normal	1504	1	0	0

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**1140**

Electronic Acknowledgement Receipt	
EFS ID:	19767297
Application Number:	13487172
International Application Number:	
Confirmation Number:	5823
Title of Invention:	METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/ NACK INFORMATION FOR CARRIER AGGREGATION
First Named Inventor/Applicant Name:	Xiaobo Chen
Customer Number:	74365
Filer:	Ira Stuart Matsil/Shandy Sarchet
Filer Authorized By:	Ira Stuart Matsil
Attorney Docket Number:	HW 82713780US09
Receipt Date:	04-AUG-2014
Filing Date:	02-JUN-2012
Time Stamp:	16:05:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1140
RAM confirmation Number	2527
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Issue Fee Payment (PTO-85B)	IssueFee.pdf	154360	no	1
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	IDS.PDF	689941	no	4
Warnings:					
Information:					
3	Foreign Reference	RU2005124991A_pto.PDF	478898	no	8
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	34012	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1357211		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

74368 7506 05/02/2014

Slater & Matsil, L.L.P.
IPR Department
17950 Preston Road, Suite 1000
IPR department
Dallas, TX 75252

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/487,172	06/02/2012	Xiaobo Chen	HW 82713780US09	5823

TITLE OF INVENTION: METHOD, BASE STATION, AND USER EQUIPMENT FOR FEEDING BACK ACK/NACK INFORMATION FOR CARRIER AGGREGATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEES DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	08/04/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
NOORISTANY, SULAIMAN	2478	370-329000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address for Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication for "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Slater & Matsil, L.L.P.
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Huawei Technologies Co., Ltd. Shenzhen, China

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order # of Copies

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

☒ Payment by credit card. ~~Form PTO-2038 is attached.~~

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 50-1065 ~~(enclose an extra copy of this form)~~

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Ira S Matsil/ Date August 4, 2014

Typed or printed name Ira S. Matsil Registration No. 35,272

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Samsung Exhibit 1002, Page 544

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13487172
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Sulaiman Nooristany
Attorney Docket Number	HW 82713780US09

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100103899	A1	2010-04-29	Kwak, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2005124991	RU	A	2007-02-10	Samsung Electronics Co., Ltd.	Equivalent to US 20100103899 A1	☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.N./

Receipt date: 08/04/2014

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13487172 13487172 - GAU: 2478
Filing Date	2012-06-02
First Named Inventor	Xiaobo Chen
Art Unit	2478
Examiner Name	Sulaiman Nooristany
Attorney Docket Number	HW 82713780US09

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Sulaiman Nooristany/	Date Considered	08/19/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.N./

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/13/2013	04/24/2014							
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	3	-	-							
	4	-	-							
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12	34	✓	=							
13	35	✓	=							
	36	✓	-							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
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3	37		=							
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6	39		=							
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8	42		=							
14	43		=							
15	44		=							

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

CPC		
Symbol	**Type**	**Version**

CPC Combination Sets				
Symbol	**Type**	**Set**	**Ranking**	**Version**

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	15	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	04/24/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	329	H	0	4	W	72 04 (2009.01.01)						

CROSS REFERENCE(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	15	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	04/24/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 15	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	04/24/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

CPC		
Symbol	**Type**	**Version**

CPC Combination Sets				
Symbol	**Type**	**Set**	**Ranking**	**Version**

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	11	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	09/30/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	329	H	0	4	W	72 :2009.01.01:						

CROSS REFERENCE(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	11	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	09/30/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

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	15		31												
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NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	11	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	09/30/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/13/2013	04/24/2014							
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	2	-	-							
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	35	✓	=							
	36	✓	-							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE							
Final	Original	11/13/2013	04/24/2014						
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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

CPC		
Symbol	Type	Version

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	11	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	09/30/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	Art Unit
	SULAIMAN NOORISTANY	2478

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	329	H	0	4	W	72 :04 :2009.01.01:						

CROSS REFERENCE(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE (Assistant Examiner)	(Date)	Total Claims Allowed: 11	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478 (Primary Examiner)	09/30/2014 (Date)	O.G. Print Claim(s) 17	O.G. Print Figure 5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13487172	CHEN ET AL.
	Examiner	**Art Unit**
	SULAIMAN NOORISTANY	2478

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	1	17		33										
	2		18	9	34										
	3		19		35										
	4		20		36										
	5		21		37										
	6		22		38										
	7		23	4	39										
	8	2	24	5	40										
	9		25	7	41										
	10		26	8	42										
	11		27	10	43										
	12	3	28	11	44										
	13		29												
	14		30												
	15		31												
	16	6	32												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	11	
/SULAIMAN NOORISTANY/ Primary Examiner.Art Unit 2478	09/30/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	17	5

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/13/2013	04/24/2014							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
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	8	-	-							
	9	-	-							
	10	-	-							
	11	-	-							
	12	-	-							
	13	-	-							
	14	-	-							
	15	-	-							
	16	-	-							
1	17	✓	=							
	18	✓	-							
	19	✓	-							
	20	✓	-							
	21	✓	-							
	22	✓	-							
	23	✓	-							
2	24	✓	=							
	25	✓	-							
	26	✓	-							
	27	✓	-							
3	28	✓	=							
	29	✓	-							
	30	✓	-							
	31	✓	-							
6	32	✓	=							
	33	✓	=							
9	34	✓	=							
	35	✓	=							
	36	✓	-							

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CLAIM		DATE								
Final	Original	11/13/2013	04/24/2014							
	37		=							
	38		=							
4	39		=							
5	40		=							
7	41		=							
8	42		=							
10	43		=							
11	44		=							

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/487,172	11/11/2014	8885587	HW 82713780US09	5823

74365 7590 10/22/2014

Slater & Matsil, L.L.P.
17950 Preston Road, Suite 1000
Dallas, TX 75252

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Xiaobo Chen, Shenzhen, CHINA;
Chaojun Li, Shenzhen, CHINA;

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