AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas - Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:23-cv-409	3/11/2024	Eastern District of Texas - Marshall Division

PLAINTIFF	DEFENDANT
ASUS TECHNOLOGY LICENSING INC. AND CELERITY IP, LLC	SAMSUNG ELECTRONICS CO., LTD., SAMSUNG ELECTRONICS AMERICA, INC., AND SAMSUNG RESEARCH AMERICA

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	10,187,878 B2	1/22/2019	ASUS TECHNOLOGY LICENSING INC.
2	11,291,052 B2	3/29/2022	ASUS TECHNOLOGY LICENSING INC.
3	10,104,658 B2	10/16/2018	ASUS TECHNOLOGY LICENSING INC.
4	10,785,759 B2	9/22/2010	ASUS TECHNOLOGY LICENSING INC.
5	10,986,585 B2	4/20/2021	ASUS TECHNOLOGY LICENSING INC.

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

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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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/395,760	04/20/2021	10986585	5261.16US01	4258

87197 7590 03/31/2021

Skaar Ulbrich Macari, P.A.
601 Carlson Parkway
Suite 1050
Minneapolis, MN 55305

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):

Ko-Chiang Lin, Taipei City, TAIWAN;
ASUSTek Computer Inc., Taipei City, TAIWAN;
Yu-Hsuan Guo, Taipei City, TAIWAN;
Ming-Che Li, Taipei City, TAIWAN;
Hsin-Hsi Tsai, Taipei City, TAIWAN;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. 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	16395760
Filing Date	2019-04-26
First Named Inventor	Ko-Chiang LIN
Art Unit	2648
Examiner Name	TALUKDER, MD K.
Attorney Docket Number	5261.16US01

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
Change(s) applied to document, /J.M./ 2/3/2021	1	20170019864	A1	2017-01-19	~~LG ELECTRONICS INC~~. Hwang et al.	
	2	20100272091	A1	2010-10-28	FABIEN 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	2012060659	WO	A2	2012-05-10	SAMSUNG ELECTRONICS CO., LTD.		

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.K.T/

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

87197 7590 01/11/2021

Skaar Ulbrich Macari, P.A.
601 Carlson Parkway
Suite 1050
Minneapolis, MN 55305

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/395,760	04/26/2019	Ko-Chiang Lin	5261.16US01	4258

TITLE OF INVENTION: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/12/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
TALUKDER, MD K	2648	455-522000

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 03-09 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 Skaar Ulbrich Macari, P.A.
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: ASUSTek Computer Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Taipei City, Taiwan

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☒ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-4970

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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.
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.
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 /Scott G. Ulbrich/ Date March 18, 2021

Typed or printed name Scott G. Ulbrich Registration No. 48005

Electronic Patent Application Fee Transmittal

Application Number:	16395760
Filing Date:	26-Apr-2019
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Filer:	Scott Ulbrich/Christy Ulbrich
Attorney Docket Number:	5261.16US01

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

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:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
UTILITY APPL ISSUE FEE	1501	1	1200	1200
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt

EFS ID:	42223416
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	87197
Filer:	Scott Ulbrich/Christy Ulbrich
Filer Authorized By:	Scott Ulbrich
Attorney Docket Number:	5261.16US01
Receipt Date:	18-MAR-2021
Filing Date:	26-APR-2019
Time Stamp:	23:22:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1200
RAM confirmation Number	E20213HN22551952
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

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)	Issue_Fee_PartB_5261_16US01.pdf	1109071 fa46a38cd15253077948 3ead98986b04047d0144	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32199 3a463c3e86acd9b3ffc17d1926cc566ce20b5a30	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1141270		

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.

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

87197 7590 01/11/2021

Skaar Ulbrich Macari, P.A.
601 Carlson Parkway
Suite 1050
Minneapolis, MN 55305

EXAMINER	
TALUKDER, MD K	
ART UNIT	PAPER NUMBER
2648	

DATE MAILED: 01/11/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/395,760	04/26/2019	Ko-Chiang Lin	5261.16US01	4258

TITLE OF INVENTION: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/12/2021

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

Samsung Electronics v. Asus Tech Licensing EX-1003, 10 of 673

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

87197 7590 01/11/2021

Skaar Ulbrich Macari, P.A.
601 Carlson Parkway
Suite 1050
Minneapolis, MN 55305

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

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/395,760	04/26/2019	Ko-Chiang Lin	5261.16US01	4258

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APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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EXAMINER	ART UNIT	CLASS-SUBCLASS
TALUKDER, MD K	2648	455-522000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

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❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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.
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.
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. _____

Samsung Electronics v. Asus Tech Licensing EX-1003, 11 of 673

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.
16/395,760	04/26/2019	Ko-Chiang Lin	5261.16US01	4258

87197 7590 01/11/2021

Skaar Ulbrich Macari, P.A.
601 Carlson Parkway
Suite 1050
Minneapolis, MN 55305

EXAMINER	
TALUKDER, MD K	
ART UNIT	**PAPER NUMBER**
2648	

DATE MAILED: 01/11/2021

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 30 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. 16/395,760	Applicant(s) Lin et al.	
	Examiner MD K TALUKDER	Art Unit 2648	AIA (FITF) Status Yes

-- 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 12/15/2020.
   ☐ 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 1-20 . 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 _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/MD K TALUKDER/
Primary Examiner, Art Unit 2648

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/15/2020 has been entered.

REASONS FOR ALLOWANCE

3. Claims are allowed over the prior art of record. The following is an examiner's statement of reasons for allowance: Interpreting the claims in light of the specification and based on applicant's argument filed on 12/15/2020, claims has been found allowable because the prior art of record, does not teach, suggest or disclose "the first pathloss value is used for deriving a power headroom value included in a first power headroom report; the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is separate from the first pathloss reference and is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell; the UE derives the pathloss change based on the first pathloss value and the second pathloss value; and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold" in combination with the rest of the limitations of the claim. The prior art of the record does not disclose each and every aspect of the above claim. Any comments considered necessary by applicant must be

submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MD K TALUKDER whose telephone number is (571)270-3222. The examiner can normally be reached on 10 am to 6 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wesley Kim can be reached on 571-272-7867. 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. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MD K TALUKDER/
Primary Examiner, Art Unit 2648

Notice of References Cited	Application/Control No. 16/395,760	Applicant(s)/Patent Under Reexamination Lin et al.	
	Examiner MD K TALUKDER	Art Unit 2648	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20190349866-A1	11-2019	Lin; Ko-Chiang	H04B7/0426	1/1
*	B	US-20170359734-A1	12-2017	Lee; Moon-il	H04B7/0617	1/1
*	C	US-20100272046-A1	10-2010	Guo; Yu-Hsuan	H04W52/365	370/329
*	D	US-20150282150-A1	10-2015	Nigam; Anshuman	H04W28/0278	370/329
*	E	US-20200107272-A1	04-2020	HE; Linhai	H04L5/0053	1/1
*	F	US-20200084735-A1	03-2020	Cheng; Peng	H04W52/146	1/1
*	G	US-20180132197-A1	05-2018	Lin; Ko-Chiang	H04W52/42	1/1
*	H	US-20180310257-A1	10-2018	Papasakellariou; Aris	H04W52/50	1/1
*	I	US-20130121203-A1	05-2013	Jung; Sung Hoon	H04W52/365	370/252
*	J	US-20160057712-A1	02-2016	Wen; Pingping	H04W52/365	370/329
*	K	US-20160270094-A1	09-2016	Dinan; Esmael Hejazi	H04W52/325	1/1
*	L	US-20160330698-A1	11-2016	LOEHR; JOACHIM	H04W72/04	1/1
*	M	US-20170019866-A1	01-2017	MALKAMAKI; Esa	H04W24/10	1/1

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC 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.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	**Art Unit**
	MD K TALUKDER	2648

CPC								
Symbol							**Type**	**Version**
H04W	/	52	/	242			F	2013-01-01
H04W	/	52	/	146			I	2013-01-01
H04W	/	52	/	365			I	2013-01-01
H04W	/	72	/	14			I	2013-01-01

CPC Combination Sets									
Symbol							**Type**	**Set**	**Ranking**	**Version**
	/		/							

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/MD K TALUKDER/ Primary Examiner, Art Unit 2648	27 December 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	27

U.S. Patent and Trademark Office

Part of Paper No.: 20201227

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	**Art Unit**
	MD K TALUKDER	2648

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04W	/	52	/	24

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/MD K TALUKDER/ Primary Examiner, Art Unit 2648 (Primary Examiner)	27 December 2020 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 27

U.S. Patent and Trademark Office

Part of Paper No.: 20201227

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	**Art Unit**
	MD K TALUKDER	2648

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/MD K TALUKDER/ Primary Examiner, Art Unit 2648	27 December 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	27

U.S. Patent and Trademark Office

Part of Paper No.: 20201227

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	Art Unit
	MD K TALUKDER	2648

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04W52/242, H04W52/146, H04W52/365, H04W72/14	04/08/2020	Talukder
H04W52/242, H04W52/146, H04W52/365, H04W72/14	09/25/2020	Talukder
H04W52/242, H04W52/146, H04W52/365, H04W72/14	12/25/2020	Talukder

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
455		04/09/2020	Talukder
370		04/09/2020	Talukder
455		12/26/2020	Talukder
370		12/26/2020	Talukder

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	Art Unit
	MD K TALUKDER	2648

Search Notes		
Search Notes	**Date**	**Examiner**
East Searched	04/08/2020	Talukder
Inventor Searched	04/09/2020	Talukder
Assignee Searched	04/09/2020	Talukder
East Searched	09/25/2020	Talukder
Inventor Searched	09/25/2020	Talukder
Assignee Searched	09/25/2020	Talukder
East Searched	12/26/2020	Talukder
Inventor Searched	12/26/2020	Talukder
Assignee Searched	12/26/2020	Talukder

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
H04W52/242, H04W52/146, H04W52/365, H04W72/14		12/26/2020	Talukder
455		12/27/2020	Talukder
370		12/27/2020	Talukder

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	((grant$4 near3 config$3) grant$config$3) and ("20180132197" "20180115957" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "20150304967" "20180310254" "9426752" "20200084735" "20200100194" "9363771" "9686706" "8437798" "20180332543" "20110158117" "20150087296" "9386470" "10206184" "20140241197" "20190215712" "20120008552" "20140153534" "20120044882" "20140029586" "20170347326" "20160227505" "9756594" "20160183203" "9344985" "10560901").pn.	US-PGPUB; USPAT	OR	ON	2020/12/27 10:43
S1	1	"16395760"	US-PGPUB; USPAT	OR	ON	2020/04/08 11:54
S2	0	"2017359734"	US-PGPUB; USPAT	OR	ON	2020/04/08 13:15
S3	2	"20170359734"	US-PGPUB; USPAT	OR	ON	2020/04/08 13:15
S4	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/04/08 13:18
S5	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3))	US-PGPUB; USPAT	OR	ON	2020/04/08 13:18
S6	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/04/08 13:19

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S9	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/04/08 13:24
S10	0	"20100272046" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/04/08 13:26
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S14	65	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007"	US-PGPUB; USPAT	OR	ON	2020/04/08 15:49

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reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899" "20190159141" "20170006559" "8811322" "10448374" "9161317" "20190372806" "20190199554" "20120224552" "20130225228" "20190190747" "10595285" "9419768" "20200008162" "9918287"

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S18	3	(2nd another other second initial primary) adj4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257"	US-PGPUB; USPAT	OR	ON	2020/04/08 19:15

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S19	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold with (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/04/08 19:44
S20	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power	US-PGPUB; USPAT	OR	ON	2020/04/08 20:09

		RSRP) same threshold same (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal				
S21	115	(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/04/09 13:24
S22	48	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/04/09 13:25
S23	32	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold and (path$1loss near4 (chang$3 difference different)) same ((serving adj2 cell) station eNodeB (access adj2 point) BS$1)	US-PGPUB; USPAT	OR	ON	2020/04/09 13:39
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S29	28	S28 and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/04/09 16:47
S30	119	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 18:58
S31	170	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 18:59
S32	930	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/04/09 19:01
S33	0	((("Lin") near3 ("Ko-Chiang"))).INV.	USOCR	OR	OFF	2020/04/09 19:01
S34	163	((("Guo") near3 ("Yu-Hsuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/04/09 19:01
S35	14	S32 and S34	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2020/04/09 19:02

			DERWENT; IBM_TDB			
S36	0	S35 and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 19:02
S37	6,665	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/15 20:20
S38	261	((("Lin") near3 ("Ko-Chiang"))).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/15 20:20
S39	91	S37 and S38	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/15 20:25
S40	57	S37 and S38	US-PGPUB; USPAT	OR	OFF	2020/08/15 20:25
S41	1	"16395760"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S42	0	"2017359734"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S43	2	"20170359734"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S44	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S45	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3))	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S46	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

S47	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) with threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S48	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S49	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S50	0	"20100272046" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S51	1	"20100272046"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S52	2	"20150282150"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S53	189	("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S54	65	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S55	60	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899" "20190159141" "20170006559" "8811322" "10448374" "9161317" "20190372806" "20190199554" "20120224552" "20130225228" "20190190747" "10595285" "9419768" "20200008162" "9918287"

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S56	40	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S57	4	(2nd another other second) near4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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		"20130258980" "9107176").pn. and @ad<"20180510"				
S58	3	(2nd another other second initial primary) adj4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S59	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold with (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S60	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

		RSRP) same threshold same (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal				
S61	127	(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S62	48	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S63	32	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold and (path$1loss near4 (chang$3 difference different)) same ((serving adj2 cell) station eNodeB (access adj2 point) BS$1)	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S64	3	((grant$4 near3 config$3) grant$config$3) and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S68	28	serving near2 cell same (PHR (power near3 report)) same2 (no$1 doesn$1t) with PUSCH and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S69	28	S68 and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S70	133	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 21:29
S71	193	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 21:29
S72	988	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/09/24 21:29
S73	0	((("Lin") near3 ("Ko-Chiang"))).INV.	USOCR	OR	OFF	2020/09/24 21:29
S74	176	((("Guo") near3 ("Yu-Hsuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/24 21:29
S75	21	S72 and S74	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2020/09/24 21:29

			DERWENT; IBM_TDB			
S76	0	S75 and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 21:29
S77	6,713	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/09/24 21:29
S78	262	((("Lin") near3 ("Ko-Chiang"))).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/09/24 21:29
S79	92	S77 and S78	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/09/24 21:29
S80	58	S77 and S78	US-PGPUB; USPAT	OR	OFF	2020/09/24 21:29
S81	133	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same (reference prior initial primary) with (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 09:38
S82	25	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 09:39
S83	1,015	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/12/26 09:45

S84	401	((("LIN") near3 ("Ko-Chiang")) OR (("GUO") near3 ("Yu-Hsuan")) OR (("LI") near3 ("Ming-Che")) OR (("TSAI") near3 ("Hsin-Hsi"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2020/12/26 09:46
S89	1,015	((("ASUSTek") near3 ("Computer") near3 ("Inc"))).AS,AANM.	USPAT	OR	OFF	2020/12/26 10:54
S90	401	((("LIN") near3 ("Ko-Chiang")) OR (("GUO") near3 ("Yu-Hsuan")) OR (("LI") near3 ("Ming-Che")) OR (("TSAI") near3 ("Hsin-Hsi"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2020/12/26 10:54
S91	47	S89 and S90	US-PGPUB; USPAT	OR	OFF	2020/12/26 10:55
S94	1	"16395760"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:18
S95	0	"2017359734"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:18
S96	2	"20170359734"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:18
S97	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/12/26 14:18
S98	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3))	US-PGPUB; USPAT	OR	ON	2020/12/26 14:18
S99	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:18
S100	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) with threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:18
S101	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

S102	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S103	0	"20100272046" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S104	1	"20100272046"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S105	2	"20150282150"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S106	189	("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899" "20190159141" "20170006559" "8811322" "10448374" "9161317" "20190372806" "20190199554" "20120224552" "20130225228" "20190190747" "10595285" "9419768"

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S110	4	(2nd another other second) near4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S111	3	(2nd another other second initial primary) adj4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S112	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold with (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S113	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold same (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S114	129	(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S115	48	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S116	32	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

		different)) near7 threshold and (path$1loss near4 (chang$3 difference different)) same ((serving adj2 cell) station eNodeB (access adj2 point) BS$1)				
S117	3	((grant$4 near3 config$3) grant$config$3) and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S121	28	serving near2 cell same (PHR (power near3 report)) same2 (no$1 doesn$1t) with PUSCH and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S122	28	S121 and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S123	137	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S124	210	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S125	1,015	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/12/26 14:19
S126	0	((("Lin") near3 ("Ko-Chiang"))).INV.	USOCR	OR	OFF	2020/12/26 14:19
S127	185	((("Guo") near3 ("Yu-Hsuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/12/26 14:19
S128	23	S125 and S127	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S129	0	S128 and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S130	6,810	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/12/26 14:19

S131	280	((("Lin") near3 ("Ko-Chiang"))).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/12/26 14:19
S132	97	S130 and S131	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/12/26 14:19
S133	63	S130 and S131	US-PGPUB; USPAT	OR	OFF	2020/12/26 14:19
S134	1	"16395760"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S135	0	"2017359734"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S136	2	"20170359734"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S137	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S138	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3))	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S139	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S140	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) with threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S141	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S142	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

		near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal				
S143	0	"20100272046" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S144	1	"20100272046"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S145	2	"20150282150"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
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S147	65	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

reference near3 signal and
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S148	60	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S149	40	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S150	4	(2nd another other second) near4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S151	3	(2nd another other second initial primary) adj4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S152	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold with (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S153	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold same (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S154	129	(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S155	48	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S156	32	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold and (path$1loss near4 (chang$3 difference different)) same ((serving adj2 cell)	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

		station eNodeB (access adj2 point) BS$1)				
S157	3	((grant$4 near3 config$3) grant$config$3) and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899" "20190159141" "20170006559" "8811322" "10448374" "9161317" "20190372806" "20190199554"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S160	112	serving near2 cell same (PHR (power near3 report)) and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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S161	28	serving near2 cell same (PHR (power near3 report)) same2 (no$1 doesn$1t) with PUSCH and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406"	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19

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"10425900" "9179424" "20150189604"
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S162	28	S161 and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/12/26 14:19
S163	137	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S164	210	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S165	1,015	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/12/26 14:19
S166	0	((("Lin") near3 ("Ko-Chiang"))).INV.	USOCR	OR	OFF	2020/12/26 14:19
S167	185	((("Guo") near3 ("Yu-Hsuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/12/26 14:19
S168	23	S165 and S167	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S169	0	S168 and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S170	6,810	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/12/26 14:19
S171	280	((("Lin") near3 ("Ko-Chiang"))).INV.	US-PGPUB; USPAT;	OR	OFF	2020/12/26 14:19

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S172	97	S170 and S171	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/12/26 14:19
S173	63	S170 and S171	US-PGPUB; USPAT	OR	OFF	2020/12/26 14:19
S174	133	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same (reference prior initial primary) with (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S175	25	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/26 14:19
S176	1,015	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/12/26 14:20
S177	401	((("LIN") near3 ("Ko-Chiang")) OR (("GUO") near3 ("Yu-Hsuan")) OR (("LI") near3 ("Ming-Che")) OR (("TSAI") near3 ("Hsin-Hsi"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2020/12/26 14:20
S178	1,015	((("ASUSTek") near3 ("Computer") near3 ("Inc"))).AS,AANM.	USPAT	OR	OFF	2020/12/26 14:20
S179	401	((("LIN") near3 ("Ko-Chiang")) OR (("GUO") near3 ("Yu-Hsuan")) OR (("LI") near3 ("Ming-Che")) OR (("TSAI") near3 ("Hsin-Hsi"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	OFF	2020/12/26 14:20
S180	47	S178 and S179	US-PGPUB; USPAT	OR	OFF	2020/12/26 14:20
S184	40	(path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2020/12/26 16:00

		loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899" "20190159141" "20170006559" "8811322" "10448374" "9161317" "20190372806" "20190199554" "20120224552" "20130225228"	EPO; JPO; DERWENT; IBM_TDB			

		"20190190747" "10595285" "9419768" "20200008162" "9918287" "20160262119" "9036556" "10439847" "20170188315" "9629106" "20170339645" "20130301536" "20150271811" "10194406" "20150304967" "20180310254" "9426752" "20200084735" "20200100194" "9363771" "9686706" "8437798" "20180332543" "20110158117" "20150087296" "9386470" "10206184" "20140241197" "20190215712" "20120008552" "20140153534" "20120044882" "20140029586" "20170347326" "20160227505" "9756594" "20160183203" "9344985" "10560901" "9844009" "20110159914" "20170094612" "20190261281" "20180279234" "20190387483" "9392554" "10420040" "20170201955" "8688163" "9439158" "20190150104" "20130301568" "20180279235" "20190327733" "20130250875" "9723577" "9615338" "20200107272" "20180139030" "20140023010" "9532253" "9226247" "10015755" "10051582" "10098076" "20190394012" "20190166539" "20160302162" "9451564" "20190124606" "20140177467" "20190253197" "9510305" "10206183" "20130250889" "20130258980" "9107176").pn. and @ad<"20180510"				
S185	3	455/$.ccls. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 18:57
S188	31	(370/$.ccls. 455/$.ccls.) and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) and (power$3 near3 (adjust$4 control$3)) with power$3 same head$1room and (plurality multiple several second 2nd) with (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/27 09:20

S189	6	"20170019866"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/27 09:22

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	6	370/$.ccls. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/27 11:23
S85	127	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same (reference prior initial primary) with (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 09:38
S86	19	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 09:39
S87	19	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 09:45
S181	127	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same (reference prior initial primary) with (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 14:20

S182	19	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 14:20
S183	19	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 14:20
S186	3	455/$.ccls. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 18:57
S187	3	455/$.ccls. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) same (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT	OR	ON	2020/12/26 20:26
S190	31	(370/$.ccls. 455/$.ccls.) and (path$1loss power$1loss (path near2 loss) (power near2 loss)) with (reference prior initial primary) same (compar$3 threshold) and (power$3 near3 (adjust$4 control$3)) with power$3 same head$1room and (plurality multiple several second 2nd) with (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/12/27 09:20

12/27/2020 11:25:44 AM
C:\Users\mtalukder\Documents\EAST\Workspaces\16395760.wsp

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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(Not for submission under 37 CFR 1.99)

Application Number	16395760
Filing Date	2019-04-26
First Named Inventor	Ko-Chiang LIN
Art Unit	2648
Examiner Name	TALUKDER, MD K.
Attorney Docket Number	5261.16US01

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	1	20170019864	A1	2017-01-19	LG ELECTRONICS INC.	
	2	20100272091	A1	2010-10-28	FABIEN et al.	

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	1	2012060659	WO	A2	2012-05-10	SAMSUNG ELECTRONICS CO., LTD.		

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Filing Date	2019-04-26
First Named Inventor	Ko-Chiang LIN
Art Unit	2648
Examiner Name	TALUKDER, MD K.
Attorney Docket Number	5261.16US01

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	Office Action to the corresponding Korean Patent Application rendered by the Korean Intellectual Property Office (KIPO) on October 26, 2020, 10 pages (including English translation)	X

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Examiner Signature	/MD K TALUKDER/	Date Considered	12/27/2020

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Samsung Electronics v. Asus Tech Licensing EX-1003, 114 of 673

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Filing Date	2019-04-26
First Named Inventor	Ko-Chiang LIN
Art Unit	2648
Examiner Name	TALUKDER, MD K.
Attorney Docket Number	5261.16US01

CERTIFICATION STATEMENT

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☒ A certification statement is not submitted herewith.

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Signature	/Scott G. Ulbrich/	Date (YYYY-MM-DD)	2020-12-16
Name/Print	Scott G. Ulbrich	Registration Number	48005

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Samsung Electronics v. Asus Tech Licensing EX-1003, 115 of 673

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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.

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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.

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Bibliographic Data

Application No: 16/395,760

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /MD K TALUKDER/ Examiner's Signature [ ] Initials

Title: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
04/26/2019	455	2648	5261.16US01
RULE			

APPLICANTS

ASUSTek Computer Inc., Taipei City, TAIWAN

INVENTORS

Ko-Chiang Lin, Taipei City, TAIWAN

Yu-Hsuan Guo, Taipei City, TAIWAN

Ming-Che Li, Taipei City, TAIWAN

Hsin-Hsi Tsai, Taipei City, TAIWAN

CONTINUING DATA

This application has PRO of 62669461 05/10/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/09/2019

STATE OR COUNTRY

TAIWAN

ADDRESS

Skaar Ulbrich Macari, P.A.
601 Carlson Parkway
Suite 1050
Minneapolis, MN 55305
UNITED STATES

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Filing Date	2019-04-26
First Named Inventor	Ko-Chiang LIN
Art Unit	2648
Examiner Name	TALUKDER, MD K.
Attorney Docket Number	5261.16US01

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	1	2012060659	WO	A2	2012-05-10	SAMSUNG ELECTRONICS CO., LTD.		

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	First Named Inventor	Ko-Chiang LIN
	Art Unit	2648
	Examiner Name	TALUKDER, MD K.
	Attorney Docket Number	5261.16US01

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	Office Action to the corresponding Korean Patent Application rendered by the Korean Intellectual Property Office (KIPO) on October 26, 2020, 10 pages (including English translation)	X

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SIGNATURE

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Signature	/Scott G. Ulbrich/	Date (YYYY-MM-DD)	2020-12-16
Name/Print	Scott G. Ulbrich	Registration Number	48005

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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.

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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.

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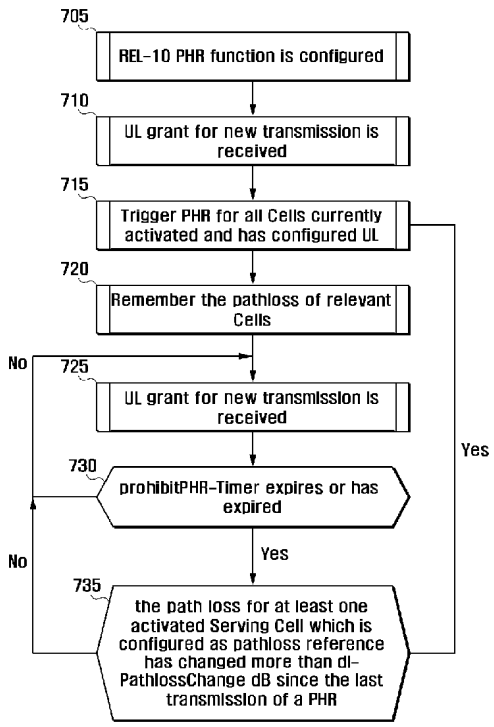
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[Continued on next page]

(54) Title: POWER HEADROOM REPORT METHOD AND APPARATUS FOR MOBILE COMMUNICATION SYSTEM SUPPORTING CARRIER AGGREGATION

[Fig. 7]



(57) Abstract: A Power Headroom Report (PHR) method and apparatus for a mobile communication system supporting carrier aggregation are provided. The method for transmitting PHR of a terminal in a mobile communication system includes configuring, when a PHR is triggered for at least one activated serving cell, an extended PHR for the at least one activated serving cell, the PHR being triggered when a change of a downlink path loss in the at least one activated serving cell is greater than a predetermined threshold value, and transmitting the extended PHR.

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Description

Title of Invention: POWER HEADROOM REPORT METHOD AND APPARATUS FOR MOBILE COMMUNICATION SYSTEM SUPPORTING CARRIER AGGREGATION

Technical Field

[1] The present invention relates to a method and apparatus for a mobile communication system. More particularly, the present invention relates to an improved power headroom report method and apparatus for a mobile communication system supporting carrier aggregation.

Background Art

[2] Mobile communication systems have been developed to provide subscribers with voice communication services on the move. With the advancements of various technologies, the mobile communication systems have evolved to support high speed data communication services as well as the voice communication services.

[3] Recently, as a next generation mobile communication system of the 3rd Generation Partnership Project (3GPP), Long Term Evolution (LTE) is under development. The LTE system is a technology for realizing high-speed packet-based communication at about 100 Mbps. Regarding the commercialization of the LTE system, a discussion is being held on several schemes, namely one scheme for reducing the number of nodes located in a communication path by simplifying a configuration of the network, and another scheme for maximally approximating wireless protocols to wireless channels.

[4] Unlike voice communication service, data communication service is characterized in that the resource is allocated according to the amount of data to be transmitted and channel conditions. Accordingly, in the wireless communication system, such as cellular communication system, a scheduler manages resource allocation in consideration of the amount of resources, channel conditions, and amount of data. It is also the case in the LTE system that the scheduler, which is located in the base station, manages and allocates the radio resources.

[5] Recently, LTE-Advanced (LTE-A) is actively being discussed as an evolution of the LTE with new techniques to increase the data rate. Carrier Aggregation (CA) is one of the representative techniques that are newly adopted in LTE-A. Unlike data communication of the related art in which a User Equipment (UE) uses a single uplink carrier and a single downlink carrier, the carrier aggregation enables the UE to use multiple uplink and/or downlink carriers.

Disclosure of Invention

Technical Problem

[6] Since the uplink transmission power determination algorithm of the related art is designed for the UE operating with one uplink carrier and one downlink carrier, it is difficult to apply the transmission power determination process of the related art for uplink transmission power determination of the UE supporting carrier aggregation. In particular, there is a need to define a procedure and method for reporting Power Headroom (PH) of the UE supporting carrier aggregation.

Solution to Problem

[7] Aspects of the present invention are to address at least the above-mentioned problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present invention is to provide a method and apparatus for transmitting and receiving Power Headroom (PH) information for multiple carriers efficiently in a mobile communication system supporting carrier aggregation.

[8] It is another object of the present invention to provide a method and apparatus for triggering a PH Report (PHR) more efficiently in a mobile communication system supporting carrier aggregation.

[9] In accordance with an aspect of the present invention, a method for transmitting a PHR of a terminal in a mobile communication system is provided. The method includes configuring, when a PHR is triggered for at least one activated serving cell, an extended PHR for the at least one activated serving cell, the PHR being triggered when a change of a downlink path loss in the at least one activated serving cell is greater than a predetermined threshold value, and transmitting the extended PHR.

[10] In accordance with another aspect of the present invention, an apparatus for transmitting PHR of a terminal in a mobile communication system is provided. The apparatus includes a controller for detecting a PHR trigger, when a change of a downlink path loss in at least one activated serving cell becomes greater than a predetermined threshold value, and for configuring an extended PHR for the at least one activated serving cell, and a transmitter for transmitting the extended PHR.

[11] In accordance with another aspect of the present invention, a method for receiving PHR of a base station in a mobile communication system is provided. The method includes receiving an extended PHR from a terminal, and determining a difference between a maximum transmission power of the terminal and an estimated uplink power per activated serving cell by analyzing the extended PHR, wherein the terminal configures and transmits the extended PHR when a change of a downlink path loss in the activated serving cell is greater than a predetermined threshold.

[12] In accordance with still another aspect of the present invention, an apparatus for receiving PHR of a base station in a mobile communication system is provided. The

apparatus includes a receiver for receiving an extended PHR transmitted by a terminal, and a controller for determining a difference between a maximum transmission power of the terminal and an estimated uplink power per activated serving cell by analyzing the extended PHR, wherein the terminal configures and transmits the extended PHR when a change of a downlink path loss in the activated serving cell is greater than a predetermined threshold.

[13] Other aspects, advantages, and salient features of the invention will become apparent to those skilled in the art from the following detailed description, which, taken in conjunction with the annexed drawings, discloses exemplary embodiments of the invention.

Advantageous Effects of Invention

[14] According to the present invention, the PHR method and apparatus of exemplary embodiments are capable of reporting PHs for multiple carriers efficiently in the mobile communication supporting carrier aggregation. The power headroom report method and apparatus of the present invention is capable of improving PH reporting efficiency in the mobile communication system supporting carrier aggregation.

Brief Description of Drawings

[15] The above and other aspects, features, and advantages of certain exemplary embodiments of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

[16] FIG. 1 is a diagram illustrating an architecture of a Long Term Evolution (LTE) mobile communication system according to an exemplary embodiment of the present invention;

[17] FIG. 2 is a diagram illustrating a protocol stack of a mobile communication system according to an exemplary embodiment of the present invention;

[18] FIG. 3 is a diagram illustrating exemplary carrier aggregation in an LTE mobile communication system according to an exemplary embodiment of the present invention

[19] FIG. 4 is a diagram illustrating a principle of carrier aggregation in an LTE mobile communication according to an exemplary embodiment of the present invention;

[20] FIG. 5 is a diagram illustrating an exemplary scenario of Power Headroom (PH) reporting according to an exemplary embodiment of the present invention;

[21] FIG. 6 is a diagram illustrating a principle of determining downlink carrier on which path loss is referenced according to an exemplary embodiment of the present invention;

[22] FIG. 7 is a flowchart illustrating a power headroom report method according to an exemplary embodiment of the present invention; and

[23] FIG. 8 is a block diagram illustrating a configuration of a User Equipment (UE)

according to an exemplary embodiment of the present invention.

[24] Throughout the drawings, it should be noted that like reference numbers are used to depict the same or similar elements, features, and structures.

Mode for the Invention

[25] The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments of the invention as defined by the claims and their equivalents. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions may be omitted for clarity and conciseness.

[26] The terms and words used in the following description and claims are not limited to the bibliographical meanings, but, are merely used by the inventor to enable a clear and consistent understanding of the invention. Accordingly, it should be apparent to those skilled in the art that the following description of exemplary embodiments of the present invention is provided for illustration purpose only and not for the purpose of limiting the invention as defined by the appended claims and their equivalents.

[27] It is to be understood that the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a component surface" includes reference to one or more of such surfaces.

[28] Exemplary embodiments of the present invention relate to a method and apparatus for reporting Power Headroom (PH) information for multiple uplink carriers efficiently in a mobile communication system supporting carrier aggregation.

[29] For convenience in description, the exemplary embodiments of the present invention are described in the context of a mobile communication system described below with reference to FIGs. 1, 2, and 3. However, the present invention is not limited to the mobile communication system described herein and is equally applicable to other mobile communication systems.

[30] FIG. 1 is a diagram illustrating an architecture of a Long Term Evolution (LTE) mobile communication system according to an exemplary embodiment of the present invention.

[31] Referring to FIG. 1, the Radio Access Network (RAN) of the LTE mobile communication system includes evolved Node Bs (eNBs) 105, 110, 115, and 120, a Mobility Management Entity (MME) 125, and a Serving-Gateway (S-GW) 130. The User Equipment (UE) 135 connects to an external network via eNBs 105, 110, 115, and 120 and the S-GW 130.

[32] The eNBs 105, 110, 115, and 120 perform a similar function as legacy node Bs of a Universal Mobile Communications System (UMTS). However, as compared to the legacy node Bs, the eNBs 105, 110, 115, and 120 allow the UE to establish a radio link and are responsible for more complicated functions. In the LTE system, all the user traffic including real time services such as Voice over Internet Protocol (VoIP) are provided through a shared channel and thus there is a need for a device which is located in the eNB to schedule data based on the state information of the UEs. In order to implement a data rate of up to 100Mbps, the LTE system adopts Orthogonal Frequency Division Multiplexing (OFDM) as a radio access technology. Also, the LTE system adopts Adaptive Modulation and Coding (AMC) to determine the modulation scheme and channel coding rate based on the channel conditions experienced by the UE. S-GW 130 is an entity to provide data bearers so as to establish and release data bearers under the control of the MME 125. MME 125 is responsible for various control functions and is connected to the plurality of eNBs 105, 110, 115, and 120.

[33] FIG. 2 is a diagram illustrating a protocol stack of a mobile communication system according to an exemplary embodiment of the present invention.

[34] Referring to FIG. 2, the protocol stack of the LTE system includes Packet Data Convergence Protocol (PDCP) layer 205 and 240, Radio Link Control (RLC) layer 210 and 235, Medium Access Control (MAC) layer 215 and 230, and Physical (PHY) layer 220 and 225. The PDCP layer 205 and 240 is responsible for Internet Protocol (IP) header compression/decompression. The RLC 210 and 235 is responsible for segmenting a PDCP Protocol Data Unit (PDU) into segments of appropriate size for an Automatic Repeat Request (ARQ) operation. The MAC layer 215 and 230 is responsible for establishing a connection to a plurality of RLC entities so as to multiplex RLC PDUs into MAC PDUs and demultiplex the MAC PDUs into RLC PDUs. The PHY layer 220 and 225 performs channel coding on the MAC PDU and modulates the MAC PDU into OFDM symbols to transmit over a radio channel or performs demodulating and channel-decoding on the received OFDM symbols and delivers the decoded data to a higher layer. In view of transmission, the data input to a protocol entity is referred to as Service Data Unit (SDU), and the data output by the protocol entity is referred to as the PDU.

[35] A description is made of Carrier Aggregation (CA) with reference to FIG. 3.

[36] FIG. 3 is a diagram illustrating exemplary carrier aggregation in an LTE mobile communication system according to an exemplary embodiment of the present invention.

[37] Referring to FIG. 3, an eNB can use multiple carriers transmitted and received in different frequency bands. For example, the eNB 305 can be configured to use the carrier 315 with center frequency f1 and the carrier 310 with center frequency f3. If carrier aggregation is not supported, the UE 330 transmits/receives a data unit in one of

the carriers 310 and 315. However, if carrier aggregation is supported, the UE 330 can transmit/receive data using both the carriers 310 and 315. The eNB can increase the amount of resources to be allocated to the UE 330 supporting carrier aggregation based on the channel conditions experienced by the UE 330 so as to improve the data rate of the UE 330.

[38] In a case where a cell is configured with one downlink carrier and one uplink carrier, the carrier aggregation can be understood as if the UE communicates data via multiple cells. With the use of carrier aggregation, the maximum data rate increases in proportion to the number of aggregated carriers. The aggregated carriers are configured via Radio Resource Control (RRC) signaling. In LTE, it is possible to add or remove a carrier to or from the carrier aggregation using an RRCConnectionReconfiguration message. Although a specific carrier is configured, data transmission is not yet performed. In order to use the corresponding carrier, the carrier is activated by MAC signaling. In LTE, the configured carrier is activated by a MAC Control Element (CE) in a MAC PDU. Since the service is provided through the multiple activated carriers, multiple serving cells exist.

[39] Meanwhile, in order to mitigate interference, the uplink transmission power should be maintained below an appropriate level. For this purpose, the UE calculates the uplink transmission power using a predetermined function and performs uplink transmission at the calculated uplink transmission power. For example, the UE calculates the required uplink transmission power value by inputting the input values such as the scheduling information including an amount of resources and a Modulation and Coding Scheme (MCS) allocated to the UE, and information used for estimating the channel condition such as a path loss, and performs uplink transmission by applying the calculated uplink transmission power value. The available uplink transmission power value of the UE is limited to the maximum transmission power value of the UE such that when the calculated transmission power value exceeds the maximum transmission power value the UE performs the uplink transmission at the maximum transmission power. In this case, the uplink transmission power is not enough, resulting in uplink transmission quality degradation. Accordingly, it is preferred that the eNB performs scheduling such that the required transmission power does not exceed the maximum transmission power. However, since a few parameters such as path loss cannot be determined by the eNB, the UE has to report its PH value to the eNB by means of a PH Report (PHR).

[40] There are several factors influencing power headroom: 1) an amount of allocated transmission resources, 2) an MCS to be applied to uplink transmission, 3) a Path Loss (PL) of the related downlink carrier, and 4) an accumulated value of transmission power control command. Among them, the path loss and the accumulated transmission

power control command value are variable according to the uplink carrier such that, when multiple uplink carriers are aggregated, it is preferred to configure the transmission of PHR per carrier. However, in order to transmit the PHR efficiently, it can be advantageous to report the PHs of all the uplink carriers on one uplink carrier. Depending on the management policy, it may be necessary to transmit the PH of the carrier on which no Physical Uplink Shared CHannel (PUSCH) transmission takes place. In this case, it can be more efficient to report the PHs of the multiple uplink carriers on a single uplink carrier. For this purpose, the PHR of the related art should be extended. The multiple PHs carried by a PHR can be arranged in a predetermined order.

[41] FIG. 4 is a diagram illustrating a principle of carrier aggregation in an LTE mobile communication according to an exemplary embodiment of the present invention.

[42] Referring to FIG. 4, five downlink carriers can be aggregated for the UE including downlink carrier 1 405, downlink carrier 2 410, downlink carrier 3 415, downlink carrier 4 420, and downlink carrier 5 425. Similarly, five uplink carriers can be aggregated for the UE including uplink carrier 1 430, uplink carrier 2 435, uplink carrier 3 440, uplink carrier 4 445, and uplink carrier 5 450. Here, one of the aggregated carriers can be selected to transmit the PHs for the 5 uplink carriers. For example, when three uplink carriers 440, 445, and 450 are aggregated for the UE, a PHR can be configured to carry the PHs for the three uplink carriers.

[43] PHR is triggered when the path loss of the connected downlink carrier is equal to or greater than a predetermined threshold value, a prohibit PHR time expires, or a predetermined time period elapses after the PHR generation. Once a PHR has been triggered, the UE waits until the time for the uplink transmission arrives, e.g., the time for which the uplink transmission resource is allocated, rather than transmitting the PHR immediately. This is because PHR is not information that is very sensitive to delay. The UE transmits PHR at the first uplink transmission. A PHR is MAC layer control information and has the length of 8 bits. The first two bits of a PHR are reserved for future use, and the remaining 6 bits are used to indicate the value in the range between -23dB and 40dB as the PH of the UE. The UE calculates the PH using the following equation:

[44] MathFigure 1

[Math.1]

$$PH(i)=P_{CMAX,c}(i)-\{10\log_{10}(M_{PUSCH,c}(i))+P_{O\_PUSCH,c}(j)+\alpha_c(j)\cdot PL_c+\Delta_{TF,c}(i)+f_c(i)\}$$

[45] The PH(i) of the ith subframe in the serving cell c is calculated with the maximum uplink transmission power $P_{CMAX,c}(i)$, number of resource blocks $M_{PUSCH,c}(i)$, power offset derived from MCS $\Delta_{TF,c}$, Path Loss PL_c, and accumulated TPC commands $f_c(i)$.

In equation (1), PL_c denotes the pass loss of cell which provides information on the path loss in the service cell c. The path loss used to determine uplink transmission power of a certain serving cell is the path loss of the downlink channel of the corresponding cell or the path loss of a downlink channel of another cell. The cell of which path loss is to be used is selected by the eNB and notified to the UE in the call setup process. In equation (1), $f_c(i)$ is the accumulated value of the accumulated Transmission Power Control (TPC) commands of the serving cell c. $P_{O\_PUSCH,c}$ denotes a higher layer parameter corresponding to the sum of cell-specific and UE-specific values. Typically, $P_{O\_PUSCH,c}$ is set to a value determined depending on the transmission type of the PUSCH such as semi-persistent scheduling, dynamic scheduling, and a random access response. αc denotes a 3-bit cell specific value provided from a higher layer as the weight applied to the path loss when calculating uplink transmission power (i.e., the higher this value is, the more the path loss influences the uplink transmission power), and its value is limited according to the transmission type of the PUSCH. j denotes the transmission type of the PUSCH. The parameter j is set to 0 for semi-persistent scheduling, 1 for dynamic scheduling, and 2 for random access response. If there is no PUSCH transmission, M_{PUSCH} and Δ_{TF} are not applied to equation (1).

[46] In the mobile communication system supporting carrier aggregation, there can be a serving cell in which no PUSCH transmission takes place and a serving cell in which PUSCH transmission takes place. Also, the PH for a serving cell can be reported in another serving cell. In the mobile communication system supporting carrier aggregation, when the PHs of multiple serving cells are to be reported, the UE can transmit the PHs in a single PHR. This method is advantageous in that it reduces the signaling overhead as compared to the method of transmitting the PHs individually, and the eNB can acquire the PH for the carrier on which no PUSCH is transmitted.

[47] FIG. 5 is a diagram illustrating an exemplary scenario of PH reporting according to an exemplary embodiment of the present invention.

[48] Referring to FIG. 5, the diagram shows a scenario in which each of two serving cells CC1 and CC2 transmits the PHs of both the serving cells. In the time duration 505 for which PUSCH transmission takes place in CC1 but not in CC2, the UE can transmit MAC PDU 510 containing the CC1 PH 515 and CC2 PH 520. Also, in the time duration 525 for which PUSCH transmission takes place in CC2 but not in CC1, the UE can transmit MAC PDU 530 containing the CC1 H 535 and CC2 PH 540.

[49] Typically, PHR is triggered when the path loss on the downlink carrier associated with an uplink carrier becomes equal to or greater than a predetermined threshold value or a predetermined time period has elapsed after creating a PHR in a serving cell.

[50] The eNB provides a UE with the parameters related to the PHR trigger operation. The parameters include periodicPHR-Timer, prohibitPHR-Timer, and dl-

PathlossChange. The periodicPHR-Timer is a timer for triggering PHR periodically. In order to prevent PHR from being triggered too frequently, the prohibitPHR-Timer is used. Also, PHR is triggered when the path loss of the downlink carrier associated with an uplink carrier becomes equal to or greater than a predetermined threshold value, which is referred to as dl-PathlossChange. In the PHR procedure of the related art, the downlink carrier associated with an uplink carrier is determined and fixed to a specific one. This means that the path loss on the downlink carrier associated with the corresponding uplink carrier is also fixed. In the system supporting carrier aggregation, however, there can be multiple downlink carriers that can be associated with one uplink carrier. In particular, the downlink carrier of which path loss is referenced can be a downlink carrier of another serving cell other than the same serving cell. At this time, the eNB notifies the UE of the cell in which path loss is referenced for determining uplink transmission power through an RRC signaling message. In the present exemplary embodiment, the eNB notifies the UE of the serving cell of which downlink carrier's path loss is to be referenced for a PHR trigger through an RRC control message. The serving cell of which the downlink carrier's path loss is referenced for uplink transmission power configuration for a certain serving cell and the serving cell of which downlink carrier's path loss is to be referenced for determining a PHR trigger can be identical with each other. In this case, it is possible to inform of the two items of information simultaneously rather than separately. In a case where a plurality of serving cells is managed by an eNB, the eNB notifies the UE of the use of extended PHR (or REL-10 PHR) and other information.

[51] FIG. 6 is a diagram illustrating a principle of determining downlink carrier on which path loss is referenced according to an exemplary embodiment of the present invention.

[52] Referring to FIG. 6, reference numbers 605, 610, and 615 denote serving cells 1, 2, and 3. A downlink carrier 620 of the serving cell 605 is associated with an uplink subcarrier 635 of the serving cell 605 and an uplink subcarrier 640 of the serving cell 610. Also, a downlink carrier 625 of the serving cell 610 is associated with an uplink subcarrier 640 of the serving cell 610. Meanwhile, the serving cell 615 has a downlink carrier 630 but no uplink carrier. Reference numbers 635 and 640 denote uplink carriers. In an Secondary Cell (SCell) configuration process, the uplink carriers 635 and 640 are linked with the downlink carriers 620 and 625. If the service cell 605 is configured as a Primary Cell (PCell), the path loss of the downlink carrier 620 is referenced to determine whether to trigger PHR for the uplink carrier 635. If the path loss of a downlink carrier is referenced, this means that the path loss of the downlink carrier is used for configuring the uplink transmission power originally, but the meaning is expended for a PHR trigger. That is, if the displacement of the path loss is

considered as a condition for a PHR trigger, this means that the path loss of the indicated downlink carrier's path loss is applied. In order to trigger a PHR for uplink carrier 640, the path loss of the downlink carrier 620 can be referenced in place of that of the downlink carrier 625. The reason why the path loss of a downlink carrier of other cell is used is because the received power can be strong enough on a downlink carrier but weak on another downlink carrier. Accordingly, by using the path loss of the downlink carrier having good received signal strength, it is possible to acquire more accurate displacement of the path loss. The eNB notifies the UE of the downlink carrier of which path loss is previously referenced. When configuring a SCell, the serving cell of which path loss is referenced for calculating uplink transmission power of the SCell is indicated in RadioResourceConfigDedicatedSCell as SCell configuration information. Accordingly, a serving cell can provide the path loss information or not. If a serving cell provides pass loss information for the same serving cell or other serving cell, the UE can determine whether to trigger PHR by referencing the displacement of the path loss of the corresponding serving cell. That is, the UE determines whether to trigger PHR based on the displacement of the path loss of the currently activated serving cell. In more detail, the UE triggers PHR when the path loss of one or more serving cells changes by as much as a predetermined amount than the path loss at the most recent PHR transmission. Accordingly, if a serving cell is configured with an uplink carrier but does not provide a path loss, the UE does not trigger a PHR in response to the displacement of the path loss of the downlink carrier of the corresponding serving cell. In the UE procedure according to an exemplary embodiment of the present invention, if REL-10 PHR is configured with the SCell configuration and if a new uplink transmission takes place, the UE reports PHs for all of the activated serving cells that are configured with uplink carriers. This is to report the initial state after SCell configuration. In order to use to determine whether to trigger PHR afterward, the UE saves the path loss values of the downlink carriers. The UE monitors to determine whether the displacement of the path loss of the serving that is referenced for estimating the path loss of each uplink carrier exceeds dl-pathlosschange. If the path loss displacement is greater than dl-PathlossChange on at least one uplink carrier and if the prohibitPHR-Timer expires or has expired, the UE triggers PHR immediately for all of the activated serving calls configured with uplink carriers.

[53] FIG. 7 is a flowchart illustrating a power headroom report method according to an exemplary embodiment of the present invention.

[54] Referring to FIG. 7, the UE fist configures an SCell along with a REL-10 PHR configuration in step 705. In a case where an eNB manages multiple serving cells, the extended PHR is used always. If an uplink grant for a new transmission is received in

step 710 after the REL-10 PHR configuration, the UE triggers PHR for all activated service cells configured with uplink carriers in step 715. In order to determine whether to trigger PHR afterward, the UE saves the path losses of reference downlink carriers in step 720. Afterward, if an uplink grant for a new transmission is received in step 725, the UE determines whether prohibitPHR-Timer expires or has expired in step 730. If prohibitPHR-Timer has not expired, this means that PHR is prohibited, and thus the UE returns to step 725 and waits until a next uplink grant for a new transmission is received. If the prohibitPHR-Timer expires or has expired, the UE, in step 735, determines whether the path loss change on at least one downlink carrier associated, for path loss reference, with the uplink carrier is larger than dl-PathlossChange. If not, the UE returns to step 725 and waits until a next uplink grant for a new transmission is received. If so, the UE triggers PHR for all activated serving cells configured with uplink carriers.

[55] If PHR is triggered, the UE calculates PHs for individual uplink carriers and configures an extended PHR. Even when there is no real PUSCH transmission, the eNB can trigger PHR to acquire path loss information on a specific uplink carrier. If PHR is triggered for a specific serving cell, the UE determines a PH calculation scheme depending on whether PUSCH is transmitted. If there is a PUSCH transmission in the corresponding serving cell, the UE calculates a PH according to the method of the related art using equation (1). If there is no PUSCH transmission in the serving cell, this means no transmission resource is allocated such that it is not clear to determine the values of M_{PUSCH} and Δ_{TF} and, as a consequence, a device allowing for the eNB and UE to calculate and interpret the PH using the same M_{PUSCH} and Δ_{TF}. This can be addressed with a fixed transmission format (e.g., a transmission resource amount and MCS level) for use in PH calculation in a case of no PUSCH transmission, the transmission format being agreed upon between the UE and the eNB. Assuming that the reference transmission format is a combination of 1 Resource Block (RB) and a lowest MCS level, both the M_{PUSCH} and Δ_{TF} are set to 0 and this is the same as omitting these parameters in equation (1). That is, since there is no real data transmission in the corresponding serving cell, no $P_{CMAX,c}(i)$ exists. Accordingly, the value of $P_{CMAX,c}(i)$ should be determined. For such a virtual transmission, virtual $P_{CMAX,c}(i)$ is defined and adopted. $P_{CMAX,c}(i)$ can be determined using the maximum allowed UE output power P_{EMAX} and nominal UE power $P_{PowerClass}$. For example, $P_{CMAX,c}(i)$ can be determined as equation (2):

[56] MathFigure 2

[Math.2]

$$P_{CMAX,c} = \min\{P_{EMAX}, P_{PowerClass}\}$$

[57] P_{CMAX} has the relationship of $P_{CMAX\_L} \leq P_{CMAX} \leq P_{PowerClass}$. Here, if zero power back-off is considered, $P_{CMAX\_L} = P_{CMAX\_H}$ and thus $P_{CMAX} = P_{CMAX\_H}$. At this time, P_{CMAX} is the least one of $P_{PowerClass}$ and P_{EMAX}. P_{EMAX} is the cell-specific maximum allowed UE transmission power, and $P_{PowerClass}$ is the UE-specific maximum allowed power.

[58] Accordingly, when there is no PUSCH transmission in the corresponding serving cell, PH is defined as equation (3):

[59] MathFigure 3

[Math.3]

$$PH(i) = \min\{P_{EMAX}, P_{PowerClass}\} - \{P_{O\_PUSCH,c}(j) + \alpha_c(j) \cdot PL_c + f_c(i)\}$$

[60] where $P_{O\_PUSCH,c}$, α_c, $f_c(i)$, and PL_c are set to the values of the serving cell for which PH is calculated for other than the serving cell in which PH is transmitted. The PH calculated by equation (3) is reported to the eNB along with other PHs in the PHR transmitted in other serving cell. The eNB can determine the PHs for individual serving cells with only one PHR. However, there is a problem in that the eNB does not know whether the individual serving cells' PHs carried in the PHR are calculated based on the real PUSCH transmissions or a PUSCH reference format. Without this information, it is not possible for the eNB to interpret the PHs correctly, resulting in inefficient scheduling. In order to address this problem, an indicator should be provided for indicating whether each PH is calculated based on the real PUSCH transmission or the PUSCH reference format in the PHR format of the related art. Accordingly, a calculation type indicator is included. The calculation type indicator can be configured with 1 bit. When reporting a PH for a certain cell, the UE sets the one-bit calculation type indicator to a predetermined value (e.g., 0) to indicate that the PH is calculated by applying a real transmission format or another value (e.g., 1) to indicate that the PH is calculated by applying the reference format (i.e., RB=0 and $\Delta_{TF} = 0$) because of no PUSCH transmission in the corresponding cell.

[61] FIG. 8 is a block diagram illustrating a configuration of a UE according to an exemplary embodiment of the present invention.

[62] Referring to FIG. 8, the UE includes a transceiver 805, a PH calculator 815, a controller 810, a multiplexer/demultiplexer 820, a control message processor 835, and various higher layer devices 825 and 830.

[63] The transceiver 805 receives data and control signals on the downlink carriers and transmits data and control signals on the uplink carriers. In a case where a plurality of carriers is aggregated, the transceiver 805 can transmit/receive the data and control signals over a plurality of carriers.

[64] The controller 810 controls the multiplexer/demultiplexer 820 to generate MAC PDUs according to the control signal received by means of the transceiver 805, e.g.,

the scheduling information in the uplink grant. The controller detects the PHR trigger. If a PHR trigger is detected, the controller 810 controls the PH calculator 815 to calculate the PH. Whether PHR is triggered can be determined by checking the PHR parameter provided by the control message processor 835. In a case where the PHs of multiple uplink carriers are configured into a PHR, the controller 810 controls the multiplexer/demultiplexer 820 to insert into the MAC PDU an indicator indicating whether the PH for each carrier is derived from a real P_{CMAX} or a virtual P_{CMAX}. The controller 810 generates the PHR with the PHs provided by the PH calculator 815 and sends the PHR to the multiplexer/demultiplexer 820. The PH calculator 815 calculates PH according to the control signal from the controller 810 and sends the PH to the controller 810. In a case where a plurality of carriers is aggregated, the PH calculator 815 can calculate PHs for the respective carriers, and especially the PH for the carrier having the PUSCH transmission being calculated using a virtual P_{CMAX}.

[65] The multiplexer/demultiplexer 820 multiplexes the data from the higher layer devices 825 and 830 and/or control message processor 835 and demultiplexes the data received by the transceiver 805 to the higher layer devices 825 and 830 and/or the control message processor 835.

[66] The control message processor 835 processes the control message transmitted by the network and performs a corresponding action. The control message processor 835 forwards the PHR parameter carried in the control message to the controller 810 or the information on the newly activated carriers to the transceiver 805 to set the carriers. The higher layer devices 825 and 830 can be implemented for the respective services so as to deliver the data generated by the user service such as File Transfer Protocol (FTP) and VoIP to the multiplexer/demultiplexer 820 or process and deliver the data from the multiplexer/demultiplexer 820 to the service applications of the higher layer.

[67] Although not depicted, the base station apparatus of an exemplary embodiment of the present invention can include a transceiver, a controller, and a scheduler. The transceiver receives the extended PHR transmitted by the UE. The controller analyzes the extended PHR to determine PH per serving cell. The scheduler allocates uplink resources according to the PH per serving cell.

[68] As described above, the PHR method and apparatus of exemplary embodiments of the present invention are capable of reporting PHs for multiple carriers efficiently in the mobile communication supporting carrier aggregation. The power headroom report method and apparatus of the present invention is capable of improving PH reporting efficiency in the mobile communication system supporting carrier aggregation.

[69] While the invention has been shown and described with reference to certain 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 and their equivalents.

Claims

[Claim 1] A method for transmitting a Power Headroom Report (PHR) of a terminal in a mobile communication system, the method comprising:
configuring, when a PHR is triggered for at least one activated serving cell, an extended PHR for the at least one activated serving cell, the PHR being triggered when a change of a downlink path loss in the at least one activated serving cell is greater than a predetermined threshold value; and
transmitting the extended PHR.

[Claim 2] The method of claim 1, further comprising determining, when an uplink resource is assigned for a new transmission, whether the change of the downlink path loss is greater than the predetermined threshold value.

[Claim 3] The method of claim 1, further comprising:
indicating a downlink carrier of the at least one activated serving cell in association with an uplink carrier of the at least one activated serving cell; and
measuring the downlink path loss on the indicated downlink carrier.

[Claim 4] The method of claim 3, wherein the at least one activated serving cell of which the downlink carrier is referenced for downlink path loss is identical with or different from the serving cell to which the uplink carrier belongs.

[Claim 5] An apparatus for transmitting a Power Headroom Report (PHR) of a terminal in a mobile communication system, the apparatus comprising:
a controller for detecting a PHR trigger, when a change of a downlink path loss in at least one activated serving cell becomes greater than a predetermined threshold value, and for configuring an extended PHR for the at least one activated serving cell; and
a transmitter for transmitting the extended PHR.

[Claim 6] The apparatus of claim 5, wherein the controller determines, when an uplink resource is assigned for a new transmission, whether the change of the downlink path loss is greater than the predetermined threshold value.

[Claim 7] The apparatus of claim 5, wherein a downlink carrier of the at least one activated serving cell is indicated in association with the uplink carrier of the at least one activated serving cell, and the controller measures the downlink path loss on the indicated downlink carrier.

[Claim 8] The apparatus of claim 7, wherein the at least one activated serving cell of which downlink carrier is referenced for downlink path loss is identical with or different from the serving cell to which the uplink carrier belongs.

[Claim 9] A method for receiving a Power Headroom Report (PHR) of a base station in a mobile communication system, the method comprising:
receiving an extended PHR from a terminal; and
determining a difference between a maximum transmission power of the terminal and an estimated uplink power per activated serving cell by analyzing the extended PHR,
wherein the terminal configures and transmits the extended PHR when a change of a downlink path loss in the activated serving cell is greater than a predetermined threshold.

[Claim 10] The method of claim 9, wherein the terminal determines, when uplink resource is assigned for a new transmission, whether the change of downlink path loss is greater than the predetermined threshold.

[Claim 11] The method of claim 9, further comprising indicating a downlink carrier of the activated serving cell of which downlink path loss is to be measured in association with the uplink carrier of the activated serving cell, the activated serving cell having the downlink carrier for measuring the downlink path loss being identical with or different from the serving cell to which the uplink carrier belongs.

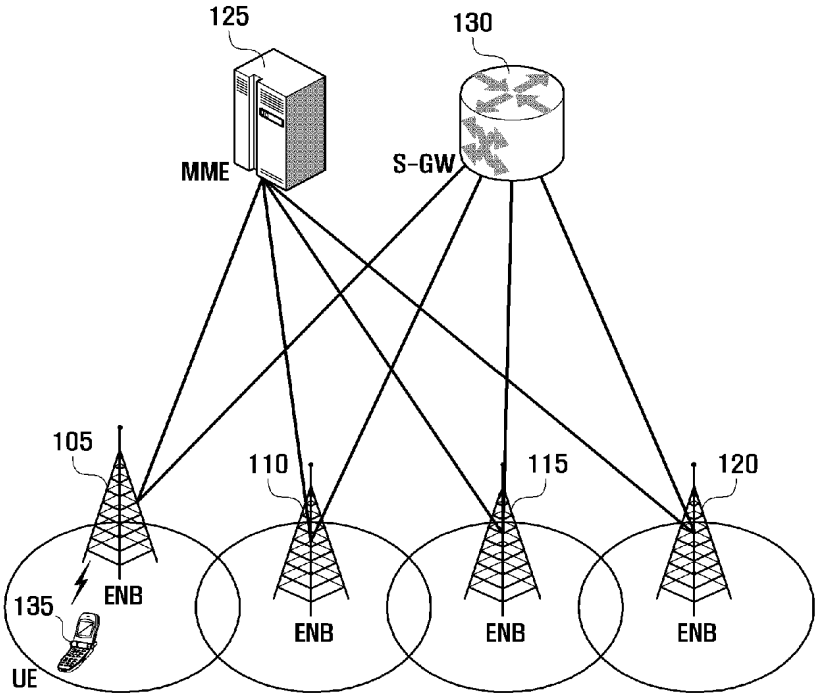
[Claim 12] An apparatus for receiving a Power Headroom Report (PHR) of a base station in a mobile communication system, the apparatus comprising:
a receiver for receiving an extended PHR transmitted by a terminal; and
a controller for determining a difference between a maximum transmission power of the terminal and an estimated uplink power per activated serving cell by analyzing the extended PHR,
wherein the terminal configures and transmits the extended PHR when a change of a downlink path loss in the activated serving cell is greater than a predetermined threshold.

[Claim 13] The apparatus of claim 12, wherein the terminal determines, when uplink resource is assigned for a new transmission, whether the change of downlink path loss is greater than the predetermined threshold.

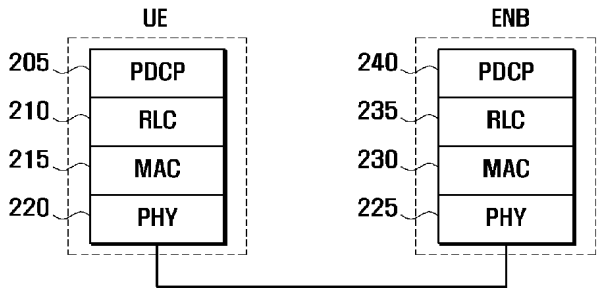
[Claim 14] The apparatus of claim 12, wherein the controller informs of a downlink carrier of the activated serving cell of which downlink path loss is to be measured in association with the uplink carrier of the activated serving cell, the activated serving cell having the downlink

carrier for measuring the downlink path loss being identical with or different from the serving cell to which the uplink carrier belongs.

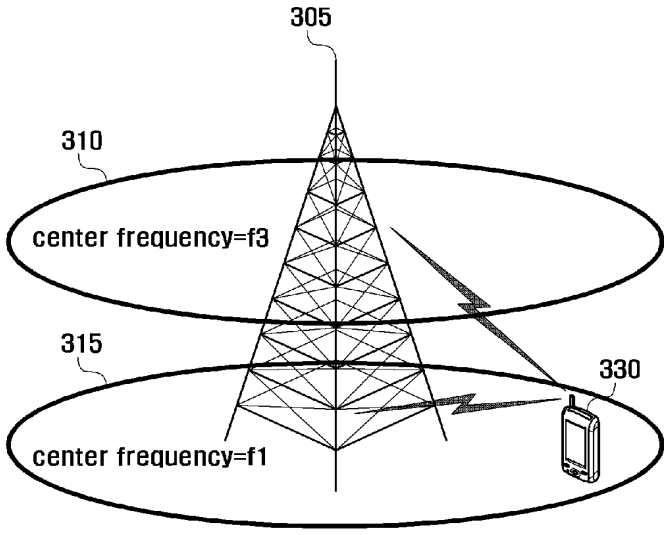
[Fig. 1]



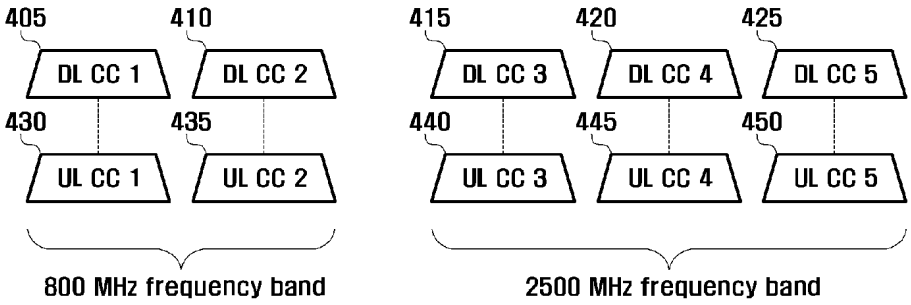
[Fig. 2]



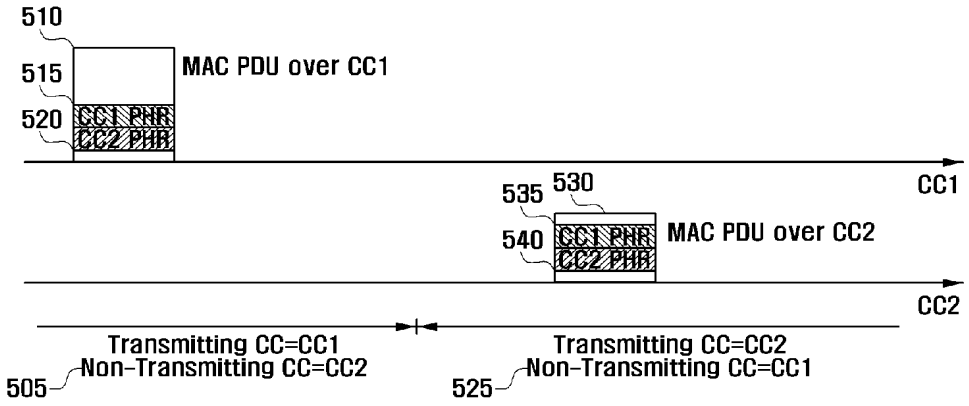
[Fig. 3]



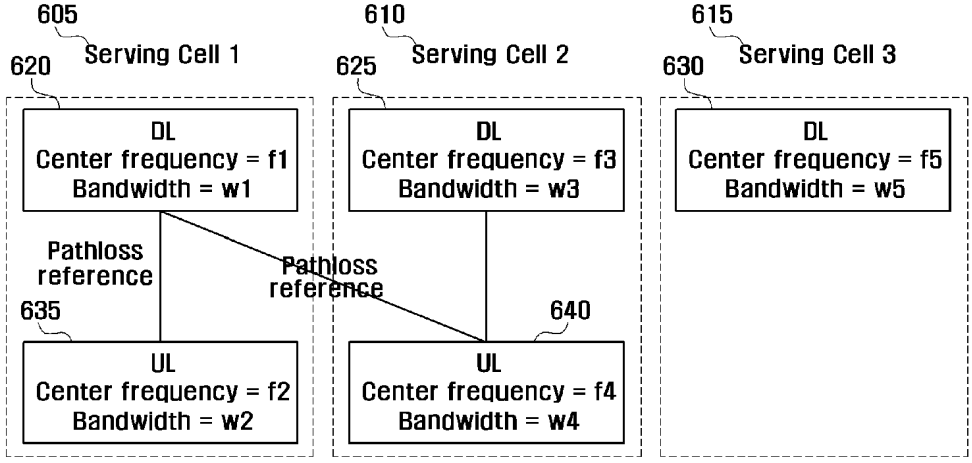
[Fig. 4]



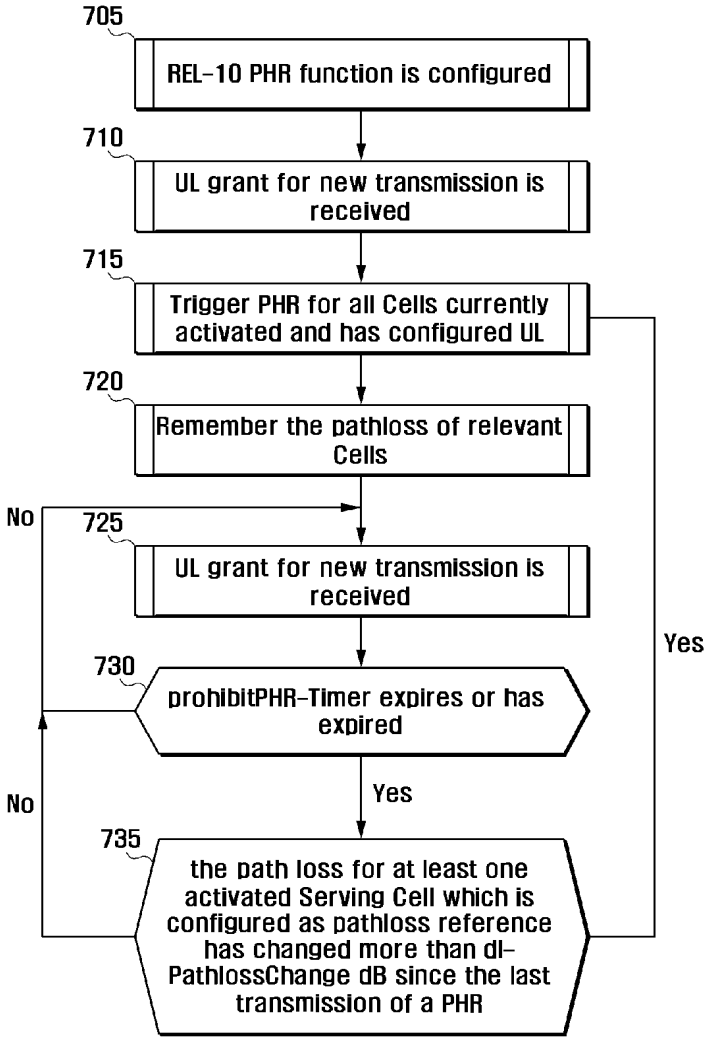
[Fig. 5]



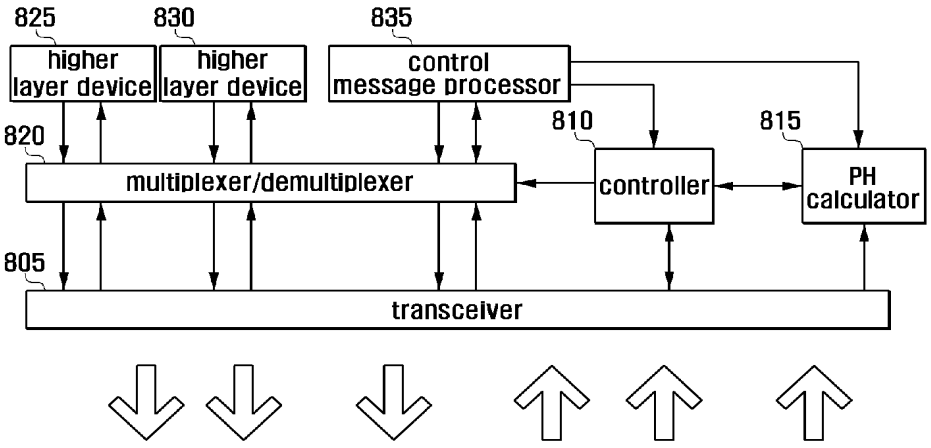
[Fig. 6]



[Fig. 7]


705
REL-10 PHR function is configured
710
UL grant for new transmission is received
715
Trigger PHR for all Cells currently activated and has configured UL
720
Remember the pathloss of relevant Cells
No
725
UL grant for new transmission is received
730
prohibitPHR-Timer expires or has expired
Yes
No
735
the path loss for at least one activated Serving Cell which is configured as pathloss reference has changed more than dl-PathlossChange dB since the last transmission of a PHR
Yes

[Fig. 8]


825
higher layer device
830
higher layer device
835
control message processor
820
multiplexer/demultiplexer
810
controller
815
PH calculator
805
transceiver

Electronic Acknowledgement Receipt

EFS ID:	41410168
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	87197
Filer:	Scott Ulbrich/Christy Ulbrich
Filer Authorized By:	Scott Ulbrich
Attorney Docket Number:	5261.16US01
Receipt Date:	16-DEC-2020
Filing Date:	26-APR-2019
Time Stamp:	19:39:56
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_transmittal.pdf	38111 3e0c2f2e998bac7f34515bf6d96c02eab081ffa2	no	2

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	IDS_Form.pdf	1034576 0ea91ec86e29e3b8f45d7e301d088ea91e0a9775	no	4
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Information:					
3	Foreign Reference	WO2012060659A2.pdf	1092381 811501fe505f67683a0ad432c9d1b49ba8243dac	no	22
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	KR_OA_.pdf	1976111 76aa7452a622a8738d4de001aa4e51dce9a3a09f	no	10
Warnings:					
Information:					
			Total Files Size (in bytes):	4141179	

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<u>New Applications Under 35 U.S.C. 111</u>
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.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
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.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
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.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Attorney Docket No.: 5261.16US01
Ko-Chiang LIN	Confirmation No.: 4258
Application No.: 16/395,760	Examiner: TALUKDER, MD K.
Filed: April 26, 2019	Group Art Unit: 2648

For: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

INFORMATION DISCLOSURE STATEMENT

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

Pursuant to 37 CFR § 1.56, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached Form PTO/SB/08a. It is respectfully requested that the information be expressly considered during the prosecution of the above-referenced application, and be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

The listing of a reference herein is not an admission that the reference is prior art or is material to patentability. 37 CFR § 1.97(h). Applicant reserves the right to establish the patentability of any claimed invention over any of the information provided herewith, and/or prove that this information may not be prior art, and/or prove that this information may not be enabling for any aspect of the information provided herewith.

This Information Disclosure Statement is being filed before the mailing date of the first Office Action on the merits following a Request for Continued Prosecution under 37 C.F.R. § 1.114. Accordingly, no fee is required.

Attached hereto is one non-English language foreign reference. The concise explanation of the relevance of the Korean Office Action is provided in the English language translation attached behind the document.

Applicant additionally notes the following:

- US 2017/0019864 A1 is the US counterpart of KR 1020160141728 A (noted in the Korean Office Action).
- US 2010/0272091 A1 is the US counterpart of JP 2012522473 (noted in the Korean Office Action).
- WO 2012060659 A2 is a counterpart of JP 2017034724 (noted in the Korean Office Action).

Respectfully submitted,

/Scott G. Ulbrich/
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Please grant any extension of time necessary for entry; charge any additional fee due to Deposit Account No 50-4970.

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. 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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	16/395,760	Filing Date	2019-04-26	Docket Number (if applicable)	5261.16US01	Art Unit	2648
First Named Inventor	Ko-Chiang LIN			Examiner Name	TALUKDER, MD K.		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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Signature of Registered U.S. Patent Practitioner			
Signature	/Scott G. Ulbrich/	Date (YYYY-MM-DD)	2020-12-15
Name	Scott G. Ulbrich	Registration Number	48005

This collection of information is required by 37 CFR 1.114. 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.

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

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 the Freedom of Information Act requires disclosure of these records.

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.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Attorney Docket No.: 5261.16US01
Ko-Chiang LIN	Confirmation No.: 4258
Application No.: 16/395,760	Examiner: TALUKDER, MD K.
Filed: April 26, 2019	Group Art Unit: 2648

For: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

RESPONSE TO OFFICE ACTION
SUBMITTED WITH REQUEST FOR CONTINUED EXAMINATION

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

INTRODUCTORY COMMENTS

This paper is submitted in response to the final Office Action mailed on September 30, 2020. Applicant believes that this Response addresses each concern raised by the Examiner in the Office Action and each of the claims is now in condition for allowance.

This Response consists of the following sections:

A. AMENDMENTS TO THE CLAIMS

B. REMARKS

Samsung Electronics v. Asus Tech Licensing EX-1003, 151 of 673

A. AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method for deriving a pathloss change, comprising:

a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report;

the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is separate from the first pathloss reference and is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell;

the UE derives the pathloss change based on the first pathloss value and the second pathloss value; and

the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

2. (Currently Amended) The method of claim 1, wherein the second power headroom report is transmitted via the first PUSCH transmission [[if]] when the second power headroom report is triggered.

3. (Original) The method of claim 1, wherein the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission.

4. (Original) The method of claim 3, wherein a second downlink control information (DCI) scheduling the second PUSCH transmission indicates the first pathloss reference.

5. (Original) The method of claim 3, wherein the second PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

6. (Original) The method of claim 1, wherein a first DCI scheduling the first PUSCH transmission indicates the second pathloss reference.

7. (Original) The method of claim 1, wherein the first PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference.

8. (Currently Amended) The method of claim 1, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell [[if]] when the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

9. (Original) The method of claim 8, wherein the pathloss reference configuration is *PUSCH-PathlossReferenceRS.*

10. (Currently Amended) A method for deriving a pathloss change, comprising:

a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a first power headroom value included in a first power headroom report;

the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is separate from the first pathloss reference and is used for deriving a second power headroom value;

the UE derives the pathloss change based on the first pathloss value and the second pathloss value; and

the UE determines whether a second power headroom report to include the second power headroom value is triggered based on whether the pathloss change is more than a threshold.

11. (Original) The method of claim 10, wherein the second pathloss value is not

used for power control for a Physical Uplink Shared Channel (PUSCH) transmission on the serving cell.

12. (Original) The method of claim 10, wherein the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference.

13. (Original) The method of claim 10, wherein the first pathloss value is used for power control for a PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the PUSCH transmission.

14. (Original) The method of claim 13, wherein a downlink control information (DCI) scheduling the PUSCH transmission indicates the first pathloss reference.

15. (Original) The method of claim 13, wherein the PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

16. (Currently Amended) The method of claim 10, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell [[if]] when the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

17. (Currently Amended) A User Equipment (UE) for deriving a pathloss change, comprising:

a control circuit;

a processor ~~installed in~~ provided with the control circuit; and

a memory ~~installed in the control circuit and~~ operatively coupled to the processor;

wherein the processor is configured to execute a program code ~~stored in the memory~~ to:

derive a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report;

derive a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is separate from the first pathloss reference and is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell;

derive the pathloss change based on the first pathloss value and the second pathloss value; and

determine whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

18. (Currently Amended) The UE of claim 17, wherein the second power headroom report is transmitted via the first PUSCH transmission [[if]] when the second power headroom report is triggered.

19. (Original) The UE of claim 17, wherein the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission.

20. (Currently Amended) The UE of claim 17, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell [[if]] when the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

B. REMARKS

Claims 1-20 were pending at the time of the September 30, 2020 Office Action. In this Response, claims 1-2, 8, 10, 16-18, and 20 are amended. No claims are cancelled or added. The amendments do not constitute new matter as support is found throughout the specification and drawings, including at least Fig. 21 and corresponding Paragraphs [0406]-[0410] of Applicant's application publication. Reconsideration of the rejections and favorable action are earnestly solicited.

REQUEST FOR CONTINUED EXAMINATION

Applicant respectfully requests continued examination of the present application pursuant to 37 CFR 1.114.

CLAIM INTERPRETATION

Claims 2, 8, 16, 18, and 20 contain "IF" statements. The Examiner asserted that the functional language recited after "IF" is an optional step and was "not given any patentable weight." While Applicant respectfully traverses this interpretation, the subject claims have been amended to provide clarification and to advance examination, without disclaimer or prejudice.

CLAIM REJECTIONS UNDER 35 U.S.C. §103

Claims 1-4, 6, 9-11, 13-14, and 17-19 were rejected under 35 U.S.C. §103 as being unpatentable over Lee (U.S. Pub. No. 2017/0359734) and further in view of Nigam (U.S. Pub. No. 2015/0282150). **Claims 5, 7, and 15** were rejected under 35 U.S.C. §103 as being unpatentable over Lee in view of Nigam and further in view of Dinan (U.S. Pub. No. 2016/0270094). **Claims 8, 12, 16, and 20** were rejected under 35 U.S.C. §103 as being unpatentable over Lee In view of Nigam and further in view of Loehr (U.S. Pub. No. 2016/0330698). Applicant respectfully traverses these rejections as explained below.

Applicant's claims have been amended to clarify that the second pathloss value is derived from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is **separate from the first pathloss reference.** Applicant

respectfully asserts that the cited references, including Lee, fail to teach or suggest, alone or in combination, such a separate pathloss value derivation feature.

For instance, the Office Action asserts that the following teachings from Lee disclose deriving a second pathloss value from a second pathloss of the serving cell after deriving the first pathloss value.

> A PHR may be triggered if a prohibitPHR-Timer expires or has expired and the path loss has changed more than dl-PathlossChange dB for at least one activated Serving Cell which is used as a pathloss reference since the last transmission of a PHR when the WTRU has UL resources for new transmission.
>
> ...
>
> A PHR may be triggered if: 1) a prohibitPHR-Timer expires or has expired, 2) when the WTRU has UL resources for new transmission, and 3) when the following in this transmission time interval (TTI) for any of the active SCells with configured UL is true: there are UL resources allocated for transmission or there is a PUCCH transmission on this cell, and the required power backoff due to power management (as allowed by P-MPR,) for this cell has changed more than dl-Pathloss Change dB since the last transmission of a PHR when the WTRU had UL resources allocated for transmission or PUCCH transmission on this cell.

Lee, Paragraphs [0099], [0103].

Applicant respectfully disagrees with this interpretation of Lee and asserts that Lee merely teaches general pathloss measurement based on a single pathloss reference and fails to teach or suggest at least deriving a second pathloss value from a second pathloss reference **after deriving the first pathloss value**, and **wherein the second pathloss reference is separate from the first pathloss reference**, as now recited in each of Applicant's independent claims 1, 10, and 17. Applicant's amended claims make it clear that the first pathloss value and the second pathloss value are **derived from wholly separate pathloss references**.

In summary, Applicant respectfully requests withdrawal of the §103 rejections for at least the foregoing reasons.

Any further traverse regarding the claims is reserved since the preceding is believed to be sufficient to overcome the rejections. Furthermore, nothing in this Response should be

construed as an intent to concede any issue with regard to any claim, except as specifically stated herein.

CONCLUSION

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested. The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,

/Scott G. Ulbrich/
Scott G. Ulbrich (Reg. No. 48005)

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Please grant any extension of time necessary for entry; charge any additional fee due to Deposit Account No 50-4970.

Electronic Patent Application Fee Transmittal

Application Number:	16395760
Filing Date:	26-Apr-2019
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Filer:	Scott Ulbrich/Christy Ulbrich
Attorney Docket Number:	5261.16US01

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

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:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1360	1360
		Total in USD ($)		**1360**

Electronic Acknowledgement Receipt

EFS ID:	41397602
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	87197
Filer:	Scott Ulbrich/Christy Ulbrich
Filer Authorized By:	Scott Ulbrich
Attorney Docket Number:	5261.16US01
Receipt Date:	15-DEC-2020
Filing Date:	26-APR-2019
Time Stamp:	23:52:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1360
RAM confirmation Number	E2020BEN52378018
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Authorized User	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	RCE_request.pdf	1349930 a5c885077a0aadd5908386ee92a7c433d4e532e3	no	3
Warnings:					
Information:					
2		FINAL_RCE_Response.pdf	90356 8541131c2907fbc8435f4b38637851584f3b0f74	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	8

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30648 85df24091476d5d14f253f5d8374445fe7a8940f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1470934		

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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

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/395,760	Filing Date 04/26/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	12/15/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $480 =	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 $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/ALLYSON PURNELL/
*** 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 number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. 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, 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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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/395,760	04/26/2019	Ko-Chiang Lin	1426-343.101

CONFIRMATION NO. 4258

POWER OF ATTORNEY NOTICE

106622
Blue Capital Law Firm, P.C.
650 Town Center Drive, Suite 1530
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OC000000120490324

Date Mailed: 10/09/2020

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/06/2020.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ggasgedom/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/395,760	04/26/2019	Ko-Chiang Lin	1426-343.101

CONFIRMATION NO. 4258

POA ACCEPTANCE LETTER

87197
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Minneapolis, MN 55305

OC000000120490468

Date Mailed: 10/09/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/06/2020.

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.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ggasgedom/

PTO/AIA/80 (07-17)
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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(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 87197

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(c).

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

[X] The address associated with Customer Number: 87197

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: ASUSTeK COMPUTER INC.
No. 15, Lite Road, Peitou Dist.
Taipei City, TAIWAN 112

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, 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 MWH-HSU HSU	Date 2019.7.5
Name Ming-Hsiu HSU	Telephone
Title Director	

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 update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 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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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: ASUSTek Computer Inc.

Application No./Patent No.: 16/395,760 Filed/Issue Date: 26-APR-2019

Titled: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

ASUSTek Computer Inc., a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

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 049006, Frame 0967, or for which a copy thereof is attached.

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

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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**.

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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

☑ As required by 37 CFR 3.73(c)(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.

/Scott G. Ulbrich/	October 6, 2020
Signature	Date
Scott G. Ulbrich	48005
Printed or Typed Name	Title or Registration 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:

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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.

Electronic Acknowledgement Receipt

EFS ID:	40768058
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	106622
Filer:	Scott Ulbrich/Lindsey Bullington
Filer Authorized By:	Scott Ulbrich
Attorney Docket Number:	1426-343.101
Receipt Date:	06-OCT-2020
Filing Date:	26-APR-2019
Time Stamp:	11:59:45
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	Power of Attorney	POA.pdf	72931 1ea7bc5cff74fa80a481ce13b2f9f311fd8369de	no	1

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	373c.pdf	118684 d5b635a07d15f49dda173e1f41bae36bf7d3ec36	no	3
Warnings:					
Information:					
			Total Files Size (in bytes):	191615	

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/395,760	04/26/2019	Ko-Chiang Lin	1426-343.101	4258

106622 7590 09/30/2020

Blue Capital Law Firm, P.C.
650 Town Center Drive, Suite 1530
Costa Mesa, CA 92626

EXAMINER	
TALUKDER, MD K	

ART UNIT	PAPER NUMBER
2648	

NOTIFICATION DATE	DELIVERY MODE
09/30/2020	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@bluecapitallaw.com

Office Action Summary	Application No. 16/395,760	Applicant(s) Lin et al.	
	Examiner MD K TALUKDER	Art Unit 2648	AIA (FITF) Status Yes

-- 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 MONTHS 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 _____.

☐ 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) 1-20 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) 1-20 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 _____ 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/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

2. It would be of great assistance to the office if all incoming papers pertaining to a filed application carried the following items:

i. Application number (checked for accuracy, including series code and serial no.).
ii. Group art unit number (copied from most recent Office communication).
iii. Filing date.
iv. Name of the examiner who prepared the most recent Office action.
v. Title of invention.
vi. Confirmation number (See MPEP § 503).

3. The Examiner has pointed out particular references contained in the prior art of record within the body of this action for the convenience of the Applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages, paragraph and figures may apply. Applicant, in preparing the response, should consider fully the entire reference as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

4. **Claim interpretation**: When multiple limitations are connected with "OR", one of the limitations does have any patentable weight since both of the limitations are optional.

Claim Interpretation ("If" statements)

5. Claims 2, 8, 18, 20 contain "If" statements. It is not clear whether the functional language recited afterwards is optional step or required functionality. Examiner read the functional language recited afterwards (after "IF") is optional step. The "If statement" will never occur; according to the broadest reasonable interpretation by the examiner since it is optional. Therefore, limitations after "if" are not given any patentable weight. For the purpose of expediting the processing of the application, Claims have been rejected in view of the prior art (see below) based on a broader interpretation that meets the claimed subject matter as interpreted by the Examiner.

Claim Rejection- 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-4, 6, 9-11, 13-14, 17-19 are rejected under 35 U.S.C. 103 as being unpatentable over Lee (Pub No. 20170359734) and further in view of Nigam (Pub No. 20150282150).

Regarding claim 1, Lee discloses a method for deriving a pathloss change, comprising: a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell (Para. 99: "**A PHR may be triggered if a prohibitPHR-Timer expires or has expired and the path loss has changed more than dl-Pathloss Change dB for at least one activated Serving Cell which is used as a pathloss reference since the last transmission of a PHR when the WTRU has UL resources for new transmission**") (**dl-Pathloss Change from 1st**

pathloss- pathloss reference to 2nd path-loss); wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report (**Para. 98-99: Power headroom Report);** the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value (Para. 99 & 103: **Path-loss changed calculated based on the first path-loss value. Multiple pathloss calculated and find the difference between multiple path-loss. dl-Pathloss Changed. dl-Pathloss → 1st pathloss-pathloss reference to 2nd path-loss**) & (Para. 131: "**A WTRU may measure two or more cell-specific CSI-RS and measure the received signal to noise ratio (SNR) received signal to interference plus noise ratio (SINR), which may be considered as reference signal received power (RSRP), pathloss…**"→That is multiple pathloss value calculation); the UE derives the pathloss change based on the first pathloss value and the second pathloss value (Para. 103: "…**the required power backoff due to power management (as allowed by P-MPR,) for this cell has changed more than dl-Pathloss Change dB since the last transmission of a PHR when the WTRU had UL resources allocated for transmission or PUCCH transmission on this cell**") (Pathloss changed from the last path loss).

Lee is silent regarding wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

In a similar field of endeavor, Nigam discloses the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell (Para. 48) & (Para. 48: "**P.sub.CMax denotes maximum allowed transmission (Tx) power on the frequency of the serving cell and P.sub.PUSCH denotes the transmit power**

used for the last Physical Uplink Shared Channel (PUSCH) transmission") and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold (Para. 45: "**The UE performs the PHR periodically of in an event-driven manner. For example, when the pathloss from the eNB changes more than a threshold, the UE transmits PHR**") (**PHR→** power headroom report).

Therefore it would have been obvious to one of the ordinary skilled in the art before the effective filing date of the invention to use the wireless power control system of Nigam's disclosure with the wireless beam control system, as taught by Lee. Doing so would have resulted in effectively and efficiently controlling power in a wireless system to minimize path-loss in the wireless communication.

Regarding claim 2 & 18, Lee, remains as applied above and continue to teach the second power headroom report is transmitted via the first PUSCH transmission if the second power headroom report is triggered (Para. **72 & Para. 98-99**).

Regarding claim 3 & 13 & 19, Lee continues to teach the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission (Para. **72 & Para. 98-99**).

Regarding claim 4 & 14, Lee continues to teach a second downlink control information (DCI) scheduling the second PUSCH transmission indicates the first pathloss reference (Para. **78 & Para. 99**).

Regarding claim 6, Lee continues to teach a first DCI scheduling the first PUSCH transmission indicates the second pathloss reference (**Para. 78 & 131).**

Regarding claim 9, Lee teaches the pathloss reference configuration is PUSCH-PathlossReferenceRS (**Para. 118 & 119).**

Regarding claim 10, Claim 10 corresponds to claim 1 and is analyzed accordingly.

Regarding claim 11, Lee teaches the second pathloss value is not used for power control for a Physical Uplink Shared Channel (PUSCH) transmission on the serving cell Para. 72: **PUSCH used for large amount of feedback**).

Regarding claim 17, Lee discloses a User Equipment (UE) for deriving a pathloss change (**Fig. 1C**), comprising: a control circuit; a processor installed in the control circuit (**Fig. 1B: Processor-118**); and a memory installed in the control circuit and operatively coupled to the processor (**Fig. 1B: Processor-118 with memory-130/132**); wherein the processor is configured to execute a program code stored in the memory to: derives a first pathloss value from a first pathloss reference of a serving cell (Para. 99: "**A PHR may be triggered if a prohibitPHR-Timer expires or has expired and the path loss has changed more than dl-Pathloss Change dB for at least one activated Serving Cell which is used as a pathloss reference since the last transmission of a PHR when the WTRU has UL resources for new transmission**") (**dl-Pathloss Change from 1st pathloss- pathloss reference to 2nd path-loss**); wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report (**Para. 98-99: Power headroom Report);** derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value (Para. 99) & (Para. 131: "**A WTRU may measure two or more cell-specific CSI-RS and measure the received signal to noise ratio (SNR) received signal to interference plus noise ratio (SINR), which may be considered as reference signal received power (RSRP), pathloss…**"); the UE derives the pathloss change based on the first pathloss value and the second pathloss value (Para. 103: "…**the required power backoff due to power management (as allowed by P-MPR,) for this cell has changed more than dl-Pathloss Change dB since the last transmission of a PHR**

when the WTRU had UL resources allocated for transmission or PUCCH transmission on this cell") (Pathloss changed from the last path loss).

Lee is silent regarding wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

In a similar field of endeavor, Nigam discloses the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell (Para. 48) & (Para. 48: "**P.sub.CMax denotes maximum allowed transmission (Tx) power on the frequency of the serving cell and P.sub.PUSCH denotes the transmit power used for the last Physical Uplink Shared Channel (PUSCH) transmission**") and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold (Para. 45: "**The UE performs the PHR periodically of in an event-driven manner. For example, when the pathloss from the eNB changes more than a threshold, the UE transmits PHR**") (**PHR→** power headroom report).

Claims 5, 7 & 15 are rejected under 35 U.S.C. 103 as being unpatentable over Lee (Pub No. 20170359734), in view of Nigam (Pub No. 20150282150) and further in view of Dinan (Pub No. 20160270094).

Regarding claim 5 & 15, Lee is silent regarding the second PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

Dinan discloses the second PUSCH transmission is configured by a parameter

ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference (**Para. 128 & 150).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Regarding claim 7, Lee is silent regarding the first PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference.

Dinan discloses the first PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference (**Para. 128 & 150).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Claims 8, 12 & 16 & 20 are rejected under 35 U.S.C. 103 as being unpatentable over Lee (Pub No. 20170359734), in view of Nigam (Pub No. 20150282150) and further in view of Loehr (Pub No. 20160330698).

Regarding claim 8 & 16, Lee is silent regarding the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

Loehr discloses the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report (Para. 94 & 156).

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Regarding claim 12, Lee is silent regarding the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference.

Loehr discloses the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference **(Para. 94 & 156).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Regarding claim 20, Lee is silent regarding the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

Loehr discloses the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report **(Para. 94 & 156).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Response to Arguments

7. i. Applicant's arguments, with regards to claim 1 have been fully considered but they are not persuasive.

Applicant argues prior art does not disclose "derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value".

Examiner respectfully disagrees with the applicant arguments because prior art either explicitly or inherently discloses each and every aspect of the above limitations.

Lee discloses the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value (Para. 99: Pathloss change calculated based on the first and another pathloss value. Para. 103: dl-Pathloss Changed) & (Para. 131: Multiple pathloss value calculation for dl).

CONCLUSION

THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication from the examiner should be directed to Patent Examiner Md Talukder whose telephone number is (571) 270-3222. The examiner can normally be reached on Mon-Th 8:00 am to 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisors, Wesley Kim can be reached on 571-272-7867.

Information regarding the status of an application may be obtaining from the patent application information retrieval (PAIR) system. Status information for the published applications may be obtained from either private PAIR or public PAIR. Status information for unpublished application is available through private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have any questions on access to the private PAIR system, contract the Electronics Business Center (EBC) at 866-217-9197. If you would like assistance from USPTO customer service representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA).

/MD K TALUKDER/
Primary Examiner, Art Unit 2648

Notice of References Cited	Application/Control No. 16/395,760	Applicant(s)/Patent Under Reexamination Lin et al.	
	Examiner MD K TALUKDER	Art Unit 2648	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20190349866-A1	11-2019	Lin; Ko-Chiang	H04B7/0617	1/1
*	B	US-20170359734-A1	12-2017	Lee; Moon-il	H04B7/086	1/1
*	C	US-20100272046-A1	10-2010	Guo; Yu-Hsuan	H04W52/365	370/329
*	D	US-20150282150-A1	10-2015	Nigam; Anshuman	H04W28/0278	370/329
*	E	US-20200107272-A1	04-2020	HE; Linhai	H04L5/0053	1/1
*	F	US-20200084735-A1	03-2020	Cheng; Peng	H04W52/36	1/1
*	G	US-20180132197-A1	05-2018	Lin; Ko-Chiang	H04W52/42	1/1
*	H	US-20180310257-A1	10-2018	Papasakellariou; Aris	H04W52/50	1/1
*	I	US-20130121203-A1	05-2013	Jung; Sung Hoon	H04W52/365	370/252
*	J	US-20160057712-A1	02-2016	Wen; Pingping	H04W52/365	370/329
*	K	US-20160270094-A1	09-2016	Dinan; Esmael Hejazi	H04W52/325	1/1
*	L	US-20160330698-A1	11-2016	LOEHR; JOACHIM	H04W72/04	1/1
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC 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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	Art Unit
	MD K TALUKDER	2648

CPC - Searched*		
Symbol	Date	Examiner
H04W52/242, H04W52/146, H04W52/365, H04W72/14	04/08/2020	Talukder
H04W52/242, H04W52/146, H04W52/365, H04W72/14	09/25/2020	Talukder

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
455		04/09/2020	Talukder
370		04/09/2020	Talukder

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
East Searched	04/08/2020	Talukder
Inventor Searched	04/09/2020	Talukder
Assignee Searched	04/09/2020	Talukder
East Searched	09/25/2020	Talukder
Inventor Searched	09/25/2020	Talukder
Assignee Searched	09/25/2020	Talukder

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	Art Unit
	MD K TALUKDER	2648

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	Art Unit
	MD K TALUKDER	2648

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	04/09/2020	09/26/2020							
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"16395760"	US-PGPUB; USPAT	OR	ON	2020/04/08 11:54
S2	0	"2017359734"	US-PGPUB; USPAT	OR	ON	2020/04/08 13:15
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S19	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold with (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/04/08 19:44
S20	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold same (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/04/08 20:09
S21	115	(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/04/09 13:24
S22	48	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/04/09 13:25
S23	32	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold and (path$1loss near4 (chang$3 difference different)) same ((serving adj2 cell) station eNodeB (access adj2 point) BS$1)	US-PGPUB; USPAT	OR	ON	2020/04/09 13:39
S24	3	((grant$4 near3 config$3) grant$config$3) and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489"	US-PGPUB; USPAT	OR	ON	2020/04/09 16:21

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S27	112	serving near2 cell same (PHR (power near3 report)) and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156"	US-PGPUB; USPAT	OR	ON	2020/04/09 16:43

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S28	28	serving near2 cell same (PHR (power near3 report)) same2 (no$1 doesn$1t) with PUSCH and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649"	US-PGPUB; USPAT	OR	ON	2020/04/09 16:44

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S29	28	S28 and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/04/09 16:47
S30	119	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and	US-PGPUB; USPAT;	OR	ON	2020/04/09 18:58

		(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S31	170	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 18:59
S32	930	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/04/09 19:01
S33	0	((("Lin") near3 ("Ko-Chiang"))).INV.	USOCR	OR	OFF	2020/04/09 19:01
S34	163	((("Guo") near3 ("Yu-Hsuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/04/09 19:01
S35	14	S32 and S34	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 19:02
S36	0	S35 and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 19:02
S37	6,665	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/15 20:20
S38	261	((("Lin") near3 ("Ko-Chiang"))).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/08/15 20:20
S39	91	S37 and S38	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2020/08/15 20:25

			DERWENT; IBM_TDB			
S40	57	S37 and S38	US-PGPUB; USPAT	OR	OFF	2020/08/15 20:25
S41	1	"16395760"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S42	0	"2017359734"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S43	2	"20170359734"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S44	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S45	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3))	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S46	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S47	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) with threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S48	1	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S49	2	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S50	0	"20100272046" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

		(adjust$4 control$3)) and reference near3 signal				
S51	1	"20100272046"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S52	2	"20150282150"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S53	189	("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798" "20190394732" "20150003345" "20190357156" "10212669" "10575265" "10405284" "10362544" "10455526" "10499350" "10536909" "20150341870" "20120224535" "20130010720" "9838982" "9055585" "20160135173" "20130121203" "9148860" "9025541" "20180310259" "9756583" "20170019864" "20200053710" "9918286" "20190082397" "10154465" "20180152901" "20200053657" "9838975" "9288771" "20170325181" "9883493" "20170041882" "10182406" "20200068507" "20190098586" "10244489" "20190253985" "20190191394" "20180131425" "10425900" "9179424" "20150189604" "20190364513" "9408162" "20160021624" "20190306874" "20120082046" "9532320" "9794894" "20140307681" "20170064649" "10375719" "20160270007" "20190082398" "9844008" "20180332541" "20160119883" "20160242128" "20190053170" "10548096" "20160270094" "20180279339" "20150195795" "20190082399" "20140171144" "9288770" "20180310257" "20180167883" "9144035" "20190200304" "10271292" "20180007642" "10057862" "9191899"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S57	4	(2nd another other second) near4 (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) and reference near3 signal and power same head$1room and ("20180132197" "20180115957" "10383067" "20180049137" "10602456"	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29

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S59	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold with (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S60	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold same (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S61	127	(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S62	48	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S63	32	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold and (path$1loss near4 (chang$3 difference different)) same ((serving adj2 cell) station eNodeB (access adj2 point) BS$1)	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
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S69	28	S68 and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/09/24 21:29
S70	133	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (PHR (power adj3 headroom)) with	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2020/09/24 21:29

		(path$1loss near4 (chang$3 difference different)) near7 threshold	DERWENT; IBM_TDB			
S71	193	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 21:29
S72	988	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/09/24 21:29
S73	0	((("Lin") near3 ("Ko-Chiang"))).INV.	USOCR	OR	OFF	2020/09/24 21:29
S74	176	((("Guo") near3 ("Yu-Hsuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/24 21:29
S75	21	S72 and S74	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 21:29
S76	0	S75 and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/09/24 21:29
S77	6,713	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/09/24 21:29
S78	262	((("Lin") near3 ("Ko-Chiang"))).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/09/24 21:29
S79	92	S77 and S78	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/09/24 21:29

S80	58	S77 and S78	US-PGPUB; USPAT	OR	OFF	2020/09/24 21:29

EAST Search History (Interference)

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9/26/2020 11:05:52 AM
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
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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	16395760
Filing Date	2019-04-26
First Named Inventor	LIN, KO-CHIANG
Art Unit	2648
Examiner Name	MD K. Talukder
Attorney Docket Number	1426-343.101

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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	1	2016158535	WO		2018-01-25	Takeda Kazuki et al.		☐

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.K.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16395760
	Filing Date	2019-04-26
	First Named Inventor	LIN, KO-CHIANG
	Art Unit	2648
	Examiner Name	MD K. Talukder
	Attorney Docket Number	1426-343.101

	1	Huawei, HISilicon, "Consideration on PHR Multi-Beam Operation", R2-1801043 Revision of R2-1713177, 3GPP TSG-RAN2 Meeting #AH-1801, Vancouver, Canada, 22nd-26th January 2018.	☐
	2	ASUSTek, "Pathloss Reference Change for Triggering PHR", R2-1804289 (Resubmission of R2-1801899), 3GPP TSG-RAN WG2 Meeting #101bis, Sanya, China, 16th-20th April 2018.	☐
	3	Office Action from Japan Patent Office in corresponding JP Application No. 2019-085017, dated June 16, 2020	☒

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EXAMINER SIGNATURE

Examiner Signature	/MD K TALUKDER/	Date Considered	09/26/2020

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Bibliographic Data

Application No: 16/395,760

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Title: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
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CONTINUING DATA

This application has PRO of 62669461 05/10/2018

FOREIGN APPLICATIONS

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	1	2016158535	WO		2018-01-25	Takeda Kazuki et al.		☐

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	1	Huawei, HISilicon, "Consideration on PHR Multi-Beam Operation", R2-1801043 Revision of R2-1713177, 3GPP TSG-RAN2 Meeting #AH-1801, Vancouver, Canada, 22nd-26th January 2018.	☐
	2	ASUSTek, "Pathloss Reference Change for Triggering PHR", R2-1804289 (Resubmission of R2-1801899), 3GPP TSG-RAN WG2 Meeting #101bis, Sanya, China, 16th-20th April 2018.	☐
	3	Office Action from Japan Patent Office in corresponding JP Application No. 2019-085017, dated June 16, 2020	☒

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Ko-Chiang Lin; Yu-Hsuan Guo; Ming-Che Li; Hsin-Hsi Tsai	
Title:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	
Serial No.:	16/395,760	Filed: April 26, 2019
Examiner:	MD K. Talukder	Group Art Unit: 2648
Attorney Docket No.:	1426-343.101 (1070170-US)	

CERTIFICATE OF EFS-WEB TRANSMISSION
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I hereby certify that the enclosed 3 Page Information Disclosure Statement Transmittal; 2 Page Information Disclosure Statement by Applicant with 5 references are being transmitted to the United States Patent and Trademark Office via EFS-Web on July 14, 2020.

Date: July 14, 2020 /Sandy Kim/
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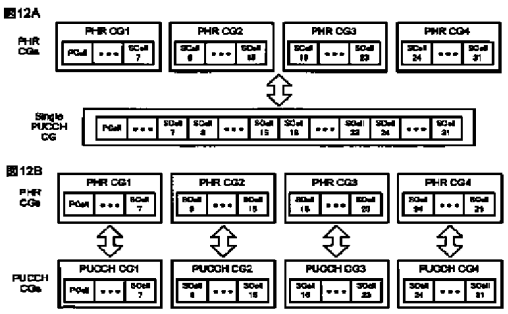
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最終頁に続く

(54)【発明の名称】ユーザ端末、無線基地局及び無線通信方法

(57)【要約】
ユーザ端末に設定可能なコンポーネントキャリア数が既存システムより拡張される場合であっても、通信を適切に行うこと。本発明の一態様に係るユーザ端末は、複数のコンポーネントキャリア（ＣＣ：Component Carrier）を利用して通信可能なユーザ端末であって、アクティベートされたＣＣのうち、所定のセルグループを構成するＣＣごとのＰＨ（Power Headroom）に関する情報を含むＰＨＲ（Power Headroom Report）を生成する生成部と、生成したＰＨＲを送信する送信部と、を有する。



【特許請求の範囲】
【請求項１】
複数のコンポーネントキャリア（ＣＣ：Component Carrier）を利用して通信可能なユーザ端末であって、
アクティベートされたＣＣのうち、所定のセルグループを構成するＣＣごとのＰＨ（Power Headroom）に関する情報を含むＰＨＲ（Power Headroom Report）を生成する生成部と、
生成したＰＨＲを送信する送信部と、を有することを特徴とするユーザ端末。
【請求項２】
前記送信部は、所定のセルグループに関するＰＨＲを、当該所定のセルグループで送信することを特徴とする請求項１に記載のユーザ端末。
【請求項３】
前記送信部は、所定のセルグループに関するＰＨＲを、当該所定のセルグループと異なるセルグループで送信することを特徴とする請求項１に記載のユーザ端末。
【請求項４】
前記生成部は、所定のセルグループに関するＰＨＲであることを示すＬＣＩＤ（Logical Channel ID）を、ＭＡＣ（Medium Access Control）ヘッダに含むＰＨＲを生成することを特徴とする請求項２又は請求項３に記載のユーザ端末。
【請求項５】
前記生成部は、所定のセルグループに関する情報を含むことを示すフィールドを、ＭＡＣ ＣＥ（Control Element）に含むＰＨＲを生成することを特徴とする請求項４に記載のユーザ端末。
【請求項６】
前記ＬＣＩＤは、対応するセルグループごとに異なる値をとることを特徴とする請求項４に記載のユーザ端末。
【請求項７】
前記所定のセルグループは、ＰＵＣＣＨ（Physical Uplink Control Channel）が設定されたＣＣを含む１つ以上のＣＣから構成されるＰＵＣＣＨセルグループと関連付けられていることを特徴とする請求項１から請求項６のいずれかに記載のユーザ端末。
【請求項８】
ＰＨＲ送信条件に関する情報を受信する受信部をさらに有し、
前記送信部は、セルグループごとに設定される前記条件に基づいて、ＰＨＲを送信するタイミングを判断することを特徴とする請求項１から請求項７のいずれかに記載のユーザ端末。
【請求項９】
複数のコンポーネントキャリア（ＣＣ：Component Carrier）を利用するユーザ端末と通信可能な無線基地局であって、
前記ユーザ端末にアクティベートされたＣＣのうち、所定のセルグループを構成するＣＣごとのＰＨ（Power Headroom）に関する情報を含むＰＨＲ（Power Headroom Report）を受信する受信部と、
前記ＰＨＲに基づいて、前記ユーザ端末の上り送信電力を制御する制御部と、を有することを特徴とする無線基地局。
【請求項１０】
複数のコンポーネントキャリア（ＣＣ：Component Carrier）を利用して通信可能なユーザ端末の無線通信方法であって、
アクティベートされたＣＣのうち、所定のセルグループを構成するＣＣごとのＰＨ（Power Headroom）に関する情報を含むＰＨＲ（Power Headroom Report）を生成する工程と、
生成したＰＨＲを送信する工程と、を有することを特徴とする無線通信方法。

【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、次世代移動通信システムにおけるユーザ端末、無線基地局及び無線通信方法に関する。
【背景技術】
【０００２】
ＵＭＴＳ（Universal Mobile Telecommunications System）ネットワークにおいて、さらなる高速データレート、低遅延などを目的としてロングタームエボリューション（ＬＴＥ：Long Term Evolution）が仕様化された（非特許文献１）。そして、ＬＴＥからのさらなる広帯域化及び高速化を目的として、ＬＴＥアドバンストと呼ばれるＬＴＥの後継システム（ＬＴＥ－Ａとも呼ばれる）が検討され、ＬＴＥ Ｒｅｌ．１０～１２として仕様化されている。
【０００３】
ＬＴＥ Ｒｅｌ．１０～１２の広帯域化技術の１つは、キャリアアグリゲーション（ＣＡ：Carrier Aggregation）である。ＣＡによれば、複数の基本周波数ブロックを一体として通信に用いることができる。ＣＡにおける基本周波数ブロックは、コンポーネントキャリア（ＣＣ：Component Carrier）と呼ばれ、ＬＴＥ Ｒｅｌ．８のシステム帯域に相当する。
【０００４】
また、ＬＴＥでは、ユーザ端末（ＵＥ）がネットワーク側の装置（例えば、無線基地局（ｅＮＢ））に対して、サービングセル毎の上り余剰送信電力（ＰＨ：Power Headroom）に関する情報を含むＰＨＲ（Power Headroom Report）をフィードバックする。無線基地局は、ＰＨＲに基づいてユーザ端末の上り送信電力を動的に制御することができる。
【先行技術文献】
【非特許文献】
【０００５】
【非特許文献１】3GPP TS 36.300 “Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2”
【発明の概要】
【発明が解決しようとする課題】
【０００６】
ＬＴＥの後継システム（ＬＴＥ Ｒｅｌ．１０～１２）におけるＣＡでは、ユーザ端末あたりの設定可能なＣＣ数が最大５個に制限されている。一方、ＬＴＥのさらなる後継システムであるＬＴＥ Ｒｅｌ．１３以降では、より柔軟かつ高速な無線通信を実現するために、ユーザ端末に設定可能なＣＣ数の制限を緩和し、６個以上のＣＣ（５個を超えるＣＣ）を設定することが検討されている。ここで、設定可能なＣＣ数を６個以上とするキャリアアグリゲーションは、例えば、拡張ＣＡなどと呼ばれてもよい。
【０００７】
しかしながら、ユーザ端末に設定可能なＣＣ数が６個以上（例えば、３２個）に拡張される場合、既存システム（Ｒｅｌ．１０～１２）におけるＰＨＲの利用方法をそのまま適用することが困難となる。例えば、既存システムでは、５ＣＣ以下のＣＡを前提としているため、６ＣＣ以上のＣＡを適用する場合、各ＣＣについてのＰＨに関する情報を無線基地局に適切なタイミングで通知できない場合がある。このため、無線基地局がユーザ端末の上り送信電力を適切に制御できなくなるおそれがある。
【０００８】
本発明はかかる点に鑑みてなされたものであり、ユーザ端末に設定可能なコンポーネントキャリア数が既存システムより拡張される場合であっても、通信を適切に行うことができるユーザ端末、無線基地局及び無線通信方法を提供することを目的とする。

【課題を解決するための手段】

【０００９】

本発明の一態様に係るユーザ端末は、複数のコンポーネントキャリア（ＣＣ：Component Carrier）を利用して通信可能なユーザ端末であって、アクティベートされたＣＣのうち、所定のセルグループを構成するＣＣごとのＰＨ（Power Headroom）に関する情報を含むＰＨＲ（Power Headroom Report）を生成する生成部と、生成したＰＨＲを送信する送信部と、を有する。

【発明の効果】

【００１０】

本発明によれば、ユーザ端末に設定可能なコンポーネントキャリア数が既存システムより拡張される場合であっても、通信を適切に行うことができる。

【図面の簡単な説明】

【００１１】

【図１】Ｒｅｌ．１３　ＣＡの一例を示す図である。

【図２】ＰＵＣＣＨ　ＣＧモードの一例を示す図である。

【図３】第１の実施形態におけるＰＨＲタイマ及びパラメータセットの適用範囲を示す図である。

【図４】第１の実施形態におけるＰＨＲ　ＭＡＣ　ＣＥの一例を示す図である。

【図５】第２の実施形態におけるＰＨＲタイマ及びパラメータの適用範囲を示す図である。

【図６】第２の実施形態におけるＰＨＲ　ＭＡＣ　ＣＥの一例を示す図である。

【図７】第１の実施形態におけるＰＨＲトリガのタイミングの一例を示す図である。

【図８】図７の時刻t_1及びt_2で送信されるＰＨＲの一例を示す図である。

【図９】余剰電力（ＰＨ）とＰＵＣＣＨ／ＰＵＳＣＨ送信電力との関係の一例を示す図である。

【図１０】第２の実施形態におけるＰＨＲトリガのタイミングの一例を示す図である。

【図１１】図１０Ｂで送信されるＰＨＲの一例を示す図である。

【図１２】ＰＨＲ　ＣＧとＰＵＣＣＨ　ＣＧとの対応関係の一例を示す図である。

【図１３】ＰＨＲ　ＣＧとＰＵＣＣＨ　ＣＧとの対応関係の別の一例を示す図である。

【図１４】方法１の概念説明図である。

【図１５】図１４で送信されるＰＨＲ　ＭＡＣ　ＣＥの構成の一例を示す図である。

【図１６】上り共有チャネルに用いられるＬＣＩＤ値の一例を示す図である。

【図１７】方法２の概念説明図である。

【図１８】図１７で送信されるＰＨＲ　ＭＡＣ　ＣＥの構成の一例を示す図である。

【図１９】方法２の別の一例を示す図である。

【図２０】本発明の一実施形態に係る無線通信システムの概略構成の一例を示す図である。

【図２１】本発明の一実施形態に係る無線基地局の全体構成の一例を示す図である。

【図２２】本発明の一実施形態に係る無線基地局の機能構成の一例を示す図である。

【図２３】本発明の一実施形態に係るユーザ端末の全体構成の一例を示す図である。

【図２４】本発明の一実施形態に係るユーザ端末の機能構成の一例を示す図である。

【発明を実施するための形態】

【００１２】

従来のＬＴＥの後継システム（ＬＴＥ　Ｒｅｌ．１０～１２）におけるＣＡでは、ユーザ端末当たりに設定可能なＣＣ数が最大５個に制限されている。一方、ＬＴＥのさらなる後継システムであるＬＴＥ　Ｒｅｌ．１３以降においては、ユーザ端末当たりに設定可能なＣＣの数の制限を緩和し、６個以上のＣＣ（セル）を設定する拡張キャリアアグリゲーション（ＣＡ　enhancement、enhanced　ＣＡ、Ｒｅｌ．１３　ＣＡなどともいう）が検討されている。

【００１３】

図１は、Ｒｅｌ．１３　ＣＡの一例を示す図である。図１に示すように、Ｒｅｌ．１３ＣＡでは、例えば、最大３２個のＣＣを束ねることが想定される。このように多くのＣＣに関する上り制御情報（ＵＣＩ）をＰＣｅｌｌのＰＵＣＣＨのみで送信することは、通信オーバヘッドや制御性の観点から非効率であるため、Ｒｅｌ．１３　ＣＡではＰＵＣＣＨセルグループ（ＰＵＣＣＨ　ＣＧ）をサポートすることが検討されている。

【００１４】

ＰＵＣＣＨ　ＣＧごとに１つのＰＵＣＣＨセルが設定される。例えば、ＰＵＣＣＨセル（ＰＵＣＣＨ設定セル）は、ＰＣｅｌｌであってもよいし、ＰＵＣＣＨ送信可能に設定されたＳＣｅｌｌ（ＰＵＣＣＨ　ＳＣｅｌｌ）であってもよい。図１の場合、それぞれ８つのセルから構成されるＰＵＣＣＨ　ＣＧが４つ設定されており、ＳＣｅｌｌ　８やＳＣｅｌｌ　２４などがＰＵＣＣＨ　ＳＣｅｌｌとして設定されている。

【００１５】

なお、ＰＵＣＣＨ　ＣＧは、必ずしも２つ以上設定されなくてもよい。Ｒｅｌ．１３ＣＡは、複数のＰＵＣＣＨセルが設定される（Multiple PUCCH CGs）モードと、単一のセル（ＰＣｅｌｌ）だけでＰＵＣＣＨを送信する（Single PUCCH CG）モードをサポートすることが検討されている。

【００１６】

図２は、ＰＵＣＣＨ　ＣＧモードの一例を示す図である。図２Ａは、ユーザ端末が複数のセルを用いてｅＮＢに上り信号を送信する例を示している。また、図２Ｂ及び２Ｃは、図２Ａの例に対応するＰＵＣＣＨ　ＣＧモードの例を示している。例えば、複数のＰＵＣＣＨ　ＣＧが設定されてもよいし（図２Ｂ）、１つのＰＵＣＣＨ　ＣＧが設定されてもよい（図２Ｃ）。

【００１７】

ところで、ＬＴＥでは、ユーザ端末が無線基地局に対して、サービングセル毎のＰＨに関する情報（ＰＨ情報）を含むＰＨＲ（Power Headroom Report）をフィードバックする。ＰＨＲは、ＭＡＣ　ＰＤＵ（Medium Access Control Protocol Data Unit）に含まれるＰＨＲ　ＭＡＣ　ＣＥ（Control Element）により構成される。ＰＨＲは、ＰＵＳＣＨ（Physical Uplink Shared Channel）を用いてＭＡＣシグナリングにより送信される。無線基地局は、受信したＰＨＲに基づいてユーザ端末の送信電力を動的に制御することができる。

【００１８】

現状、２タイプのＰＨ（Ｔｙｐｅ　１　ＰＨ、Ｔｙｐｅ　２　ＰＨ）が規定されている。Ｔｙｐｅ　１　ＰＨは、ＰＵＳＣＨのみを考慮した場合のＰＨであり、Ｔｙｐｅ　２　ＰＨは、ＰＵＳＣＨ及びＰＵＣＣＨの両方を考慮した場合のＰＨである。なお、ＰＨ情報は、ＰＨの値であってもよいし、ＰＨの値（又はレベル）と関連付けられたインデックスであってもよい。

【００１９】

無線基地局は、ユーザ端末に対して、ＰＨＲ送信条件に関するＰＨＲ設定情報を送信する。例えば当該通知には、ＲＲＣシグナリングが用いられる。ユーザ端末は、通知されたＰＨＲ設定情報に基づいて、ＰＨＲを送信するタイミングを判断する。つまり、ＰＨＲ送信条件を満たす場合、ＰＨＲがトリガされる。

【００２０】

ここで、ＰＨＲ設定情報としては、例えば、２つのタイマ（periodicPHR-Timer及びprohibitPHR-Timer）と、所定の閾値（dl-PathlossChange）と、を用いることができる。例えば、prohibitPHR-Timerが満了（expire）し、下りリンクのパスロス値が以前のＰＨＲ送信時の値からdl-PathlossChange以上値が変化した場合に、ＰＨＲがトリガされる。また、periodicPHR-Timerが満了した場合にも、ＰＨＲがトリガされる。他にもＰＨＲがトリガされる条件は規定され得るが、ここでは説明を省略する。ＰＨＲ設定情報は、ＰＨＲタイマ及びパラメータセットと呼ばれてもよい。

【００２１】

しかしながら、既存システム（Ｒｅｌ．１０～１２）では、５ＣＣ以下のＣＡを前提としているため、６ＣＣ以上のＣＡを適用する場合に、どのようにＰＨＲを送信するかが定められていない。このため、全ＣＣについてのＰＨ情報を無線基地局に通知できない場合がある。

【００２２】

また、既存システムのＣＡでは、ＰＵＣＣＨを送信可能なＣＣは１ＣＣ以下であったため、２ＣＣ以上でＰＵＣＣＨを送信可能な場合のＰＨＲ構成が定められていない。このため、無線基地局は所定のＰＵＣＣＨセルについて、ＰＨを適切に把握できないおそれがある。

【００２３】

以上のように、６ＣＣ以上のＣＡを適用する場合には、適切なＰＨＲ報告を行うことができず、無線基地局がユーザ端末の各ＣＣの上り送信電力を適切に制御できなくなるおそれがある。これにより、上りリンクスループットの低下や通信品質の劣化を招き、拡張ＣＡの効率が劣化するおそれがある。

【００２４】

そこで、本発明者らは、ＬＴＥ　Ｒｅｌ．１３以降において、６個以上のＣＣ（例えば、３２個のＣＣ）に対応した上り送信電力制御を可能とするために、既存システムとは異なる新しいＰＨＲ構成を導入することを着想し、本発明に至った。

【００２５】

以下、本発明に係る実施形態について説明する。各実施形態では、ユーザ端末が従来のＰＨＲ（ＰＨＲ　ＭＡＣ　ＣＥ）でサポートできない９個以上のＣＣを設定される場合の例について説明するが、本発明の適用はこれに限られるものではない。例えば、８個以下、５個以下のＣＣを設定される場合であっても、各実施形態で説明するＰＨＲを用いることができる。

【００２６】

（第１の実施形態：ＣＡベースのＰＨＲ）

本発明の第１の実施形態では、従来のＣＡで用いられるＰＨＲをさらに拡張したＰＨＲを用いる。

【００２７】

図３は、第１の実施形態におけるＰＨＲタイマ及びパラメータセットの適用範囲を示す図である。図３に示されるように、第１の実施形態によれば、全ＰＵＣＣＨ　ＣＧ（つまり全ＣＣ）を１つのタイマ及びパラメータセットで管理する。つまり、いずれかのＣＣでＰＨＲがトリガされたら、アクティベートされた（アクティブな）全ＣＣのＰＨ情報を含むＰＨＲを送信する。

【００２８】

図４は、第１の実施形態におけるＰＨＲ　ＭＡＣ　ＣＥの一例を示す図である。図４の構成では、既存システムのＣＡで用いられるＰＨＲ（Extended PHR MAC CE）とは異なり、最大３２セルについてのＰＨ情報を含むことができる。ＰＵＣＣＨセル（ＰＣｅｌｌ及びＰＵＣＣＨ　ＳＣｅｌｌ）については、Ｔｙｐｅ　２　ＰＨ情報も含める。

【００２９】

図４に示すように、ＣＡベースの場合、各セルについて昇順に、Ｔｙｐｅ　２　ＰＨ情報及びＴｙｐｅ　１　ＰＨ情報を含むようにＰＨＲが構成される。ここで、Ｔｙｐｅ　２　ＰＨ情報を通知する必要のないＣＣ（ＰＵＣＣＨが設定されていないＳＣｅｌｌ）については、Ｔｙｐｅ　１　ＰＨ情報のみが含まれる。

【００３０】

以上、第１の実施形態によれば、６ＣＣ以上のＣＡを適用する場合であっても、全てのＣＣのＰＨ情報を含むＰＨＲを無線基地局に通知することができる。

【００３１】

（第２の実施形態：ＤＣベースのＰＨＲ）

本発明の第２の実施形態では、従来のＤＣで用いられるＰＨＲをさらに拡張したＰＨＲ

を用いる。

[００３２]

図５は、第２の実施形態におけるＰＨＲタイマ及びパラメータの適用範囲を示す図である。図５に示されるように、第２の実施形態によれば、ＰＵＣＣＨ　ＣＧごとに別々のタイマ及びパラメータセットで管理する。また、いずれかのＣＣでＰＨＲがトリガされたら、アクティベートされた（アクティブな）全ＣＣのＰＨ情報を含むＰＨＲを送信する。

[００３３]

図６は、第２の実施形態におけるＰＨＲ　ＭＡＣ　ＣＥの一例を示す図である。図６の構成では、既存システムのＤＣで用いられるＰＨＲ（Dual Connectivity PHR MAC CE）とは異なり、最大３２セルについてのＰＨ情報を含むことができる。ＰＵＣＣＨセル（ＰＣｅｌｌ及びＰＵＣＣＨ　ＳＣｅｌｌ）については、Ｔｙｐｅ　２　ＰＨ情報も含める。

[００３４]

図６に示すように、ＤＣベースの場合、ＰＵＣＣＨセルについて昇順に、まずＴｙｐｅ　２　ＰＨ情報を含み、その後各セルについて昇順に、Ｔｙｐｅ　１　ＰＨ情報を含むようにＰＨＲが構成される。ここで、Ｔｙｐｅ　２　ＰＨ情報を通知する必要のないＣＣ（ＰＵＣＣＨが設定されていないＳＣｅｌｌ）については、Ｔｙｐｅ　１　ＰＨ情報のみが含まれる。

[００３５]

以上、第２の実施形態によれば、６ＣＣ以上のＣＡを適用する場合であっても、全てのＣＣのＰＨ情報を含むＰＨＲを無線基地局に通知することができる。

[００３６]

なお、第１及び第２の実施形態に示した例は一例に過ぎず、データの配列順、数などはこれに限られない。例えば、情報を含めるセル数は最大３２セルに限られない。また、ＰＵＣＣＨ　ＳＣｅｌｌについては、Ｔｙｐｅ　２　ＰＨ情報を含めない構成とすることで、情報量を低減してもよい。

[００３７]

また、第１及び第２の実施形態におけるＰＨＲ　ＭＡＣ　ＣＥに対応して、既存システム（Ｒｅｌ．１０～１２）で利用されていないＬＣＩＤ（Logical Channel ID）が利用されてもよい。つまり、ＭＡＣ　ＰＤＵがＭＡＣヘッダに所定のＬＣＩＤを含むことで、当該ＭＡＣ　ＰＤＵが第１又は第２の実施形態におけるＰＨＲに相当するＭＡＣ　ＣＥを含むことを示してもよい。

[００３８]

（第３の実施形態：ＰＨＲ　ＣＧ単位のＰＨＲ）

本発明の第３の実施形態では、ＣＣを所定の規則に基づいてグルーピングしたＰＨＲ　ＣＧ（ＰＨＲセルグループ）単位で生成したＰＨＲを用いる。

[００３９]

第３の実施形態の説明の前に、本発明者らが当該実施形態を見出すに至るまでの検討及び着想について概説する。

[００４０]

上述した第１及び第２の実施形態によれば、既存システムのＰＨＲをベースとして拡張ＣＡに対応したＰＨＲを利用することができるため、実装コストは低く、移行が容易に行えるというメリットがある。一方で、第１の実施形態のように１つのＰＨＲタイマ及びパラメータセットで管理する場合、ＣＣごと（又はＣＧごと）に異なるＰＨ報告周期やＰＨ報告条件を設定することができない。例えば、ＰＵＣＣＨ　ＣＧ１は小さなパスロス変化でＰＨＲを送信させ、ＰＵＣＣＨ　ＣＧ２は大きなパスロス変化でＰＨＲを送信させる、といった制御ができない。

[００４１]

また、第１及び第２の実施形態では、いずれかのＣＣでＰＨ報告がトリガされたときにアクティブな全ＣＣのＰＨ情報を送信することを前提としているが、その分オーバヘッド

が大きいという課題がある。ここで、ＰＵＣＣＨ　ＳＣｅｌｌのＴｙｐｅ　２　ＰＨ情報を削減することによりオーバヘッドは低減可能である。しかしながら、Ｔｙｐｅ　２　ＰＨ情報がＰＨＲに含まれない場合、無線基地局はＰＵＣＣＨ　ＳＣｅｌｌの電力を正しく把握できなくなる。

【００４２】

これらの課題について、以下で詳しく説明する。図７は、第１の実施形態におけるＰＨＲトリガのタイミングの一例を示す図である。本例において、拡張ＣＡの構成は図３と同じとする。また、ＰＵＣＣＨ　ＣＧ２については、下りリンクのパスロスが１ｄＢ変化した際（dl-PathlossChange=1dB）にＰＨＲを報告させる比較的細かなＴＰＣ（Transmit Power Control）が好ましく、ＰＵＣＣＨ　ＣＧ３については、パスロスが３ｄＢ変化した際（dl-PathlossChange=3dB）にＰＨＲを報告させる比較的大まかなＴＰＣが好ましい場合を想定する。

【００４３】

第１の実施形態では、１つのＰＨＲパラメータセットを用いることしかできないため、ＰＵＣＣＨ　ＣＧ３向けのパラメータセットでは、ＰＵＣＣＨ　ＣＧ２の電力制御を適切に行うことができない。一方、ＰＵＣＣＨ　ＣＧ２向けのパラメータセットでは、ＰＵＣＣＨ　ＣＧ３によるＰＨＲトリガが増大し、不要な通信が増大することが問題となる。

【００４４】

オーバヘッドについて、ＰＵＣＣＨ　ＣＧ２向けのパラメータセットを用いる場合を例に説明する。図７の時刻t_1及びt_2では、ＣＧ２のパスロス変化によりＰＨＲがトリガされ、時刻t_3では、ＣＧ３のパスロス変化によりＰＨＲがトリガされる。

【００４５】

図８は、図７の時刻t_1及びt_2で送信されるＰＨＲの一例を示す図である。これらの時刻間でＰＳＤ（送信電力密度）が変化したＣＧはＰＵＣＣＨ　ＣＧ２のみである。したがって、ＰＵＣＣＨ　ＣＧ２以外のＰＨ情報は、これらのＰＨＲで同じ（又はほぼ同じ）内容が通知されるため、冗長である。

【００４６】

次に、第１の実施形態において、ＰＵＣＣＨ　ＳＣｅｌｌのＴｙｐｅ　２　ＰＨ情報を削減することについて検討する。図９は、余剰電力（ＰＨ）とＰＵＣＣＨ／ＰＵＳＣＨ送信電力との関係の一例を示す図である。図９Ａ及び９Ｂは、ＰＣｅｌｌに関する。各電力は、以下の通りである。

（ＰＵＳＣＨに用いられる電力）　＝　$P_{CMAX,c}2-PH1$、

（ＰＵＣＣＨに用いられる電力）　＝　$P_{CMAX,c}1-PH2-(P_{CMAX,c}2-PH1)$。

ここで、ＰＨ１は、Ｔｙｐｅ　１　ＰＨであり、ＰＨ２は、Ｔｙｐｅ　２　ＰＨである。

【００４７】

図９Ｃは、ＰＵＣＣＨ　ＳＣｅｌｌに関する。ＰＵＳＣＨに用いられる電力は、$P_{CMAX,c}m-PH1$で求めることができる。一方、Ｔｙｐｅ　２　ＰＨに関する情報が使えない場合、無線基地局はＰＵＣＣＨ　ＳＣｅｌｌのＰＵＣＣＨに用いられる電力を特定することができない。このため、オーバヘッドを低減するためにＴｙｐｅ　２　ＰＨに関する情報を削減することは、好ましくない。

【００４８】

第２の実施形態の場合、ＣＧごとにタイマ及びパラメータセットを設定できるため、ＣＧごとのＰＨ報告周期の変更や、異なるパスロス変化をトリガとする設定が可能である。図１０は、第２の実施形態におけるＰＨＲトリガのタイミングの一例を示す図である。図１０Ａは、各ＰＵＣＣＨ　ＣＧのＰＨＲタイマ及びパラメータセットを示す。各ＣＧでＰＨＲタイマ及びパラメータセットが独立に設定されている。

【００４９】

図１０Ｂは、図１０ＡのＰＨＲタイマ及びパラメータセットに従って制御されるＰＨＲトリガのタイミングの一例を示す図である。ここでは、時刻０ｍｓで両ＣＧの各タイマが

起動したものとして説明する。ｔ＝１０ｍｓでは、ＣＧ１のprohibitPHR-Timerが満了し、かつパスロス値がdl-PathlossChange以上変動しているため、ＣＧ１のＰＨＲが送信される。また、ｔ＝２０ｍｓでは、ＣＧ２のprohibitPHR-Timerが満了し、かつパスロス値がdl-PathlossChange以上変動しているため、ＣＧ２のＰＨＲが送信される。なお、あるＣＧでＰＨＲが送信されると、当該ＣＧのタイマはリスタートされる。

【００５０】

図１１は、図１０Ｂで送信されるＰＨＲの一例を示す図である。具体的には、図１１Ａは、図１０Ｂのｔ＝１０ｍｓ、７０ｍｓで送信されるＰＨＲの一例を示す図である。また、図１１Ｂは、図１０Ｂのｔ＝２０ｍｓ、９０ｍｓで送信されるＰＨＲの一例を示す図である。

【００５１】

図１１Ａに示すＣＧ１のＰＨＲについて、ＰＳＤが変化したＣＧはＰＵＣＣＨ　ＣＧ１のみである。したがって、ＰＵＣＣＨ　ＣＧ１以外のＰＨ情報は、変化していない。また、図１１Ｂに示すＣＧ２のＰＨＲについて、ＰＳＤが変化したＣＧはＰＵＣＣＨ　ＣＧ２のみである。したがって、ＰＵＣＣＨ　ＣＧ２以外のＰＨ情報は、変化していない。

【００５２】

このように、ＣＧごとにＰＨＲタイマ及びパラメータセットを設定した場合であっても、ＰＨＲには他のＣＧに関するＰＨ情報が含まれてしまい、無駄なオーバヘッドが生じることとなる。

【００５３】

また、図１０Ｂでは、ｔ＝７０ｍｓやｔ＝９０ｍｓにおいて、２つのＣＧ両方がＰＨＲ送信条件を満たすため、２つのＰＨＲが送信される。ところが、各ＣＧで送信されるＰＨＲは、全く同じ内容である。したがって、一方のＰＨＲが含む情報は全くのオーバヘッドである。

【００５４】

また、第２の実施形態であっても、図９で述べたように、Ｔｙｐｅ　２　ＰＨ情報がない場合、ＰＵＣＣＨに用いられる電力を特定することができないため、オーバヘッドの削減は容易でない。

【００５５】

本発明者らは、以上説明したような課題について検討した。この結果、ＣＣを所定の規則に基づいてグルーピングすることを着想した。また、ＰＨＲに、全アクティブＣＣのＰＨ情報を含めるのではなく、所定のグループに属するＣＣのＰＨ情報のみを含めるようにすることを着想した。そして本発明者らは、これらの着想に基づいて、本発明の第３の実施形態を見出した。本発明の第３の実施形態の構成によれば、グループごとにＰＨＲタイマ及びパラメータを独立に設定することができるとともに、ＰＨＲのオーバヘッドを大きく低減することができる。

【００５６】

以下、本発明の第３の実施形態について説明する。

【００５７】

＜ＰＨＲ　ＣＧの構成＞

第３の実施形態では、ユーザ端末には、ＰＨＲセルグループ（ＰＨＲ　ＣＧ）が設定される。ＰＨＲ　ＣＧは、１つ以上のＣＣを含むように構成される。ユーザ端末は、各ＰＨＲ　ＣＧについて、異なるＰＨＲタイマ及びパラメータを用いてＰＨＲの送信タイミングの制御を行う。

【００５８】

ＰＨＲ　ＣＧは、既存のＣＧや、別途規定されるＣＧなどに基づいて構成されてもよい。例えば、ＰＨＲ　ＣＧは、ＰＵＣＣＨ　ＣＧに基づいて構成されてもよいし、ＴＡＧ（Timing Advance Group）に基づいて構成されてもよい。

【００５９】

ユーザ端末は、所定のＭＡＣ　ＣＥに、特定のＰＨＲ　ＣＧに属するアクティブセルの

ＰＨに関する情報のみを含むように構成する。また、ＰＵＣＣＨセル（ＰＣｅｌｌ及びＰＵＣＣＨ　ＳＣｅｌｌ）に関しては、Ｔｙｐｅ　１　ＰＨ情報だけでなく、Ｔｙｐｅ　２　ＰＨ情報も含める。

【００６０】

図１２及び１３を参照して、ＰＨＲ　ＣＧと他の種類のＣＧとの想定される対応関係について説明する。ここでは、他の種類のＣＧとしてＰＵＣＣＨ　ＣＧを例に挙げるが、これに限られるものではない。また、ユーザ端末は３２ＣＣをＣＡするように設定されているものとするが、これに限られない。

【００６１】

図１２は、ＰＨＲ　ＣＧとＰＵＣＣＨ　ＣＧとの対応関係の一例を示す図である。図１２Ａは、ユーザ端末が単一のＰＵＣＣＨ　ＣＧを設定されている場合の一例を示す。本例では、ＰＵＣＣＨ　ＣＧに含まれるＣＣは、８ＣＣを構成単位として４つのＰＨＲ　ＣＧに割り振られる。また、図１２Ｂは、ユーザ端末が複数のＰＵＣＣＨ　ＣＧを設定されている場合の一例を示す。本例では、１つのＰＵＣＣＨ　ＣＧが１つのＰＨＲ　ＣＧに対応するように構成されている。

【００６２】

図１３は、ＰＨＲ　ＣＧとＰＵＣＣＨ　ＣＧとの対応関係の別の一例を示す図である。図１３Ａは、ＰＨＲ　ＣＧの数がＰＵＣＣＨ　ＣＧの数より多くなるように構成する場合の一例を示す。本例では、複数のＰＨＲ　ＣＧが１つのＰＵＣＣＨ　ＣＧに対応するように構成されている。図１３Ｂは、ＰＨＲ　ＣＧの数がＰＵＣＣＨ　ＣＧの数より少なくなるように構成する場合の一例を示す。本例では、１つのＰＨＲ　ＣＧが複数のＰＵＣＣＨ　ＣＧに対応するように構成されている。

【００６３】

図１２及び１３で示すように、ＰＨＲ　ＣＧは柔軟に構成することができる。したがって、同じＰＨＲタイマ及びパラメータを適用したいＣＣの組み合わせに応じて、適切なＰＨＲ　ＣＧを設定することができる。

【００６４】

なお、ＰＨＲ　ＣＧの構成に関する情報は、例えば、下り制御信号（ＤＣＩ）、上位レイヤシグナリング（例えば、ＲＲＣシグナリング）、報知情報、又はこれらの組み合わせなどによって、ユーザ端末に通知されてもよい。例えば、ＰＨＲ　ＣＧとＰＵＣＣＨ　ＣＧＣとの対応関係の設定情報が通知されてもよいし、ＰＨＲ　ＣＧを構成するＣＣの情報が通知されてもよい。ＰＨＲ　ＣＧの構成に関する情報は、ＰＨＲ設定情報とともに、又はＰＨＲ設定情報に含まれて送信されてもよい。また、ＰＨＲ　ＣＧの構成に関する情報は、予め設定されていてもよい。

【００６５】

＜ＰＨＲの送信方法＞

第３の実施形態において、ＰＨＲの送信方法として、以下の２つを説明する。方法１では、ＰＨＲ　ＣＧｎ（ｎは、例えば自然数）のＰＨＲは、当該ＰＨＲ　ＣＧｎに含まれるアクティベートされたＣＣのいずれかで送信される。方法２では、ＰＨＲ　ＣＧｎ（ｎは、例えば自然数）のＰＨＲは、ＰＨＲ　ＣＧに関係なく任意のアクティベートされたセルで送信される。

【００６６】

つまり、方法１では、所定のＣＧに関するＰＨＲ　ＭＡＣ　ＣＥを、当該所定のＣＧに属するセルで送信することができる。また、方法２では、所定のＣＧに関するＰＨＲ　ＭＡＣ　ＣＥを、当該所定のＣＧと同じＣＧに属するＣＣ及び／又は異なるＣＧに属するＣＣで送信することができる。これらのＰＨＲ　ＭＡＣ　ＣＥは、従来のＰＨＲ　ＭＡＣ　ＣＥ（Extended PHR MAC CE、Dual Connectivity PHR MAC CEなど）に比べて多くの情報を含むことができる。

【００６７】

図１４は、方法１の概念説明図である。図１４では、ユーザ端末は３２ＣＣでＣＡする

ように設定されており、ＰＨＲ　ＣＧ１がＰＣｅｌｌ及びＳＣｅｌｌ　１～１５で構成され、ＰＨＲ　ＣＧ２がＳＣｅｌｌ　１６～３１で構成されるように設定されている。

【００６８】

また、本例ではＳＣｅｌｌ　１５及びＳＣｅｌｌ　１６にＰＵＳＣＨが割り当てられており、これらのＰＵＳＣＨでＰＨＲ　ＣＧ１及び２のＰＨＲがそれぞれ送信されるものとする。なお、ＰＨＲ　ＣＧ１及び２は、それぞれＰＵＣＣＨ　ＣＧ１及び２に対応するものとするが、この構成に限られるものではない。

【００６９】

図１５は、図１４で送信されるＰＨＲ　ＭＡＣ　ＣＥの構成の一例を示す図である。図１４では、各ＰＨＲ　ＣＧはそれぞれ１６ＣＣで構成されている。このため、図１５Ａに示すように、ＰＨＲ　ＣＧ１のＰＨＲ　ＭＡＣ　ＣＥは、ＰＨＲ　ＣＧ１に含まれる１６ＣＣのＰＨ情報を含むように構成される。また、図１５Ｂに示すように、ＰＨＲ　ＣＧ２のＰＨＲ　ＭＡＣ　ＣＥは、ＰＨＲ　ＣＧ２に含まれる１６ＣＣのＰＨ情報を含むように構成される。

【００７０】

このようにすることで、冗長なＰＨ情報の送信を低減することができる。例えば、図１０Ｂに示した例では、ｔ＝１０ｍｓ、７０ｍｓ及び９０ｍｓではＰＨＲ　ＣＧ１のＰＨＲ　ＭＡＣ　ＣＥ（図１５Ａ）を送信すればよく、ｔ＝２０ｍｓ、７０ｍｓ及び９０ｍｓではＰＨＲ　ＣＧ２のＰＨＲ　ＭＡＣ　ＣＥ（図１５Ｂ）を送信すればよい。７０ｍｓ及び９０ｍｓで各ＣＧを用いてＰＨＲが送信されるが、これらのＰＨＲは、それぞれのＣＧに属するＣＣのＰＨ情報のみを含むため、冗長な情報は送信されない。

【００７１】

方法１のＰＨＲは、既存のＰＨＲとは異なる新しいＰＨＲであることを示すための情報を含む。当該新しいＰＨＲは、ＰＨＲ　ＣＧ　ＰＨＲと呼ばれてもよい。具体的には、方法１におけるＭＡＣ　ＰＤＵは、既存システム（ＲｅＩ．１０～１２）で利用されていないＬＣＩＤをＭＡＣヘッダに含む。

【００７２】

図１６は、上り共有チャネルに用いられるＬＣＩＤ値の一例を示す図である。図１６において、インデックス「１０１１１」に対応するＬＣＩＤは、当該ＬＣＩＤを含むＭＡＣ　ＰＤＵがＰＨＲ　ＣＧ　ＰＨＲに相当するＭＡＣ　ＣＥを含むことを示している。ここで、既存システムにおいて、インデックス「１０１１１」に対応するＬＣＩＤは、予約されていたに過ぎず、利用されてこなかった。

【００７３】

なお、ＰＨＲ　ＣＧ　ＰＨＲを示すＬＣＩＤは、図１６の構成に限られず、例えば別のインデックスに割り当てられてもよい。

【００７４】

方法１では、ＰＨＲを受信した無線基地局は、ＰＨＲ　ＣＧ　ＰＨＲを示すＬＣＩＤを検出した場合、当該ＰＨＲが、ＰＨＲ送信に用いられたＣＧのＰＨ情報を含むと判断する。つまり、無線基地局は、ＰＨＲ送信に用いられたＵＬサービングセルが属するＰＨＲ　ＣＧに応じて、ＰＨＲが対応するＣＧを把握する。

【００７５】

以上述べたように、方法１では、ＰＨＲ　ＭＡＣ　ＣＥに、全アクティブＣＣのＰＨ情報を含めるのではなく、ＰＨＲを送信するＰＨＲ　ＣＧに属するＣＣのＰＨ情報のみを含めるため、オーバヘッドを好適に低減することができる。なお、方法１では、任意のＰＨＲ　ＣＧに含まれるすべてのＣＣが非アクティブの場合、当該ＰＨＲ　ＣＧのＰＨＲはタイマ等に関わらず送信しないものとしてもよい。このようにすることで、使用していない（非アクティブな）ＣＣのＰＨＲが不要に送信される機会を抑え、オーバヘッドをさらに低減することができる。

【００７６】

一方、方法２は、さらに２つに大別することができる。１つは、ＭＡＣ　ＰＤＵに、複

数のＣＧに関するＰＨを含むことができるＭＡＣ　ＣＥを含む方法（方法２－１）である。もう１つは、ＭＡＣ　ＰＤＵに、１つのＣＧに関するＰＨを含むことができるＭＡＣ　ＣＥを複数含む方法（方法２－２）である。

【００７７】

図１７は、方法２の概念説明図である。図１７では、ユーザ端末は３２ＣＣでＣＡするように設定されており、ＰＨＲ　ＣＧ１がＰＣｅｌｌ及びＳＣｅｌｌ　１～１５で、ＰＨＲ　ＣＧ２がＳＣｅｌｌ　１６～３１で構成されるように設定されている。

【００７８】

また、本例ではＳＣｅｌｌ　１５のみにＰＵＳＣＨが割り当てられており、当該ＰＵＳＣＨでＰＨＲ　ＣＧ１及び２のＰＨＲが送信されるものとする。なお、ＰＨＲ　ＣＧ１及び２は、それぞれＰＵＣＣＨ　ＣＧ１及び２に対応するものとするが、この構成に限られるものではない。

【００７９】

まず、方法２－１について説明する。方法２－１のＰＨＲ　ＭＡＣ　ＣＥは、当該ＰＨＲ　ＭＡＣ　ＣＥがどのＰＨＲ　ＣＧに対応する情報を含むかを特定するためのフィールドを含む。図１８は、図１７で送信されるＰＨＲ　ＭＡＣ　ＣＥの構成の一例を示す図である。

【００８０】

方法２－１のＰＨＲ　ＭＡＣ　ＣＥでは、既存のＰＨＲ　ＭＡＣ　ＣＥに存在しない「CG_i」というフィールドが追加されている。当該フィールド「CG_i」は、ＭＡＣ　ＣＥが所定のＰＨＲ　ＣＧ（ＰＨＲ　ＣＧｉ）の情報を含むか否かを示すために用いられる。例えば、CG_iが‘１’の場合、ＰＨＲ　ＣＧｉのＰＨ情報を含むことを示してもよいし、CG_iが‘０’の場合、ＰＨＲ　ＣＧｉのＰＨ情報を含まないことを示してもよい。

【００８１】

図１８Ａは、ＰＨＲ　ＣＧ１　ＰＨＲ　ＭＡＣ　ＣＥが含む情報の一例を示す。ユーザ端末は、図１８Ａの構成において、例えば$CG_1=1$かつ$CG_2=CG_3=CG_4=0$と設定する。これにより、当該ＭＡＣ　ＣＥを受信する無線基地局は、当該ＭＡＣ　ＣＥがＣＧ１に関する情報を含むと認識することができる。

【００８２】

図１８Ｂは、ＰＨＲ　ＣＧ２　ＰＨＲ　ＭＡＣ　ＣＥが含む情報の一例を示す。ユーザ端末は、図１８Ｂの構成において、例えば$CG_2=1$かつ$CG_1=CG_3=CG_4=0$と設定する。これにより、当該ＭＡＣ　ＣＥを受信する無線基地局は、当該ＭＡＣ　ＣＥがＣＧ２に関する情報を含むと認識する。

【００８３】

なお、図１８ではCG_iとしてCG_1～CG_4の４つのフィールドを示したが、ＭＡＣ　ＣＥに含まれるCG_iの数（つまり、設定されるＰＨＲ　ＣＧの最大数）は、これに限られない。例えば、ＰＨＲ　ＣＧの最大数は４、８、１６、３２などであってもよい。

【００８４】

方法２－１のＰＨＲは、既存のＰＨＲとは異なる新しいＰＨＲであることを示すための情報を含む。具体的には、方法２－１のＭＡＣ　ＰＤＵは、既存システム（Ｒｅｌ．１０～１２）で利用されていないＬＣＩＤをＭＡＣヘッダに含む。当該ＬＣＩＤは、方法１について上述した新しいＬＣＩＤと同じであってもよいし、異なってもよい。

【００８５】

方法２－１では、ＰＨＲを受信した無線基地局は、例えばＰＨＲ　ＣＧ　ＰＨＲを示すＬＣＩＤを検出した場合、当該ＰＨＲが、複数のＣＧのＰＨ情報を含むと判断する。そして、当該無線基地局は、ＭＡＣ　ＣＥのCG_iフィールドに基づいて、当該ＭＡＣ　ＣＥがどのＣＧに関するＰＨ情報を含むかを認識し、認識したＣＧに関するＰＨ情報を取得する。

【００８６】

次に、方法２－２について説明する。方法２－２では、方法１と同じＰＨＲ　ＭＡＣ

ＣＥ（どのＰＨＲ　ＣＧに対応する情報を含むかを特定するためのフィールドを含まないＭＡＣ　ＣＥ）の構成を用いることができる。この場合、複数のＰＨＲ　ＣＧに関するＰＨＲ　ＭＡＣ　ＣＥを区別するために、ＰＨＲ　ＣＧごとに異なるＬＣＩＤを設定する。

【００８７】

図１９は、方法２の別の一例を示す図である。図１９においては、ＰＨＲ　ＣＧの最大数ｍ＝２である例を説明するが、ｍの値はこれに限られない。図１９Ａは、上り共有チャネルに用いられるＬＣＩＤ値の別の一例を示す図である。

【００８８】

図１９Ａにおいて、インデックス「１０１１１」に対応するＬＣＩＤは、ＭＡＣ　ＰＤＵに、ＰＨＲ　ＣＧ１用のＰＨＲ　ＭＡＣ　ＣＥ（例えば図１５ＡのＰＨＲ　ＣＧ１　ＰＨＲ　ＭＡＣ　ＣＥ）が含まれることを示している。また、図１９Ａにおいて、インデックス「１０１１０」に対応するＬＣＩＤは、ＭＡＣ　ＰＤＵに、ＰＨＲ　ＣＧ２用のＰＨＲ　ＭＡＣ　ＣＥ（例えば図１５ＢのＰＨＲ　ＣＧ２　ＰＨＲ　ＭＡＣ　ＣＥ）が含まれることを示している。

【００８９】

ここで、既存システムにおいて、インデックス「１０１１１」及び「１０１１０」に対応するＬＣＩＤは、予約されていたに過ぎず、利用されてこなかった。なお、ＰＨＲ　ＣＧ　ＰＨＲを示すＬＣＩＤは、図１９Ａの構成に限られず、例えば別のインデックスに割り当てられてもよい。また、方法２－２だけではなく、方法１においても、図１９Ａのようにに異なるＬＣＩＤが設定されてもよい。

【００９０】

図１９Ｂは、方法２－２におけるＰＨＲ　ＭＡＣ　ＣＥを含むＭＡＣ　ＰＤＵの一例を示す図である。当該ＭＡＣ　ＰＤＵは、ＰＨＲ　ＣＧ１及びＣＧ２両方のＰＨＲ　ＭＡＣ　ＣＥを含むように構成される。また、これら２つのＣＧに関するＭＡＣ　ＣＥを含んでいることを示すために、対応するサブヘッダ（ＬＣＩＤ＝１０１１１、１０１１０）をＭＡＣヘッダに含める。

【００９１】

方法２－２では、ＰＨＲを受信した無線基地局は、所定のＰＨＲ　ＣＧ　ＰＨＲを示すＬＣＩＤを検出した場合、当該ＰＨＲが、対応するＣＧのＰＨ情報を含むと判断する。そして、当該無線基地局は、認識したＭＡＣ　ＣＥに基づいて、対応するＣＧに関するＰＨ情報を取得する。

【００９２】

以上述べたように、方法２では、ＰＨＲには、全アクティブＣＣのＰＨ情報を含めるのではなく、所定のＰＨＲ　ＣＧに属するＣＣのＰＨ情報を含めるだけで足りるため、オーバヘッドを好適に低減することができる。また、ユーザ端末は、任意のＣＣを用いて任意のＣＧのＰＨＲを送信することができるため、ＣＣ間のトラフィック制御などをより柔軟に行うことができる。

【００９３】

方法２－１では、ＭＡＣ　ＣＥに、ＣＧを示す新たなフィールドを設けることで、複数のＣＧに関するＰＨ情報を含めることができる。方法２－２では、複数のＬＣＩＤを規定することで、ＭＡＣ　ＰＤＵに、別々のＣＧに対応する複数のＰＨＲ　ＭＡＣ　ＣＥを含めることができる。

【００９４】

なお、方法２では、任意のＰＨＲ　ＣＧに含まれるすべてのＣＣが非アクティブの場合、当該ＰＨＲ　ＣＧのＰＨＲはタイマ等に関わらず送信しないものとしてもよい。このようにすることで、使用していない（非アクティブな）ＣＣのＰＨＲが不要に送信される機会を抑え、オーバヘッドをさらに低減することができる。

【００９５】

（無線通信システム）

以下、本発明の一実施形態に係る無線通信システムの構成について説明する。この無線

通信システムでは、本発明の上記各実施形態に係る無線通信方法が適用される。なお、上記各実施形態に係る無線通信方法は、それぞれ単独で適用されてもよいし、組み合わせて適用されてもよい。

【００９６】

図２０は、本発明の一実施形態に係る無線通信システムの概略構成の一例を示す図である。無線通信システム１では、ＬＴＥシステムのシステム帯域幅（例えば、２０ＭＨｚ）を１単位とする複数の基本周波数ブロック（コンポーネントキャリア）を一体としたキャリアアグリゲーション（ＣＡ）及び／又はデュアルコネクティビティ（ＤＣ）を適用することができる。なお、無線通信システム１は、ＳＵＰＥＲ　３Ｇ、ＬＴＥ－Ａ（ＬＴＥ－Ａｄｖａｎｃｅｄ）、ＩＭＴ－Ａｄｖａｎｃｅｄ、４Ｇ、５Ｇ、ＦＲＡ（Ｆｕｔｕｒｅ　Ｒａｄｉｏ　Ａｃｃｅｓｓ）などと呼ばれても良い。

【００９７】

図２０に示す無線通信システム１は、マクロセルＣ１を形成する無線基地局１１と、マクロセルＣ１内に配置され、マクロセルＣ１よりも狭いスモールセルＣ２を形成する無線基地局１２ａ－１２ｃとを備えている。また、マクロセルＣ１及び各スモールセルＣ２には、ユーザ端末２０が配置されている。

【００９８】

ユーザ端末２０は、無線基地局１１及び無線基地局１２の双方に接続することができる。ユーザ端末２０は、異なる周波数を用いるマクロセルＣ１とスモールセルＣ２を、ＣＡ又はＤＣにより同時に使用することが想定される。また、ユーザ端末２０は、複数のセル（ＣＣ）（例えば、６個以上のＣＣ）を用いてＣＡ又はＤＣを適用することができる。

【００９９】

ユーザ端末２０と無線基地局１１との間は、相対的に低い周波数帯域（例えば、２ＧＨｚ）で帯域幅が狭いキャリア（既存キャリア、Ｌｅｇａｃｙ　ｃａｒｒｉｅｒなどと呼ばれる）を用いて通信を行うことができる。一方、ユーザ端末２０と無線基地局１２との間は、相対的に高い周波数帯域（例えば、３．５ＧＨｚ、５ＧＨｚなど）で帯域幅が広いキャリアが用いられてもよいし、無線基地局１１との間と同じキャリアが用いられてもよい。なお、各無線基地局が利用する周波数帯域の構成はこれに限られない。無線基地局１１と無線基地局１２との間（又は、２つの無線基地局１２間）は、有線接続（例えば、ＣＰＲＩ（Ｃｏｍｍｏｎ　Ｐｕｂｌｉｃ　Ｒａｄｉｏ　Ｉｎｔｅｒｆａｃｅ）に準拠した光ファイバ、Ｘ２インターフェースなど）又は無線接続する構成とすることができる。

【０１００】

無線基地局１１及び各無線基地局１２は、それぞれ上位局装置３０に接続され、上位局装置３０を介してコアネットワーク４０に接続される。なお、上位局装置３０には、例えば、アクセスゲートウェイ装置、無線ネットワークコントローラ（ＲＮＣ）、モビリティマネジメントエンティティ（ＭＭＥ）などが含まれるが、これに限定されるものではない。また、各無線基地局１２は、無線基地局１１を介して上位局装置３０に接続されてもよい。

【０１０１】

なお、無線基地局１１は、相対的に広いカバレッジを有する無線基地局であり、マクロ基地局、集約ノード、ｅＮＢ（ｅＮｏｄｅＢ）、送受信ポイント、などと呼ばれてもよい。また、無線基地局１２は、局所的なカバレッジを有する無線基地局であり、スモール基地局、マイクロ基地局、ピコ基地局、フェムト基地局、ＨｅＮＢ（Ｈｏｍｅ　ｅＮｏｄｅＢ）、ＲＲＨ（Ｒｅｍｏｔｅ　Ｒａｄｉｏ　Ｈｅａｄ）、送受信ポイントなどと呼ばれてもよい。以下、無線基地局１１及び１２を区別しない場合は、無線基地局１０と総称する。

【０１０２】

各ユーザ端末２０は、ＬＴＥ、ＬＴＥ－Ａなどの各種通信方式に対応した端末であり、移動通信端末だけでなく固定通信端末を含んでもよい。

【０１０３】

無線通信システム１においては、無線アクセス方式として、下りリンクにＯＦＤＭＡ（

直交周波数分割多元接続）が適用され、上りリンクにＳＣ－ＦＤＭＡ（シングルキャリア－周波数分割多元接続）が適用される。ＯＦＤＭＡは、周波数帯域を複数の狭い周波数帯域（サブキャリア）に分割し、各サブキャリアにデータをマッピングして通信を行うマルチキャリア伝送方式である。ＳＣ－ＦＤＭＡは、システム帯域幅を端末毎に１つ又は連続したリソースブロックからなる帯域に分割し、複数の端末が互いに異なる帯域を用いることで、端末間の干渉を低減するシングルキャリア伝送方式である。なお、上り及び下りの無線アクセス方式は、これらの組み合わせに限られない。

【０１０４】

無線通信システム１では、下りリンクのチャネルとして、各ユーザ端末２０で共有される下り共有チャネル（ＰＤＳＣＨ：Physical Downlink Shared Channel）、報知チャネル（ＰＢＣＨ：Physical Broadcast Channel）、下りＬ１／Ｌ２制御チャネルなどが用いられる。ＰＤＳＣＨにより、ユーザデータや上位レイヤ制御情報、ＳＩＢ（System Information Block）などが伝送される。また、ＰＢＣＨにより、ＭＩＢ（Master Information Block）が伝送される。

【０１０５】

下りＬ１／Ｌ２制御チャネルは、ＰＤＣＣＨ（Physical Downlink Control Channel）、ＥＰＤＣＣＨ（Enhanced Physical Downlink Control Channel）、ＰＣＦＩＣＨ（Physical Control Format Indicator Channel）、ＰＨＩＣＨ（Physical Hybrid-ARQ Indicator Channel）などを含む。ＰＤＣＣＨにより、ＰＤＳＣＨ及びＰＵＳＣＨのスケジューリング情報を含む下り制御情報（ＤＣＩ：Downlink Control Information）などが伝送される。ＰＣＦＩＣＨにより、ＰＤＣＣＨに用いるＯＦＤＭシンボル数が伝送される。ＰＨＩＣＨにより、ＰＵＳＣＨに対するＨＡＲＱの送達確認信号（ＡＣＫ／ＮＡＣＫ）が伝送される。ＥＰＤＣＣＨは、ＰＤＳＣＨ（下り共有データチャネル）と周波数分割多重され、ＰＤＣＣＨと同様にＤＣＩなどの伝送に用いられる。

【０１０６】

無線通信システム１では、上りリンクのチャネルとして、各ユーザ端末２０で共有される上り共有チャネル（ＰＵＳＣＨ：Physical Uplink Shared Channel）、上り制御チャネル（ＰＵＣＣＨ：Physical Uplink Control Channel）、ランダムアクセスチャネル（ＰＲＡＣＨ：Physical Random Access Channel）などが用いられる。ＰＵＳＣＨにより、ユーザデータや上位レイヤ制御情報が伝送される。また、ＰＵＣＣＨにより、下りリンクの無線品質情報（ＣＱＩ：Channel Quality Indicator）、送達確認信号などが伝送される。ＰＲＡＣＨにより、セルとの接続確立のためのランダムアクセスプリアンブルが伝送される。

【０１０７】

＜無線基地局＞

図２１は、本発明の一実施形態に係る無線基地局の全体構成の一例を示す図である。無線基地局１０は、複数の送受信アンテナ１０１と、アンプ部１０２と、送受信部１０３と、ベースバンド信号処理部１０４と、呼処理部１０５と、伝送路インターフェース１０６とを備えている。なお、送受信アンテナ１０１、アンプ部１０２、送受信部１０３は、それぞれ１つ以上を含むように構成されればよい。

【０１０８】

下りリンクにより無線基地局１０からユーザ端末２０に送信されるユーザデータは、上位局装置３０から伝送路インターフェース１０６を介してベースバンド信号処理部１０４に入力される。

【０１０９】

ベースバンド信号処理部１０４では、ユーザデータに関して、ＰＤＣＰ（Packet Data Convergence Protocol）レイヤの処理、ユーザデータの分割・結合、ＲＬＣ（Radio Link Control）再送制御などのＲＬＣレイヤの送信処理、ＭＡＣ（Medium Access Control）再送制御（例えば、ＨＡＲＱ（Hybrid Automatic Repeat reQuest）の送信処理）、スケジューリング、伝送フォーマット選択、チャネル符号化、逆高速フーリエ変換（

ＩＦＦＴ：Ｉｎｖｅｒｓｅ Ｆａｓｔ Ｆｏｕｒｉｅｒ Ｔｒａｎｓｆｏｒｍ）処理、プリコーディング処理などの送信処理が行われて送受信部１０３に転送される。また、下り制御信号に関しても、チャネル符号化や逆高速フーリエ変換などの送信処理が行われて、送受信部１０３に転送される。

【０１１０】

送受信部１０３は、ベースバンド信号処理部１０４からアンテナ毎にプリコーディングして出力されたベースバンド信号を無線周波数帯に変換して送信する。送受信部１０３で周波数変換された無線周波数信号は、アンプ部１０２により増幅され、送受信アンテナ１０１から送信される。送受信部１０３は、本発明に係る技術分野での共通認識に基づいて説明されるトランスミッター／レシーバー、送受信回路又は送受信装置から構成することができる。なお、送受信部１０３は、一体の送受信部として構成されてもよいし、送信部及び受信部から構成されてもよい。

【０１１１】

一方、上り信号については、送受信アンテナ１０１で受信された無線周波数信号がアンプ部１０２で増幅される。送受信部１０３はアンプ部１０２で増幅された上り信号を受信する。送受信部１０３は、受信信号をベースバンド信号に周波数変換して、ベースバンド信号処理部１０４に出力する。

【０１１２】

ベースバンド信号処理部１０４では、入力された上り信号に含まれるユーザデータに対して、高速フーリエ変換（ＦＦＴ：Ｆａｓｔ Ｆｏｕｒｉｅｒ Ｔｒａｎｓｆｏｒｍ）処理、逆離散フーリエ変換（ＩＤＦＴ：Ｉｎｖｅｒｓｅ Ｄｉｓｃｒｅｔｅ Ｆｏｕｒｉｅｒ Ｔｒａｎｓｆｏｒｍ）処理、誤り訂正復号、ＭＡＣ再送制御の受信処理、ＲＬＣレイヤ及びＰＤＣＰレイヤの受信処理がなされ、伝送路インターフェース１０６を介して上位局装置３０に転送される。呼処理部１０５は、通信チャネルの設定や解放などの呼処理や、無線基地局１０の状態管理や、無線リソースの管理を行う。

【０１１３】

なお、送受信部１０３は、ユーザ端末２０に対して、後述の送信信号生成部３０２が生成する上り送信電力制御情報や、ＰＨＲ設定情報などを含む下り信号を送信する。

【０１１４】

伝送路インターフェース１０６は、所定のインターフェースを介して、上位局装置３０と信号を送受信する。また、伝送路インターフェース１０６は、基地局間インターフェース（例えば、ＣＰＲＩ（Ｃｏｍｍｏｎ Ｐｕｂｌｉｃ Ｒａｄｉｏ Ｉｎｔｅｒｆａｃｅ）に準拠した光ファイバ、Ｘ２インターフェース）を介して隣接無線基地局１０と信号を送受信（バックホールシグナリング）してもよい。

【０１１５】

図２２は、本実施形態に係る無線基地局の機能構成の一例を示す図である。なお、図２２では、本実施形態における特徴部分の機能ブロックを主に示しており、無線基地局１０は、無線通信に必要な他の機能ブロックも有しているものとする。図２２に示すように、ベースバンド信号処理部１０４は、制御部（スケジューラ）３０１と、送信信号生成部３０２と、マッピング部３０３と、受信信号処理部３０４と、測定部３０５と、を備えている。

【０１１６】

制御部（スケジューラ）３０１は、無線基地局１０全体の制御を実施する。制御部３０１は、本発明に係る技術分野での共通認識に基づいて説明されるコントローラ、制御回路又は制御装置から構成することができる。

【０１１７】

制御部３０１は、例えば、送信信号生成部３０２による信号の生成や、マッピング部３０３による信号の割り当てを制御する。また、制御部３０１は、受信信号処理部３０４による信号の受信処理や、測定部３０５による信号の測定を制御する。

【０１１８】

制御部３０１は、システム情報、ＰＤＳＣＨで送信される下りデータ信号、ＰＤＣＣＨ及び／又はＥＰＤＣＣＨで伝送される下り制御信号のスケジューリング（例えば、リソース割り当て）を制御する。また、同期信号や、ＣＲＳ（Cell-specific Reference Signal）、ＣＳＩ－ＲＳ（Channel State Information Reference Signal）、ＤＭ－ＲＳ（Demodulation Reference Signal）などの下り参照信号のスケジューリングの制御を行う。

【０１１９】

また、制御部３０１は、ＰＵＳＣＨで送信される上りデータ信号、ＰＵＣＣＨ及び／又はＰＵＳＣＨで送信される上り制御信号（例えば、送達確認信号（ＨＡＲＱ－ＡＣＫ））、ＰＲＡＣＨで送信されるランダムアクセスプリアンブルや、上り参照信号などのスケジューリングを制御する。

【０１２０】

さらに、制御部３０１は、無線基地局１０に接続するユーザ端末２０の上り送信電力を調整するために、送信信号生成部３０２及びマッピング部３０３を制御する。具体的には、制御部３０１は、ユーザ端末２０から報告されるＰＨＲやチャネル状態情報（ＣＳＩ）、上りリンクデータの誤り率、ＨＡＲＱ再送回数などに基づいて、送信電力制御（ＴＰＣ）コマンドを含む下り制御情報（ＤＣＩ）を生成するように送信信号生成部３０２に指示を出し、当該ＤＣＩをユーザ端末２０に通知させるようにマッピング部３０３を制御する。

【０１２１】

ここで、制御部３０１は、受信信号処理部３０４から入力されるＰＨＲに基づいて、ユーザ端末２０が利用する各アクティブＣＣに関するＰＨを取得する。ここで、ＰＨＲは、従来のＣＡで用いられるＰＨＲをさらに拡張したＰＨＲ（第１の実施形態）、従来のＤＣで用いられるＰＨＲをさらに拡張したＰＨＲ（第２の実施形態）、ＰＨＲ　ＣＧ単位でＰＨ情報を含むか否かを変更できるＰＨＲ（第３の実施形態）などを用いる。

【０１２２】

また、制御部３０１は、ユーザ端末２０から通知されたＰＨＲに基づいて、ＣＣごとの余剰送信電力を算出（推定）する。そして、余剰送信電力を考慮して、スケジューリング及び送信電力制御を行ってもよい。

【０１２３】

なお、制御部３０１は、ＰＨＲタイマ及びパラメータセットを設定するための情報（ＰＨＲ設定情報）を生成してユーザ端末２０に送信するように、送信信号生成部３０２及びマッピング部３０３を制御してもよい。当該情報は、例えば全ＣＧ（全ＣＣ）に１つのタイマ及びパラメータセットを適用することを示す情報（第１の実施形態）、ＣＧごとに異なるタイマ及びパラメータセットを適用することを示す情報（第２、第３の実施形態）であってもよい。

【０１２４】

送信信号生成部３０２は、制御部３０１からの指示に基づいて、下り信号（下り制御信号、下りデータ信号、下り参照信号など）を生成して、マッピング部３０３に出力する。送信信号生成部３０２は、本発明に係る技術分野での共通認識に基づいて説明される信号生成器、信号生成回路又は信号生成装置から構成することができる。

【０１２５】

送信信号生成部３０２は、例えば、制御部３０１からの指示に基づいて、下り信号の割り当て情報を通知するＤＬアサインメント及び上り信号の割り当て情報を通知するＵＬグラントを生成する。また、下りデータ信号には、各ユーザ端末２０からのチャネル状態情報（ＣＳＩ：Channel State Information）などに基づいて決定された符号化率、変調方式などに従って符号化処理、変調処理が行われる。

【０１２６】

また、送信信号生成部３０２は、上述したように、ユーザ端末２０の上り送信電力を制御するための情報、ＰＨＲ設定情報などを含む下り信号を生成する。

【０１２７】
マッピング部３０３は、制御部３０１からの指示に基づいて、送信信号生成部３０２で生成された下り信号を、所定の無線リソースにマッピングして、送受信部１０３に出力する。マッピング部３０３は、本発明に係る技術分野での共通認識に基づいて説明されるマッパー、マッピング回路又はマッピング装置から構成することができる。
【０１２８】
受信信号処理部３０４は、送受信部１０３から入力された受信信号に対して、受信処理（例えば、デマッピング、復調、復号など）を行う。ここで、受信信号は、例えば、ユーザ端末２０から送信される上り信号（上り制御信号、上りデータ信号、上り参照信号など）である。受信信号処理部３０４は、本発明に係る技術分野での共通認識に基づいて説明される信号処理器、信号処理回路又は信号処理装置から構成することができる。
【０１２９】
受信信号処理部３０４は、受信処理により復号された情報を制御部３０１に出力する。また、受信信号処理部３０４は、受信信号や、受信処理後の信号を、測定部３０５に出力する。
【０１３０】
測定部３０５は、受信した信号に関する測定を実施する。測定部３０５は、本発明に係る技術分野での共通認識に基づいて説明される測定器、測定回路又は測定装置から構成することができる。
【０１３１】
測定部３０５は、例えば、受信した信号の受信電力（例えば、ＲＳＲＰ（Reference Signal Received Power））、受信品質（例えば、ＲＳＲＱ（Reference Signal Received Quality））やチャネル状態などについて測定してもよい。測定結果は、制御部３０１に出力されてもよい。
【０１３２】
＜ユーザ端末＞
図２３は、本実施形態に係るユーザ端末の全体構成の一例を示す図である。ユーザ端末２０は、複数の送受信アンテナ２０１と、アンプ部２０２と、送受信部２０３と、ベースバンド信号処理部２０４と、アプリケーション部２０５と、を備えている。なお、送受信アンテナ２０１、アンプ部２０２、送受信部２０３は、それぞれ１つ以上を含むように構成されればよい。
【０１３３】
送受信アンテナ２０１で受信された無線周波数信号は、アンプ部２０２で増幅される。送受信部２０３は、アンプ部２０２で増幅された下り信号を受信する。送受信部２０３は、受信信号をベースバンド信号に周波数変換して、ベースバンド信号処理部２０４に出力する。送受信部２０３は、本発明に係る技術分野での共通認識に基づいて説明されるトランスミッター／レシーバー、送受信回路又は送受信装置から構成することができる。なお、送受信部２０３は、一体の送受信部として構成されてもよいし、送信部及び受信部から構成されてもよい。
【０１３４】
送受信部２０３は、ユーザ端末２０の上り送信電力を制御するための情報、ＰＨＲ設定情報などを含む下り信号などを受信する。また、ＰＨＲ　ＣＧの構成に関する情報を受信してもよい（第３の実施形態）。
【０１３５】
ベースバンド信号処理部２０４は、入力されたベースバンド信号に対して、ＦＦＴ処理や、誤り訂正復号、再送制御の受信処理などを行う。下りリンクのユーザデータは、アプリケーション部２０５に転送される。アプリケーション部２０５は、物理レイヤやＭＡＣレイヤより上位のレイヤに関する処理などを行う。また、下りリンクのデータのうち、報知情報もアプリケーション部２０５に転送される。
【０１３６】

一方、上りリンクのユーザデータについては、アプリケーション部２０５からベースバンド信号処理部２０４に入力される。ベースバンド信号処理部２０４では、再送制御の送信処理（例えば、ＨＡＲＱの送信処理）や、チャネル符号化、プリコーディング、離散フーリエ変換（ＤＦＴ：Discrete Fourier Transform）処理、ＩＦＦＴ処理などが行われて送受信部２０３に転送される。送受信部２０３は、ベースバンド信号処理部２０４から出力されたベースバンド信号を無線周波数帯に変換して送信する。送受信部２０３で周波数変換された無線周波数信号は、アンプ部２０２により増幅され、送受信アンテナ２０１から送信される。

【０１３７】

図２４は、本実施形態に係るユーザ端末の機能構成の一例を示す図である。なお、図２４においては、本実施形態における特徴部分の機能ブロックを主に示しており、ユーザ端末２０は、無線通信に必要な他の機能ブロックも有しているものとする。図２４に示すように、ユーザ端末２０が有するベースバンド信号処理部２０４は、制御部４０１と、送信信号生成部４０２と、マッピング部４０３と、受信信号処理部４０４と、測定部４０５と、を備えている。

【０１３８】

制御部４０１は、ユーザ端末２０全体の制御を実施する。制御部４０１は、本発明に係る技術分野での共通認識に基づいて説明されるコントローラ、制御回路又は制御装置から構成することができる。

【０１３９】

制御部４０１は、例えば、送信信号生成部４０２による信号の生成や、マッピング部４０３による信号の割り当てを制御する。また、制御部４０１は、受信信号処理部４０４による信号の受信処理や、測定部４０５による信号の測定を制御する。

【０１４０】

制御部４０１は、無線基地局１０から送信された下り制御信号（ＰＤＣＣＨ／ＥＰＤＣＣＨで送信された信号）及び下りデータ信号（ＰＤＳＣＨで送信された信号）を、受信信号処理部４０４から取得する。制御部４０１は、下り制御信号や、下りデータ信号に対する再送制御の要否を判定した結果などに基づいて、上り制御信号（例えば、送達確認信号（ＨＡＲＱ－ＡＣＫ）など）や上りデータ信号の生成を制御する。

【０１４１】

また、制御部４０１は、ユーザ端末２０の上り送信電力を制御する。具体的には、制御部４０１は、無線基地局２０からのシグナリング（例えば、ＴＰＣコマンド）に基づいて、各ＣＣの送信電力を制御する。また、制御部４０１は、ＣＣごとの最大許容送信電力、ＰＵＣＣＨ送信電力、ＰＵＳＣＨ送信電力などに基づいて、各ＣＣのＰＨを算出する。算出したＰＨは、送信信号生成部４０２に出力され、ＰＨＲの作成に利用される。

【０１４２】

また、制御部４０１は、受信信号処理部４０４からＰＨＲタイマ及びパラメータセットを設定するための情報（ＰＨＲ設定情報）が入力されると、測定部４０５に対して、ＰＨＲタイマ及びパラメータの設定を行う。さらに、制御部４０１は、測定部４０５から所定のＣＧ（例えば、ＰＵＣＣＨ　ＣＧ、ＰＨＲ　ＣＧ）に関するＰＨＲをトリガするように通知された場合、送信信号生成部４０２及びマッピング部４０３に対して、対応するＰＨＲを生成して送信するように制御する。

【０１４３】

送信信号生成部４０２は、制御部４０１からの指示に基づいて、上り信号（上り制御信号、上りデータ信号、上り参照信号など）を生成して、マッピング部４０３に出力する。送信信号生成部４０２は、本発明に係る技術分野での共通認識に基づいて説明される信号生成器、信号生成回路又は信号生成装置から構成することができる。

【０１４４】

送信信号生成部４０２は、例えば、制御部４０１からの指示に基づいて、送達確認信号（ＨＡＲＱ－ＡＣＫ）やチャネル状態情報（ＣＳＩ）に関する上り制御信号を生成する。

また、送信信号生成部４０２は、制御部４０１からの指示に基づいて上りデータ信号を生成する。例えば、送信信号生成部４０２は、無線基地局１０から通知される下り制御信号にＵＬグラントが含まれている場合に、制御部４０１から上りデータ信号の生成を指示される。

【０１４５】

送信信号生成部４０２は、制御部４０１からの指示に基づいて、１ＣＧ又は複数ＣＧに関するＰＨ情報を含むＰＨＲ　ＭＡＣ　ＣＥを生成して、ＭＡＣ　ＰＤＵを構成し、送信信号に含めてマッピング部４０３に出力する。ここで、送信信号生成部４０２は、当該ＭＡＣ　ＰＤＵに、ＰＨＲ　ＭＡＣ　ＣＥが関連するＣＧを特定するための情報（例えば、ＬＣＩＤ）を含めてもよい。なお、送信信号生成部４０２は、ユーザ端末２０に設定されたＣＣ数に従って、各実施形態のＰＨＲ、既存システムのＰＨＲのうち、いずれを用いるかを決定して、決定したＰＨＲを含む送信信号を生成するようにしてもよい。

【０１４６】

マッピング部４０３は、制御部４０１からの指示に基づいて、送信信号生成部４０２で生成された上り信号を無線リソースにマッピングして、送受信部２０３へ出力する。マッピング部４０３は、本発明に係る技術分野での共通認識に基づいて説明されるマッパー、マッピング回路又はマッピング装置から構成することができる。

【０１４７】

受信信号処理部４０４は、送受信部２０３から入力された受信信号に対して、受信処理（例えば、デマッピング、復調、復号など）を行う。ここで、受信信号は、例えば、無線基地局１０から送信される下り信号（下り制御信号、下りデータ信号、下り参照信号など）である。受信信号処理部４０４は、本発明に係る技術分野での共通認識に基づいて説明される信号処理器、信号処理回路又は信号処理装置から構成することができる。また、受信信号処理部４０４は、本発明に係る受信部を構成することができる。

【０１４８】

受信信号処理部４０４は、受信処理により復号された情報を制御部４０１に出力する。受信信号処理部４０４は、例えば、報知情報、システム情報、ＲＲＣシグナリング、ＤＣＩなどを、制御部４０１に出力する。また、受信信号処理部４０４は、受信信号や、受信処理後の信号を、測定部４０５に出力する。

【０１４９】

測定部４０５は、受信した信号に関する測定を実施する。測定部４０５は、本発明に係る技術分野での共通認識に基づいて説明される測定器、測定回路又は測定装置から構成することができる。

【０１５０】

測定部４０５は、例えば、受信した信号の受信電力（例えば、ＲＳＲＰ）、受信品質（例えば、ＲＳＲＱ）やチャネル状態などについて測定してもよい。測定結果は、制御部４０１に出力されてもよい。

【０１５１】

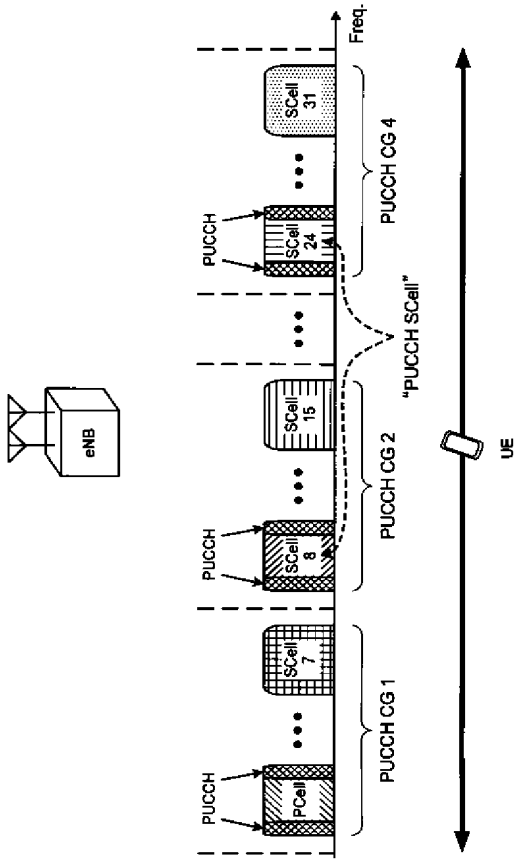
測定部４０５は、各ＣＣの下りリンクのパスロスについて測定することができる。また測定部４０５は、２つのＰＨＲタイマ（periodicPHR-Timer及びprohibitPHR-Timer）を有している。測定部４０５は、制御部４０１からＰＨＲタイマ、パスロスに関する情報を設定される。測定部４０５は、ＰＨＲタイマとパスロスに基づいて、所定のＣＧに関するＰＨＲをトリガするように、制御部４０１に通知する。

【０１５２】

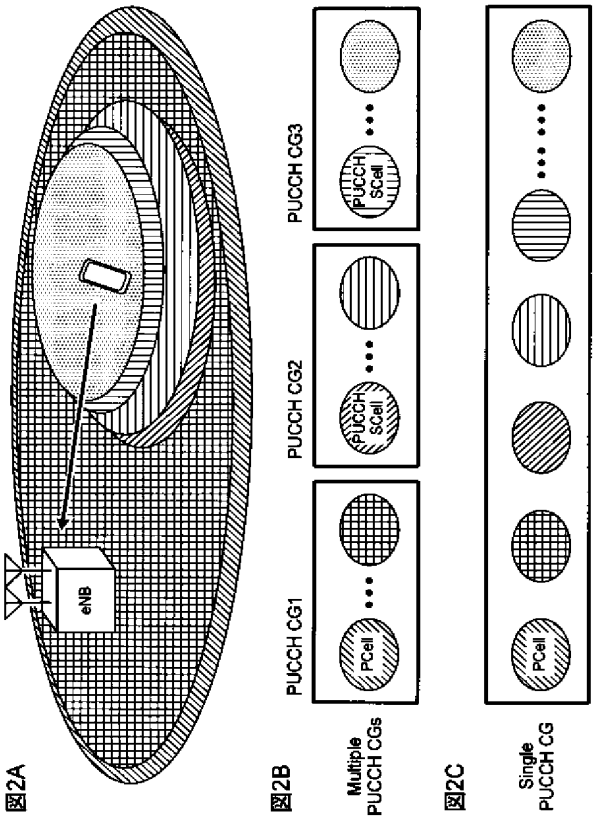
なお、上記実施形態の説明に用いたブロック図は、機能単位のブロックを示している。これらの機能ブロック（構成部）は、ハードウェア及びソフトウェアの任意の組み合わせによって実現される。また、各機能ブロックの実現手段は特に限定されない。すなわち、各機能ブロックは、物理的に結合した１つの装置により実現されてもよいし、物理的に分離した２つ以上の装置を有線又は無線で接続し、これら複数の装置により実現されてもよい。

【０１５３】
例えば、無線基地局１０やユーザ端末２０の各機能の一部又は全ては、ＡＳＩＣ（Application Specific Integrated Circuit）、ＰＬＤ（Programmable Logic Device）、ＦＰＧＡ（Field Programmable Gate Array）などのハードウェアを用いて実現されても良い。また、無線基地局１０やユーザ端末２０は、プロセッサ（ＣＰＵ：Central Processing Unit）と、ネットワーク接続用の通信インターフェースと、メモリと、プログラムを保持したコンピュータ読み取り可能な記憶媒体と、を含むコンピュータ装置によって実現されてもよい。つまり、本発明の一実施形態に係る無線基地局、ユーザ端末などは、本発明に係る無線通信方法の処理を行うコンピュータとして機能してもよい。
【０１５４】
ここで、プロセッサやメモリなどは情報を通信するためのバスで接続される。また、コンピュータ読み取り可能な記録媒体は、例えば、フレキシブルディスク、光磁気ディスク、ＲＯＭ（Read Only Memory）、ＥＰＲＯＭ（Erasable Programmable ＲＯＭ）、ＣＤ－ＲＯＭ（Compact Disc－ＲＯＭ）、ＲＡＭ（Random Access Memory）、ハードディスクなどの記憶媒体である。また、プログラムは、電気通信回線を介してネットワークから送信されても良い。また、無線基地局１０やユーザ端末２０は、入力キーなどの入力装置や、ディスプレイなどの出力装置を含んでいてもよい。
【０１５５】
無線基地局１０及びユーザ端末２０の機能構成は、上述のハードウェアによって実現されてもよいし、プロセッサによって実行されるソフトウェアモジュールによって実現されてもよいし、両者の組み合わせによって実現されてもよい。プロセッサは、オペレーティングシステムを動作させてユーザ端末の全体を制御する。また、プロセッサは、記憶媒体からプログラム、ソフトウェアモジュールやデータをメモリに読み出し、これらに従って各種の処理を実行する。
【０１５６】
ここで、当該プログラムは、上記の各実施形態で説明した各動作を、コンピュータに実行させるプログラムであれば良い。例えば、ユーザ端末２０の制御部４０１は、メモリに格納され、プロセッサで動作する制御プログラムによって実現されてもよく、他の機能ブロックについても同様に実現されてもよい。
【０１５７】
以上、本発明について詳細に説明したが、当業者にとっては、本発明が本明細書中に説明した実施形態に限定されるものではないということは明らかである。例えば、上述の各実施形態は単独で用いてもよいし、組み合わせて用いてもよい。本発明は、特許請求の範囲の記載により定まる本発明の趣旨及び範囲を逸脱することなく修正及び変更態様として実施することができる。したがって、本明細書の記載は、例示説明を目的とするものであり、本発明に対して何ら制限的な意味を有するものではない。
【０１５８】
本出願は、２０１５年３月３１日出願の特願２０１５－０７１９２４に基づく。この内容は、全てここに含めておく。

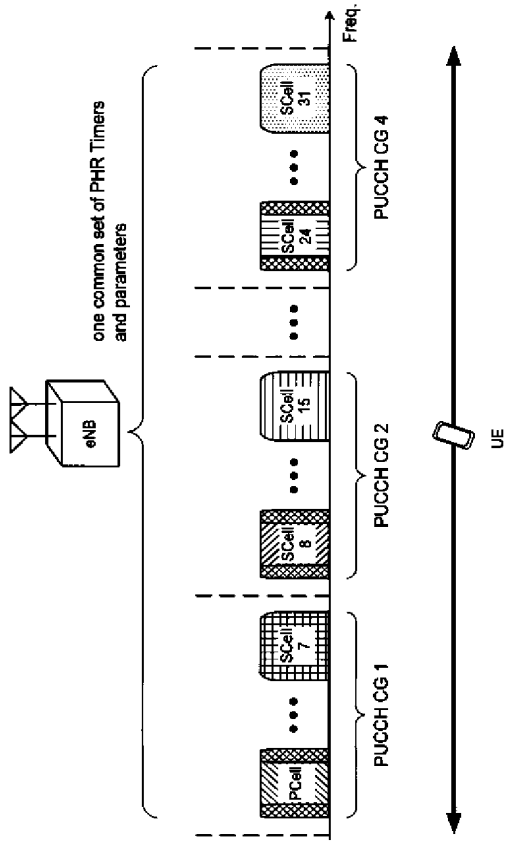
【 図 1 】


eNB
Freq.
PUCCH
PCell
SCell 7
SCell 8
SCell 15
SCell 24
SCell 31
PUCCH CG 1
PUCCH CG 2
PUCCH CG 4
"PUCCH SCell"
UE

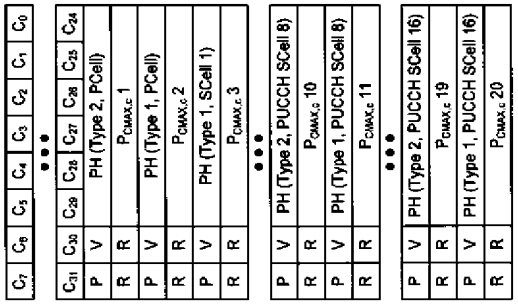
【 図 2 】


eNB
図2A
PUCCH CG1
PUCCH CG2
PUCCH CG3
PCell
PUCCH SCell
図2B
Multiple PUCCH CGs
図2C
Single PUCCH CG

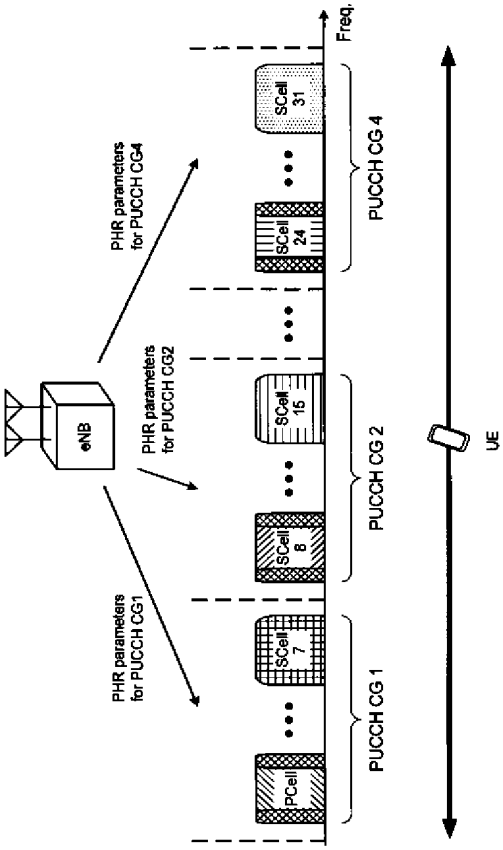
【 図 3 】


eNB
one common set of PHR Timers and parameters
Freq.
PUCCH
PCell
SCell 7
SCell 8
SCell 15
SCell 24
SCell 31
PUCCH CG 1
PUCCH CG 2
PUCCH CG 4
UE

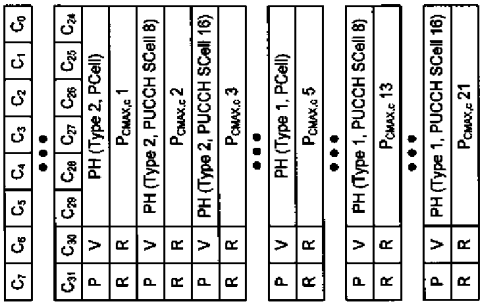
【 図 4 】


C7 C6 C5 C4 C3 C2 C1 C0
C31 C30 C29 C28 C27 C26 C25 C24
P V PH (Type 2, PCell)
R R PCMAX,c 1
P V PH (Type 1, PCell)
R R PCMAX,c 2
P V PH (Type 1, SCell 1)
R R PCMAX,c 3
P V PH (Type 2, PUCCH SCell 8)
R R PCMAX,c 10
P V PH (Type 1, PUCCH SCell 8)
R R PCMAX,c 11
P V PH (Type 2, PUCCH SCell 16)
R R PCMAX,c 19
P V PH (Type 1, PUCCH SCell 16)
R R PCMAX,c 20

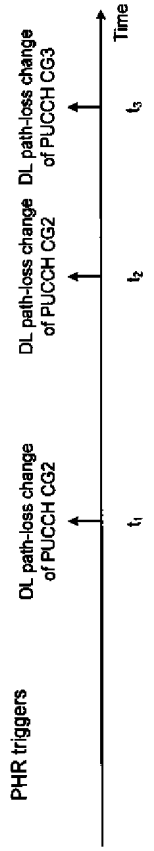
【 図 5 】


Freq.
eNB
PHR parameters for PUCCH CG1
PHR parameters for PUCCH CG2
PHR parameters for PUCCH CG4
PCell
SCell 7
SCell 8
SCell 15
SCell 24
SCell 31
PUCCH CG 1
PUCCH CG 2
PUCCH CG 4
UE

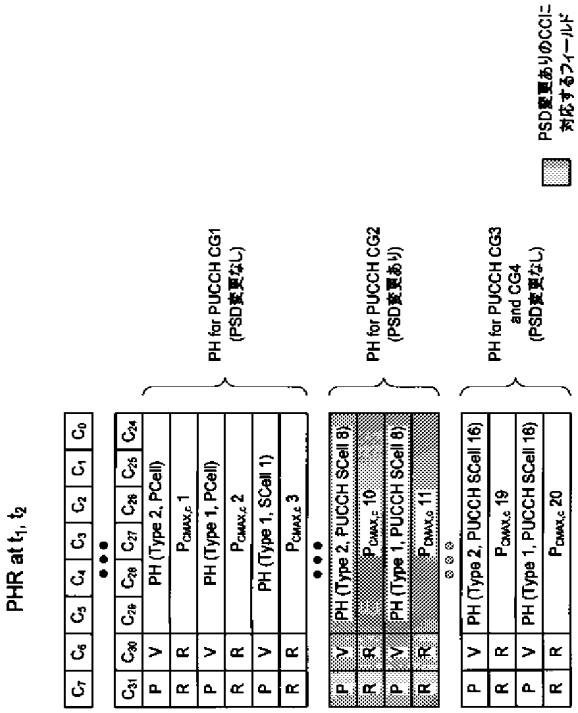
【 図 6 】


C7 C6 C5 C4 C3 C2 C1 C0
C31 C30 C29 C28 C27 C26 C25 C24
P V PH (Type 2, PCell)
R R PCMAX,c 1
P V PH (Type 2, PUCCH SCell 8)
R R PCMAX,c 2
P V PH (Type 2, PUCCH SCell 16)
R R PCMAX,c 3
P V PH (Type 1, PCell)
R R PCMAX,c 5
P V PH (Type 1, PUCCH SCell 8)
R R PCMAX,c 13
P V PH (Type 1, PUCCH SCell 16)
R R PCMAX,c 21

【 図 7 】


Time
PHR triggers
DL path-loss change of PUCCH CG2
DL path-loss change of PUCCH CG2
DL path-loss change of PUCCH CG3
t1
t2
t3

【 図 8 】


PHR at t1, t2
PH for PUCCH CG1 (PSD変更なし)
PH for PUCCH CG2 (PSD変更あり)
PH for PUCCH CG3 and CG4 (PSD変更なし)
PSD変更ありのCCに対応するフィールド
PH (Type 2, PCell)
PCMAX,c 1
PH (Type 1, PCell)
PCMAX,c 2
PH (Type 1, SCell 1)
PCMAX,c 3
PH (Type 2, PUCCH SCell 8)
PCMAX,c 10
PH (Type 1, PUCCH SCell 8)
PCMAX,c 11
PH (Type 2, PUCCH SCell 16)
PCMAX,c 19
PH (Type 1, PUCCH SCell 16)
PCMAX,c 20

【 図 9 】

図 9A

図 9B

図 9C

【 図 10 】

図10A

PHR parameters	prohibitPHR-Timer	dl-PathlossChange	periodicPHR-Timer
PUCCH CG1	10 ms	1 dB	20 ms
PUCCH CG2	20 ms	3 dB	50 ms

図10B

【 図 11 】

図 11A

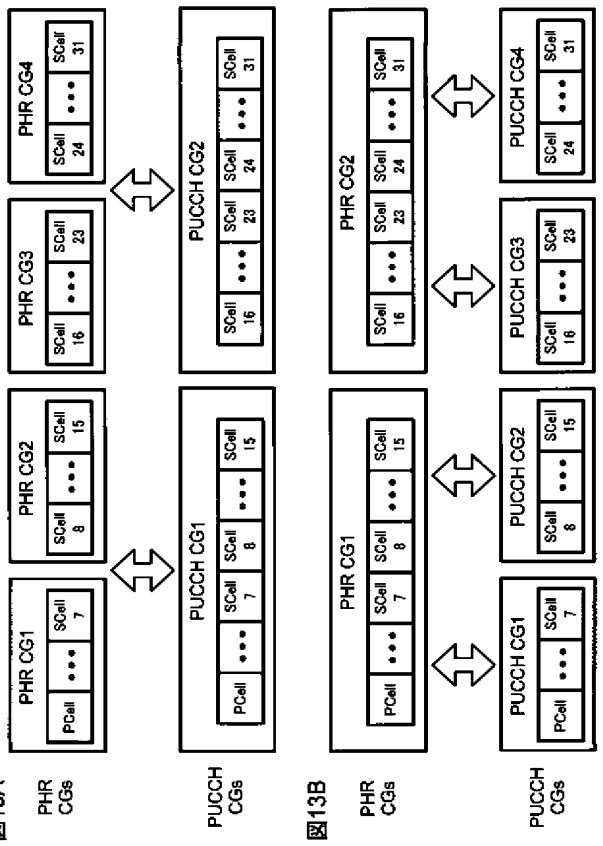
図 11B

【 図 12 】

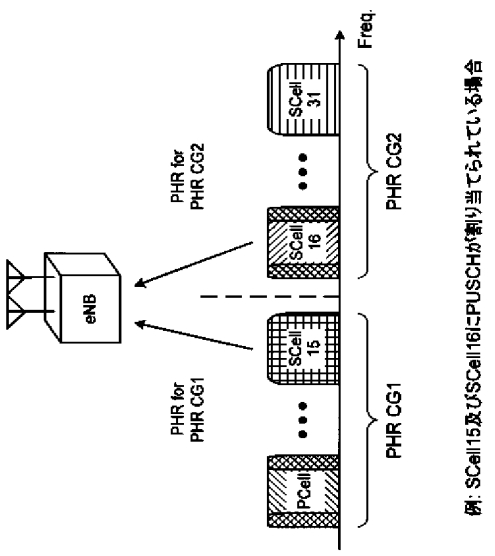
図12A

図12B

【 図１３ 】



【 図１４ 】



【 図１５ 】

図 15A

PHR CG1 PHR MAC CE

C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0
C_{16}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 3					
•••							
P	V	PH (Type 1, SCell 15)					
R	R	$P_{CMAX,c}$ 17					

図 15B

PHR CG2 PHR MAC CE

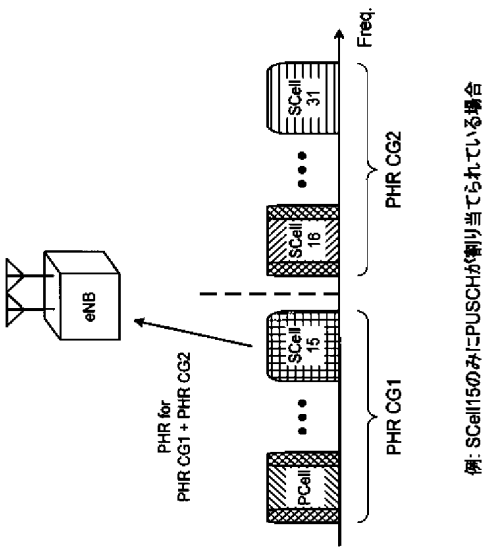
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}
P	V	PH (Type 2, PUCCH SCell 16)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PUCCH SCell 16)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, SCell 17)					
R	R	$P_{CMAX,c}$ 3					
•••							
P	V	PH (Type 1, SCell 31)					
R	R	$P_{CMAX,c}$ 17					

【 図１６ 】

UL-SCHのためのLCIDの値

Index	LCID values
00000	CCCH
00001-01010	Identity of the logical channel
01011-10110	Reserved
10111	**PHR CG Power Headroom Report**
11000	Dual Connectivity Power Headroom Report
11001	Extended Power Headroom Report
11010	Power Headroom Report
11011	C-RNTI
11100	Truncated BSR
11101	Short BSR
11110	Long BSR
11111	Padding

【 図１７ 】



例: SCell15のみにPUSCHが割り当てられている場合

【 図１８ 】

図 18A

PHR MAC CE for PHR CG 1

CG_4	CG_3	CG_2	CG_1	R	R	R	R	
C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0	
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8	
P	V	PH (Type 2, PCell)						
R	R	$P_{CMAX,c}$ 1						
P	V	PH (Type 1, PCell)						
R	R	$P_{CMAX,c}$ 2						
P	V	PH (Type 1, SCell 1)						
R	R	$P_{CMAX,c}$ 3						
•••								
P	V	PH (Type 1, SCell 15)						
R	R	$P_{CMAX,c}$ 17						

図 18B

PHR MAC CE for PHR CG 2

CG_4	CG_3	CG_2	CG_1	R	R	R	R	
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}	
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}	
P	V	PH (Type 2, PUCCH SCell 16)						
R	R	$P_{CMAX,c}$ 1						
P	V	PH (Type 1, PUCCH SCell 16)						
R	R	$P_{CMAX,c}$ 2						
P	V	PH (Type 1, SCell 17)						
R	R	$P_{CMAX,c}$ 3						
•••								
P	V	PH (Type 1, SCell 31)						
R	R	$P_{CMAX,c}$ 17						

【 図１９ 】

図 19A

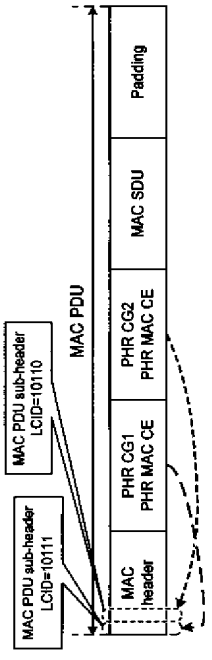
例: m = 2 の場合

UL-SCHのためのLCIDの値

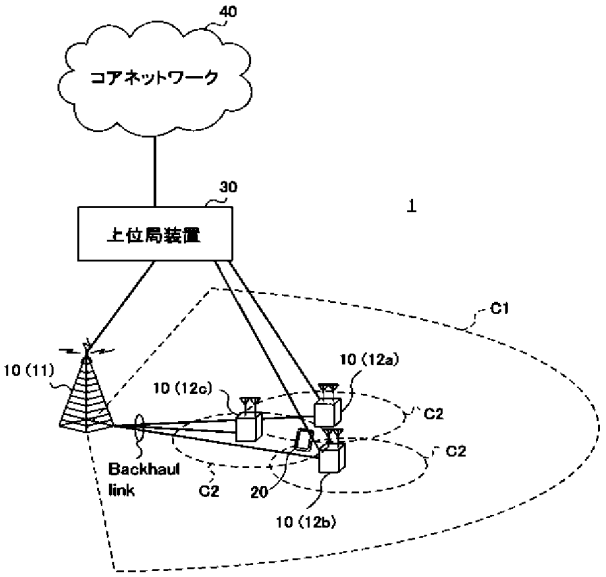
Index	LCID values
00000	CCCH
00001-01010	Identity of the logical channel
01011-10101	Reserved
10110	**PHR CG2 Power Headroom Report**
10111	**PHR CG1 Power Headroom Report**
11000	Dual Connectivity Power Headroom Report
•••	•••
11111	Padding

図 19B

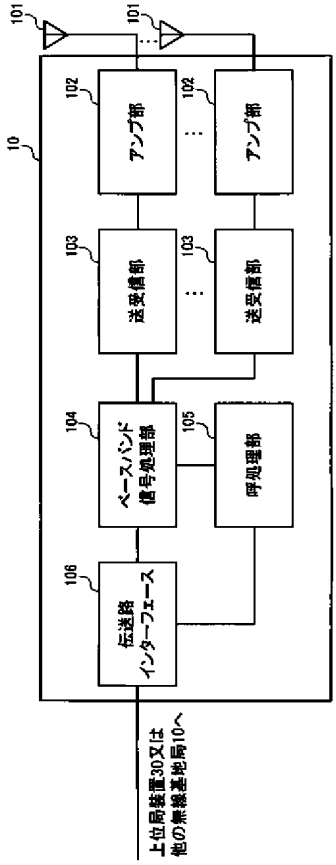
例: m = 2 の場合



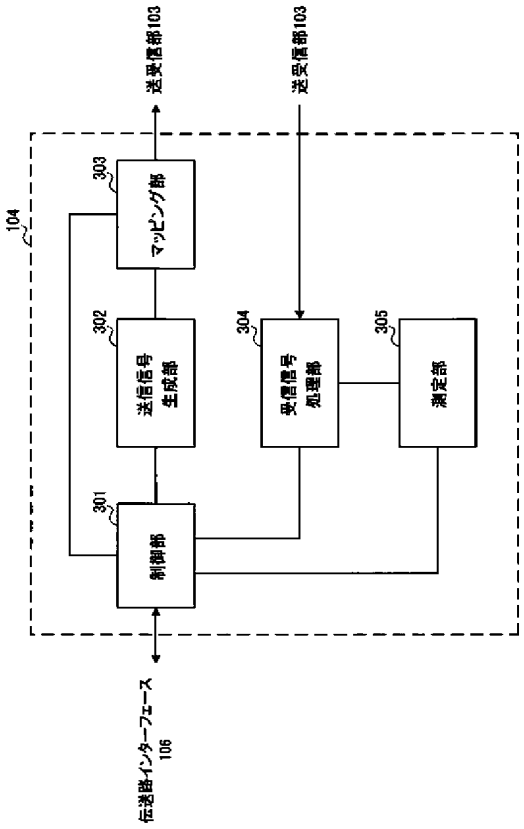
【 図２０ 】



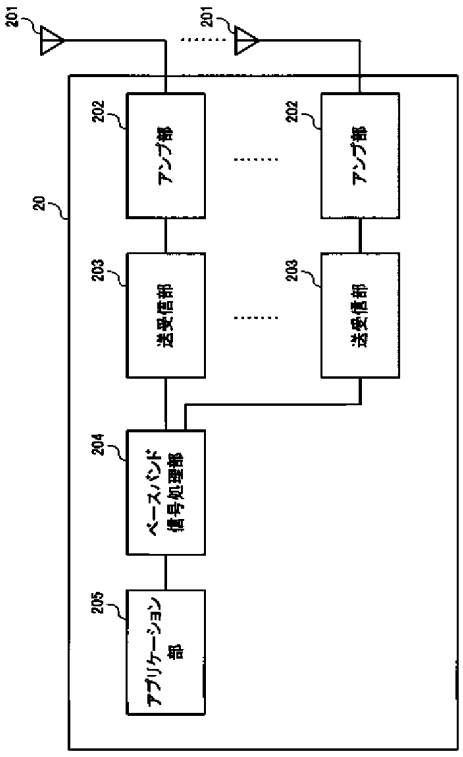
【図２１】



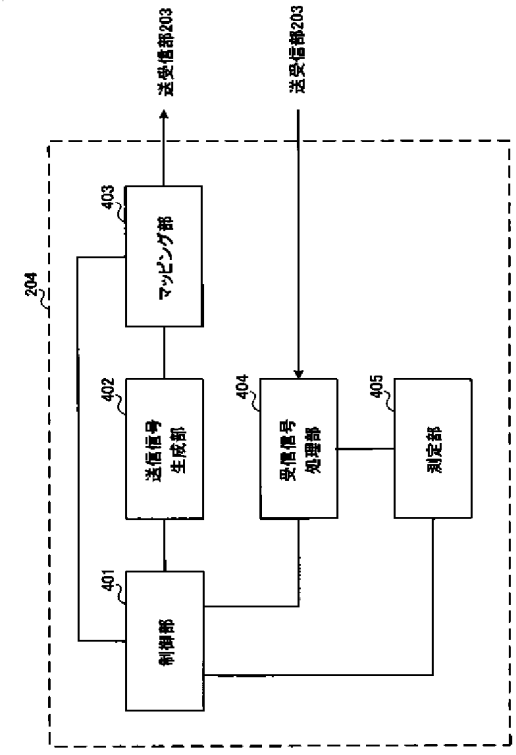
【図２２】



【図２３】



【図２４】



【 国際調査報告 】

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/058867

A. CLASSIFICATION OF SUBJECT MATTER
H04W52/34(2009.01)i, *H04J11/00*(2006.01)i, *H04J99/00*(2009.01)i, *H04W72/04*(2009.01)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)
H04W52/34, H04J11/00, H04J99/00, H04W72/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	NTT DOCOMO, INC., Discussion on PUCCH on SCell, 3GPP TSG-RAN WG2 #89 R2-150112, 2015.01.30, http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_89/Docs/R2-150112.zip	1,7,9-10 2-4,8 5-6
Y A	NTT DOCOMO, INC., PUCCH on SCell for UEs supporting UL-CA, 3GPP TSG RAN WG1 Meeting #80 R1-150509, 2015.02.18, http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_80/Docs/R1-150509.zip	2-4,8 5-6
Y	JP 2013-534769 A (Nokia Siemens Networks Oy), 05 September 2013 (05.09.2013), paragraph [0031]; fig. 11 & WO 2011/161014 A1 page 11, lines 5 to 10; fig. 11	4,8

☒ 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
24 May 2016 (24.05.16)

Date of mailing of the international search report
31 May 2016 (31.05.16)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3,Kasumigaseki,Chiyoda-ku,
Tokyo 100-8915,Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/058867

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Samsung, Power headroom report for inter-ENB CA, 3GPP TSG RAN WG2 #84 R2-133823, 2013.11.01, http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_84/Docs/R2-133823.zip	8
P,A	NTT DOCOMO, INC., Views on the remaining issues on PUCCH on SCell for up to 5 CCs, 3GPP TSG RAN WG1 Meeting #80bis R1-151967, 2015.04.11, p.1-2, http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_80b/Docs/R1-151967.zip	1-10
P,A	Huawei, HiSilicon, RRC configuration enhancement for B5C, 3GPP TSG-RAN WG2 Meeting #90 R2-152251, 2015.05.15, http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_90/Docs/R2-152251.zip	5

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

国際調査報告

国際出願番号　ＰＣＴ／ＪＰ２０１６／０５８８６７

A.　発明の属する分野の分類（国際特許分類（ＩＰＣ））

Int.Cl.　H04W52/34(2009.01)i, H04J11/00(2006.01)i, H04J99/00(2009.01)i, H04W72/04(2009.01)i

B.　調査を行った分野

調査を行った最小限資料（国際特許分類（ＩＰＣ））

Int.Cl.　H04W52/34, H04J11/00, H04J99/00, H04W72/04

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	１９２２－１９９６年
日本国公開実用新案公報	１９７１－２０１６年
日本国実用新案登録公報	１９９６－２０１６年
日本国登録実用新案公報	１９９４－２０１６年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

C.　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求項の番号
X Y A	NTT DOCOMO, INC., Discussion on PUCCH on SCell, 3GPP TSG-RAN WG2 #89 R2-150112, 2015.01.30, http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_89/Docs/R2-150112.zip	1,7,9-10 2-4,8 5-6
Y A	NTT DOCOMO, INC., PUCCH on SCell for UEs supporting UL-CA, 3GPP TSG RAN WG1 Meeting #80 R1-150509, 2015.02.18, http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_80/Docs/R1-150509.zip	2-4,8 5-6

☑　C欄の続きにも文献が列挙されている。　　☐　パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー
「A」特に関連のある文献ではなく、一般的技術水準を示すもの
「E」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「O」口頭による開示、使用、展示等に言及する文献
「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「T」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
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「Y」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「&」同一パテントファミリー文献

国際調査を完了した日 ２４．０５．２０１６	国際調査報告の発送日 ３１．０５．２０１６
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様式ＰＣＴ／ＩＳＡ／２１０（第２ページ）（２０１５年１月）

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C（続き）．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求項の番号
Y	JP 2013-534769 A (ノキア　シーメンス　ネットワークス　オサケユキチュア) 2013.09.05, 段落［００３１］, 図１１ & WO 2011/161014 A1, p.11, lines 5-10 , figure 11	4,8
Y	Samsung, Power headroom report for inter-ENB CA, 3GPP TSG RAN WG2 #84 R2-133823, 2013.11.01, http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_84/Docs/R2-133823.zip	8
P,A	NTT DOCOMO, INC., Views on the remaining issues on PUCCH on SCell for up to 5 CCs, 3GPP TSG RAN WG1 Meeting #80bis R1-151967, 2015.04.11, p.1-2, http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_80b/Docs/R1-151967.zip	1-10
P,A	Huawei, HiSilicon, RRC configuration enhancement for B5C, 3GPP TSG-RAN WG2 Meeting #90 R2-152251, 2015.05.15, http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_90/Docs/R2-152251.zip	5

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Ｆターム(参考)　5K067 AA43　DD11　EE02　EE10　GG08　JJ14

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Electronic Acknowledgement Receipt

EFS ID:	39996513
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	106622
Filer:	Sang N. Dang/Sandy Kim
Filer Authorized By:	Sang N. Dang
Attorney Docket Number:	1426-343.101
Receipt Date:	14-JUL-2020
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Time Stamp:	15:33:28
Application Type:	Utility under 35 USC 111(a)

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1		1426-343-101--IDSasFiled07142020.pdf	153574 c3c64f3bd919639ba66df4728a2ebf7727377873	yes	6

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	Document Description		**Start**	**End**	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Form (SB08)		4	5	
	Miscellaneous Incoming Letter		6	6	
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Information:					
2	Foreign Reference	WO2016158535.pdf	1082903 9be97944f7a185c9b8d1dd49ede3969258b7f6e2	no	32
Warnings:					
Information:					
3	Non Patent Literature	R2-1801043.pdf	670292 f2e6f8d6d0925a28e123a3328943050c3b50b53d	no	6
Warnings:					
Information:					
4	Non Patent Literature	R2-1804289.pdf	494668 4cf3abb676565af4203f7636d8dabc442512b90b	no	6
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5	Non Patent Literature	NPL--JPOfficeAction.pdf	90329 fe029d4c88150fe8a165e9dacbc894cb26873b9f	no	3
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Information:					
6	Non Patent Literature	NPL--JPOfficeActionEnglish.pdf	28325 dd32760ff55395ab2adb60c35d1d6fd8446fb62a	no	3
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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.

Information Disclosure Statement Transmittal

Docket Number
1426-343.101

Address To
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

In Re Application Of:

Ko-Chiang Lin

Application No.	16/395,760
Filing Date	April 26, 2019
Examiner	MD K. Talukder
Art Unit	2648

Title of Invention

METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

BASIS FOR FILING (Select 1, 2 or 3 below.)

37 CFR 1.97(b)

1) ☐ The Information Disclosure Statement submitted herewith is being filed within three months of the filing of a national application other than a continued prosecution application under 37 CFR 1.53 (d); within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; before the mailing of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

37 CFR 1.97(c)

2) ☒ The Information Disclosure Statement submitted herewith is being filed after the period specified in 37 CFR 1.97(b), but before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application, and is accompanied by one of:

a) ☒ the statement specified in 37 CFR 1.97(e);

OR

b) ☐ the fee set forth in 37 CFR 1.17(p).

37 CFR 1.97(d)

3) ☐ The Information Disclosure Statement submitted herewith is being filed after the period specified in 37 CFR 1.97(c), and on or before payment of the issue fee, and is accompanied by the Statement as specified in 37 CFR 1.97(e) and the fee set forth in 37 CFR 1.17(p).

Samsung Electronics v. Asus Tech Licensing EX-1003, 273 of 673

Information Disclosure Statement Transmittal

Docket Number
1426-343.101

STATEMENT UNDER 37 CFR 1.97(e) ACCOMPANYING INFORMATION DISCLOSURE STATEMENT

The Information Disclosure Statement submitted herewith is submitted under one of the following conditions, which satisfies the requirement under 37 CFR 1.97(e). (Select 4 or 5 below if applicable.)

4) [X] 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; or

5) [ ] 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.

Remarks (Enter Remarks Below or Attach Document Containing Remarks)

Fee set forth in 37 CFR 1.17(p):

[X] No additional fee is required.

[ ] A check in the amount of _____ is attached.

[ ] The Director is hereby authorized to charge and credit Deposit Account No. _____ as described below.

- [ ] Charge the amount of _____
- [ ] Credit any overpayment.
- [ ] Charge any additional fee required.

[ ] Payment by credit card. Form PTO-2038 is attached.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Information Disclosure Statement Transmittal

Docket Number
1426-343.101

Correspondence Address

Customer Number	106622		
-OR-			
Name			
Address			
City		State	
Country		Postal Code	
Phone Number			
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Certificate of Mailing by Express Mail

I hereby certify that this Transmittal Letter, accompanying documents and fee (if appropriate) are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date indicated below:

(Date of Mailing)

(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

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I hereby certify that this Transmittal Letter, accompanying documents and fee authorization (if appropriate) is being facsimile transmitted to the United States Patent and Trademark Office on the date indicated below:

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If a practitioner is not present in the drop-down list, you must close this form and select 'Add Practitioner...' in the Form Manager's Utility menu.

Verify that the signatory information is correct and press the 'eSign' button to electronically sign the submission. If you prefer to sign the form manually, simply do not click the 'eSign' button; just print and manually sign.

Signatory Drop-Down Box Sang N. Dang

Name	Sang N. Dang			Registration Number	51,186
Signatory Capacity	Attorney for Applicant(s)		E-mail Address	sdang@bluecapitallaw.com	
eSign	/Sang N. Dang/			Date Signed	07-14-2020

Samsung Electronics v. Asus Tech Licensing EX-1003, 275 of 673

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	16/395,760
Confirmation No.	:	4258
Applicant	:	Ko-Chiang Lin; Yu-Hsuan Guo; Ming-Che Li; Hsin-Hsi Tsai
Filed	:	July 20, 2018
Title	:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
TC/A.U.	:	2648
Examiner	:	MD K. Talukder
Docket No.	:	1426-343.101 (1070170-US)
Customer No.	:	106622

Amendment to Office Action

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

Dear Sir:

In response to the non-final Office Action mailed on April 15, 2020, having a three-month period for filing a response to **July 15, 2020**, please amend the above-identified application as follows:

Amendments to Claims begin on page 2.

Remarks begin on page 6.

IN THE CLAIMS:

1. (Original) A method for deriving a pathloss change, comprising:

a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report;

the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell;

the UE derives the pathloss change based on the first pathloss value and the second pathloss value; and

the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

2. (Original) The method of claim 1, wherein the second power headroom report is transmitted via the first PUSCH transmission if the second power headroom report is triggered.

3. (Original) The method of claim 1, wherein the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission.

4. (Original) The method of claim 3, wherein a second downlink control information (DCI) scheduling the second PUSCH transmission indicates the first pathloss reference.

5. (Original) The method of claim 3, wherein the second PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

6. (Original) The method of claim 1, wherein a first DCI scheduling the first PUSCH transmission indicates the second pathloss reference.

7. (Original) The method of claim 1, wherein the first PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference.

8. (Original) The method of claim 1, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

9. (Original) The method of claim 8, wherein the pathloss reference configuration is *PUSCH-PathlossReferenceRS*.

10. (Original) A method for deriving a pathloss change, comprising:

a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a first power headroom value included in a first power headroom report;

the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for deriving a second power headroom value;

the UE derives the pathloss change based on the first pathloss value and the second pathloss value; and

the UE determines whether a second power headroom report to include the second power headroom value is triggered based on whether the pathloss change is more than a threshold.

11. (Original) The method of claim 10, wherein the second pathloss value is not used for power control for a Physical Uplink Shared Channel (PUSCH) transmission on the serving cell.

12. (Original) The method of claim 10, wherein the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference.

13. (Original) The method of claim 10, wherein the first pathloss value is used for power control for a PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the PUSCH transmission.

14. (Original) The method of claim 13, wherein a downlink control information (DCI) scheduling the PUSCH transmission indicates the first pathloss reference.

15. (Original) The method of claim 13, wherein the PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

16. (Original) The method of claim 10, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

17. (Original) A User Equipment (UE) for deriving a pathloss change, comprising:
a control circuit;
a processor installed in the control circuit; and
a memory installed in the control circuit and operatively coupled to the processor;
wherein the processor is configured to execute a program code stored in the memory to:
derive a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report;
derive a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell;

derive the pathloss change based on the first pathloss value and the second pathloss value; and

determine whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

18. (Original) The UE of claim 17, wherein the second power headroom report is transmitted via the first PUSCH transmission if the second power headroom report is triggered.

19. (Original) The UE of claim 17, wherein the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission.

20. (Original) The UE of claim 17, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

REMARKS

Claims 1-20 are pending in the application. In the Office Action, Claims 1-4, 6, 9-11, 13-14, and 17-19 stand rejected under 35 U.S.C. § 103 as being unpatentable over Lee (U.S. Patent Publication No. 2017/0359734) in view of Nigam (U.S. Patent Publication No. 2015/0282150). *See* Office Action, Page 3. Furthermore, Claims 5, 7, and 15 stand rejected under 35 U.S.C. § 103 as being unpatentable over Lee in view of Nigam, and further in view of Dinan (U.S. Patent Publication No. 2016/0270094). *See* Office Action, Page 7. In addition, Claims 8, 12, 16 and 20 stand rejected under 35 U.S.C. § 103 as being unpatentable over Lee in view of Nigam, and further in view of Loehr (U.S. Patent Publication No. 2016/0330698). *See* Office Action, Page 8. Applicants respectfully traverse the rejection, and respectfully request reconsideration of the claims.

Claims 1 and 17 recite the UE "derives [or derive] a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell" and "derives [or derive] the pathloss change based on the first pathloss value and the second pathloss value". Similarly, claim 10 recites "derives [or derive] a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for deriving a second power headroom value" and "derives [or derive] the pathloss change based on the first pathloss value and the second pathloss value". Applicants respectfully submit that the cited prior art references fail to disclose the noted limitations.

The Office Action cites to Paragraph [0131] of Lee and alleges that Paragraph [0131] discloses the claim limitation "derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value". See Office Action, Page 4. In particular, the Office Action cites to the following language of Paragraph [0131] of Lee:

> A WTRU may measure two or more cell-specific CSI-RS and measure the received signal to noise ratio (SNR) received signal to interference plus noise ratio (SINR), which may be considered as reference signal received power (RSRP), pathloss ...

See Office Action, Page 4, citing Paragraph [0131] of Lee.

Applicants respectfully disagree. The cited language of Paragraph [0131] of Lee seems

to disclose that the WTRU may measure pathloss in general. However, the cited language from Lee does not disclose the UE "derives a second pathloss value from a second pathloss reference of the serving cell" as recited in the claims. In fact, it is unclear which pathloss value of Lee the Office Action equates to the "second pathloss value" recited in the claims, and which pathloss reference of Lee the Office Action equates to the "second pathloss reference" recited in the claims.

Furthermore, the Office Action cites to Paragraph [0103] of Lee and alleges that Paragraph [0103] discloses the claim limitation "derives the pathloss change based on the first pathloss value and the second pathloss value." *See* Office Action, Page 4. Applicants respectfully disagree. In particular, Paragraph [0103] of Lee states:

> [0103] A PHR may be triggered if: 1) a prohibitPHR-Timer expires or has expired, 2) when the WTRU has UL resources for new transmission, and 3) when the following in this transmission time interval (TTI) for any of the active SCells with configured UL is true: there are UL resources allocated for transmission or there is a PUCCH transmission on this cell, and the required power backoff due to power management (as allowed by P-MPR,) for this cell has changed more than dl-Pathloss Change dB since the last transmission of a PHR when the WTRU had UL resources allocated for transmission or PUCCH transmission on this cell.

As seen, Paragraph [0103] of Lee merely describes when PHR may be triggered. However, Paragraph [0103] of Lee does **not** disclose the UE "derives the pathloss change based on the first pathloss value and the second pathloss value" as recited in the claims. Especially, the first pathloss value and the second pathloss value are derived from different pathloss references. In fact, as discussed above, Lee does **not** even disclose the UE "derives a second pathloss value from a second pathloss reference of the serving cell."

Also, the Office Action admits that Lee is silent regarding wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell." *See* Office Action, Page 4. Nevertheless, the Office Action cites to Paragraph [0048] of Nigam in rejecting the claims. *See* Office Action, Page 4. In particular, the Office Action seems to **arbitrarily** equate the variable "P_{PUSCH}" disclosed in Nigam to the "second pathloss reference" recited in the claims. *See* Office Action, Page 4 ("Para. 48: 'P.sub.PUSCH denotes the transmit power used for the last Physical Uplink Shared Channel (PUSCH) transmission'").

Applicants respectfully disagree. As discussed above, the claims recite "derives a second pathloss value from a second pathloss reference of the serving cell". Even if the variable "P_{PUSCH}" disclosed in Nigam could be equated to the "second pathloss reference" recited in the claims, Lee and Nigam fails to disclose how "P_{PUSCH}" is used to derive the "second pathloss value." In fact, as discussed above, Lee does **not** even disclose the UE "derives a second pathloss value from a second pathloss reference of the serving cell."

For the reasons stated above, Applicants respectfully submit that claims 1-20 are patentable over the cited prior art references.

Allowance of the claims at an early date is solicited. The Examiner is invited to contact Applicant's undersigned counsel by telephone at (714) 839-3800 to expedite the prosecution of this case should there be any unresolved matters remaining.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made.

Respectfully submitted,
Sang N. Dang
BLUE CAPITAL LAW FIRM, P.C.

Dated: July 1, 2020

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Ko-Chiang Lin; Yu-Hsuan Guo; Ming-Che Li; Hsin-Hsi Tsai	
Title:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	
Serial No.:	16/395,760	Filed: April 26, 2019
Examiner:	MD K. Talukder	Group Art Unit: 2648
Attorney Docket No.:	1426-343.101 (1070170-US)	

CERTIFICATE OF EFS-WEB TRANSMISSION
UNDER 37 CFR § 1.8

I hereby certify that the enclosed 2 Page Amendment Transmittal; and 8 Page Amendment are being transmitted to the United States Patent and Trademark Office via EFS-Web on July 1, 2020.

Date: July 1, 2020 /Sandy Kim/
Sandy Kim

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Electronic Acknowledgement Receipt

EFS ID:	39889691
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	106622
Filer:	Sang N. Dang/Sandy Kim
Filer Authorized By:	Sang N. Dang
Attorney Docket Number:	1426-343.101
Receipt Date:	01-JUL-2020
Filing Date:	26-APR-2019
Time Stamp:	16:27:29
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		1426-343-101--ROAof04152020asFiled07012020.pdf	175358 dc10f36b7af2f10045cd9a0aca890fc3e7a0a033	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Amendment/Req. Reconsideration-After Non-Final Reject	3	3
	Claims	4	7
	Applicant Arguments/Remarks Made in an Amendment	8	10
	Miscellaneous Incoming Letter	11	11
Warnings:			
Information:			
	Total Files Size (in bytes):	175358	

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.

Amendment Transmittal Letter

Docket Number
1426-343.101

Address To
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Title of Invention

METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

First Named Inventor	Ko-Chiang Lin
Application No.	16/395,760
Filing Date	April 26, 2019
Examiner	MD K. Talukder
Art Unit	2648

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

☐ **Applicant claims Small Entity Status.** See 37 CFR 1.27.

Fee Calculation

Claims as Amended

For	#Filed	#Previously Paid For	#Extra	Rate	Fee
Total Claims	20	- 20 =		x ☐ =	
Total Indep. Claims	3	- 3 =		x =	
Multiple Dependent Claims (check if applicable) ☐					
				TOTAL	0

Method of Payment

☐ Deposit Account ☐ Credit Card ☐ Check ☐ Money Order ☐ Other: _____

Deposit Account Number

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge the fee(s) set forth above
☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17
☐ Charge fee(s) indicated above, **except for the filing fee**
☐ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on form PTO-2038.

Amount Grand Total 0

Amendment Transmittal Letter

Docket Number
1426-343.101

Correspondence Address

Customer Number	106622		
-OR-			
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Country		Postal Code	
Phone Number			
E-mail Address			

Certificate of Mailing by Express Mail

I hereby certify that this Amendment, accompanying documents, and fee (if appropriate) are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date indicated below:

(Date of Mailing)

(Typed or Printed Name of Person Mailing Correspondence)

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Certificate of Mailing by First Class Mail

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Certificate of Transmission

I hereby certify that this Amendment, accompanying documents, and fee (if appropriate) authorization are being facsimile transmitted to the United States Patent and Trademark Office on the date indicated below:

(Date of Transmission) *(Name of Person Transmitting Correspondence)*

(Signature of Person Transmitting Correspondence)

Signature Instructions

Select the name of the person who will electronically sign the Amendment from the drop-down box below.

If a practitioner is not present in the drop-down list, you must close this form and select 'Add Practitioner...' in the Form Manager's Utility menu.

Verify that the signatory information is correct and press the 'eSign' button to electronically sign the submission. If you prefer to sign the form manually, simply do not click the 'eSign' button; just print and manually sign.

Signatory Drop-Down Box Sang N. Dang

Name	Sang N. Dang	Registration Number	51,186
Signatory Capacity	Attorney for Applicant(s)	E-mail Address	sdang@bluecapitallaw.com
eSign	/Sang N. Dang/	Date Signed	07-01-2020

Samsung Electronics v. Asus Tech Licensing EX-1003, 288 of 673

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/395,760	Filing Date 04/26/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	07/01/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	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 $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/ALLYSON PURNELL/
*** 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 number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. 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, 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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/395,760	04/26/2019	Ko-Chiang Lin	1426-343.101	4258

106622 7590 04/15/2020

Blue Capital Law Firm, P.C.
650 Town Center Drive, Suite 1530
Costa Mesa, CA 92626

EXAMINER	
TALUKDER, MD K	

ART UNIT	PAPER NUMBER
2648	

NOTIFICATION DATE	DELIVERY MODE
04/15/2020	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@bluecapitallaw.com

Office Action Summary	Application No. 16/395,760	Applicant(s) Lin et al.	
	Examiner MD K TALUKDER	Art Unit 2648	AIA (FITF) Status Yes

-- 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 MONTHS 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 04/26/2019.

☐ 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) 1-20 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) 1-20 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 _____ 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/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

2. It would be of great assistance to the office if all incoming papers pertaining to a filed application carried the following items:

i. Application number (checked for accuracy, including series code and serial no.).
ii. Group art unit number (copied from most recent Office communication).
iii. Filing date.
iv. Name of the examiner who prepared the most recent Office action.
v. Title of invention.
vi. Confirmation number (See MPEP § 503).

3. The Examiner has pointed out particular references contained in the prior art of record within the body of this action for the convenience of the Applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages, paragraph and figures may apply. Applicant, in preparing the response, should consider fully the entire reference as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

4. **Claim interpretation**: When multiple limitations are connected with "OR", one of the limitations does have any patentable weight since both of the limitations are optional.

Claim Interpretation ("If" statements)

5. Claims 2, 8, 18, 20 contain "If" statements. It is not clear whether the functional language recited afterwards is optional step or required functionality. Examiner read the functional language recited afterwards (after "IF") is optional step. The "If statement" will never occur; according to the broadest reasonable interpretation by the examiner since it is optional. Therefore, limitations after "if" are not given any patentable weight. For the purpose of expediting the processing of the application, Claims have been rejected in view of the prior art (see below) based on a broader interpretation that meets the claimed subject matter as interpreted by the Examiner.

Claim Rejection- 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-4, 6, 9-11, 13-14, 17-19 are rejected under 35 U.S.C. 103 as being unpatentable over Lee (Pub No. 20170359734) and further in view of Nigam (Pub No. 20150282150).

Regarding claim 1, Lee discloses a method for deriving a pathloss change, comprising: a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell (Para. 99: "**A PHR may be triggered if a prohibitPHR-Timer expires or has expired and the path loss has changed more than dl-Pathloss Change dB for at least one activated Serving Cell which is used as a pathloss reference since the last transmission of a PHR when the WTRU has UL resources for new transmission**") (**dl-Pathloss Change from 1st**

pathloss- pathloss reference to 2nd path-loss); wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report (**Para. 98-99: Power headroom Report);** the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value (Para. 99) & (Para. 131: "**A WTRU may measure two or more cell-specific CSI-RS and measure the received signal to noise ratio (SNR) received signal to interference plus noise ratio (SINR), which may be considered as reference signal received power (RSRP), pathloss…**"); the UE derives the pathloss change based on the first pathloss value and the second pathloss value (Para. 103: "…**the required power backoff due to power management (as allowed by P-MPR,) for this cell has changed more than dl-Pathloss Change dB since the last transmission of a PHR when the WTRU had UL resources allocated for transmission or PUCCH transmission on this cell**") (Pathloss changed from the last path loss).

Lee is silent regarding wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

In a similar field of endeavor, Nigam discloses the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell (Para. 48) & (Para. 48: "**P.sub.CMax denotes maximum allowed transmission (Tx) power on the frequency of the serving cell and P.sub.PUSCH denotes the transmit power used for the last Physical Uplink Shared Channel (PUSCH) transmission**") and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold (Para. 45: "**The UE performs the PHR periodically of in an**

event-driven manner. For example, when the pathloss from the eNB changes more than a threshold, the UE transmits PHR") (**PHR→** power headroom report).

Therefore it would have been obvious to one of the ordinary skilled in the art before the effective filing date of the invention to use the wireless power control system of Nigam's disclosure with the wireless beam control system, as taught by Lee. Doing so would have resulted in effectively and efficiently controlling power in a wireless system to minimize path-loss in the wireless communication.

Regarding claim 2 & 18, Lee, remains as applied above and continue to teach the second power headroom report is transmitted via the first PUSCH transmission if the second power headroom report is triggered (Para. **72 & Para. 98-99**).

Regarding claim 3 & 13 & 19, Lee continues to teach the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission (Para. **72 & Para. 98-99**).

Regarding claim 4 & 14, Lee continues to teach a second downlink control information (DCI) scheduling the second PUSCH transmission indicates the first pathloss reference (Para. **78 & Para. 99**).

Regarding claim 6, Lee continues to teach a first DCI scheduling the first PUSCH transmission indicates the second pathloss reference (**Para. 78 & 131).**

Regarding claim 9, Lee teaches the pathloss reference configuration is PUSCH-PathlossReferenceRS (**Para. 118 & 119).**

Regarding claim 10, Claim 10 corresponds to claim 1 and is analyzed accordingly.

Regarding claim 11, Lee teaches the second pathloss value is not used for power control for a Physical Uplink Shared Channel (PUSCH) transmission on the serving cell Para. 72: **PUSCH used for large amount of feedback**).

Regarding claim 17, Lee discloses a User Equipment (UE) for deriving a pathloss change **(Fig. 1C)**, comprising: a control circuit; a processor installed in the control circuit **(Fig. 1B: Processor-118)**; and a memory installed in the control circuit and operatively coupled to the processor **(Fig. 1B: Processor-118 with memory-130/132)**; wherein the processor is configured to execute a program code stored in the memory to: derives a first pathloss value from a first pathloss reference of a serving cell (Para. 99: "**A PHR may be triggered if a prohibitPHR-Timer expires or has expired and the path loss has changed more than dl-Pathloss Change dB for at least one activated Serving Cell which is used as a pathloss reference since the last transmission of a PHR when the WTRU has UL resources for new transmission**") **(dl-Pathloss Change from 1st pathloss- pathloss reference to 2nd path-loss)**; wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report **(Para. 98-99: Power headroom Report);** derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value (Para. 99) & (Para. 131: "**A WTRU may measure two or more cell-specific CSI-RS and measure the received signal to noise ratio (SNR) received signal to interference plus noise ratio (SINR), which may be considered as reference signal received power (RSRP), pathloss…**"); the UE derives the pathloss change based on the first pathloss value and the second pathloss value (Para. 103: "…**the required power backoff due to power management (as allowed by P-MPR,) for this cell has changed more than dl-Pathloss Change dB since the last transmission of a PHR**

when the WTRU had UL resources allocated for transmission or PUCCH transmission on this cell") (Pathloss changed from the last path loss).

Lee is silent regarding wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

In a similar field of endeavor, Nigam discloses the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell (Para. 48) & (Para. 48: "**P.sub.CMax denotes maximum allowed transmission (Tx) power on the frequency of the serving cell and P.sub.PUSCH denotes the transmit power used for the last Physical Uplink Shared Channel (PUSCH) transmission**") and the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold (Para. 45: "**The UE performs the PHR periodically of in an event-driven manner. For example, when the pathloss from the eNB changes more than a threshold, the UE transmits PHR**") (**PHR→** power headroom report).

Claims 5, 7 & 15 are rejected under 35 U.S.C. 103 as being unpatentable over Lee (Pub No. 20170359734), in view of Nigam (Pub No. 20150282150) and further in view of Dinan (Pub No. 20160270094).

Regarding claim 5 & 15, Lee is silent regarding the second PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

Dinan discloses the second PUSCH transmission is configured by a parameter

ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference **(Para. 128 & 150).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Regarding claim 7, Lee is silent regarding the first PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference.

Dinan discloses the first PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference **(Para. 128 & 150).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Claims 8, 12 & 16 & 20 are rejected under 35 U.S.C. 103 as being unpatentable over Lee (Pub No. 20170359734), in view of Nigam (Pub No. 20150282150) and further in view of Loehr (Pub No. 20160330698).

Regarding claim 8 & 16, Lee is silent regarding the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

Loehr discloses the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report (Para. 94 & 156).

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Regarding claim 12, Lee is silent regarding the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference.

Loehr discloses the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference **(Para. 94 & 156).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Regarding claim 20, Lee is silent regarding the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

Loehr discloses the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report **(Para. 94 & 156).**

At the time of filling, it would have been obvious to use pahloss configuring system to control power based on the pathloss.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MD K TALUKDER whose telephone number is (571)270-3222. The examiner can normally be reached on 10 am to 6 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wesley Kim can be reached on 571-272-7867. 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. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MD K TALUKDER/
Primary Examiner, Art Unit 2648

Notice of References Cited	Application/Control No. 16/395,760	Applicant(s)/Patent Under Reexamination Lin et al.	
	Examiner MD K TALUKDER	Art Unit 2648	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20190349866-A1	11-2019	Lin; Ko-Chiang	H04B7/0426	1/1
*	B	US-20170359734-A1	12-2017	Lee; Moon-il	H04B7/061	1/1
*	C	US-20100272046-A1	10-2010	Guo; Yu-Hsuan	H04W72/1284	370/329
*	D	US-20150282150-A1	10-2015	Nigam; Anshuman	H04W72/0406	370/329
*	E	US-20200107272-A1	04-2020	HE; Linhai	H04W52/325	1/1
*	F	US-20200084735-A1	03-2020	Cheng; Peng	H04W52/36	1/1
*	G	US-20180132197-A1	05-2018	Lin; Ko-Chiang	H04W52/365	1/1
*	H	US-20180310257-A1	10-2018	Papasakellariou; Aris	H04W72/1289	1/1
*	I	US-20130121203-A1	05-2013	Jung; Sung Hoon	H04W52/30	370/252
*	J	US-20160057712-A1	02-2016	Wen; Pingping	H04W52/365	370/329
*	K	US-20160270094-A1	09-2016	Dinan; Esmael Hejazi	H04W52/325	1/1
*	L	US-20160330698-A1	11-2016	LOEHR; JOACHIM	H04W4/70	1/1
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
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	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
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*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.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	Art Unit
	MD K TALUKDER	2648

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	04/09/2020								
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/395,760	Lin et al.
	Examiner	Art Unit
	MD K TALUKDER	2648

CPC - Searched*		
Symbol	Date	Examiner
H04W52/242, H04W52/146, H04W52/365, H04W72/14	04/08/2020	Talukder

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
455		04/09/2020	Talukder
370		04/09/2020	Talukder

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
East Searched	04/08/2020	Talukder
Inventor Searched	04/09/2020	Talukder
Assignee Searched	04/09/2020	Talukder

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"16395760"	US-PGPUB; USPAT	OR	ON	2020/04/08 11:54
S2	0	"2017359734"	US-PGPUB; USPAT	OR	ON	2020/04/08 13:15
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S20	0	"20170359734" and (path$1loss power$1loss (path near2 loss) (power near2 loss)) and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold same (headroom PHR) and (power near3 (adjust$4 control$3)) and reference near3 signal	US-PGPUB; USPAT	OR	ON	2020/04/08 20:09
S21	115	(PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/04/09 13:24
S22	48	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT	OR	ON	2020/04/09 13:25
S23	32	(455/$.ccls. 370/$.ccls.) and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold and (path$1loss near4 (chang$3 difference different)) same ((serving adj2 cell) station eNodeB (access adj2 point) BS$1)	US-PGPUB; USPAT	OR	ON	2020/04/09 13:39
S24	3	((grant$4 near3 config$3) grant$config$3) and ("20180132197" "20180115957" "10383067" "20180049137" "10602456" "20190313348" "9826489" "20190313343" "20150319716" "20190253986" "20140219234" "9237528" "20150098424" "20180103433" "20160330698" "10117194" "10178632" "20200053724" "20130100916" "9049619" "20180368081" "10462755" "10390310" "20190166561" "20190261280" "20160198421" "10560900" "20180063798"	US-PGPUB; USPAT	OR	ON	2020/04/09 16:21

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"20150195795" "20190082399"
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"20190372806" "20190199554"
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S29	28	S28 and (path$1loss power$1loss (path near2 loss) (power near2 loss))	US-PGPUB; USPAT	OR	ON	2020/04/09 16:47
S30	119	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (PHR (power adj3 headroom)) with (path$1loss near4 (chang$3 difference different)) near7 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 18:58
S31	170	(H04W52/242, H04W52/146, H04W52/365, H04W72/14).cpc. and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 18:59
S32	930	((("ASUSTEK") near3 ("COMPUTER") near3 ("INC"))).AS,AANM.	USPAT	OR	OFF	2020/04/09 19:01
S33	0	((("Lin") near3 ("Ko-Chiang"))).INV.	USOCR	OR	OFF	2020/04/09 19:01

S34	163	((("Guo") near3 ("Yu-Hsuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/04/09 19:01
S35	14	S32 and S34	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 19:02
S36	0	S35 and (path$1loss power$1loss (path near2 loss) (power near2 loss)) same reference near3 signal and (path$1loss power$1loss (path near2 loss) power RSRP) same threshold and (power near3 (adjust$4 control$3)) same2 power same head$1room	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/09 19:02

EAST Search History (Interference)

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4/9/2020 8:54:36 PM
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
Approved for use through 07/31/2016. 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	16395760
Filing Date	2019-04-26
First Named Inventor	LIN, KO-CHIANG
Art Unit	2648
Examiner Name	MD K. Talukder
Attorney Docket Number	1426-343.101

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	20160165556		2016-06-09	Heo Youn Hyoung et al.	

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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	107889209	CN		2018-04-06	Chai Li et al.		☐
	2	103813430	CN		2014-05-21	Wan Lu et al.		☐
	3	107534942	CN		2018-01-02	Dinan Esmael		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16395760
	Filing Date	2019-04-26
	First Named Inventor	LIN, KO-CHIANG
	Art Unit	2648
	Examiner Name	MD K. Talukder
	Attorney Docket Number	1426-343.101

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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]
	1	ASUSTeK, "Pathloss reference change for triggering PHR", 3GPP TSG-RAN WG2 Meeting #101bis, R2-1804289, 16th–20th.	☐
	2	Office Action from TIPO in corresponding TIPO Application No. 108114737, dated January 9, 2020.	☐
	3	3GPP Technical Specification, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for control, (Release 15)", 3GPP TS 38.213 V15.1.0, 2018-03.	☐

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EXAMINER SIGNATURE

Examiner Signature	/MD K TALUKDER/	Date Considered	04/09/2020

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Bibliographic Data

Application No: 16/395,760

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /MD K TALUKDER/ Examiner's Signature | Initials

Title: METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
04/26/2019	455	2648	1426-343.101
RULE			

APPLICANTS

ASUSTek Computer Inc., Taipei City, TAIWAN

INVENTORS

Ko-Chiang Lin Taipei City, TAIWAN

Yu-Hsuan Guo Taipei City, TAIWAN

Ming-Che Li Taipei City, TAIWAN

Hsin-Hsi Tsai Taipei City, TAIWAN

CONTINUING DATA

This application has PRO of 62669461 05/10/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/09/2019

STATE OR COUNTRY

TAIWAN

ADDRESS

Blue Capital Law Firm, P.C.
650 Town Center Drive, Suite 1530
Costa Mesa, CA 92626
UNITED STATES

FILING FEE RECEIVED

$1,720

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	
Filing Date	2019-04-26
First Named Inventor	LIN, KO-CHIANG
Art Unit	
Examiner Name	
Attorney Docket Number	1426-343.001

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
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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	20100273515		2010-10-28	Jean-Aicard Fabien	

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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	2012145974	WO		2012-11-01	LIU YANG et al.		☐

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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]

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2019-04-26
	First Named Inventor	LIN, KO-CHIANG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	1426-343.001

	1		☐

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Examiner Signature	/MD K TALUKDER/	Date Considered	04/09/2020

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
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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	16395760
Filing Date	2019-04-26
First Named Inventor	LIN, KO-CHIANG
Art Unit	2648
Examiner Name	Wesley Leo Kim
Attorney Docket Number	1426-343.101

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

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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	3319376	EP		2019-05-09	LIN, KO-CHIANG		☐

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NON-PATENT LITERATURE DOCUMENTS

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Filing Date	2019-04-26
First Named Inventor	LIN, KO-CHIANG
Art Unit	2648
Examiner Name	Wesley Leo Kim
Attorney Docket Number	1426-343.101

	1	ASUSTEK: "Pathloss reference change for triggering PHR", 3GPP DRAFT; R2-1804289, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ;FRANCE vol. RAN WG2, no. Sanya, China; 20180416 - 20180420 14 April 2018 (2018-04-14), XP051428045.	☐
	2	HUAWEI ET AL: "Consideration on PHR with multi-beam operation", 3GPP DRAFT; R2-1801043 CONSIDERATION ON PHR WITH MULTI-BEAM OPERATION, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES : F-06921 SOPHIA-ANTIPOLIS CEDEX vol. RAN WG2, no. Vancouver, Canada; 20180122 - 20180126 12 January 2018 (2018-01-12), XP051386539.	☐
	3	ASUSTEK: " Impact of pathloss reference on PHR triggering",3GPP DRAFT; R2-1806917, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCI0LES ; F-06921 SOPHIA-ANTIP0LIS CEDEX ;FRANCE vol. RAN WG2, no. Busan, Korea; 20180521 - 20180525 20 May 2018 (2018-05-20), XP051443358.	☐
	4	European Search Report from corresponding EP Application No. 19171289.2, dated September 24, 2019	☐

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Examiner Signature	/MD K TALUKDER/	Date Considered	04/09/2020

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Filing Date	2019-04-26
First Named Inventor	LIN, KO-CHIANG
Art Unit	2648
Examiner Name	MD K. Talukder
Attorney Docket Number	1426-343.101

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	1	20160165556		2016-06-09	Heo Youn Hyoung et al.	

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	1	107889209	CN		2018-04-06	Chai Li et al.		☐
	2	103813430	CN		2014-05-21	Wan Lu et al.		☐
	3	107534942	CN		2018-01-02	Dinan Esmael		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16395760
	Filing Date	2019-04-26
	First Named Inventor	LIN, KO-CHIANG
	Art Unit	2648
	Examiner Name	MD K. Talukder
	Attorney Docket Number	1426-343.101

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NON-PATENT LITERATURE DOCUMENTS

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	1	ASUSTeK, "Pathloss reference change for triggering PHR", 3GPP TSG-RAN WG2 Meeting #101bis, R2-1804289, 16th–20th.	☐
	2	Office Action from TIPO in corresponding TIPO Application No. 108114737, dated January 9, 2020.	☐
	3	3GPP Technical Specification, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical layer procedures for control, (Release 15)", 3GPP TS 38.213 V15.1.0, 2018-03.	☐

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Electronic Acknowledgement Receipt

EFS ID:	38301527
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	106622
Filer:	Sang N. Dang/Sandy Kim
Filer Authorized By:	Sang N. Dang
Attorney Docket Number:	1426-343.101
Receipt Date:	15-JAN-2020
Filing Date:	26-APR-2019
Time Stamp:	13:29:08
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	Foreign Reference	FOR--CN107889209.pdf	8142234 922cb880f627dba6a765deaa8591fb8ad96b2eeb	no	46

Warnings:

Information:					
2	Foreign Reference	FOR-CN103813430.pdf	2351970 949c0f1f5c212911477939e9e9780bc04898473c	no	14
Warnings:					
Information:					
3	Foreign Reference	CN107534942A.pdf	3257641 36d35d5639fa1a0fc150218579dfbf03749b8591	no	48
Warnings:					
Information:					
4	Non Patent Literature	R2-1804289.pdf	207370 6c4fb0c83acbb851db6c92bdf09d04eb3437bf09	no	3
Warnings:					
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5	Non Patent Literature	NPL-TIPOOfficeAction.pdf	899297 2f394e475505c525e623ebc985244b7df4080fb3	no	10
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Information:					
6	Non Patent Literature	NPL--3GPP.pdf	699091 158a78068b8a00437c76f004e0ccdc751d4884f5	no	77
Warnings:					
Information:					
7	Information Disclosure Statement (IDS) Form (SB08)	1426-343-101--IDSasFiled01152020v2.pdf	55472 775a9bd3a771512dcba884f36d30a6d3435fa5ee	no	2
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New Applications Under 35 U.S.C. 111

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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.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 107889209 A
(43)申请公布日 2018.01.06

(21)申请号 201610871474.2

(22)申请日 2016.09.29

(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 柴丽 唐珣 苗金华

(74)专利代理机构 北京亿腾知识产权代理事务所 11309
代理人 陈霁

(51)Int.Cl.
H04W 52/36(2009.01)

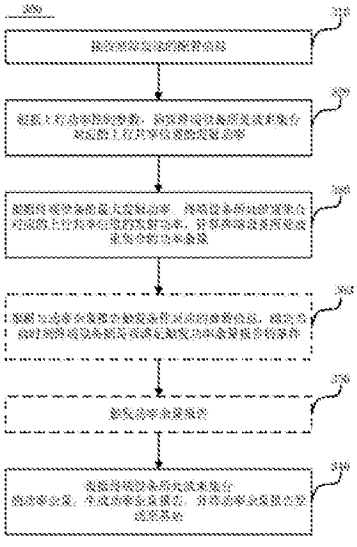
权利要求书12页 说明书30页 附图3页

(54)发明名称

一种功率控制的方法及终端设备

(57)摘要

本发明实施例公开了一种功率控制的方法及终端设备。所述方法包括：接收基站发送的配置信息，其中配置信息包括：上行功率控制参数。根据上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率。根据终端设备的最大发射功率和终端设备所处波束集合的上行共享信道的发射功率，计算终端设备所处波束集合的功率余量。根据终端设备所处波束集合的功率余量，生成功率余量报告，并将功率余量报告发送至基站。在波束域计算波束集合的功率余量，并以功率余量报告形式发送至基站，以便基站对终端设备侧的功率进行调整。基于上述方法，可以避免由于功率控制不准确导致的终端设备之间干扰增加、资源调度不充分或者上行吞吐量降低等问题。



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1.一种功率控制的方法，所述方法包括：

接收基站发送的配置信息，其中所述配置信息包括：上行功率控制参数；

根据所述上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率，其中，所述波束集合包括n条波束，n为大于或者等于1的正整数；

根据所述终端设备的最大发射功率和所述终端设备所处波束集合的上行共享信道的发射功率，计算所述终端设备所处波束集合的功率余量；

根据所述终端设备所处波束集合的功率余量，生成功率余量报告，并将所述功率余量报告发送至基站。

2.根据权利要求1所述的方法，其特征在于，所述接收基站发送的配置信息后，所述方法还包括：

根据上行功率控制参数，估算终端设备所处波束集合的物理上行控制信道的发射功率。

3.根据权利要求2所述的方法，其特征在于，当确定所述终端设备将所述上行共享信道和所述物理上行控制信道同时发送至基站时，所述方法还包括：根据所述终端设备的最大发射功率、所述终端设备所处波束集合的所述上行共享信道的发射功率以及所述终端设备所处波束集合的物理上行控制信道的发射功率，计算所述终端设备所在波束集合的功率余量。

4.根据权利要求1-3任一项所述的方法，其特征在于，所述根据上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率的方式包括：

根据所述上行功率控制参数，分别估算所述终端设备所处波束集合中每一波束的上行共享信道的发射功率；

或者，

根据所述上行功率控制参数，分别估算所述终端设备所处k组波束中每一组波束的上行共享信道的发射功率，其中，所述k组波束构成所述波束集合，k为大于或者等于1的正整数。

5.根据权利要求2或3所述的方法，其特征在于，所述根据上行功率控制参数，估算终端设备所处波束集合对应的物理上行控制信道的发射功率的方式包括：

根据上行功率控制参数，分别估算所述波束集合中每一条波束的物理上行控制信道的发射功率；

或者，

根据所述上行功率控制参数，分别估算k组波束中每一组的物理上行控制信道的发射功率，其中，所述k组波束构成所述波束集合，k为大于或者等于1的正整数。

6.根据权利要求4所述的方法，其特征在于，所述根据所述终端设备的最大发射功率、所述终端设备所处波束集合的所述上行共享信道的发射功率，计算所述终端设备处波束集合的功率余量的方式，包括：

依次根据所述终端设备的最大发射功率、所述波束集合中第p条波束的所述上行共享信道的发射功率，计算所述波束集合中第p条波束的功率余量，直至所述波束集合中每一条波束的功率余量计算完成，其中p为大于或者等于1，且小于或者等于n的正整数；

或者，

Samsung Electronics v. Asus Tech Licensing EX-1003, 338 of 673

依次根据所述终端设备的最大发射功率、所述k组波束中第q组波束的上行共享信道的发射功率，计算所述k组波束中的第q组波束的功率余量，直至所述k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

7.根据权利要求5所述的方法，其特征在于，所述根据所述终端设备的最大发射功率、所述终端设备所处波束集合的所述上行共享信道的发射功率以及所述终端设备所处波束集合的物理上行控制信道的发射功率，计算所述终端设备所处波束集合的功率余量的方式，包括：

依次根据终端设备的最大发射功率、所述波束集合中第p条波束的所述上行共享信道的发射功率，以及所述波束集合中第p条波束的所述物理上行控制信道的发射功率，计算所述波束集合中第p条波束的功率余量，直至所述波束集合中每一条波束的功率余量计算完成，其中，所述p为大于或者等于1，且小于或者等于n的正整数；

或者，

依次根据所述终端设备的最大发射功率、所述k组波束中第q组波束的上行共享信道的发射功率，以及所述k组波束中第q组波束的物理上行控制信道的发射功率，计算所述k组波束中第q组波束的功率余量，直至所述k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

8.根据权利要求1-7任一项所述的方法，其特征在于，所述将所述功率余量报告发送至基站之前，所述方法还包括：触发功率余量报告。

9.根据权利要求8所述的方法，其特征在于，所述配置信息中还包括与功率余量报告触发条件对应的参数信息，所述触发功率余量报告之前，所述方法还包括：

根据所述与所述功率余量报告触发条件对应的参数信息，确定当前时刻终端设备侧是否满足触发功率余量报告的条件，且仅在所述终端设备侧满足触发功率余量报告的条件时，触发功率余量报告；

其中，与功率余量报告触发条件对应的参数信息包括：

功率余量触发周期、禁止功率余量报告触发周期和下行路径损耗值。

10.根据权利要求9所述的方法，其特征在于，所述触发功率余量报告的条件包括：

当前时刻为所述功率余量报告的触发周期对应的时间；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且当前时刻，所述波束集合中任一条波束的下行路径损耗大于下行路径损耗的门限值；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且当前时刻，m条波束中每一条波束对应的下行路径损耗均大于下行路径损耗的门限值，其中，所述m条波束为所述波束集合的子集，且m为大于或者等于2，小于或者等于n的正整数，此时n为大于或者等于2的正整数；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且当前时刻，所述波束集合中波束对应的下行路径损耗的平均值或者加权平均值大于下行路径损耗的门限值；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且所述当前时刻，所述波束集合中预先设定的一条波束的下行路径损耗大于下行路径损耗的门限值。

11.根据权利要求1-10任一项所述的方法，其特征在于，所述配置上行功率控制参数的方式包括以下至少一种：

Samsung Electronics v. Asus Tech Licensing EX-1003, 339 of 673

以波束集合中的每一条波束为粒度；

以k组波束中的每一组波束为粒度；

以载波为粒度；

以服务小区为粒度；

以终端设备为粒度。

12.根据权利要求9或10所述的方法，其特征在于，所述配置功率余量报告触发条件的参数信息的方式包括以下至少一种：

以波束集合中的每一条波束为粒度；

以k组波束中的每一组波束为粒度；

以载波为粒度；

以服务小区为粒度；

以终端设备为粒度。

13.根据权利要求12所述的方法，其特征在于，所述配置所述上行功率控制参数以及配置所述与功率余量报告触发条件对应的参数信息时，如果以所述波束集合中的每一条波束为粒度时，所述配置参数中还包括：

波束的标识/标号；

或者，识别波束的信号的标识/标号，其中，所述识别波束的信号包括如下之一或组合：波束的参考信号、波束的发现信号、波束标识。

14.根据权利要求12所述的方法，其特征在于，所述配置所述上行功率控制参数以及配置所述与功率余量报告触发条件对应的参数信息时，如果以所述k组波束中的每一组波束为粒度时，所述配置参数中还包括：

识别k组波束中每一组波束的标识/标号；

或者，识别k组波束中每一组波束的信号的标识/标号。

15.根据权利要求9-14任一项所述的方法，其特征在于，所述触发功率余量报告之前所述方法还包括：对所述波束集合中每一条波束对应的下行路径损耗进行估计和/或对所述k组波束中的每一组波束对应的下行路径损耗进行估计。

16.根据权利要求15所述的方法，其特征在于，所述对所述波束集合中每一条波束对应的下行路径损耗进行估计包括：

分别根据所述波束集合中每一条波束对应的参考信号功率和参考信号接收功率，估计所述波束集合中每一条波束对应的下行路径损耗，其中，所述参考信号接收功率的测量是基于所述波束集合中每一条波束对应的信道状态信息参考信号，和/或者基于所述波束集合中每一条波束对应的波束参考信号。

17.根据权利要求15所述的方法，其特征在于，对所述k组波束中的每一组波束对应的下行路径损耗进行估计，包括：

分别根据所述k组波束中每一组波束对应的参考信号功率和参考信号接收功率，估计所述k组波束中每一组波束绑定对应的下行路径损耗，其中，所述参考信号接收功率的测量是基于所述k组波束中每一组波束对应的信道状态信息参考信号，和/或者基于所述k组波束中每一组波束对应的波束参考信号。

18.根据权利要求16或17所述的方法，其特征在于，所述波束集合中每一条波束对应的

Samsung Electronics v. Asus Tech Licensing EX-1003, 340 of 673

参考信号功率的接收功率或者所述k组波束中每一组波束对应的参考信号接收功率的测量形式包括：

经过无线资源控制层过滤，或者不经过无线资源控制层过滤，其中，所述经过无线资源控制层过滤为：对当前参考信号接收功率值与历史的参考信号接收功率值进行加权平均；

不经过无线资源控制层过滤为：所述终端设备直接将所述当前参考信号接收功率值作为最终参考信号接收功率值，其中，所述当前参考信号接收功率值和所述历史的参考信号接收功率值均指的是所述波束集合中每一条波束对应的参考信号接收功率，或者均指的是所述k组波束中每一组波束对应的参考信号接收功率。

19.根据权利要求16-18所述的方法，其特征在于，所述参考信号接收功率的测量周期设置为固定值Fms，其中F为小于或者等于100的正整数；

或者，所述参考信号接收功率的测量周期依据如下参数之一或组合进行设置，所述参数包括：频率或频段配置、上下行子帧配比、帧结构模式、无线接入方式以及波束配置方式。

20.根据权利要求4所述的方法，其特征在于，所述当确定所述终端设备将所述上行共享信道和所述物理上行控制信道同时发送至基站时，所述根据所述上行功率控制参数，估算所述波束集合中第p条波束的上行共享信道的发射功率的计算公式如下：

$$P_{PUSCH,c}(i)_{beam\_p} = \min\left\{\begin{array}{c} 10\log_{10}\widetilde{P_{CMAX,c}(i)}_{beam\_p} - \widetilde{P_{PUCCH,c}(i)}_{beam\_p} \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)_{beam\_p} + P_{o\_PUSCH,c}(j)_{beam\_p} + \alpha_c(j)\cdot PL_{c\_beam\_p} \\ +\Delta_{TF,c}(i) + f_c(i)_{beam\_p} \end{array}\right\}$$

其中，$P_{PUSCH,c}(i)_{beam_p}$为为所述终端设备提供服务的第p条波束对应的子帧i的所述上行共享信道的发射功率，$p_{CMAX,c}(i)_{beam_p}$为为所述终端设备提供服务的所述第p条波束对应的子帧i的最大发射功率；$P_{PUCCH,c}(i)_{beam_p}$为为所述终端设备提供服务的所述第p条波束对应的子帧i的所述物理上行控制信道的发射功率，$10\log_{10}(M_{PUSCH,c}(i))_{beam_p}$为为所述终端设备提供服务的所述第p条波束对应的子帧i上基站分配给所述终端设备的资源块个数；$P_{o_PUSCH,c}(j)_{beam_p}$为基站期望的为所述终端设备提供服务的所述第p条波束的接收功率水平，j＝0对应半静态调度，j＝1对应动态调度，j＝2对应随机接入响应中授权参数值，

$P_{o\_PUSCH,c}(j)_{beam\_p}=P_{o\_UE\_PUSCH,c}(j)_{beam\_p}+P_{o\_NOMINAL\_PUSCH,c}(j)_{beam\_p}$，$P_{o_NOMINAL_PUSCH,c}(j)_{beam_p}$表示正常解调时，基站期望的为所述终端设备提供服务的所述第p条波束对应的所述上行共享信道的发射功率水平，$P_{o\ UE\ PUSCH,c}(j)\ _{beam\ p}$为为所述终端设备提供服务的所述第p条波束上相对于$P_{o_NOMINAL_PUSCH,c}$的功率偏置；$PL_{c_beam_p}$为为所述终端设备提供服务的所述第p条波束对应的下行路损值，$\alpha_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_{beam_p}$为为所述终端设备提供服务的所述第p条波对应的所述上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}(i)}_{beam_p}$是$P_{CMAX,c}(i)_{beam_p}$的线性值；$\widetilde{P_{PUCCH,c}(i)}_{beam_p}$是$P_{PUCCH,c}(i)_{beam_p}$的线性值；beam_p则代表所述波束集合中的第p条波束，其中p为大于1且小于或者等于n的正整数。

21.根据权利要求4所述的方法，其特征在于，所述当确定所述终端设备将所述上行共

Samsung Electronics v. Asus Tech Licensing EX-1003, 341 of 673

享信道和所述物理上行控制信道同时发送至基站时，所述根据所述上行功率控制参数，估算所述终端设备所处k组波束中第q组波束的上行共享信道的发射功率的计算公式如下：

$$P_{PUSCH,c}(i)\_beamq = \min\left\{\begin{array}{c} 10\log_{10}\widetilde{P_{CMAX,c}}(i)\_beamq - \widetilde{P_{PUCCH,c}}(i)\_beamq \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)\_beamq + P_{o\_PUSCH,c}(j)\_beamq + \alpha_c(j)\cdot PL_{c}\_beamq \\ +\Delta_{TF,c}(i) + f_c(i)\_beamq \end{array}\right\}$$

其中，$P_{PUSCH,c}(i)_beamq$为为所述终端设备提供服务的第q组波束对应的所述上行共享信道的发射功率，$p_{CMAX,c}(i)_beamq$为为所述终端设备提供服务的所述第q组波束对应的子帧i的最大发射功率；$P_{PUCCH,c}(i)_beamq$为为所述终端设备提供服务的所述第q组波束对应的子帧i的物理上行控制信道的发射功率；$P_{PUCCH,c}(i)_beamq$为为所述终端设备提供服务的所述第q组波束对应的所述物理上行控制信道的发射功率，$10\log_{10}(M_{PUSCH,c}(i))_beamq$为为所述终端设备提供服务的所述第q组波束对应的子帧i上基站分配给该终端设备的资源块个数；$P_{o_PUSCH,c}(j)_beamq$为基站期望的为所述终端设备提供服务的所述第q组波束的接收功率水平，j＝0对应半静态调度，j＝1对应动态调度，j＝2对应随机接入响应中授权参数值，

$P_{o\_PUSCH,c}(j)\_beamq = P_{o\_UE\_PUSCH,c}(j)\_beamq + P_{o\_NOMINAL\_PUSCH,c}(j)\_beamq$，$P_{o_NOMINAL_PUSCH,c}(j)_beamq$表示正常解调时，基站期望的为所述终端设备提供服务的所述第q组波束对应的所述上行共享信道的发射功率水平，$P_{o_UE_PUSCH,c}(j)_beamq$为为所述终端设备提供服务的所述第q组波束上相对于$P_{o_NOMINAL_PUSCH,c}$的功率偏置；$PL_{c}_beamq$为为所述终端设备提供服务的所述第q组波束对应的下行路损值，$\alpha_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_beamq$为为所述终端设备提供服务的所述第q组波束对应的所述上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}}(i)_beamq$是$P_{CMAX,c}(i)_beamq$的线性值；$\widetilde{P_{PUCCH,c}}(i)_beamq$是$P_{PUCCH,c}(i)_beamq$的线性值；beamq则代表所述波束集合中的第q组波束，其中q为大于1且小于或者等于k的正整数。

22.根据权利要求20或21所述的方法，其特征在于，所述终端设备的上行共享信道的发射功率的调整量和/或者物理上行控制信道的发射功率的调整量通过以下方式之一或者组合获取：

通过下行物理控制信令获取，其中，所述下行物理控制信令中携带波束信息；

通过无线资源控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以所述波束集合中的每一条波束或所述k组波束中每一组波束为粒度分配；

通过媒体接入控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以所述波束集合中的每一条波束或所述k组波束中每一组波束为粒度分配；

通过无线资源控制层分配的发送功率控制索引绑定，和/或，发送功率控制-无线网络临时标识绑定，和/或，波束资源绑定，和/或k组波束中每一组波束绑定。

23.根据权利要求15所述的方法，其特征在于，所述对所述波束集合中每一条波束对应的下行路径损耗进行估计之前，所述方法还包括：

确定与所述波束集合中每一条波束对应的下行波束；

对所述下行波束的路径损耗进行估计，其中，所述波束集合中的波束为上行波束，所述

Samsung Electronics v. Asus Tech Licensing EX-1003, 342 of 673

波束集合中每一条波束的时间根据与之对应的下行波束的时间进行估计，和/或所述波束集合中每一条波束的频率根据与之对应的下行波束的频率进行估计，和/或所述波束集合中每一条波束的无线信道质量根据与之对应的下行波束的无线信道质量进行估计。

24.根据权利要求23所述的方法，其特征在于，所述确定所述波束集合中每一条波束对应的下行波束，包括：

通过无线资源控制层或媒体接入控制层进行配置；

或者，

通过无线资源控制层或媒体接入控制层为所述波束集合中的一条或多条波束配置一个用于无线信道质量评估的参考下行波束；

或者，

终端设备在波束初始接入，和/或波束扫描，和/或波束训练过程中获得分别与波束集合中每一条波束配对下行波束。

25.根据权利要求8所述的方法，其特征在于，所述配置信息中还包括：

第一控制信令，所述第一控制信令用于指示所述终端设备配置功率余量报告类型，其中，所述配置功率余量报告的类型包括以下至少一种：

应用于波束技术的基于波束的功率余量报告；

应用于波束技术的基于波束组的功率余量报告；

应用于载波聚合的基于载波和波束的第一扩展功率余量报告；

应用于载波聚合的基于载波和波束组的第二扩展功率余量报告；

应用于双连接场景的基于服务小区和波束的第一双连接功率余量报告；

应用于双连接场景的基于服务小区和波束组的第二双连接功率余量报告

应用于大量载波聚合的基于载波和波束的第三扩展功率余量报告；

应用于大量载波聚合的基于载波和波束组的第四扩展功率余量报告。

26.根据权利要求25所述的方法，其特征在于，所述终端设备根据所述第一控制信令，配置所述功率余量报告类型后，所述方法还包括：通过媒体接入控制层向所述基站发送功率余量报告媒体访问控制信令，所述功率余量报告媒体访问控制信令用于指示所述功率余量报告已经配置完成。

27.一种终端设备，其特征在于，所述终端设备包括：

接收模块，用于接收基站发送的配置信息，其中所述配置信息包括：上行功率控制参数；

处理模块，用于根据所述上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率，其中，所述波束集合包括n条波束，n为大于或者等于1的正整数；

根据所述终端设备的最大发射功率和所述终端设备所处波束集合的上行共享信道的发射功率，计算所述终端设备所处波束集合的功率余量；

并根据所述终端设备所处波束集合的功率余量，生成功率余量报告；

发送模块，用于将所述功率余量报告发送至基站。

28.根据权利要求27所述的终端设备，其特征在于，所述处理模块还用于：

根据上行功率控制参数，估算终端设备所处波束集合的物理上行控制信道的发射功率。

Samsung Electronics v. Asus Tech Licensing EX-1003, 343 of 673

29.根据权利要求28所述的终端设备，其特征在于，所述处理模块还用于：确定所述终端设备将所述上行共享信道和物理上行控制信道是否同时发送至基站；

且当确定所述终端设备将所述上行共享信道和所述物理上行控制信道同时发送至基站时，根据所述终端设备的最大发射功率、所述终端设备所处波束集合的所述上行共享信道的发射功率以及所述终端设备所处波束集合的物理上行控制信道的发射功率，计算所述终端设备所在波束集合的功率余量。

30.根据权利要求27-29任一项所述的终端设备，其特征在于，所述处理模块根据所述上行功率控制参数，估算所述终端设备所处波束集合的上行共享信道的发射功率的方式包括：

根据所述上行功率控制参数，分别估算所述终端设备所处波束集合中每一波束的上行共享信道的发射功率；

或者，

根据所述上行功率控制参数，分别估算所述终端设备所处k组波束中每一组波束的上行共享信道的发射功率，其中，所述k组波束构成所述波束集合，k为大于或者等于1的正整数。

31.根据权利要求28或29所述的终端设备，其特征在于，所述处理模块根据所述上行功率控制参数，估算所述终端设备所处波束集合对应的物理上行控制信道的发射功率的方式包括：

根据上行功率控制参数，分别估算所述波束集合中每一条波束的物理上行控制信道的发射功率；

或者，

根据所述上行功率控制参数，分别估算k组波束中每一组的物理上行控制信道的发射功率，其中，所述k组波束构成所述波束集合，k为大于或者等于1的正整数。

32.根据权利要求30所述的终端设备，其特征在于，所述处理模块根据所述终端设备的最大发射功率、所述终端设备所处波束集合的所述上行共享信道的发射功率，计算所述终端设备处波束集合的功率余量的方式，包括：

依次根据所述终端设备的最大发射功率、所述波束集合中第p条波束的所述上行共享信道的发射功率，计算所述波束集合中第p条波束的功率余量，直至所述波束集合中每一条波束的功率余量计算完成，其中p为大于或者等于1，且小于或者等于n的正整数；

或者，

依次根据所述终端设备的最大发射功率、所述k组波束中第q组波束的上行共享信道的发射功率，计算所述k组波束中的第q组波束的功率余量，直至所述k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

33.根据权利要求31所述的终端设备，其特征在于，所述处理模块根据所述终端设备的最大发射功率、所述终端设备所处波束集合的所述上行共享信道的发射功率以及所述终端设备所处波束集合的物理上行控制信道的发射功率，计算所述终端设备所处波束集合的功率余量的方式，包括：

依次根据终端设备的最大发射功率、所述波束集合中第p条波束的所述上行共享信道的发射功率，以及所述波束集合中第p条波束的所述物理上行控制信道的发射功率，计算所

Samsung Electronics v. Asus Tech Licensing EX-1003, 344 of 673

述波束集合中第p条波束的功率余量，直至所述波束集合中每一条波束的功率余量计算完成，其中，所述p为大于或者等于1，且小于或者等于n的正整数；

或者，

依次根据所述终端设备的最大发射功率、所述k组波束中第q组波束的上行共享信道的发射功率，以及所述k组波束中第q组波束的物理上行控制信道的发射功率，计算所述k组波束中第q组波束的功率余量，直至所述k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

34.根据权利要求27-33任一项所述的终端设备，其特征在于，所述终端设备还包括：触发模块，用于触发功率余量报告。

35.根据权利要求34所述的终端设备，其特征在于，所述配置信息中还包括与功率余量报告触发条件对应的参数信息，所述触发模块还用于：

根据所述与所述功率余量报告触发条件对应的参数信息，确定当前时刻终端设备侧是否满足触发功率余量报告的条件，且仅在所述终端设备侧满足触发功率余量报告的条件时，触发功率余量报告；

其中，与功率余量报告触发条件对应的参数信息包括：

功率余量触发周期、禁止功率余量报告触发周期和下行路径损耗值。

36.根据权利要求35所述的终端设备，其特征在于，所述触发功率余量报告的条件包括：

当前时刻为所述功率余量报告的触发周期对应的时间；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且当前时刻，所述波束集合中任一条波束的下行路径损耗大于下行路径损耗的门限值；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且当前时刻，m条波束中每一条波束对应的下行路径损耗均大于下行路径损耗的门限值，其中，所述m条波束为所述波束集合的子集，且m为大于或者等于2，小于或者等于n的正整数，此时n为大于或者等于2的正整数；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且当前时刻，所述波束集合中波束对应的下行路径损耗的平均值或者加权平均值大于下行路径损耗的门限值；

或者，当前时刻不属于所述禁止功率余量报告触发周期，且所述当前时刻，所述波束集合中预先设定的一条波束的下行路径损耗大于下行路径损耗的门限值。

37.根据权利要求27-36任一项所述的终端设备，其特征在于，所述配置上行功率控制参数的方式包括以下至少一种：

以波束集合中的每一条波束为粒度；

以k组波束中的每一组波束为粒度；

以载波为粒度；

以服务小区为粒度；

以终端设备为粒度。

38.根据权利要求35或36所述的终端设备，其特征在于，所述配置功率余量报告触发条件的参数信息的方式包括以下至少一种：

以波束集合中的每一条波束为粒度；

Samsung Electronics v. Asus Tech Licensing EX-1003, 345 of 673

以k组波束中的每一组波束为粒度；

以载波为粒度；

以服务小区为粒度；

以终端设备为粒度。

39.根据权利要求38所述的终端设备，其特征在于，所述配置所述上行功率控制参数以及配置所述与功率余量报告触发条件对应的参数信息时，如果以所述波束集合中的每一条波束为粒度时，所述配置参数中还包括：

波束的标识/标号；

或者，识别波束的信号的标识/标号，其中，所述识别波束的信号包括如下之一或组合：波束的参考信号、波束的发现信号、波束标识。

40.根据权利要求38所述的终端设备，其特征在于，所述配置所述上行功率控制参数以及配置所述与功率余量报告触发条件对应的参数信息时，如果以所述k组波束中的每一组波束为粒度时，所述配置参数中还包括：

识别k组波束中每一组波束的标识/标号；

或者，识别k组波束中每一组波束的信号的标识/标号。

41.根据权利要求35-40任一项所述的终端设备，其特征在于，所述处理模块还用于：

对所述波束集合中每一条波束对应的下行路径损耗进行估计和/或对所述k组波束中的每一组波束对应的下行路径损耗进行估计。

42.根据权利要求41所述的终端设备，其特征在于，所述处理模块具体用于：

分别根据所述波束集合中每一条波束对应的参考信号功率和参考信号接收功率，估计所述波束集合中每一条波束对应的下行路径损耗，其中，所述参考信号接收功率的测量是基于所述波束集合中每一条波束对应的信道状态信息参考信号，和/或者基于所述波束集合中每一条波束对应的波束参考信号。

43.根据权利要求41所述的终端设备，其特征在于，所述处理模块具体用于：

分别根据所述k组波束中每一组波束对应的参考信号功率和参考信号接收功率，估计所述k组波束中每一组波束绑定对应的下行路径损耗，其中，所述参考信号接收功率的测量是基于所述k组波束中每一组波束对应的信道状态信息参考信号，和/或者基于所述k组波束中每一组波束对应的波束参考信号。

44.根据权利要求42或43所述的终端设备，其特征在于，所述每一条波束对应的参考信号功率的接收功率或者所述k组波束中每一组波束对应的参考信号接收功率的测量形式包括：

经过无线资源控制层过滤，或者不经过无线资源控制层过滤，其中，所述经过无线资源控制层过滤为：对当前参考信号接收功率值与历史的参考信号接收功率值进行加权平均；

不经过无线资源控制层过滤为：所述终端设备直接将所述当前参考信号接收功率值作为最终参考信号接收功率值，其中，所述当前参考信号接收功率值和所述历史的参考信号接收功率值均指的是所述波束集合中每一条波束对应的参考信号接收功率，或者均指的是所述k组波束中每一组波束对应的参考信号接收功率。

45.根据权利要求42-44任一项所述的终端设备，其特征在于，所述参考信号接收功率的测量周期设置为固定值Fms，其中F为小于或者等于100的正整数；

Samsung Electronics v. Asus Tech Licensing EX-1003, 346 of 673

或者，所述参考信号接收功率的测量周期依据如下参数之一或组合进行设置，所述参数包括：频率或频段配置、上下行子帧配比、帧结构模式、无线接入方式以及波束配置方式。

46.根据权利要求30所述的终端设备，其特征在于，所述当所述处理模块确定所述终端设备将所述上行共享信道和所述物理上行控制信道同时发送至基站时，所述根据所述上行功率控制参数，估算所述波束集合中第p条波束的上行共享信道的发射功率的计算公式如下：

$$P_{PUSCH,c}(i)_{beam\_p} = \min\left\{\begin{array}{c} 10\log_{10}\widetilde{P_{CMAX,c}(i)_{beam\_p}} - \widetilde{P_{PUCCH,c}(i)_{beam\_p}} \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)_{beam\_p} + P_{o\_PUSCH,c}(j)_{beam\_p} + \alpha_c(j)\cdot PL_{c\_beam\_p} \\ +\Delta_{TF,c}(i) + f_c(i)_{beam\_p} \end{array}\right\}$$

其中，$P_{PUSCH,c}(i)_{beam_p}$为为所述终端设备提供服务的第p条波束对应的子帧i的所述上行共享信道的发射功率，$p_{CMAX,c}(i)_{beam_p}$为为所述终端设备提供服务的所述第p条波束对应的子帧i的最大发射功率；$P_{PUCCH,c}(i)_{beam_p}$为为所述终端设备提供服务的所述第p条波束对应的子帧i的所述物理上行控制信道的发射功率，$10\log_{10}(M_{PUSCH,c}(i))_{beam_p}$为为所述终端设备提供服务的所述第p条波束对应的子帧i上基站分配给所述终端设备的资源块个数；$P_{o_PUSCH,c}(j)_{beam_p}$为基站期望的为所述终端设备提供服务的所述第p条波束的接收功率水平，j＝0对应半静态调度，j＝1对应动态调度，j＝2对应随机接入响应中授权参数值，

$P_{o\_PUSCH,c}(j)_{beam\_p}=P_{o\_UE\_PUSCH,c}(j)_{beam\_p}+P_{o\_NOMINAL\_PUSCH,c}(j)_{beam\_p}$，$P_{o_NOMINAL_PUSCH,c}(j)_{beam_p}$表示正常解调时，基站期望的为所述终端设备提供服务的所述第p条波束对应的所述上行共享信道的发射功率水平，$P_{o_UE_PUSCH,c}(j)_{beam_p}$为为所述终端设备提供服务的所述第p条波束上相对于$P_{o_NOMINAL_PUSCH,c}$的功率偏置；$PL_{c_beam_p}$为为所述终端设备提供服务的所述第p条波束对应的下行路损值，$\alpha_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_{beam_p}$为为所述终端设备提供服务的所述第p条波对应的所述上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}(i)_{beam_p}}$是$P_{CMAX,c}(i)_{beam_p}$的线性值；$\widetilde{P_{PUCCH,c}(i)_{beam_p}}$是$P_{PUCCH,c}(i)_{beam_p}$的线性值；beam_p则代表所述波束集合中的第p条波束，其中p为大于1且小于或者等于n的正整数。

47.根据权利要求30所述的终端设备，其特征在于，所述当所述处理模块确定所述终端设备将所述上行共享信道和所述物理上行控制信道同时发送至基站时，所述根据所述上行功率控制参数，估算所述终端设备所处k组波束中第q组波束的上行共享信道的发射功率的计算公式如下：

$$P_{PUSCH,c}(i)_{beamq} = \min\left\{\begin{array}{c} 10\log_{10}\widetilde{P_{CMAX,c}(i)_{beamq}} - \widetilde{P_{PUCCH,c}(i)_{beamq}} \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)_{beamq} + P_{o\_PUSCH,c}(j)_{beamq} + \alpha_c(j)\cdot PL_{c\_beamq} \\ +\Delta_{TF,c}(i) + f_c(i)_{beamq} \end{array}\right\}$$

其中，$P_{PUSCH,c}(i)_{beamq}$为为所述终端设备提供服务的第q组波束对应的所述上行共享信

Samsung Electronics v. Asus Tech Licensing EX-1003, 347 of 673

道的发射功率，$p_{CMAX,c}(i)_beamq$为为所述终端设备提供服务的所述第q组波束对应的子帧i的最大发射功率；$P_{PUCCH,c}(i)_beamq$为为所述终端设备提供服务的所述第q组波束对应的子帧i的物理上行控制信道的发射功率；$P_{PUCCH,c}(i)_beamq$为为所述终端设备提供服务的所述第q组波束对应的所述物理上行控制信道的发射功率，$10\log_{10}(M_{PUSCH,c}(i))_beamq$为为所述终端设备提供服务的所述第q组波束对应的子帧i上基站分配给该终端设备的资源块个数；$P_{o_PUSCH,c}(j)_beamq$为基站期望的为所述终端设备提供服务的所述第q组波束的接收功率水平，j＝0对应半静态调度，j＝1对应动态调度，j＝2对应随机接入响应中授权参数值，

$P_{o\_PUSCH,c}(j)\_beamq=P_{o\_UE\_PUSCH,c}(j)\_beamq+P_{o\_NOMINAL\_PUSCH,c}(j)\_beamq$，$P_{o_NOMINAL_PUSCH,c}(j)_beamq$表示正常解调时，基站期望的为所述终端设备提供服务的所述第q组波束对应的所述上行共享信道的发射功率水平，$P_{o_UE_PUSCH,c}(j)_beamq$为为所述终端设备提供服务的所述第q组波束上相对于$P_{o\ NOMINAL\ PUSCH,c}$的功率偏置；$PL_{c\ beamq}$为为所述终端设备提供服务的所述第q组波束对应的下行路损值，$\alpha_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_bcamq$为为所述终端设备提供服务的所述第q组波束对应的所述上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}(i)}_beamq$是$P_{CMAX,c}(i)_beamq$的线性值；$\widetilde{P_{PUCCH,c}(i)}_beamq$是$P_{PUCCH,c}(i)_beamq$的线性值；beamq则代表所述波束集合中的第q组波束，其中q为大于1且小于或者等于k的正整数。

48.根据权利要求46或47所述的终端设备，其特征在于，所述终端设备的上行共享信道的发射功率的调整量和/或者物理上行控制信道的发射功率的调整量通过以下方式之一或者组合获取：

通过下行物理控制信令获取，其中，所述下行物理控制信令中携带波束信息；

通过无线资源控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以所述波束集合中的每一条波束或所述k组波束中每一组波束为粒度分配；

通过媒体接入控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以所述波束集合中的每一条波束或所述k组波束中每一组波束为粒度分配；

通过无线资源控制层分配的发送功率控制索引绑定，和/或，发送功率控制-无线网络临时标识绑定，和/或，波束资源绑定，和/或k组波束中每一组波束绑定。

49.根据权利要求41所述的终端设备，其特征在于，所述处理模块还用于：

确定与所述波束集合中每一条波束对应的下行波束；

对所述下行波束的路径损耗进行估计，其中，所述波束集合中的波束为上行波束，所述波束集合中每一条波束的时间根据与之对应的下行波束的时间进行估计，和/或所述波束集合中每一条波束的频率根据与之对应的下行波束的频率进行估计，和/或所述波束集合中每一条波束的无线信道质量根据与之对应的下行波束的无线信道质量进行估计。

50.根据权利要求49所述的终端设备，其特征在于，所述处理模块确定所述波束集合中每一条波束对应的下行波束，具体包括：

通过无线资源控制层或媒体接入控制层进行配置；

或者，

通过无线资源控制层或媒体接入控制层为所述波束集合中的一条或多条波束配置一个用于无线信道质量评估的参考下行波束；

或者，

Samsung Electronics v. Asus Tech Licensing EX-1003, 348 of 673

终端设备在波束初始接入，和/或波束扫描，和/或波束训练过程中获得分别与波束集合中每一条波束配对下行波束。

51.根据权利要求34所述的终端设备，其特征在于，所述配置信息中还包括：

第一控制信令，所述第一控制信令用于指示所述终端设备配置功率余量报告类型，其中，所述配置功率余量报告的类型包括以下至少一种：

应用于波束技术的基于波束的功率余量报告；

应用于波束技术的基于波束组的功率余量报告；

应用于载波聚合的基于载波和波束的第一扩展功率余量报告；

应用于载波聚合的基于载波和波束组的第二扩展功率余量报告；

应用于双连接场景的基于服务小区和波束的第一双连接功率余量报告；

应用于双连接场景的基于服务小区和波束组的第二双连接功率余量报告

应用于大量载波聚合的基于载波和波束的第三扩展功率余量报告；

应用于大量载波聚合的基于载波和波束组的第四扩展功率余量报告。

52.根据权利要求51所述的终端设备，其特征在于，所述发送模块还用于：通过媒体接入控制层向所述基站发送功率余量报告媒体访问控制信令，所述功率余量报告媒体访问控制信令用于指示所述功率余量报告已经配置完成。

Samsung Electronics v. Asus Tech Licensing EX-1003, 349 of 673

一种功率控制的方法及终端设备

技术领域

[0001] 本发明涉及移动通信技术领域，尤其涉及一种功率控制的方法及终端设备。

背景技术

[0002] 为了让eNodeB能够动态的为终端分配合适的资源，终端需要将其功率余量信息报告给eNodeB。eNodeB将会根据功率余量报告(Power headroom report，简称PHR)调整终端设备当前的发射功率。而如果终端向基站发送的功率余量报告不准确的话，就会导致基站对终端分配的调度资源不合理，进一步导致终端之间干扰增加、资源调度不充分或者上行吞吐量降低等问题。

[0003] 为了解决上述问题，现有技术中，终端基于服务小区的小区参考信号(Cell Reference Signal，简称CRS)的下行路径损耗和其他相关参数计算功率余量(Power headroom，简称PH)和上行共享信道的发射功率以及物理上行控制信道(Physical Uplink Control Channel，简称PUCCH)发射功率，并向基站报告功率余量报告。

[0004] 但是，伴随移动宽带的迅猛发展和智能手机的普及，全球移动数据流量年复合增长率高达67％，同时网络流量的分布极度不平衡，热点区域的容量需求呈现出爆炸式增长。现有的低频段组网所能实现的网络覆盖以及频谱利用率等已经完全不能够达到用户的需求。所以，在未来的5G网络中，将会在高频100G组网。然而利用现有的技术(在当前的LTE系统中，小区覆盖是全天线覆盖)，在高频段组网时，将会出现网络覆盖范围小、功率能耗大、路径损耗大、频谱效率低以及系统容量小等一系列的问题。因此利用终端基于服务小区的CRS的下行路损和其他相关参数计算功率余量和上行共享信道的发射功率以及物理上行控制信道发射功率等的方法在高频组网阶段实现将会非常困难，那么在高频组网阶段，找到一种计算功率余量和上行共享信道的发射功率以及物理上行控制信道发射功率，并向基站发送功率余量报告，以便基站根据功率余量报告调整终端设备侧的发射功率的方法，是亟待解决的问题。

发明内容

[0005] 本发明实施例提供了一种功率控制的方法及终端设备。

[0006] 第一方面，本发明提供了一种功率控制的方法，该方法包括：接收基站发送的配置信息，其中配置信息包括：上行功率控制参数；

[0007] 根据上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率，其中，波束集合包括n条波束，n为大于或者等于1的正整数；

[0008] 根据终端设备的最大发射功率和终端设备所处波束集合的上行共享信道的发射功率，计算终端设备所处波束集合的功率余量；

[0009] 根据终端设备所处波束集合的功率余量，生成功率余量报告，并将功率余量报告发送至基站。

[0010] 在一个可选的实现方式中，接收基站发送的配置信息后，该方法还包括：

Samsung Electronics v. Asus Tech Licensing EX-1003, 350 of 673

[0011] 根据上行功率控制参数，估算终端设备所处波束集合的物理上行控制信道的发射功率。

[0012] 在另一个可选的实现方式中，当确定终端设备将上行共享信道和物理上行控制信道同时发送至基站时，该方法还包括：根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率以及终端设备所处波束集合的物理上行控制信道的发射功率，计算终端设备所在波束集合的功率余量。

[0013] 在又一个可选的实现方式中，根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率，计算终端设备处波束集合的功率余量的方式，包括：

[0014] 依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中p为大于或者等于1，且小于或者等于n的正整数；

[0015] 或者，

[0016] 依次根据终端设备的最大发射功率、k组波束中第q组波束的上行共享信道的发射功率，计算k组波束中的第q组波束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

[0017] 在再一个可选的实现方式中，根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率以及终端设备所处波束集合的物理上行控制信道的发射功率，计算终端设备所处波束集合的功率余量的方式，包括：

[0018] 依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，以及波束集合中第p条波束的物理上行控制信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中，p为大于或者等于1，且小于或者等于n的正整数；

[0019] 或者，

[0020] 依次根据终端设备的最大发射功率、k组波束中第q组波束的上行共享信道的发射功率，以及k组波束中第q组波束的物理上行控制信道的发射功率，计算k组波束中第q组波束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

[0021] 第二方面，本发明提供了一种终端设备，该终端设备包括：

[0022] 接收模块，用于接收基站发送的配置信息，其中配置信息包括：上行功率控制参数；

[0023] 处理模块，用于根据上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率，其中，波束集合包括n条波束，n为大于或者等于1的正整数；

[0024] 根据终端设备的最大发射功率和终端设备所处波束集合的上行共享信道的发射功率，计算终端设备所处波束集合的功率余量；

[0025] 并根据终端设备所处波束集合的功率余量，生成功率余量报告；

[0026] 发送模块，用于将功率余量报告发送至基站。

[0027] 在一个可选的实现方式中：根据上行功率控制参数，估算终端设备所处波束集合的物理上行控制信道的发射功率。

[0028] 在另一个可选的实现方式中，处理模块还用于：确定终端设备将上行共享信道和

Samsung Electronics v. Asus Tech Licensing EX-1003, 351 of 673

所述物理上行控制信道是否同时发送至基站；

[0029] 且当确定终端设备将上行共享信道和物理上行控制信道同时发送至基站时，根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率以及终端设备所处波束集合的物理上行控制信道的发射功率，计算所述终端设备所在波束集合的功率余量。

[0030] 在又一个可选的实现方式中，处理模块根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率，计算终端设备处波束集合的功率余量的方式，包括：

[0031] 依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中p为大于或者等于1，且小于或者等于n的正整数；

[0032] 或者，

[0033] 依次根据终端设备的最大发射功率、k组波束中第q组波束的上行共享信道的发射功率，计算k组波束中的第q组波束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

[0034] 在再一个可选的实现方式中，处理模块根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率以及终端设备所处波束集合的物理上行控制信道的发射功率，计算终端设备所处波束集合的功率余量的方式，包括：

[0035] 依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，以及波束集合中第p条波束的物理上行控制信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中，p为大于或者等于1，且小于或者等于n的正整数；

[0036] 或者，

[0037] 依次根据终端设备的最大发射功率、k组波束中第q组波束的上行共享信道的发射功率，以及k组波束中第q组波束的物理上行控制信道的发射功率，计算k组波束中第q组波束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

[0038] 基于上述技术方案，本发明实施例提供的一种功率控制的方法及终端设备，在波束域计算上行共享信道的发射功率、物理上行控制信道的发射功率，以及波束集合的功率余量，并生成功率余量报告。将功率余量报告发送至基站，以便基站根据功率余量报告对终端设备侧的功率进行调整。基于上述方法，可以避免由于功率控制不准确，而导致的终端设备之间干扰增加、资源调度不充分或者上行吞吐量降低等问题。

附图说明

[0039] 图1为本发明实施例提供的一种由波束集合构成小区的示意图；

[0040] 图2为本发明实施例提供的，基站和终端设备之间通过波束实现通信交互的示意图；

[0041] 图3为本发明实施例一提供的一种功率控制方法流程示意图；

[0042] 图4为本发明实施例二提供的一种终端设备的虚拟装置结构示意图；

Samsung Electronics v. Asus Tech Licensing EX-1003, 352 of 673

[0043] 图5为本发明实施例三提供的一种终端设备的实体装置结构示意图。

具体实施方式

[0044] 下面通过附图和实施例，对本发明的技术方案做进一步的详细描述。

[0045] 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做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。

[0046] 为了帮助运营商最大限度的利用已有站址和频谱资源，改善网络覆盖和容量，本发明中将采用有源天线阵列技术，结合创新的导频信号设计和用户信道高精度估计算法，形成极其精确的用户级超窄波束，将能量定向投放到用户位置，限制改善网络覆盖能力，降低无线网络的能耗，尤其是在中高频组网的情况下，改善网络覆盖能力的效果尤为明显。波束集合可以由多个用户级超窄波束构成，具体如图1所示。图1为本发明实施例提供的一种由波束集合构成小区的示意图。而终端设备则可以同时接收通过多个波束发送的信号，具体如图2所示，图2为本发明实施例提供的，基站和终端设备之间通过波束实现通信交互的示意图。也即是说，终端设备和基站之间，可以通过波束集合中的至少一条波束进行信令/数据交互。图2中显示的是终端设备和基站之间，通过波束5、6、7，以及波束14、15、16进行进行信令/数据交互。其中，本发明中的波束资源，UE可见或者不可见.如，UE只能区分不同的识别波束的信号，并不能区分不同的波束。

[0047] 终端设备首先接收基站发送的配置信息，该配置信息中包括上行功率控制参数。根据上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率，其中，波束集合中包括n条波束，n为大于或者等于1的正整数。判断终端设备是否同时将上行共享信道和物理上行控制信道发送至基站，当并不同时发送时，则可以根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率，计算终端设备所处波束集合的功率余量。而如果判断终端设备同时将上行共享信道和物理上行控制信道发送至基站时，则需要根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率，以及终端设备所处波束集合的物理上行控制信道的发射功率计算终端设备所处波束集合的功率余量。因此，在计算功率余量之前，该方法还包括计算终端设备所处波束集合的物理上行控制信道的发射功率。最终，将计算完成的功率余量报告发送至基站，以便基站根据功率余量报告对终端设备侧的发射功率进行调整。具体估算上行共享信道的发射功率和估算物理上行控制信道的发射功率的方法以及确定最终的功率余量报告的方法将在下文中的实施例一做详细的介绍。

[0048] 图3为本发明实施例一提供的一种功率控制方法流程示意图300。具体如图3所示，该方法包括：

[0049] 步骤310，接收基站发送的配置信息。

[0050] 具体的，基站发送的配置信息可以包括上行功率控制参数。其中，上行功率控制参数主要可以包括：标称物理上行控制信道的发射功率，如PUCCH，e-PUCCH，g-PUCCH的基准发射功率(如，p0-NominalPUCCH)、UE特定的物理上行控制信道的发射功率，如PUCCH，e-PUCCH，g-PUCCH的基准发射功率(p0-UE-PUCCH)、标称上行物理数据(或共享)信道，如物理

Samsung Electronics v. Asus Tech Licensing EX-1003, 353 of 673

上行共享信道(Physical Uplink Shared Channel,简称PUSCH),c-PUSCH,g-PUSCH的基准发射功率(如,p0-Nominal PUSCH)、UE特定的上行物理数据(或共享)信道的发射功率,如PUSCH,e-PUSCH,g-PUSCH的基准发射功率(如,p0-UE-PUSCH)、下行路损补偿因子(alpha)等信息。这里的基准发射功率指的是基站期望终端设备侧的接收功率水平。而配置上行功率控制参数的方式可以包括以下至少一种:以波束集合中的每一条波束为粒度、以k组波束中的每一组波束为粒度、以载波为粒度、以服务小区为粒度和以终端设备为粒度。

[0051] 步骤320,根据上行功率控制参数,估算终端设备所处波束集合对应的上行共享信道的发射功率。

[0052] 在本发明中所指的波束集合,是终端设备所处的波束集合,即,终端可以用来发送或接收数据/信号的波束,可以是终端的服务波束或是地理位置可达的波束;波束是由多天线技术的波束赋形技术形成的。具体如图1所示,一个波束集合由至少一条波束组成。该波束的波束宽度较窄,一般小于120度。

[0053] 具体的,根据配置信息,估算终端设备所处波束集合对应的上行共享信道的发射功率。终端设备所处波束集合对应的上行共享信道的发射功率可以包括两种表现形式,具体为:

[0054] 根据上行功率控制参数,分别估算波束集合中每一波束的上行共享信道的发射功率并统计;或者根据上行功率控制参数,分别估算终端设备所处波束集合中k组波束的上行共享信道的发射功率并统计,k组波束构成波束集合,k为大于或者等于1的正整数。

[0055] 其中,计算每一条波束的上行共享信道的发射功率的公式可以分别由公式3-1至公式3-2获取。不过在此之前,该方法还包括:判断终端设备侧是否将上行共享信道和物理上行控制信道同时发送至基站。

[0056] 如果判断终端设备侧将上行共享信道和物理上行控制信道不同时发送至基站时,确定利用公式3-1计算波束集合中每一条波束的上行共享信道的发射功率。

[0057] 其中,具体公式如式(3-1)所示:

$$P_{PUSCH,c}(i)_{beam\_p}$$

[0058]
$$= \min\left\{ \begin{array}{c} P_{CMAX,c\_beam\_p}(i) \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)_{beam\_p} + P_{o\_PUSCH,c}(j)_{beam\_p} + \alpha_c(j)\cdot PL_{c\_beam\_p} \\ +\Delta_{TF,c}(i)_{beam\_p} + f_c(i)_{beam\_p} \end{array} \right\} \quad (3\text{-}1)$$

[0059] 其中,$P_{PUSCH,c}(i)_{beam_p}$为为终端设备提供服务的第p条波束对应的上行共享信道的发射功率,$P_{CMAX,c_beam_p}(i)$为为终端设备提供服务的第p条波束对应的子帧i的最大发射功率;$10\log_{10}(M_{PUSCH,c}(i))_{beam_p}$为为终端设备提供服务的第p条波束对应的子帧i上基站分配给该终端设备的资源块个数;$P_{o_PUSCH,c}(j)_{beam_p}$为基站期望的为终端设备提供服务的第p条波束的接收功率水平,j=0对应半静态调度,j=1对应动态调度,j=2对应随机接入响应中授权参数值,

[0060] $P_{o\_PUSCH,c}(j)_{beam\_p}=P_{o\_UE\_PUSCH,c}(j)_{beam\_p}+P_{o\_NOMINAL\_PUSCH,c}(j)_{beam\_p}$,$P_{o_NOMINAL_PUSCH,c}(j)_{beam_p}$表示正常解调时,基站期望的为终端设备提供服务的第p条波束对应的上行共享

Samsung Electronics v. Asus Tech Licensing EX-1003, 354 of 673

信道的发射功率水平，$P_{o_UE_PUSCH,c}(j)_{beam_p}$为为终端设备提供服务的第p条波束上相对于$P_{o_NOMINAL_PUSCH,c}$的功率偏置；$PL_{c_beam_p}$为为终端设备提供服务的第p条波束对应的下行路损值，$\alpha_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_{beam_p}$为为终端设备提供服务的第p条波束对应的上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}(i)}_{beam_p}$是$P_{CMAX,c}(i)_{beam_p}$的线性值；beam_p则代表所述波束集合中的第p条波束，其中p为大于1且小于或者等于n的正整数。

[0061] 其中，终端设备的最大发射功率是名义上的(nominal)终端设备的最大发射功率，即，允许的最大功率减少(the allowed Maximum Power Reduction，简称MPR)，附加的最大功率减少(Additional Maximum Power Reduction，简称A-MPR)满足一个预设条件(如，等于0db)的发射功率。

[0062] $f_c(i)_{beam_p}$可以通过以下方式之一或者组合获取：

[0063] 通过下行物理控制信令获取，其中，下行物理控制信令中携带波束信息；

[0064] 通过无线资源控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束为粒度分配，其中，发送功率控制-无线网络临时标识用于物理控制信令的解码，tpc-Index用于指示用户终端的TPC命令的索引号：(-TPC command number 1，TPC command number 2，…，TPC command number N)；和或，通过媒体接入控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束为粒度分配，终端利用这些信息在下行物理控制信令TPC命令中获取；

[0065] 通过无线资源控制层分配的发送功率控制索引绑定，和/或，发送功率控制-无线网络临时标识绑定，和/或，波束资源绑定，和/或k组波束中每一组波束绑定。这里，绑定即是在RRC或MAC层，用信令指示TPC索引和/或TPC-RNTI和波束资源或k组波束中每一组波束的映射关系。

[0066] 如果判断当确定所述终端设备将所述上行共享信道和所述物理上行控制信道不同时发送至基站时时，确定利用公式(3-2)计算上行共享信道的发射功率。具体如公式(3-2)所示：

[0067]
$$P_{PUSCH,c}(i)_{beam\_p} = \min\left\{ \begin{array}{c} 10\log_{10}\widetilde{P_{CMAX,c}(i)}_{beam\_p} - \widetilde{P_{PUCCH,c}(i)}_{beam\_p} \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)_{beam\_p} + P_{o\_PUSCH,c}(j)_{beam\_p} + \alpha_c(j)\cdot PL_{c\_beam\_p} \\ +\Delta_{TF,c}(i) + f_c(i)_{beam\_p} \end{array} \right\} \quad (3\text{-}2)$$

[0068] 其中，$P_{PUSCH,c}(i)_{beam_p}$为为终端设备提供服务的第p条波束对应的子帧i的上行共享信道的发射功率，$p_{CMAX,c}(i)_{beam_p}$为为终端设备提供服务的第p条波束对应的子帧i的最大发射功率；$P_{PUCCH,c}(i)_{beam_p}$为为终端设备提供服务的第p条波束对应的子帧i的物理上行控制信道的发射功率，$10\log_{10}(M_{PUSCH,c}(i))_{beam_p}$为终端设备提供服务的第p条波束对应的子帧i上基站分配给该终端设备的资源块个数；$P_{o_PUSCH,c}(j)_{beam_p}$为基站期望的为终端设备提供服务的第p条波束的接收功率水平，j＝0对应半静态调度，j＝1对应动态调度，j＝2对

Samsung Electronics v. Asus Tech Licensing EX-1003, 355 of 673

应随机接入响应中授权参数值，

[0069] $P_{o\_PUSCH,c}(j)_{beam\_p}=P_{o\_UE\_PUSCH,c}(j)_{beam\_p}+P_{o\_NOMINAL\_PUSCH,c}(j)_{beam\_p}$，$P_{o_NOMINAL_PUSCH,c}(j)_{beam_p}$表示正常解调时，基站期望的为终端设备提供服务的第p条波束对应的上行共享信道的发射功率水平，$P_{o_UE_PUSCH,c}(j)_{beam_p}$为为终端设备提供服务的第p条波束上相对于$P_{o_NOM\ INAL_PUSCH,c}$的功率偏置；$PL_{c_beam_p}$为为终端设备提供服务的第p条波束对应的下行路损值，$\alpha_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_{beam_p}$为为终端设备提供服务的第p条波对应的上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}(i)_{beam_p}}$是$P_{CMAX,c}(i)_{beam_p}$的线性值；$\widetilde{P_{PUCCH,c}(i)_{beam_p}}$是$P_{PUCCH,c}(i)_{beam\ p}$的线性值；beam_p则代表所述波束集合中的第p条波束，其中p为大于1且小于或者等于n的正整数。

[0070] 当然，读者应理解，上述计算上行共享信道的发射功率的公式，仅仅代表是在波束集合中每一条波束上第i子帧发送数据时的上行共享信道的发射功率的公式。

[0071] 而在另一种情况中，估算终端设备所处波束集合对应的上行共享信道的发射功率的另一种表现形式则是：根据上行功率控制参数，分别估算终端设备所处波束集合中k组波束的上行共享信道的发射功率，其中，k组波束构成波束集合，k为大于或者等于1的正整数。

[0072] 如果判断当确定所述终端设备将所述上行共享信道和所述物理上行控制信道不同时发送至基站时时，确定利用公式3-3计算上行共享信道的发射功率。

[0073] 具体如下式所示，

$$P_{PUSCH,c}(i)_{beamq}$$

[0074]
$$= \min\left\{ \begin{array}{c} P_{CMAX,c\_beamq}(i) \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)_{beamq} + P_{o\_PUSCH,c}(j)_{beamq} + \alpha_c(j)\cdot PL_{c\_beamq} \\ +\Delta_{TF,c}(i)_{beamq} + f_c(i)_{beamq} \end{array} \right\} \quad (3\text{-}3)$$

[0075] 其中，$P_{PUSCH,c}(i)_{beamq}$为为终端设备提供服务的第q组波束对应的上行共享信道的发射功率，$P_{CMAX,c}(i)_{beamq}$为为终端设备提供服务的第q组波束对应的子帧i的最大发射功率；$10\log_{10}(M_{PUSCH,c}(i))_{beamq}$为为终端设备提供服务的第q组波束对应的子帧i上基站分配给该终端设备的资源块个数；$P_{o_PUSCH,c}(j)_{beamq}$为基站期望的为终端设备提供服务的第q组波束的接收功率水平，j=0对应半静态调度，j=1对应动态调度，j=2对应随机接入响应中授权参数值，

[0076] $P_{o\_PUSCH,c}(j)_{beamq}=P_{o\_UE\_PUSCH,c}(j)_{beamq}+P_{o\_NOMINAL\_PUSCH,c}(j)_{beamq}$，$P_{o_NOMINAL_PUSCH,c}(j)_{beamq}$表示正常解调时，基站期望的为终端设备提供服务的第q组波束对应的上行共享信道的发射功率水平，$P_{o_UE_PUSCH,c}(j)_{beamq}$为为终端设备提供服务的第q组波束上相对于$P_{o_NOMINAL_PUSCH,c}$的功率偏置；$PL_{c_beamq}$为为终端设备提供服务的第q组波束对应的下行路损值，$\alpha_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_{beamq}$为为终端设备提供服务的第q组波束对应的上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}(i)_{beamq}}$是$P_{CMAX,c}(i)_{beamq}$的线性值；

Samsung Electronics v. Asus Tech Licensing EX-1003, 356 of 673

beamq则代表所述波束集合中的第q组波束，其中q为大于1且小于或者等于n的正整数。

[0077] 其中，终端设备的最大发射功率是名义上的(nominal)终端设备的最大发射功率，即，允许的最大功率减少(the allowed Maximum Power Reduction，简称MPR)，附加的最大功率减少(Additional Maximum Power Reduction，简称A-MPR)满足一个预设条件(如，等于0db)的发射功率。

[0078] $f_c(i)_beamq$可以通过以下方式之一或者组合获取：

[0079] 通过下行物理控制信令获取，其中，下行物理控制信令中携带波束信息；

[0080] 通过无线资源控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束为粒度分配，其中，发送功率控制-无线网络临时标识用于物理控制信令的解码，tpc-Index用于指示用户终端的TPC命令的索引号：(-TPC command number 1，TPC command number 2，…，TPC command number N)；和或，通过媒体接入控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束为粒度分配，终端利用这些信息在下行物理控制信令TPC命令中获取；

[0081] 通过无线资源控制层分配的发送功率控制索引绑定，和/或，发送功率控制-无线网络临时标识绑定，和/或，波束资源绑定，和/或k组波束中每一组波束绑定。这里，绑定即是在RRC或MAC层，用信令指示TPC索引和/或TPC-RNTI和波束资源或k组波束中每一组波束的映射关系。

[0082] 如果判断终端设备侧将上行共享信道和物理上行控制信道同时发送至基站时，确定利用公式3-4计算上行共享信道的发射功率。

[0083] 具体如下式所示：

$$P_{PUSCH,c}(i)\_beamq$$

[0084]
$$= \min\left\{\begin{array}{c} 10\log_{10}\widetilde{P_{CMAX,c}}(i)\_beamq - \widetilde{P_{PUCCH,c}}(i)\_beamq \\ 10\log_{10}\left(M_{PUSCH,c}(i)\right)\_beamq + P_{o\_PUSCH,c}(j)\_beamq + \alpha_c(j)\cdot PL_{c}\_beamq \\ +\Delta_{TF,c}(i) + f_c(i)\_beamq \end{array}\right\} \quad (3\text{-}4)$$

[0085] 其中，$P_{PUSCH,c}(i)_beamq$为为终端设备提供服务的第q组波束对应的上行共享信道的发射功率，$p_{CMAX,c}(i)_beamq$为为终端设备提供服务的第q组波束对应的子帧i的最大发射功率；$P_{PUCCH,c}(i)_beamq$为为终端设备提供服务的第q组波束对应的子帧i的物理上行控制信道的发射功率；$P_{PUCCH,c}(i)_beamq$为为终端设备提供服务的第q组波束对应的物理上行控制信道的发射功率，$10\log_{10}(M_{PUSCH,c}(i))_beamq$为为终端设备提供服务的第q组波束对应的子帧i上基站分配给该终端设备的资源块个数；$P_{o_PUSCH,c}(j)_beamq$为基站期望的为终端设备提供服务的第q组波束的接收功率水平，j＝0对应半静态调度，j＝1对应动态调度，j＝2对应随机接入响应中授权参数值，

[0086] $P_{o\_PUSCH,c}(j)\_beamq = P_{o\_UE\_PUSCH,c}(j)\_beamq + P_{o\_NOMINAL\_PUSCH,c}(j)\_beamq$，$P_{o_NOMINAL_PUSCH,c}(j)_beamq$表示正常解调时，基站期望的为终端设备提供服务的第q组波束对应的上行共享信道的发射功率水平，$P_{o_UE_PUSCH,c}(j)_beamq$为为终端设备提供服务的第q组波束上相对于$P_{o_NOMINAL_PUSCH,c}$的功率偏置；$PL_{c}_beamq$为为终端设备提供服务的第q组波束对应的下行路损

Samsung Electronics v. Asus Tech Licensing EX-1003, 357 of 673

值，$q_c(j)$为路径损耗补偿因子，取值范围为0到1；$\Delta_{TF,c}(i)$为不同的调制与编码策略格式相对于参考调制与编码策略格式的功率偏置值；$f_c(i)_beamq$为为终端设备提供服务的第q组波束对应的上行共享信道的发射功率的调整量；$\widetilde{P_{CMAX,c}(i)_beamq}$是$P_{CMAX,c}(i)_beamq$的线性值；$\widetilde{P_{PUCCH,c}(i)_beamq}$是$P_{PUCCH,c}(i)_beamq$的线性值；beamq则代表所述波束集合中的第q组波束，其中q为大于1且小于或者等于k的正整数。

[0087] 其中，终端设备的最大发射功率是名义上的(nominal)终端设备的最大发射功率，即，允许的最大功率减少(the allowed Maximum Power Reduction，简称MPR)，附加的最大功率减少(Additional Maximum Power Reduction，简称A-MPR)满足一个预设条件(如，等于0db)的发射功率。

[0088] $f_c(i)_beamq$可以通过以下方式之一或者组合获取：

[0089] 通过下行物理控制信令获取，其中，下行物理控制信令中携带波束信息；

[0090] 通过无线资源控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束绑定为粒度分配，其中，发送功率控制-无线网络临时标识用于物理控制信令的解码，tpc-Index用于指示用户终端的TPC命令的索引号：(-TPC command number 1，TPC command number 2，…，TPC command number N)；和或，通过媒体接入控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束绑定为粒度分配，终端利用这些信息在下行物理控制信令TPC命令中获取；

[0091] 通过无线资源控制层分配的发送功率控制索引绑定，和/或，发送功率控制-无线网络临时标识绑定，和/或，波束资源绑定，和/或k组波束中每一组波束绑定绑定。这里，绑定即是在RRC或MAC层，用信令指示TPC索引和/或TPC-RNTI和波束资源或k组波束中每一组波束绑定的映射关系。

[0092] 而根据上行功率控制参数，估算终端设备所处波束集合对应的上行共享信道的发射功率之后，该方法还包括：根据上行功率控制参数，估算终端设备所处波束集合对应的物理上行控制信道的发射功率。与估算终端设备所处波束集合对应的上行共享信道的发射功率类似，终端设备所处波束集合对应的物理上行控制信道的发射功率的表现形式同样包括两种。其中一种为根据上行功率控制参数，估算波束集合中每一条波束分别对应的物理上行控制信道的发射功率；另一种为根据上行功率控制参数，分别估算终端设备所处波束集合中k组波束的物理上行控制信道的发射功率。

[0093] 其中，根据上行功率控制参数，分别估算波束集合中第p条波束对应的物理上行控制信道的发射功率的公式，如式(3-5)所示：

[0094]
$$P_{PUCCH}(i)\_beam\_p = \min\left\{\begin{array}{c} P_{CMAX,c}(i)\_beam\_p \\ p_{O\_PUCCH\_beam\_p} + PL_{c\_beam\_p} + h(n_{CQI}, n_{HARQ}, n_{SR})\_beam\_p \\ +\Delta_{F_{PUCCH}}(F)\_beam\_p + \Delta_{TxD}(F')\_beam\_p + g(i)\_beam\_p \end{array}\right\} \quad (3\text{-}5)$$

[0095] 其中，$P_{CMAX,c}(i)_beam_p$为为终端设备提供服务的第p条波束对应子帧i的最大发射功率；$PL_{c_beam_p}$为为终端设备提供服务的第p条波束对应的下行路径损耗值；$p_{O_PUCCH_beam_p}$为

Samsung Electronics v. Asus Tech Licensing EX-1003, 358 of 673

无线资源控制层信令设置的为终端设备提供服务的第p条波束对应的功率基准值；$h(n_{CQI}, n_{HARQ}, n_{SR})_{beam_p}$为根据所承载的信道质量指示和确认比特数量在为终端设备提供服务的第p条波束上设置的物理上行控制信道发送功率偏移量；$\Delta_{F_{PUCCH}(F)_beam_p}$为物理上行控制信道格式F相对于PUCCH格式1a的功率偏移量，$\Delta_{TxD}(F')_{beam\ p}$为根据调制编码方式和数据类型所确定的为终端设备提供服务的第p条波束对应的功率偏移量；$g(i)_{beam_p}$为为终端设备提供服务的第p条波束对应的终端闭环功率控制的调整值；beam_p示为终端设备提供服务的第p条波束，p小于或者等于波束集合中波束的总条数。

[0096] 其中，$g(i)_{beam_k}$可以通过以下至少一种方式获取：

[0097] 通过下行物理控制信令获取，其中，下行物理控制信令中携带波束信息；

[0098] 通过无线资源控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束绑定为粒度分配，其中，发送功率控制-无线网络临时标识用于物理控制信令的解码，tpc-Index用于指示用户终端的TPC命令的索引号：(-TPC command number 1,TPC command number 2,…,TPC command number N)；和或，通过媒体接入控制层分配的发送功率控制索引和/或发送功率控制-无线网络临时标识，以波束集合中的每一条波束或k组波束中每一组波束绑定为粒度分配，终端利用这些信息在下行物理控制信令TPC命令中获取；

[0099] 通过无线资源控制层分配的发送功率控制索引绑定，和/或，发送功率控制-无线网络临时标识绑定，和/或，波束资源绑定，和/或k组波束中每一组波束绑定绑定。这里，绑定即是在无线资源控制层或媒体接入控制层，用信令指示TPC索引和/或TPC-RNTI和波束资源或k组波束中每一组波束绑定的映射关系。

[0100] 而另一种情况中，根据上行功率控制参数，分别估算终端设备所处k组波束中每一组波束的物理上行控制信道的发射功率的公式，如式3-6所示：

[0101]
$$P_{PUCCH}(i)_{beamq} = \min\left\{\begin{array}{c} P_{CMAX,c}(i)_{beamq} \\ P_{O\_PUCCH\_beamq} + PL_{c\_beamq} + h(n_{CQI}, n_{HARQ}, n_{SR})_{beamq} \\ +\Delta_{F_{PUCCH}(F)\_beamq} + \Delta_{TxD}(F')_{beamq} + g(i)_{beamq} \end{array}\right\} \quad (3\text{-}6)$$

[0102] 其中，$P_{CMAX,c}(i)_{beamq}$为为终端设备提供服务的第q组波束对应子帧i的最大发射功率；PL_{c_beamq}为为终端设备提供服务的第q组波束对应的下行路径损耗值；$p_{O_PUCCH_beamq}$为无线资源控制层信令设置的为终端设备提供服务的第q组波束对应的功率基准值；$h(n_{CQI}, n_{HARQ}, n_{SR})_{beamq}$为根据所承载的信道质量指示和确认比特数量在为终端设备提供服务的第q组波束上设置的物理上行控制信道发送功率偏移量；$\Delta_{F_{PUCCH}(F)_beamq}$为物理上行控制信道格式F相对于PUCCH格式1a的功率偏移量，$\Delta_{TxD}(F')_{beamq}$为根据调制编码方式和数据类型所确定的为终端设备提供服务的第q组波束对应的功率偏移量；$g(i)_{beamq}$为为终端设备提供服务的第q组波束对应的终端闭环功率控制的调整值；beamq示为终端设备提供服务的第q组波束，q小于或者等于k的总条数。

[0103] 当然，公式3-3和3-5实际是分别计算波束集合中第p条波束在第i子帧时对应的上行共享信道的发射功率和物理上行控制信道的发射功率。而在实际计算过程中，需要根据

Samsung Electronics v. Asus Tech Licensing EX-1003, 359 of 673

与3-3或3-5相同或者相似的公式，分别计算波束集合中每一条波束在不同的子帧上发送数据时上行共享信道的发射功率和物理上行控制信道的发射功率，并统计。

[0104] 与之类似的，公式3-4和3-6实际是计算波束集合分成的k组波束中的第q组波束在子帧i时对应的上行共享信道的发射功率和物理上行控制信道的发射功率。而在实际过程中，则需要根据与公式3-4，或公式3-6相同或相似的公式，分别计算k组波束中每一组波束分别在不同子帧上发送数据时上行共享信道的发射功率和物理上行控制信道的发射功率，并统计。

[0105] 步骤330，根根据终端设备的最大发射功率、终端设备所处波束集合对应的所述上行共享信道的发射功率，计算所述终端设备所处波束集合的功率余量。

[0106] 本发明中描述的所有公式中的提及的终端设备的最大发射功率(The configured maximum UE output power，简称PCMAX)是基站配置的数值，公式中提及到包括PCMAX，c beam_p，指终端在波束集合中的第p个波束上的最大发射功率，或者公式中提及到包括PCMAX，c_beamq，指终端在波束集合中的第q组波束上的最大发射功率。与计算上行共享信道的发射功率和物理上行控制信道的发射功率相类似的，根据终端设备最大发射功率、终端设备所处波束集合对应的物理上行控制信道的发射功率，计算功率余量的方式同样可以包括两种。其中，采用第一种计算方式的前提条件是：确定终端设备将上行共享信道和物理上行控制信道不同时发送至基站；采用第二种计算方式的前提条件则是：确定终端设备将上行共享信道和物理上行控制信道同时发送至基站。另外，计算功率余量时，针对上述所说的每一种计算方式，还分别包括两种细分的计算方式。例如，当确定终端上设备将上行共享信道和物理上行控制信道不同时发送基站时，则终端设备将会根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率计算终端设备所处波束集合的功率余量。

[0107] 而对应的，细分的方式包括：第一种，依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中，p为大于或等于1，且小于或者等于n的正整数。

[0108] 第二种，依次依据终端设备的最大发射功率、k组波束集合中第q组波束的上行共享信道的发射功率，计算k组波束中的第q组波束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。同上文所述，k组波束构成了整个波束集合。

[0109] 上述两种计算功率余量的公式分别如式3-7和3-8所示。

[0110]
$$PH_{type\ 1,c}(i)\_beam\_p = P_{CMAX,c}(i)\_beam\_p - \left\{ \begin{array}{l} 10\log_{10}(M_{PUSCH,c}(i)\_beam\_p + P_{O\_PUSCH,c}(j)\_beam\_p \\ +\alpha_c(j)\cdot PL_{c\_beam\_p} + \Delta_{TF,c}(i)\_beam\_k + f_c(i)\_beam\_p) \end{array} \right\} \quad (3\text{-}7)$$

[0111] 其中，该公式中的参数可以参照估算波束集合中第p条波束的上行共享信道的发射功率以及估算波束集合中第p条波束的物理上行控制信道的发射功率时的计算公式中各参数的示义，这里不再赘述。

Samsung Electronics v. Asus Tech Licensing EX-1003, 360 of 673

$$PH_{type\ 1\_2,c}(i)\_beamq =$$

[0112] $$p_{CMAX,c}(i)\_beamq - \begin{Bmatrix} 10\log_{10}(M_{PUSCH,c}(i)\_beamq + P_{O\_PUSCH,c}(j)\_beamq \\ +\alpha_c(j)\cdot PL_{c\_beamq} + \Delta_{TF,c}(i)\_beamq + f_c(i)\_beamq) \end{Bmatrix}$$

(3-8)

[0113] 其中，该公式中的参数可以参照上文中估算k组波束中第q组波束的上行共享信道的发射功率以及估算k组波束中第q组波束的物理上行控制信道的发射功率时的计算公式中各参数的示义，这里不再赘述。

[0114] 当确定终端上设备将上行共享信道和物理上行控制信道同时发送基站时，则终端设备将会根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率和终端设备所处波束集合的物理上行控制信道的发射功率，计算终端设备所处波束集合的功率余量。

[0115] 而对应的，细分的方式包括：第一种，依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，以及波束集合中第p条波束的物理上行控制信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中，p为大于或等于1，且小于或者等于n的正整数。

[0116] 第二种，依次依据终端设备的最大发射功率、k组波束集合中第q组波束的上行共享信道的发射功率，以及k组波束中第q组波束的物理上行控制信道的发射功率，计算k组波束中的第q组波束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。同上文所述，k组波束构成了整个波束集合。

[0117] 上述两种计算功率余量的公式分别如式3-9和3-10所示。

$$PH_{type\ 2\_1}(i)\_beam\_p = p_{CMAX,c}(i)\_beam\_p -$$

[0118] $$10\log_{10}\left(10^{\frac{(M_{PUSCH,c}(i)\_beam\_p + P_{O\_PUSCH,c}(i)\_beam\_p + \alpha_c(j)\cdot PL_{c\_beam\_p} + \Delta_{TF,c}(i)\_beam\_p + f_c(i)\_beam\_p)}{10}} + 10^{\frac{(P_{O\_PUCCH,c}(i)\_beam\_p + PL_{c\_beam\_p} + h(n_{CQI},n_{HARQ},n_{SR})\_beam\_p + \Delta_{F\_PUCCH}(F)\_beam\_p) + \Delta_{TxD}(F')\_beam\_p + g(i)\_beam\_p}{10}}\right)$$

(3-9)

[0119] 其中，该公式中的参数可以参照估算波束集合中第p条波束的上行共享信道的发射功率以及估算波束集合中第p条波束的物理上行控制信道的发射功率时的计算公式中各参数的示义，这里不再赘述。

Samsung Electronics v. Asus Tech Licensing EX-1003, 361 of 673

[0120]
$$PH_{type\ 2\_2}(i)\_beamq = P_{CMAX,c}(i)\_beamq - 10\log_{10}\left(10^{\frac{(M_{PUSCH,c}(i)\_beamq + P_{O\_PUSCH,c}(j)\_beamq + \alpha_c(j)\cdot PL_{c\_beamq} + \Delta_{TF,c}(i)\_beamq + f_c(i)\_beamq)}{10}} + 10^{\frac{(P_{O\_PUCCH,c}(j)\_beamq + PL_{c\_beamq} + h(n_{CQI},n_{HARQ},n_{SR})\_beamq + \Delta_{F\_PUCCH}(F)\_beamq) + \Delta_{TxD}(F')\_beamq + g(i)\_beamq}{10}}\right)$$

(3-10)

[0121] 其中,该公式中的参数可以参照上文中估算k组波束中第q组波束的上行共享信道的发射功率以及估算k组波束中第q组波束的物理上行控制信道的发射功率时的计算公式中各参数的示义,这里不再赘述。

[0122] 读者还应理解的是,上述公式3-2、3-4、3-6、3-8以及公式3-10中,均以k组波束中的每一组波束为"单位",分别估算每一组波束的上行共享信道的发射功率、物理上行控制信道的发射功率以及对应的功率余量等。这里,是将一组波束作为一个资源块整体,然后分别估算的是整组波束的上行共享信道的发射功率、物理上行控制信道的发射功率以及对应的功率余量。

[0123] 步骤340,根据终端设备所处波束集合的功率余量,生成功率余量报告,并将功率余量报告发送至基站。

[0124] 具体的,在生成功率余量报告时,可以包括k组波束中每一组波束对应或者波束集合中每一条波束分别对应的如下参数之一或者组合:功率余量、物理上行控制信道的发射功率和上行共享信道的发射功率等。或者,还可以包括波束集合对应的子载波号(例如如表2中的C1-C3等)以及其他信息,具体详见表1至表7中所呈现的内容。

[0125] 步骤310中所述的配置信息中,还可以包括第一控制信令。该第一控制信令用于指示终端设备配置功率余量的报告类型。其中,配置功率余量报告的类型包括一下至少一种:应用于波束技术的基于波束的功率余量报告;应用于波束技术的基于波束组的功率余量报告;应用于载波聚合的基于载波和波束的第一扩展功率余量报告;应用于载波聚合的基于载波和波束组的第二扩展功率余量报告;应用于双连接场景的基于服务小区和波束的第一双连接功率余量报告;应用于双连接场景的基于服务小区和波束组的第二双连接功率余量报告;应用于大量载波聚合的基于载波和波束的第三扩展功率余量报告;应用于大量载波聚合的基于载波和波束组的第四扩展功率余量报告。

[0126] 在生成功率余量报告之前,终端设备将会根据基站发送的第一控制信令,配置功率余量报告的类型。并且,终端设备在配置功率余量报告后,还会通过MAC层向基站上报PHR MAC信令,用以告知基站,功率余量报告已经配置完成。

[0127] 与上述功率余量报告的类型对应的,例如,

[0128] 第一种类型,基站指示终端设备配置功率余量报告类型为PH,那么终端设备将会把PHR以PH MAC CE形式发送给基站。

Samsung Electronics v. Asus Tech Licensing EX-1003, 362 of 673

[0129] 第二种类型，基站指示UE配置功率余量报告类型为扩展的功率余量报告extendedPH时，那么终端设备将会把PHR以extended PH MAC CE。

[0130] 第三种类型，基站指示终端设备配置功率余量报告类型为dual Connectivity PHR，即应用于双连接场景的基于服务小区的dual ConnectivityPHR，那么终端设备将会把功率余量报告以dual Connectivity PHR MAC。

[0131] 第四种类型，基站指示UE配置功率余量报告类型为extendedPH2时，即，应用于大量载波聚合(massive carrier aggregation)的功率余量报告PHR，那么终端设备将会把PHR以extendedPH2MAC CE。

[0132] 第五种类型，基站指示UE配置功率余量报告类型为第五类型PH-B时，即，应用于波束技术的基于波束的功率余量报告类型时，那么终端设备将会把PHR以PH-B MAC CE形式发送给基站，如表1。

[0133] 第六种类型，基站指示终端设备配置功率余量报告类型为第六类型extended PH-B时，即，应用于载波聚合的基于载波和波束的第一扩展功率余量报告(extended PHR)，，那么终端设备将会把功率余量报告以extended PH-B MAC CE，如表2或表3或表4。表2表示的是一个MAC PDU指示某一个波束在不同载波的功率余量报告。而需要发送多个波束的的功率余量报告时，需要发多个MAC PDU；表3，4，一个MAC PDU指示每一个载波的不同波束的功率余量报告；表3的MAC PDU中只有pcell(primary cell主载波)应用的载波聚合，该载波上有多个波束。

[0134] 第七种类型，基站指示终端设备配置功率余量报告类型为第七类型dual Connectivity PHR-B PH时，即，应用于双连接场景的基于服务小区和波束的dualConnectivityPHR-B那么终端设备将会把功率余量报告以dual Connectivity PHR-B MAC，如表5。

[0135] 第八种类型，基站指示终端设备配置功率余量报告类型为extended PH2-B时，即，应用于大量载波聚合的基于载波和波束的功率余量报告PHR，那么终端设备将会把PHR以extended PH2-B MAC CE，如表6或表7，表6中只有pcell有PUCCH，表7中的scell(secondary cell辅小区)可以有PUCCH。

[0136] 当然，与上述第六种类型对应的，还可以包括应用于载波聚合的基于载波和波束组的第二扩展功率余量报告，终端设备向基站发送的功率余量报告的表格则与表3或表4类似，不过，表中功率余量对应的则是一组波束的功率余量报告。或者，与第七中类型对应的，还可以包括：应用于双链接场景的基于服务小区和波束组的第二双连接功率余量报告，终端设备向基站发送的功率余量报告的表格则与表5类似，同样的，表中功率余量对应的则是一组波束的功率余量报告。或者，与第八种类型对应的，还可以包括：应用于大量载波聚合的基于载波和波束组的第四扩展功率余量报告，终端设备向基站发送的功率余量报告的表格则与表6或表7类似，不过，表中功率余量对应的则是一组波束的功率余量报告。

[0137] 具体的PHR报告的表现形式可以由如下表格1-7显示：

[0138] 表格1

Samsung Electronics v. Asus Tech Licensing EX-1003, 363 of 673

[0139]

B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
R	R	PH_7					
R	R	PH_6					
R	R	PH_5					
R	R	PH_4					
R	R	PH_3					
R	R	PH_2					
R	R	PH_1					

[0140] 在表格1中,B1～B7为波束集合中波束的标号(例如B1代表波束1,B2代表波束2),R为预留位,PH1为与波束标号为B1对应的波束的功率余量,PH2为与波束标号为B2对应的波束的功率余量,以此类推,PH7为与波束标号为B7对应的波束的功率余量。

[0141] 表2:

[0142]

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
P	V	PH(Type2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH(Type1, PCell)					
R	R	$P_{CMAX,c}$ 2					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
P	V	PH(Type1, SCell1)					
R	R	$P_{CMAX,c}$ 3					
...							
B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0
P	V	PH(Type1, SCell n)					
R	R	$P_{CMAX,c}$ m					

[0143] 表2代表的是在载波聚合的情况下的PHR报告的表现形式,其中,C1～C7代表载波的区号,B0～B7同样代表波束标号。当C1～C7中Ci对应的值为1时,才会出现该表格中与Ci对应的功率余量的相关参数。其中i大于或者等于1,小于或者等于7。P代表powerbackoff,即功率回退,P的取值可以为1或0,当P的值为1时,计算功率余量,将会用到功率回退。而如果P的取值为0时,则计算功率余量时将不会用到功率回退。V是一个形式参数,代表一个虚拟值,用于确定PUSCH是否有发送实际的数据,当V的取值为1时代表PUSCH上没有发送数据,为0则代表发送了一个实际的数据,R同样代表预留符号。Pcmaxci代表功率余量在第i个载波上发送。而在表2中,只有第一个表格上采用的是type2类型,也即是说第一载波携带的是

Samsung Electronics v. Asus Tech Licensing EX-1003, 364 of 673

主载波的功率余量相关参数。而第2到第m个载波携带的是辅载波的功率余量相关参数，采用的是type1的类型计算功率余量(因为辅载波并没有PUCCH)。每一个物理载波中均包含一个波束集合，每个波束集合中包含8条波束。因此，PH(Type1,SCelln)则代表功率余量通过类型1的公式计算，主要计算的PH是辅载波n的功率余量。

[0144] 表3

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PCell, beam k)					
R	R	$P_{CMAX,c}$ 1, 1					
P	V	PH (Type 1, PCell, beam k)					
R	R	$P_{CMAX,c}$ 1, 2					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ 1, k					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 2, 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 2, 2					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ 2, k					
...							
...							
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ m, 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ m, 2					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ m, k					

[0145]

Samsung Electronics v. Asus Tech Licensing EX-1003, 365 of 673

[0146] 表3中的参数与表2中的参数含义相同或者相似，这里不再赘述。但是在表2中，在发送主服务波束集合的功率余量时，加入beamk，其代表的是主波束集合中具体的某条波束。也即是表格中将明确说明主波束集合对应的波束集合中具体波束的功率余量。即表3中将介绍所有波束的具体功率余量、以及PUSCH发射功率和PUCCH的发射功率等的状况。

[0147] 具体表格4～7：

[0148] 表4

[0149]

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PCell, beam k)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell, beam k)					
R	R	$P_{CMAX,c}$ 2					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell 1, beam k)					
R	R	$P_{CMAX,c}$ 3					
...							
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell n, beam k)					
R	R	$P_{CMAX,c}$ m					

[0150] 表5

Samsung Electronics v. Asus Tech Licensing EX-1003, 366 of 673

[0151]

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PCell, beam k)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell, beam k)					
R	R	$P_{CMAX,c}$ 2					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PUCCH,SCell1, beam k)					
R	R	$P_{CMAX,c}$ 3					
P	V	PH (Type 2, PUCCH,SCell2, beam k)					
R	R	$P_{CMAX,c}$ 4					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell 1, beam k)					
R	R	$P_{CMAX,c}$ 5					
...							
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell n, beam k)					
R	R	$P_{CMAX,c}$ m					

[0152] 表6

Samsung Electronics v. Asus Tech Licensing EX-1003, 367 of 673

[0153]

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PCell, Beam k)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell , Beam k)					
R	R	$P_{CMAX,c}$ 2					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell, beam k)					
R	R	$P_{CMAX,c}$ 3					

...

B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell n, beam k)					
R	R	$P_{CMAX,c}$ m					

[0154] 表7

Samsung Electronics v. Asus Tech Licensing EX-1003, 368 of 673

[0155]

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PCell, Beam k)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell 1 , Beam k)					
R	R	$P_{CMAX,c}$ 2					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 2, PUCCH Scell, beam k)					
R	R	$P_{CMAX,c}$ 3					
B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell 1, beam k)					
R	R	$P_{CMAX,c}$ 4					

...

B_7	B_6	B_5	B_4	B_3	B_2	B_1	R
P	V	PH (Type 1, SCell n, beam k)					
R	R	$P_{CMAX,c}$ m					

[0156] 表4至表7中的参数与表1至表3中的参数含义类似，不同的就是表4至表7中将功率余量报告的情况介绍的更详细一些，这里不再介绍。

[0157] 不过，在步骤340之前，该方法还包括：步骤350，触发功率余量报告。

[0158] 而在步骤310中所介绍的配置信息中，该配置信息中还可以包括与功率余量报告触发条件对应的参数信息。

[0159] 而配置上行功率控制参数的方式可以包括以下至少一种：以波束集合中的每一条波束为粒度；以k组波束中的每一组波束为粒度；以载波为粒度；以服务小区为粒度；以终端设备为粒度。类似的，配置功率余量报告触发条件的参数信息的方式同样包括以下至少一

Samsung Electronics v. Asus Tech Licensing EX-1003, 369 of 673

种:以波束集合中的每一条波束为粒度;以k组波束中的每一组波束为粒度;以载波为粒度;以服务小区为粒度;以终端设备为粒度。

[0160] 需要说明的是,不论配置上行功率控制参数还是配置与功率余量报告触发条件对应的参数信息时,如果采用的是以波束集合中的每一条波束为粒度时,均需要在配置信息中包括波束标识或标号。又或者是用于识别波束的信号的标识或标号。其中,波束标识或者标号用于识别配置的参数存放于哪一条波束中。识别波束的信号的标识或标号的作用等同于识别配置的参数存放于哪一条波束中。用于识别波束的信号可以包括以下一种或多种:波束的参考信号、波束标识。当然,还可以是在波束的发现信号中包括波束的参考信号。以波束集合中的每一条波束为粒度,则是说明为波束集合中的每一条波束均配置一套配置参数,包括上行功率控制参数和与功率余量报告触发条件对应的参数信息。而以终端设备为粒度配置与功率余量报告触发条件对应的参数信息,则是为每一个终端设备配置一套与功率余量报告触发条件对应的参数信息。类似的,以服务小区、以k组波束中的每一组波束为粒度或者以载波为粒度,则分别是为每一个服务小区或者为以k组波束中的每一组波束或者每一个载波分别配置一套配置参数。

[0161] 对应的,配置上行功率控制参数以及配置与功率余量报告触发条件对应的参数信息时,如果以k组波束中的每一组波束为粒度时,配置参数中还包括:识别k组波束中每一组波束的标识/标号;或者,识别k组波束中每一组波束的信号的标识/标号。

[0162] 在步骤350之前,该方法还可以包括:步骤360:根据与功率余量报告触发条件对应的参数信息,确定当前时刻终端设备侧是否满足触发功率余量报告的条件。且仅在终端设备侧满足触发功率余量报告的条件时,触发功率余量报告。其中,与功率余量报告触发条件对应的参数信息包括:功率余量触发周期、禁止功率余量报告触发周期和下行路径损耗值。

[0163] 而对应的,触发功率余量报告的条件包括以下条件之一:

[0164] 1)当前时刻为所述功率余量报告的触发周期对应的时间;

[0165] 2)当前时刻不属于所述禁止功率余量报告触发周期,且当前时刻,所述波束集合中任一条波束的下行路径损耗大于下行路径损耗的门限值;

[0166] 3)当前时刻不属于所述禁止功率余量报告触发周期,且当前时刻,m条波束中每一条波束对应的下行路径损耗均大于下行路径损耗的门限值,其中,所述m条波束为所述波束集合的子集,且m为大于或者等于2,小于或者等于n的正整数,此时n为大于或者等于2的正整数;

[0167] 4)当前时刻不属于所述禁止功率余量报告触发周期,且当前时刻,所述波束集合中波束对应的下行路径损耗的平均值或者加权平均值大于下行路径损耗的门限值;

[0168] 5)当前时刻不属于所述禁止功率余量报告触发周期,且所述当前时刻,所述波束集合中预先设定的一条波束的下行路径损耗大于下行路径损耗的门限值。

[0169] 针对条件1)-5),均是以一条波束或者波束集合中的多条波束为例进行说明的,而在实际应用中,还可以应用其他类似的场景。例如,如果波束集合以k组形式出现时,那么条件1)-5)中的"一条波束"则可以替换为"一组波束","多条波束"替换为"多组波束"等等。当然,这仅仅是例举了两种不同的组合,本发明中同样可以包括与上述两种触发条件相类似的其他形式的触发条件。例如,可以为一种终端接收的多条波束设置一套功率余量报告触发条件,或者为一个服务小区内的所有波束设置一套功率余量报告触发条件等等。

Samsung Electronics v. Asus Tech Licensing EX-1003, 370 of 673

[0170] 在一个具体例子中，为波束集合中每一条波束分别设置第一定时器，如，周期功率余量报告定时器，定时器用于确定当前时刻是否为功率余量报告的触发周期对应的时间，例如周期为10ms，那么定时器启动后，过了10ms，定时器超时，即可以触发功率余量报告，且定时器会按照以10ms为间隔重新启动；或者，第二种情况中，设置第二定时器的同时，设定与波束集合中每一条波束分别对应的下行路径损耗的门限值。第二定时器用于设定禁止功率余量报告触发周期，如，禁止功率余量报告定时器。设置这两个参数的目的是为了避免如果功率余量报告在一段时间内，多次超过门限值时，频繁的触发功率余量报告，由此导致的增加终端设备侧负载，浪费资源的发生。例如，第二定时器设定禁止功率余量报告触发的周期为1小时，当UE发送了一个PHR后，启动该定时器，并从此刻开始计时，1小时内，即使当前时间范围内，功率余量已经超出门限范围，也要禁止功率余量报告的触发。直至超过1小时后，定时器超时后，才允许该条波束的功率余量超出门限范围时，触发功率余量报告。

[0171] 在上述参数中，不论是根据波束集合中每一条波束进行限定功率余量报告的触发，还是根据波束集合中不同分组进行限定，又或者是根据波束集合本身进行限定等等，均需要估计与之对应的确定下行路径损耗。对于下行路径损耗估计则可以包括：对波束集合中每一条波束对应的下行路径损耗进行估计，和/或，对k组波束中的每一组波束对应的下行路径损耗进行估计。

[0172] 具体的，对所述波束集合中每一条波束对应的下行路径损耗进行估计包括：

[0173] 分别根据波束集合中每一条波束对应的参考信号功率和参考信号接收功率，估计波束集合中每一条波束对应的下行路径损耗，其中，参考信号功率由基站配置，参考信号接收功率的测量是基于波束集合中每一条波束对应的信道状态信息参考信号，和/或者基于波束集合中每一条波束对应的波束参考信号。

[0174] 对k组波束中的每一组波束对应的下行路径损耗进行估计，包括：

[0175] 分别根据k组波束中每一组波束对应的参考信号功率和参考信号接收功率，估计k组波束中每一组波束绑定对应的下行路径损耗，其中，参考信号功率由基站配置，参考信号接收功率的测量是基于k组波束中每一组波束对应的信道状态信息参考信号，和/或者基于k组波束中每一组波束对应的波束参考信号。

[0176] 其中，每一条波束对应的参考信号功率的接收功率或者k组波束中每一组波束对应的参考信号接收功率的测量形式包括：

[0177] 经过无线资源控制层过滤，或者不经过无线资源控制层过滤。

[0178] 具体的，经过无线资源控制层过滤为：对当前参考信号接收功率值与历史的参考信号接收功率值进行加权平均。如，对于高频波束不经过无线资源控制层过滤，对于低频波束经过无线资源控制层过滤。

[0179] 不经过无线资源控制层过滤为：终端设备直接将当前参考信号接收功率值作为最终参考信号接收功率值，其中，当前参考信号接收功率值和历史的参考信号接收功率值均指的是波束集合中每一条波束对应的参考信号接收功率，或者均指的是k组波束中每一组波束对应的参考信号接收功率。

[0180] 而具体参考信号接收功率的测量周期的设置则可以包括以下形式之一：

[0181] 设置为固定值Fms，其中F为小于或者等于100的正整数；

[0182] 或者，参考信号接收功率的测量周期依据如下参数之一或组合进行设置，具体参

Samsung Electronics v. Asus Tech Licensing EX-1003, 371 of 673

数包括:频率或频段配置、上下行子帧配比、帧结构模式、无线接入方式以及波束配置方式,比如,高频段的测量周期选择较短周期,低频带的测量周期选择较长的周期,下行子帧比例多的测量周期选择较短周期,下行子帧比例小的测量周期选择较短周期;波束配置中波束宽度较宽的选择较长周期,波束配置中波束宽度较宽的选择较短周期。

[0183] 其中,无线接入类型,包括以下参数中的至少一种:每个子帧OFDM时间符号数目,子帧长度,循环前缀长度,循环前缀的开销,编码方式(比如,LDPC码,Turbo码和polar码),HARQ的定时,子载波间隔。

[0184] 而具体的波束配置方式,可以包括以下参数中的至少一种:

[0185] 天线信息、扰码序列索引SCID扰码序列索引、预编码信息、信道矩阵信息、码本信息、层信息、天线端口数、天线端口号、波束优化能力信息、有效时间、有效时长、控制信道、波束宽度和波束角度。

[0186] 另外,在估计下行路损时,还需要配置波束集合的内容。具体的,配置的波束集合的内容可以包括:一个或多个CSI-RS/BEAM-RS配置索引和对应的CSI-RS/BEAM-RS配置信息,其中CSI-RS/BEAM-RS配置信息可以为天线端口(antennaPortsCount)、资源配置(resourceConfig)、子帧配置(subframeConfig)、CSI-RS/beam-RS参考信号功率信息等中的一种或者多种的组合。CSI-RS参考信号功率信息可以是发射功率信息,或上行共享信道每资源元素能量(EnergyPerResourceElement,EPRE)与CSI-RS/beam-RSEPRE的比例信息。或者,配置的波束集合的内容还可以仅包括CSI-RS/BEAM-RS配置索引信息,而其他配置信息和被测的波束集合或波束组合包含在不同的无线资源控制信元(informationelement,IE)中。又或者,配置的波束集合的内容还可以仅包括所述波束集合所在波束集合的波束集合索引和对应的物理波束集合标识配置信息。而其它配置信息和测量集合包含在不同的无线资源控制信元中。具体如何估计下行路径损耗是现有技术,这里不再赘述。不过下行路径损耗可以基于如下一种情况进行计算:基于波束集合中所有波束中最小下行路损,或所有波束的下行路损的加权平均值(不同的波束可以取值为不同的因子,所有因子的和为1),或最小的m个波束的下行路损的平均值或加权平均值,或者下行路损与最小下行路损的差值不超过门限值的n个波束的下行路损的平均值或加权平均值或任一个满足上述触发条件的波束。其中n小于等于波束集合中所有波束个数。

[0187] 另外,在估计下行路损时,还需要配置波束集合的内容。具体的,配置的波束集合的内容可以包括:一个或多个CSI-RS/BEAM-RS配置索引和对应的CSI-RS/BEAM-RS配置信息,其中CSI-RS/BEAM-RS配置信息可以为天线端口(antennaPortsCount)、资源配置(resourceConfig)、子帧配置(subframeConfig)、CSI-RS/beam-RS参考信号功率信息等中的一种或者多种的组合。CSI-RS参考信号功率信息可以是发射功率信息,或上行共享信道每资源元素能量(EnergyPerResourceElement,EPRE)与CSI-RS/beam-RSEPRE的比例信息。或者,配置的波束集合的内容还可以仅包括CSI-RS/BEAM-RS配置索引信息,而其他配置信息和被测的波束集合或波束组合包含在不同的无线资源控制信元(informationelement,IE)中。又或者,配置的波束集合的内容还可以仅包括所述波束集合所在物理小区的小区索引和对应的物理小区标识配置信息。而其它配置信息和测量集合包含在不同的无线资源控制信元中。配置波束集合的目的在于,在估算下行路径损耗时,能够根据波束集合内容,确定当前估算的是波束集合中哪一条波束的下行路径损耗。具体如何估计下行路径损耗是现

Samsung Electronics v. Asus Tech Licensing EX-1003, 372 of 673

有技术，这里不再赘述。不过下行路径损耗可以基于如下一种情况进行计算：基于波束集合中所有波束中最小下行路损，或所有波束的下行路损的加权平均值（不同的波束可以取值为不同的因子，所有因子的和为1），或最小的m个波束的下行路损的平均值或加权平均值，或者下行路损与最小下行路损的差值不超过门限值的n个波束的下行路损的平均值或加权平均值或任一个满足上述触发条件的波束。其中n小于等于波束集合中所有波束个数。

[0188] 具体的，对波束集合中的每一条波束的下行路径损耗进行估计，实际上是首先估计与波束集合中每一条波束分别对应的下行波束的下行路径损耗，然后将下行波束的下行路径损耗作为该波束的下行路径损耗。也即是，波束集合中的波束其实均指的是上行波束。

[0189] 因此，在对波束集合中每一条波束对应的下行路径损耗进行估计之前，首先要确定与波束集合中每一条波束对应的下行波束。对下行波束的路径损耗进行估计。其中，波束集合中每一条波束的时间根据与之对应的下行波束的时间进行估计，和/或波束集合中每一条波束的频率根据与之对应的下行波束的频率进行估计，和/或波束集合汇总每一条波束的无线信道质量根据与之对应的下行波束的无线信道质量进行估计。

[0190] 而具体的，确定波束集合中每一条波束对应下行波束，方法可以包括：

[0191] 通过无线资源控制层（专用信令和/或系统信息中）或媒体接入控制层进行配置具体的上下行配对的波束和/或波束组合；

[0192] 或者，

[0193] 通过无线资源控制层（专用信令和/或系统信息中）或媒体接入控制层为所述波束集合中的一条或多条波束配置一个用于无线信道质量评估的参考下行波束；

[0194] 或者，

[0195] 终端设备在波束初始接入，和/或波束扫描，和/或波束训练过程中获得分别与波束集合中每一条波束配对下行波束。

[0196] 还需要说明的是，在本发明的一个具体例子中，可以为一个波束集合或者波束集合中的每一条波束配置一套上行功率控制参数。可选的，还可以针对波束集合中的每个BEAM-RS（波束：BEAM，RS：参考信号）配置信息配置信息分别配置一套上述上行功率控制参数。此时，上行功率控制参数配置信息可以和所关联的上行波束集合的其他配置信息包含在不同的无线资源控制信元中。

[0197] 进一步可选的，在上述计算波束集合中每一条波束分别对应的功率余量、上行共享信道的发射功率以及物理上行控制信道的发射功率的同时，还可以计算每一条波束对应的探测参考符号对应的发射功率。

[0198] 具体计算公式如式3-11所示：

$$P_{SRS,c}(i)\_beam\_p =$$

[0199] $$\min\left\{P_{CMAX,c}(i), P_{SRS\ OFFSET,c}(m) + 10\log_{10}\left(M_{SRS,c}\right)\_beam\_p + \right.$$

$$\left. POPUSCH,cj\_beam\_p + \alpha cj \cdot PLc\_beam\_p + fc(i)\_beam\_p \right\} \quad (3\text{-}11)$$

[0200] 其中，$P_{SRS\ OFFSET,c}(m)$为无线资源控制层半静态配置的功率偏移值，m可取0和1，分别对应SRS发送触发Type0和Type1；MSRS，c为SRS传输使用的RB个数，而上述公式中的其他参数则可以参照上文中估算波束集合中第p条波束的上行共享信道的发射功率或者物理

Samsung Electronics v. Asus Tech Licensing EX-1003, 373 of 673

上行控制信道发射功率的参数释义，这里不再赘述。

[0201] 对应的，如果计算终端设备所处波束集合的功率余量是以k组波束为基准计算时，对应的k组波束中每一组对应的探测参考符号对应的发射功率，则可以按照公式3-12所示，计算：

[0202] $$P_{SRS,c}(i)\_beamq = \min\left\{P_{CMAX,c}(i), P_{SRS\_OFFSET,c}(m) + 10\log_{10}\left(M_{SRS,c}\right)\_beamq + P_{O\_PUSCH,c}(j)\_beamq + \alpha cj \cdot PLc\_beamq + fc(i)\_beamq\right\} \quad (3\text{-}12)$$

[0203] 其中，$P_{SRS_OFFSET,c}(m)$为无线资源控制层半静态配置的功率偏移值，m可取0和1，分别对应SRS发送触发Type0和Type1；MSRS，c为SRS传输使用的RB个数，而上述公式中的其他参数则可以参照上文中估算k组波束中第q组波束的上行共享信道的发射功率或者物理上行控制信道发射功率的参数释义，这里不再赘述。

[0204] 本发明实施例提供的一种功率控制方法，在波束域计算上行共享信道的发射功率、物理上行控制信道的发射功率，以及波束集合的功率余量，并生成功率余量报告。将功率余量报告发送至基站，以便基站根据功率余量报告对终端设备侧的功率进行调整。基于上述方法，可以避免由于功率控制不准确导致的终端设备之间增加干扰、资源调度不充分或者上行吞吐量降低等问题。

[0205] 与本发明实施例一提供的一种功率控制方法相对应的，本发明实施例二提供了一种终端设备，具体如图4所示，图4为本发明实施例提供的一种终端设备的结构示意图。该终端设备包括：接收模块401，处理模块402，发送模块403。

[0206] 接收模块401，用于接收基站发送的配置信息，其中配置信息包括：上行功率控制参数。

[0207] 处理模块402，用于根据上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率，其中，波束集合包括n条波束，n为大于或者等于1的正整数。

[0208] 具体的，处理模块402根据上行功率控制参数，估算终端设备所处波束集合的上行共享信道的发射功率，可以包括以下两种形式：

[0209] 根据所述上行功率控制参数，分别估算所述终端设备所处波束集合中每一波束的上行共享信道的发射功率；或者，根据所述上行功率控制参数，分别估算所述终端设备所处k组波束中每一组波束的上行共享信道的发射功率，其中，所述k组波束构成所述波束集合，k为大于或者等于1的正整数。

[0210] 然后，根据终端设备的最大发射功率和终端设备所处波束集合的上行共享信道的发射功率，计算终端设备所处波束集合的功率余量。

[0211] 当然，与之对应的，计算终端设备所处波束集合的功率余量的方式同样可以包括以下两种：

[0212] 依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中p为大于或者等于1，且小于或者等于n的正整数；或者，依次根据终端设备的最大发射功率、k组波束中第q组波束的上行共享信道的发射功率，计算k组波束中的第q组波

Samsung Electronics v. Asus Tech Licensing EX-1003, 374 of 673

束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

[0213] 然而，利用上述两种计算功率余量的方式的前提条件是处理模块402确定终端设备将上行共享信道和物理上行控制信道不同时发送至基站。

[0214] 即，处理模块402还用于，确定终端设备将上行共享信道和物理上行控制信道是否同时发送至基站。而当确定终端设备将上行共享信道和物理上行控制信道同时发送至基站时，则会根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率以及终端设备所处波束集合的物理上行控制信道的发射功率，计算终端设备所在波束集合的功率余量。

[0215] 因此，在此之前，处理模块402还需要根据上行功率控制参数，估算终端设备所处波束集合的物理上行控制信道的发射功率。

[0216] 具体包括：根据上行功率控制参数，分别估算波束集合中每一条波束的物理上行控制信道的发射功率；或者，根据上行功率控制参数，分别估算k组波束中每一组的物理上行控制信道的发射功率，其中，k组波束构成波束集合，k为大于或者等于1的正整数。

[0217] 与上述根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率计算终端设备所在波束集合的功率余量的方式相类似的，根据终端设备的最大发射功率、终端设备所处波束集合的上行共享信道的发射功率以及终端设备所处波束集合的物理上行控制信道的发射功率，计算终端设备所在波束集合的功率余量的方式同样包括以下两种：

[0218] 依次根据终端设备的最大发射功率、波束集合中第p条波束的上行共享信道的发射功率，以及波束集合中第p条波束的物理上行控制信道的发射功率，计算波束集合中第p条波束的功率余量，直至波束集合中每一条波束的功率余量计算完成，其中，p为大于或者等于1，且小于或者等于n的正整数；

[0219] 或者，

[0220] 依次根据终端设备的最大发射功率、k组波束中第q组波束的上行共享信道的发射功率，以及k组波束中第q组波束的物理上行控制信道的发射功率，计算k组波束中第q组波束的功率余量，直至k组波束中每一组波束的功率余量计算完成，其中q为大于或者等于1，且小于或者等于k的正整数。

[0221] 发送模块403，用于将功率余量报告发送至基站。

[0222] 另外，在配置信息中还可以包括第一控制信令，第一控制信令用于指示终端设备配置功率余量报告类型，其中，配置功率余量报告的类型包括以下至少一种：

[0223] 应用于波束技术的基于波束的功率余量报告；

[0224] 应用于波束技术的基于波束组的功率余量报告；

[0225] 应用于载波聚合的基于载波和波束的第一扩展功率余量报告；

[0226] 应用于载波聚合的基于载波和波束组的第二扩展功率余量报告；

[0227] 应用于双连接场景的基于服务小区和波束的第一双连接功率余量报告；

[0228] 应用于双连接场景的基于服务小区和波束组的第二双连接功率余量报告

[0229] 应用于大量载波聚合的基于载波和波束的第三扩展功率余量报告；

[0230] 应用于大量载波聚合的基于载波和波束组的第四扩展功率余量报告。

Samsung Electronics v. Asus Tech Licensing EX-1003, 375 of 673

[0231] 在终端设备根据第一控制信令，配置功率余量报告类型后，发送模块403还用于：通过媒体接入控制层向基站发送功率余量报告媒体访问控制信令，其中，功率余量报告媒体访问控制信令用于指示所述功率余量报告已经配置完成。

[0232] 优选的，该终端设备中还可以包括触发模块404，用于在发送模块403将功率余量报告发送至基站之前，触发功率余量报告。

[0233] 进一步优选的，在接收模块接收的基站发送的配置信息中，还包括与功率余量报告触发条件对应的参数信息。触发模块404则还用于：根据与功率余量报告触发条件对应的参数信息，确定当前时刻终端设备侧是否满足触发功率余量报告的条件，且仅在终端设备侧满足触发功率余量报告的条件时，触发功率余量报告。其中，与功率余量报告触发条件对应的参数信息包括：功率余量触发周期、禁止功率余量报告触发周期和下行路径损耗值。

[0234] 具体的，触发功率余量报告的条件包括：当前时刻为功率余量报告的触发周期对应的时间。

[0235] 或者，当前时刻不属于禁止功率余量报告触发周期，且当前时刻，波束集合中任一条波束的下行路径损耗大于下行路径损耗的门限值。

[0236] 或者，当前时刻不属于禁止功率余量报告触发周期，且当前时刻，m条波束中每一条波束对应的下行路径损耗均大于下行路径损耗的门限值，其中，m条波束为波束集合的子集，且m为大于或者等于2，小于或者等于n的正整数，此时n为大于或者等于2的正整数。

[0237] 或者，当前时刻不属于禁止功率余量报告触发周期，且当前时刻，波束集合中波束对应的下行路径损耗的平均值或者加权平均值大于下行路径损耗的门限值。

[0238] 或者，当前时刻不属于禁止功率余量报告触发周期，且当前时刻，波束集合中预先设定的一条波束的下行路径损耗大于下行路径损耗的门限值。

[0239] 上行功率控制参数的配置方式可以包括以下至少一种：

[0240] 以波束集合中的每一条波束为粒度；

[0241] 以k组波束中的每一组波束为粒度；

[0242] 以载波为粒度；

[0243] 以服务小区为粒度；

[0244] 以终端设备为粒度。

[0245] 类似的，置功率余量报告触发条件的参数信息的方式也包括以下至少一种：以波束集合中的每一条波束为粒度；

[0246] 以k组波束中的每一组波束为粒度；

[0247] 以载波为粒度；

[0248] 以服务小区为粒度；

[0249] 以终端设备为粒度。

[0250] 进一步的，配置上行功率控制参数以及配置与功率余量报告触发条件对应的参数信息时，如果以所述波束集合中的每一条波束为粒度时，所述配置参数中还包括：

[0251] 波束的标识/标号；

[0252] 或者，识别波束的信号的标识/标号，其中，所述识别波束的信号包括如下之一或组合：波束的参考信号、波束的发现信号、波束标识。

[0253] 或者，配置上行功率控制参数以及配置与功率余量报告触发条件对应的参数信息

Samsung Electronics v. Asus Tech Licensing EX-1003, 376 of 673

时，如果以k组波束中的每一组波束为粒度时，那么配置参数中将还包括：识别k组波束中每一组波束的标识/标号；

[0254] 或者，识别k组波束中每一组波束的信号的标识/标号。

[0255] 而在确定触发功率余量报告的触发条件时，需要计算下行路径损耗。也即是，处理模块402还用于：对波束集合中每一条波束对应的下行路径损耗进行估计和/或对k组波束中的每一组波束对应的下行路径损耗进行估计。

[0256] 具体的，处理模块402对波束集合中每一条波束对应的下行路径损耗进行估计，可以包括：分别根据波束集合中每一条波束对应的参考信号功率和参考信号接收功率，估计波束集合中每一条波束对应的下行路径损耗，其中，参考信号接收功率的测量是基于波束集合中每一条波束对应的信道状态信息参考信号，和/或者基于波束集合中每一条波束对应的波束参考信号。

[0257] 而处理模块402对k组波束中的每一组波束对应的下行路径损耗进行估计，具体可以包括：分别根据k组波束中每一组波束对应的参考信号功率和参考信号接收功率，估计k组波束中每一组波束绑定对应的下行路径损耗，其中，参考信号接收功率的测量是基于k组波束中每一组波束对应的信道状态信息参考信号，和/或者基于k组波束中每一组波束对应的波束参考信号。

[0258] 其中，每一条波束对应的参考信号功率的接收功率或者k组波束中每一组波束对应的参考信号接收功率的测量形式包括：

[0259] 经过无线资源控制层过滤，或者不经过无线资源控制层过滤。

[0260] 这里，经过无线资源控制层过滤指的是：对当前参考信号接收功率值与历史的参考信号接收功率值进行加权平均；

[0261] 不经过无线资源控制层过滤指的是：终端设备直接将当前参考信号接收功率值作为最终参考信号接收功率值，其中，当前参考信号接收功率值和历史的参考信号接收功率值均指的是波束集合中每一条波束对应的参考信号接收功率，或者均指的是k组波束中每一组波束对应的参考信号接收功率。参考信号接收功率的测量周期可以设置为固定值Fms，F为小于或者等于100的正整数；或者，也可以依据如下参数之一或组合进行设置，参数包括：频率或频段配置、上下行子帧配比、帧结构模式、无线接入方式以及波束配置方式。

[0262] 而处理模块402无论是估计波束集合中每一条波束的下行路损，还是估计k组波束中每一组波束的下行路径损耗，均需要首先估计与波束集合中每一条波束分别对应的下行波束，或者k组波束中，每一组波束里的任一条波束对应的下行波束。即，波束集合中每一条波束均是上行波束，而估计下行路径损耗需要根据下行波束确定，然后粗略作为上行波束的下行路径损耗。因此，在估计下行路径损耗之前，处理模块402还用于：确定与波束集合中每一条波束对应的下行波束。对下行波束的路径损耗进行估计，其中，波束集合中的波束为上行波束，所波束集合中每一条波束的时间根据与之对应的下行波束的时间进行估计，和/或波束集合中每一条波束的频率根据与之对应的下行波束的频率进行估计，和/或波束集合中每一条波束的无线信道质量根据与之对应的下行波束的无线信道质量进行估计。

[0263] 而处理模块具体确定与波束集合中每一条波束对应的下行波束时，则可以通过无线资源控制层或媒体接入控制层进行配置；或者，通过无线资源控制层或媒体接入控制层为所述波束集合中的一条或多条波束配置一个用于无线信道质量评估的参考下行波束；或

Samsung Electronics v. Asus Tech Licensing EX-1003, 377 of 673

者，终端设备在波束初始接入，和/或波束扫描，和/或波束训练过程中获得分别与波束集合中每一条波束配对下行波束等方式确定。

[0264] 本发明实施例二提供的终端设备运行时执行本发明实施例一中提供的执行的方法步骤，其工作细节参考本发明实施例一提供的方法。

[0265] 本实施例二提供的一种终端设备，在波束域计算上行共享信道的发射功率、物理上行控制信道的发射功率，以及波束集合的功率余量，并生成功率余量报告。将功率余量报告发送至基站，以便基站根据功率余量报告对终端设备侧的功率进行调整。基于上述方法，可以避免由于功率控制不准确，而导致的终端设备之间干扰增加、资源调度不充分或者上行吞吐量降低等问题。

[0266] 与本发明实施例一和实施例二分别对应的，本发明实施例三还提供了一种终端设备，具体如图5所示，该终端设备包括接收器501、发射器502、处理器503、存储器504、通信接口505以及总线506。终端设备中的接收器501、发射器502、处理器503、存储器504和通信接口505可以通过总线506建立通信连接。

[0267] 接收器501，用于接收基站发送的配置信息。

[0268] 发射器502，用于向基站发送配置功率余量报告成功的响应消息，以及向基站发送功率余量报告。

[0269] 处理器503可以为中央处理器(英文:central processing unit，缩写:CPU)，主要用于执行实施例二中所述的处理模块和触发模块对应的方法步骤等。

[0270] 存储器504用于存储处理器所执行的指令，以及功率余量报告的相关参数信息等。存储器504可以包括易失性存储器(英文:volatile memory)，例如随机存取存储器(英文:random-access memory，缩写:RAM)；存储器也可以包括非易失性存储器(英文:non-volatile memory)，例如只读存储器(英文:read-only memory，缩写:ROM)，快闪存储器，硬盘(英文:hard disk drive，缩写:HDD)或固态硬盘(英文:solid state drive，缩写:SSD)；存储器504还可以包括上述种类的存储器的组合。

[0271] 具体终端设备中各个器件所执行均是本发明实施例一中提供的方法步骤，其工作细节参考本发明实施例一提供的方法。这里不再赘述。

[0272] 基于上述技术方案，本发明实施例提供的一种功率控制的方法及终端设备，在波束域计算上行共享信道的发射功率、物理上行控制信道的发射功率，以及波束集合的功率余量，并生成功率余量报告。将功率余量报告发送至基站，以便基站根据功率余量报告对终端设备侧的功率进行调整。基于上述方法，可以避免由于功率控制不准确，而导致的终端设备之间干扰增加、资源调度不充分或者上行吞吐量降低等问题。

[0273] 专业人员应该还可以进一步意识到，结合本文中所公开的实施例描述的各示例的单元及算法步骤，能够以电子硬件、计算机软件或者二者的结合来实现，为了清楚地说明硬件和软件的可互换性，在上述说明中已经按照功能一般性地描述了各示例的组成及步骤。这些功能究竟以硬件还是软件方式来执行，取决于技术方案的特定应用和设计约束条件。专业技术人员可以对每个特定的应用来使用不同方法来实现所描述的功能，但是这种实现不应认为超出本发明的范围。

[0274] 结合本文中所公开的实施例描述的方法或算法的步骤可以用硬件、处理模块执行的软件模块，或者二者的结合来实施。软件模块可以置于随机存储器(RAM)、内存、只读存储

Samsung Electronics v. Asus Tech Licensing EX-1003, 378 of 673

器(ROM)、电可编程ROM、电可擦除可编程ROM、寄存器、硬盘、可移动磁盘、CD-ROM、或技术领域内所公知的任意其它形式的存储介质中。

[0275] 以上所述的具体实施方式，对本发明的目的、技术方案和有益效果进行了进一步详细说明，所应理解的是，以上所述仅为本发明的具体实施方式而已，并不用于限定本发明的保护范围，凡在本发明的精神和原则之内，所做的任何修改、等同替换、改进等，均应包含在本发明的保护范围之内。

Samsung Electronics v. Asus Tech Licensing EX-1003, 379 of 673

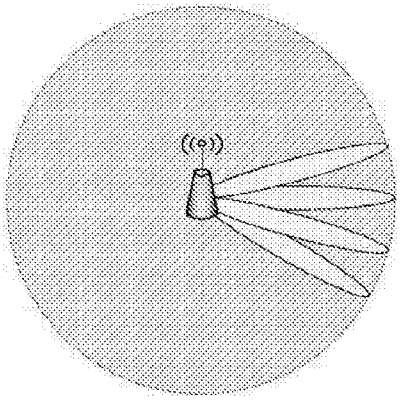


图1

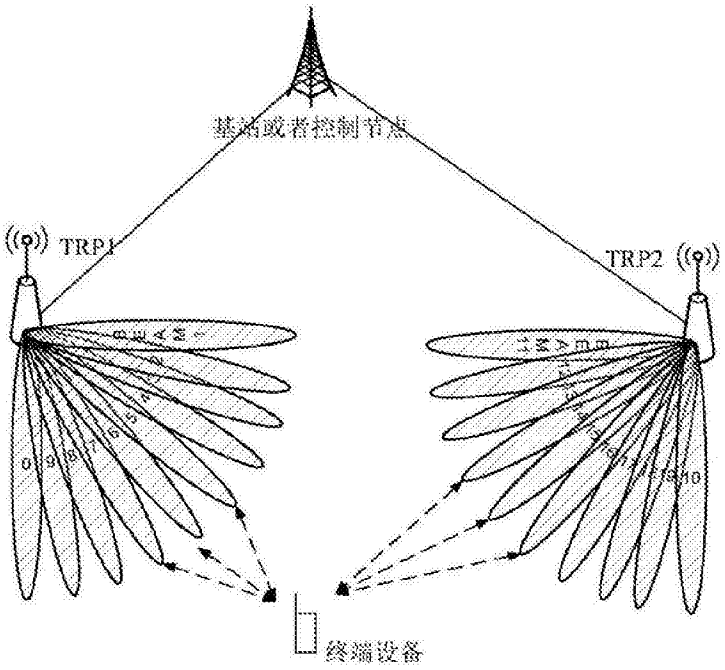


图2

Samsung Electronics v. Asus Tech Licensing EX-1003, 380 of 673

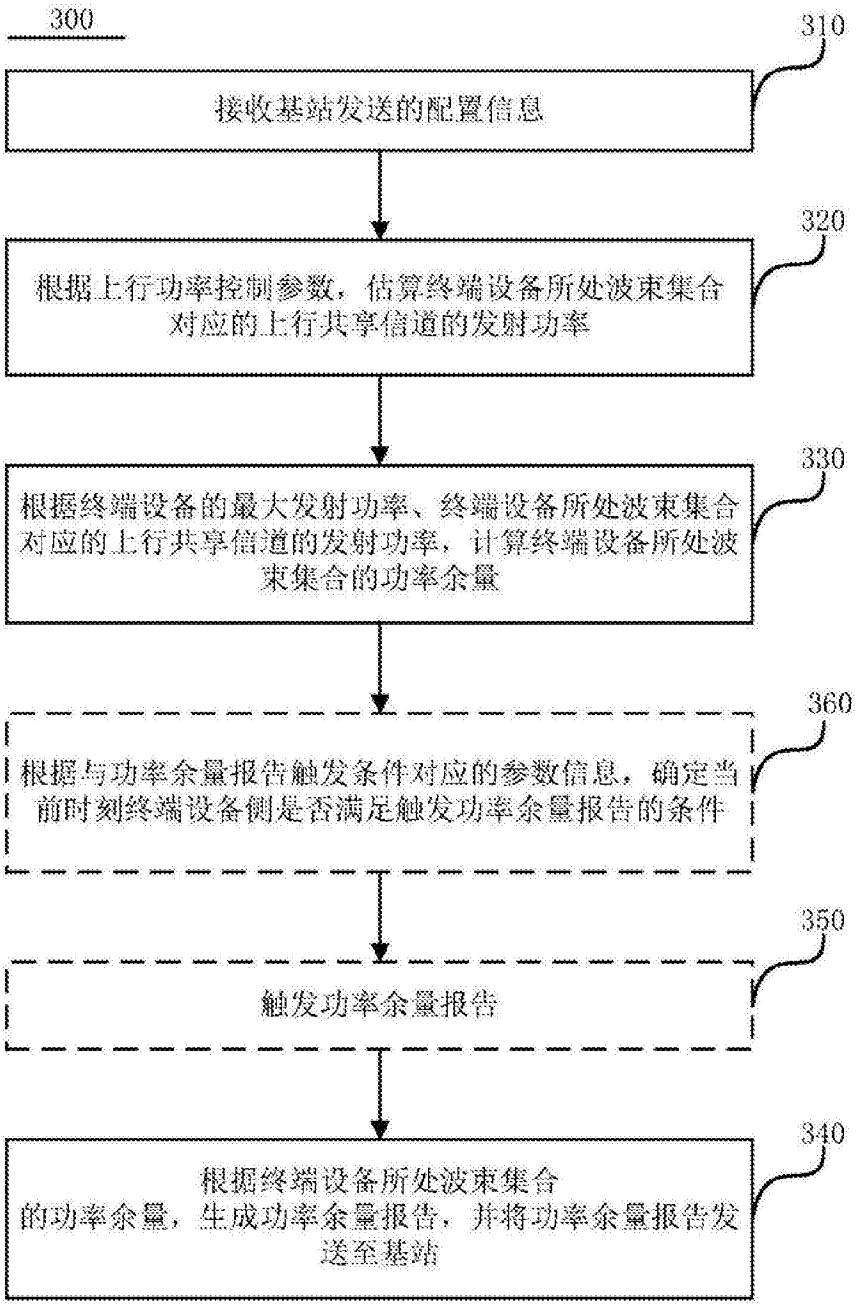


图3

Samsung Electronics v. Asus Tech Licensing EX-1003, 381 of 673

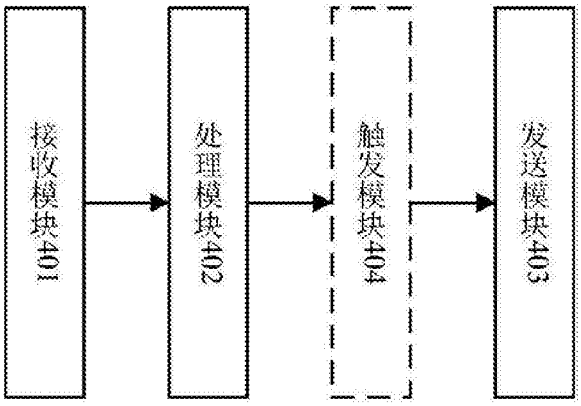


图4

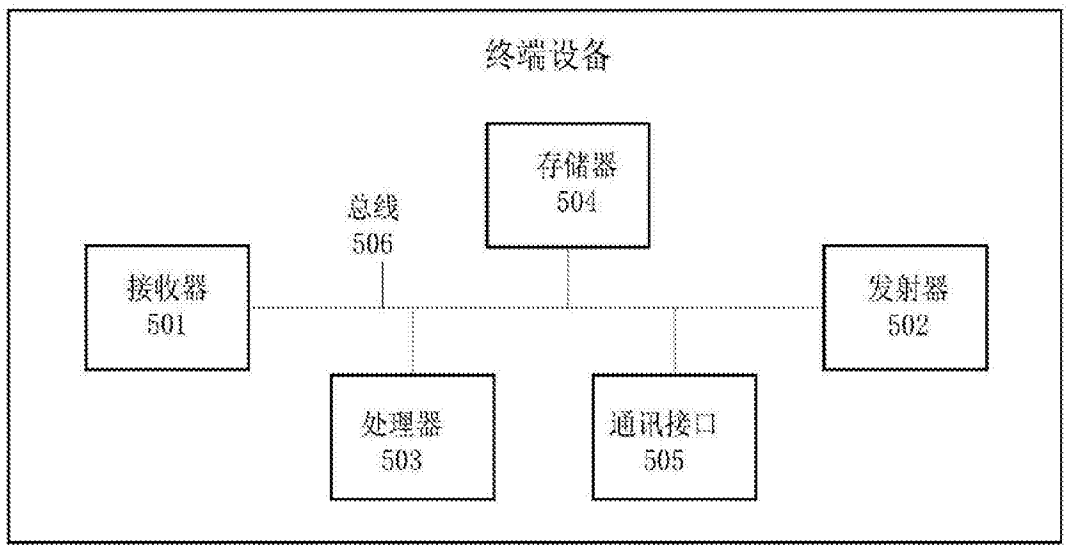


图5

Samsung Electronics v. Asus Tech Licensing EX-1003, 382 of 673

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H04W 52/32(2009.01)

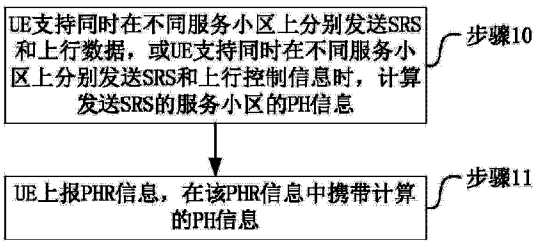
权利要求书2页 说明书9页 附图2页

(54)发明名称

一种载波聚合系统中的功率上报方法及装置

(57)摘要

本发明公开了一种载波聚合系统中的功率上报方法及装置，保证服务小区上数据和信令的传输。该方法包括：UE支持同时在不同服务小区上分别发送SRS和上行数据，或UE支持同时在不同服务小区上分别发送SRS和上行控制信息时，UE采用下式之一计算发送SRS的服务小区的PH信息：PH信息=UE在发送SRS的服务小区的最大发送功率-UE在该服务小区上估计的上行数据传输信道发送功率；PH信息=UE在发送SRS的服务小区的最大发送功率 UE在该服务小区上估计的上行数据传输信道发送功率-SRS的发送功率；UE上报PHR信息，在该PHR信息中携带所述PH信息。该装置位于UE，包括PH信息计算模块和PHR信息上报模块。



CN 103813430 A

1. 一种载波聚合系统中的功率上报方法，包括：

用户设备（UE）支持同时在不同服务小区上分别发送侦听参考信号（SRS）和上行数据，或 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，所述 UE 采用下式之一计算发送 SRS 的服务小区的功率余量（PH）信息：

所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率；

所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率 -SRS 的发送功率；

UE 上报功率余量报告（PHR）信息，在所述 PHR 信息中携带所述 PH 信息。

2. 如权利要求 1 所述的方法，其特征在于：

当 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据时，所述 UE 上报 PHR 信息，包括：

所述 UE 同时在不同服务小区上分别发送 SRS 和上行数据时，向控制站上报本 UE 的 PHR 信息；或者，所述 UE 同时在不同服务小区上分别发送 SRS 和上行数据之前，向控制站上报本 UE 的 PHR 信息。

3. 如权利要求 1 所述的方法，其特征在于：

当 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，所述 UE 上报 PHR 信息，包括：

所述 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息时，向控制站上报本 UE 的 PHR 信息；或者，所述 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息之前，向控制站上报本 UE 的 PHR 信息。

4. 如权利要求 1 或 2 或 3 所述的方法，其特征在于：

所述不同服务小区，包括主服务小区和已激活的辅服务小区，或任意两个已激活的服务小区。

5. 如权利要求 4 所述的方法，其特征在于：

所述不同的服务小区属于同一载波组或属于不同载波组。

6. 如权利要求 1 所述的方法，其特征在于：

所述方法还包括，在所述 PHR 信息中携带与所述 PH 信息对应的所述服务小区的指示标识，当所述发送 SRS 的小区中仅有 SRS 发送时，所述服务小区的指示标识用于标识当前服务小区上无上行数据或上行控制信息发送。

7. 一种载波聚合系统中的功率上报装置，位于用户设备（UE），包括功率余量（PH）信息计算模块和功率余量报告（PHR）信息上报模块，其中：

所述 PH 信息计算模块，用于在当前 UE 支持同时在不同服务小区上分别发送侦听参考信号（SRS）和上行数据，或当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，采用下式之一计算发送 SRS 的服务小区的 PH 信息：

所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率；

所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率 -SRS 的发送功率；

Samsung Electronics v. Asus Tech Licensing EX-1003, 384 of 673

所述 PHR 信息上报模块，用于上报 PHR 信息，在所述 PHR 信息中携带所述 PH 信息计算模块计算的 PH 信息。

8. 如权利要求 7 所述的装置，其特征在于：

在当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据时，所述 PHR 信息上报模块上报 PHR 信息，包括：

所述 PHR 信息上报模块在当前 UE 同时在不同服务小区上分别发送 SRS 和上行数据时，向控制站上报本 UE 的 PHR 信息；或者，在当前 UE 同时在不同服务小区上分别发送 SRS 和上行数据之前，向控制站上报本 UE 的 PHR 信息。

9. 如权利要求 7 所述的装置，其特征在于：

在当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，所述 PHR 信息上报模块上报 PHR 信息，包括：

所述 PHR 信息上报模块在当前 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息时，向控制站上报本 UE 的 PHR 信息；或者，在当前 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息之前，向控制站上报本 UE 的 PHR 信息。

10. 如权利要求 7 或 8 或 9 所述的装置，其特征在于：

所述不同服务小区，包括主服务小区和已激活的辅服务小区，或任意两个已激活的服务小区。

11. 如权利要求 10 所述的装置，其特征在于：

所述不同的服务小区属于同一载波组或属于不同载波组。

12. 如权利要求 7 所述的装置，其特征在于：

所述 PHR 信息上报模块还用于在所述 PHR 信息中携带与所述 PH 信息对应的所述服务小区的指示标识，当所述发送 SRS 的小区中仅有 SRS 发送时，所述服务小区的指示标识用于标识当前服务小区上无上行数据或上行控制信息发送。

Samsung Electronics v. Asus Tech Licensing EX-1003, 385 of 673

一种载波聚合系统中的功率上报方法及装置

技术领域

[0001] 本发明涉及移动通讯技术领域，具体涉及一种载波聚合系统中的功率上报方法及装置。

背景技术

[0002] 目前，无线通信系统使用电磁波与固定的或者移动的无线通信用户设备(无线电话或附有无线通信卡的笔记本和电脑等设备均可被称为用户设备)进行通信。一般来说，在进行无线通信时，用户设备(User Equipment，简称UE)位于系统的无线覆盖范围之内，并通过无线通信信道中的载波与系统进行通信。

[0003] 无线通信系统的控制网元可以根据系统约定的通信协议或技术控制其他设备。控制网元包括控制站和网络。控制站包括但不限于基站(N ode B，或者 eNode B，包括宏基站，微基站，家庭基站等)、中继站(Relay Station，简称 RS)和用户设备，当用户设备用做控制站时，该用户设备可以是根据预定规则在用户设备中挑选的作为临时的控制站。通信协议或技术包括但不限于 GSM (Global System for Mobile Communications，全球移动通信系统)、CDMA (Code Division Multiple Access，码分多址)、EDGE (Enhanced Data Rate for GSM Evolution，增强型数据速率 GSM 演进技术)、CDMA2000、TD-SCDMA (Time Division-Synchronous Code Division Multiple Access，时分同步码分多址)、HSPA (High Speed Packet Access，高速分组接入)、WCDMA (Wideband Code Division Multiple Access，宽带码分多址)、EVDO (Evolution Data Only，仅演进数据)、HSOPA (High Speed OFDM Packet Access，高速正交频分复用分组接入)、WiMAX (World Interoperability for Microwave Access，微波存取全球互通)、LTE (Long Term Evolution，长期演进) 和 LTE-A (LTE-Advanced，长期演进 - 高级)。

[0004] LTE 的上行功率控制的主要过程为：

[0005] (1) UE 接收到 TPC (transmitting power control，功率控制命令)；

[0006] (2) UE 进行下行无线信道导频接收功率的测量，计算路径损耗(Pathloss)，UE 以 Pathloss、上行共享信道带宽、传输块格式和 TPC 等参数计算发射功率 P；如果用户设备触发了 PHR (power headroom report，功率余量报告)，并满足发送条件，那么 UE 还需要在上行共享信道上发送 PHR。

[0007] (3)eNodeB (演进型基站)收到物理上行共享信道和 / 或 PHR 后，通过 DCI Format 0/3/3A 的物理下行控制信道向 UE 发送 TPC；返回执行步骤(1)。

[0008] 系统中 UE 采用动态的资源分配方式，并且采用自适应的信道编码调制方式 (adaptive modulation and coding，AMC)，在 LTE 中，UE 的上行发射功率与资源分配、编码调制方式相关，因此单独的功率控制方式还不足以完成 LTE 中 UE 的功率控制任务，通过 UE 向 eNodeB 发送的 PHR 作为 PUSCH (物理上行共享信道) 的资源预算信息，为 eNodeB 进行上行链路资源分配提供依据。如果 PHR 反映出 UE 有较大的功率余量，那么 eNodeB 可以分配较多的无线资源块给 UE；如果 PHR 反映出 UE 已经没有功率余量，或者没有较多的功率余量，

Samsung Electronics v. Asus Tech Licensing EX-1003, 386 of 673

那么 eNodeB 只能分配较少的无线资源块或者低阶调制命令给 UE。

[0009] LTE 系统中 UE 向 eNodeB 的 PHR 的发送频率低于 eNodeB 向 UE 的 TPC 的发送频率。PHR 的发送需要有两个步骤：首先是触发，然后是上报。UE 在周期 PHR 定时器到期时或者路损变化较大或者 PHR 配置或重配置时触发 PHR 上报，当 UE 获得了足够用于 PHR 的 PUSCH 资源后，UE 向 eNodeB 上报 PHR。

[0010] PHR 的计算为 $PH(i)=P_{CMAX}-P_{ue,tx}$，PH 为功率余量值（Power headroom），P_{cMAX} 为 UE 配置最大发射功率（configured maximum output power），$P_{CMAX\_L} \leq P_{CMAX} \leq P_{CMAX\_H}$，$P_{CMAX\_L}$ 为最大发射功率最低值，P_{CMAX_H} 为最大发射功率最高值，P_{CMAX} 的取值范围主要有两种受限因素：

[0011] 1）受限于 eNodeB 的控制，比如在微基站的小覆盖场景，eNodeB 会控制 UE 的最大发射功率，以减少 UE 对邻区的干扰；

[0012] 2）UE 的无用带外辐射（Out of band emission），如为了满足 SEM（Spectrum emission mask，频谱发射屏蔽）和 ACLR（Adjacent Channel Leakage Ratio，邻带泄露比）等要求，UE 可以设计复杂的滤波器，用来减少带外辐射，或者 UE 降低最大发射功率，前者会增加 UE 的成本，后者降低了 UE 的上行能力。由于降低发射功率（也称为功率回退，power reduce，PR）的方法简单有效，大量 UE 在实现时会采用该方法来达到带外辐射的要求。不过为了保证 UE 的上行发送能力，不允许 UE 无限制的降低功率，以至于不能进行基本的上行业务，协议中定义允许的 MPR（Maximum Power Reduction，最大功率回退值），由于带外辐射的大小跟发送数据的调制解调配置，以及占用的带宽都有关系，如 LTE 在协议 36.101 中，按不同的发送带宽和调制解调模式设置了不同的 MPR，各 UE 可以按自身的实现设置实际的 PR 值，只要满足 PR ≤ MPR 即可。

[0013] 所以考虑到功率回退后，UE 在额定的发射功率 $P_{powerclass}$ 的基础上减去实际的功率回退值，并且还需要考虑上述的网络允许的最大发射功率后，取两者中的最小值为实际的 P_{CMAX}。

[0014] $P_{ue,tx}$ 为 UE 上行理论发射功率。在 LTE 中，PHR 中只考虑 PUSCH 的发射功率，所以 $P_{ue,tx} = P_{Ue,pusch}$，$P_{ue,pusch}$ 在 LTE 中为 PUSCH 的发射功率，定义为 $P_{ue,pusch} = 10\log_{10}(M_{PUSCH}(i))+P_{O\_PUSCH}(t)+\alpha(t)\cdot PL+\Delta_{TF}(i)+f(i)$，其中的 $M_{PUSCH}(i)$ 为 PUSCH 的发送带宽由调度的 MCS（Modulation and Coding Scheme，调制编码格式）配置决定，$P_{O\_PUSCH}(t)$ 为开环功控调整值，$\alpha(t)$ 为部分路损补偿值，t 为半静态变量，PL 为路损、$\Delta_{TF}(i)$ 为传输格式补偿值，f(i) 为闭环功控调整值，即 PUSCH 的发射功率跟 PUSCH 的占用资源的带宽，UE 和基站间的路损以及开环功控和闭环功控的配置相关。如果不考虑由于功率管理（power management）带来的功率回退（即 P-MPR 的限制），PHR 计算公式为 $PH(i) = P_{CMAX}-\{10\log_{10}(M_{PUSCH}(i))+P_{O\_PUSCH}(t)+a(t)\cdot PL+\Delta_{TF}(i)+f(i)\}$，其中 PHR 以 dB 为单位，公式中功率以 dBm 为单位。

[0015] 在 LTE 中，如果不考虑由于功率管理（power management）带来的功率回退（即 P-MPR 的限制），PHR 上报的触发（trigger）主要有以下三种情况：

[0016] 1）PHR 禁止定时器（prohibitPHR-Timer）超时，并且路损相对于上一次 PHR 上报的变化量大于预定门限值 dl-PathlossChange（单位是分贝 dB）时；

[0017] 2）PHR 周期定时器（periodicPHR-Timer）超时；

[0018] 3）PHR 功能实体的配置或重配置；

Samsung Electronics v. Asus Tech Licensing EX-1003, 387 of 673

[0019] 当 PHR 被触发后，当 UE 有上行调度资源可以容纳 PHR 时，UE 将 PHR 发送给 eNB。

[0020] 随着通信系统和技术的发展，为提高系统性能，载波聚合通信系统开始出现。载波聚合技术包括多种方式，其中之一就是载波聚合(Carrier Aggregation，CA)。例如，在 LTE-A 系统中，所谓载波聚合，就是多个分量载波(Component Carrier，CC)可以聚合在一起用来提供更大的带宽。

[0021] 在载波聚合系统中，对于某一个用户来说，可以有一个第一载波和一个或多个第二载波。第一载波一般为主要的载波，可以承载信令和数据，第二载波主要用于承载数据，也可以承载部分信令。载波可以分为上行载波(用于用户设备到控制站通信)和下行载波(用于控制站到用户设备通信)。对应第一载波的无线服务区为第一服务区，对应第二载波的无线服务区为第二服务区。在不同的系统中，第一载波，第一服务区和第二载波，第二服务区的概念和名称都会有相应的细节定义。

[0022] 例如在 LTE-A 系统中，配置了载波聚合的用户设备在网内只有一个无线资源管理(Radio Resource Control，RRC)连接。无线资源管理连接建立或重新建立或切换发生时，提供 NAI (Network Access Identifier，网络访问标识符)移动信息和安全输入的服务区(Serving Cell)被称为主服务区(Primary Cell，PCell)，即第一服务区，而根据用户设备能力配置可以配置一个或者多个辅服务区(Secondary Cell，SCell)，即第二服务区。进一步的，主服务区对应的载波就是第一载波，即主载波，其中包括用于控制站到用户设备数据传输的下行主分量载波(Downlink Primary Component Carrier，DL PCC)和用于用户设备到控制站数通信的上行主分量载波(Uplink Primary Component Carrier，UL PCC)。类似的，辅服务区对应的载波就是第二载波，即辅载波，其中，包括用于控制站到用户设备数据传输的下行辅分量载波(Downlink Secondary Component Carrier，DL SCC)和用于用户设备到控制站数据通信的上行辅分量载波(Uplink Secondary Component Carrier，UL SCC)。

[0023] 载波聚合系统中，PHR 被触发的条件还包括了 SCell 的激活。

[0024] 在 LTE 系统中，为了实现并保持用户设备与基站之间的上行同步，基站根据基站与各用户设备之间的传输时延发送时间提前量(Timing Advance，简称为 TA)给各用户设备，用户设备根据基站发送的时间提前量提前或推迟各自上行传输的时机，从而弥补用户终端至基站的传输时延，使得不同用户设备的上行信号都在基站的接收窗口之内到达基站。

[0025] 引入载波聚合技术后，用户设备可以同时工作在多个分量载波上，这些分量载波在频带上可以是连续的，也可以是不连续的；可以是同一频带内的，还可以是来自于不同频带。对于分量载波不连续的情况，或者分量载波来自于不同频带的情况，由于各分量载波具有不同的传输特性，各分量载波上的时间提前量可能互不相同；即使各分量载波属于同一频带且在频带上连续，如果各分量载波源自不同的射频拉远单元(remote radio units，简称为 RRU)，或者为了增加小区覆盖，各分量载波分别经由不同的中继器(repeater)处理，则各分量载波上的时间提前量也可能互不相同。LTE 系统中，UE 只工作在一个载波上(对于时分双工模式是一个载波，对于频分双工模式包括上行、下行一对载波，为描述方便，这里简称一个载波)，仅需要在一个载波的上行发送 SRS (侦听参考信号，sounding reference signal)，而在载波聚合中，UE 可以同时工作在多个分量载波上，并且可以在这些分量载波上发送 SRS。

Samsung Electronics v. Asus Tech Licensing EX-1003, 388 of 673

[0026] 在 Rel-10 载波聚合系统中，不支持 UE 的不同服务小区上的 SRS 与上行数据（在 PUSCH（物理层上行共享信道，Physical uplink share channel）上传输的数据）并行传输，也不支持 UE 的不同服务小区上的 SRS 与上行控制信息（在 PUCCH（物理层上行控制信道，Physical uplink control channel）上传输的数据）并行传输，在 Rel-11 中，UE 支持了不同服务小区上 SRS 和上行数据并行传输以及不同服务小区上 SRS 和上行控制信息并行传输，此时由于 SRS 与上行数据或上行控制信息并发可能导致的 UE 上行发送功率受限从而无法保证 UE 上行数据传输和信令传输的质量。目前为止，针对这一问题尚未提出有效的解决办法，这里就需要考虑一种适当的功率上报方法以解决上述问题。

发明内容

[0027] 本发明要解决的技术问题是提供一种载波聚合系统中的功率上报方法及装置，能够解决当 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据，或 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，保证服务小区上数据和信令的传输。

[0028] 为解决上述技术问题，本发明提供了一种载波聚合系统中的功率上报方法，包括：

[0029] 用户设备（UE）支持同时在不同服务小区上分别发送侦听参考信号（SRS）和上行数据，或 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，所述 UE 采用下式之一计算发送 SRS 的服务小区的功率余量（PH）信息：

[0030] 所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率；

[0031] 所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率 -SRS 的发送功率；

[0032] UE 上报功率余量报告（PHR）信息，在所述 PHR 信息中携带所述 PH 信息。

[0033] 进一步地，当 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据时，所述 UE 上报 PHR 信息，包括：

[0034] 所述 UE 同时在不同服务小区上分别发送 SRS 和上行数据时，向控制站上报本 UE 的 PHR 信息；或者，所述 UE 同时在不同服务小区上分别发送 SRS 和上行数据之前，向控制站上报本 UE 的 PHR 信息。

[0035] 进一步地，当 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，所述 UE 上报 PHR 信息，包括：

[0036] 所述 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息时，向控制站上报本 UE 的 PHR 信息；或者，所述 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息之前，向控制站上报本 UE 的 PHR 信息。

[0037] 进一步地，所述不同服务小区，包括主服务小区和已激活的辅服务小区，或任意两个已激活的服务小区。

[0038] 进一步地，所述不同的服务小区属于同一载波组或属于不同载波组。

[0039] 进一步地，所述方法还包括，在所述 PHR 信息中携带与所述 PH 信息对应的所述服务小区的指示标识，当所述发送 SRS 的小区中仅有 SRS 发送时，所述服务小区的指示标识用于标识当前服务小区上无上行数据或上行控制信息发送。

Samsung Electronics v. Asus Tech Licensing EX-1003, 389 of 673

[0040] 为解决上述技术问题，本发明还提供了一种载波聚合系统中的功率上报装置，位于用户设备(UE)，包括功率余量(PH)信息计算模块和功率余量报告(PHR)信息上报模块，其中：

[0041] 所述 PH 信息计算模块，用于在当前 UE 支持同时在不同服务小区上分别发送侦听参考信号(SRS)和上行数据，或当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，采用下式之一计算发送 SRS 的服务小区的 PH 信息：

[0042] 所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率；

[0043] 所述 PH 信息 =UE 在所述发送 SRS 的服务小区的最大发送功率 -UE 在所述服务小区上估计的上行数据传输信道发送功率 -SRS 的发送功率；

[0044] 所述 PHR 信息上报模块，用于上报 PHR 信息，在所述 PHR 信息中携带所述 PH 信息计算模块计算的 PH 信息。

[0045] 进一步地，在当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据时，所述 PHR 信息上报模块上报 PHR 信息，包括：

[0046] 所述 PHR 信息上报模块在当前 UE 同时在不同服务小区上分别发送 SRS 和上行数据时，向控制站上报本 UE 的 PHR 信息；或者，在当前 UE 同时在不同服务小区上分别发送 SRS 和上行数据之前，向控制站上报本 UE 的 PHR 信息。

[0047] 进一步地，在当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，所述 PHR 信息上报模块上报 PHR 信息，包括：

[0048] 所述 PHR 信息上报模块在当前 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息时，向控制站上报本 UE 的 PHR 信息；或者，在当前 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息之前，向控制站上报本 UE 的 PHR 信息。

[0049] 进一步地，所述不同服务小区，包括主服务小区和已激活的辅服务小区，或任意两个已激活的服务小区。

[0050] 进一步地，所述不同的服务小区属于同一载波组或属于不同载波组。

[0051] 进一步地，所述 PHR 信息上报模块还用于在所述 PHR 信息中携带与所述 PH 信息对应的所述服务小区的指示标识，当所述发送 SRS 的小区中仅有 SRS 发送时，所述服务小区的指示标识用于标识当前服务小区上无上行数据或上行控制信息发送。

[0052] 本申请通过 UE 在服务小区上向基站主动发送 UE 的即时功率信息，解决了当 UE 可以同时在不同小区上分别发送 SRS 和上行数据，或同时在不同小区上分别发送 SRS 和上行控制信息时，保证服务小区上数据和信令的传输的问题，使得基站侧能调整用户设备在服务小区上传输数据和 / 或信令的功率，并正确解调相关数据和 / 或信令，进而达到了提高传输效率的效果。

附图说明

[0053] 图 1 为本发明实施例 1 的流程图；

[0054] 图 2 为本发明上报装置结构示意图；

[0055] 图 3 为本发明应用示例 1 的流程图；

[0056] 图 4 为本发明应用示例 2 的流程图；

Samsung Electronics v. Asus Tech Licensing EX-1003, 390 of 673

[0057] 图 5 为本发明应用示例 3 的流程图。

具体实施方式

[0058] 为使本发明的目的、技术方案和优点更加清楚明白，下文中将结合附图对本发明的实施例进行详细说明。需要说明的是，在不冲突的情况下，本申请中的实施例及实施例中的特征可以相互任意组合。

[0059] 实施例 1

[0060] 本实施例介绍载波聚合系统中的功率上报方法，如图 1 所示，包括：

[0061] 步骤 10，UE 支持同时在不同服务小区上分别发送 SRS 和上行数据，或 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，该 UE 采用下式之一计算发送 SRS 的服务小区的 PH 信息：

[0062] PH 信息 =UE 在发送 SRS 的服务小区的最大发送功率 -UE 在该服务小区上估计的上行数据传输信道发送功率； 式（1）

[0063] PH 信息 =UE 在发送 SRS 的服务小区的最大发送功率 -UE 在该服务小区上估计的上行数据传输信道发送功率 -SRS 的发送功率； 式（2）

[0064] 上述 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据，是指：UE 支持在一个服务小区发送 SRS，同时在另一个服务小区发送上行数据（在 PUSCH 上发送上行数据）；UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息，是指：UE 支持在一个服务小区发送 SRS，同时在另一个服务小区发送上行控制信息（即在 PUCCH 上发送上行控制信息）。

[0065] UE 采用式（1）计算的 PH，未考虑 SRS 的功率，UE 在上报发送 SRS 的服务小区的 PH 时不考虑 SRS 的功率可以减少 UE 实现的复杂度，由于 SRS 发送时占用的功率较少，因此在计算功率余量时出于实现简单的考虑可以不计算 SRS 的功率。

[0066] UE 采用式（2）计算的 PH，考虑了 SRS 的功率，UE 在上报服务小区的 PH 值时考虑 SRS 的功率可以使该服务小区 PH 值的计算更加精确，UE 向基站上报 PHR 后，基站根据 PHR 中该服务小区的 PH 信息对 UE 进行功率调整，UE 可以实现更精确地上行功率控制。

[0067] 步骤 11，UE 上报 PHR 信息，在该 PHR 信息中携带计算的 PH 信息。

[0068] 当 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据时，UE 上报 PHR 信息的触发条件包括：UE 同时在不同服务小区上分别发送 SRS 和上行数据时，或 UE 同时在不同服务小区上分别发送 SRS 和上行数据之前。即 UE 同时在不同服务小区上分别发送 SRS 和上行数据时，向控制站上报本 UE 的 PHR 信息；或者，UE 同时在不同服务小区上分别发送 SRS 和上行数据之前，向控制站上报本 UE 的 PHR 信息。

[0069] 当 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，UE 上报 PHR 信息的触发条件包括：UE 同时在不同服务小区上分别发送 SRS 和上行控制信息时，或 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息之前。即 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息时，向控制站上报本 UE 的 PHR 信息；或者，UE 同时在不同服务小区上分别发送 SRS 和上行控制信息之前，向控制站上报本 UE 的 PHR 信息。

[0070] UE 在上报 PHR 之后，根据控制站反馈的功率控制信息调整或者不调整服务小区上的上行数据传输功率和 / 或上行信令传输功率。本文所述控制站包括：宏基站、微基站，微微基站或中继站。

Samsung Electronics v. Asus Tech Licensing EX-1003, 391 of 673

[0071] 上述不同服务小区，包括主服务小区和已激活的辅服务小区，或任意两个已激活的服务小区。不同服务小区可属于同一载波组或也可以属于不同载波组。

[0072] 在一个优选实施例中，还可以在该 PHR 信息中携带该服务小区的指示标识，该指示标识与 PH 信息对应，每个服务小区的 PH 信息对应一个指示标识，在 UE 支持同时在不同小区发送 SRS 和上行数据（或上行控制信息）的场景下，当发送 SRS 的小区中仅有 SRS 发送时，该服务小区的指示标识用于标识当前服务小区上无上行数据或上行控制信息发送。例如：在某服务小区如果仅有 SRS 发送，则将指示标识设置为有效（例如 V=1），如果该服务小区既有 SRS 发送又有上行数据或上行控制信息发送，则将指示标识设置为无效（例如 V=0）。当该服务小区既有 SRS 发送又有上行数据或上行控制信息发送时，计算该 PH 值的上行数据传输信道发送功率将为实际发送功率，而非估计值。

[0073] 实施例 2

[0074] 实现上述实施例 1 方法的功率上报装置位于 UE，如图 2 所示，包括 PH 信息计算模块 21 和 PHR 信息上报模块 22，其中：

[0075] 该 PH 信息计算模块 21，用于在当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行数据，或当前 UE 支持同时在不同服务小区上分别发送 SRS 和上行控制信息时，采用下式之一计算发送 SRS 的服务小区的 PH 信息：

[0076] PH 信息 =UE 在该发送 SRS 的服务小区的最大发送功率 -UE 在该服务小区上估计的上行数据传输信道发送功率；

[0077] PH 信息 =UE 在该发送 SRS 的服务小区的最大发送功率 -UE 在该服务小区上估计的上行数据传输信道发送功率 -SRS 的发送功率；

[0078] 该 PHR 信息上报模块 22，用于上报 PHR 信息，在所述 PHR 信息中携带该 PH 信息计算模块 21 计算的 PH 信息。

[0079] 该 PHR 信息上报模块 22 可以在当前 UE 同时在不同服务小区上分别发送 SRS 和上行数据时，向控制站上报本 UE 的 PHR 信息；或者，在当前 UE 同时在不同服务小区上分别发送 SRS 和上行数据之前，向控制站上报本 UE 的 PHR 信息；或者，在当前 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息时，向控制站上报本 UE 的 PHR 信息；或者，在当前 UE 同时在不同服务小区上分别发送 SRS 和上行控制信息之前，向控制站上报本 UE 的 PHR 信息。

[0080] 该 PHR 信息上报模块 22 还用于在所述 PHR 信息中携带与 PH 信息对应的该发送 SRS 的服务小区的指示标识，当所述发送 SRS 的小区中仅有 SRS 发送时，该服务小区的指示标识用于标识当前服务小区上无上行数据或上行控制信息发送。

[0081] 下文通过应用示例对上述实施例方法进行举例说明，在不冲突的情况下，本应用示例中的特征可以相互组合。

[0082] 在以下示例中以控制站为基站为例说明采用上述功率上报方法后的功率控制方法。

[0083] 应用示例 1

[0084] 本示例描述 UE 在 SCell1（辅服务小区 1）上发送 SRS，在 SCell2（辅服务小区 2）上发送 PUSCH 的场景，如图 3 所示，包括以下步骤：

[0085] 步骤 101：当 UE 判断符合 PHR 上报触发条件时，UE 同时在 SCell2 的上行数据中携带 PHR 信息；

Samsung Electronics v. Asus Tech Licensing EX-1003, 392 of 673

[0086] 在本示例中，PHR 的触发条件包括以下任意之一：

[0087] 1)PHR 禁止定时器(prohibitPHR-Timer)超时，并且路损相对于上一次 PHR 上报的变化量大于预定门限值 dl-PathlossChange（单位是分贝 dB）时；

[0088] 2)PHR 周期定时器(periodicPHR-Timer)超时；

[0089] 3)PHR 功能实体的配置或重配置；

[0090] 4)某一个 SCell 被激活。

[0091] UE 触发了 PHR 后，可以等到有上行资源分配时再发送 PHR，即 PHR 的触发不一定和 PHR 的发送在同一个时间单位，因为 PHR 的优先级比普通数据高，可以优先占用上行资源。

[0092] 在本示例中 UE 的 PHR 信息中包括 SCell1 对应的 PH 信息以及 SCell2 对应的 PH 信息以及小区的指示标识。由于 SCell1 上无 PUSCH 发送，因此 SCell1 的 PH 值对应的指示标志位 V=1；由于 SCell2 上发送 PUSCH，则 SCell2 的 PH 值对应的指示标志位 V=0。

[0093] 在本示例中，UE 上报的 PHR 中 SCell1 对应的 PH 值可采用上述公式(1)计算，也可以采用上述公式(2)计算。

[0094] 步骤 102：基站接收到 UE 发送的上行数据信息，获得 PHR 携带的功率信息；

[0095] 步骤 103：UE 接收基站反馈的功率控制信息，调整或者不调整服务小区上的上行数据传输功率和 / 或上行信令传输功率。

[0096] 如果功率控制信息指示用户设备调整服务小区上的上行数据传输功率和 / 或上行信令传输功率，则用户设备调整服务小区上的上行数据传输功率和 / 或上行信令传输功率；如果功率控制信息指示用户设备无需调整服务小区上的上行数据传输功率和 / 或上行信令传输功率或者不包含相关功率调整信息，则用户设备无需调整服务小区上已有的上行数据传输功率和 / 或上行信令传输功率。

[0097] 应用示例 2

[0098] 本示例中，UE 有一个主服务小区 PCell1，和两个辅服务小区 SCell1 和 SCell2，如图 4 所示，包括以下步骤：

[0099] 步骤 201：当 UE 判断符合 PHR 上报触发条件时，UE 在 PCell1 的上行数据中携带 PHR 信息；

[0100] 本示例中，触发 PHR 的条件为：

[0101] SCell1 和 SCell2 在同一子帧向基站分别发送 SRS 和上行数据(在 PUSCH 信道上发送数据)之前，或者 SCell1 和 SCell2 在同一子帧向基站分别发送 SRS 和上行控制信息(在 PUCCH 上发送信息)之前。

[0102] UE 判断在随后的一帧或者若干帧中将同时在两个 SCell 分别发送 SRS 和上行控制信息(或上行数据)，因此 UE 在 PCell 上的上行数据中携带 PHR 信息。例如，UE 将在子帧 N 在 SCell1 和 SCell1 分别向基站侧发送 SRS 和上行数据，而在子帧 N-2，UE 在 PCell1 向基站发送的上行数据中就携带 PHR 信息。

[0103] UE 的 PHR 信息中携带了 SCell1 和 SCell2 的 PH 信息；由于当前 SCell1 上无上行数据或上行控制信息发送，则 SCell1 的 PH 值对应的指示标志位 V=1；由于当前 SCell2 上无上行数据或上行控制信息发送，则 SCell2 的 PH 值对应的指示标志位 V=1。

[0104] 本示例中，UE 上报的 PHR 中，将发送单独发送 SRS 的 SCell1 对应的 PH 值可采用上述公式(1)计算，也可以采用上述公式(2)计算。如果采用公式(2)计算，其中的 SRS 发

Samsung Electronics v. Asus Tech Licensing EX-1003, 393 of 673

送功率为估计值。

[0105] 步骤 202、步骤 203 与示例 1 相同。

[0106] 应用示例 3

[0107] 本示例描述 UE 在 SCell1 上发送 SRS，在 SCell2 上发送上行数据的场景，如图 5 所示，包括以下步骤：

[0108] 步骤 301：当 UE 判断符合 PHR 上报触发条件时，UE 同时在上行数据中携带 PHR 信息；

[0109] 在本示例中，PHR 的触发条件为：

[0110] SCell1 和 SCell2 同时向基站分别发送 SRS 和上行数据，或同时向基站分别发送 SRS 和上行控制信息时；

[0111] UE 的 PHR 信息中包括了 SCell1 和 SCell2 对应的 PH 信息以及对应小区的指示标识，由于 SCell1 上无上行数据发送，则 SCell1 的 PH 值对应的指示标志位 V=1；由于 SCell2 上发送上行数据，则 SCell2 的 PH 值对应的标志位 V=0。

[0112] 在本示例中，UE 上报的 PHR 中 SCell1 对应的 PH 值可采用上述公式(1)计算，也可以采用上述公式(2)计算。

[0113] 步骤 302、步骤 303 与示例 1 相同。

[0114] 本领域普通技术人员可以理解上述方法中的全部或部分步骤可通过程序来指令相关硬件完成，所述程序可以存储于计算机可读存储介质中，如只读存储器、磁盘或光盘等。可选地，上述实施例的全部或部分步骤也可以使用一个或多个集成电路来实现。相应地，上述实施例中的各模块 / 单元可以采用硬件的形式实现，也可以采用软件功能模块的形式实现。本发明不限制于任何特定形式的硬件和软件的结合。

[0115] 当然，本发明还可有其他多种实施例，在不背离本发明精神及其实质的情况下，熟悉本领域的技术人员当可根据本发明作出各种相应的改变和变形，但这些相应的改变和变形都应属于本发明所附的权利要求的保护范围。

Samsung Electronics v. Asus Tech Licensing EX-1003, 394 of 673

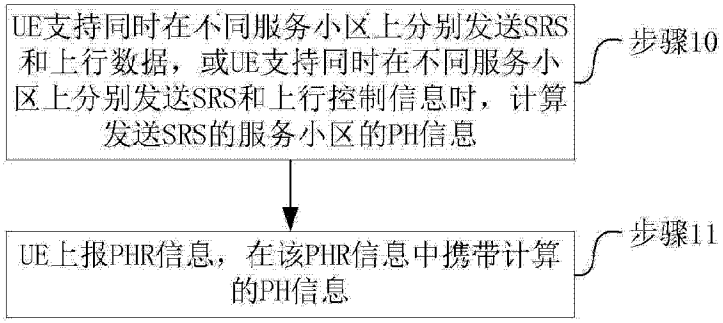


图 1

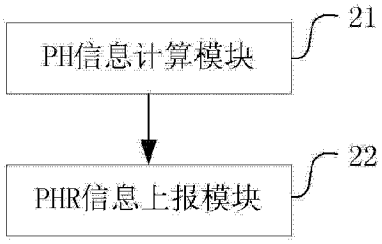


图 2

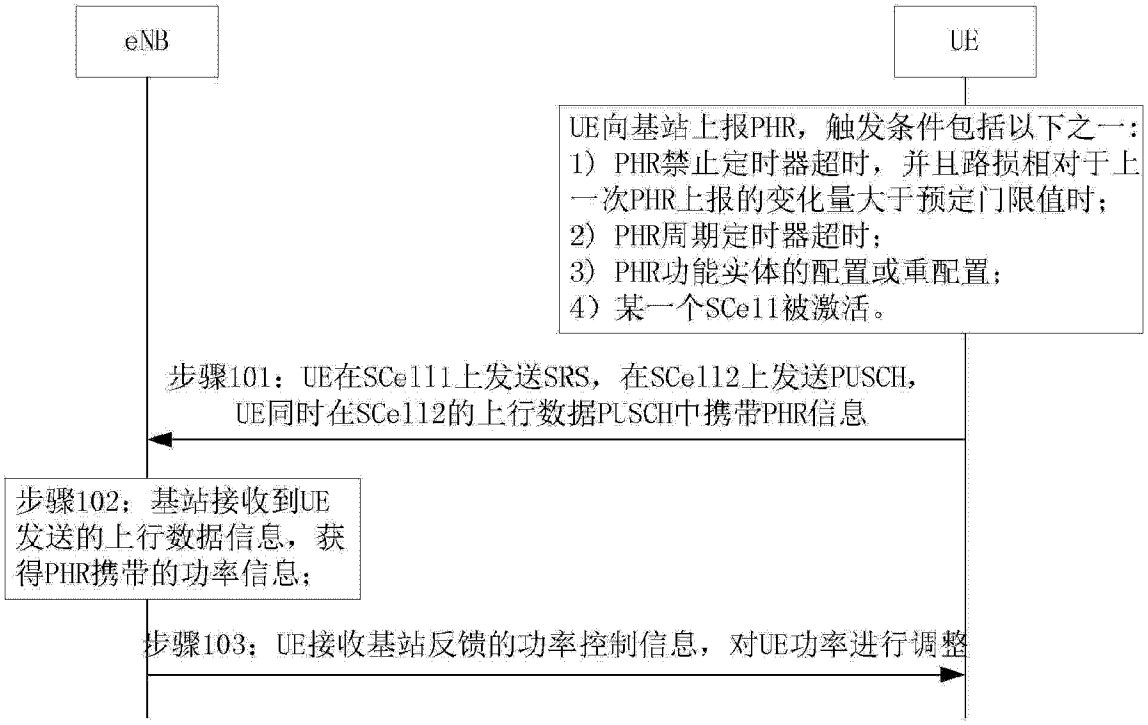


图 3

Samsung Electronics v. Asus Tech Licensing EX-1003, 395 of 673

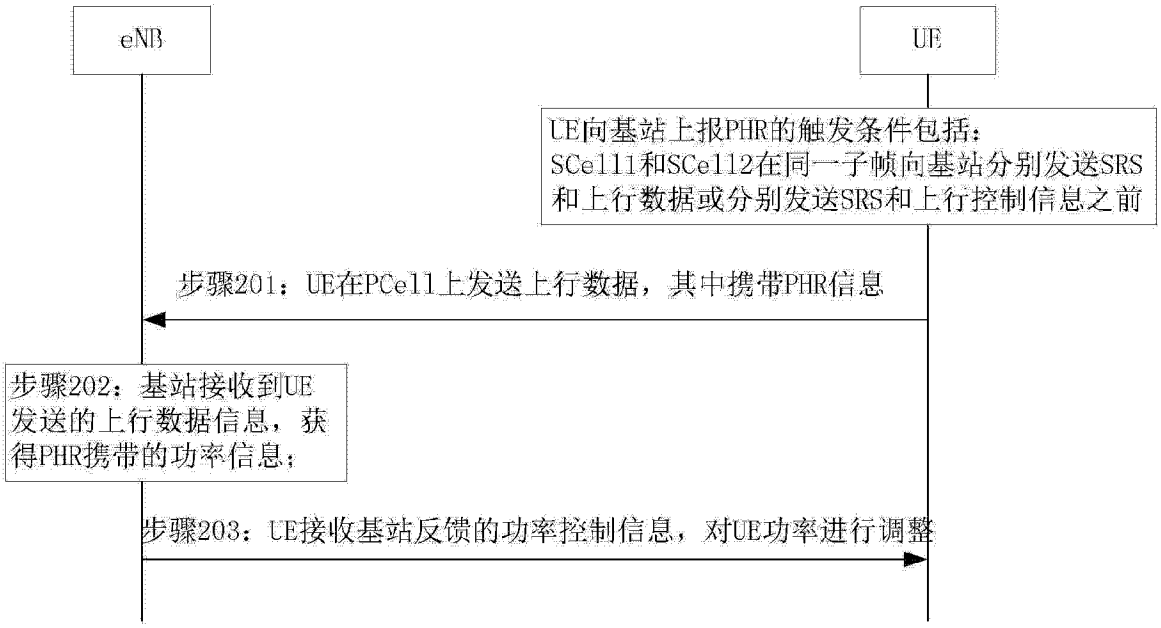


图 4

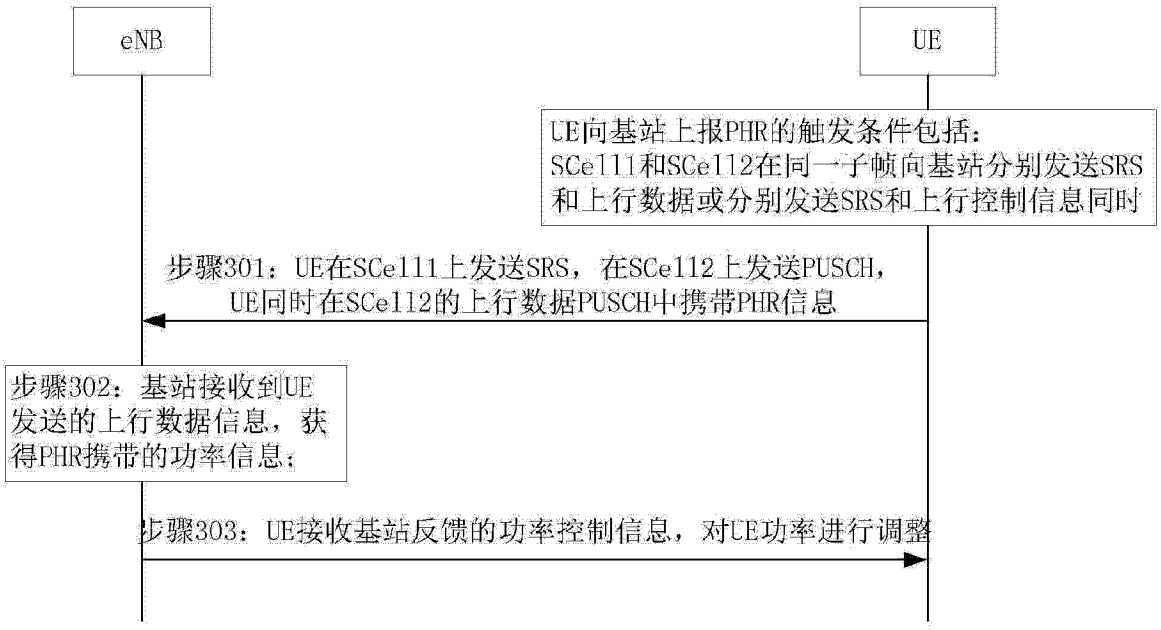


图 5

Samsung Electronics v. Asus Tech Licensing EX-1003, 396 of 673

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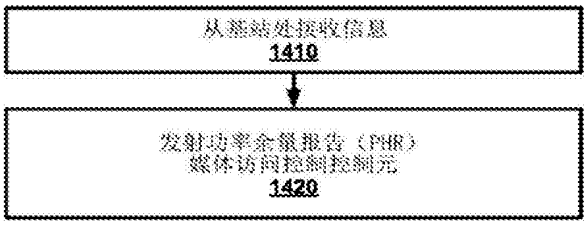
权利要求书4页 说明书26页 附图17页

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用于载波聚合的功率余量方法

(57)摘要

一种接收信息的无线装置，该信息包括与基站通信的多个小区的配置参数。该信息包括指示了新扩展的功率余量报告已配置的第一信息元(IE)。当辅小区配置有物理上行控制信道(PUCCH)且第二IE指示了功率余量报告被配置为建立时，第一IE被配置为建立。该无线装置传输包括一个或多个功率余量报告的媒体访问控制(MAC)数据包。



CN 107534942 A

1.一种方法,包括:

通过无线装置接收至少一个信息,该至少一个信息包括:

与基站通信的多个小区的配置参数;

第一信息元(IE),该第一信息元指示了新扩展的功率余量报告已配置,其中在以下情况第一IE被配置为建立:

多个小区的辅小区配置有物理上行控制信道(PUCCH);和

第二IE指示了功率余量报告被配置为建立;和

当激活了辅小区时,发射媒体访问控制(MAC)数据包,该数据包包括主小区的第一个类型2的功率余量域和辅小区的第二个类型2的功率余量域。

2.根据权利要求1所述的方法,其中MAC数据包进一步包括子报头,该子报头包括逻辑信道标识符(LCID)。

3.根据权利要求1所述方法,其中:

第二个类型2的功率余量等级的计算使用PUCCH的已计算功率和物理上行共享信道的已计算功率;和

辅小区的类型1的功率余量等级的计算使用物理上行共享信道的已计算功率。

4.根据权利要求1所述的方法,其中功率余量报告配置为以下中的至少一个:功率余量报告;双连接功率余量报告;扩展的功率余量报告;或者新扩展的功率余量报告。

5.根据权利要求1所述的方法,其中该至少一个信息包括阻止功率余量报告计时器IE,和周期性的功率余量报告计时器IE。

6.根据权利要求1所述的方法,其中多个小区中小区的小区索引大于预定义的值。

7.根据权利要求1所述的方法,其中配置有上行链路的小区的小区索引大于预定义的值。

8.一种无线装置,包括:

一个或多个处理器;和

存储指令的存储器,当执行该指令时,使得该无线装置:

接收至少一个信息,该至少一个信息包括:

与基站通信的多个小区的配置参数;

第一信息元(IE),该第一信息元指示了新扩展的功率余量报告已配置,其中在以下情况第一IE被配置为建立:

多个小区的辅小区配置有物理上行控制信道(PUCCH);和

第二IE指示了功率余量报告被配置为建立;和

当激活了辅小区时,发射媒体访问控制(MAC)数据包,该数据包包括主小区的第一个类型2的功率余量域和辅小区的第二个类型2的功率余量域。

9.根据权利要求8所述的无线装置,其中MAC数据包可以包括子报头,该子报头包括逻辑信道标识符(LCID)。

10.根据权利要求8所述的无线装置,其中:

第二个类型2的功率余量等级的计算使用PUCCH的已计算功率和物理上行共享信道的已计算功率;

且辅小区的类型1的功率余量等级的计算使用物理上行共享信道的已计算功率。

Samsung Electronics v. Asus Tech Licensing EX-1003, 398 of 673

11.根据权利要求8所述的无线装置，其中功率余量报告配置为以下中的至少一个：功率余量报告；双连接功率余量报告；扩展的功率余量报告；或者新扩展的功率余量报告。

12.根据权利要求8所述的无线装置，其中该至少一个信息包括阻止功率余量报告计时器IE，和周期性的功率余量报告计时器IE。

13.根据权利要求8所述的无线装置，其中多个小区中小区的小区索引大于预定义的值。

14.根据权利要求8所述的无线装置，其中配置有上行链路的小区的小区索引大于预定义的值。

15.一种方法，包括：

通过基站给无线装置发射至少一个信息，该至少一个信息包括：

与基站通信的多个小区的配置参数；

第一信息元(IE)，该第一信息元指示了新扩展的功率余量报告已配置，其中在以下情况第一IE被配置为建立：

多个小区的辅小区配置有物理上行控制信道(PUCCH)；和

第二IE指示了功率余量报告被配置为建立；和

当在无线装置中激活了辅小区时，接收媒体访问控制(MAC)数据包，该数据包包括主小区的第一个类型2的功率余量域和辅小区的第二个类型2的功率余量域。

16.根据权利要求15所述的方法，其中MAC数据包进一步包括子报头，该子报头包括逻辑信道标识符(LCID)。

17.根据权利要求15所述方法，其中：

第二个类型2的功率余量等级的计算使用物理上行控制信道的已计算功率和物理上行共享信道的已计算功率；且

辅小区的类型1的功率余量等级的计算使用物理上行共享信道的已计算功率。

18.根据权利要求15所述的方法，其中功率余量报告配置为以下中的至少一个：功率余量报告；双连接功率余量报告；扩展的功率余量报告；或者新扩展的功率余量报告。

19.根据权利要求15所述的方法，其中多个小区中小区的小区索引大于预定义的值。

20.根据权利要求15所述的方法，其中配置有上行链路的小区的小区索引大于预定义的值。

21.一种方法，包括：

通过无线装置接收至少一个信息，该至少一个信息包括多个小区的配置参数，该多个小区包括：

主小区，该主小区具有发射至基站的主物理上行控制信道(PUCCH)；和

PUCCH辅小区，该PUCCH辅小区具有发射至基站的辅PUCCH；

发射功率余量报告(PHR)媒体访问控制的控制元(MAC CE)，该功率余量报告(PHR)媒体访问控制的控制元(MAC CE)包括：

第一域，该第一域指示在PHR MAC CE中是否存在PUCCH辅小区的类型2的功率余量域；和

第二域，只有当第一域指示PUCCH辅小区的类型2的功率余量域存在时，第二域指示PUCCH辅小区的类型2的功率余量等级。

Samsung Electronics v. Asus Tech Licensing EX-1003, 399 of 673

22.根据权利要求21所述的方法，其中该至少一个信息进一步包括第一信息元，该第一信息元指示是否为主小区配置同步的PUCCH传输和物理上行共享信道传输。

23.根据权利要求21所述的方法，其中该至少一个信息进一步包括第二信息元，该第二信息元指示是否可以为PUCCH辅小区配置同步的PUCCH传输和物理上行共享信道传输。

24.根据权利要求21所述的方法，其中PHR MAC CE进一步包括第三域，该第三域指示主小区的类型2的功率余量等级。

25.根据权利要求21所述的方法，其中当激活PUCCH辅小区时，无线装置上报PUCCH辅小区的类型2的功率余量等级。

26.根据权利要求21所述的方法，其中PHR MAC CE包括PUCCH辅小区的类型1的功率余量域，该类型1的功率余量域不同于类型2的功率余量域。

27.根据权利要求21所述方法，其中：

类型2的功率余量等级的计算使用物理上行控制信道的已计算功率和物理上行共享信道的已计算功率；且

类型1的功率余量等级的计算使用物理上行共享信道的已计算功率。

28.根据权利要求21所述的方法，进一步包括通过测量路径损耗参考的信号获得测量值，其中类型2的功率余量等级的计算使用该测量值。

29.根据权利要求21所述的方法，其中对应上行数据包调度或上行功率控制的至少一个，由基站使用PHR MAC CE。

30.一种方法，包括：

通过基站发射至少一个信息，该至少一个信息包括多个小区的配置参数，该多个小区包括：

主小区，该主小区具有由基站接收的主物理上行控制信道(PUCCH)；和

PUCCH辅小区，该PUCCH辅小区具有由基站接收的辅PUCCH；

接收功率余量报告(PHR)媒体访问控制的控制元(MAC CE)，该功率余量报告(PHR)媒体访问控制的控制元(MAC CE)包括：

第一域，该第一域指示在PHR MAC CE中存在PUCCH辅小区的类型2的功率余量域；

第二域，该第二域指示PUCCH辅小区的类型2的功率余量等级；和

第三域，该第三域指示主小区的类型2的功率余量等级。

31.根据权利要求30所述的方法，其中该至少一个信息进一步包括第一信息元，该第一信息元指示是否为主小区配置同步的PUCCH传输和物理上行共享信道传输。

32.根据权利要求30所述的方法，其中该至少一个信息进一步包括第二信息元，该第二信息元指示是否可以为PUCCH辅小区配置同步的PUCCH传输和物理上行共享信道传输。

33.根据权利要求30所述的方法，其中PHR MAC CE进一步包括第四域，该第四域指示主小区的类型1的功率余量等级。

34.根据权利要求30所述的方法，其中当在无线装置中激活PUCCH辅小区时，基站接收PUCCH辅小区的类型2的功率余量等级。

35.根据权利要求30所述的方法，其中PHR MAC CE包括PUCCH辅小区的类型1的功率余量域，该类型1的功率余量域不同于PUCCH辅小区的类型2的功率余量域。

36.根据权利要求30所述方法，其中：

Samsung Electronics v. Asus Tech Licensing EX-1003, 400 of 673

类型2的功率余量等级的计算使用物理上行控制信道的已计算功率和物理上行共享信道的已计算功率;且

类型1的功率余量等级的计算使用物理上行共享信道的已计算功率。

37.根据权利要求30所述的方法,进一步包括通过测量路径损耗参考的信号获得测量值,其中类型2的功率余量等级的计算使用该测量值。

38.根据权利要求30所述的方法,其中对应上行数据包调度或上行功率控制的至少一个,由基站使用PHR MAC CE。

39.一种无线装置,包括:

一个或多个处理器;和

存储指令的存储器,当执行该指令时,使得该无线装置:

接收来自基站至少一个信息,该至少一个信息包括多个小区的配置参数,该多个小区包括:

主小区,该主小区具有发射至基站的主PUCCH;和

PUCCH辅小区,该PUCCH辅小区具有发射至基站的辅PUCCH;

发射功率余量报告(PHR)媒体访问控制的控制元(MAC CE),该功率余量报告(PHR)媒体访问控制的控制元(MAC CE)包括:

第一域,该第一域指示在PHR MAC CE中是否存在PUCCH辅小区的类型2的功率余量域;和

第二域,只有当第一域指示PUCCH辅小区的类型2的功率余量域存在时,第二域指示PUCCH辅小区的类型2的功率余量等级。

40.根据权利要求39所述的方法,其中PHR MAC CE包括PUCCH辅小区的类型1的功率余量域,该类型1的功率余量域不同于类型2的功率余量域。

Samsung Electronics v. Asus Tech Licensing EX-1003, 401 of 673

用于载波聚合的功率余量方法

[0001] 相关申请的交叉引用

[0002] 本申请要求2015年03月09日提交的62/130,554号美国临时申请的优先权,其通过引用整体并入此文。

附图说明

[0003] 结合附图,此处描述了本申请的各种实施例的多个示例。

[0004] 图1为根据本发明实施例的一方面描述正交频分复用(OFDM)子载波的示例集的示意图;

[0005] 图2为根据本发明实施例的一方面描述载波组中两个载波的示例传输时间和接收时间的示意图;

[0006] 图3为根据本发明实施例的一方面描述正交频分复用无线资源的示意图;

[0007] 图4为根据本发明实施例的一方面的基站和无线装置的结构图;

[0008] 图5A、图5B、图5C和图5D为根据本发明实施例的一方面的上行和下行信号传输的示例性示意图;

[0009] 图6为根据本发明实施例的一方面的带有载波聚合(CA)和双连接(DC)的协议结构的示例性示意图;

[0010] 图7为根据本发明实施例的一方面的带有载波聚合和双连接的协议结构的示例性示意图;

[0011] 图8显示了根据本发明实施例的一方面的示例性时间提前量组(TAG)配置;

[0012] 图9为根据本发明实施例的一方面的辅时间提前量组中随机访问过程中的示例性信息流;

[0013] 图10为根据本发明实施例的一方面将小区分成物理上行控制信道(PUCCH)组的示例性分组;

[0014] 图11根据本发明实施例的一方面说明了将小区分成一个或多个物理上行控制信道组和一个或多个时间提前量组的示例性分组;

[0015] 图12根据本发明实施例的一方面说明了将小区分成一个或多个物理上行控制信道组和一个或多个时间提前量组的示例性分组;

[0016] 图13为根据本发明实施例的一方面的示例性媒体访问控制分组数据单元(MAC PDU);

[0017] 图14为根据本发明实施例的一方面的示例性流程图;

[0018] 图15为根据本发明实施例的一方面的示例性流程图。

具体实施方式

[0019] 本发明的示例性实施例使得多个物理上行控制信道(PUCCH)组能够运行。此处公开的本技术的实施例可以用于多载波通信系统的技术领域。更尤其地,此处公开的本技术的实施例可以涉及物理上行控制信道组的运行。

Samsung Electronics v. Asus Tech Licensing EX-1003, 402 of 673

[0020] 以下的首字母缩略词在本技术披露中贯穿使用：

[0021] ASIC 专用集成电路

[0022] BPSK 二进制相移键控

[0023] CA 载波聚合

[0024] CSI 信道状态信息

[0025] CDMA 码分多址

[0026] CSS 公共搜索空间

[0027] CPLD 复杂可编程逻辑器件

[0028] CC 分量载波

[0029] DL 下行链路

[0030] DCI 下行控制信息

[0031] DC 双连接

[0032] EPC 演进的分组核心

[0033] E-UTRAN 演进的通用陆地无线接入网

[0034] FPGA 现场可编程门阵列

[0035] FDD 频分复用

[0036] HDL 硬件描述语言

[0037] HARQ 混合自动重传请求

[0038] IE 信息元

[0039] LTE 长期演进MCG主单元组

[0040] MeNB 主进化节点B

[0041] MIB 主信息块

[0042] MAC 媒体访问控制

[0043] MAC 媒体访问控制

[0044] MME 移动性管理实体

[0045] NAS 非接入层

[0046] OFDM 正交(orthogonal)频分复用

[0047] PDCP 分组数据会聚协议

[0048] PDU 分组数据单元

[0049] PHY 物理层的

[0050] PDCCH 物理下行控制信道

[0051] PHICH 物理HARQ指示信道

[0052] PUCCH 物理上行控制信道

[0053] PUSCH 物理上行共享信道

[0054] PCell 主小区

[0055] PCell 主小区

[0056] PCC 主分量载波

[0057] PSCell 主辅小区

[0058] pTAG 主时间提前量组

Samsung Electronics v. Asus Tech Licensing EX-1003, 403 of 673

[0059] QAM 正交(quadrature)幅度调制

[0060] QPSK 正交(quadrature)相移键控

[0061] RBG 资源块组

[0062] RLC 无线链路控制

[0063] RRC 无线资源控制

[0064] RA 随机访问

[0065] RB 资源块

[0066] SCC 辅分量载波

[0067] SCell 辅小区

[0068] SCell 辅小区

[0069] SCG 辅小区组

[0070] SeNB 辅进化节点B

[0071] sTAG 辅时间提前量组

[0072] SDU 服务数据单元S-GW服务网关

[0073] SRB 信令无线承载

[0074] SC-OFDM 单载波OFDM

[0075] SFN 系统帧号

[0076] SIB 系统信息块

[0077] TAI 跟踪区域标识符

[0078] TAT 时间对准定时器

[0079] TDD 时分双工

[0080] TDMA 时分多址

[0081] TA 时间提前量

[0082] TAG 时间提前量组

[0083] TB 传输块

[0084] UL 上行链路

[0085] UE 用户设备

[0086] VHDL VHSIC硬件描述语言

[0087] 本发明的示例性实施例可以使用各种物理层调制和传输方法来实现。示例性传输方法可以包括但不限于以下:CDMA、OFDM、TDMA、小波技术,以及/或相似的。也可以使用混合传输方法,例如TDMA/CDMA,和OFDM/CDMA。各种调制方案可以被应用于物理层的信号传输。调制方案的示例包括但不限于以下:相位、振幅、代码,这些的组合以及/或类似的。示例性无线传输方法可以使用BPSK、QPSK、16-QAM、64-QAM、256-QAM和/或类似的来实施QAM。依据传输要求和无线条件,物理无线传输可以通过动态或半动态地改变调制和编码方案来增强。

[0088] 图1为根据本发明实施例的一方面描述正交频分复用(OFDM)子载波的示例集的示意图。正如示例中说明的,示意图中的箭头可以表示多载波OFDM系统中的子载波。OFDM系统可以使用诸如OFDM技术、SC-OFDM技术或类似的技术。例如,箭头101显示了子载波传输信息符。图1是用于举例说明的目的,且通常多载波OFDM系统可以在载波中包括更多的子载波。

Samsung Electronics v. Asus Tech Licensing EX-1003, 404 of 673

例如，载波中子载波的数量可以在10-10000个子载波的范围内。图1显示了传输频带中的两个保护频带106和107。正如图1中说明的，保护频带106是位于子载波103和子载波104之间。子载波A的示例集102包括子载波103和子载波104。图1还说明了子载波B的示例集105。正如说明的，在子载波B的示例集105的任意两个子载波间不存在保护频带。多载波OFDM通信系统中的载波可以是连续载波、非连续载波，或者连续载波和非连续载波两者的结合。

[0089] 图2为根据本发明实施例的一方面描述两个载波的示例传输时间和接收时间的示意图。多载波OFDM通信系统可以包括一个或多个载波，例如，从1-10个载波。载波A204和载波B205可以具有相同或不同的时间结构。虽然图2显示了两个同步的载波，但载波A 204和载波B 205可以和彼此同步或者不同步。可以针对FDD和TDD双工机制支持不同的无线帧结构。图2显示了示例性FDD帧定时。下行链路和上行链路传输可以被组织成无线帧201。在这个示例中，无线帧持续时间为10毫秒。其它帧持续时间，例如，在1-100毫秒的范围内也可以得到支持。在这个示例中，每个10毫秒的无线帧201可以被划分成10个等同大小的子帧202。其它子帧持续时间例如包括0.5毫秒、1毫秒、2毫秒和5毫秒也可以得到支持。子帧可以包括两个或多个时隙（例如时隙206和207）。对于FDD的示例，10个子帧可以用于下行链路传输，且在每个10毫秒的间隔中10个子帧可以用于上行链路传输。上行链路和下行链路传输可以在频域中分离。时隙可以包括多个OFDM符号203。时隙206中OFDM符号203的数量可以依据循环前缀长度和子载波间距而定。

[0090] 图3为根据本发明实施例的一方面描述正交频分复用无线资源的示意图。用时间304和频率305表示的资源网格结构在图3中进行了说明。下行链路子载波或资源块（RB）的数量（在这个示例中6-100个RB）可以至少部分地依据小区中配置的下行传输带宽306。最小的无线资源单元可以被称为资源元（如301）。资源元可以被分组成资源块（如302）。资源块可以被分组成更大的被称为资源块组（RBG）（如303）的无线资源。时隙206中已发射的信号可以用多个子载波的一个或几个资源网格以及多个OFDM符号来描述。资源块可以用于描述某些物理信道到资源元间的映射。其它预定义的物理资源元的组在本系统中可以通过无线技术来实施。例如，24个子载波可以在5毫秒的时间内被分组为无线块。在说明性示例中，资源块可以对应于时域中的一个时隙和频域中的180kHz（对于15KHz子载波带宽和12个子载波）。

[0091] 图5A、图5B、图5C和图5D为根据本发明实施例的一方面的上行和下行信号传输的示例性示意图。图5A显示了示例性上行链路物理信道。表示物理上行共享信道的基带信号可以执行以下过程。这些功能是作为示例来说明的且它预示着其它方法可以在各种实施例中实施。这些功能可以包括扰频处理、扰频位数的调制以生成复值符号、将复值调制符号映射至一个或几个传输层、转换预编码以生成复值符号、复值符号的预编码、预编码的复值符号至资源元的映射、每个天线端口的复值时域单载波频分多址（SC-FDMA）信号的生成，以及/或类似的。

[0092] 对每个天线端口的复值SC-FDMA基带信号和/或复值物理随机接入信道（PRACH）基带信号的载波频率的示例性调制和上变换显示在图5B中。在传输之前可以使用滤波。

[0093] 下行链路传输的示例性结构显示在图5C中。表示下行物理信道的基带信号可以执行以下过程。这些功能是作为示例来说明的且它预示着其它方法可以在各种实施例中实施。所述功能包括对每个码字中的码率进行扰频处理以在物理信道被发送；扰频位数的调

Samsung Electronics v. Asus Tech Licensing EX-1003, 405 of 673

制以生成复值调制符号;将复值调制符号映射至一个或几个传输层;对每个层上复值调制符号进行预编码以在天线端口上传输;每个天线端口的复值调制符号至资源元的映射;每个天线端口的复值时域OFDM的生成,以及/或类似的。

[0094] 对每个天线端口的复值OFDM基带信号的载波频率的示例性调制和上变换显示在图5D中。在传输之前可以使用滤波。

[0095] 图4为根据本发明实施例的一方面的基站401和无线装置406的示例性框图。通信网络400可以包括至少一个基站401和至少一个无线装置406。基站401可以包括至少一个通信接口402、至少一个处理器403以及至少一套编码指令405,所述至少一套编码指令405存储在非暂时存储器404中且可由至少一个处理器403执行。无线装置406可以包括至少一个通信接口407、至少一个处理器408以及至少一套编码指令410,所述至少一套编码指令410存储在非暂时存储器409中且可由至少一个处理器408执行。基站401中的通信接口402可以配置为通过通信路径与无线装置406中的通信接口407进行通信,其中通信路径包括至少一个无线链路411。无线链路411可以是双向连接。无线装置406中的通信接口407也可以配置为与基站401中的通信接口402进行通信。基站401和无线装置406可以配置为经过无线链路411使用多个频率载波来发送和接收数据。根据实施例的一些方面,可以使用收发器。收发器是包括发射器和接收器两者的装置。收发器可以用于诸如无线装置、基站、中继节点和/或类似的装置中。通信接口402、407和无线链路411中实施的无线技术的示例性实施例在图1、图2、图3、图5和相关文本中有说明。

[0096] 接口可以是硬件接口、固件接口、软件接口和/或其结合。硬件接口可以包括连接器、电线、电子设备诸如驱动器、放大器和/或类似的。软件接口可以包括存储在存储器装置中以执行协议、协议层、通信驱动器、装置驱动器及其结合,和/或类似的代码。固件接口可以包括嵌入式硬件和存储在存储器装置中的代码和/或与存储器装置通信的代码的结合,以实现连接、电子设备的操作、协议、协议层、通信驱动程序、装置驱动程序、硬件的操作及其结合,以及/或类似的。

[0097] 不管装置是处于运行状态还是非运行状态,配置的条件可以涉及装置的性能。不管装置是处于运行状态还是非运行状态,配置还可以涉及装置中影响装置运行特性的具体设置。换句话说,不管装置是处于运行状态还是非运行状态,硬件、软件、固件、寄存器、存储值和/或类似的可以在装置中“配置”以给装置提供具体特性。条件例如“装置中产生的控制信息”可以意为控制信息具有参数,不管装置是处于运行状态还是非运行状态,所述参数可以用来配置装置中的具体特性。

[0098] 根据实施例的一些方面,LTE网络可以包括大量基站,从而提供用户平面PDCP/RLC/MAC/PHY以及面向无线装置的控制平面(RRC)协议终端。一个或多个基站可以与其它一个或多个基站互相连接(例如使用X2接口)。基站还可以使用,例如系统信息(SI)接口至EPC,来连接。例如,基站可以使用SI-MME接口相互连接至MME,以及使用SI-U接口相互连接至S-G。SI接口可以支持多个MME/服务网关和基站之间的多对多关联。基站可以包括许多区域,例如:1、2、3、4或6部分。基站可以包括许多小区,例如,从1-50个小区或更多。例如,小区可以被归类为主小区或辅小区。在RRC连接建立/重建立/切换时,一个服务小区可以提供NAS(非接入层)移动信息(例如TAI),并且在RRC连接重建立/切换时,一个服务小区可以提供安全输入。这个小区可以被称为主小区(PCell)。在下行链路中,与主小区对应的载波可

Samsung Electronics v. Asus Tech Licensing EX-1003, 406 of 673

以是下行主分量载波(DL PCC),而在上行链路中,它可以是上行主分量载波(UL PCC)。根据无线设备的性能,辅小区(SCells)可以配置为与主小区一起形成一组服务小区。在下行链路中,与辅小区对应的载波可以是下行辅分量载波(DL SCC),而在上行链路中,它可以是上行辅分量载波(UL SCC)。辅小区可以有或没有上行载波。

[0099] 小区,其包括下行载波和选择性的上行载波,可以被分配物理小区ID和小区索引。载波(下行或上行)可以只属于一个小区。小区ID或小区索引还可以识别小区的下行载波或上行载波(取决于使用它的内容)。在说明书中,小区ID可以同样指代载波ID,且小区索引可以指代载波索引。在实施中,物理小区ID或小区索引可以归属于小区。使用下行载波上传输的同步信号可以确定小区ID。使用RRC信息可以确定小区索引。例如,当说明书涉及用于第一下行载波的第一物理小区ID时,说明书可能是指用于包括第一下行载波的小区的第一物理小区ID。相同的概念可以应用至,例如,载波激活。当说明书指出第一载波被激活了,说明书可能同样地是指包括第一载波的小区被激活了。

[0100] 实施例可以根据需要来配置其运行。当满足某些标准时可以执行所公开的机理,例如,在无线装置、基站、无线环境、网络、上述结合中,和/或类似的。例如,示例性标准可以至少部分地基于流量负载、初始系统启动、打包尺寸、流量特性、上述结合,和/或类似的。当满足一个或多个标准时,可以应用各种示例性实施例。因此,有可能实施示例性实施例,该示例性实施例选择性地实施所公开的协议。

[0101] 基站可以与多个无线装置通信。无线装置可以支持多种技术,和/或同一技术的多种版本。无线装置根据它的无线装置类型和/或性能可以具有特定的性能。基站可以包括许多区域。当此公开涉及到基站与多个无线装置通信时,此公开可以是指覆盖区域内的全部无线装置的子集。例如,此公开可以是指给定LTE版本的多个无线装置具有给定性能且位于基站的给定区域。此公开中的多个无线装置可以是指选定的多个无线装置,和/或在覆盖区域内按照公开方法执行的全部无线装置的子集,和/或类似的。在覆盖区域可以有多个无线装置,该多个无线装置可以不遵循所公开的方法,例如,由于这些无线装置是基于LTE技术的更老版本来执行。

[0102] 图6和图7为根据本发明实施例的一方面的带有载波聚合(CA)和双连接(DC)的协议结构的示例性示意图。通用演进的陆地无线接入网(E-UTRAN)可以支持双连接(DC)操作,从而RRC_CONNECTED中的许多RX/TX UE可以被配置为使用无线资源,所述无线资源由位于两个进化节点(eNBs)中的两个调度器提供,所述两个进化节点通过非理想回程经由X2接口连接。涉及某个UE双连接的进化节点可以设定为两种不同的任务角色:进化节点可以作为主进化节点(MeNB)或者辅进化节点(SeNB)。在双连接中,UE可以被连接至一个主进化节点和一个辅进化节点。在双连接中实施的方法可以被扩展为包括两个以上的进化节点。图7说明了当配置了MCG(主小区组)和SCG(辅小区组)时UE侧的MAC实体的一个示例性结构,并且它不会限制实施。为简单起见,媒体广播组播服务(MBMS)接收没有在这个图中显示。

[0103] 在双连接中,特定承载使用的无线协议架构可以取决于该承载是如何建立的。可以存在三种选择,MCG承载、SCG承载和如图6所示的分叉承载。RRC可以位于主进化节点中,且SRB可以被配置为MCG承载类型且可以使用主进化节点的无线资源。双连接也可以描述为具有至少一个承载,该至少一个承载被配置为使用由辅进化节点提供的无线资源。在本发明的示例性实施例中,双连接可以或者不可以被配置/实施。

Samsung Electronics v. Asus Tech Licensing EX-1003, 407 of 673

[0104] 在双连接的情况下,UE可以配置有两个MAC实体:一个用于主进化节点的MAC实体,和一个用于辅进化节点的MAC实体。在双连接中,UE配套的服务小区可以包括两个子集:包括主进化节点的服务小区的主小区组(MCG),以及包括辅进化节点的服务小区的辅小区组(SCG)。对于SCG,可以应用以下的一个或多个:SCG中的至少一个小区具有配置的上行分量载波,并且它们中的一个,被称为PSCell(或者SCG的PCell,或者有时叫做PCell),被配置有PUCCH资源;当配置了SCG,至少有一个SCG承载或一个分叉承载;根据PSCell上物理层问题或随机访问问题或者RLC最大数量的检测,完成与SCG相关的重传,或者根据SCG添加或SCG改变期间PSCell上的访问问题的检测:RRC连接重建立程序可能没被触发,则朝SCG小区的UL传输被停止,MeNB可能通过UE被告知SCG失败类型,对于分叉承载,经由MeNB的DL数据传输被保持;RLC AM承载可以针对分叉承载进行配置;比如PCell、PSCell可以不被取消激活;PSCell可以随着SCG的改变而改变(例如随着安全钥匙的改变和RACH(随机接入信道)程序);和/或既不支持分叉承载和SCG承载之间的直接承载类型改变也不支持SCG和分叉承载的同步配置。

[0105] 关于MeNB和SeNB之间的相互作用,可以应用以下原理中的一个或多个:MeNB可以维护UE的无线资源管理(RRM)测量配置,并且可以(例如,基于接收到的检测报告或流量条件或承载类型)决定请求SeNB提供针对UE的附加资源(服务小区);一旦接受来自MeNB的请求,SeNB可以创建容器,该容器可以致使针对UE附加服务小区的配置(或者决定它没有可利用资源来这样做);对于UE性能协调,MeNB可以给SeNB提供(部分)接入层(AS)配置和UE性能;MeNB和SeNB可以通过使用RRC容器交换携带在X2信息中的关于UE的信息(内部节点信息);SeNB可以对它已有的服务小区的进行重新配置(例如,面向SeNB的PUCCH);SeNB可以决定哪个小区为SCG内的PSCell;MeNB可以不改变由SeNB提供的RRC配置的文本;在SCG添加和SCG SCell添加的情况下,MeNB可以提供针对SCG小区的最近检测结果;MeNB和SeNB都可以通过操作维护和管理(OAM)知道彼此的SFN和子帧偏移(例如,针对测量间隙的不连续接收(DRX)的比对和识别)。在一实例中,当添加新的SCG SCell,专用的RRC信令可以被用于发送关于CA的小区的所需系统信息,除了从SCG的PSCell的MIB处获得的SFN。

[0106] 根据实施例的一些方面,具有上行链路的服务小区可以被分组在TA组(TAG),其中相同的时间对准(TA)应用至服务小区。一个TAG中的服务小区可以使用相同的计时参考。对于给定的TAG,用户设备(UE)可以使用一个下行载波作为给定时间的计时参考。UE可以在TAG中使用下行载波作为TAG的计时参考。对于给定的TAG,UE可以同步上行子帧和属于相同TAG的上行载波的帧传输计时。根据实施例的一些方面,具有上行链路的服务小区可以对应于由相同接收器托管的服务小区,其中相同的TA应用至服务小区。TA组可以包括至少一个具有配置好上行链路的服务小区。支持许多TA的UE可以支持两个或多个TA组。一个TA组可以包括PCell,且可以被称为主TAG(pTAG)。在有许多TAG的配置中,至少一个TA组可以不包括PCell且可以被称为辅TAG(sTAG)。相同TA组中的载波可以使用相同的TA值以及相同的计时参考。当配置了DC时,属于小区组(MCG或者SCG)的小区可以被分组成许多包括pTAG和和一个或多个sTAG的TAG。

[0107] 图8显示了根据本发明实施例的一方面的示例性时间提前量组配置。在示例1中,pTAG包括PCell,并且sTAG包括SCell1。在示例2中,pTAG包括PCell和SCell1,并且sTAG包括SCell2和SCell3。在示例3中,pTAG包括PCell和SCell1,sTAG1包括SCell2和SCell3,并且

Samsung Electronics v. Asus Tech Licensing EX-1003, 408 of 673

sTAG2包括SCell4。在小区组(MCG或者SCG)中可以支持多达四个TAG,并且也可以提供其他示例性的TAG配置。在本公开的各个示例中,描述了针对pTAG和sTAG的示例性方法。描述了具有一个示例性sTAG的操作,且相同的操作可以被应用至其它sTAG。该示例性方法可以被应用至具有许多sTAG的配置。

[0108] 根据实施例的一些方面,在MCG和/或SCG中,TA维护、路径损耗参考处理以及pTAG的计时参考可以服从LTE版本10的原理。UE可能需要检测下行路径损耗以计算上行传输功率。路径损耗参考可以被用于上行功率控制和/或随机接入前导的传输。UE可以使用接收到的信号在路径损耗参考小区检测下行路径损耗。对于pTAG中的SCell,小区的路径损耗参考的选择可以选自和/或受限于如下两种选项:a)使用系统信息块2(SIB2)被连接至上行SCell的下行SCell,和b)下行pCell。使用RRC信息作为SCell初始配置和/或重新配置的部分,对于pTAG中的SCell的路径损耗参考可以是可配置的。根据实施例的一些方面,SCell配置的物理配置专用的SCell信息元(IE)可以包括pTAG中SCell的路径损耗参考SCell(下行载波)。使用系统信息块2(SIB2)被连接至上行SCell的下行SCell,可以是指被连接至SCell下行链路的SIB2。不同的TAG可以在不同的带中运行。对于sTAG中的上行载波,路径损耗参考可以只对下行SCell是可配置的,该下行SCell使用SCell的系统信息块2(SIB2)被连接至上行SCell。

[0109] 为了得到sTAG的初始上行链路(UL)时间对准,eNB可以创建RA程序。在sTAG中,UE可以使用来自这个sTAG的任意激活的SCell的一个作为计时参考小区。在一个示例性实施例中,sTAG中的SCell的计时参考可以是SIB2,该SIB2被连接至SCell的下行链路,最近的RA程序的前导在该SCell上被发送。每个TA组可以有一个计时参考和一个时间对准计时器(TAT)。TAG的TAT可以配置有不同的值。在MAC实体中,当与pTAG有关的TAT停止时:所有的TAT可以认为停止了,UE可以刷新服务小区的HARQ缓冲区,UE可以清除任何已配置的下行任务/上行上行授权,且UE中的RRC可以为所有已配置的服务小区释放PUCCH/声音参考信号(SRS)。当pTAG的TAT不再运行时,sTAG的TAT可以不运行。当与sTAG有关的TAT停止时:a)SRS传输可以在相应的SCell上停止,b)可以释放SRS的RRC配置,c)相应的SCell的CSI上报配置可以维持,和/或d)UE中的MAC可以刷新相应的SCell的上行HARQ缓冲区。

[0110] eNB可以通过激活的SCell的PDCCH顺序创建RA程序。这个PDCCH顺序可以在这个SCell的调度小区上被发送。当为小区配置了跨载波调度时,调度小区可以与用于前导传输的小区不同,且PDCCH顺序可以包括SCell索引。至少一基于非竞争的RA程序可以得到支持以用于被分配给sTAG的SCell。

[0111] 图9为根据本发明实施例的一方面的辅时间提前量组中随机访问过程中的示例性信息流。eNB发送激活命令600以激活SCell。前导602可以由UE发送,作为对属于sTAG的SCell上的PDCCH顺序601的响应。在示例性实施例中,SCell的前导传输可以由网络使用PDCCH格式1A来控制。作为SCell上前导传输的响应的Msg2信息603(RAR:随机访问响应),可以发送给PCell公共搜索空间(CSS)中的随机访问-无线网络临时标识(RA-RNTI)。上行数据包604可以在发送前导的SCell上被发送。

[0112] 根据实施例的一些方面,可以通过随机访问程序完成初始的计时对准。这可以涉及UE传输随机访问前导和eNB,在随机访问响应窗口内以初始TA指令NTA(时间提前量)来响应。在UE中设定NTA=0,则随机访问前导的开始可以对准相应的上行子帧的开始。eNB可以

Samsung Electronics v. Asus Tech Licensing EX-1003, 409 of 673

从UE发射的随机访问前导处估计上行链路定时。TA指令可以由eNB基于理想的UL定时与实际的UL定时之差的估计而获得。UE可以确定相对相应的sTAG的下行链路的初始上行传输定时，其中前导在该sTAG上被发送。

[0113] 服务小区至TAG的映射可以由带有RRC信令的服务eNB来配置。TAG配置和重新配置的方法可以是基于RRC信令的。根据实施例的一些方面，当eNB执行SCell附加配置时，相关的TAG配置可以针对SCell配置。在示例性实施例中，通过移除(释放)SCell且添加(配置)新的带有已更新TAG ID的SCell，eNB可以修改SCell的TAG配置。该新的带有已更新TAG ID的SCell可以是开始闲置的，随后被分配已更新的TAG ID。eNB可以激活已更新的新的SCell，以及开始在已激活的SCell上调度数据包。在示例性实施中，可能不太可能改变与SCell有关的TAG，相反的，SCell可能需要被移除且新的SCell可能需要添加另一个TAG。例如，如果有需要将SCell从sTAG移至pTAG，至少一个RRC信息，例如至少一个RRC重新配置信息，可以被发送给UE，通过释放SCell然后配置SCell作为pTAG的部分以重新配置TAG配置(当添加/配置没有TAG索引的SCell时，SCell可以被明确地分配给pTAG)。PCell可以不改变它的TA组且可以总是pTAG的成员。

[0114] RRC连接重新配置程序的目的可以是修改RRC连接，(例如，建立、修改和/或释放RB，执行接管，建立、修改和/或释放检测，添加、修改和/或释放SCell)。如果接受到的RRC连接重新配置信息包括sCellToReleaseList，则UE可以执行SCell释放。如果接受到的RRC连接重新配置信息包括sCellToAddModList，则UE可以执行SCell添加或修改。

[0115] 在LTE版本10和版本11的CA中，PUCCH仅在PCell(PSCell)上被发送给eNB。在LTE版本12以及更早的版本中，UE可以在一个小区(PCell或PSCell)上发送PUCCH信息至给定的eNB。

[0116] 随着支持UE的CA的数量以及聚合载波的数量增加，PUCCH的数量以及PUCCH有效载荷的大小也会增加。调节PCell上的PUCCH传输可以致使PCell上高PUCCH载荷。SCell上的PUCCH可以被引入从PCell中卸载PUCCH资源。可以配置一个以上的PUCCH，例如PCell上的PUCCH以及SCell上的另一个PUCCH。图10为根据本发明实施例的一方面将小区分成物理上行控制信道(PUCCH)组的示例性分组。在示例性实施例中，一个、两个或多个小区可以配置有PUCCH资源以用于发送CSI/应答(ACK)/否定回答(NACK)至基站。小区可以被分组成多个PUCCH组，且组里的一个或多个小组可以配置有PUCCH。在示例性的配制中，一个SCell可以属于一个PUCCH组。具有已配置被发送至基站的PUCCH的SCell可以被称为PUCCH SCell，且具有被发送至相同基站的共同PUCCH资源的小区组可以被称为PUCCH组。

[0117] 在版本12中，PUCCH可以被配置在PCell和/或PSCell上，但是不能被配置在其它SCell上。在示例性实施例中，UE可以发射信息，该信息指示UE在PCell和SCell上支持PUCCH配置。这样的指示可以从UE支持的双连接的指示中分离。在示例性实施例中，UE可以既支持DC又支持PUCCH组。在示例性实施例中，DC或者PUCCH组可以被配置，但不是两者。在另一个示例性实施例中，可以支持包括DC和PUCCH组两者的更复杂的配置。

[0118] 当UE能够配置PUCCH组，且如果UE指示它支持同步的PUCCH/PUSCH传输性能，则它可能暗示UE支持在PCell和SCell上的同步的PUCCH/PUSCH传输。当配置了许多PUCCH组时，PUCCH可以配置有或者没有同步的PUCCH/PUSCH传输。

[0119] 在示例性实施例中，实现两个服务区上基站的PUCCH传输可以如图10所示。第一组

Samsung Electronics v. Asus Tech Licensing EX-1003, 410 of 673

小区可以使用PCell上的PUCCH，且可以被称为PUCCH组1或者主PUCCH组。第二组小区可以使用SCell上的PUCCH，且可以被称为PUCCH组2或者辅PUCCH组。可以配置一个、两个或多个PUCCH组。在示例中，小区可以被分成两个PUCCH组，且每个PUCCH组可以包括带有PUCCH资源的小区。PCell可以为主PUCCH组提供PUCCH资源，且辅PUCCH组中的SCell可以为辅PUCCH组中的小区提供PUCCH资源。在示例性实施例中，可以配置不同PUCCH组中小区之间的非跨载波调度。当没有配置不同PUCCH组中小区之间的跨载波调度时，PHICH信道上的ACK/NACK可以受限于PUCCH组内。下行和上行调度活动在属于不同PUCCH组的小区之间可以是分离的。

[0120] SCell上的PUCCH可以携带HARQ-ACK和CSI信息。PCell可以配置有PUCCH资源。在示例性实施例中，针对SCell上PUCCH的SCell PUCCH功率控制的RRC参数可以不同于PCell PUCCH上的那些参数。对于SCell上PUCCH的传输功率控制指令可以在携带PUCCH的SCell上的DCI中被传输。

[0121] PUCCH组之间的PUCCH传输上的UE程序可以是不同的和/或独立的。例如，对于PUCCH PCell和PUCCH SCell，DL HARQ-ACK计时的确定、HARQ-ACK和/或CSI的PUCCH资源确定、PUCCH上同步HARQ-ACK+CSI的高层配置、一个子帧中同步HARQ-ACK+SRS的高层配置可以被不同地配置。

[0122] PUCCH组可以是一组由RRC配置的服务小区，且可以使用组中相同的服务小区以用于PUCCH的传输。主PUCCH组可以是包括PCell的PUCCH组。辅PUCCH组可以是不包括PCell的PUCCH小区组。在示例性的配置中，SCell可以属于一个PUCCH组。当一个SCell可以属于PUCCH组时，那个SCell的ACK/NACK或CSI可以通过那个PUCCH组的PUCCH被传输(通过PUCCH SCell或者PUCCH PCell)。SCell上的PUCCH可以减少PCell上的PUCCH载荷。PUCCH SCell可以用于在相应的PUCCH组中的SCells的UCI传输。

[0123] 在示例性实施例中，灵活的PUCCH配置是可能的，在这种灵活的PUCCH配置里控制信令在一个、两个或多个PUCCH上被发送。除了PCell之外，有可能配置选定数量的SCell以用于PUCCH传输(文中称为PUCCH SCell)。在特定PUCCH SCell中传输的控制信令信息可以与相应的PUCCH组中的一系列SCell有关，该SCell由网络通过RRC信令配置。

[0124] 由PUCCH信道携带的PUCCH控制信令可以被分布到PCell和SCell之间以用于卸载或鲁棒性目的。通过使能SCell中的PUCCH，可能对于给定的UE在PCell和选定数量的SCell(例如PUCCH SCell)之间分布全局的CSI报告是可能的，从而通过给定UE在特定小区上限制PUCCH CSI资源消耗。有可能将特定SCell的CSI报告映射至选定的PUCCH SCell。SCell可以被分配特定的周期性和时间偏移以用于控制信息的传输。服务小区的周期性的CSI可以通过RRC信令在PUCCH上被映射(在PCell或者PUCCH-SCell上)。分布CSI报告、HARQ反馈和/或跨PUCCH SCell调度请求的可能性可以提供灵活性和性能提高。服务小区的HARQ反馈可以通过RRC信令在PUCCH上被映射(在PCell或者PUCCH SCell上)。

[0125] 在示例性实施例中，PUCCH传输可以配置在PCell上以及CA中的一个SCell上。使用PUCCH组的概念可以实现SCell PUCCH，其中聚合小区被分组成两个或多个PUCCH组。PUCCH组中的一个小区可以被配置为携带PUCCH。可以配置5个以上的载波。在示例性实施例中，多达n个载波可以被聚合。例如，n可以为16、32或64。一些CC可以具有非向后的兼容配置，仅支持高级UE(例如支持许可协助访问的SCell)。在示例性实施例中，可以支持一个SCell PUCCH(例如两个PUCCH组)。在另一个示例性实施例中，可以使用携带PUCCH的具有许多(一

Samsung Electronics v. Asus Tech Licensing EX-1003, 411 of 673

个以上)SCell的PUCCH组概念(例如,可以有两个以上的PUCCH组)。

[0126] 在示例性的实施例中,给定的PUCCH组可以不包括MCG和SCG两者的服务小区。PUCCH中的一个可以被配置在PCell上。在示例性实施例中,服务小区的PUCCH映射可以由RRC信息配置。在示例性实施例中,SCell索引和ServCell索引的最大值可以是31(从0-31)。在示例中,stag-Id的最大值可以是3。已调度小区的通信接口(CIF)可以被准确配置。通过给定SCell的PUCCH配置可以配置PUCCH SCell。PUCCH SCell的HARQ反馈和CSI报告可以在那个PUCCH SCell的PUCCH上被发送。如果没有显示那个SCell的PUCCH SCell,则SCell的HARQ反馈和CSI报告可以在PCell的PUCCH上被发送。SCell的HARQ反馈和CSI报告可以在PUCCH SCell的PUCCH上被发送;因此它们可以不在不同PUCCH SCell的PUCCH上被发送。UE可以给服务小区上报类型2的PH,该服务小区配置有PUCCH。在示例性实施例中,对于PUCCH SCell,可以支持MAC的激活和取消激活。eNB可以管理SCell的激活/取消激活状态。新添加的PUCCH SCell可以初始化为取消激活的。在示例性实施例中,可以支持PUCCH组和TAG的独立配置。图11和图12显示了TAG和PUCCH组的示例性配置。例如,一个TAG可以包括许多具有PUCCH的服务小区。例如,每个TAG可以仅仅包括PUCCH组的小区。例如,TAG可以包括属于不同PUCCH组的服务小区(没有PUCCH)。

[0127] 在TAG和PUCCH组之间可能没有一一映射。例如,在配置中,一PUCCH SCell可以属于主TAG。在示例性的实施中,一个PUCCH组的服务小区可以在不同的TAG中且一个TAG的服务小区可以在不同的PUCCH组中。PUCCH组和TAG的配置可以由eNB的实施来决定。在另一个示例性的实施中,有关PUCCH小区配置的限制可以是特定的。例如,在示例性实施例中,给定PUCCH组的小区可以属于相同的TAG。在示例中,TAG可以仅仅包括PUCCH组的小区。在示例中,可以实施TAG和PUCCH组之间的一一映射。在实施中,小区配置可以受限于这些示例中的一些。在其它实施中,可以允许以下配置中的一些或全部。

[0128] 在示例性实施例中,对于pTAG中的SCell,计时参考可以是PCell。对于sTAG中的SCell,计时参考可以是sTAG中的任意激活的SCell。对于pTAG中的SCell(配置有或者没有PUCCH),路径损耗参考可以配置为PCell或连接至SCell的SIB-2。对于sTAG中的SCell,路径损耗参考可以是连接至SCell的SIB-2。当与pTAG有关的TAT停止了,与sTAG有关的TAT可以认为是停止了。当包括PUCCH SCell的sTAG的TAT停止了,MAC可以指示RRC给PUCCH组释放PUCCH资源。当包括PUCCH SCell的sTAG的TAT没有运行时,辅PUCCH组中SCell的上行传输(PUSCH)可以不被影响,其中该辅PUCCH组不属于包括PUCCH SCell的sTAG。包括PUCCH SCell的sTAG的TAT终止可以不触发其它TAG的TAT终止,其中相同PUCCH组中其它SCell属于其它TAG。当与不包括PUCCH SCell的sTAG有关的TAT没有运行时,无线设备可以停止sTAG中SCell的上行传输且可以不影响其它TAG。

[0129] 在示例性实施例中,每个TAG而言,MAC实体可以具有可配置的计时器timeAlignmentTimer(时间对准计时器)。timeAlignmentTimer可以用于控制MAC实体认为多长时间是属于有关TAG的服务小区的对准的上行时间。当接收到计时提前指令MAC控制元,MAC实体可以为指示的TAG的应用计时提前指令;开始或重启与指示的TAG有关的timeAlignmentTimer。当属于TAG的服务小区在随机访问响应消息中接收到计时提前指令时,和/或如果随机访问前导没有被MAC实体选择,则MAC实体可以为这个TAG应用计时提前指令和开始或重启与这个TAG有关的timeAlignmentTimer。另外,如果与这个TAG有关的

Samsung Electronics v. Asus Tech Licensing EX-1003, 412 of 673

timeAlignmentTimer没有运行，则可以为这个TAG应用计时提前指令以及可以开始与这个TAG有关的timeAlignmentTimer。当争用解决方案被认为是不成功的，可以停止与这个TAG有关的timeAlignmentTimer。另外，MAC实体可以忽略接收到的计时提前指令。

[0130] 本发明的示例性实施例可以使许多PUCCH组能够运行。其它示例性实施例可以包括非暂时有形的计算机可读介质，其包括可由一个或多个处理器执行的指令以致使PUCCH组的运行。但是其它示例性实施例可以包括一种产品，该产品包括非暂时有形的计算机可读机构——可访问的介质，其具有在其上编码的指令以使得可编程硬件致使一装置(例如无线通信器、UE、基站等等)能够使PUCCH组运行。装置可以包括处理器、存储器、接口和/或类似的。其它示例性实施例可以包括通信网络，该通信网络包括诸如基站、无线装置(或用户设备:UE)、服务器、转换器、天线和或类似的装置。在示例性实施例中，一个或多个TAG可以连同PUCCH组配置一起配置。

[0131] 图13为根据本发明实施例的一方面的示例性MAC PDU。在示例性实施例中，MAC PDU可以包括MAC报头、零或多个MAC服务数据单元(MAC SDU)、零或多个MAC控制元以及选择性填充。MAC报头和MAC SDU可以是可变大小的。MAC PDU可以包括一个或多个MAC PDU子报头。子报头可以对应于MAC SDU、MAC控制元或者填充。MAC PDU子报头可以包括消息头R、F2、E、LCID、F和/或L。MAC PDU中最后的子报头以及固定大小的MAC控制元的子报头可以包括四个消息头R、F2、E和/或LCID。与填充相对应的MAC PDU子报头可以包括四个消息头R、F2、E和/或LCID。

[0132] 在示例性实施例中，LCID或逻辑信道ID域可以识别相应的MAC SDU的逻辑信道实例或者相应的MAC控制元或填充的类型。对于包含在MAC PDU中的MAC SDU、MAC控制元或者填充，可以有一个LCID域。除了那个，当需要单字节或两字节填充但又不能在MAC PDU的末端通过填充来完成时，在MAC PDU中可以包含有一个或两个附加的LCID域。该LCID域的大小可以是，例如5比特。L或者长度域可以以字节为单位指示相应的MAC SDU或者大小可变的MAC控制元的长度。除了最后的子报头和对应于固定大小的MAC控制元的子报头，每个MAC PDU子报头可以有一个L域。L域的大小可以由F域和F2域来指示。F或Format域可以指示长度域的大小。除了最后的子报头和对应于固定大小的MAC控制元的子报头，以及除了当F2被设置为等于1时，每个MAC PDU子报头可以有一个F域。F域的大小可以是1比特。在示例中，如果包括F域，和/或如果MAC SDU或者大小可变的MAC控制元的大小小于128字节，则F域的值被设置为0，否则它被设置为1。F2或Format2域可以指示长度域的大小。每个MAC PDU子报头可以有一个F2域。F2域的大小可以是1比特。在示例中，如果MAC SDU或者大小可变的MAC控制元的大小大于32767字节并且如果相应的子报头不是最后的子报头，则F2域的值可以被设置为1，否则它被设置为0。E或Extension域可以是指示在MAC子报头中是否存在多个域的标记。E域可以被设置为“1”以指示至少R/F2/E/LCID域的另一个设置。E域可以被设置为“0”以指示MAC SDU、MAC控制元或填充(padding)在下一个字节开始。R或保留比特，设置为“0”。

[0133] MAC PDU子报头可以具有和相应的MAC SDU、MAC控制元以及填充相同的顺序。MAC控制元可以放在任何MAC SDU之前。除了当需要单字节或两字节填充时，填充可以发生在MAC PDU的末端。填充可以具有任意值且MAC实体可以忽略它。当在MAC PDU末端执行填充时，可以允许零或多个填充字节。当需要单字节或两字节填充时，对应于填充的一个或两个MAC子报头可以放在MAC PDU的开端在任何其它MAC PDU子报头之前。在示例中，一个MAC

Samsung Electronics v. Asus Tech Licensing EX-1003, 413 of 673

PDU的最大值可以以每个传输块(TB)每个MAC实体被传输，一个MCH MAC PDU的最大值可以以每个发送时间间隔(TTI)被传输。

[0134] 至少一个RRC信息可以给至少一个小区提供配置参数以及给PUCCH组提供配置参数。在一个或多个RRC信息中的信息元可以提供已配置的小区与PUCCH SCell之间的映射。小区可以被分组成多个小区组且小区可以被分配给已配置的PUCCH组的一个。在PUCCH组和带有配置PUCCH资源的小区之间可以有一一对应的关系。至少一个RRC信息可以提供SCell和PUCCH组，以及PUCCH SCell上的PUCCH配置之间的映射。

[0135] SCell的系统信息(公共参数)可以被携带在专用的RRC信息的RadioResourceConfigCommonSCell(无线资源配置公共辅小区)中。PUCCH相关信息的一些可以被包括在SCell的公共信息中(例如RadioResourceConfigCommonSCell中)。SCell和PUCCH资源的专用配置参数可以由专用的RRC信令来配置，例如，使用RadioResourceConfigCommonSCell。

[0136] IE PUCCH-ConfigCommon和IE PUCCH-ConfigDedicated可以用来分别指定公共的PUCCH配置以及UE特定的PUCCH配置。

[0137] 在示例中，PUCCH-ConfigCommon可以包括：deltaPUCCH-Shift:ENUMERATED{ds1,ds2,ds3};nRB-CQI:INTEGER(0..98);nCS-AN:INTEGER(0..7);和/或n1PUCCH-AN:INTEGER(0..2047)。参数deltaPUCCH-Shift(Δ_{shift}^{PUCCH})、nRB-CQI($N_{RB}^{(2)}$)、nCS-An($N_{cs}^{(1)}$)和n1PUCCH-AN($N_{PUCCH}^{(1)}$)可以是PUCCH的物理层参数。

[0138] 可以使用PUCCH-ConfigDedicated。PUCCH-ConfigDedicated可以包括：ackNackRepetition CHOICE{release:NULL,setup:SEQUENCE{repetitionFactor:ENUMERATED{n2,n4,n6,spare1},n1PUCCH-AN-Rep:INTEGER(0..2047)}},tdd-AckNackFeedbackMode:ENUMERATED{bundling,multiplexing}OPTIONAL}。ackNackRepetitionj参数指示是否配置了ACK/NACK重复。n2对应于重复因子2，n4对应于repetitionFactor参数(N_{ANRep})的4。n1PUCCH-AN-Rep参数可以是$n_{PUCCH,ANRep}^{(1,p)}$天线端口P0和天线端口P1。dd-AckNackFeedbackMode参数可以指示所使用的TDD ACK/NACK反馈模式中的一个。树脂捆绑可以对应于ACK/NACK捆绑的使用，然而，数值复用可以对应于ACK/NACK复用。相同的数值可以应用至PUCCH以及PUSCH上的ACK/NACK反馈模式。

[0139] 参数PUCCH-ConfigDedicated可以包括同步PUCCH-PUSCH参数，该同步PUCCH-PUSCH参数指示是否配置了同步的PUCCH和PUSCH传输。当在配置有PCell的带中nonContiguousUL-RA-WithinCC-Info设置为支持时，E-UTRAN可以给PCell配置这个域。当在配置有PSCell的带(band)中nonContiguousUL-RA-WithinCC-Info设置为支持时，E-UTRAN可以给PSCell配置这个域。当在配置有PUCCH SCell的带中nonContiguousUL-RA-WithinCC-Info设置为支持时，E-UTRAN可以给PUCCH SCell配置这个域。

[0140] UE可以发射无线性能给eNB以指示UE是否支持PUCCH组的配置。UE性能信息中的同步PUCCH-PUSCH可以应用至PCell和SCell两者。对于PCell和PUCCH SCell，同步PUCCH+PUSCH可以分开配置(使用独立IE)。例如，PCell和PUCCH SCell可以具有不同的或相同的与同步PUCCH+PUSCH相关的配置。

[0141] 考虑到小区载荷、载波质量(例如使用检测报告)、载波配置和/或其它参数，eNB可

Samsung Electronics v. Asus Tech Licensing EX-1003, 414 of 673

以在当前SCell或候选SCell中选择PUCCH SCell。从功能的角度来看，PUCCH小区组管理程序可以包括PUCCH小区组添加、PUCCH小区组释放、PUCCH小区组改变和/或PUCCH小区组重新配置。PUCCH小区组添加程序可以用于添加辅PUCCH小区组(例如，在辅PUCCH小区组中添加PUCCH SCell和一个或多个SCell)。在示例性实施例中，使用一个或多个RRC信息，小区可以被释放和添加。在另一个示例性实施例中，使用第一RRC信息，小区可以被释放，然后使用第二RRC信息，小区可以被添加。

[0142] 当包括PUCCH SCell的SCell被配置时，他们可以是处于取消激活的状态。通过激活MAC CE，在RRC配置程序之后可以激活PUCCH SCell。eNB可以给UE发射MAC CE激活指令。UE可以可以激活SCell以作为接收MAC CE激活指令的响应。

[0143] 在示例性实施例中，计时器一旦开始就在运行，直到它被停止或终止；否则它可能不在运行。如果计时器没有在运行它可以被开始，或者如果它在运行它可以被重启。例如，计时器可以从它的初始值处开始或重启。

[0144] RRC信息中的示例性功率余量触发条件配置参数如下所示。可以实施其它例子。phr-Config CHOICE{release NULL,setup SEQUENCE{periodicPHR-Timer ENUMERATED{sf10,sf20,sf50,sf100,sf200,sf500,sf1000,infinity},prohibitPHR-Timer ENUMERATED{sf0,sf10,sf20,sf50,sf100,sf200,sf500,sf1000},dl-PathlossChange ENUMERATED{dB1,dB3,dB6,infinity}}

[0145] 参数periodicPHR-Timer可以是PHR上报的计时器。关于子帧数量方面的值。值sf10对应于10个子帧，sf20对应于20个子帧等等。

[0146] 参数prohibitPHR-Timer可以是PHR报告的计时器。关于子帧数量方面的值。值sf0对应于0个子帧，sf100对应于100个子帧等等。

[0147] 参数dl-PathlossChange可以是由PHR报告的功率检测引起的下行路径损耗改变以及所需功率回退的改变。有关dB的值。值dB1对应于1dB，dB3对应于3dB等等。相同的值可以应用于每个服务小区(虽然每个小区独立执行相关的功能)。

[0148] 功率余量报告程序可以用来提供服务eNB，该服务eNB具有关于标称UE最大传输功率和每个激活的服务小区的UL-SCH(上行同步信道)传输的估计功率之差的信息。功率余量报告程序还可以提供服务eNB，该服务eNB具有关于标称UE最大功率与SpCell和/或PUCCH SCell上UL-SCH和PUCCH传输的估计功率之差的信息。

[0149] 可以定义功率余量的上报周期、延迟和映射。通过配置至少两个计时器periodicPHR-Timer和prohibitPHR-Timer，以及通过发射dl-PathlossChange信号，RRC可以控制功率余量上报，其中dl-PathlossChange信号可以在检测的下行路径损耗和功率回退中设置改变以触发PHR，该下行路径损耗和功率回退由功率管理(如由P-MPRC允许的)引起。

[0150] 在示例性实施例中，如果一个或多个以下事件发生(没有以任何特定顺序排列)，则功率余量报告(PHR)可以被触发。第一，当MAC实体具有新传输的UL资源时，对于任何MAC实体的至少一个激活的服务小区，prohibitPHR-Timer终止或已经终止以及路径损耗已经改变的多于dl-PathlossChange dB，其中在这个MAC实体中PHR的最后传输后该服务小区被用作路径损耗参考。第二，periodicPHR-Timer终止。第三，一旦经由更上层的功率余量上报功能的配置或重新配置，该更上层并不用于使此功能失效。第四，具有配置的上行链路的任

Samsung Electronics v. Asus Tech Licensing EX-1003, 415 of 673

意MAC实体的SCell的激活;第五,PSCell的添加;和/或第六,当MAC实体具有新传输的UL资源,并且对于具有配置的上行链路的任意MAC实体的激活的服务小区在这个TTI中以下为真时(可以有分配给传输的UL资源或者在这个小区上可以有PUCCH传输,并且当MAC实体在这个小区上具有分配给传输或者PUCCH传输的UL资源时,从PHR的最后功率传输后这个小区由功率管理(如P-MPR允许的)引起的所需功率回退已经改变地超过dl-PathlossChange dB),prohibitPHR-Timer终止或已经终止。

[0151] 在示例性实施中,当由功率管理引起的所需功率回退暂时减小(例如对于长达几十毫秒)时,MAC实体可以避免触发PHR,并且当PHR由其它触发条件触发时,在PCMAX,c/PH的值方面MAC实体可以避免反射这样的暂时减小。

[0152] 如果MAC实体具有分配给这个TTI的新传输的UL资源,且如果在最近的MAC重置后它是第一个分配给新传输的UL资源则MAC实体可以开始periodicPHR-Timer。如果功率余量上报程序确定至少一个PHR已经被触发了并且没有取消,且如果分配的UL资源可以为相应的PHR配置调节相应的PHR MAC控制元加上它的子报头以作为逻辑信道优化的结果,则UE可以发射相应的PHR报告。

[0153] 例如,UE可以为一个或多个激活的具有配置上行链路的服务小区发射相应的PHR报告,如果:如果既没有配置extendedPHR又没有配置dualConnectivityPHR,则分配的UL资源可以调节PHR MAC控制元加上它的子报头,和/或如果配置了extendedPHR,则Extended PHR MAC控制元加上它的子报头,和/或如果配置了dualConnectivityPHR,则双连接PHR MAC控制元加上它的子报头,以作为逻辑信道优先化的结果。

[0154] 在LTE版本10的载波聚合(CA)中,扩展的功率余量报告(PHR)MAC控制元(CE)被引入以调节PCell的类型2的功率余量(PH)以及SCell的类型1的PH。当支持同步PUCCH-PUSCH配置时可以使用类型2的PH。在DC中,因为PUCCH可以在PCell和PSCell上被发射,因此PHR MAC CE可以包含2个类型2的PH和几个类型1的PH。DC PHR MAC CE被引入以包括额外的PSCell的类型2的PH。对于DC,PH可以被独立上报给eNB,但PHR可以包括主动服务小区的PH。

[0155] 在LTE版本12中,定义了有关MAC CE的三种功率余量类型:1)功率余量报告MAC CE,2)扩展的功率余量报告MAC CE,3)双连接功率余量。MAC CE可以由MAC子报头中的逻辑信道ID(LCID)域来定义。LCID域可以识别相应的MAC SDU的逻辑信道实例或者相应的MAC控制元和/或填充的类型。

[0156] 版本12中的UL-SCH MAC CE的LCID值在3GPP TS 36.321V12.4.0中定义为:索引11000:双连接功率余量报告;索引11001:扩展的功率余量报告;和索引11010:功率余量报告

[0157] 如果配置了extendedPHR模式且当满足PHR的传输条件时,UE可以生成和发射例如由LCID=11001来标识的扩展的PHR MAC控制元。

[0158] 如果配置了dualConnectivityPHR模式且当满足PHR的传输条件时,UE可以生成和发射例如由LCID=11000来标识的双连接功率余量报告。

[0159] 如果配置了PHR,但既没有配置extendedPHR模式也没有配置dualConnectivityPHR模式,且当满足PHR的传输条件时,UE可以生成和发射功率余量报告,例如,用LCID=11010。

[0160] 当在UE中配置了具有同步PUCCH+PUSCH传输的PUCCH SCell时(在UE中没有配置

Samsung Electronics v. Asus Tech Licensing EX-1003, 416 of 673

DC)，LTE版本12并没有显示地址配置、信息格式、触发条件以及功率余量的处理。由于UE中可能没有配置双连接，版本12的双连接功率余量报告可能不能应用在这样的情况中。由于当配置了PUCCH组时它并不出现支持两个类型2的功率余量的传输，版本12的扩展的功率余量报告可能不能应用。由于它显示仅支持一个服务小区，版本12的功率余量报告报告可能不能应用。可以有用于增强功率余量实施的需要以有效支持PUCCH组配置。也可以有用于增强功率余量实施的需要以加强不被已有的PHR格式支持的小区配置。

[0161] 新的PHR可以被称为extendedPHR2MAC CE和/或扩展的小区配置PHR MAC CE和/或新扩展的PHR MAC CE。新的PHR还可以被称为其它名字(例如PUCCH组PHR MAC CE、加强的配置MAC CE、32小区PHR MAC CE等等，和/或类似的)。除了PUCCH组，ExtendedPHR2MAC CE还可以支持附加功能。例如，ExtendedPHR2MAC CE可以支持5个以上的小区，其包括主小区和k个以上的辅小区(例如，k＝4、7等等，可以支持多达32个小区)和/或许多其它功能。

[0162] 对于extendedPHR2，如果实施具有新的MAC LCID的新PHR MAC CE指令格式，则所使用的MAC LCID的数量可以增加。MAC LCID可以被包括在MAC子报头中。在示例性实施例中，对于extendedPHR2可以使用已有的MAC LCID(例如，双连接的LCID或者扩展的PHR的LCID)。UE可以在单播消息中发射PHR MAC CE给eNB。UE和eNB两者都可以具有关于UE当前RRC配置的信息。UE可以使用相同的LCID用于一个或多个PHR传输，且UE可以基于RRC配置参数识别PHR的格式。

[0163] 对于extendedPHR2，这个增强可能不需要引入新的LCID。两个不同的功率余量MAC CE可以使用相同的LCID。这个方法可以减少在MAC层中使用的LCID的数量(相比于引入新的LCID的情况)以及可以进一步简化UE实施。除了LCID，RRC配置参数可以用来确定PHR MAC CE的格式。

[0164] UE可以分析UE RRC小区配置以确定PHR MAC CE的格式。例如，对于没有配置PUCCH SCell的eNB的多个小区来说(例如5个小区)，如果UE配置有第一RRC配置，则使用与extendedPHR功率余量有关的进程可以更新MAC CE中的域。如果UE配置有PUCCH组，则使用与extendedPHR2PHR有关的进程可以更新MAC CE中的域。另一方面，接收PHR MAC CE的eNB可以具有关于UE传输PHR MAC CE的RRC配置的信息，且可以基于相应的RRC配置编译PHR MAC CE域。

[0165] 在LTE高级版本12中，当给定的小区配置了同步PUCCH-PUSCH时，例如PCell和/或PSCell，可以上报类型2的功率余量。在被配置后PCell和/或PSCell可以是活跃的。当PCell和PSCell配置了同步PUCCH-PUSCH时，PCell和PSCell的类型1和类型2的PH域可以被包括在PHR报告中。在示例性实施例中，在一些情况下可以取消激活PUCCH SCell。如果和当PUCCH SCell被取消激活，可能没有必要将PUCCH SCell的类型1和类型2的PH报告包括在extendedPHR2报告中。这个可能需要PHR的新进程和格式的实施，其中PUCCH SCell的类型1和类型2的PHR可以上报或者不上报。

[0166] 在当前的DC PHR MAC CE中，当PCell的类型2的PH被上报时，在八位组指示每个小区PH的存在后，包括类型2的PH域的八位组可以首先被包括，并且在其后跟着包括有关PCMAX,c域的八位组(如果上报)。当PSCell上报类型2的PH，包括类型2的PH域的八位组可以被包括和在其后跟着包括有关PCMAX,c域的八位组(如果上报)。

[0167] 在extendedPHR2PHR MAC CE中，当PUCCH SCell被取消激活时，PUCCH SCell的类

Samsung Electronics v. Asus Tech Licensing EX-1003, 417 of 673

型2的PH域可以不被上报(即使PUCCH SCell配置了同步PUCCH-PUSCH)。在示例性实施例中，使用存在于PHR MAC CE的Ci位图中的ServCellIndex比特，UE可以指示PUCCH SCell的类型2的PH域的存在。这个方法当需要时可以允许选择性传输PUCCH SCell的类型2的PH。可以包括类型1的PH以及带有有关PCMAX,c域的八位组(如果上报)(例如基于ServCellIndex的升序)。对于PCell以及如位图中指示的MAC实体的其它服务小区，可以上报类型1。

[0168] 在示例性实施例中，当配置了DC PHR时，UE和eNB可以不使用ServCellIndex bit Ci(或者另一个指示符)来确定PCell的类型2的PH之后的第二个类型2的PH的存在。然而，当配置了PUCCH组PHR时，UE和eNB可以使用ServCellIndex bit Ci(或者另一个指示符)来确定类型2的PH的存在。在PHR MAC CE中，该示例性实施例可以加强类型2的PH域已有的实施进程。不同于DC PHR MAC CE，根据ServCellIndex bit Ci(或者另一个指示符)的值，在PHR中可以存在或者不存在第二个类型2的PH。例如，PUCCH SCell的索引ServCellIndex的值0(或者另一个指示符)可以指示第二个类型2的PHR和PCMAX,c没有上报。PUCCH SCell的索引ServCellIndex的值1可以指示第二个类型2的PHR上报了。在第二个类型2的PH之后相应的PCMAX,c也可以上报(根据PH进程如果有需要)。

[0169] 在示例性实施例中，UE可以接收至少一个RRC信息，该RRC信息包括多个小区的配置参数，该多个小区包括主小区和一个或多个辅小区。该多个小区可以被分组成多个物理上行控制信道(PUCCH)组，其包括：包括主小区的主PUCCH组；和在一个或多个辅小区中包括PUCCH辅小区的辅PUCCH组。在示例中，RRC信息可以包括一个或多个参数，该参数指示同步PUCCH和物理上行共享信道传输是否配置在主小区和PUCCH辅小区。UE可以传输功率余量报告(PHR)媒体访问控制的控制元(MAC CE)。PHR MAC CE可以包括：指示主小区的类型2的功率余量的第一参数；指示PUCCH辅小区的类型2的功率余量是否存在于PHR MAC CE的第二参数(例如，对应于PUCCH SCell的ServCellIndex bit Ci)；以及只有当第二参数指示PUCCH辅小区的类型2的功率余量存在时，指示PUCCH辅小区的类型2的功率余量的第三参数。当PUCCH辅小区的类型2的功率余量不存在时，则相应的PCMAX,c可能不存在。在示例中，当激活PUCCH SCell时，第二参数指示主小区的类型2的PHR域以及PUCCH SCell的类型2的PHR域的存在。当激活PUCCH SCell时，主小区的类型2的PHR域以及PUCCH SCell的类型2的PHR域被包括和上报在PHR报告中。

[0170] 在示例性实施例中，在UE中可以实施以下进程。如果配置了extendedPHR2，则对于每个激活的具有配置上行链路的服务小区：a)获取类型1的功率余量的值；和b)如果在TTI内服务小区上的MAC实体具有分配给传输的UL资源，则从物理层获取相应的PCMAX,c域的值。

[0171] 如果配置了extendedPHR2，且如果配置和激活了PUCCH SCell，则：a)获取PCell和PUCCH SCell的类型2的功率余量的值；和b)从物理层获取相应的PCMAX,c域的值。否则，如果配置了extendedPHR2，且如果没有配置PUCCH SCell或者PUCCH SCell被取消激活了，则：如果PCell配置了同步PUCCH-PUSCH，则：a)获取PCell的类型2的功率余量的值；和b)从物理层获取相应的PCMAX,c域的值。

[0172] 基于物理层上报的值，根据MAC实体配置的ServCellIndex和PUCCH，UE可以指导复用和组装进程以生成和发射extendedPHR2的扩展PHR MAC控制元。

[0173] 在示例性实施例中，当配置了extendedPHR2时，在PHR中类型2和PCMAX,c域的传输

Samsung Electronics v. Asus Tech Licensing EX-1003, 418 of 673

可以实施以下进程。如果配置和激活了PUCCH SCell，则无线装置可以获取用于传输的PCell和PUCCH SCell的类型2的功率余量的值；并且无线装置可以从物理层获取用于传输的相应的PCMAX，c域的值。在这个情况下，PUCCH SCell和PCell的类型2的PH可以被传输，而不管是否配置了PCell和/或the PUCCH SCell的同步PUCCH-PUSCH。在不同的PUCCH组中PUCCH和PUSCH的平行传输是可能的。当没有配置PUCCH SCell或者取消激活了PUCCH SCell时：如果PCell配置了同步PUCCH-PUSCH，则无线装置可以获取用于传输的PCell的类型2的功率余量的值；并且无线装置可以从物理层获取用于传输的相应的PCMAX，c域的值。在这个情况下，当PCell没有配置同步PUCCH-PUSCH时，可以不传输PCell的类型2的PH。当没有配置PUCCH SCell或者取消激活了PUCCH SCell时，不上报PUCCH SCell的类型1的PHR和类型2的PHR。

[0174] 在示例性实施例中，在MAC-MainConfig中可以引入新的信息元以指示extendedPHR2PHR(或者称为扩展的小区配置PHR、新扩展的PHR)，MAC CE格式被UE使用以上报功率余量。新的IE可以称为extendedPHR2和/或其它名称。使用extendedPHR2PHR MAC CE(例如使用值的释放/建立)，extendedPHR2IE可以指示功率余量是否上报了。如果配置了PUCCH SCell(配置了PUCCH组)，E-UTRAN可以配置值的建立。如果配置了phr-Config，则E-UTRAN可以配置extendedPHR2。如果释放了phr-Config，则UE可以释放extendedPHR2。使用extendedPHR2PHR MAC CE(例如使用值的释放/建立)，extendedPHR2IE可以指示功率余量是否上报了。在示例性实施例中，当配置了具有加强的PHR格式的第一配置时，E-UTRAN可以配置extendedPHR2。例如，如果配置了主小区和k个以上配置有上行链路的辅小区时(例如k＝4、7)，E-UTRAN可以配置值的建立。例如，如果具有配置了上行链路的任何服务小区具有高于n(例如n＝4、7)的servingCellIndex，则E-UTRAN可以配置值的建立。如果配置了PUCCH SCell(配置了PUCCH组)，E-UTRAN可以配置值的建立。如果配置了phr-Config，则E-UTRAN可以配置extendedPHR2。如果释放了pa hr-Config，则UE可以释放extendedPHR2。

[0175] 使用extendedPHR2PHR MAC CE(例如使用值的释放/建立)，extendedPHR2IE可以指示功率余量是否上报了。在示例性实施例中，如果具有配置了上行链路的任何服务小区具有高于n(例如n＝4、7)的servingCellIndex，和/或如果配置了PUCCH SCell(具有配置了上行链路的服务小区的任意数量)，则E-UTRAN可以配置值的建立。如果配置了phr-Config，则E-UTRAN可以配置extendedPHR2。如果释放了phr-Config，则UE可以释放extendedPHR2。

[0176] 在本发明的实施例中，可以使用新的RRC配置参数(extendedPHR2)来配置和使能UE中的extendedPHR2PHR。例如，当在UE中建立extendedPHR2时，UE可以建立有许多小区和PUCCH组。在示例性实施例中，UE可以分析小区的RRC配置和extendedPHR2以确定要被传输的extendedPHR2MAC CE的格式。如果建立了extendedPHR2，当需要时，UE可以使用extendedPHR2PHR MAC CE和LCID传输PHR。

[0177] 在示例性实施例中，当配置并取消激活了PUCCH SCell时，可以使用extendedPHR2PHR报告格式，且PUCCH SCell的Ci值可以设置为指示PUCCH SCell被取消激活了的值(例如0)。MACE CE中预定义的格式和/或值可以被用来指示PUCCH SCell被取消激活了。对于取消激活的PUCCH SCell，UE可以不发射类型1和类型2的PH报告。

[0178] 使用RRC信息中MAC-MainConfig中的新IE，在extendedPHR2的实施中可以提供灵活性，和提供性能去配置extendedPHR2PHR的附加参数，以及在UE中提供附加的PHR上报性

Samsung Electronics v. Asus Tech Licensing EX-1003, 419 of 673

能。

[0179] 在示例性实施例中，扩展的功率余量报告MAC控制元可以包括一个或多个域。对于extendedPHR，扩展的功率余量报告(PHR)MAC控制元可以被具有LCID和/或RRC配置的MAC PDU子报头识别。扩展的PHR MAC CE可以有可变的大小。当类型2的PH被上报时，在八位组指示每个SCell的PH的存在后，包括类型2的PH域的八位组可以首先被包括，并且在其后跟着包括有关PCMAX,c域的八位组(如果上报)。然后对于位图中指示的PCell和每个SCell，它可以基于ServCellIndex以升序的形式跟着具有类型1的PH域的八位组和具有有关PCMAX,c域的八位组(如果上报)。

[0180] 在示例性实施例中，对于extendedPHR2，扩展的功率余量报告(PHR)MAC控制元可以被具有LCID和/或RRC配置的MAC PDU子报头识别。他们可以有可变的大小。一个或多个具有C域的八位组可以被用于指示每个SCell中PH的存在。当PCell的类型2的PH被上报时，在八位组指示每个SCell的PH的存在后，包括类型2的PH域的八位组可以首先被包括，并且在其后跟着包括有关PCMAX,c域的八位组(如果上报)。然后它可以跟着PUCCH SCell的类型2的PH域(如果配置了SCell上的PUCCH，且可以上报针对PUCCH SCell的类型2的PH)，在其后跟着包括有关PCMAX,c域的八位组(如果上报)。对于位图中指示的PCell和每个SCell，它可以基于ServCellIndex以升序的形式跟着具有类型1的PH域的八位组和具有有关PCMAX,c域的八位组(如果上报)。

[0181] 扩展的PHR MAC控制元可以定义如下。Ci域可以指示带有SCell索引i的SCell的PH域的存在。设置为“1”的Ci域可以指示上报了带有SCell索引i的SCell的PH域。设置为“0”的Ci域可以指示没有上报带有SCell索引i的SCell的PH域。“R”域可以是设置为“0”的保留位。“V”域可以指示PH值是否是基于实际传输或者参考格式。对于类型1的PH，V＝0可以指示PUSCH上的实际传输，且V＝1可以指示使用了PUSCH参考格式。对于类型2的PH，V＝0可以指示PUCCH上的实际传输，且V＝1可以指示使用了PUCCH参考格式。对于类型1和类型2的PH，V＝0可以指示包括有关PCMAX,c域的八位组的存在，且V＝1可以指示可以省略包括有关PCMAX,c域的八位组。功率余量(PH)域可以指示功率余量等级。该域的长度可以是，例如，6bits。“P”域可以指示MAC实体是否应用了由功率管理(如由P-MPRc允许的)引起的功率回退。如果相应的PCMAX,c域想要具有不同的值且如果没有应用由功率管理引起的功率回退，MAC实体可以设置P＝1。“PCMAX,c”域，如果存在，则可以指示PCMAX,c或者用于先前PH域的计算的$\tilde{P}_{CMAX,c}$。

[0182] 可以有两种类型的UE功率余量报告，类型1和类型2。对于服务小区c的子帧i，UE功率余量PH可以是有效的。

[0183] 如果UE配置有SCG，且如果CG更高层的参数phr-ModeOtherCG-r12指示在那个CG上传输的功率余量报告为“虚拟的”，假定UE没有在其它CG的任何服务小区上发射PUSCH/PUCCH，则UE可以计算PH。

[0184] 如果UE配置有用于计算属于MCG的小区的功率余量的SCG，则术语“服务小区”可以是指属于MCG的服务小区。对于计算属于SCG的小区的功率余量，术语“服务小区”可以是指属于SCG的服务小区。术语“主小区”可以是指SCG的PSCell。如果UE配置有用于计算属于主PUCCH组的小区的功率余量的PUCCH SCell，则术语“服务小区”可以是指属于主PUCCH组的服务小区。对于计算属于辅PUCCH组的小区的功率余量，术语“服务小区”可以是指属于辅

Samsung Electronics v. Asus Tech Licensing EX-1003, 420 of 673

PUCCH组的服务小区。术语“主小区”可以是指辅PUCCH组的PUCCH-SCell。

[0185] 此处显示了示例性的类型1和类型2的功率余量计算方式。示例性参数和示例性方法显示在标准文件3GPP TS 36.213，相应的LTE版本的标准文件。

[0186] 类型1：

[0187] 如果UE在服务小区c的子帧i中发射没有PUCCH的PUSCH，则计算类型1的报告的功率余量可以使用

[0188] $PH_{type1,c}(i) = P_{CMAX,c}(i)$

[0189] $$-\{10\log_{10}(M_{PUSCH,c}(i)) + P_{O\_PUSCH,c}(j) + \alpha_c(j) \cdot PL_c + \Delta_{TF,c}(i) + f_c(i)\}\ [dB]$$

[0190] 其中，示例性$P_{CMAX,c}(i)$、$M_{PUSCH,c}(i)$、$P_{O\_PUSCH,c}(j)$、$\alpha_c(j)$、PL_c、$\Delta_{TF,c}(i)$和$f_c(i)$可以定义如下。$P_{CMAX,c}(i)$可以是服务小区c的子帧i中配置的UE发射功率，且$\widehat{P}_{CMAX,c}(i)$可以是$P_{CMAX,c}(i)$的线性值。$M_{PUSCH,c}(i)$可以是PUSCH资源分配的带宽，其以对服务小区c的子帧i有效的资源块的数量来表示。使用RRC配置参数可以配置$P_{O_PUSCH,c}(j)$。如果UE配置有服务小区c的更高层参数UplinkPowerControlDedicated-v12x0，且如果子帧i属于由更高层参数tpc-SubframeSet-r12指示的上行功率控制子帧集2。对于j＝0或1，$\alpha_c(j) = \alpha_{c,2} \in \{0, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1\}$。$\alpha_{c,2}$是参数alpha-SubframeSet2-r12，其由每个服务小区c的更高层提供。对于j＝2，$\alpha_c(j) = 1$。否则：对于j＝0或1，$\alpha_c \in \{0, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1\}$可以是由服务小区的更高层提供的3bit参数。对于j＝2，$\alpha_c(j) = 1$。PL_c可以是UE中计算的以dB表示的服务小区c的下行路径损耗估计，且PL_c＝referenceSignalPower——更高层过滤的RSRP，其中referenceSignalPower由参考服务小区的更高层和RSRP以及参考服务小区的更高层滤波器配置提供。对于$K_s = 1.25$，$\Delta_{TF,c}(i) = 10\log_{10}((2^{BPRE \cdot K_s} - 1) \cdot \beta_{offset}^{PUSCH})$，且对于$K_s = 0$，$\Delta_{TF,c}(i) = 0$，其中$K_s$由参数deltaMCS-Enabled给定，该参数由每个服务小区c的更高层提供。每个服务小区c的BPRE和β_{offset}^{PUSCH}，根据以下来计算。对于传输模式2，$K_s = 0$；f(i)可以是功率控制指令的函数。

[0191] 例如，PL_c为UE中计算的以dB为单位的服务小区c的下行路径损耗估计且PL_c＝referenceSignalPower——更高层过滤的RSRP，其中referenceSignalPower由更高层提供。使用在一个或多个路径损耗参考小区上接收的信号，UE可以测量一个或更多路径损耗值。可以配置服务小区的路径损耗参考小区。UE可以计算PL_c且可以使用一个或多个路径损耗值(PL_c)以用于类型1和类型2的功率余量域的计算。如果服务小区c属于包括主小区的TAG，则对于主小区的上行链路，主小区可以被用作参考服务小区以确定referenceSignalPower和更高层过滤的RSRP。对于辅小区的上行链路，由更高层参数pathlossReferenceLinking配置的服务小区可以被用作参考服务小区以确定referenceSignalPower和更高层过滤的RSRP。如果服务小区c属于包括PSCell的TAG，则对于PSCell的上行链路，PSCell可以被用作参考服务小区以确定referenceSignalPower和更高层过滤的RSRP。对于除了PSCell的辅小区的上行链路，由更高层参数pathlossReferenceLinking配置的服务小区可以被用作参考服务小区以确定referenceSignalPower和更高层过滤的RSRP。

[0192] 如果UE在服务小区c的子帧i中发射带有PUCCH的PUSCH，则计算类型1的报告的功

Samsung Electronics v. Asus Tech Licensing EX-1003, 421 of 673

率余量可以使用：

[0193]

$$PH_{type1,c}(i) = \widetilde{P}_{CMAX,c}(i) - \left\{10\log_{10}\left(M_{PUSCH,c}(i)\right) + P_{O\_PUSCH\ \ ,c}(j) + \alpha_c(j)\cdot PL_c + \Delta_{TF,c}(i) + f_c(i)\right\}\ [dB]$$

[0194] 假定PUSCH仅在子帧i中传输，则可以计算$\widetilde{P}_{CMAX,c}(i)$。对于这种情况，物理层可以给更高层传送$\widetilde{P}_{CMAX,c}(i)$而不是$P_{CMAX,c}(i)$。如果UE在服务小区c的子帧i中没有发射PUSCH，则计算类型1的报告的功率余量可以使用

[0195] $$PH_{type1,c}(i) = \widetilde{P}_{CMAX,c}(i) - \left\{P_{O\_PUSCH\ \ ,c}(1) + \alpha_c(1)\cdot PL_c + f_c(i)\right\}\ [dB]$$

[0196] 其中，假定MPR＝0dB、A-MPR＝0dB、P-MPR＝0dB且□TC＝0dB，则可以计算示例$\widetilde{P}_{CMAX,c}(i)$。

[0197] 类型2：

[0198] 如果UE在主小区的子帧i中发射与PUCCH同步的PUSCH，则计算类型2的报告的功率余量使用：

[0199]

$$PH_{type2}(i) = P_{CMAX,c}(i) - 10\log_{10}\left(\begin{array}{l}10^{\left(10\log_{10}\left(M_{PUSCH,c}(i)\right) + P_{O\_PUSCH,c}(j) + \alpha_c(j)\cdot PL_c + \Delta_{TF,c}(i) + f_c(i)\right)/10} \\ + 10^{\left(P_{O\_PUCCH} + PL_c + h\left(n_{CQI}, n_{HARQ}, n_{SR}\right) + \Delta_{F\_PUCCH}(F) + \Delta_{TxD}(F') + g(i)\right)/10}\end{array}\right)\ [dB]$$

[0200] 如果UE在主小区的子帧i中发射没有PUCCH的PUSCH，则计算类型2的报告的功率余量使用：

[0201]

$$PH_{type2}(i) = P_{CMAX,c}(i) - 10\log_{10}\left(\begin{array}{l}10^{\left(10\log_{10}\left(M_{PUSCH,c}(i)\right) + P_{O\_PUSCH,c}(j) + \alpha_c(j)\cdot PL_c + \Delta_{TF,c}(i) + f_c(i)\right)/10} \\ + 10^{\left(P_{O\_PUCCH} + PL_c + g(i)\right)/10}\end{array}\right)\ [dB]$$

[0202] 其中，示例$P_{CMAX,c}(i)$、$M_{PUSCH,c}(i)$、$P_{O\_PUSCH,c}(j)$、$\alpha_c(j)$、$\Delta_{TF,c}(i)$和$f_c(i)$可以是主小区参数。如果UE在主小区的子帧i中发射没有PUSCH的PUCCH，则计算类型2的报告的功率余量使用：

[0203]

$$PH_{type2}(i) = P_{CMAX,c}(i) - 10\log_{10}\left(\begin{array}{l}10^{\left(P_{O\_PUSCH,c}(j) + \alpha_c(j)\cdot PL_c + f_c(i)\right)/10} \\ + 10^{\left(P_{O\_PUCCH} + PL_c + h\left(n_{CQI}, n_{HARQ}, n_{SR}\right) + \Delta_{F\_PUCCH}(F) + \Delta_{TxD}(F') + g(i)\right)/10}\end{array}\right)\ [dB]$$

[0204] 其中，示例$P_{CMAX,c}(1)$、$\alpha_c(1)$和$f_c(i)$为主小区参数。如果UE在服务小区c的子帧i中没有发射PUSCH，则计算类型2的报告的功率余量可以使用：

[0205] $$PH_{type2}(i) = \widetilde{P}_{CMAX,c}(i) - 10\log_{10}\left(\begin{array}{l}10^{\left(P_{O\_PUSCH,c}(1) + \alpha_c(1)\cdot PL_c + f_c(i)\right)/10} \\ + 10^{\left(P_{O\_PUCCH} + PL_c + g(i)\right)/10}\end{array}\right)\ [dB]$$

[0206] 其中，假定MPR＝0dB、A-MPR＝0dB、P-MPR＝0dB且Tc＝0dB，则可以计算示例$\widetilde{P}_{CMAX,c}(i)$，$P_{O\_PUSCH,c}(1)$、$\alpha_c(1)$和$f_c(i)$为主小区参数。如果UE不能确定主小区的子帧i中是否有对应于PDSCH传输的PUCCH传输，或者使用了哪个PUCCH，则在生成类型2的报告的功率余

Samsung Electronics v. Asus Tech Licensing EX-1003, 422 of 673

量之前，用如下条件进行(E)PDCCH检测：(1)如果UE配置了具有信道选择的PUCCH格式1b和simultaneousPUCCH-PUSCH，或者(2)如果对于配置有PUCCH格式3和simultaneousPUCCH-PUSCH的UE来说，具有信道选择的PUCCH格式1b被用于HARQ-ACK反馈，则UE可以被允许计算类型2的功率余量，使用：

[0207]

$$PH_{type2}(i)=P_{CMAX,c}(i)-10\log_{10}\left(10^{\left(10\log_{10}(M_{PUSCH,c}(i))+P_{O\_PUSCH,c}(j)+\alpha_c(j)\cdot PL_c+\Delta_{TF,c}(i)+f_c(i)\right)/10}+10^{\left(P_{O\_PUCCH}+PL_c+g(i)\right)/10}\right)\ [dB]$$

[0208] 其中，示例$P_{CMAX,c}(i)$、$M_{PUSCH,c}(i)$、$P_{O\_PUSCH,c}(j)$、$\alpha_c(j)$、PL_c、$\Delta_{TF,c}(i)$和$f_c(i)$为主小区参数。

[0209] 功率余量可以四舍五入至[40;-23]dB、步长为1dB范围内最接近的值，且由物理层传输至更高层。如果UE为服务小区c配置有更高层参数UplinkPowerControlDedicated-v12x0，且如果子帧i属于由更高层参数tpc-SubframeSet-r12指示的上行功率控制子帧集2，则UE可以使用$f_{c,2}(i)$而不是$f_c(i)$来计算子帧i和服务小区c的$PH_{type1,c}(i)$和$PH_{type2,c}(i)$。

[0210] 图14为根据本发明实施例的一方面的示例性流程图。无线装置在步骤1410处接收来自基站的至少一个信息。该信息可以包括多个小区的配置参数。该多个小区可以包括主小区和PUCCH辅小区。主小区可以包括发射至基站的主物理上行控制信道(PUCCH)。PUCCH辅小区可以包括发射至基站的辅PUCCH。功率余量报告(PHR)媒体访问控制控制元(MAC CE)可以通过UE(无线装置)在步骤1420处被发射。PHR MAC CE可以包括第一域和第二域。第一域可以指示在PHR MAC CE中是否存在PUCCH辅小区的类型2的功率余量域。只有当第一域指示PUCCH辅小区的类型2的功率余量域存在时，第二域可以指示PUCCH辅小区的类型2的功率余量等级。

[0211] 该至少一个信息可以进一步包括第一信息元，该第一信息元指示是否可以为主小区配置同步的PUCCH传输和物理上行共享信道传输。该至少一个信息可以进一步包括第二信息元，该第二信息元指示是否可以为PUCCH辅小区配置同步的PUCCH传输和物理上行共享信道传输。

[0212] PHR MAC CE可以进一步包括第三域，该第三域指示主小区的类型2的功率余量等级。PHR MAC CE可以包括PUCCH辅小区的类型1的功率余量域，其不同于PUCCH辅小区的类型2的功率余量域。PHR MAC CE可以被基站使用上行数据包调度或上行功率控制的至少一个。

[0213] 在示例性实施中，类型2的功率余量等级的计算可以使用物理上行控制信道的已计算功率和物理上行共享信道的已计算功率。类型1的功率余量等级的计算可以使用物理上行共享信道的已计算功率。通过测量路径损耗参考的信号可以获得测量值。类型2的功率余量等级的计算可以使用测量值。当激活PUCCH辅小区时，无线装置可以上报PUCCH辅小区的类型2的功率余量等级以及主小区的类型2的功率余量。

[0214] 图15为根据本发明实施例的一方面的示例性流程图。基站在步骤1510处给无线装置发射至少一个信息。该信息可以包括多个小区的配置参数。该多个小区可以包括主小区和PUCCH辅小区。主小区可以包括发射至基站的主物理上行控制信道(PUCCH)。PUCCH辅小区可以包括发射至基站的辅PUCCH。

[0215] 功率余量报告(PHR)媒体访问控制的控制元(MAC CE)可以在步骤1520处被接收。PHR MAC CE可以包括第一域、第二域和第三域。第一域可以指示在PHR MAC CE中存在PUCCH

Samsung Electronics v. Asus Tech Licensing EX-1003, 423 of 673

辅小区的类型2的功率余量域。第二域可以指示PUCCH辅小区的类型2的功率余量等级。第三域可以指示主小区的类型2的功率余量等级。

[0216] 该至少一个信息可以包括第一信息元，该第一信息元指示是否为主小区配置同步的PUCCH传输和物理上行共享信道传输。该信息还可以包括第二信息元，该第二信息元指示是否可以为PUCCH辅小区配置同步的PUCCH传输和物理上行共享信道传输。

[0217] PHR MAC CE可以包括第四域，该第四域指示主小区的类型1的功率余量等级。PHR MAC CE可以包括PUCCH辅小区的类型1的功率余量域，其不同于PUCCH辅小区的类型2的功率余量域。PHR MAC CE可以被基站使用上行数据包调度和/或上行功率控制。

[0218] 当在无线装置中激活PUCCH辅小区时，基站可以接收PUCCH辅小区的类型2的功率余量等级以及主小区的类型2的功率余量等级。

[0219] 主PUCCH组可以包括一组服务小区，该一组服务小区包括PCell，其中PCell的PUCCH信令与PCell上的PUCCH有关联。PUCCH组可以包括主PUCCH组或者辅PUCCH组。辅PUCCH组可以包括一组SCell，该一组SCell的PUCCH信令与PUCCH SCell上的PUCCH相关联。

[0220] 关于物理上行控制信道(PUCCH)，PUCCH可以在PCell、PUCCH SCell(如果CA中配置了这种)和PSCell(在DC中)上被发射。

[0221] 关于载波聚合，UE的服务小区的配置集可以包括一个PCell和一个或多个SCell。如果没有配置DC，则可以在SCell和/或PUCCH SCell上配置附加的PUCCH。但配置了PUCCH SCell，RRC可以配置每个服务小区至主PUCCH组和/或辅PUCCH组的映射(例如，对于每个SCell，PCell和/或PUCCH SCell是否用于ACK NAK和CSI报告的传输)。

[0222] 关于功率余量上报。如果配置了extendedPHR2：对于每个激活的具有配置上行链路的服务小区：a)获取类型1的功率余量的值；和b)如果在TTI内服务小区上的MAC实体具有分配给传输的UL资源：则从物理层获取相应的PCMAX，c域的值。如果配置和激活了PUCCH SCell：a)可以获取PCell和PUCCH SCell的类型2的功率余量的值，和/或b)可以从物理层获取相应的PCMAX，c域的值。否则(当没有配置PUCCH SCell或者PUCCH SCell被取消激活时)，如果PCell配置了同步PUCCH-PUSCH，则：a)可以获取PCell的类型2的功率余量的值；b)可以从物理层获取相应的PCMAX，c域的值。基于物理层上报的值，根据MAC实体配置的ServCellIndex和PUCCH，可以指导复用和组装进程以生成和发射extendedPHR2的扩展PHR MAC控制元。

[0223] 关于扩展的功率余量报告MAC控制元，可以考虑如下。对于extendedPHR，扩展的功率余量报告(PHR)MAC控制元可以被具有LCID和/或RRC配置的MAC PDU子报头识别。一个或多个具有C域的八位组可以被用于指示每个SCell中PH的存在。当PCell的类型2的PH被上报时，在八位组指示每个SCell的PH的存在后，包括类型2的PH域的八位组可以首先被包括，并且在其后跟着包括有关PCMAX，c域的八位组(如果上报)。然后它可以跟着PUCCH SCell的类型2的PH域(如果配置了SCell上的PUCCH，且可以上报针对PUCCH SCell的类型2的PH)，在其后跟着包括有关PCMAX，c域的八位组(如果上报)。然后对于位图中指示的PCell和每个SCell，它可以基于ServCellIndex以升序的形式跟着具有类型1的PH域的八位组和具有有关PCMAX，c域的八位组(如果上报)。

[0224] 扩展的PHR MAC控制元可以包括许多域，本文讨论该域的至少一些。Ci可以指示带有SCell索引i的SCell的PH域的存在。可以设置Ci域为“1”以指示上报了带有SCell索引i的

Samsung Electronics v. Asus Tech Licensing EX-1003, 424 of 673

SCell的PH域。可以设置Ci域为“0”以指示没有上报带有SCell索引i的SCell的PH域。R域可以是保留位，设置为，例如“0”。V域可以指示PH值是否是基于实际传输或者参考格式。对于类型1的PH，V＝0可以指示PUSCH上的实际传输，且V＝1可以指示使用了PUSCH参考格式。对于类型2的PH，V＝0可以指示PUCCH上的实际传输，且V＝1可以指示使用了PUCCH参考格式。另外，对于类型1和类型2的PH，V＝0可以指示包括有关PCMAX，c域的八位组的存在，且V＝1可以指示省略包括有关PCMAX，c域的八位组；

[0225] 功率余量(PH)域可以指示功率余量等级。该域的长度可以是，例如，6bits。P域可以指示MAC实体是否应用了由功率管理(例如，如由P-MPRc允许的)引起的功率回退。如果相应的PCMAX，c域想要具有不同的值且如果没有应用由功率管理引起的功率回退，MAC实体可以设置P＝1。PCMAX，c域，如果存在，则可以指示PCMAX，c或者用于先前PH域的计算的 $\tilde{P}_{CMAX,c}$。

[0226] 图14为根据本发明实施例的一方面的示例性流程图。无线装置在步骤1410处接收来自基站的至少一个信息。该信息可以包括多个小区和第一信息元(IE)以及第二信息元的配置参数。可以使用该多个小区与基站进行通信。IE可以指示了新扩展的功率余量报告已配置。当多个小区中的辅小区配置有PUCCH时，第一IE被配置为建立，且第二IE指示了功率余量报告被配置为建立。

[0227] 当建立了IE的值，它暗指在无线装置(UE)中配置了由IE表示的功能。当第二IE被配置为建立时，它指示在UE中配置了功率余量上报。当第一IE被配置为建立时，它指示在UE中配置了扩展的PHR2。

[0228] 当激活了辅小区时，可以在步骤1420处发射媒体访问控制(MAC)数据包，该数据包包括主小区的第一个类型2的功率余量域和辅小区的第二个类型2的功率余量域。MAC数据包可以包括子报头，该子报头包括逻辑信道标识符(LCID)。

[0229] 该信息可以包括阻止功率余量报告计时器IE，和/或周期性的功率余量报告计时器IE。在示例性的实施中，多个小区中小区的小区索引可以比预定义的值大(例如5或者7)。具有配置上行链路的小区的小区索引可以比预定义的值大(例如5或者7)。

[0230] 第二个类型2的功率余量等级的计算可以使用PUCCH的已计算功率和物理上行共享信道的已计算功率。辅小区的类型1的功率余量等级的计算可以使用物理上行共享信道的已计算功率。功率余量报告可以配置为以下中的至少一个：功率余量报告、双连接功率余量报告、扩展的功率余量报告、新扩展的功率余量报告及其结合，和/或类似的。

[0231] 根据图14可以实施各种实施例。例如，无线装置在步骤1410处可以接收来自基站的至少一个信息。该信息可以包括多个小区和第一信息元(IE)以及第二信息元的配置参数。多个小区的每个小区可以具有配置的上行链路以用于与基站的通信。第一IE可以指示了新扩展的功率余量报告已配置。第一IE可以被配置为建立，当：多个小区中第一个小区的索引比预定义的值大时；且第二IE指示了功率余量报告被配置为建立。在步骤1420处，可以给eNB发射媒体访问控制(MAC)数据包，该数据包包括第一个小区的功率余量值。

[0232] 在示例性实施例中，无线装置可以接收至少一个信息，该至少一个信息包括多个小区的配置参数。多个小区的每个小区可以具有配置的上行链路以用于与基站的通信。该至少一个信息可以包括第一IE和第二IE。第一IE可以指示了新扩展的功率余量报告已配置(功率余量报告)。第一IE被配置为建立，当：多个小区中第一个小区的索引比预定义的值大

Samsung Electronics v. Asus Tech Licensing EX-1003, 425 of 673

(例如5或7)时;且第二IE指示了功率余量报告被配置为建立。无线装置可以发射媒体访问控制(MAC)数据包,该数据包包括第一个小区的功率余量值。

[0233] 在示例性实施例中,无线装置可以接收至少一个信息,该至少一个信息包括多个小区的配置参数。多个小区的每个小区可以具有配置的上行链路以用于与基站的通信。该至少一个信息可以包括第一IE和第二IE。第一IE可以指示了新扩展的功率余量报告已配置(功率余量报告)。第一IE被配置为建立,当:多个小区的数量比预定义的值大(例如5、7或8);且第二IE指示了功率余量报告被配置为建立时。无线装置可以发射媒体访问控制(MAC)数据包,该数据包包括第一个小区的功率余量值。

[0234] 在本说明书中,不定冠词和类似的词组被解释为"至少一个"和"一个或多个"。在本说明书中,词语"可以"被解释为"可以,例如"。换句话说,词语"可以"表示跟着词语"可以"的词组为许多合适可能性中的一个例子,其可以或者可以不用于各个实施例中的一个或多个。如果A和B都是集合且A的每一个元素也是B的元素,则A被称为B的子集。在本说明书中,仅考虑了非空集和子集。例如,B={cell1,cell2}的可能子集为:{cell1}、{cell2}和{cell1,cell2}。

[0235] 在本说明书中,参数(信息元:IE)可以包括一个或多个物体,且那些物体的每一个可以包括一个或多个其它物体。例如,如果参数(IE)N包括参数(IE)M,且参数(IE)M包括参数(IE)K,且参数(IE)K包括参数(信息元)J,则,例如,N包括K,且N包括J。在示例性实施例中,当一个或多个信息包括多个参数时,它暗指多个参数中的参数在一个或多个信息中的至少一个中,但不必在一个或多个信息的每个中。

[0236] 在公开的实施例中所描述的许多元件可以作为模块来实施。模块在本文定义为可分离元件,其执行已定义的功能且具有已定义的与其它元件的接口。本公开所描述的模块可以在硬件、结合硬件的软件、固件、湿件(即具有生物元素的硬件)或其结合中实施,所有这些在行为上是等同的。例如,模块可以作为以计算机语言写成的软件程序来实施,该软件程序配置为由硬件机构(如C、C++、Fortran、Java、Basic、Matlab或者类似的)或者建模/仿真程序(例如Simulink、Stateflow、GNU Octave、或LabVIEWMathScript)来执行。另外,有可能使用物理硬件来实施模块,该物理硬件包括离散的或可编程的模拟、数字的和/或量子硬件。可编程硬件的例子包括:计算机、微型控制器、微型处理器、专用集成电路(ASIC);现场可编程门阵列(FPGA);和复杂可编程逻辑器件(CPLD)。计算机、微型控制器和微型处理器都使用诸如汇编、C、C++或类似的语言来编程。FPGA、ASIC和CPLD经常使用硬件描述语言(HDL)来编程,例如超高速集成电路(VHSIC)的硬件描述语言(VHDL)或者Verilog,Verilog在可编程器件上配置带有更少功能的内部硬件模块之间的连接。最后,需要强调以上提及的技术通常结合起来使用,以实现功能模块的结果。

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[0238] 虽然以上描述了各个实施例,但应该理解为它们是以举例而不是限制的方式来呈现。对相关领域的技术人员来说,在不偏离本精神和范围的前提下本文可以做出形式和细节上的各种改变是很明显的。事实上,在阅读以上描述之后,对于相关领域的技术人员来说,如何实施各个实施例是很明显的。因此,本实施例不应该限制于任何以上所描述的示例

Samsung Electronics v. Asus Tech Licensing EX-1003, 426 of 673

性实施例。尤其地，应该注意到，对于示例性的目的，以上解释集中在使用频分双工(FFD)通信系统的示例上。然而，本领域技术人员将意识到本发明的实施例还可以在包括一个或多个时分双工(TDD)小区的系统中实施(例如帧结构2和/或帧结构3——许可协助访问)。所公开的方法和系统可以在无线或有线系统中实施。本发明中所呈现的各个实施例的功能可以结合。一个实施例的一个或多个功能(方法或系统)可以在其它实施例中实施。仅仅显示了有限数量的示例结合，以向本领域技术人员指示功能的可行性，即在各个实施例中可以结合功能以创建增强的传输和接收系统和方法。

[0239] 另外，应该理解为强调功能和优势的任何附图仅仅是为了示例的目的来呈现的。所公开的架构是足够灵活且可配置的，以使得除了所显示方式之外的方式可以使用它。例如，在任何流程图中列出的功能可以被重定序或者在一些实施例中选择性地使用。

[0240] 进一步，本公开的摘要的目的在于使美国专利商标局和公众，通常且尤其是对专利或法律术语或措辞不熟悉的本领域的科学家、工程师和从业者，来从粗略检查中快速确定本申请的技术公开的性质和本质。本公开的摘要并不意在以任何方式限制范围。

[0241] 最后，申请人意指仅仅包括表达用语“用于……的装置”或“用于……的步骤”的权利要求在35 U.S.C.112的第六段下进行解释。

Samsung Electronics v. Asus Tech Licensing EX-1003, 427 of 673

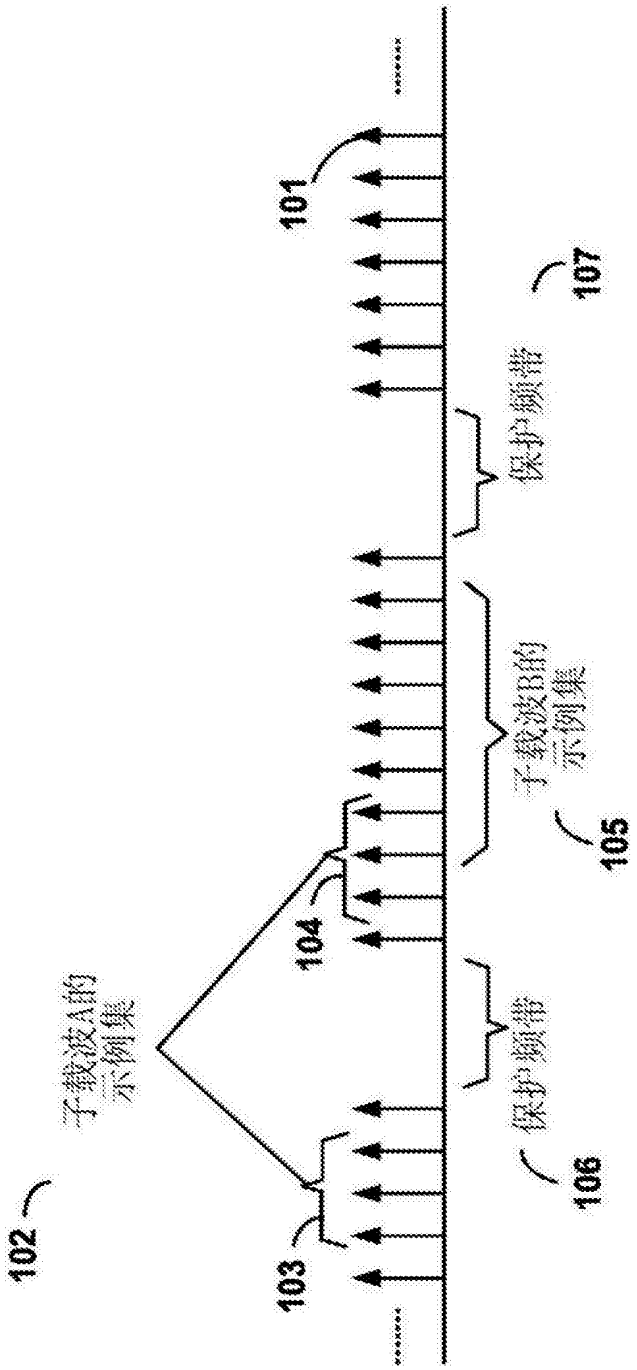


图1

Samsung Electronics v. Asus Tech Licensing EX-1003, 428 of 673

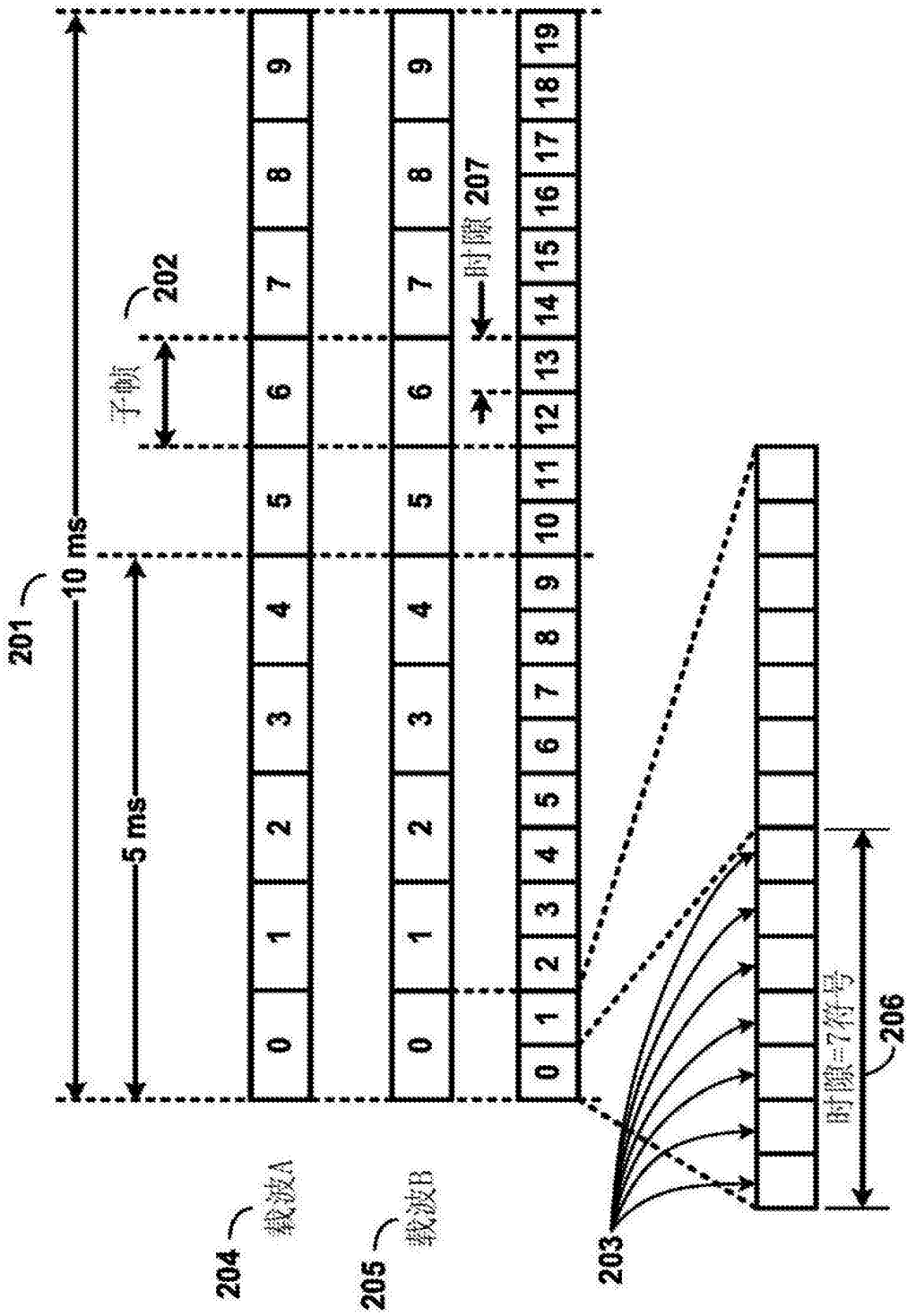


图2

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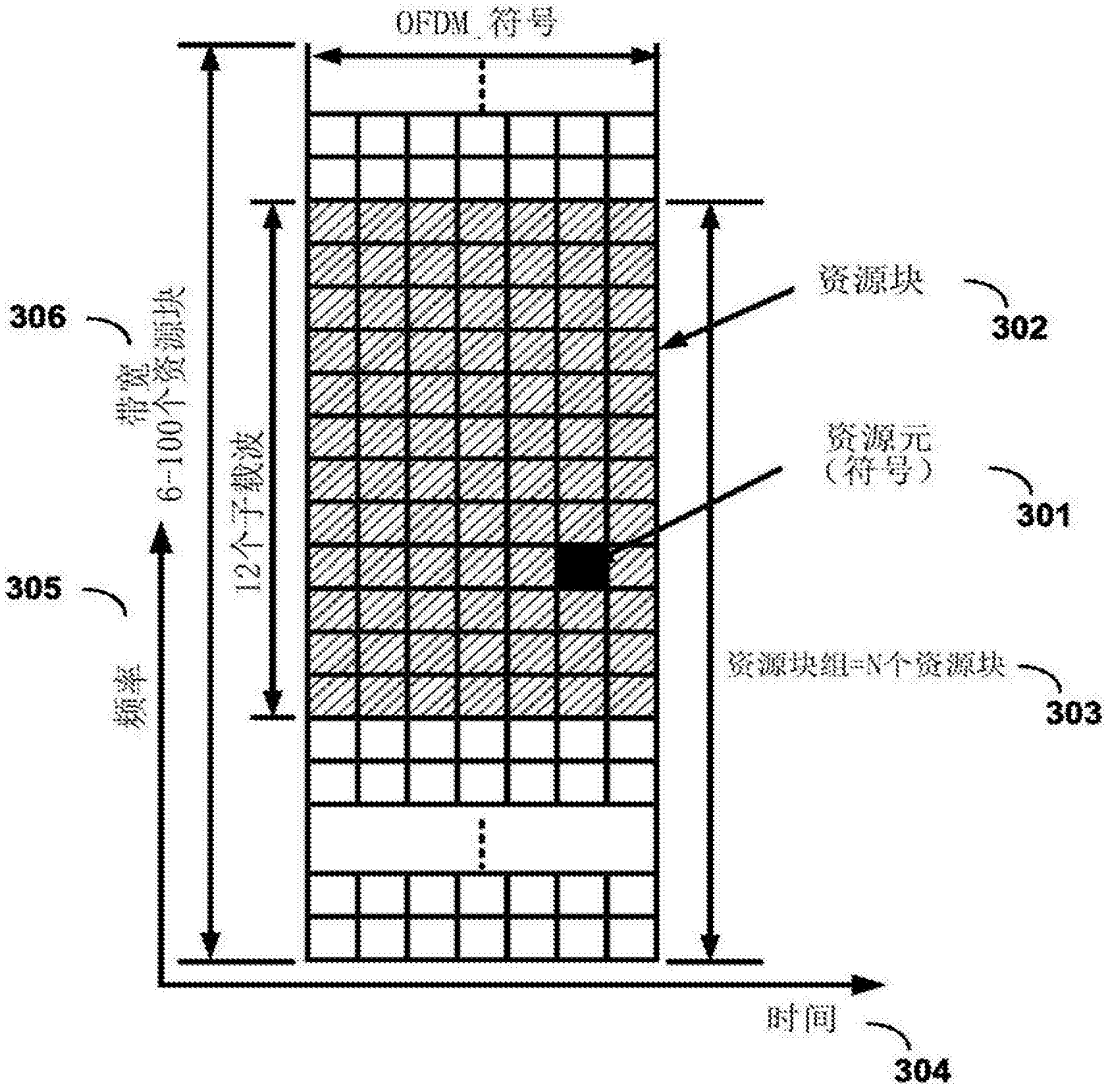


图3

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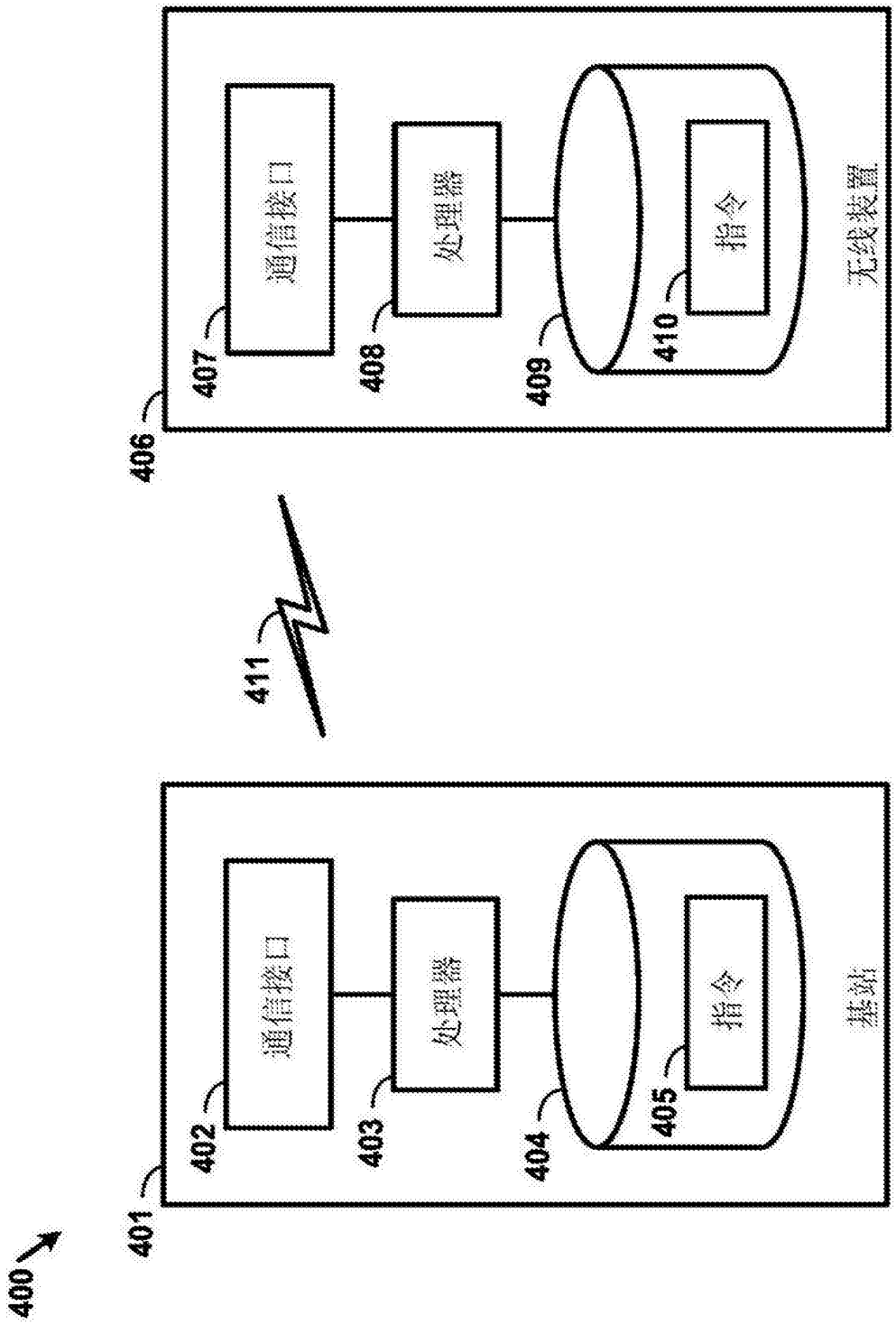


图4

Samsung Electronics v. Asus Tech Licensing EX-1003, 431 of 673

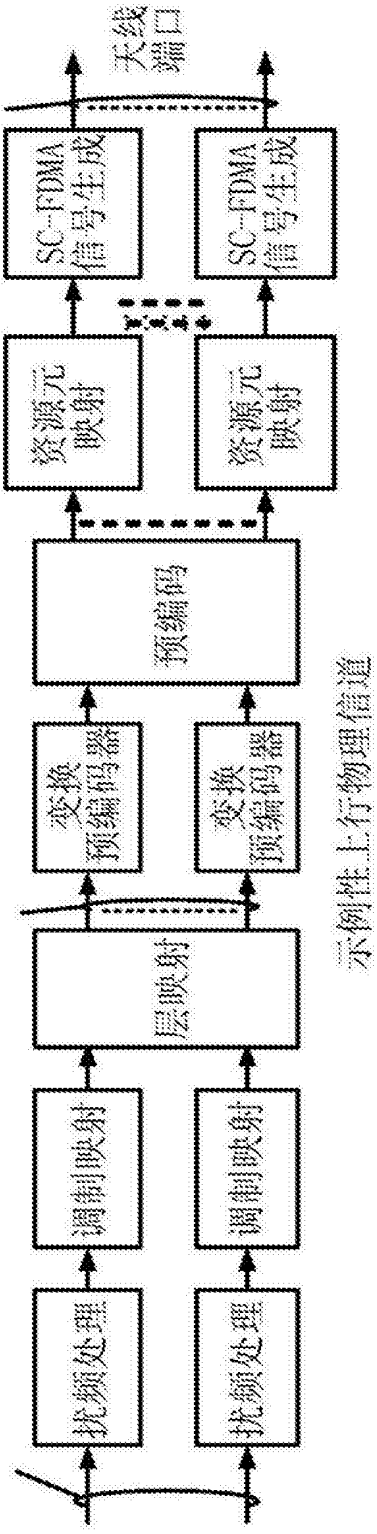


图5A

Samsung Electronics v. Asus Tech Licensing EX-1003, 432 of 673

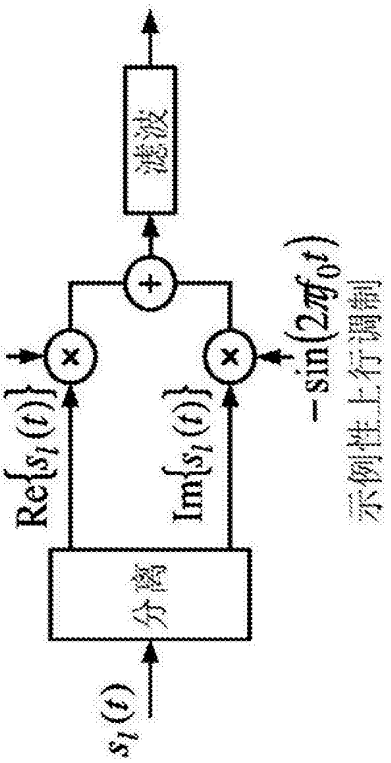


图5B

Samsung Electronics v. Asus Tech Licensing EX-1003, 433 of 673

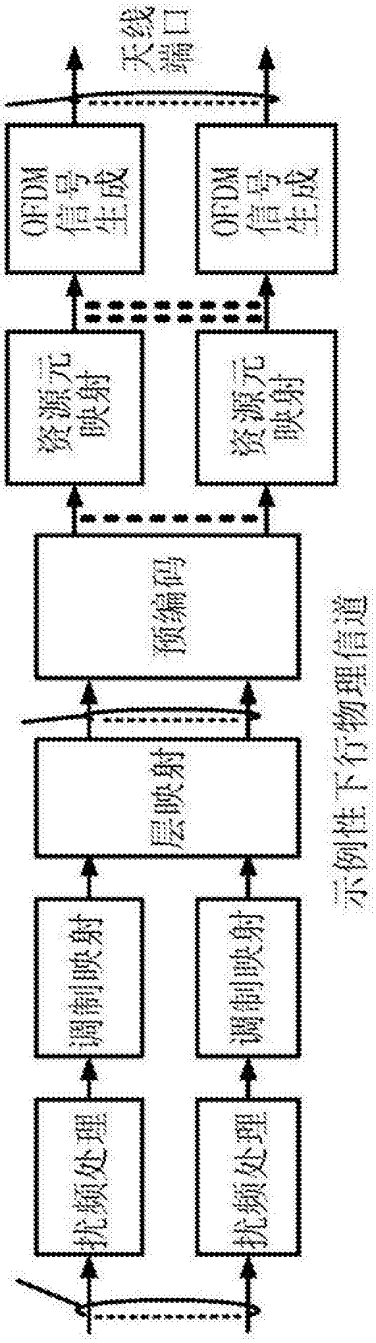


图5C

Samsung Electronics v. Asus Tech Licensing EX-1003, 434 of 673

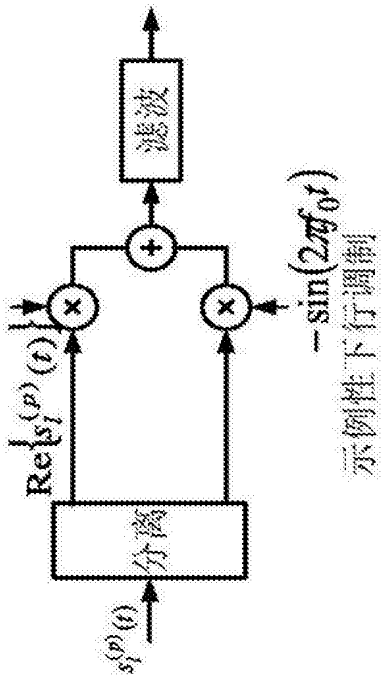


图5D

Samsung Electronics v. Asus Tech Licensing EX-1003, 435 of 673

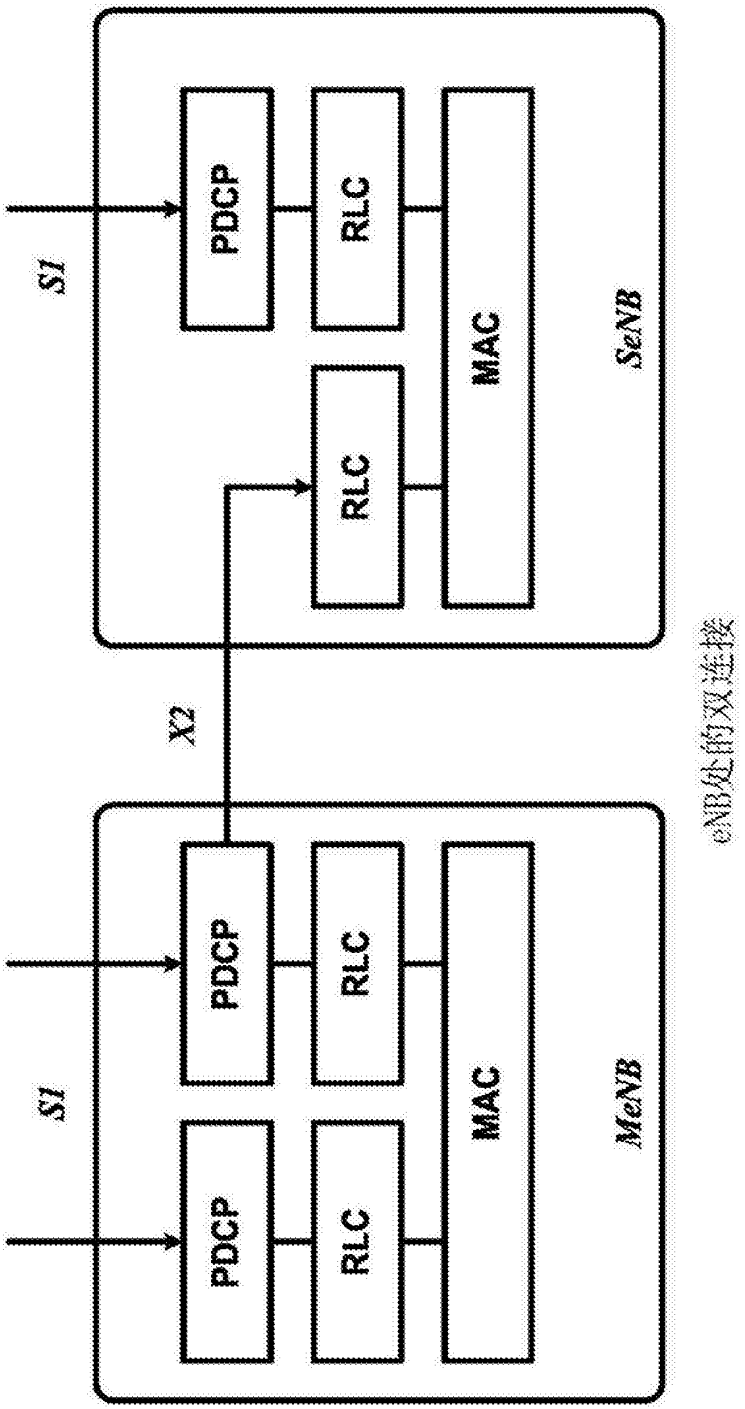


图6

Samsung Electronics v. Asus Tech Licensing EX-1003, 436 of 673

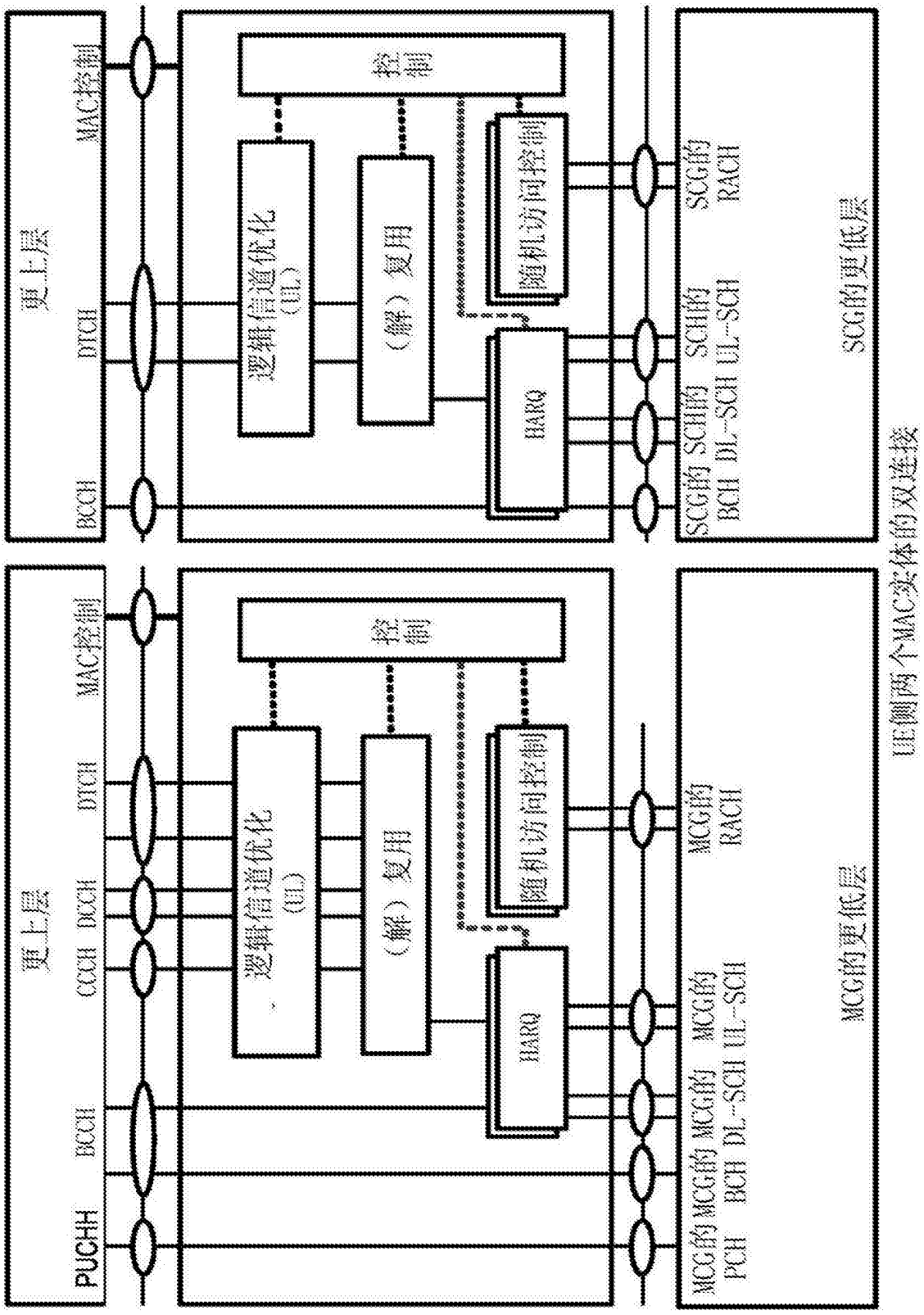


图7

Samsung Electronics v. Asus Tech Licensing EX-1003, 437 of 673

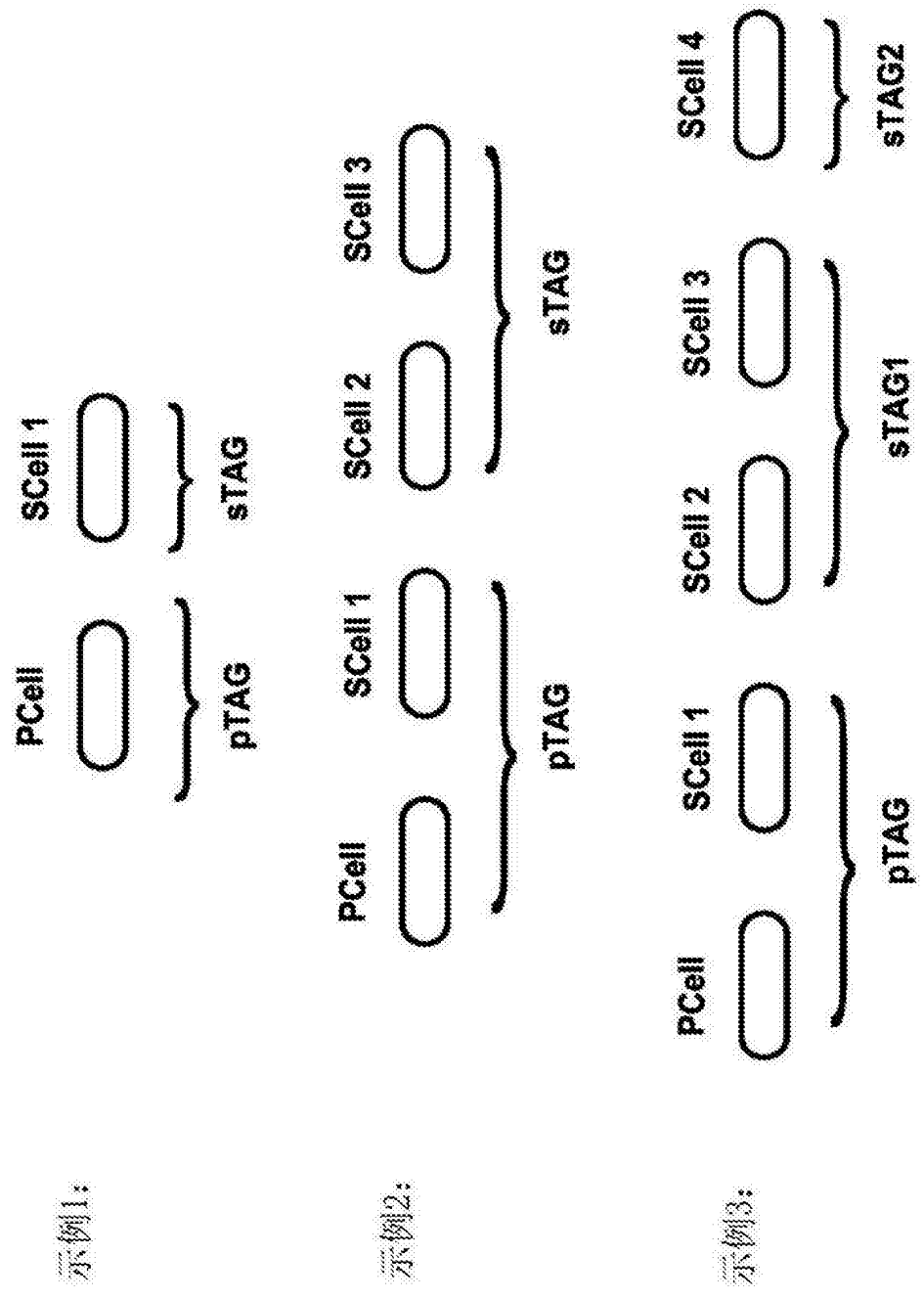


图8

Samsung Electronics v. Asus Tech Licensing EX-1003, 438 of 673

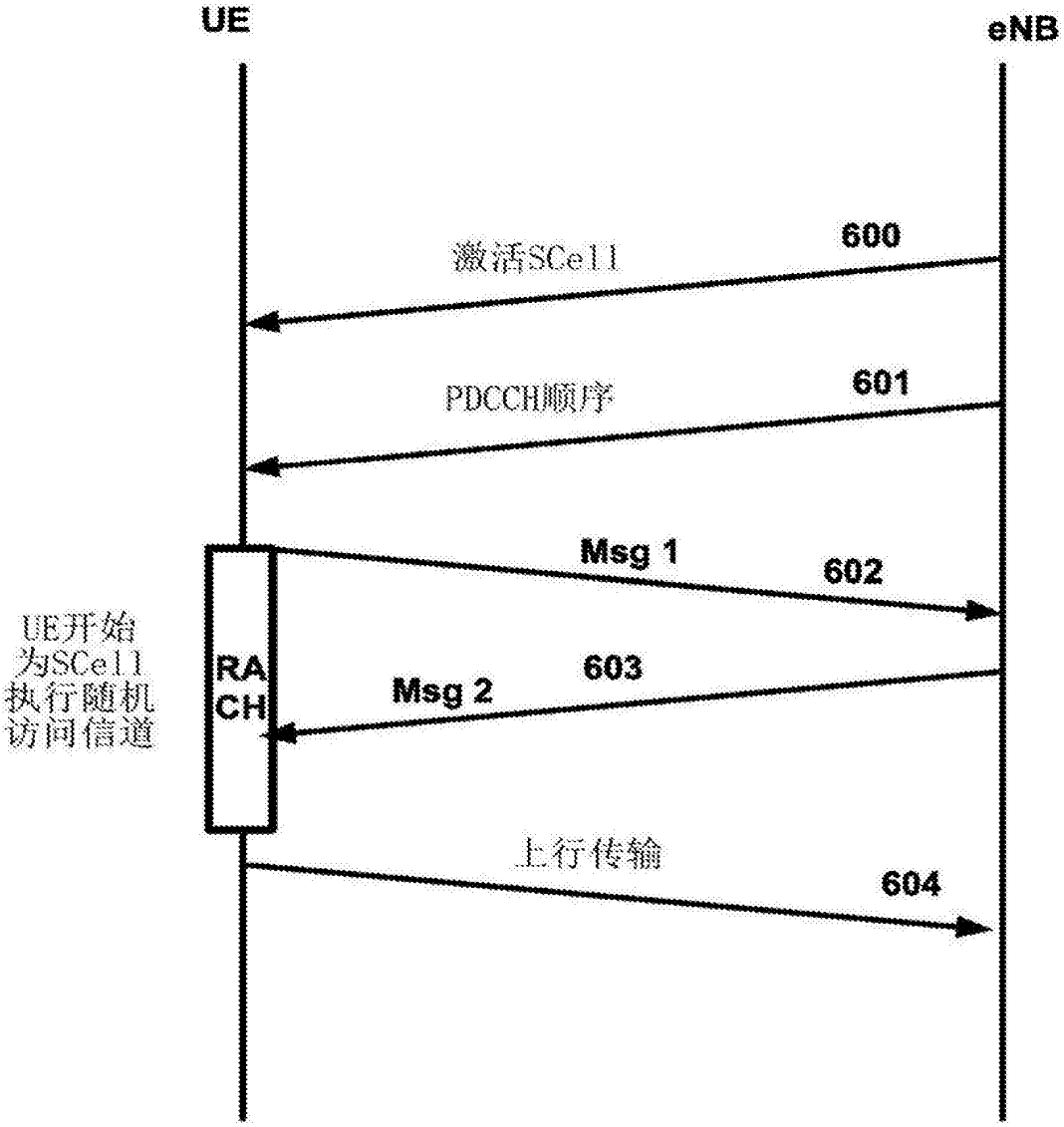


图9

Samsung Electronics v. Asus Tech Licensing EX-1003, 439 of 673

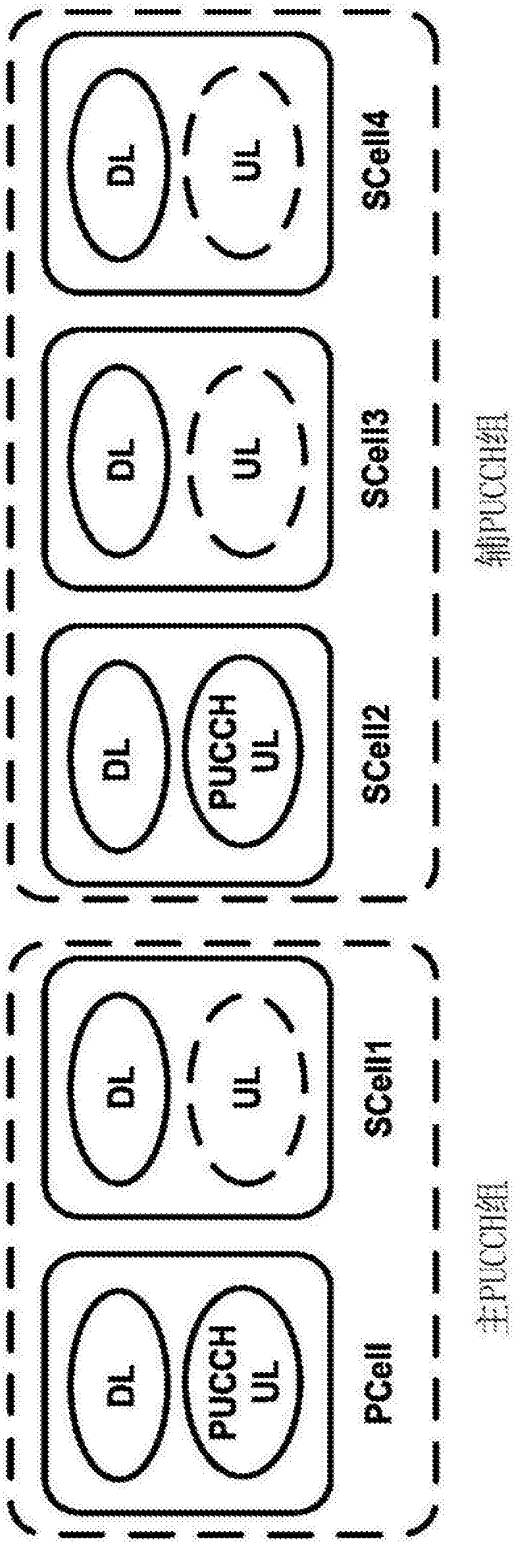


图10

Samsung Electronics v. Asus Tech Licensing EX-1003, 440 of 673

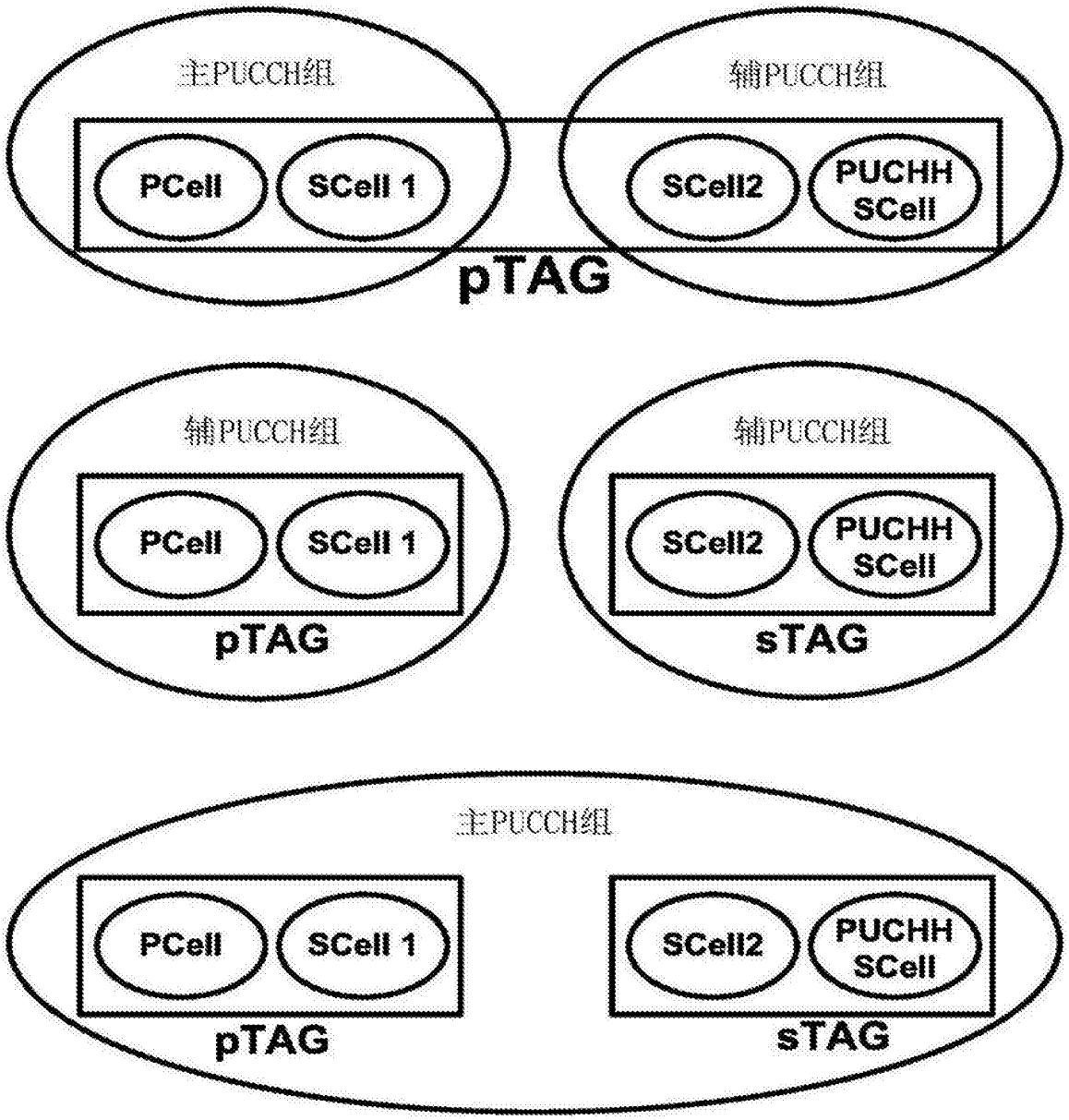


图11

Samsung Electronics v. Asus Tech Licensing EX-1003, 441 of 673

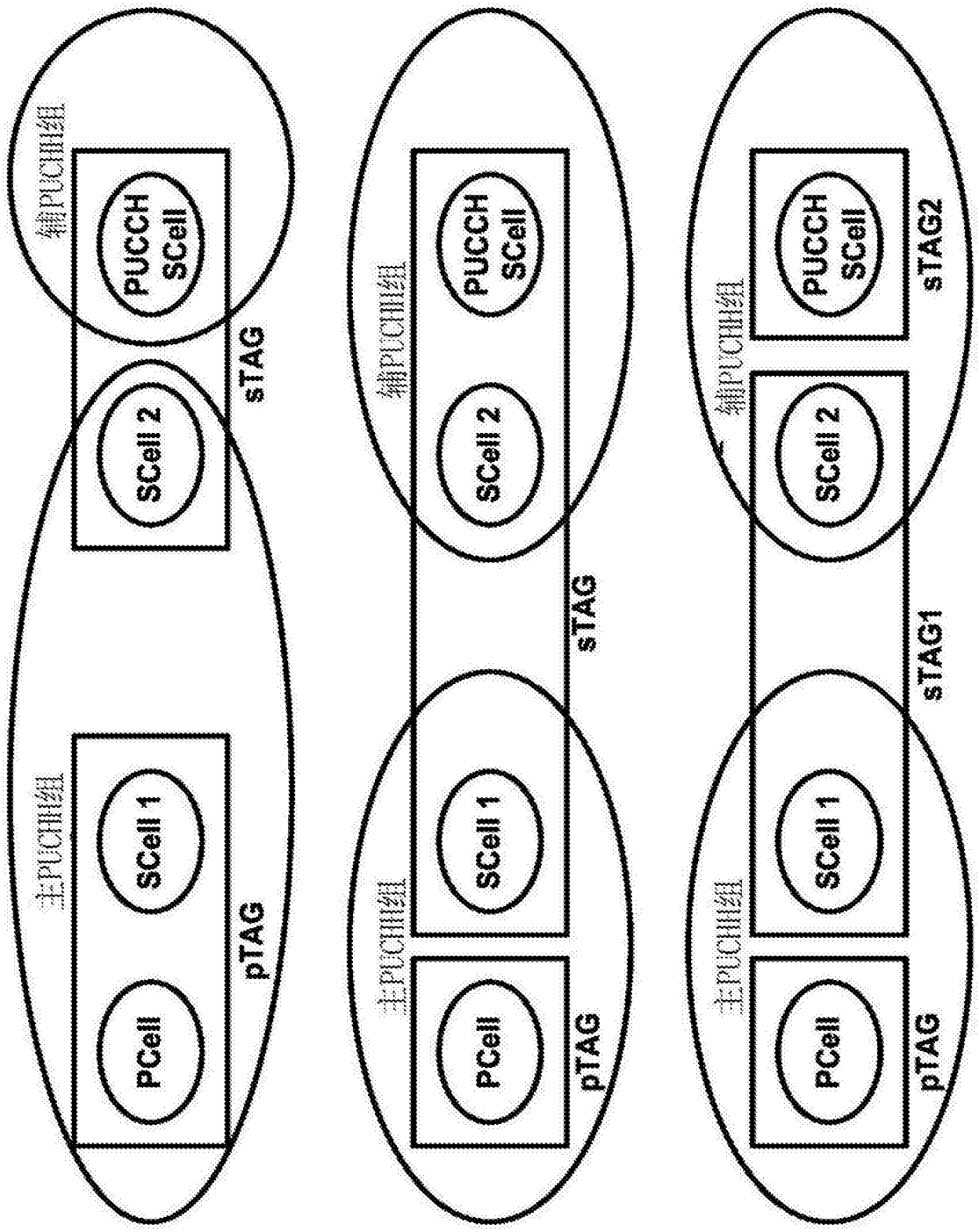


图12

Samsung Electronics v. Asus Tech Licensing EX-1003, 442 of 673

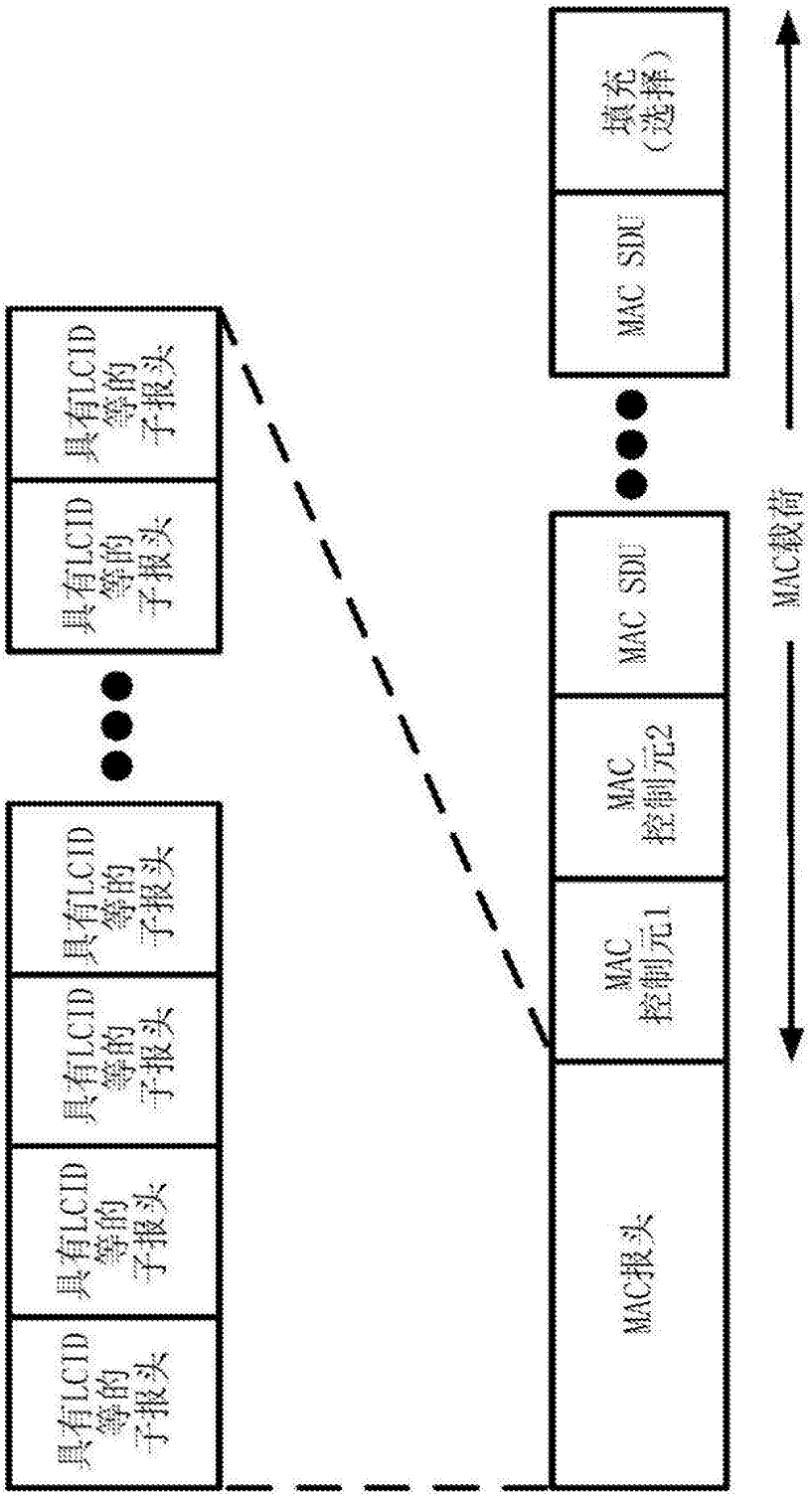


图13

Samsung Electronics v. Asus Tech Licensing EX-1003, 443 of 673

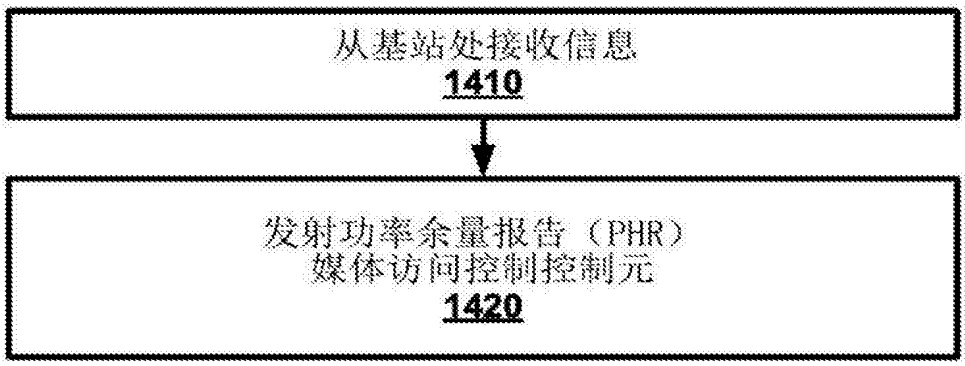


图14

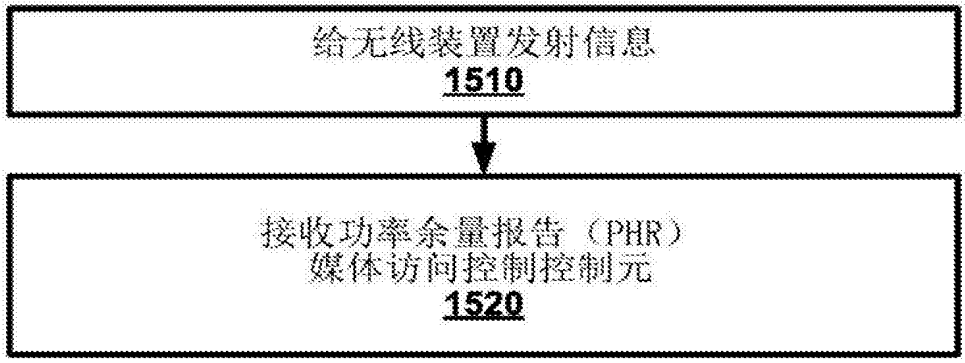


图15

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
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650 Town Center Drive, Suite 1530
Costa Mesa, CA 92626

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Publication No.US-2019-0349866-A1
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(Not for submission under 37 CFR 1.99)

Application Number	16395760
Filing Date	2019-04-26
First Named Inventor	LIN, KO-CHIANG
Art Unit	2648
Examiner Name	Wesley Leo Kim
Attorney Docket Number	1426-343.101

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
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	1	3319376	EP		2019-05-09	LIN, KO-CHIANG		☐

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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	16395760
	Filing Date	2019-04-26
	First Named Inventor	LIN, KO-CHIANG
	Art Unit	2648
	Examiner Name	Wesley Leo Kim
	Attorney Docket Number	1426-343.101

	1	ASUSTEK: "Pathloss reference change for triggering PHR", 3GPP DRAFT; R2-1804289, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ;FRANCE vol. RAN WG2, no. Sanya, China; 20180416 - 20180420 14 April 2018 (2018-04-14), XP051428045.	☐
	2	HUAWEI ET AL: "Consideration on PHR with multi-beam operation", 3GPP DRAFT; R2-1801043 CONSIDERATION ON PHR WITH MULTI-BEAM OPERATION, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES : F-06921 SOPHIA-ANTIPOLIS CEDEX vol. RAN WG2, no. Vancouver, Canada; 20180122 - 20180126 12 January 2018 (2018-01-12), XP051386539.	☐
	3	ASUSTEK: " Impact of pathloss reference on PHR triggering",3GPP DRAFT; R2-1806917, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCI0LES ; F-06921 SOPHIA-ANTIP0LIS CEDEX ;FRANCE vol. RAN WG2, no. Busan, Korea; 20180521 - 20180525 20 May 2018 (2018-05-20), XP051443358.	☐
	4	European Search Report from corresponding EP Application No. 19171289.2, dated September 24, 2019	☐

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(11) EP 3 319 376 A2

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(43) Date of publication:
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(51) Int Cl.:
H04W 52/36 *(2009.01)*

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BA ME
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(30) Priority: **08.11.2016 US 201662419101 P**

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(54) METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR BEAM OPERATION IN A WIRELESS COMMUNICATION SYSTEM

(57) Methods and apparatuses for triggering a power headroom report for beam operation in a wireless communication system are disclosed herein. In one method, a user equipment (UE) uses multiple beams for transmission (2805). The UE triggers a power headroom report due to a change of a pathloss being larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams (2810).

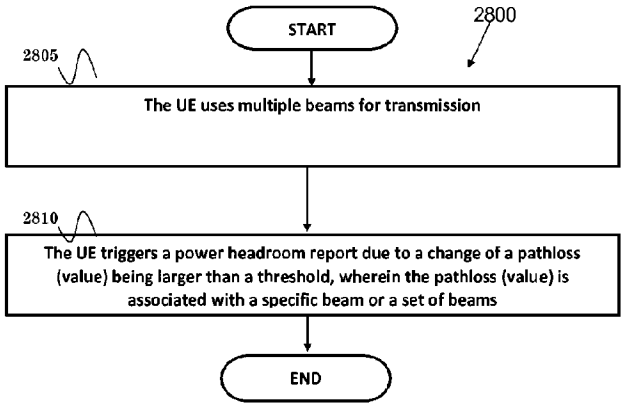


FIG. 28

EP 3 319 376 A2

Description

[0001] This disclosure generally relates to wireless communication networks, and more particularly, to a method and apparatus for triggering a power headroom report for beam operation in a wireless communication system.

[0002] With the rapid rise in demand for communication of large amounts of data to and from mobile communication devices, traditional mobile voice communication networks are evolving into networks that communicate with Internet Protocol (IP) data packets. Such IP data packet communication can provide users of mobile communication devices with voice over IP, multimedia, multicast and on-demand communication services.

[0003] An exemplary network structure is an Evolved Universal Terrestrial Radio Access Network (E-UTRAN). The E-UTRAN system can provide high data throughput in order to realize the above-noted voice over IP and multimedia services. A new radio technology for the next generation (e.g., 5G) is currently being discussed by the 3GPP standards organization. Accordingly, changes to the current body of 3GPP standard are currently being submitted and considered to evolve and finalize the 3GPP standard.

SUMMARY

[0004] Methods and apparatuses for triggering a power headroom report for beam operation in a wireless communication system are disclosed herein and are defined in independent claims 1, 9, and 13, respectively. The dependent claims define preferred embodiments thereof. In one method, a user equipment (UE) uses multiple beams for transmission. The UE triggers a power headroom report due to a change of a pathloss being larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

FIG. 1 shows a diagram of a wireless communication system according to one exemplary embodiment.

FIG. 2 is a block diagram of a transmitter system (also known as access network) and a receiver system (also known as user equipment or UE) according to one exemplary embodiment.

FIG. 3 is a functional block diagram of a communication system according to one exemplary embodiment.

FIG. 4 is a functional block diagram of the program code of FIG. 3 according to one exemplary embodiment.

FIG. 5A is an example of digital beamforming.

FIG. 5B is an example of analogue beamforming.

FIG. 5C is an example of hybrid beamforming, fully connected.

FIG. 5D is an example of hybrid beamforming, sub-array.

FIG. 6 is a reproduction of Table 5.1.1.1-1from 3GPP TS 36.213 v14.0.0 illustrating K_{PUSCH} for TDD configuration 0-6.

FIG. 7 is a reproduction of Table 5.1.1.1-2 from 3GPP TS 36.213 v14.0.0 providing the mapping of TPC Command Field in DCI format 0/3/4/6-0A to absolute and accumulated $\delta_{PUSCH,c}$ values.

FIG. 8 is a reproduction of Table 5.1.1.1-3 from 3GPP TS 36.213 v14.0.0 providing the mapping of TPC Command Field in DCI format 3A to accumulated $\delta_{PUSCH,c}$ values.

FIG. 9 is a reproduction of Table 5.1.2.1-1 from 3GPP TS 36.213 v14.0.0 providing mapping of TPC Command Field in DCI format 1A/1B/1D/1/2A/2B/2C/2D/2/3/6-1A to δ_{PUCCH} values.

FIG. 10 is a reproduction of Table 5.1.2.1-2 from 3GPP TS 36.213 v14.0.0 providing mapping of TPC Command Field in DCI format 3A to δ_{PUCCH} values.

FIG. 11 (A and B) is a reproduction of Table 6.2.2-1 from 3GPP TS 36.101 v14.1.0 providing UE power class.

Samsung Electronics v. Asus Tech Licensing EX-1003, 449 of 673

FIG. 12 is a reproduction of Table 6.2.3-1 from 3GPP TS 36. 101 v14.1.0 providing Maximum Power Reduction (MPR) for Power Class 1 and 3.

FIG. 13 (A and B) is a reproduction of Table 6.2.4-1 from 3GPP TS 36. 101 v14.1.0 providing Additional Maximum Power Reduction (A-MPR).

FIG. 14 is a reproduction of Table 6.2.5-1 from 3GPP TS 36. 101 v14.1.0 providing P_{CMAX} tolerance.

FIG. 15 is a reproduction of Table 6.2.5-1A from 3GPP TS 36. 101 v14.1.0 providing P_{CMAX} tolerance for power class 5.

FIG. 16 is a reproduction of Table 6.2.5A-1 from 3GPP TS 36. 101 v14.1.0 providing P_{CMAX} tolerance for uplink inter-band CA (two bands).

FIG. 17 is a reproduction of Table 6.2.5A-2 from 3GPP TS 36. 101 v14.1.0 providing P_{CMAX} tolerance.

FIG. 18 is a reproduction of Table 6.2.5B-1 from 3GPP TS 36. 101 v14.1.0 providing $P_{CMAX,c}$ tolerance in closed-loop spatial multiplexing scheme.

FIG. 19 is a reproduction of Figure 6.1.3.6-1 from 3GPP TS 36.321 v14.0.0 illustrating a PHR MAC control element.

FIG. 20 is a reproduction of Table 6.1.3.6-1 from 3GPP TS 36.321 v14.0.0 providing Power Headroom levels for PHR.

FIG. 21 is a reproduction of Figure 6.1.3.6a-2 from 3GPP TS 36.321 v14.0.0 illustrating Extended PHR MAC Control Element.

FIG. 22 is a reproduction of Figure 6.1.3.6a1-3 from 3GPP TS 36.321 v14.0.0 illustrating Extended PHR MAC Control Element supporting PUCCH on SCell.

FIG. 23 is a reproduction of Figure 6.1.3.6a2-4 from 3GPP TS 36.321 v14.0.0 illustrating Extended PHR MAC Control Element supporting 32 serving cells with configured uplink.

FIG. 24 is a reproduction of Figure 6.1.3.6a3-5 from 3GPP TS 36.321 v14.0.0 illustrating Extended PHR MAC Control Element supporting 32 serving cells with configured uplink and PUCCH on SCell.

FIG. 25 is a reproduction of Table 6.1.3.6a-1 from 3GPP TS 36.321 v14.0.0 providing Nominal UE transmit power level for Extended PHR and for Dual Connectivity PHR.

FIG. 26 is a flow diagram for one exemplary embodiment from the perspective of a user equipment (UE).

FIG. 27 is a flow diagram for another exemplary embodiment from the perspective of a UE.

FIG. 28 is a flow diagram for another exemplary embodiment from the perspective of a UE.

FIG. 29 is a flow diagram for another exemplary embodiment from the perspective of a UE.

FIG. 30 is a flow diagram for another exemplary embodiment from the perspective of a UE.

DETAILED DESCRIPTION

[0006] The exemplary wireless communication systems and devices described below employ a wireless communication system, supporting a broadcast service. Wireless communication systems are widely deployed to provide various types of communication such as voice, data, and so on. These systems may be based on code division multiple access (CDMA), time division multiple access (TDMA), orthogonal frequency division multiple access (OFDMA), 3GPP LTE (Long Term Evolution) wireless access, 3GPP LTE-A or LTE-Advanced (Long Term Evolution Advanced), 3GPP2 UMB (Ultra Mobile Broadband), WiMax, or some other modulation techniques.

[0007] In particular, the exemplary wireless communication systems devices described below may be designed to support one or more standards such as the standard offered by a consortium named "3rd Generation Partnership Project"

referred to herein as 3GPP, including: R2-162366, "Beam Forming Impacts"; R2-163716, "Discussion on terminology of beamforming based high frequency NR"; R2-162709, "Beam support in NR"; R2-162762, "Active Mode Mobility in NR: SINR drops in higher frequencies"; TS 36.213 v14.0.0, "E-UTRA Physical layer procedures (Release 14)"; TS 36.101 v14.1.0, "E-UTRA User Equipment (UE) radio transmission and reception (Release 14)"; and TS 36.321 v14.0.0, "E-UTRA Medium Access Control (MAC) protocol specification(Release 14)". The standards and documents listed above are hereby expressly incorporated by reference in their entirety.

[0008] FIG. 1 shows a multiple access wireless communication system according to one embodiment of the invention. An access network 100 (AN) includes multiple antenna groups, one including 104 and 106, another including 108 and 110, and an additional including 112 and 114. In FIG. 1, only two antennas are shown for each antenna group, however, more or fewer antennas may be utilized for each antenna group. Access terminal 116 (AT) is in communication with antennas 112 and 114, where antennas 112 and 114 transmit information to access terminal 116 over forward link 120 and receive information from access terminal 116 over reverse link 118. Access terminal (AT) 122 is in communication with antennas 106 and 108, where antennas 106 and 108 transmit information to access terminal (AT) 122 over forward link 126 and receive information from access terminal (AT) 122 over reverse link 124. In a FDD system, communication links 118, 120, 124 and 126 may use different frequency for communication. For example, forward link 120 may use a different frequency then that used by reverse link 118.

[0009] Each group of antennas and/or the area in which they are designed to communicate is often referred to as a sector of the access network. In the embodiment, antenna groups each are designed to communicate to access terminals in a sector of the areas covered by access network 100.

[0010] In communication over forward links 120 and 126, the transmitting antennas of access network 100 may utilize beamforming in order to improve the signal-to-noise ratio of forward links for the different access terminals 116 and 122. Also, an access network using beamforming to transmit to access terminals scattered randomly through its coverage causes less interference to access terminals in neighboring cells than an access network transmitting through a single antenna to all its access terminals.

[0011] An access network (AN) may be a fixed station or base station used for communicating with the terminals and may also be referred to as an access point, a Node B, a base station, an enhanced base station, an evolved Node B (eNB), or some other terminology. An access terminal (AT) may also be called user equipment (UE), a wireless communication device, terminal, access terminal or some other terminology.

[0012] FIG. 2 is a simplified block diagram of an embodiment of a transmitter system 210 (also known as the access network) and a receiver system 250 (also known as access terminal (AT) or user equipment (UE) in a MIMO system 200. At the transmitter system 210, traffic data for a number of data streams is provided from a data source 212 to a transmit (TX) data processor 214.

[0013] Preferably, each data stream is transmitted over a respective transmit antenna. TX data processor 214 formats, codes, and interleaves the traffic data for each data stream based on a particular coding scheme selected for that data stream to provide coded data.

[0014] The coded data for each data stream may be multiplexed with pilot data using OFDM techniques. The pilot data is typically a known data pattern that is processed in a known manner and may be used at the receiver system to estimate the channel response. The multiplexed pilot and coded data for each data stream is then modulated (i.e., symbol mapped) based on a particular modulation scheme (e.g., BPSK, QPSK, M-PSK, or M-QAM) selected for that data stream to provide modulation symbols. The data rate, coding, and modulation for each data stream may be determined by instructions performed by processor 230.

[0015] The modulation symbols for all data streams are then provided to a TX MIMO processor 220, which may further process the modulation symbols (e.g., for OFDM). TX MIMO processor 220 then provides N_T modulation symbol streams to N_T transmitters (TMTR) 222a through 222t. In certain embodiments, TX MIMO processor 220 applies beamforming weights to the symbols of the data streams and to the antenna from which the symbol is being transmitted.

[0016] Each transmitter 222 receives and processes a respective symbol stream to provide one or more analog signals, and further conditions (e.g., amplifies, filters, and upconverts) the analog signals to provide a modulated signal suitable for transmission over the MIMO channel. N_T modulated signals from transmitters 222a through 222t are then transmitted from N_T antennas 224a through 224t, respectively.

[0017] At receiver system 250, the transmitted modulated signals are received by N_R antennas 252a through 252r and the received signal from each antenna 252 is provided to a respective receiver

[0018] (RCVR) 254a through 254r. Each receiver 254 conditions (e.g., filters, amplifies, and downconverts) a respective received signal, digitizes the conditioned signal to provide samples, and further processes the samples to provide a corresponding "received" symbol stream.

[0019] An RX data processor 260 then receives and processes the N_R received symbol streams from N_R receivers 254 based on a particular receiver processing technique to provide N_T "detected" symbol streams. The RX data processor 260 then demodulates, deinterleaves, and decodes each detected symbol stream to recover the traffic data for the data stream. The processing by RX data processor 260 is complementary to that performed by TX MIMO processor 220 and

TX data processor 214 at transmitter system 210.

[0020] A processor 270 periodically determines which pre-coding matrix to use (discussed below). Processor 270 formulates a reverse link message comprising a matrix index portion and a rank value portion.

[0021] The reverse link message may comprise various types of information regarding the communication link and/or the received data stream. The reverse link message is then processed by a TX data processor 238, which also receives traffic data for a number of data streams from a data source 236, modulated by a modulator 280, conditioned by transmitters 254a through 254r, and transmitted back to transmitter system 210.

[0022] At transmitter system 210, the modulated signals from receiver system 250 are received by antennas 224, conditioned by receivers 222, demodulated by a demodulator 240, and processed by a RX data processor 242 to extract the reserve link message transmitted by the receiver system 250. Processor 230 then determines which pre-coding matrix to use for determining the beamforming weights then processes the extracted message.

[0023] Turning to FIG. 3, this figure shows an alternative simplified functional block diagram of a communication device according to one embodiment of the invention. As shown in FIG. 3, the communication device 300 in a wireless communication system can be utilized for realizing the UEs (or ATs) 116 and 122 in FIG. 1 or the base station (or AN) 100 in FIG. 1, and the wireless communications system is preferably the LTE system. The communication device 300 may include an input device 302, an output device 304, a control circuit 306, a central processing unit (CPU) 308, a memory 310, a program code 312, and a transceiver 314. The control circuit 306 executes the program code 312 in the memory 310 through the CPU 308, thereby controlling an operation of the communications device 300. The communications device 300 can receive signals input by a user through the input device 302, such as a keyboard or keypad, and can output images and sounds through the output device 304, such as a monitor or speakers. The transceiver 314 is used to receive and transmit wireless signals, delivering received signals to the control circuit 306, and outputting signals generated by the control circuit 306 wirelessly. The communication device 300 in a wireless communication system can also be utilized for realizing the AN 100 in FIG. 1.

[0024] FIG. 4 is a simplified block diagram of the program code 312 shown in FIG. 3 in accordance with one embodiment of the invention. In this embodiment, the program code 312 includes an application layer 400, a Layer 3 portion 402, and a Layer 2 portion 404, and is coupled to a Layer 1 portion 406. The Layer 3 portion 402 generally performs radio resource control. The Layer 2 portion 404 generally performs link control. The Layer 1 portion 406 generally performs physical connections.

[0025] As described in 3GPP R2-162366, in lower frequency bands (e.g., current LTE bands < 6GHz), the required cell coverage may be provided by forming a wide sector beam for transmitting downlink common channels. However, utilizing wide sector beam on higher frequencies (>> 6GHz) the cell coverage is reduced with same antenna gain. Thus, in order to provide required cell coverage on higher frequency bands, higher antenna gain is needed to compensate for the increased path loss. To increase the antenna gain over a wide sector beam, larger antenna arrays (number of antenna elements ranging from tens to hundreds) are used to form high gain beams.

[0026] As a consequence, the high gain beams are narrow compared to a wide sector beam so multiple beams for transmitting downlink common channels are needed to cover the required cell area. The number of concurrent high gain beams that an access point is able to form may be limited by the cost and complexity of the utilized transceiver architecture. In practice, on higher frequencies, the number of concurrent high gain beams is much less than the total number of beams required to cover the cell area. In other words, the access point is able to cover only part of the cell area by using a subset of beams at any given time.

[0027] As described in 3GPP R2-163716, beamforming is a signal processing technique used in antenna arrays for directional signal transmission/reception. With beamforming, a beam can be formed by combining elements in a phased array of antennas in such a way that certain signals at particular angles experience constructive interference while other signals experience destructive interference. Different beams can be utilized simultaneously using multiple arrays of antennas.

[0028] Beamforming can be categorized into three types of implementations: digital beamforming, hybrid beamforming, and analog beamforming as shown in FIGS. 5A-5D. For digital beamforming, the beam is generated on the digital domain, i.e. the weighting of each antenna element can be controlled by a baseband (e.g., connected to a transceiver unit (TXRU)). Therefore, it is very easy to tune the beam direction of each sub-band differently across the system bandwidth. Also, changing beam direction from time to time does not require any switching time between orthogonal frequency division multiplexing (OFDM) symbols. All beams whose directions cover the whole coverage can be generated simultaneously. However, this structure requires (almost) one-to-one mapping between TXRU (transceiver/RF chain) and antenna element and is quite complicated as the number of antenna element increases and system bandwidth increases (also heat problem exists). For analog beamforming, the beam is generated on the analog domain. That is, the weighting of each antenna element can be controlled by an amplitude/phase shifter in the radio frequency (RF) circuit. Since the weighting is purely controlled by the circuit, the same beam direction would apply on the whole system bandwidth. Also, if beam direction is to be changed, switching time is required. The number of beams generated simultaneous by an analog beamforming depends on the number of TXRU. For a given size of an array, the increase of TXRU

may decrease the antenna element of each beam so that a wider beam would be generated. In sum, analog beamforming could avoid the complexity and heat problem of digital beamforming even though analog beamforming is more restricted in operation. Hybrid beamforming can be considered as a compromise between analog and digital beamforming as the beam can come from both analog and digital domain.

[0029] In 3GPP R2-162709, an evolved Node B (eNB) may have multiple transmission/reception points (TRPs) that are either centralized or distributed. Each TRP can form multiple beams. The number of beams and the number of simultaneous beams in the time/frequency domain depend on the number of antenna array elements and the RF at the TRP.

[0030] The potential mobility type for a New Radio (NR) can be listed as follows: intra-TRP mobility; inter-TRP mobility; and inter-NR eNB mobility.

[0031] In 3GPP R2-162762, the reliability of a system purely relying on beamforming and operating in higher frequencies might be challenging because coverage may be more sensitive to both time and space variations. As a consequence, the Signal to Interference Plus Noise Ratio (SINR) of a narrow link can drop much quicker than in the case of Long Term Evolution (LTE).

[0032] Using antenna arrays at access nodes with the number of elements in the hundreds, a fairly regular grid-of-beams coverage pattern with tens or hundreds of candidate beams per node may be created. The coverage area of an individual beam from such array may be small, down to the order of tens of meters in width. As a consequence, channel quality degradation outside the current serving beam area is quicker than in the case of wide area coverage, as provided by LTE.

[0033] With the support of beam operation and TRP, a cell may have multiple choices to schedule a UE. For example, there may be multiple beams from a TRP transmitting the same data to the UE, which can provide more reliability for the transmission. Alternatively, multiple beams from multiple TRPs may transmit the same data to the UE. To increase the throughput, it is also possible for a single TRP to transmit different data on different beams for the UE. Also, multiple TRPs can transmit different data on different beams to the UE.

[0034] To maintain the balance between the UL transmission performance, UE power consumption, and interference mitigation, UE transmission power needs to be properly controlled. The power may be controlled by some open loop parameter, e.g., the required received power or the pathloss between the UE and the base station. The power may also be controlled based on some close loop parameter, e.g., the power control command sent from the base station to the UE. Additional details are disclosed in 3GPP TS 36.213 v14.0.0 as quoted below:

5 Power control

[0035] Downlink power control determines the Energy Per Resource Element (EPRE). The term resource element energy denotes the energy prior to CP insertion. The term resource element energy also denotes the average energy taken over all constellation points for the modulation scheme applied. Uplink power control determines the average power over a SC-FDMA symbol in which the physical channel is transmitted.

5.1 Uplink power control

[0036] Uplink power control controls the transmit power of the different uplink physical channels.

[0037] If a UE is configured with a LAA SCell for uplink transmissions, the UE shall apply the procedures described for PUSCH and SRS in this clause assuming frame structure type 1 for the LAA SCell unless stated otherwise.

[0038] For PUSCH, the transmit power $\hat{P}_{PUCCH,c}(i)$ defined in subclause 5.1.1, is first scaled by the ratio of the number of antennas ports with a non-zero PUSCH transmission to the number of configured antenna ports for the transmission scheme. The resulting scaled power is then split equally across the antenna ports on which the non-zero PUSCH is transmitted.

[0039] For PUCCH or SRS, the transmit power $\hat{P}_{PUCCH}(i)$, defined in subclause 5.1.1.1, or $\hat{P}_{SRS,c}(i)$ is split equally across the configured antenna ports for PUCCH or SRS. $\hat{P}_{SRS,c}(i)$ is the linear value of $P_{SRS,c}(i)$ defined in subclause 5.1.3.

[0040] A cell wide overload indicator (OI) and a High Interference Indicator (HII) to control UL interference are defined in [9].

[0041] For a serving cell with frame structure type 1, a UE is not expected to be configured with *UplinkPowerControlDedicated-v12x0.*

5.1.1 Physical uplink shared channel

[0042] If the UE is configured with a SCG, the UE shall apply the procedures described in this clause for both MCG and SCG

Samsung Electronics v. Asus Tech Licensing EX-1003, 453 of 673

- When the procedures are applied for MCG, the terms 'secondary cell', 'secondary cells' , 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell, serving cells belonging to the MCG respectively.

- When the procedures are applied for SCG, the terms 'secondary cell', 'secondary cells', 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells (not including PSCell), serving cell, serving cells belonging to the SCG respectively. The term 'primary cell' in this clause refers to the PSCell of the SCG.

[0043] If the UE is configured with a PUCCH-SCell, the UE shall apply the procedures described in this clause for both primary PUCCH group and secondary PUCCH group

- When the procedures are applied for primary PUCCH group, the terms 'secondary cell', 'secondary cells' , 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell, serving cells belonging to the primary PUCCH group respectively.

- When the procedures are applied for secondary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell, serving cells belonging to the secondary PUCCH group respectively.

5.1.1.1 UE behaviour

[0044] The setting of the UE Transmit power for a Physical Uplink Shared Channel (PUSCH) transmission is defined as follows.

[0045] If the UE transmits PUSCH without a simultaneous PUCCH for the serving cell *c*, then the UE transmit power $P_{PUSCH,c}(i)$ for PUSCH transmission in sub frame *i* for the serving cell *c* is given by

$$P_{\mathrm{PUSCH,c}}(i) = \min\begin{Bmatrix} P_{\mathrm{CMAX},c}(i), \\ 10\log_{10}(M_{\mathrm{PUSCH,c}}(i)) + P_{\mathrm{O\_PUSCH,c}}(j) + \alpha_c(j)\cdot PL_c + \Delta_{\mathrm{TF,c}}(i) + f_c(i) \end{Bmatrix} \text{ [dBm]}$$

[0046] If the UE transmits PUSCH simultaneous with PUCCH for the serving cell *c*, then the UE transmit power $P_{PUSCH,c}(i)$ for the PUSCH transmission in subframe *i* for the serving cell *c* is given by

$$P_{\mathrm{PUSCH,c}}(i) = \min\begin{Bmatrix} 10\log_{10}\left(\hat{P}_{\mathrm{CMAX},c}(i) - \hat{P}_{\mathrm{PUCCH}}(i)\right), \\ 10\log_{10}(M_{\mathrm{PUSCH,c}}(i)) + P_{\mathrm{O\_PUSCH,c}}(j) + \alpha_c(j)\cdot PL_c + \Delta_{\mathrm{TF,c}}(i) + f_c(i) \end{Bmatrix} \text{ [dBm]}$$

[0047] If the UE is not transmitting PUSCH for the serving cell c, for the accumulation of TPC command received with DCI format 3/3A for PUSCH, the UE shall assume that the UE transmit power $P_{PUSCH,c}(i)$ for the PUSCH transmission in subframe *i* for the serving cell *c* is computed by

$$P_{\mathrm{PUSCH,c}}(i) = \min\left\{P_{\mathrm{CMAX,c}}(i),\ P_{\mathrm{O\_PUSCH,c}}(1) + \alpha_c(1)\cdot PL_c + f_c(i)\right\} \quad \text{[dBm]}$$

where,

- $P_{CMAX,c}(i)$ is the configured UE transmit power defined in [6] in subframe i for serving cell c and $\hat{P}_{CMAX,c}(i)$ is the linear value of $P_{CMAX,c}(i)$. If the UE transmits PUCCH without PUSCH in subframe *i* for the serving cell c, for the accumulation of TPC command received with DCI format 3/3A for PUSCH, the UE shall assume $P_{CMAX,c}(i)$ as given by subclause 5.1.2.1. If the UE does not transmit PUCCH and PUSCH in subframe *i* for the serving cell c, for the accumulation of TPC command received with DCI format 3/3A for PUSCH, the UE shall compute $P_{CMAX,c}(i)$ assuming MPR=0dB, A-MPR=OdB, P-MPR=0dB and ΔT_C =0dB, where MPR, A-MPR, P-MPR and ΔT_C are defined in [6].

- $\hat{P}_{PUCCH}(i)$ is the linear value of $P_{PUCCH}(i)$ defined in subclause 5.1.2.1

- $M_{PUSCH,c}(i)$ is the bandwidth of the PUSCH resource assignment expressed in number of resource blocks valid for subframe *i* and serving cell *c* .

- If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell c and if subframe *i* belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-Subframe-Set-r12,*

  - whenj=0, $P_{O\_PUSCH,c}(0) = P_{O\_UE\_PUSCH,c,2}(0) + P_{O\_NOMINAL\_PUSCH,c,2}(0)$, where j=0 is used for PUSCH (re)transmissions corresponding to a semi-persistent grant. $P_{O\_UE\_PUSCH,c,2}(0)$ and $P_{O\_NOMINAL\_PUSCH,c,2}(0)$ are the parameters *p0-UE-PUSCH-Persistent-SubframeSet2-r12 and p0-NominalPUSCH-Persistent -SubframeSet2-r12* respectively provided by higher layers, for each serving cell *c.*

  - when j=1,$P_{O\_PUSCH,c}(1) = P_{O\_UE\_PUSCH,c,2}(1) + P_{O\_NOMINAL\_PUSCH,c,2}(1)$, where j=1 is used for PUSCH (re)transmissions corresponding to a dynamic scheduled grant. $P_{O\_UE\_PUSCH,c,2}(1)$ and $P_{O\_NOMINAL\_PUSCH,c,2}(1)$ are the parameters *p0-UE-PUSCH-SubframeSet2-r12 and p0-NominalPUSCH-SubframeSet2-r12* respectively, provided by higher layers for serving cell *c.*

  - when j=2, $P_{O\_PUSCH,c}(2) = P_{O\_UE\_PUSCH,c}(2) + P_{O\_NOMINAL\_PUSCH,c}(2)$ where $P_{O\_UE\_PUSCH,c}(2) = 0$ and $P_{O\_NOMINAL\_PUSCH,c}(2) = P_{O\_PRE} + \Delta_{PREAMBLE\_Msg3}$, where the parameter *preambleInitialReceivedTargetPower* [8] (P_{O_PRE}) and $\Delta_{PREAMBLE\_Msg3}$ are signalled from higher layers for serving cell *c,* where j=2 is used for PUSCH (re)transmissions corresponding to the random access response grant.

Otherwise

- $P_{O\_PUSCH,c}(j)$ is a parameter composed of the sum of a component $P_{O\_NOMINAL\_PUSCH,c}(j)$ provided from higher layers for *j=0* and *1* and a component $P_{O\_UE\_PUSCH,c}(j)$ provided by higher layers for *j=0* and *1* for serving cell *c.* For PUSCH (re)transmissions corresponding to a semi-persistent grant then *j=0* , for PUSCH (re)transmissions corresponding to a dynamic scheduled grant then *j=1* and for PUSCH (re)transmissions corresponding to the random access response grant then *j=2.* $P_{O\_UE\_PUSCH,c}(2) = 0$ and $P_{O\_NOMINAL\_PUSCH,c}(2) = P_{O\_PRE} + \Delta_{PREAMBLE\_Msg3}$, where the parameter *preambleInitialReceivedTargetPower* [8] (P_{O_PRE}) and $\Delta_{PREAMBLE\_Msg3}$ are signalled from higher layers for serving cell *c.*

- If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell *c* and if subframe *i* belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-Subframe-Set-r12,*

  - For *j=0* or 1, $\alpha_c(j) = \alpha_{c,2} \in \{0, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1\}$. $\alpha_{c,2}$ is the parameter *alpha-SubframeSet2-r12* provided by higher layers for each serving cell *c.*

  - For *j*=2, $\alpha_c(j) = 1$.

  Otherwise

  - For *j=0* or *1*, $\alpha_c \in \{0, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1\}$ is a 3-bit parameter provided by higher layers for serving cell *c.* For *j*=2, $\alpha_c(j)$=1.

- PL_c is the downlink path loss estimate calculated in the UE for serving cell c in dB and PL_c = *referenceSignalPower* - higher layer filtered RSRP, where *referenceSignalPower* is provided by higher layers and RSRP is defined in [5] for the reference serving cell and the higher layer filter configuration is defined in [11] for the reference serving cell.

  - If serving cell c belongs to a TAG containing the primary cell then, for the uplink of the primary cell, the primary cell is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP. For the uplink of the secondary cell, the serving cell configured by the higher layer parameter *pathlossReferenceLinking* defined in [11] is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP.

  - If serving cell c belongs to a TAG containing the PSCell then, for the uplink of the PSCell, the PSCell is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP; for the uplink of the secondary cell other than PSCell, the serving cell configured by the higher layer parameter *pathlossReferenceLinking* defined in [11] is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP.

- If serving cell *c* belongs to a TAG not containing the primary cell or PSCell then serving cell *c* is used as the reference serving cell for determining *referenceSignalPower* and higher layer filtered RSRP.

- $\Delta_{TF,c}(i) = 10\log_{10}\left(\left(2^{BPRE \cdot K_s} - 1\right) \cdot \beta_{offset}^{PUSCH}\right)$ for K_S = 1.25 and 0 for K_S = 0 where K_S is given by the parameter *deltaMCS-Enabled* provided by higher layers for each serving cell *c*. *BPRE* and β_{offset}^{PUSCH}, for each serving cell *c*, are computed as below. K_S = 0 for transmission mode 2.

- *BPRE* = O_{CQI}/N_{RE} for control data sent via PUSCH without UL-SCH data and $\sum_{r=0}^{C-1} K_r / N_{RE}$ for other cases.

- where *C* is the number of code blocks, K_r is the size for code block *r*, O_{CQI} is the number of CQI/PMI bits including CRC bits and N_{RE} is the number of resource elements determined as $N_{RE} = M_{sc}^{PUSCH-initial} \cdot N_{symb}^{PUSCH\text{-}initial}$, where *C*, K_r, $M_{sc}^{PUSCH\ initial}$ and $N_{symb}^{PUSCH\text{-}initial}$ are defined in [4].

- $\beta_{offset}^{PUSCH} = \beta_{offset}^{CQI}$ for control data sent via PUSCH without UL-SCH data and 1 for other cases.

- $\delta_{PUSCH,c}$ is a correction value, also referred to as a TPC command and is included in PDCCH/EPDCCH with DCI format 0/4 or in MPDCCH with DCI format 6-0A for serving cell c or jointly coded with other TPC commands in PDCCH/MPDCCH with DCI format 3/3A whose CRC parity bits are scrambled with TPC-PUSCH-RNTI. If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell *c* and if subframe *i* belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-SubframeSet-r12*, the current PUSCH power control adjustment state for serving cell *c* is given by $f_{c,2}(i)$, and the UE shall use $f_{c,2}(i)$ instead of $f_c(i)$ to determine $P_{PUSCH,c}(i)$. Otherwise, the current PUSCH power control adjustment state for serving cell *c* is given by $f_c(i)$. $f_{c,2}(i)$ and $f_c(i)$ are defined by:

- $f_c(i) = f_c(i\text{-}1) + \delta_{PUSCH,c}(i\text{-}K_{PUSCH})$ and $f_{c,2}(i) = f_{c,2}(i\text{-}1) + \delta_{PUSCH,c}(i\text{-}K_{PUSCH})$ if accumulation is enabled based on the parameter *Accumulation-enabled* provided by higher layers or if the TPC command $\delta_{PUSCH,c}$ is included in a PDCCH/EPDCCH with DCI format 0 or in a MPDCCH with DCI format 6-0A for serving cell *c* where the CRC is scrambled by the Temporary C-RNTI

  - where $\delta_{PUSCH,c}(i\text{-}K_{PUSCH})$ was signalled on PDCCH/EPDCCH with DCI format 0/4 or MPDCCH with DCI format 6-0A or PDCCH/MPDCCH with DCI format 3/3A on subframe $i - K_{PUSCH}$, and where $f_c(0)$ is the first value after reset of accumulation. For a BL/CE UE configured with CEModeA, subframe $i - K_{PUSCH}$ is the last subframe in which the MPDCCH with DCI format 6-0A or MPDCCH with DCI format 3/3A is transmitted.

  - The value of K_{PUSCH} is

    - For FDD or FDD-TDD and serving cell frame structure type 1, K_{PUSCH} = 4

    - For TDD, if the UE is configured with more than one serving cell and the TDD UL/DL configuration of at least two configured serving cells is not the same, or if the UE is configured with the parameter *EIMTA-Main ConfigServCell-r12* for at least one serving cell, or for FDD-TDD and serving cell frame structure type 2, the "TDD UL/DL configuration" refers to the UL-reference UL/DL configuration (defined in subclause 8.0) for serving cell *c*.

    - For TDD UL/DL configurations 1-6, K_{PUSCH} is given in Table 5.1.1.1-1

    - For TDD UL/DL configuration 0

      - If the PUSCH transmission in subframe 2 or 7 is scheduled with a PDCCH/EPDCCH of DCI format 0/4 or a MPDCCH of DCI format 6-0A in which the LSB of the UL index is set to 1, K_{PUSCH} = 7

- For all other PUSCH transmissions, K_{PUSCH} is given in Table 5.1.1.1-1.

- For serving cell *c* and a non-BL/CE UE, the UE attempts to decode a PDCCH/EPDCCH of DCI format 0/4 with the UE's C-RNTI or DCI format 0 for SPS C-RNTI and a PDCCH of DCI format 3/3A with this UE's TPC-PUSCH-RNTI in every subframe except when in DRX or where serving cell *c* is deactivated.

- For serving cell *c* and a BL/CE UE configured with CEModeA, the UE attempts to decode a MPDCCH of DCI format 6-0A with the UE's C-RNTI or SPS C-RNTI and a MPDCCH of DCI format 3/3A with this UE's TPC-PUSCH-RNTI in every BL/CE downlink subframe except when in DRX

- For a non-BL/CE UE, if DCI format 0/4 for serving cell c and DCI format 3/3A are both detected in the same subframe, then the UE shall use the $\delta_{PUSCH,c}$ provided in DCI format 0/4.

- For a BL/CE UE configured with CEModeA, if DCI format 6-0A for serving cell *c* and DCI format 3/3A are both detected in the same subframe, then the UE shall use the $\delta_{PUSCH,c}$ provided in DCI format 6-0A.

- $\delta_{PUSCH,c}$ = 0 dB for a subframe where no TPC command is decoded for serving cell *c* or where DRX occurs or *i* is not an uplink subframe in TDD or FDD-TDD and serving cell c frame structure type 2.

- The $\delta_{PUSCH,c}$ dB accumulated values signalled on PDCCH/EPDCCH with DCI format 0/4 or MPDCCH with DCI format 6-0A are given in Table 5.1.1.1-2. If the PDCCH/EPDCCH with DCI format 0 or MPDCCH with DCI format 6-0A is validated as a SPS activation or release PDCCH/EPDCCH/MPDCCH, then $\delta_{PUSCH,c}$ is 0dB.

- The δ_{PUSCH} dB accumulated values signalled on PDCCH/MPDCCH with DCI format 3/3A are one of SET1 given in Table 5.1.1.1-2 or SET2 given in Table 5.1.1.1-3 as determined by the parameter *TPC-Index* provided by higher layers.

- If UE has reached $P_{CMAX,c}(i)$ for serving cell c, positive TPC commands for serving cell c shall not be accumulated

- If UE has reached minimum power, negative TPC commands shall not be accumulated

- If the UE is not configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell *c*, the UE shall reset accumulation

  - For serving cell *c*, when $P_{O\_UE\_PUSCH,c}$ value is changed by higher layers

  - For serving cell *c*, when the UE receives random access response message for serving cell *c*

- If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell *c*,

  - the UE shall reset accumulation corresponding to $f_c(*)$ for serving cell *c*

    - when $P_{O\_UE\_PUSCH,c}$ value is changed by higher layers

    - when the UE receives random access response message for serving cell *c*

  - the UE shall reset accumulation corresponding to $f_{c,2}(*)$ for serving cell *c*
  - when $P_{O\_UE\_PUSCH,c,2}$ value is changed by higher layers

- If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell *c* and

  - if sub frame *i* belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-SubframeSet-r12* $f_c(i) = f_c(i\text{-}1)$

  - if subframe *i* does not belong to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-SubframeSet-r12* $f_{c,2}(i) = f_{c,2}(i\text{-}1)$

- $f_c(i) = \delta_{PUSCH,c}(i- K_{PUSCH})$ and $f_{c,2}(i) = \delta_{PUSCH,c}(i-K_{PUSCH})$ if accumulation is not enabled for serving cell c based on the parameter *Accumulation-enabled* provided by higher layers

  - where $\delta_{PUSCH,c}(i-K_{PUSCH})$ was signalled on PDCCH/EPDCCH with DCI format 0/4 or MPDCCH with DCI format 6-0A for serving cell c on subframe $i - K_{PUSCH}$. For a BL/CE UE configured with CEModeA, subframe $i-K_{PUSCH}$ is the last subframe in which the MPDCCH with DCI format 6-0A or MPDCCH with DCI format 3/3A is transmitted.

  - The value of K_{PUSCH} is

    - For FDD or FDD-TDD and serving cell frame structure type 1, $K_{PUSCH} = 4$

    - For TDD, if the UE is configured with more than one serving cell and the TDD UL/DL configuration of at least two configured serving cells is not the same, or if the UE is configured with the parameter *EIMTA-MainConfigServCell-r12* for at least one serving cell, or FDD-TDD and serving cell frame structure type 2, the "TDD UL/DL configuration" refers to the UL-reference UL/DL configuration (defined in subclause 8.0) for serving cell c.

    - For TDD UL/DL configurations 1-6, K_{PUSCH} is given in Table 5.1.1.1-1.

    - For TDD UL/DL configuration 0

      - If the PUSCH transmission in subframe 2 or 7 is scheduled with a PDCCH/EPDCCH of DCI format 0/4 or a MPDCCH with DCI format 6-0A in which the LSB of the UL index is set to 1, $K_{PUSCH} = 7$

      - For all other PUSCH transmissions, K_{PUSCH} is given in Table 5.1.1.1-1.

  - The $\delta_{PUSCH,c}$ dB absolute values signalled on PDCCH/EPDCCH with DCI format 0/4 or a MPDCCH with DCI format 6-0A are given in Table 5.1.1.1-2. If the PDCCH/EPDCCH with DCI format 0 or a MPDCCH with DCI format 6-0A is validated as a SPS activation or release PDCCH/EPDCCH/MPDCCH, then $\delta_{PUSCH,c}$ is 0dB.

  - for a non-BL/CE UE, $f_c(i) = f_c(i\text{-}1)$ and $f_{c,2}(i) = f_{c,2}(i\text{-}1)$ for a subframe where no PDCCH/EPDCCH with DCI format 0/4 is decoded for serving cell c or where DRX occurs or i is not an uplink subframe in TDD or FDD-TDD and serving cell c frame structure type 2.

  - for a BL/CE UE configured with CEModeA, $f_c(i) = f_c(i\text{-}1)$ and $f_{c,2}(i) = f_{c,2}(i\text{-}1)$ for a subframe where no MPDCCH with DCI format 6-0A is decoded for serving cell c or where DRX occurs or i is not an uplink subframe in TDD.

  - If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell c and

    - if sub frame i belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-SubframeSet-r12* $f_c(i) = f_c(i\text{-}1)$
    - if subframe i does not belong to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-SubframeSet-r12* $f_{c,2}(i) = f_{c,2}(i\text{-}1)$

- For both types of $f_c(*)$ (accumulation or current absolute) the first value is set as follows:

  - If $P_{O\_UE\_PUSCH,c}$ value is changed by higher layers and serving cell c is the primary cell or, if $P_{O\_UE\_PUSCH,c}$ value is received by higher layers and serving cell c is a Secondary cell

    - $f_c(0) = 0$

  - Else

    - If the UE receives the random access response message for a serving cell c

Samsung Electronics v. Asus Tech Licensing EX-1003, 458 of 673

- $f_c(0) = \Delta P_{rampup,c} + \delta_{msg2,c}$ where
  - $\delta_{msg2,c}$ is the TPC command indicated in the random access response corresponding to the random access preamble transmitted in the serving cell *c*, see subclause 6.2, and

$$\Delta P_{rampup,c} = \min\left[\left\{\max\left(0, P_{CMAX,c} - \begin{pmatrix} 10\log_{10}(M_{PUSCH,c}(0)) \\ + P_{O\_PUSCH,c}(2) + \delta_{msg2} \\ + \alpha_c(2)\cdot PL + \Delta_{TF,c}(0) \end{pmatrix}\right)\right\}, \Delta P_{rampuprequested,c}\right] \text{ and } \Delta P_{rampuprequested,c}$$

is provided by higher layers and
corresponds to the total power ramp-up requested by higher layers from the first to the last preamble in the serving cell *c*, $M_{PUSCH,c}(0)$ is the bandwidth of the PUSCH resource assignment expressed in number of resource blocks valid for the subframe of first PUSCH transmission in the serving cell *c*, and $\Delta_{TF,c}(0)$ is the power adjustment of first PUSCH transmission in the serving cell *c*.

- If $P_{O\_UE\_PUSCH,c,2}$ value is received by higher layers for a serving cell c.
  - $f_{c,2}(0) = 0$

[0048] FIG. 6 (a reproduction of Table 5.1.1.1-1 from 3GPP TS 36.213 v14.0.0)
[0049] FIG. 7 (a reproduction of Table 5.1.1.1-2 from 3GPP TS 36.213 v14.0.0)
[0050] FIG. 8 (a reproduction of Table 5.1.1.1-3 from 3GPP TS 36.213 v14.0.0)
[0051] If the UE is not configured with an SCG or a PUCCH-SCell, and if the total transmit power of the UE would exceed $\hat{P}_{CMAX}(i)$, the UE scales $\hat{P}_{PUSCH,c}(i)$ for the serving cell *c* in subframe *i* such that the condition

$$\sum_c w(i)\cdot \hat{P}_{\mathrm{PUSCH},c}(i) \le \left(\hat{P}_{\mathrm{CMAX}}(i) - \hat{P}_{\mathrm{PUCCH}}(i)\right)$$

is satisfied where $\hat{P}_{PUCCH}(i)$ is the linear value of $P_{PUCCH}(i)$, $\hat{P}_{PUSCH,c}(i)$ is the linear value of $P_{PUSCH,c}(i)$, $\hat{P}_{CMAX}(i)$ is the linear value of the UE total configured maximum output power P_{CMAX} defined in [6] in subframe *i* and $w(i)$ is a scaling factor of $\hat{P}_{PUSCH,c}(i)$ for serving cell c where $0 \le w(i) \le 1$. In case there is no PUCCH transmission in subframe *i* $\hat{P}_{PUCCH}(i) = 0$.
[0052] If the UE is not configured with an SCG or a PUCCH-Scell, and if the UE has PUSCH transmission with UCI on serving cell *j* and PUSCH without UCI in any of the remaining serving cells, and the total transmit power of the UE would exceed $\hat{P}_{CMAX}(i)$, the UE scales $\hat{P}_{PUSCH,c}(i)$ for the serving cells without UCI in subframe i such that the condition

$$\sum_{c\neq j} w(i)\cdot \hat{P}_{\mathrm{PUSCH},c}(i) \le \left(\hat{P}_{\mathrm{CMAX}}(i) - \hat{P}_{\mathrm{PUSCH},j}(i)\right)$$

is satisfied where $\hat{P}_{PUSCH,j}(i)$ is the PUSCH transmit power for the cell with UCI and $w(i)$ is a scaling factor of $\hat{P}_{PUSCH,c}(i)$ for serving cell *c* without UCI. In this case, no power scaling is applied to $\hat{P}_{PUSCH,j}(i)$ unless $\sum_{c\neq j} w(i)\cdot \hat{P}_{\mathrm{PUSCH},c}(i) = 0$ and the total transmit power of the UE still would exceed $\hat{P}_{CMAX}(i)$.
[0053] For a UE not configured with a SCG or a PUCCH-SCell, note that $w(i)$ values are the same across serving cells

Samsung Electronics v. Asus Tech Licensing EX-1003, 459 of 673

when $w(i) > 0$ but for certain serving cells $w(i)$ may be zero.

[0054] If the UE is not configured with an SCG or a PUCCH-SCell, and if the UE has simultaneous PUCCH and PUSCH transmission with UCI on serving cell j and PUSCH transmission without UCI in any of the remaining serving cells, and the total transmit power of the UE would exceed $\hat{P}_{CMAX}(i)$, the UE obtains $\hat{P}_{PUSCH,c}(i)$ according to

$$\hat{P}_{\mathrm{PUSCH},j}(i) = \min\left(\hat{P}_{\mathrm{PUSCH},j}(i), \left(\hat{P}_{\mathrm{CMAX}}(i) - \hat{P}_{\mathrm{PUCCH}}(i)\right)\right)$$

and

$$\sum_{c \neq j} w(i) \cdot \hat{P}_{\mathrm{PUSCH},c}(i) \leq \left(\hat{P}_{\mathrm{CMAX}}(i) - \hat{P}_{\mathrm{PUCCH}}(i) - \hat{P}_{\mathrm{PUSCH},j}(i)\right)$$

[0055] If the UE is not configured with a SCG or a PUCCH-SCell, and

- If the UE is configured with multiple TAGs, and if the PUCCH/PUSCH transmission of the UE on subframe i for a given serving cell in a TAG overlaps some portion of the first symbol of the PUSCH transmission on subframe i + 1 for a different serving cell in another TAG the UE shall adjust its total transmission power to not exceed P_{CMAX} on any overlapped portion.

- If the UE is configured with multiple TAGs, and if the PUSCH transmission of the UE on subframe i for a given serving cell in a TAG overlaps some portion of the first symbol of the PUCCH transmission on subframe i + 1 for a different serving cell in another TAG the UE shall adjust its total transmission power to not exceed P_{CMAX} on any overlapped portion.

- If the UE is configured with multiple TAGs, and if the SRS transmission of the UE in a symbol on subframe i for a given serving cell in a TAG overlaps with the PUCCH/PUSCH transmission on subframe i or subframe i + 1 for a different serving cell in the same or another TAG the UE shall drop SRS if its total transmission power exceeds P_{CMAX} on any overlapped portion of the symbol.

- If the UE is configured with multiple TAGs and more than 2 serving cells, and if the SRS transmission of the UE in a symbol on subframe i for a given serving cell overlaps with the SRS transmission on subframe i for a different serving cell(s) and with PUSCH/PUCCH transmission on subframe i or subframe i + 1 for another serving cell(s) the UE shall drop the SRS transmissions if the total transmission power exceeds P_{CMAX} on any overlapped portion of the symbol.

- If the UE is configured with multiple TAGs, the UE shall, when requested by higher layers, to transmit PRACH in a secondary serving cell in parallel with SRS transmission in a symbol on a subframe of a different serving cell belonging to a different TAG, drop SRS if the total transmission power exceeds P_{CMAX} on any overlapped portion in the symbol.

- If the UE is configured with multiple TAGs, the UE shall, when requested by higher layers, to transmit PRACH in a secondary serving cell in parallel with PUSCH/PUCCH in a different serving cell belonging to a different TAG, adjust the transmission power of PUSCH/PUCCH so that its total transmission power does not exceed P_{CMAX} on the overlapped portion.

[0056] If the UE is configured with a LAA SCell for uplink transmissions, the UE may compute the scaling factor $w(i)$ assuming that the UE performs a PUSCH transmission on the LAA SCell in subframe i irrespective of whether the UE can access the LAA SCell for the PUSCH transmission in subframe i according to the channel access procedures described in subclause 15.2.1.

[0057] For a BL/CE UE configured with CEModeA, if the PUSCH is transmitted in more than one subframe $i_0, i_1, \ldots, i_{N-1}$ where $i_0 < i_1 < \ldots < i_{N-1}$, the PUSCH transmit power in subframe i_k, k=0, 1, ..., N-1, is determined by

$$P_{\mathrm{PUSCH},c}(i_k) = P_{\mathrm{PUSCH},c}(i_0)$$

Samsung Electronics v. Asus Tech Licensing EX-1003, 460 of 673

[0058] For a BL/CE UE configured with CEModeB, the PUSCH transmit power in subframe i_k is determined by

$$P_{\mathrm{PUSCH},c}(i_k) = P_{\mathrm{CMAX},c}(i_0)$$

[0059] <...>

5.1.2 Physical uplink control channel

[0060] If the UE is configured with a SCG, the UE shall apply the procedures described in this subclause for both MCG and SCG.

- When the procedures are applied for MCG, the term 'serving cell' in this subclause refers to serving cell belonging to the MCG.

[0061] When the procedures are applied for SCG, the term 'serving cell' in this subclause refers to serving cell belonging to the SCG. The term 'primary cell' in this subclause refers to the PSCell of the SCG. If the UE is configured with a PUCCH-SCell, the UE shall apply the procedures described in this subclause for both primary PUCCH group and secondary PUCCH group.

- When the procedures are applied for the primary PUCCH group, the term 'serving cell' in this subclause refers to serving cell belonging to the primary PUCCH group.

- When the procedures are applied for the secondary PUCCH group, the term 'serving cell' in this subclause refers to serving cell belonging to the secondary PUCCH group. The term 'primary cell' in this subclause refers to the PUCCH-SCell of the secondary PUCCH group.

5.1.2.1 UE behaviour

[0062] If serving cell *c* is the primary cell, for PUCCH format 1/1 a/1b/2/2a/2b/3, the setting of the UE Transmit power P_{PUCCH} for the physical uplink control channel (PUCCH) transmission in subframe *i* for serving cell *c* is defined by

$$P_{\mathrm{PUCCH}}(i) = \min\left\{\begin{array}{l} P_{\mathrm{CMAX,c}}(i), \\ P_{0\_\mathrm{PUCCH}} + PL_c + h\left(n_{CQI}, n_{HARQ}, n_{SR}\right) + \Delta_{\mathrm{F\_PUCCH}}(F) + \Delta_{TxD}(F') + g(i) \end{array}\right\} \text{ [dBm]}$$

[0063] If serving cell *c* is the primary cell, for PUCCH format 4/5, the setting of the UE Transmit power P_{PUCCH} for the physical uplink control channel (PUCCH) transmission in subframe *i* for serving cell *c* is defined by

$$P_{\mathrm{PUCCH}}(i) = \min\left\{\begin{array}{l} P_{\mathrm{CMAX,c}}(i), \\ P_{0\_\mathrm{PUCCH}} + PL_c + 10\log_{10}\left(M_{\mathrm{PUCCH,c}}(i)\right) + \Delta_{\mathrm{TF,c}}(i) + \Delta_{\mathrm{F\_PUCCH}}(F) + g(i) \end{array}\right\} \text{ [dBm]}$$

[0064] If the UE is not transmitting PUCCH for the primary cell, for the accumulation of TPC command for PUCCH, the UE shall assume that the UE transmit power P_{PUCCH} for PUCCH in subframe *i* is computed by

$$P_{\mathrm{PUCCH}}(i) = \min\left\{P_{\mathrm{CMAX,c}}(i), P_{0\_\mathrm{PUCCH}} + PL_c + g(i)\right\} \text{ [dBm]}$$

where

- $P_{\mathrm{CMAX,c}}(i)$ is the configured UE transmit power defined in [6] in subframe i for serving cell *c*. If the UE transmits PUSCH without PUCCH in subframe *i* for the serving cell c, for the accumulation of TPC command for PUCCH, the UE shall assume $P_{\mathrm{CMAX,c}}(i)$ as given by subclause 5.1.1.1. If the UE does not transmit PUCCH and PUSCH in subframe *i* for the serving cell c, for the accumulation of TPC command for PUCCH, the UE shall compute $P_{\mathrm{CMAX,c}}(i)$ assuming MPR=0dB, A-MPR=OdB, P-MPR=0dB and ΔT_C =0dB, where MPR, A-MPR, P-MPR and ΔT_C are defined

in [6].

- The parameter $\Delta_{F\_PUCCH}(F)$ is provided by higher layers. Each $\Delta_{F\_PUCCH}(F)$ value corresponds to a PUCCH format (F) relative to PUCCH format 1a, where each PUCCH format (F) is defined in Table 5.4-1 of [3].

- If the UE is configured by higher layers to transmit PUCCH on two antenna ports, the value of $\Delta_{TxD}(F')$ is provided by higher layers where each PUCCH format F' is defined in Table 5.4-1 of [3] ; otherwise, $\Delta_{TxD}(F') = 0$.

- $h(n_{CQI}, n_{HARQ}, n_{SR})$ is a PUCCH format dependent value, where n_{CQI} corresponds to the number of information bits for the channel quality information defined in subclause 5.2.3.3 in [4]. $n_{SR} = 1$ if subframe i is configured for SR for the UE not having any associated transport block for UL-SCH, otherwise $n_{SR} = 0$. If the UE is configured with more than one serving cell, or the UE is configured with one serving cell and transmitting using PUCCH format 3, the value of n_{HARQ} is defined in subclause 10.1; otherwise, n_{HARQ} is the number of HARQ-ACK bits sent in subframe i.

  - For PUCCH format 1,1a and 1b $h(n_{CQI}, n_{HARQ}, n_{SR})=0$

  - For PUCCH format 1b with channel selection, if the UE is configured with more than one serving cell,

$$h(n_{CQI}, n_{HARQ}, n_{SR}) = \frac{(n_{HARQ} - 1)}{2}, \text{ otherwise, } h(n_{CQI}, n_{HARQ}, n_{SR}) = 0$$

  - For PUCCH format 2, 2a, 2b and normal cyclic prefix

$$h(n_{CQI}, n_{HARQ}, n_{SR}) = \begin{cases} 10\log_{10}\left(\frac{n_{CQI}}{4}\right) & \text{if } n_{CQI} \geq 4 \\ 0 & \text{otherwise} \end{cases}$$

  - For PUCCH format 2 and extended cyclic prefix

$$h(n_{CQI}, n_{HARQ}, n_{SR}) = \begin{cases} 10\log_{10}\left(\frac{n_{CQI} + n_{HARQ}}{4}\right) & \text{if } n_{CQI} + n_{HARQ} \geq 4 \\ 0 & \text{otherwise} \end{cases}$$

  - For PUCCH format 3 and when UE transmits HARQ-ACK/SR without periodic CSI,

    - If the UE is configured by higher layers to transmit PUCCH format 3 on two antenna ports, or if the UE transmits more than 11 bits of HARQ-ACK/SR

$$h(n_{CQI}, n_{HARQ}, n_{SR}) = \frac{n_{HARQ} + n_{SR} - 1}{3}$$

    - Otherwise

$$h(n_{CQI}, n_{HARQ}, n_{SR}) = \frac{n_{HARQ} + n_{SR} - 1}{2}$$

  - For PUCCH format 3 and when UE transmits HARQ-ACK/SR and periodic CSI,

    - If the UE is configured by higher layers to transmit PUCCH format 3 on two antenna ports, or if the UE transmits more than 11 bits of HARQ-ACK/SR and CSI

Samsung Electronics v. Asus Tech Licensing EX-1003, 462 of 673

$$h(n_{CQI}, n_{HARQ}, n_{SR}) = \frac{n_{HARQ} + n_{SR} + n_{CQI} - 1}{3}$$

- Otherwise

$$h(n_{CQI}, n_{HARQ}, n_{SR}) = \frac{n_{HARQ} + n_{SR} + n_{CQI} - 1}{2}$$

- For PUCCH format 4, $M_{PUCCH,c}(i)$ is the bandwidth of the PUCCH format 4 expressed in number of resource blocks valid for subframe i and serving cell *c*. For PUCCH format 5, $M_{PUCCH,c}(i) = 1$.

- $\Delta_{TF,c}(i) = 10\log_{10}(2^{1.25 \cdot BPRE(i)}-1)$ where $BPRE(i) = O_{UCI}(i)/N_{RE}(i)$,

  - $O_{UCI}(i)$ is the number of HARQ-ACK/SR/RI/CQI/PMI bits including CRC bits transmitted on PUCCH format 4/5 in subframe *i*;

  - $N_{RE}(i) = M_{PUCCH,c}(i) \cdot N_{sc}^{RB} \cdot N_{symb}^{PUCCH}$ for PUCCH format 4 and $N_{RE}(i) = N_{sc}^{RB} \cdot N_{symb}^{PUCCH}/2$ for PUCCH format 5;

  - $N_{symb}^{PUCCH} = 2 \cdot (N_{symb}^{UL} - 1) - 1$ if shortened PUCCH format 4 or shortened PUCCH format 5 is used in subframe *i* and $N_{symb}^{PUCCH} = 2 \cdot (N_{symb}^{UL} - 1)$ otherwise.

- P_{O_PUCCH} is a parameter composed of the sum of a parameter $P_{O\_NOMINAL\_PUCCH}$ provided by higher layers and a parameter $P_{O\_UE\_PUCCH}$ provided by higher layers.

- δ_{PUCCH} is a UE specific correction value, also referred to as a TPC command, included in a PDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D for the primary cell, or included in a MPDCCH with DCI format 6-1A, or included in an EPDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D for the primary cell, or sent jointly coded with other UE specific PUCCH correction values on a PDCCH/MPDCCH with DCI format 3/3A whose CRC parity bits are scrambled with TPC-PUCCH-RNTI.

  - For a non-BL/CE UE, if the UE is not configured for EPDCCH monitoring, the UE attempts to decode a PDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI and one or several PDCCHs of DCI format 1A/1B/1D/1/2A/2/2B/2C/2D with the UE's C-RNTI or SPS C-RNTI on every subframe except when in DRX.

  - If a UE is configured for EPDCCH monitoring, the UE attempts to decode

    - a PDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI and one or several PDCCHs of DCI format 1A/1B/1D/1/2A/2/2B/2C/2D with the UE's C-RNTI or SPS C-RNTI as described in subclause 9.1.1, and

    - one or several EPDCCHs of DCI format 1A/1B/1D/1/2A/2/2B/2C/2D with the UE's C-RNTI or SPS C-RNTI, as described in subclause 9.1.4.

  - For a BL/CE UE configured with CEModeA, the UE attempts to decode a MPDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI and MPDCCH of DCI format 6-1A with the UE's C-RNTI or SPS C-RNTI on every BL/CE downlink subframe except when in DRX.

  - If the UE decodes

    - a PDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D or

    - an EPDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D or

    - an MPDCCH with DCI format 6-1A
      for the primary cell and the corresponding detected RNTI equals the C-RNTI or SPS C-RNTI of the UE and

Samsung Electronics v. Asus Tech Licensing EX-1003, 463 of 673

the TPC field in the DCI format is not used to determine the PUCCH resource as in subclause 10.1, the UE shall use the δ_{PUCCH} provided in that PDCCH/EPDCCH/MPDCCH.
Else

- if the UE decodes a PDCCH/MPDCCH with DCI format 3/3A, the UE shall use the δ_{PUCCH} provided in that PDCCH/MPDCCH
  else the UE shall set δ_{PUCCH} = 0 dB.
- $g(i) = g(i-1) + \sum_{m=0}^{M-1} \delta_{PUCCH}(i - k_m)$ where $g(i)$ is the current PUCCH power control adjustment state and where $g(0)$ is the first value after reset.
- For FDD or FDD-TDD and primary cell frame structure type 1, M = 1 and k_0 = 4 .
- For TDD, values of M and k_m are given in Table 10.1.3.1-1, where the "UL/DL configuration" in Table 10.1.3.1-1 corresponds to the *eimta-HARQ-ReferenceConfig-r12* for the primary cell when the UE is configured with the parameter *EIMTA-MainConfigServCell-r12* for the primary cell.
- The δ_{PUCCH} dB values signalled on PDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D or EPDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D or MPDCCH with DCI format 6-1A are given in Table 5.1.2.1-1. If the PDCCH with DCI format 1/1A/2/2A/2B/2C/2D or EPDCCH with DCI format 1/1A/2A/2/2B/2C/2D or MPDCCH with DCI format 6-1A is validated as an SPS activation PDCCH/EPDCCH/MPDCCH, or the PDCCH/EPDCCH with DCI format 1A or MPDCCH with DCI format 6-1A is validated as an SPS release PDCCH/EPDCCH/MPDCCH, then δ_{PUCCH} is 0dB.
- The δ_{PUCCH} dB values signalled on PDCCH/MPDCCH with DCI format 3/3A are given in Table 5.1.2.1-1 or in Table 5.1.2.1-2 as semi-statically configured by higher layers.
- If $P_{O\_UE\_PUCCH}$ value is changed by higher layers,
  - $g(0) = 0$
- Else
  - $g(0) = \Delta P_{rampup} + \delta_{msg2}$, where
    - δ_{msg2} is the TPC command indicated in the random access response corresponding to the random access preamble transmitted in the primary cell, see subclause 6.2 and
    - if UE is transmitting PUCCH in subframe i,

$$\Delta P_{rampup} = \min\left[\left\{\max\left(0, P_{CMAX,c} - \left(\begin{array}{c} P_{0\_PUCCH} \\ + PL_c + h(n_{CQI}, n_{HARQ}, n_{SR}) \\ + \Delta_{F\_PUCCH}(F) + \Delta_{TxD}(F') \end{array}\right)\right)\right\}, \Delta P_{rampuprequested}\right].$$

Otherwise,

$$\Delta P_{rampup} = \min\left[\left\{\max\left(0, P_{CMAX,c} - \left(P_{0\_PUCCH} + PL_c\right)\right)\right\}, \Delta P_{rampuprequested}\right]$$

Samsung Electronics v. Asus Tech Licensing EX-1003, 464 of 673

and $\Delta P_{rampuprequested}$ is provided by higher layers and corresponds to the total power ramp-up requested by higher layers from the first to the last preamble in the primary cell.

- If UE has reached $P_{CMAX,c}(i)$ for the primary cell, positive TPC commands for the primary cell shall not be accumulated.
- If UE has reached minimum power, negative TPC commands shall not be accumulated.
- UE shall reset accumulation

  - when $P_{O\_UE\_PUCCH}$ value is changed by higher layers
  - when the UE receives a random access response message for the primary cell
  - $g(i) = g(i\text{-}1)$ if i is not an uplink subframe in TDD or FDD-TDD and primary cell frame structure type 2.

[0065] For a BL/CE UE configured with CEModeA, if the PUCCH is transmitted in more than one subframe i_0, i_1, ..., i_{N-1} where $i_0 < i_1 < ... < i_{N-1}$, the PUCCH transmit power in subframe i_k, k=0, 1, ..., N-1 is determined by

$$P_{\mathrm{PUCCH},c}(i_k) = P_{\mathrm{PUCCH},c}(i_0)$$

[0066] For a BL/CE UE configured with CEModeB, the PUCCH transmit power in subframe i_k is determined by

$$P_{\mathrm{PUCCH},c}(i_k) = P_{\mathrm{CMAX},c}(i_0)$$

[0067] FIG. 9 (a reproduction of Table 5.1.2.1-1 from 3GPP TS 36.213 v14.0.0)

[0068] FIG. 10 (a reproduction of Table 5.1.2.1-2 from 3GPP TS 36.213 v14.0.0)

5.1.3 Sounding Reference Symbol (SRS)

5.1.3.1 UE behaviour

[0069] The setting of the UE Transmit power P_{SRS} for the SRS transmitted on subframe i for serving cell c is defined by

$$P_{\mathrm{SRS,c}}(i) = \min\left\{ P_{\mathrm{CMAX,c}}(i),\ P_{\mathrm{SRS\_OFFSET,c}}(m) + 10\log_{10}(M_{\mathrm{SRS,c}}) + P_{\mathrm{O\_PUSCH,c}}(j) + \alpha_c(j)\cdot PL_c + f_c(i) \right\} \ [\mathrm{dBm}]$$

where

- $P_{CMAX,c}(i)$ is the configured UE transmit power defined in [6] in sub frame i for serving cell c.
- $P_{SRS\_OFFSET,c}(m)$ is semi-statically configured by higher layers for m=0 and m=1 for serving cell c. For SRS transmission given trigger type 0 then m=0 and for SRS transmission given trigger type 1 then m=1.
- $M_{SRS,c}$ is the bandwidth of the SRS transmission in sub frame i for serving cell c expressed in number of resource blocks.
- $f_c(i)$ is the current PUSCH power control adjustment state for serving cell c, see subclause 5.1.1.1.
- $P_{O\_PUSCH,c}(j)$ and $\alpha_c(j)$ are parameters as defined in subclause 5.1.1.1 for subframe i, where j = 1.

[0070] If the UE is not configured with an SCG or a PUCCH-SCell, and if the total transmit power of the UE for the Sounding Reference Symbol in an SC-FDMA symbol would exceed $\hat{P}_{CMAX}(i)$, the UE scales $\hat{P}_{SRS,c}(i)$ for the serving cell c and the SC-FDMA symbol in subframe i such that the condition

$$\sum_c w(i)\cdot \hat{P}_{\mathrm{SRS},c}(i) \le \hat{P}_{CMAX}(i)$$

is satisfied where $\hat{P}_{SRS,c}(i)$ is the linear value of $P_{SRS,c}(i)$, $\hat{P}_{CMAX}(i)$ is the linear value of P_{CMAX} defined in [6] in subframe i and $w(i)$ is a scaling factor of $\hat{P}_{SRS,c}(i)$ for serving cell c where $0 < w(i) \le 1$. Note that $w(i)$ values are the same across serving cells.

[0071] If the UE is not configured with an SCG or a PUCCH-SCell, and if the UE is configured with multiple TAGs and the SRS transmission of the UE in an SC-FDMA symbol for a serving cell in subframe i in a TAG overlaps with the SRS

Samsung Electronics v. Asus Tech Licensing EX-1003, 465 of 673

transmission in another SC-FDMA symbol in subframe *i* for a serving cell in another TAG, and if the total transmit power of the UE for the Sounding Reference Symbol in the overlapped portion would exceed $\hat{P}_{CMAX}(i)$, the UE scales $\hat{P}_{SRS,c}(i)$ for the serving cell *c* and each of the overlapped SRS SC-FDMA symbols in subframe *i* such that the condition

$$\sum_{c} w(i) \cdot \hat{P}_{SRS,c}(i) \leq \hat{P}_{CMAX}(i)$$

is satisfied where $\hat{P}_{SRS,c}(i)$ is the linear value of $P_{SRS,c}(i)$, $\hat{P}_{CMAX}(i)$ is the linear value of P_{CMAX} defined in [6] in subframe *i* and $w(i)$ is a scaling factor of $\hat{P}_{SRS,c}(i)$ for serving cell *c* where $0 < w(i) \leq 1$. Note that $w(i)$ values are the same across serving cells.

[0072] If the UE is configured with a LAA SCell for uplink transmissions, the UE may compute the scaling factor $w(i)$ assuming that the UE performs a SRS transmission on the LAA SCell in subframe i irrespective of whether the UE can access the LAA SCell for the SRS transmission in subframe i according to the channel access procedures described in subclause 15.2.1.

[0073] If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell c and if subframe *i* belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-SubframeSet-r12,* the UE shall use $f_{c,2}(i)$ instead of $f_c(i)$ to determine $P_{SRS,c}(i)$ for subframe *i* and serving cell *c,* where $f_{c,2}(i)$ is defined in subclause 5.1.1.1.

[0074] A power headroom report is provided by the UE to the base station to allow the base station to realize how much extra transmission power is available in the UE and how to schedule resource to the UE properly, e.g., is it proper to schedule more resources to the UE (e.g., when the UE has more power headroom). A power headroom may be calculated from the difference between a current calculated transmission UE power (if there is transmission) and a maximum transmission power of the UE. In some circumstances, e.g. multiple carrier operation, it is also possible that a power headroom is reported while there is no current transmission, e.g. reporting power headroom for a carrier without ongoing transmission with another carrier. In such a case, a difference between a reference power (calculated based on some reference parameter(s)) and a UE maximum power is reported as the power headroom, also known as virtual power headroom (PH). More details can be found in the following quotation from 3GPP TS 36.213 v14.0.0:

5.1.1.2 Power headroom

[0075] There are two types of UE power headroom reports defined. A UE power headroom *PH* is valid for subframe *i* for serving cell *c.*

[0076] If the UE is configured with a SCG, and if the higher layer parameter *phr-ModeOtherCG-r12* for a CG indicates 'virtual', for power headroom reports transmitted on that CG, the UE shall compute PH assuming that it does not transmit PUSCH/PUCCH on any serving cell of the other CG.

[0077] If the UE is configured with a SCG,

- For computing power headroom for cells belonging to MCG, the term 'serving cell' in this subclause refers to serving cell belonging to the MCG.
- For computing power headroom for cells belonging to SCG, the term 'serving cell' in this subclause refers to serving cell belonging to the SCG. The term 'primary cell' in this subclause refers to the PSCell of the SCG.

[0078] If the UE is configured with a PUCCH-SCell,

- For computing power headroom for cells belonging to primary PUCCH group, the term 'serving cell' in this subclause refers to serving cell belonging to the primary PUCCH group.
- For computing power headroom for cells belonging to secondary PUCCH group, the term 'serving cell' in this subclause refers to serving cell belonging to the secondary PUCCH group. The term 'primary cell' in this subclause refers to the PUCCH-SCell of the secondary PUCCH group.

[0079] If the UE is configured with a LAA SCell for uplink transmissions, and the UE receives PDCCH/EPDCCH with DCI format 0A/0B/4A/4B corresponding to a PUSCH transmission on the LAA SCell in subframe *i,* power headroom for subframe *i* is computed assuming that the UE performs a PUSCH transmission on the LAA SCell in subframe *i* irrespective of whether the UE can access the LAA SCell for the PUSCH transmission in subframe *i* according to the channel access procedures described in subclause 15.2.1.

Type 1:

[0080] If the UE transmits PUSCH without PUCCH in subframe i for serving cell c, power headroom for a Type 1 report is computed using

$$PH_{\text{type1,c}}(i) = P_{\text{CMAX},c}(i) - \left\{ 10\log_{10}(M_{\text{PUSCH,c}}(i)) + P_{\text{O\_PUSCH,c}}(j) + \alpha_c(j)\cdot PL_c + \Delta_{\text{TF,c}}(i) + f_c(i) \right\} \text{ [dB]}$$

where, $P_{CMAX,c}(i)$, $M_{PUSCH,c}(i)$, $P_{O\_PUSCH,c}(j)$, $\alpha_c(j)$, PL_c, $\Delta_{TF,c}(i)$ and $f_c(i)$ are defined in subclause 5.1.1.1.

[0081] If the UE transmits PUSCH with PUCCH in subframe *i* for serving cell *c*, power headroom for a Type 1 report is computed using

$$PH_{\text{type1,c}}(i) = \tilde{P}_{\text{CMAX},c}(i) - \left\{ 10\log_{10}(M_{\text{PUSCH,c}}(i)) + P_{\text{O\_PUSCH,c}}(j) + \alpha_c(j)\cdot PL_c + \Delta_{\text{TF,c}}(i) + f_c(i) \right\} \text{ [dB]}$$

where, $M_{PUSCH,c}(i)$, $P_{O\_PUSCH,c}(j)$, $\alpha_c(j)$, PL_c, $\Delta_{TF,c}(i)$ and $f_c(i)$ are defined in subclause 5.1.1.1. $\tilde{P}_{CMAX,c}(i)$ is computed based on the requirements in [6] assuming a PUSCH only transmission in subframe *i*. For this case, the physical layer delivers $\tilde{P}_{CMAX,c}(i)$ instead of $P_{CMAX,c}(i)$ to higher layers.

[0082] If the UE does not transmit PUSCH in subframe i for serving cell *c*, power headroom for a Type 1 report is computed using

$$PH_{\text{type1,c}}(i) = \tilde{P}_{\text{CMAX},c}(i) - \left\{ P_{\text{O\_PUSCH,c}}(1) + \alpha_c(1)\cdot PL_c + f_c(i) \right\} \text{ [dB]}$$

where, $\tilde{P}_{CMAX,c}(i)$ is computed assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB and ΔT_C =0dB, where MPR, A-MPR, P-MPR and ΔT_C are defined in [6]. $P_{O\_PUSCH,c}(1)$, $\alpha_c(1)$, PL_c, and $f_c(i)$ are defined in subclause 5.1.1.1.

Type 2:

[0083] If the UE transmits PUSCH simultaneous with PUCCH in subframe i for the primary cell, power headroom for a Type 2 report is computed using

$$PH_{\text{type2}}(i) = P_{\text{CMAX},c}(i) - 10\log_{10}\left(\begin{array}{l} 10^{\left(10\log_{10}(M_{\text{PUSCH,c}}(i)) + P_{\text{O\_PUSCH,c}}(j) + \alpha_c(j)\cdot PL_c + \Delta_{\text{TF,c}}(i) + f_c(i)\right)/10} \\ + \; 10^{\left(P_{\text{O\_PUCCH}} + PL_c + h\left(n_{CQI}, n_{HARQ}, n_{SR}\right) + \Delta_{\text{F\_PUCCH}}(F) - \Delta_{TxD}(F') + g(i)\right)/10} \end{array} \right) \text{ [dB]}$$

where, $P_{CMAX,c}$, $M_{PUSCH,c}(i)$, $P_{O\_PUSCH,c}(j)$, $\alpha_c(j)$, $\Delta_{TF,c}(i)$ and $f_c(i)$ are the primary cell parameters as defined in subclause 5.1.1.1 and P_{O_PUCCH}, PL_c, $h(n_{CQI}, n_{HARQ}, n_{SR})$, $\Delta_{F\_PUCCH}(F)$, $\Delta_{TxD}(F')$ and $g(i)$ are defined in subclause 5.1.2.1

[0084] If the UE transmits PUSCH without PUCCH in subframe i for the primary cell, power headroom for a Type 2 report is computed using

$$PH_{\text{type2}}(i) = P_{\text{CMAX},c}(i) - 10\log_{10}\left(\begin{array}{l} 10^{\left(10\log_{10}(M_{\text{PUSCH,c}}(i)) + P_{\text{O\_PUSCH,c}}(j) + \alpha_c(j)\cdot PL_c + \Delta_{\text{TF,c}}(i) - f_c(i)\right)/10} \\ + \; 10^{\left(P_{\text{O\_PUCCH}} + PL_c + g(i)\right)/10} \end{array} \right) \text{ [dB]}$$

where, $P_{CMAX,c}(i)$, $M_{PUSCH,c}(i)$, $P_{O\_PUSCH,c}(j)$, $\alpha_c(j)$, $\Delta_{TF,c}(i)$ and $f_c(i)$ are the primary cell parameters as defined in subclause 5.1.1.1 and P_{O_PUCCH}, PL_c and $g(i)$ are defined in subclause 5.1.2.1.

[0085] If the UE transmits PUCCH without PUSCH in subframe *i* for the primary cell, power headroom for a Type 2 report is computed using

$$PH_{\text{type2}}(i) = P_{\text{CMAX},c}(i) - 10\log_{10}\left(\begin{array}{l} 10^{\left(P_{\text{O\_PUSCH,c}}(1) + \alpha_c(1)\cdot PL_c + f_c(i)\right)/10} \\ + \; 10^{\left(P_{\text{O\_PUCCH}} + PL_c + h\left(n_{CQI}, n_{HARQ}, n_{SR}\right) + \Delta_{\text{F\_PUCCH}}(F) + \Delta_{TxD}(F') + g(i)\right)/10} \end{array} \right) \text{ [dB]}$$

where, $P_{O\_PUSCH,c}$ (1), $\alpha_c(1)$ and $f_c(i)$ are the primary cell parameters as defined in subclause 5.1.1.1, $P_{CMAX,c}(i)$,

P_{O_PUCCH}, PL_c, $h(n_{CQI}, n_{HARQ}, n_{SR})$, $\Delta_{F\_PUCCH}(F)$, $\Delta_{TxD}(F')$ and $g(i)$ are also defined in subclause 5.1.2.1.

[0086] If the UE does not transmit PUCCH or PUSCH in subframe i for the primary cell, power headroom for a Type 2 report is computed using

$$PH_{type2}(i) = \tilde{P}_{CMAX,c}(i) - 10\log_{10}\left(\begin{array}{l} 10^{\left(P_{O\_PUSCH,c}(1)+\alpha_c(1)\cdot PL_c + f_c(i)\right)/10} \\ + \; 10^{\left(P_{0\_PUCCH} - PL_c + g(i)\right)/10} \end{array}\right) \text{[dB]}$$

where, $\tilde{P}_{CMAX,c}(i)$ is computed assuming MPR=0dB, A-MPR=OdB, P-MPR=0dB and ΔT_C =0dB, where MPR,

[0087] A-MPR, P-MPR and ΔT_C are defined in [6], $P_{O\_PUSCH,c}(1)$, $\alpha_c(1)$ and $f_c(i)$ are the primary cell parameters as defined in subclause 5.1.1.1 and P_{O_PUCCH}, PL_c and $g(i)$ are defined in subclause 5.1.2.1.

[0088] If the UE is unable to determine whether there is a PUCCH transmission corresponding to PDSCH transmission(s) or not, or which PUCCH resource is used, in subframe i for the primary cell, before generating power headroom for a Type 2 report, upon (E)PDCCH detection, with the following conditions:

- if both PUCCH format 1b with channel selection and *simultaneousPUCCH-PUSCH* are configured for the UE, or
- if PUCCH format 1b with channel selection is used for HARQ-ACK feedback for the UE configured with PUCCH format 3 and *simultaneousPUCCH-PUSCH* are configured,

then, UE is allowed to compute power headroom for a Type 2 using

$$PH_{type2}(i) = P_{CMAX,c}(i) - 10\log_{10}\left(\begin{array}{l} 10^{\left(10\log_{10}(M_{PUSCH,c}(i)) + P_{O\_PUSCH,c}(j) + \alpha_c(j)\cdot PL_c + \Delta_{TF,c}(i) - f_c(i)\right)/10} \\ + \; 10^{\left(P_{0\_PUCCH} + PL_c + g(i)\right)/10} \end{array}\right) \text{[dB]}$$

where, $P_{CMAX,c}(i)$, $M_{PUSCH,c}(i)$, $P_{O\_PUSCH,c}(j)$, $\alpha_c(j)$, $\Delta_{TF,c}(i)$ and $f_c(i)$ are the primary cell parameters as defined in subclause 5.1.1.1 and P_{O_PUCCH}, PL_c and $g(i)$ are defined in subclause 5.1.2.1.

[0089] The power headroom shall be rounded to the closest value in the range [40; -23] dB with steps of 1 dB and is delivered by the physical layer to higher layers.

If the UE is configured with higher layer parameter *UplinkPowerControlDedicated-v12x0* for serving cell c and if subframe i belongs to uplink power control subframe set 2 as indicated by the higher layer parameter *tpc-Subframe-Set-r12*, the UE shall use $f_{c,2}(i)$ instead of $f_c(i)$ to compute $PH_{type1,c}(i)$ and $PH_{type2,c}(i)$ for subframe i and serving cell c, where $f_{c,2}(i)$ is defined in subclause 5.1.1.1.

[0090] The UE maximum power mentioned above for the power headroom derivation is determined by the capability of the UE and may also be controlled by the configuration of base station/cell. Also, due to the linear range of power amplifier(PA) in the UE's RF, the maximum power may be affected by the peak-to-average power ratio (PAPR) of the transmission. For example, if a transmission has a high PAPR, power back-off may be performed if the peak power would exceed the linear region when the average power is around the maximum power. A range of power back-off is allowed to balance the cost of UE PA and the UL transmission performance/coverage, which is known as maximum power reduction (MPR). Different modulation schemes (e.g. QPSK/16QAM) or different resource allocation (e.g. contiguous/non-contiguous or narrow band/ wide band resource allocation) would result in different PAPR, and thus may have different MPRs. Additional details are disclosed in 3GPP TS 36.101 v14.1.0 as quoted below:

6.2 Transmit power

6.2.1 Void

6.2.2 UE maximum output power

[0091] The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration and UL-MIMO unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

[0092] FIG. 11 (A and B) (a reproduction of Table 6.2.2-1 from 3GPP TS 36.101 v14.1.0) <...>

6.2.3 UE maximum output power for modulation / channel bandwidth

[0093] For UE Power Class 1 and 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

[0094] FIG. 12 (a reproduction of Table 6.2.3-1 from 3GPP TS 36.101 v14.1.0)

[0095] For PRACH, PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

[0096] For each subframe, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

[0097] For transmissions with non-contiguous resource allocation in single component carrier, the allowed Maximum Power Reduction (MPR) for the maximum output power in table 6.2.2-1, is specified as follows

$$MPR = CEIL\ \{M_A, 0.5\}$$

[0098] Where M_A is defined as follows

$$M_A = \begin{cases} 8.00\text{-}10.12A & ; 0.00 < A \leq 0.33 \\ 5.67 - 3.07A & ; 0.33 < A \leq 0.77 \\ 3.31 & ; 0.77 < A \leq 1.00 \end{cases}$$

Where

$$A = N_{RB\_alloc} / N_{RB.}$$

CEIL{M_A, 0.5} means rounding upwards to closest 0.5dB, i.e. MPR $\in$ [3.0, 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0]

[0099] For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5 apply. <...>

6.2.3B UE maximum output power for modulation / channel bandwidth for UL-MIMO

[0100] For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2B-1 is specified in Table 6.2.3-1. The requirements shall be met with UL-MIMO configurations defined in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5B apply.

[0101] If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.3 apply. <...>

6.2.4 UE maximum output power with additional requirements

[0102] Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power as specified in Table 6.2.2-1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

[0103] For UE Power Class 1 and 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4.-1 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

[0104] FIG. 13 (A and B) (a reproduction of Table 6.2.4-1 from 3GPP TS 36.101 v14.1.0)

6.2.5 Configured transmitted power

[0105] The UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell *c*. The configured maximum output power $P_{CMAX,c}$ is set within the following bounds:

$$P_{CMAX\_L,c} \leq P_{CMAX,c} \leq P_{CMAX\_H,c}$$

with

$$P_{CMAX\_L,c} = MIN\ \{P_{EMAX,c} - \Delta T_{C,c},\ P_{PowerClass} - MAX(MPR_c + A\text{-}MPR_c + \Delta T_{IB,c} + \Delta T_{C,c} + \Delta T_{ProSe},\ P\text{-}MPR_c)\}$$

$$P_{CMAX\_H,c} = MIN\ \{P_{EMAX,c},\ P_{PowerClass}\}$$

where

- $P_{EMAX,c}$ is the value given by IE *P-Max* for serving cell *c*, defined in [7];
- $P_{PowerClass}$ is the maximum UE power specified in Table 6.2.2-1 without taking into account the tolerance specified in the Table 6.2.2-1;
- MPR_c and $A\text{-}MPR_c$ for serving cell *c* are specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $\Delta T_{IB,c}$ is the additional tolerance for serving cell *c* as specified in Table 6.2.5-2; $\Delta T_{IB,c}$ = 0 dB otherwise;
- $\Delta T_{C,c}$ = 1.5 dB when NOTE 2 in Table 6.2.2-1 applies;
- $\Delta T_{C,c}$ = 0 dB when NOTE 2 in Table 6.2.2-1 does not apply;
- ΔT_{ProSe} = 0.1 dB when the UE supports ProSe Direct Discovery and/or ProSe Direct Communication on the corresponding E-UTRA ProSe band; ΔT_{proSe} = 0 dB otherwise.

[0106] $P\text{-}MPR_c$ is the allowed maximum output power reduction for

- a) ensuring compliance with applicable electromagnetic energy absorption requirements and addressing unwanted emissions / self desense requirements in case of simultaneous transmissions on multiple RAT(s) for scenarios not in scope of 3GPP RAN specifications;
- b) ensuring compliance with applicable electromagnetic energy absorption requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

[0107] The UE shall apply $P\text{-}MPR_c$ for serving cell *c* only for the above cases. For UE conducted conformance testing P-MPR shall be 0 dB

NOTE 1: $P\text{-}MPR_c$ was introduced in the $P_{CMAX,c}$ equation such that the UE can report to the eNB the available maximum output transmit power. This information can be used by the eNB for scheduling decisions.

NOTE 2: $P\text{-}MPR_c$ may impact the maximum uplink performance for the selected UL transmission path.

[0108] For each subframe, the $P_{CMAX\_L,c}$ for serving cell c is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum $P_{CMAX\_L,c}$ over the two slots is then applied for the entire subframe. $P_{PowerClass}$ shall not be exceeded by the UE during any period of time.

[0109] The measured configured maximum output power $P_{UMAX,c}$ shall be within the following bounds:

$$P_{CMAX\_L,c} - MAX\{T_{L,c}, T(P_{CMAX\_L,c})\} \leq P_{UMAX,c} \leq P_{CMAX\_H,c} + T(P_{CMAX\_H,c}).$$

where the tolerance $T(P_{CMAX,c})$ for applicable values of $P_{CMAX,c}$ is specified in Table 6.2.5-1, and Table 6.2.5-1A. The tolerance $T_{L,c}$ is the absolute value of the lower tolerance for the applicable operating band as specified in Table 6.2.2-1.

[0110] FIG. 14 (a reproduction of Table 6.2.5-1 from 3GPP TS 36.101 v14.1.0)

[0111] FIG. 15 (a reproduction of Table 6.2.5-1A from 3GPP TS 36.101 v14.1.0)

Samsung Electronics v. Asus Tech Licensing EX-1003, 470 of 673

[0112] For the UE which supports inter-band carrier aggregation configurations with the uplink assigned to one or two E-UTRA bands the $\Delta T_{IB,c}$ is defined for applicable bands in Table 6.2.5-2, Table 6.2.5-3 and Table 6.2.5-4. <...>

6.2.5A Configured transmitted power for CA

[0113] For uplink carrier aggregation the UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell *c* and its total configured maximum output power P_{CMAX}.

[0114] The configured maximum output power $P_{CMAX,c}$ on serving cell c shall be set as specified in subclause 6.2.5.

[0115] For uplink inter-band carrier aggregation, MPR_c and A-MPR_c apply per serving cell c and are specified in subclause 6.2.3 and subclause 6.2.4, respectively. P-MPR_c accounts for power management for serving cell *c*. $P_{CMAX,c}$ is calculated under the assumption that the transmit power is increased independently on all component carriers.

[0116] For uplink intra-band contiguous and non-contiguous carrier aggregation, MPR_c = MPR and A-MPR_c = A-MPR with MPR and A-MPR specified in subclause 6.2.3A and subclause 6.2.4A respectively. There is one power management term for the UE, denoted P-MPR, and P-MPR_c = P-MPR. $P_{CMAX,c}$ is calculated under the assumption that the transmit power is increased by the same amount in dB on all component carriers.

[0117] The total configured maximum output power P_{CMAX} shall be set within the following bounds:

$$P_{CMAX\_L} \leq P_{CMAX} \leq P_{CMAX\_H}$$

[0118] For uplink inter-band carrier aggregation with one serving cell c per operating band,

$$P_{CMAX\_L} = MIN\ \{10\log_{10}\sum MIN\ [\ p_{EMAX,c}/(\Delta t_{C,c}),\ p_{PowerClass}/(mpr_c \cdot a\text{-}mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c} \cdot \Delta t_{ProSe}),\ p_{PowerClass}/pmpr_c],\ P_{PowerClass}\}$$

$$P_{CMAX\_H} = MIN\{10\ \log_{10} \sum p_{EMAX,c}, P_{PowerClass}\}$$

where

- $p_{EMAX,c}$ is the linear value of $P_{EMAX,c}$ which is given by IE *P-Max* for serving cell c in [7];
- $P_{PowerClass}$ is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1; $p_{PowerClass}$ is the linear value of $P_{PowerClass}$;
- mpr_c and a-mpr_c are the linear values of MPR_c and A-MPR_c as specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $pmpr_c$ is the linear value of P-MPR_c;
- $\Delta t_{C,c}$ is the linear value of $\Delta T_{C,c}$. $\Delta t_{C,c}$ = 1.41 when NOTE 2 in Table 6.2.2-1 applies for a serving cell *c*, otherwise $\Delta t_{C,c}$ = 1;
- $\Delta t_{IB,c}$ is the linear value of the inter-band relaxation term $\Delta T_{IB,c}$ of the serving cell *c* as specified in Table 6.2.5-2; otherwise $\Delta t_{IB,c}$ = 1;
- Δt_{ProSe} is the linear value of ΔT_{ProSe} and applies as specified in subclause 6.2.5.

[0119] For uplink intra-band contiguous and non-contiguous carrier aggregation,

$$P_{CMAX\_L} = MIN\{10\ \log_{10} \sum p_{EMAX,c} - \Delta T_C, P_{PowerClass} - MAX(MPR + A\text{-}MPR + \Delta T_{IB,c} + \Delta T_C + \Delta T_{ProSe}, P\text{-}MPR)\}$$

$$P_{CMAX\_H} = MIN\{10\ \log_{10} \sum p_{EMAX,c}, P_{PowerClass}\}$$

where

- $p_{EMAX,c}$ is the linear value of $P_{EMAX,c}$ which is given by IE *P-Max* for serving cell c in [7];
- $P_{PowerClass}$ is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1;
- MPR and A-MPR are specified in subclause 6.2.3A and subclause 6.2.4A respectively;
- $\Delta T_{IB,c}$ is the additional tolerance for serving cell *c* as specified in Table 6.2.5-2;

Samsung Electronics v. Asus Tech Licensing EX-1003, 471 of 673

- P-MPR is the power management term for the UE;
- ΔT_C is the highest value $\Delta T_{C,c}$ among all serving cells *c* in the subframe over both timeslots. $\Delta T_{C,c}$ = 1.5 dB when NOTE 2 in Table 6.2.2A-1 applies to the serving cell *c*, otherwise $\Delta T_{C,c}$ = 0 dB;
- ΔT_{ProSe} applies as specified in subclause 6.2.5.

[0120] For combinations of intra-band and inter-band carrier aggregation with UE configured for transmission on three serving cells (up to two contiguously aggregated carriers per operating band),

$$P_{CMAX\_L} = MIN\ \{10\log_{10}\sum(p_{CMAX\_L,Bi}), P_{PowerClass}\}$$

$$P_{CMAX\_H} = MIN\{10\ \log_{10}\sum p_{EMAX,c}, P_{PowerClass}\}$$

where

- $p_{EMAX,c}$ is the linear value of $P_{EMAX,c}$ which is given by IE *P-Max* for serving cell c in [7];
- $P_{PowerClass}$ is the maximum UE power specified in Table 6.2.2A-0 without taking into account the tolerance specified in the Table 6.2.2A-0; $p_{PowerClass}$ is the linear value of $P_{PowerClass}$;
- $P_{CMAX\_L,Bi}$ is the linear values of P_{CMAX_L} as specified in corresponding operating band. $P_{CMAX\_L,c}$ specified for single carrier in subclause 6.2.5 applies for operating band supporting one serving cell. P_{CMAX_L} specified for uplink intra-band contiguous carrier aggregation in subclause 6.2.5A applies for operating band supporting two contiguous serving cells.

[0121] For each subframe, the P_{CMAX_L} is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum P_{CMAX_L} over the two slots is then applied for the entire subframe. $P_{PowerClass}$ shall not be exceeded by the UE during any period of time.

[0122] If the UE is configured with multiple TAGs and transmissions of the UE on subframe i for any serving cell in one TAG overlap some portion of the first symbol of the transmission on subframe *i* +1 for a different serving cell in another TAG, the UE minimum of P_{CMAX_L} for subframes *i* and *i* + 1 applies for any overlapping portion of subframes *i* and *i* + 1. $P_{PowerClass}$ shall not be exceeded by the UE during any period of time.

[0123] The measured maximum output power P_{UMAX} over all serving cells shall be within the following range:

$$P_{CMAX\_L}\quad MAX\{T_L, T_{LOW}(P_{CMAX\_L})\} \leq P_{UMAX} \leq P_{CMAX\_H} + T_{HIGH}(P_{CMAX\_H})$$

$$P_{UMAX} = 10\ \log_{10}\sum p_{UMAX,c}$$

where $p_{UMAX,c}$ denotes the measured maximum output power for serving cell c expressed in linear scale. The tolerances $T_{LOW}(P_{CMAX})$ and $T_{HIGH}(P_{CMAX})$ for applicable values of P_{CMAX} are specified in Table 6.2.5A-1 and Table 6.2.5A-2 for inter-band carrier aggregation and intra-band carrier aggregation, respectively. The tolerance T_L is the absolute value of the lower tolerance for applicable E-UTRA CA configuration as specified in Table 6.2.2A-0, Table 6.2.2A-1 and Table 6.2.2A-2 for inter-band carrier aggregation, intra-band contiguous carrier aggregation and intra-band non-contiguous carrier aggregation, respectively.

[0124] FIG. 16 (a reproduction of Table 6.2.5A-1 from 3GPP TS 36.101 v14.1.0)

[0125] FIG. 17 (a reproduction of Table 6.2.5A-2 from 3GPP TS 36.101 v14.1.0)

6.2.5B Configured transmitted power for UL-MIMO

[0126] For UE supporting UL-MIMO, the transmitted power is configured per each UE.

[0127] The definitions of configured maximum output power $P_{CMAX,c}$, the lower bound $P_{CMAX\_L,c}$, and the higher bound $P_{CMAX\_H,c}$ specified in subclause 6.2.5 shall apply to UE supporting UL-MIMO, where

- $P_{PowerClass}$ and $\Delta T_{C,c}$ are specified in subclause 6.2.2B;
- $MPR_{,c}$ is specified in subclause 6.2.3B;

- A-MPR$_{,c}$ is specified in subclause 6.2.4B.

[0128] The measured configured maximum output power $P_{UMAX,c}$ for serving cell c shall be within the following bounds:

$$P_{CMAX\ L,c} - MAX\{T_L, T_{LOW}(P_{CMAX\ L,c})\} \leq P_{UMAX,c} \leq P_{CMAX\ H,c} + T_{HIGH}(P_{CMAX\ H,c})$$

where $T_{LOW}(P_{CMAX\_L,c})$ and $T_{HIGH}(P_{CMAX\_H,c})$ are defined as the tolerance and applies to $P_{CMAX\_L,c}$ and $P_{CMAX\_H,c}$ separately, while T_L is the absolute value of the lower tolerance in Table 6.2.2B-1 for the applicable operating band. For UE with two transmit antenna connectors in closed-loop spatial amultiplexing scheme, the tolerance is specified in Table 6.2.5B-1. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2.

[0129] FIG. 18 (a reproduction of Table 6.2.5B-1 from 3GPP TS 36.101 v14.1.0)

[0130] If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.5 apply.

[0131] Also, to avoid excessive reporting of power headroom, a power headroom report would be triggered under certain conditions, e.g., when the pathloss/power headroom value changes a lot or the previously reporting is too far from now, e.g., a timer has expired since last report. Additional details are disclosed in 3GPP TS 36.321 v14.0.0 as quoted below:

5.4.3 Multiplexing and assembly

5.4.3.1 Logical channel prioritization

[0132] The Logical Channel Prioritization procedure is applied when a new transmission is performed.

[0133] RRC controls the scheduling of uplink data by signalling for each logical channel: *priority* where an increasing *priority* value indicates a lower priority level, *prioritisedBitRate* which sets the Prioritized Bit Rate (PBR), *bucketSizeDuration* which sets the Bucket Size Duration (BSD). For NB-IoT, *prioritisedBitRate, bucketSizeDuration* and the corresponding steps of the Logical Channel Prioritisation procedure (i.e., Step 1 and Step 2 below) are not applicable.

[0134] The MAC entity shall maintain a variable Bj for each logical channel j. Bj shall be initialized to zero when the related logical channel is established, and incremented by the product PBR × TTI duration for each TTI, where PBR is Prioritized Bit Rate of logical channel j. However, the value of Bj can never exceed the bucket size and if the value of Bj is larger than the bucket size of logical channel j, it shall be set to the bucket size. The bucket size of a logical channel is equal to PBR × BSD, where PBR and BSD are configured by upper layers.

[0135] The MAC entity shall perform the following Logical Channel Prioritization procedure when a new transmission is performed:

- The MAC entity shall allocate resources to the logical channels in the following steps:
  - Step 1: All the logical channels with Bj > 0 are allocated resources in a decreasing priority order. If the PBR of a logical channel is set to "infinity", the MAC entity shall allocate resources for all the data that is available for transmission on the logical channel before meeting the PBR of the lower priority logical channel(s);
  - Step 2: the MAC entity shall decrement Bj by the total size of MAC SDUs served to logical channel j in Step 1;
    - NOTE: The value of Bj can be negative.
  - Step 3: if any resources remain, all the logical channels are served in a strict decreasing priority order (regardless of the value of Bj) until either the data for that logical channel or the UL grant is exhausted, whichever comes first. Logical channels configured with equal priority should be served equally.
- The UE shall also follow the rules below during the scheduling procedures above:
  - the UE should not segment an RLC SDU (or partially transmitted SDU or retransmitted RLC PDU) if the whole SDU (or partially transmitted SDU or retransmitted RLC PDU) fits into the remaining resources of the associated MAC entity;
  - if the UE segments an RLC SDU from the logical channel, it shall maximize the size of the segment to fill the grant of the associated MAC entity as much as possible;
  - the UE should maximise the transmission of data.

- if the MAC entity is given an UL grant size that is equal to or larger than 4 bytes while having data available for transmission, the MAC entity shall not transmit only padding BSR and/or padding (unless the UL grant size is less than 7 bytes and an AMD PDU segment needs to be transmitted);

- for transmissions on serving cells operating according to Frame Structure Type 3, the MAC entity shall only consider logical channels for which *laa-Allowed* has been configured.

[0136] The MAC entity shall not transmit data for a logical channel corresponding to a radio bearer that is suspended (the conditions for when a radio bearer is considered suspended are defined in [8]).

[0137] If the MAC PDU includes only the MAC CE for padding BSR or periodic BSR with zero MAC SDUs and there is no aperiodic CSI requested for this TTI [2], the MAC entity shall not generate a MAC PDU for the HARQ entity in the following cases:

- in case the MAC entity is configured with *skipUplinkTxDynamic* and the grant indicated to the HARQ entity was addressed to a C-RNTI; or

- in case the MAC entity is configured with *skipUplinkTxSPS* and the grant indicated to the HARQ entity is a configured uplink grant;

[0138] For the Logical Channel Prioritization procedure, the MAC entity shall take into account the following relative priority in decreasing order:

- MAC control element for C-RNTI or data from UL-CCCH;

- MAC control element for SPS confirmation;

- MAC control element for BSR, with exception of BSR included for padding;

- MAC control element for PHR, Extended PHR, or Dual Connectivity PHR;

- MAC control element for Sidelink BSR, with exception of Sidelink BSR included for padding;

- data from any Logical Channel, except data from UL-CCCH;

- MAC control element for BSR included for padding;

- MAC control element for Sidelink BSR included for padding.

• NOTE: When the MAC entity is requested to transmit multiple MAC PDUs in one TTI, steps 1 to 3 and the associated rules may be applied either to each grant independently or to the sum of the capacities of the grants. Also the order in which the grants are processed is left up to UE implementation. It is up to the UE implementation to decide in which MAC PDU a MAC control element is included when MAC entity is requested to transmit multiple MAC PDUs in one TTI. When the UE is requested to generate MAC PDU(s) in two MAC entities in one TTI, it is up to UE implementation in which order the grants are processed.

<...>

5.4.6 Power Headroom Reporting

[0139] The Power Headroom reporting procedure is used to provide the serving eNB with information about the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission per activated Serving Cell and also with information about the difference between the nominal UE maximum power and the estimated power for UL-SCH and PUCCH transmission on SpCell and PUCCH SCell.

[0140] The reporting period, delay and mapping of Power Headroom are defined in subclause 9.1.8 of [9]. RRC controls Power Headroom reporting by configuring the two timers *periodicPHR-Timer* and *prohibitPHR-Timer,* and by signalling *dl-PathlossChange* which sets the change in measured downlink pathloss and the required power backoff due to power management (as allowed by $P\text{-}MPR_c$ [10]) to trigger a PHR [8].

[0141] A Power Headroom Report (PHR) shall be triggered if any of the following events occur:

- *prohibitPHR-Timer* expires or has expired and the path loss has changed more than *dl-PathlossChange* dB for at least one activated Serving Cell of any MAC entity which is used as a pathloss reference since the last transmission of a PHR in this MAC entity when the MAC entity has UL resources for new transmission;
- *periodicPHR-Timer* expires;
- upon configuration or reconfiguration of the power headroom reporting functionality by upper layers [8], which is not used to disable the function;
- activation of an SCell of any MAC entity with configured uplink;
- addition of the PSCell;
- *prohibitPHR-Timer* expires or has expired, when the MAC entity has UL resources for new transmission, and the following is true in this TTI for any of the activated Serving Cells of any MAC entity with configured uplink:
  - there are UL resources allocated for transmission or there is a PUCCH transmission on this cell, and the required power backoff due to power management (as allowed by $P\text{-}MPR_c$ [10]) for this cell has changed more than *dl-PathlossChange* dB since the last transmission of a PHR when the MAC entity had UL resources allocated for transmission or PUCCH transmission on this cell.

NOTE: The MAC entity should avoid triggering a PHR when the required power backoff due to power management decreases only temporarily (e.g. for up to a few tens of milliseconds) and it should avoid reflecting such temporary decrease in the values of $P_{CMAX,c}$/PH when a PHR is triggered by other triggering conditions.

[0142] If the MAC entity has UL resources allocated for new transmission for this TTI the MAC entity shall:

- if it is the first UL resource allocated for a new transmission since the last MAC reset, start *periodicPHR-Timer;*
- if the Power Headroom reporting procedure determines that at least one PHR has been triggered and not cancelled, and;
- if the allocated UL resources can accommodate the MAC control element for PHR which the MAC entity is configured to transmit, plus its subheader, as a result of logical channel prioritization:
  - if *extendedPHR* is configured:
    - for each activated Serving Cell with configured uplink:
      - obtain the value of the Type 1 power headroom;
      - if the MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI:
        - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
    - if *simultaneousPUCCH-PUSCH* is configured:
      - obtain the value of the Type 2 power headroom for the PCell;
      - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer (see subclause 5.1.1.2 of [2]);
    - instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element for *extendedPHR* as defined in subclause 6.1.3.6a based on the values reported by the physical layer;
  - else if *extendedPHR2* is configured:
    - for each activated Serving Cell with configured uplink:

Samsung Electronics v. Asus Tech Licensing EX-1003, 475 of 673

- obtain the value of the Type 1 power headroom;
- if the MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI:
  - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
- if a PUCCH SCell is configured and activated:
  - obtain the value of the Type 2 power headroom for the PCell and PUCCH SCell;
  - obtain the values for the corresponding $P_{CMAX,c}$ fields from the physical layer (see subclause 5.1.1.2 of [2]);
- else:
  - if *simultaneousPUCCH-PUSCH* is configured for the PCell:
    - obtain the value of the Type 2 power headroom for the PCell;
    - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer (see subclause 5.1.1.2 of [2]);
  - instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element for *extendedPHR2* according to configured *ServCellIndex* and the PUCCH(s) for the MAC entity as defined in subclause 6.1.3.6a based on the values reported by the physical layer;
- else if *dualConnectivityPHR* is configured:
  - for each activated Serving Cell with configured uplink associated with any MAC entity:
    - obtain the value of the Type 1 power headroom;
    - if this MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI or if the other MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI and *phr-ModeOtherCG* is set to *real* by upper layers:
      - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
  - if *simultaneousPUCCH-PUSCH* is configured:
    - obtain the value of the Type 2 power headroom for the SpCell;
    - obtain the value for the corresponding $P_{CMAX,c}$ field for the SpCell from the physical layer (see subclause 5.1.1.2 of [2]);
  - obtain the value of the Type 2 power headroom for the SpCell of the other MAC entity;
  - if *phr-ModeOtherCG* is set to *real* by upper layers:
    - obtain the value for the corresponding $P_{CMAX,c}$ field for the SpCell of the other MAC entity from the physical layer (see subclause 5.1.1.2 of [2]);
  - instruct the Multiplexing and Assembly procedure to generate and transmit a Dual Connectivity PHR MAC control element as defined in subclause 6.1.3.6b based on the values reported by the physical layer;
- else:
  - obtain the value of the Type 1 power headroom from the physical layer;

- instruct the Multiplexing and Assembly procedure to generate and transmit a PHR MAC control element as defined in subclause 6.1.3.6 based on the value reported by the physical layer;

- start or restart *periodicPHR-Timer;*

- start or restart *prohibitPHR-Timer*;

- cancel all triggered PHR(s).

<...>

6.1.3.6 Power Headroom Report MAC Control Element

[0143] The Power Headroom Report (PHR) MAC control element is identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. It has a fixed size and consists of a single octet defined as follows (figure 6.1.3.6-1):

- R: reserved bit, set to "0";

- Power Headroom (PH): this field indicates the power headroom level. The length of the field is 6 bits. The reported PH and the corresponding power headroom levels are shown in Table 6.1.3.6-1 below (the corresponding measured values in dB can be found in subclause 9.1.8.4 of [9]).

[0144] FIG. 19 (a reproduction of Figure 6.1.3.6.1 from 3GPP TS 36.321 v14.0.0)
[0145] FIG. 20 (a reproduction of Table 6.1.3.6.1 from 3GPP TS 36.321 v14.0.0)

6.1.3.6a Extended Power Headroom Report MAC Control Elements

[0146] For *extendedPHR,* the Extended Power Headroom Report (PHR) MAC control element is identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. It has a variable size and is defined in Figure 6.1.3.6a-2. When Type 2 PH is reported, the octet containing the Type 2 PH field is included first after the octet indicating the presence of PH per SCell and followed by an octet containing the associated $P_{CMAX,c}$ field (if reported). Then follows in ascending order based on the *ServCellIndex* [8] an octet with the Type 1 PH field and an octet with the associated $P_{CMAX,c}$ field (if reported), for the PCell and for each SCell indicated in the bitmap.

[0147] For *extendedPHR2,* the Extended Power Headroom Report (PHR) MAC control elements are identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. They have variable sizes and are defined in Figure 6.1.3.6a-3, Figure 6.1.3.6a-4 and Figure 6.1.3.6a-5. One octet with C fields is used for indicating the presence of PH per SCell when the highest *SCellIndex* of SCell with configured uplink is less than 8, otherwise four octets are used. When Type 2 PH is reported for the PCell, the octet containing the Type 2 PH field is included first after the octet(s) indicating the presence of PH per SCell and followed by an octet containing the associated $P_{CMAX,c}$ field (if reported). Then follows the Type 2 PH field for the PUCCH SCell (if PUCCH on SCell is configured and Type 2 PH is reported for the PUCCH SCell), followed by an octet containing the associated $P_{CMAX,c}$ field (if reported). Then follows in ascending order based on the *ServCellIndex* [8] an octet with the Type 1 PH field and an octet with the associated $P_{CMAX,c}$ field (if reported), for the PCell and for each SCell indicated in the bitmap.

[0148] The Extended PHR MAC Control Elements are defined as follows:

- C_i: this field indicates the presence of a PH field for the SCell with *SCellIndex* i as specified in [8]. The C_i field set to "1" indicates that a PH field for the SCell with *SCellIndex* i is reported. The C_i field set to "0" indicates that a PH field for the SCell with *SCellIndex* i is not reported;

- R: reserved bit, set to "0";

- V: this field indicates if the PH value is based on a real transmission or a reference format. For Type 1 PH, V=0 indicates real transmission on PUSCH and V=1 indicates that a PUSCH reference format is used. For Type 2 PH, V=0 indicates real transmission on PUCCH and V=1 indicates that a PUCCH reference format is used. Furthermore, for both Type 1 and Type 2 PH, V=0 indicates the presence of the octet containing the associated $P_{CMAX,c}$ field, and V=1 indicates that the octet containing the associated $P_{CMAX,c}$ field is omitted;

- Power Headroom (PH): this field indicates the power headroom level. The length of the field is 6 bits. The reported

PH and the corresponding power headroom levels are shown in Table 6.1.3.6-1 (the corresponding measured values in dB can be found in subclause 9.1.8.4 of [9]);

- P: this field indicates whether the MAC entity applies power backoff due to power management (as allowed by P-MPR_c [10]). The MAC entity shall set P=1 if the corresponding $P_{CMAX,c}$ field would have had a different value if no power backoff due to power management had been applied;

- $P_{CMAX,c}$: if present, this field indicates the $P_{CMAX,c}$ or $\tilde{P}_{CMAX,c}$ [2] used for calculation of the preceding PH field. The reported $P_{CMAX,c}$ and the corresponding nominal UE transmit power levels are shown in Table 6.1.3.6a-1 (the corresponding measured values in dBm can be found in subclause 9.6.1 of [9]).

[0149] FIG. 21 (a reproduction of Figure 6.1.3.6a-2 from 3GPP TS 36.321 v14.0.0)

[0150] FIG. 22 (a reproduction of Figure 6.1.3.6a1-3 from 3GPP TS 36.321 v14.0.0)

[0151] FIG. 23 (a reproduction of Figure 6.1.3.6a2-4 from 3GPP TS 36.321 v14.0.0)

[0152] FIG. 24 (a reproduction of Figure 6.1.3.6a3-5 from 3GPP TS 36.321 v14.0.0)

[0153] FIG. 25 (a reproduction of Figure 6.1.3.6a-1 from 3GPP TS 36.321 v14.0.0)

[0154] As discussed, there are several triggers for a power headroom report such as, but not limited to, a pathloss change or a timer expiration. When transmissions are performed with narrow beams, the beam used for transmission may be changed frequently due to, for example, blockage or scheduling flexibility. However, if the triggering occurs often even though the power situation is unchanged, unnecessary power headroom reports would be generated and included without providing the base station any additional information than what was previously provided. On the other hand, if the power status changes when no power headroom report is triggered, the base station may not make the correct scheduling decision since up-to-date information is not provided.

[0155] For example, when the scheduled beam changes from one beam to another beam, pathloss derived from different beams may be different. The pathloss difference may exceed the threshold and a power headroom report is triggered. However, the channel condition within each beam may be similar and the report may not be helpful. On the other hand, even if the pathloss is kept similar, it is possible that channel condition for a beam has been changing but a report is not be triggered. These above-identified analysis can also be applied to the case where the UE uses more than one beam for transmission.

[0156] Another factor which may have impact on power headroom triggering is the power control algorithm. It is possible that the power control is applied on a per UE basis, e.g. the UE would transmit on different beams with similar power level and one control loop is maintained. Alternatively, the power control can be applied on a per UE beam basis, per TRP beam basis, or per TRP basis. For example, the power control for each UE beam is controlled independently and multiple control loops are maintained. In yet another alternative, it is possible that the power control for certain UE beams is controlled in a similar way, e.g. as a group, and the power control for some other UE beams is controlled in another way, e.g. as another group. For example, UE beams associated with a same TRP belong to the same group. In another example, UE beams associated with a same base station beam or a same TRP beam belong to the same group. In sum, the triggering of the power headroom report would need to take the above aspects into account.

[0157] According to one embodiment, a power headroom report could be triggered due to a change of pathloss being larger than a threshold, wherein the pathloss is associated with a specific UE beam or a set of UE beams. The UE may determine whether the pathloss of the specific UE beam or the set of UE beams has changed if the specific UE beam or the set of UE beams is scheduled for transmission. The UE may not determine whether the pathloss of the specific UE beam or the set of UE beams has changed if the specific UE beam or the set of UE beams is not scheduled for transmission. The change of the pathloss could be derived from a comparison between a current pathloss for the specific UE beam or the set of UE beams and a previous pathloss for the specific UE beam or the set of UE beams. The comparison for the pathloss change may be done for the same UE beam or the same set of UE beams.

[0158] According to a second embodiment, a power headroom report could be triggered due to a change of pathloss being larger than a threshold, wherein the pathloss is associated with a TRP beam, a set of TRP beams, or a TRP. The UE may determine whether the pathloss has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is scheduled. The UE may not determine whether the pathloss has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is not scheduled. The change of the pathloss is derived from a comparison between a current pathloss associated with the TRP beam, the set of TRP beams, or the TRP and a previous pathloss associated with the TRP beam, the set of TRP beams, or the TRP.

[0159] According to a third embodiment, a power headroom report could be triggered due to a change (or addition or activation) of the serving TRP(s), a change (or addition or activation) of the serving TRP beam(s), a change (or addition or activation) of a candidate TRP beam(s), or an activation (or addition) of a UE beam.

[0160] In one example, if pathloss of a specific UE beam or a set of UE beams has changed more than a threshold, a power headroom report would be triggered. The power headroom report may not be triggered if the pathloss is changed

due to a change of some UE beam or some set of UE beams.

[0161] The power headroom report may include power headroom for the specific UE beam or the set of UE beams. Alternatively, the power headroom report could include power headroom for all UE beams. Alternatively, the power headroom report could include power headroom for any combination of UE beam(s) within all UE beams. In one example, a subset of the combination of UE beam(s) can be configured to report. In another example, the subset of combination of UE beam(s) can be linked to the specific UE beam or the set of UE beams. In yet another example, the subset of combination of UE beam(s) includes a UE beam that is not the specific UE beam, in which the specific UE beam is the beam whose pathloss has changed more than a threshold value. In yet another example, the subset of combination of UE beam(s) includes a UE beam which is not within the subset of UE beams.

[0162] The set of UE beams may be the UE beams associated with a TRP or the same TRP. Alternatively, the set of UE beams may be the UE beams associated with aTRP beam, the same TRP beam, a base station beam, or the same base station. In one exemplary embodiment, the set of UE beams is configured by a base station.

[0163] In one example, the power headroom for a specific UE beam is derived from or based on the UE power status of a transmission on the specific UE beam. More specifically, preferably the power headroom for the specific UE beam is the difference between a UE calculated transmission power for the specific UE beam and a maximum transmission power on the specific UE beam.

[0164] In another example, the power headroom for a set of UE beams is derived from or based on the UE power status of a transmission on the set of UE beams. More specifically, preferably the power headroom for the set of UE beams is the difference between a UE calculated transmission power for the set of UE beams and a maximum transmission power on the set of UE beams.

[0165] Preferably, the power control could be per UE. Alternatively, the power control could be per beam. Alternatively, the power control could be per beam group or per beam set. Alternatively, the power control could be per beam combination.

[0166] In another embodiment, the UE could trigger a power headroom report for a group of UE beams based on a first condition. Preferably, the group of UE beams could be a subset of UE beams that can be generated by the UE. Preferably, the triggering of a power headroom report for another group of UE beams could be based on a second condition. Preferably, the power headroom report could include the power headroom of each UE beam within the group. Preferably, the power headroom report could include the power headroom of any combination of UE beam(s) within the group. More specifically, a subset of any combination of the UE beam(s) could be configured to be included in the power headroom report. Preferably, the first condition could be that the pathloss of a UE beam within the group has changed more than a threshold. Alternatively or additionally preferably, the first condition could be that the pathloss of a combination of UE beams within the group has changed more than a threshold. Preferably, the power headroom report is not triggered if the pathloss change is due to a change of a UE beam or a set of UE beams. Preferably, a comparison for a pathloss change could be done for the same UE beam or the same set of UE beams. Preferably, the first condition could be checked if at least one UE beam within the group of UE beams is scheduled for transmission. Preferably, the first condition is not checked if none of UE beams within the group of UE beams is scheduled for transmission. Preferably, the first condition could be checked if a specific UE beam or a specific UE beam combination within the group of UE beams is scheduled for transmission. Preferably, the first condition is not checked if a specific UE beam or a specific UE beam combination within the group of UE beams is not scheduled for transmission.

[0167] Preferably, the group of UE beams could be UE beams associated with a TRP or the same TRP. Alternately or additionally preferably, the group of UE beams could be UE beams associated with a TRP beam, the same TRP beam, a base station beam, or the same base station beam. Alternatively or additionally preferably, the group of UE beams could be configured by a base station.

[0168] The per beam and/or per beam combination power headroom is preferably reported from a UE to a base station. For example, the UE calculates power headroom for each beam and/or each beam combination. Preferably, the power headroom of a beam and/or beam combination used to carry the power headroom is calculated based on real transmission power. Preferably, the power headroom of a beam and/or beam combination could be calculated assuming that the same transmission is performed on the beam and/or beam combination, wherein the beam and/or the beam combination is not used to carry (or transmit) the power headroom. Alternatively or additionally preferably, the power headroom of a beam and/or beam combination could be calculated assuming some predefined parameter, wherein the beam and/or the beam combination is not used to carry (or transmit) the power headroom. For example, a virtual power headroom is reported.

[0169] Preferably, the base station could indicate the power headroom of which beam is (to be) reported. Alternatively or additionally preferably, the base station could indicate power headroom of which beam combination is (to be) reported. Alternatively or additionally preferably, the UE could select the power headroom of which beam is reported. More specifically, preferably the UE selects the beam(s) with largest power headroom(s). Preferably, the UE could report the power headroom together with an indicator associated with the selected beam(s). Alternatively or additionally preferably, the UE could select the power headroom of which beam combination is reported. In particular, the UE could select the

Samsung Electronics v. Asus Tech Licensing EX-1003, 479 of 673

beam combination(s) with the largest power headroom(s). Alternatively or additionally preferably, the UE could report the power headroom together with an indicator associated with the selected beam combination(s).

[0170] In any of the above embodiments and preferred feature combinations, the pathloss of a UE beam could be derived from a downlink (DL) signal measured on the UE beam. Preferably, the DL signal could be transmitted on multiple TRP beams or multiple base station beams. More specifically, the multiple TRP beams or the multiple base station beams could be associated with the UE beam.

[0171] In any of the above embodiments and preferred feature combinations, the pathloss of a set of UE beams could be derived from a DL signal measured on the set of UE beams. Preferably, the DL signal could be transmitted on multiple TRP beams or multiple base station beams. More specifically, the multiple TRP beams or the multiple base station beams could be associated with the set of UE beams.

[0172] Preferably, any combination of the following DL signals can be used for pathloss measurement:

- Reference signal for pathloss measurement
- Reference signal for beam management
- Reference signal for channel state information measurement
- Reference signal for mobility management
- Reference signal for demodulation
- Beam reference signal
- Demodulation reference signal for a control channel (e.g. an uplink grant for reporting power headroom)
- Demodulation reference signal for a data channel
- Channel state information reference signal
- Synchronization signal

[0173] FIG. 26 is a flow chart 2600 according to one exemplary embodiment from the perspective of a UE. In step 2605, the UE performs an Uplink (UL) transmission with one or more UE beams. In step 2610, the UE triggers a power headroom report due to a change of a pathloss (value)being larger than a threshold for a specific UE beam or a set of UE beams.

[0174] FIG. 27 is a flow chart 2700 according to one exemplary embodiment from the perspective of a UE. In step 2705, the UE triggers a power headroom report due to a change of a pathloss (value) being larger than a threshold for the pathloss (value) associated with a TRP, a TRP beam, or a set of TRP beams.

[0175] FIG. 28 is a flow chart 2800 according to one exemplary embodiment from the perspective of a UE. In step 2805, the UE uses multiple beams for transmission. In step 2810, the UE triggers a power headroom report due to a change of a pathloss (value) being larger than a threshold, wherein the pathloss (value) is associated with a specific beam or a set of beams. The specific beam could be a specific UE beam or a specific TRP beam. The specific set of beams could be a set of UE beams or a set of TRP beams.

[0176] FIG. 29 is a flow chart 2900 according to another exemplary embodiment from the perspective of a UE. In step 2905, the UE performs an Uplink (UL) transmission with one or more UE beams. In step 2910, the UE determines whether to trigger a power headroom report for a first group of the one or multiple UE beams based on a first condition. In step 2915, the UE determines whether to trigger a power headroom report for a second group of the one or multiple UE beams based on a second condition.

[0177] FIG. 30 is a flow chart 3000 according to another exemplary embodiment from the perspective of a UE. In step 3005, the UE determines whether to trigger a power headroom report for a first group of multiple UE beams based on a first condition. In step 3010, the UE determines whether to trigger a power headroom report for a second group of the multiple UE beams based on a second condition. In step 3015, the UE triggers the power headroom report for the first group if the first condition is fulfilled. In step 3020, the UE triggers the power headroom report for the second group if the second condition is fulfilled.

[0178] Preferably, the UE could perform an uplink transmission with one or more UE beams.

[0179] Preferably, the UE could determine whether the pathloss (value) has changed if a transmission associated with the specific beam or the set of beams is scheduled. Alternatively, the UE could determine whether the pathloss (value) of the specific UE beam or the set of UE beams has changed if the specific UE beam or the set of UE beams is scheduled for transmission. Alternatively, the UE could determine whether the pathloss (value) has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is scheduled.

[0180] Preferably, the UE does not determine whether the pathloss (value) of the specific UE beam or the set of UE beams has changed if the specific beam or the set of beams is not scheduled for transmission. Alternatively or additionally, preferably the UE does not determine whether the pathloss (value) has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is not scheduled.

[0181] Furthermore, the change of the pathloss (value) could be derived from a comparison between a current pathloss (value) for the specific UE beam or the set of UE beams and a previous pathloss (value) for the specific UE beam or

Samsung Electronics v. Asus Tech Licensing EX-1003, 480 of 673

the set of UE beams. Alternatively or additionally, the change of the pathloss (value) could be derived from a comparison between a current pathloss (value) associated with the specific beam or the set of beams and a previous pathloss (value) associated with the specific beam or the set of beams. Alternatively or additionally, the change of the pathloss (value) could be derived from a comparison between a current pathloss (value) associated with the TRP beam, the set of TRP beams, or the TRP and a previous pathloss (value) associated with the TRP beam, the set of TRP beams, or the TRP.

[0182] Furthermore, the change of the pathloss (value) could be derived from a comparison of a same UE beam or a same set of UE beams.

[0183] Furthermore, preferably the power headroom report is not triggered if the pathloss (value) change is due to a change of the UE beam or the set of UE beams. Alternatively or additionally, preferably the power headroom report is triggered if the pathloss (value) change is due to a change of the UE beam or the set of UE beams.

[0184] Furthermore, preferably the UE does not trigger the power headroom report based on a change of the pathloss (value) derived from a comparison between different beams or between different sets of beams.

[0185] Furthermore, preferably a power headroom report would be triggered due to change (or addition or activation) of serving TRP(s), change (or addition or activation) of serving TRP beam(s), change (or addition or activation) of candidate TRP beam(s), or activation (or addition) of a UE beam.

[0186] Furthermore, the power headroom report could include the power headroom for the specific UE beam or the set of UE beams.

[0187] Furthermore, the power headroom report could include the power headroom for a specific UE beam or a set of UE beams.

[0188] Furthermore, the power headroom report could include the power headroom for all UE beams.

[0189] Furthermore, the power headroom report could include the power headroom for any combination of the UE beams within all the UE beams. Also, a subset of combination of UE beams can be configured to report.

[0190] Furthermore, the set of beams could be associated with a TRP or the same TRP. Alternatively or additionally, the set of beams could be associated with a TRP beam, the same TRP beam, a base station beam, or the same base station beam. Alternatively or additionally, the set of beams could be associated with a set of TRP beams or the same set of TRP beams.

[0191] Furthermore, the set of UE beams could be UE beams associated with a TRP or the same TRP. Alternatively or additionally, the set of UE beams could be UE beams associated with a TRP beam, the same TRP beam, a base station beam, or the same base station beam. Alternatively or additionally, the set of UE beams could be UE beams associated with a set of TRP beams or the same set of TRP beams.

[0192] Furthermore, the set of UE beams could be configured by a base station.

[0193] Furthermore, the power headroom for the specific UE beam could be derived based on a UE power status of a transmission on the specific UE beam. Additionally, the power headroom for the specific UE beam could be the difference between a UE calculated transmission power for the specific UE beam and a maximum transmission power on the specific UE beam.

[0194] Furthermore, the power headroom for the set of UE beams could be derived from or based on a UE power status of a transmission on the set of UE beams. Additionally, the power headroom for the set of UE beams could be the difference between a UE calculated transmission power for the set of UE beams and a maximum transmission power on the set of UE beams.

[0195] Furthermore, power control could be per UE, per beam, per beam group, per beam set, or per beam combination.

[0196] Furthermore, the first group of UE beams could be a subset of UE beams that can be generated by the UE.

[0197] Furthermore, the power headroom report could include the power headroom of each UE beam within the first or second group. Alternatively and/or additionally, the power headroom report could include the power headroom of any combination of UE beams within the first or second group. Additionally, a subset of the any combination of UE beams could be configured to be included in the power headroom report.

[0198] Furthermore, the first condition could be that a pathloss (value) of a UE beam within the first group or a combination of UE beams within the first group has changed more than a threshold.

[0199] Furthermore, the second condition could be that a pathloss (value) of a UE beam within the second group or a combination of UE beams within the second group has changed more than a threshold.

[0200] Furthermore, the first condition could be checked if at least one UE beam within the first group is scheduled for transmission.

[0201] Furthermore, preferably the first condition is not checked if none of UE beam within the first group is scheduled for transmission.

[0202] Furthermore, the first condition could be checked if a specific UE beam or a specific UE beam combination within the first group is scheduled for transmission.

[0203] Furthermore, preferably the first condition is not checked if a specific UE beam or a specific UE beam combination within the first group is not scheduled for transmission.

[0204] Furthermore, the first group could be UE beams associated with a TRP, the same TRP, a TRP beam, the same

Samsung Electronics v. Asus Tech Licensing EX-1003, 481 of 673

TRP beam, a base station beam, or the same base station beam.

[0205] Furthermore, the first group (and the second group) could be configured by a base station.

[0206] Referring back to FIGS. 3 and 4, in one embodiment, the device 300 includes a program code 312 stored in memory 310. The CPU 308 could execute program code 312 to enable the UE (i) to perform an UL transmission with one or multiple UE beams; and (ii) to trigger a power headroom report due to a change of a pathloss (value) being larger than a threshold for a specific UE beam or a set of UE beams.

[0207] In another embodiment, the CPU 308 could execute program code 312 to enable the UE to trigger a power headroom report due to a change of a pathloss (value), associated with a TRP beam, a set of TRP beams, or a TRP, being larger than a threshold.

[0208] In another embodiment, the CPU 308 could execute program code 312 to enable the UE (i) to use multiple beams for transmission; and (ii) to trigger a power headroom report due to a change of a pathloss (value) being larger than a threshold, wherein the pathloss (value) is associated with a specific beam or a set of beams.

[0209] In another embodiment, the CPU 308 could execute program code 312 to enable the UE (i) to perform an Uplink (UL) transmission with one or more UE beams; (ii) to determine whether to trigger a power headroom report for a first group of the one or multiple UE beams based on a first condition; and (iii) to determine whether to trigger a power headroom report for a second group of the one or multiple UE beams based on a second condition.

[0210] In another embodiment, the CPU 308 could execute program code 312 to enable the UE (i) to determine whether to trigger a power headroom report for a first group of multiple UE beams based on a first condition; (ii) to determine whether to trigger a power headroom report for a second group of the multiple UE beams based on a second condition; (iii) to trigger the power headroom report for the first group if the first condition is fulfilled; and (iv) to trigger the power headroom report for the second group if the second condition is fulfilled.

[0211] Furthermore, in all these embodiments or independently therefrom, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or other methods described herein.

[0212] Based on the various embodiments disclosed herein, the real power status on the UE side is reported with a proper overhead.

[0213] Various aspects of the disclosure have been described above. It should be apparent that the teachings herein may be embodied in a wide variety of forms and that any specific structure, function, or both being disclosed herein is merely representative. Based on the teachings herein one skilled in the art should appreciate that an aspect disclosed herein may be implemented independently of any other aspects and that two or more of these aspects may be combined in various ways. For example, an apparatus may be implemented or a method may be practiced using any number of the aspects set forth herein. In addition, such an apparatus may be implemented or such a method may be practiced using other structure, functionality, or structure and functionality in addition to or other than one or more of the aspects set forth herein. As an example of some of the above concepts, in some aspects concurrent channels may be established based on pulse repetition frequencies. In some aspects concurrent channels may be established based on pulse position or offsets. In some aspects concurrent channels may be established based on time hopping sequences.

[0214] Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0215] Those of skill would further appreciate that the various illustrative logical blocks, modules, processors, means, circuits, and algorithm steps described in connection with the aspects disclosed herein may be implemented as electronic hardware (e.g., a digital implementation, an analog implementation, or a combination of the two, which may be designed using source coding or some other technique), various forms of program or design code incorporating instructions (which may be referred to herein, for convenience, as "software" or a "software module"), or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

[0216] In addition, the various illustrative logical blocks, modules, and circuits described in connection with the aspects disclosed herein may be implemented within or performed by an integrated circuit ("IC"), an access terminal, or an access point. The IC may comprise a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, electrical components, optical components, mechanical components, or any combination thereof designed to perform the functions described herein, and may execute codes or instructions that reside within the IC, outside of the IC, or both. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor,

a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0217] It is understood that any specific order or hierarchy of steps in any disclosed process is an example of a sample approach. Based upon design preferences, it is understood that the specific order or hierarchy of steps in the processes may be rearranged while remaining within the scope of the present disclosure. The accompanying method claims present elements of the various steps in a sample order, and are not meant to be limited to the specific order or hierarchy presented.

[0218] The steps of a method or algorithm described in connection with the aspects disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module (e.g., including executable instructions and related data) and other data may reside in a data memory such as RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, a hard disk, a removable disk, a CD-ROM, or any other form of computer-readable storage medium known in the art. A sample storage medium may be coupled to a machine such as, for example, a computer/processor (which may be referred to herein, for convenience, as a "processor") such the processor can read information (e.g., code) from and write information to the storage medium. A sample storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in user equipment. In the alternative, the processor and the storage medium may reside as discrete components in user equipment. Moreover, in some aspects any suitable computer-program product may comprise a computer-readable medium comprising codes relating to one or more of the aspects of the disclosure. In some aspects a computer program product may comprise packaging materials.

[0219] While the invention has been described in connection with various aspects, it will be understood that the invention is capable of further modifications. This application is intended to cover any variations, uses or adaptation of the invention following, in general, the principles of the invention, and including such departures from the present disclosure as come within the known and customary practice within the art to which the invention pertains.

Claims

1. A method for a user equipment, in the following also referred to as UE, the method comprising:

   using multiple beams for transmission (2805); and
   triggering, by the UE, a power headroom report due to a change of a pathloss being larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams (2810).

2. The method of claim 1, further comprising:

   determining, by the UE, whether the pathloss has changed if a transmission associated with the specific beam or the set of beams is scheduled.

3. The method of claim 1 or 2, wherein the specific beam is a specific UE beam or a specific transmission/reception point, in the following also referred to as TRP, beam.

4. The method of any one of claims 1 to 3, wherein the set of beams is a set of UE beams or a set of TRP beams.

5. The method of any one of claims 1 to 4, wherein the set of beams is associated with a same TRP beam, a same set of TRP beams, or a same TRP.

6. The method of any one of claims 1 to 5, wherein the change of pathloss is derived from a comparison of a same UE beam or a same set of UE beams.

7. The method of any one of claims 1 to 6, wherein a change of the pathloss is derived from a comparison between a current pathloss value, associated with the specific beam or the set of beams, and a previous pathloss value, associated with the specific beam or the set of beams.

8. The method of any one of claims 1 to 7, wherein the pathloss is derived from a downlink signal measured on the specific beam or measured on the set of beams.

9. A method for a user equipment, in the following also referred to as UE, the method comprising:

   determining, by the UE, whether to trigger a power headroom report for a first group of multiple UE beams

based on a first condition (3005);
determining, by the UE, whether to trigger a power headroom report for a second group of the multiple UE beams based on a second condition (3010);
triggering, by the UE, the power headroom report for the first group if the first condition is fulfilled (3015); and
triggering, by the UE, the power headroom report for the second group if the second condition is fulfilled (3020).

10. The method of claim 9, wherein the first condition is a pathloss having changed more than a threshold for a UE beam within the first group or a combination of UE beams within the first group.

11. The method of claim 9 or 10, wherein the second condition is a pathloss having changed more than a threshold for a UE beam within the second group or a combination of UE beams within the second group.

12. The method of any one of claims 9 to 11, wherein the first group and the second group are configured by a base station.

13. AUser Equipment, in the following also referred to as UE, comprising:

a control circuit (306);
a processor (308) installed in the control circuit (306); and
a memory (310) installed in the control circuit (306) and coupled to the processor (308);
wherein the processor (308) is configured to execute a program code (312) stored in the memory (310) to perform the method steps as defined in any one of the preceding claims.

Samsung Electronics v. Asus Tech Licensing EX-1003, 484 of 673

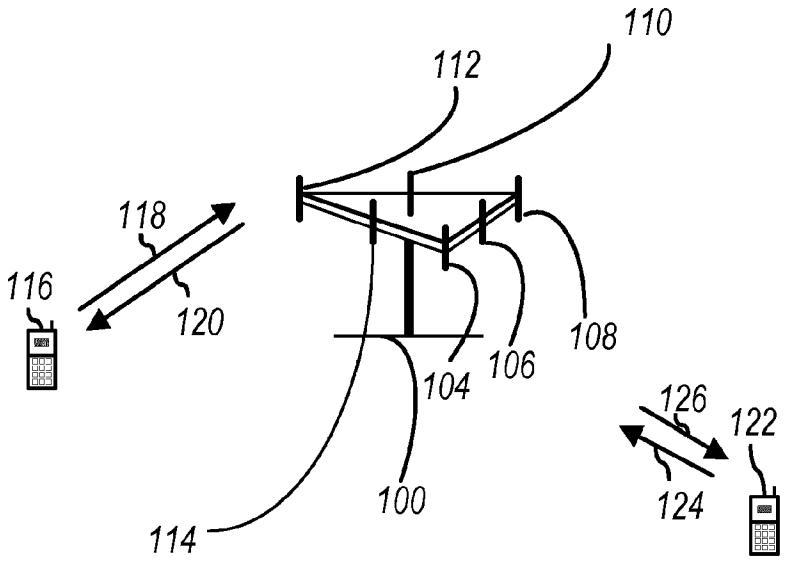


FIG. 1

Samsung Electronics v. Asus Tech Licensing EX-1003, 485 of 673

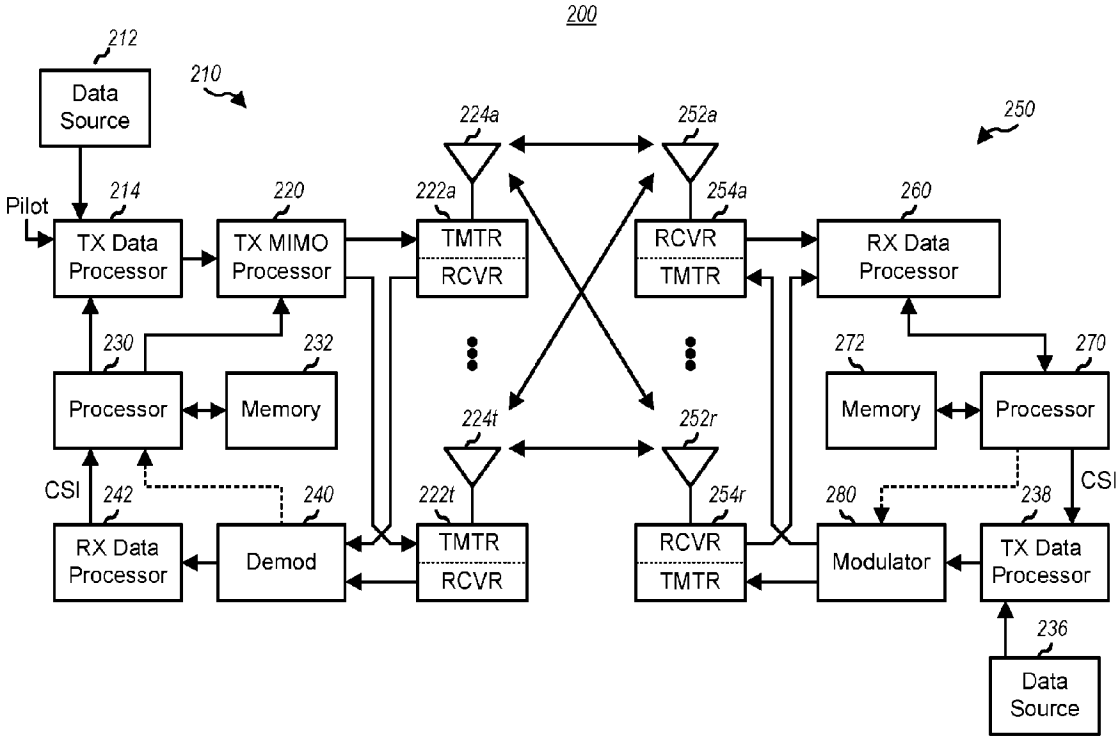

200
212
210
Data Source
224a
252a
250
Pilot
214
220
222a
254a
260
TX Data Processor
TX MIMO Processor
TMTR
RCVR
RCVR
TMTR
RX Data Processor
230
232
272
270
Processor
Memory
Memory
Processor
224t
252r
CSI
242
240
222t
254r
280
238
CSI
RX Data Processor
Demod
TMTR
RCVR
RCVR
TMTR
Modulator
TX Data Processor
236
Data Source

FIG. 2

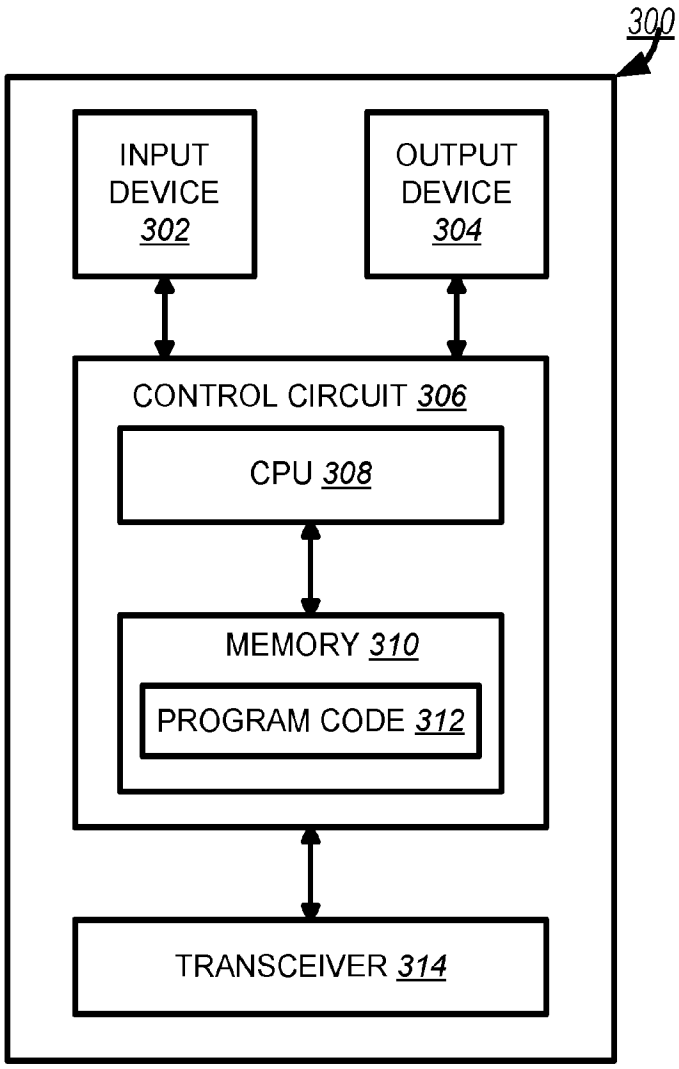


FIG. 3

Samsung Electronics v. Asus Tech Licensing EX-1003, 487 of 673

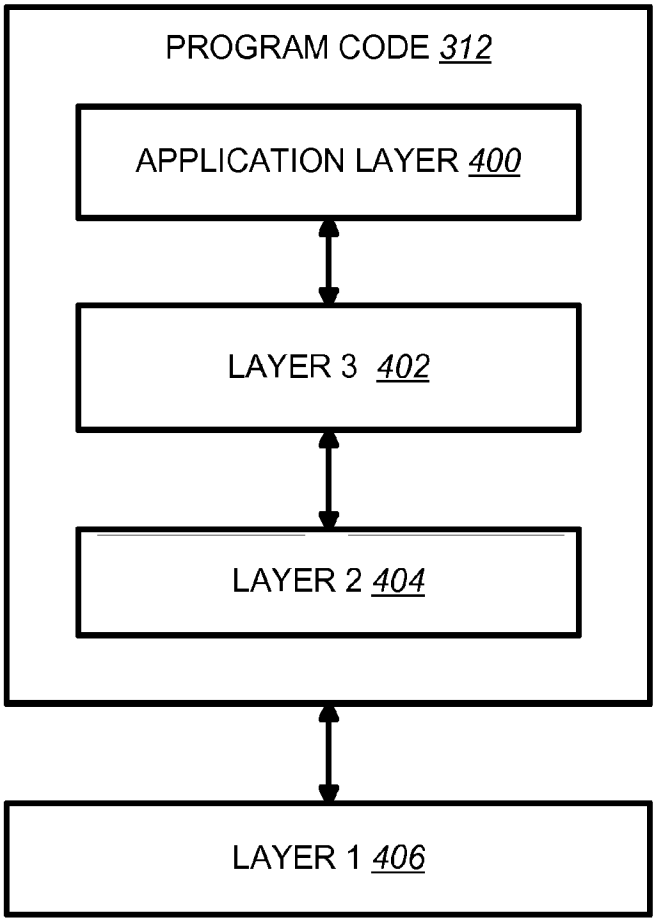


FIG. 4

Samsung Electronics v. Asus Tech Licensing EX-1003, 488 of 673

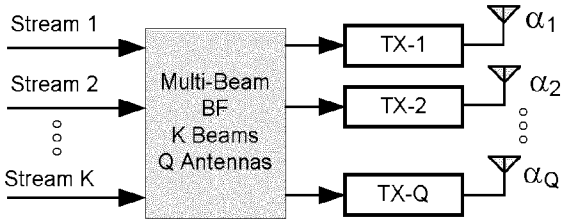


FIG. 5A

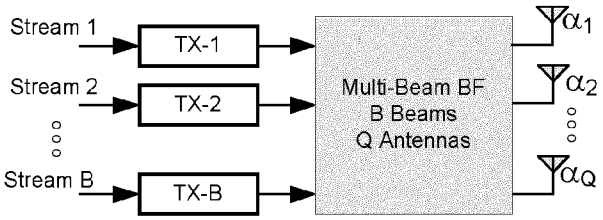


FIG. 5B

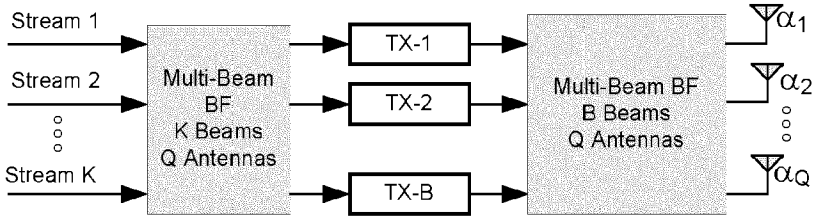


FIG. 5C

Samsung Electronics v. Asus Tech Licensing EX-1003, 489 of 673

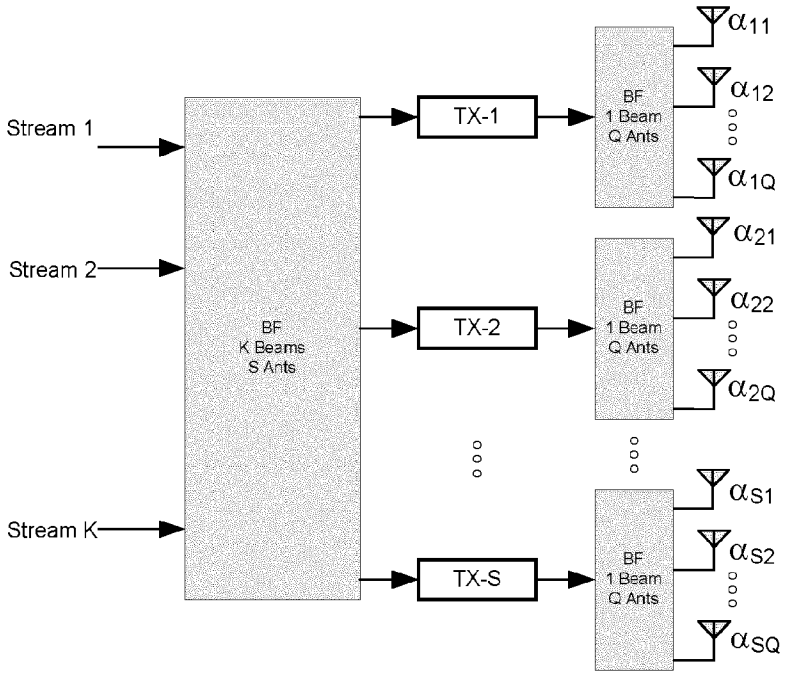


FIG. 5D

Samsung Electronics v. Asus Tech Licensing EX-1003, 490 of 673

TDD UL/DL Configuration	subframe number *i*									
	0	1	2	3	4	5	6	7	8	9
0	-	-	6	7	4	-	-	6	7	4
1	-	-	6	4	-	-	-	6	4	-
2	-	-	4	-	-	-	-	4	-	-
3	-	-	4	4	4	-	-	-	-	-
4	-	-	4	4	-	-	-	-	-	-
5	-	-	4	-	-	-	-	-	-	-
6	-	-	7	7	5	-	-	7	7	-

FIG. 6

Samsung Electronics v. Asus Tech Licensing EX-1003, 491 of 673

TPC Command Field in DCI format 0/3/4/6-0A	Accumulated $\delta_{PUSCH,c}$ [dB]	Absolute $\delta_{PUSCH,c}$ [dB] only DCI format 0/4/6-0A
0	-1	-4
1	0	-1
2	1	1
3	3	4

FIG. 7

TPC Command Field in DCI format 3A	Accumulated $\delta_{PUSCH,c}$ [dB]
0	-1
1	1

FIG. 8

Samsung Electronics v. Asus Tech Licensing EX-1003, 492 of 673

TPC Command Field in DCI format 1A/1B/1D/1/2A/2B/2C/2D/2/3	δ_{PUCCH} [dB]
0	-1
1	0
2	1
3	3

FIG. 9

TPC Command Field in DCI format 3A	δ_{PUCCH} [dB]
0	-1
1	1

FIG. 10

Samsung Electronics v. Asus Tech Licensing EX-1003, 493 of 673

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	±2		
2					23	±2[2]		
3					23	±2[2]		
4					23	±2		
5					23	±2		
6					23	±2		
7					23	±2[2]		
8					23	±2[2]		
9					23	±2		
10					23	±2		
11					23	±2		
12					23	±2[2]		
13					23	±2		
14	31	+2/-3			23	±2		
17					23	±2		
18					23	±2[5]		
19					23	±2		
20					23	±2[2]		
21					23	±2		
22					23	+2/-3.5[2]		
23					23[6]	±2[6]		
24					23	±2		
25					23	±2[2]		
26					23	±2[2]		
27					23	±2		
28					23	+2/-2.5		
30					23	±2		
31					23	±2		
…								
33					23	±2		
34					23	±2		
35					23	±2		

FIG. 11A

Samsung Electronics v. Asus Tech Licensing EX-1003, 494 of 673

36					23	±2		
37					23	±2		
38					23	±2		
39					23	±2		
40					23	±2		
41					23	±2[2]		
42					23	+2/-3		
43					23	+2/-3		
44					23	+2/[-3]		
45					23	±2		
…								
47					23	±2		
65					23	±2		
66					23	±2		
68					23	±2		
…								
70					23	±2		

1. NOTE 1: Void
2. NOTE 2: [2] refers to the transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB
3. NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.
4. NOTE 4: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance
5. NOTE 5: For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and 818 MHz.
6. NOTE 6: When NS_20 is signalled, the total output power within 2000-2005 MHz shall be limited to 7 dBm.

FIG. 11B

Samsung Electronics v. Asus Tech Licensing EX-1003, 495 of 673

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3

FIG. 12

Samsung Electronics v. Asus Tech Licensing EX-1003, 496 of 673

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	N/A
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36, 66, 70	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2, 6.6.3.3.19	41	5, 10, 15, 20	Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50 (NOTE1)	≤ 1 (NOTE1)
			15, 20	Table 6.2.4-18 (NOTE2)	
		65 (NOTE 3)	10,15,20	≥ 50	≤ 1 (NOTE 1)
			15,20	Table 6.2.4-18 (NOTE 2)	
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	N/A
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	
NS_11	6.6.2.2.1 6.6.3.3.13	23	1.4, 3, 5, 10, 15, 20	Table 6.2.4-5	

FIG. 13A

Samsung Electronics v. Asus Tech Licensing EX-1003, 497 of 673

NS_12	6.6.3.3.5	26	1.4, 3, 5, 10, 15	Table 6.2.4-6	
NS_13	6.6.3.3.6	26	5	Table 6.2.4-7	
NS_14	6.6.3.3.7	26	10, 15	Table 6.2.4-8	
NS_15	6.6.3.3.8	26	1.4, 3, 5, 10, 15	Table 6.2.4-9 Table 6.2.4-10	
NS_16	6.6.3.3.9	27	3, 5, 10	Table 6.2.4-11, Table 6.2.4-12, Table 6.2.4-13	
NS_17	6.6.3.3.10	28	5, 10	Table 5.6-1	N/A
NS_18	6.6.3.3.11	28	5	≥ 2	≤ 1
			10, 15, 20	≥ 1	≤ 4
NS_19	6.6.3.3.12	44	10, 15, 20	Table 6.2.4-14	
NS_20	6.2.2 6.6.2.2.1 6.6.3.3.14	23	5, 10, 15, 20	Table 6.2.4-15	
NS_21	6.6.2.2.1 6.6.3.3.15	30	5, 10	Table 6.2.4-16	
NS_22	6.6.3.3.16	42, 43	5, 10, 15, 20	Table 6.2.4-17	
NS_23	6.6.3.3.17	42, 43	5, 10, 15, 20	N/A	
NS_24	6.6.3.3.20	65 (NOTE 4)	5, 10, 15, 20	Table 6.2.4-19	
NS_25	6.6.3.3.21	65 (NOTE 4)	5, 10, 15, 20	Table 6.2.4-20	
NS_26	6.6.3.3.22	68	5, 10, 15	Table 6.2.4-21	
...					
NS_32	-	-	-	-	-

1. NOTE 1Applicable when the lower edge of the assigned E-UTRA UL channel bandwidth freq NOTE2 as the emissions requirement in 6.6.3.3.1 may not be met. For 10MHz channel bandwidth whose carrier frequency is larger than or equal to 1945 MHz or 15 MHz channel bandwidth whose carrier frequency is larger than or equal to 1947.5 MHz, no A-MPR applies.
2. NOTE 2 Applicable when carrier frequency is 1932.5 MHz for 15MHz channel bandwidth or 1930 MHz for 20MHz channel bandwidth case.
3. NOTE 3: Applicable when the E-UTRA carrier is within 1920-1980 MHz.
4. NOTE 4: Applicable when the upper edge of the channel bandwidth frequency is greater than 1980MHz.

FIG. 13B

Samsung Electronics v. Asus Tech Licensing EX-1003, 498 of 673

$P_{CMAX,c}$ (dBm)	Tolerance $T(P_{CMAX,c})$ (dB)
$23 < P_{CMAX,c} \leq 33$	2.0
$21 \leq P_{CMAX,c} \leq 23$	2.0
$20 \leq P_{CMAX,c} < 21$	2.5
$19 \leq P_{CMAX,c} < 20$	3.5
$18 \leq P_{CMAX,c} < 19$	4.0
$13 \leq P_{CMAX,c} < 18$	5.0
$8 \leq P_{CMAX,c} < 13$	6.0
$-40 \leq P_{CMAX,c} < 8$	7.0

FIG. 14

Samsung Electronics v. Asus Tech Licensing EX-1003, 499 of 673

$P_{CMAX,c}$ (dBm)	Tolerance $T(P_{CMAX,c})$ (dB)
$P_{CMAX,c} = 20$	2.0
$19 \leq P_{CMAX,c} < 20$	3.5
$18 \leq P_{CMAX,c} < 19$	4.0
$13 \leq P_{CMAX,c} < 18$	5.0
$8 \leq P_{CMAX,c} < 13$	6.0
$-40 \leq P_{CMAX,c} < 8$	7.0

FIG. 15

Samsung Electronics v. Asus Tech Licensing EX-1003, 500 of 673

P_{CMAX} (dBm)	Tolerance $T_{LOW}(P_{CMAX})$ (dB)	Tolerance $T_{HIGH}(P_{CMAX})$ (dB)
$P_{CMAX} = 23$	3.0	2.0
$22 \leq P_{CMAX} < 23$	5.0	2.0
$21 \leq P_{CMAX} < 22$	5.0	3.0
$20 \leq P_{CMAX} < 21$	6.0	4.0
$16 \leq P_{CMAX} < 20$	5.0	
$11 \leq P_{CMAc} < 16$	6.0	
$-40 \leq P_{CMAX} < 11$	7.0	

FIG. 16

Samsung Electronics v. Asus Tech Licensing EX-1003, 501 of 673

P_{CMAX} (dBm)	Tolerance $T_{LOW}(P_{CMAX})$ (dB)	Tolerance $T_{HIGH}(P_{CMAX})$ (dB)
$21 \leq P_{CMAX} \leq 23$	2.0	
$20 \leq P_{CMAX} < 21$	2.5	
$19 \leq P_{CMAX} < 20$	3.5	
$18 \leq P_{CMAX} < 19$	4.0	
$13 \leq P_{CMAX} < 18$	5.0	
$8 \leq P_{CMAX} < 13$	6.0	
$-40 \leq P_{CMAX} < 8$	7.0	

FIG. 17

Samsung Electronics v. Asus Tech Licensing EX-1003, 502 of 673

$P_{CMAX,c}$ (dBm)	Tolerance $T_{LOW}(P_{CMAX\_L,c})$ (dB)	Tolerance $T_{HIGH}(P_{CMAX\_H,c})$ (dB)
$P_{CMAX,c}$ =23	3.0	2.0
22 ≤ $P_{CMAX,c}$ < 23	5.0	2.0
21 ≤ $P_{CMAX,c}$ < 22	5.0	3.0
20 ≤ $P_{CMAX,c}$ < 21	6.0	4.0
16 ≤ $P_{CMAX,c}$ < 20	5.0	
11 ≤ $P_{CMAX,c}$ < 16	6.0	
-40 ≤ $P_{CMAX,c}$ < 11	7.0	

FIG. 18

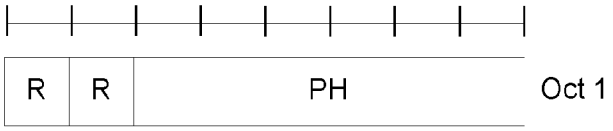


FIG. 19

Samsung Electronics v. Asus Tech Licensing EX-1003, 503 of 673

PH	Power Headroom Level
0	POWER_HEADROOM_0
1	POWER_HEADROOM_1
2	POWER_HEADROOM_2
3	POWER_HEADROOM_3
…	…
60	POWER_HEADROOM_60
61	POWER_HEADROOM_61
62	POWER_HEADROOM_62
63	POWER_HEADROOM_63

FIG. 20

Samsung Electronics v. Asus Tech Licensing EX-1003, 504 of 673

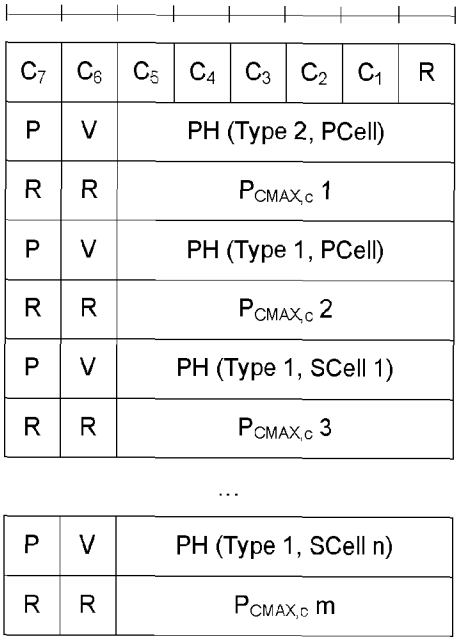
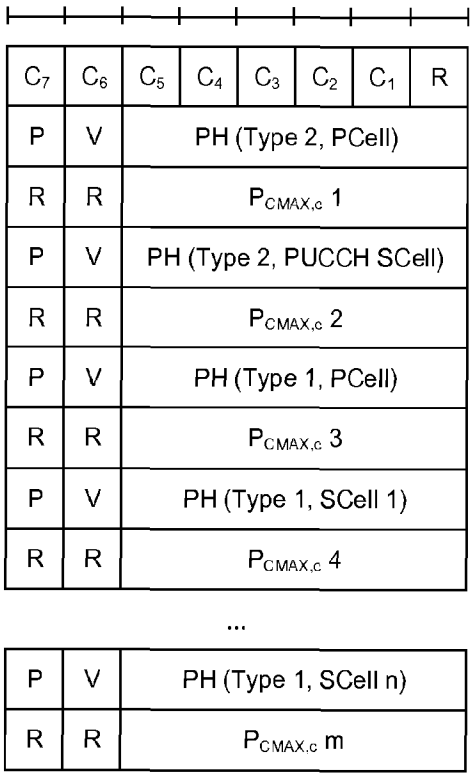


FIG. 21

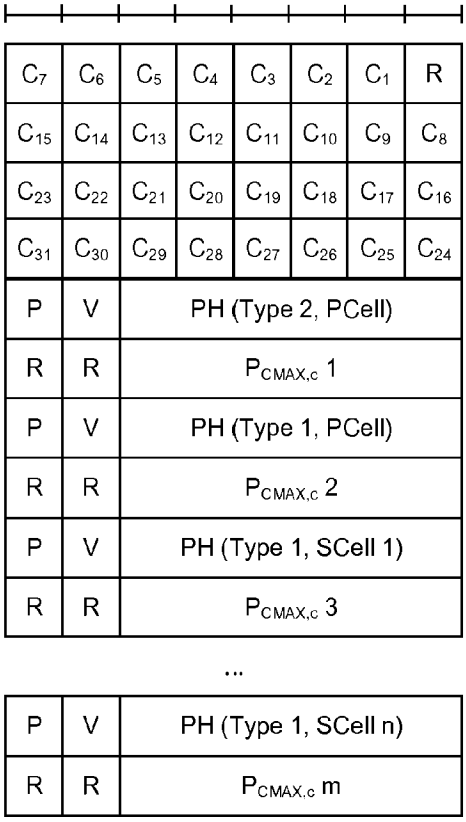
Samsung Electronics v. Asus Tech Licensing EX-1003, 505 of 673



C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 2, PUCCH SCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 3					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 4					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ m					

FIG. 22

Samsung Electronics v. Asus Tech Licensing EX-1003, 506 of 673



C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 3					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ m					

FIG. 23

Samsung Electronics v. Asus Tech Licensing EX-1003, 507 of 673

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 2, PUCCH SCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 3					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 4					
...							
P	V	PH (Type 1, SCell n)					
R	R	$P_{CMAX,c}$ m					

FIG. 24

Samsung Electronics v. Asus Tech Licensing EX-1003, 508 of 673

$P_{CMAX,c}$	Nominal UE transmit power level
0	PCMAX_C_00
1	PCMAX_C_01
2	PCMAX_C_02
...	...
61	PCMAX_C_61
62	PCMAX_C_62
63	PCMAX_C_63

FIG. 25

Samsung Electronics v. Asus Tech Licensing EX-1003, 509 of 673

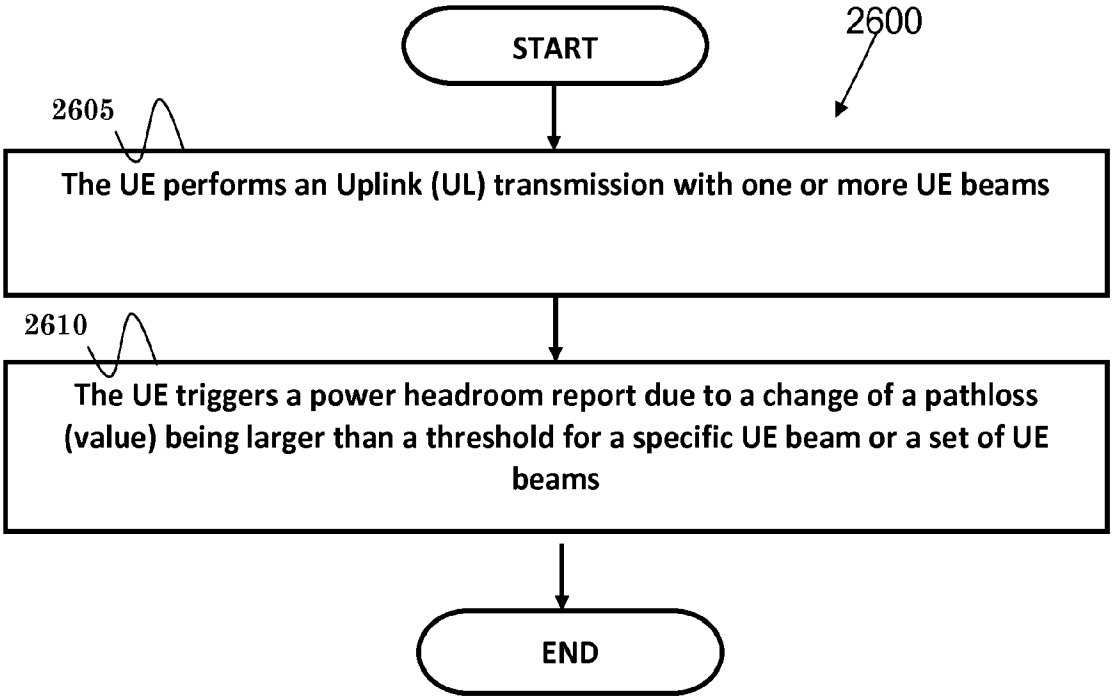


FIG. 26

Samsung Electronics v. Asus Tech Licensing EX-1003, 510 of 673

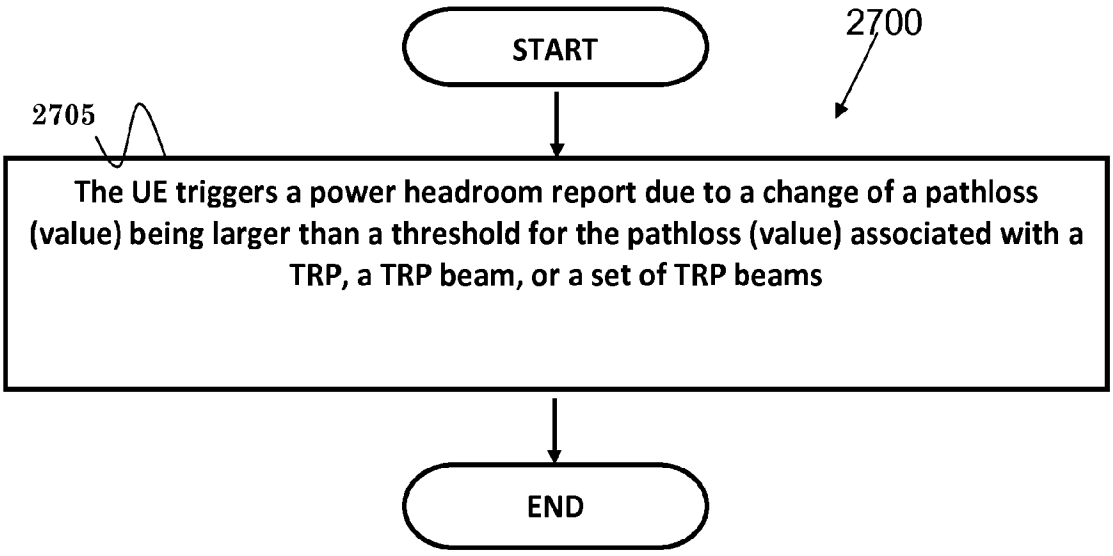


FIG. 27

Samsung Electronics v. Asus Tech Licensing EX-1003, 511 of 673

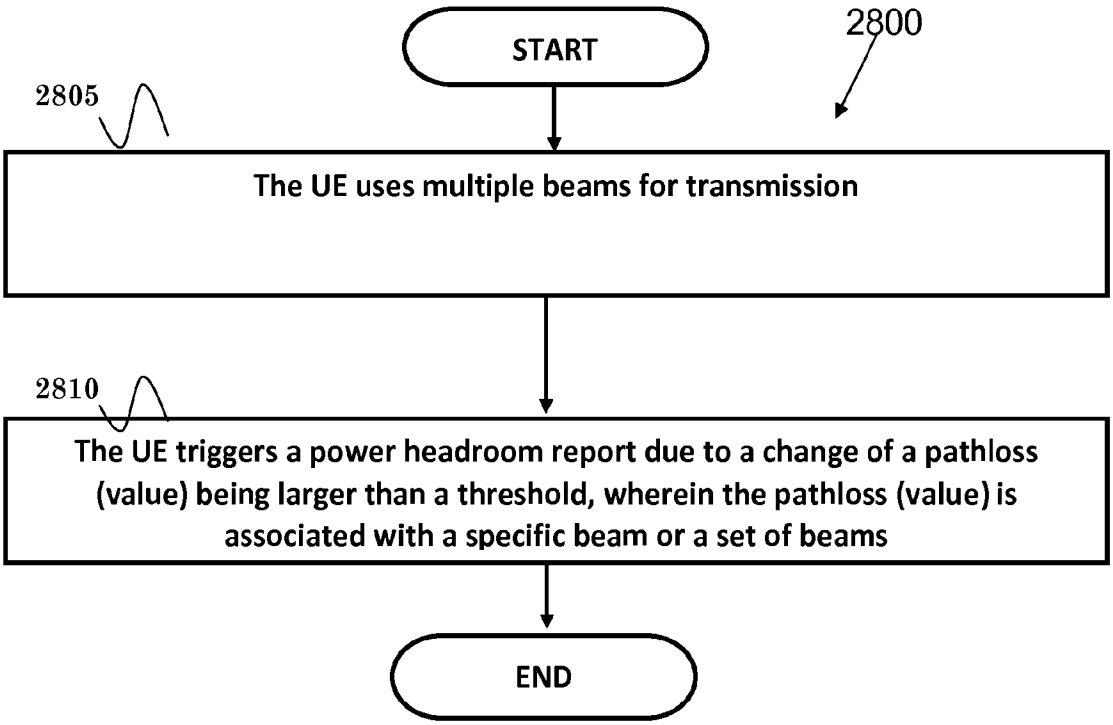


FIG. 28

Samsung Electronics v. Asus Tech Licensing EX-1003, 512 of 673

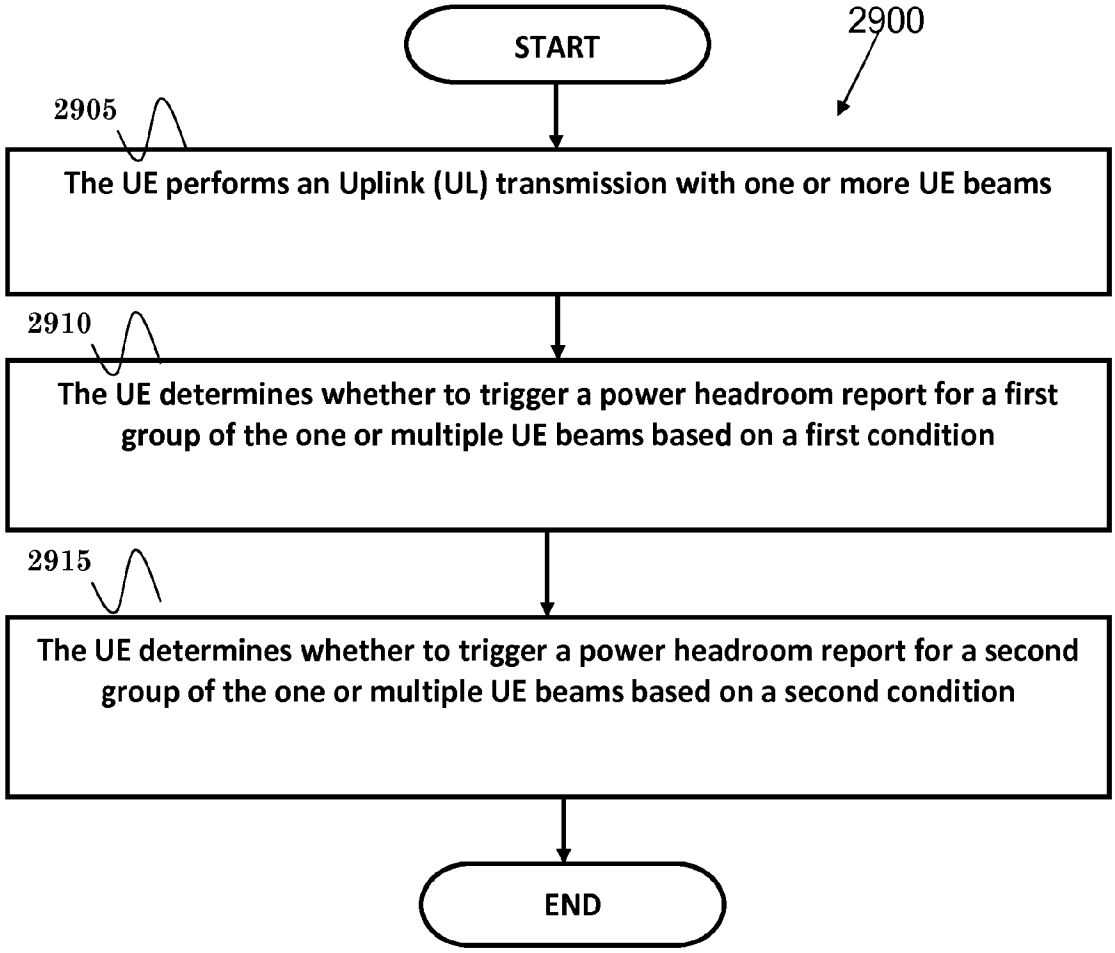


FIG. 29

Samsung Electronics v. Asus Tech Licensing EX-1003, 513 of 673

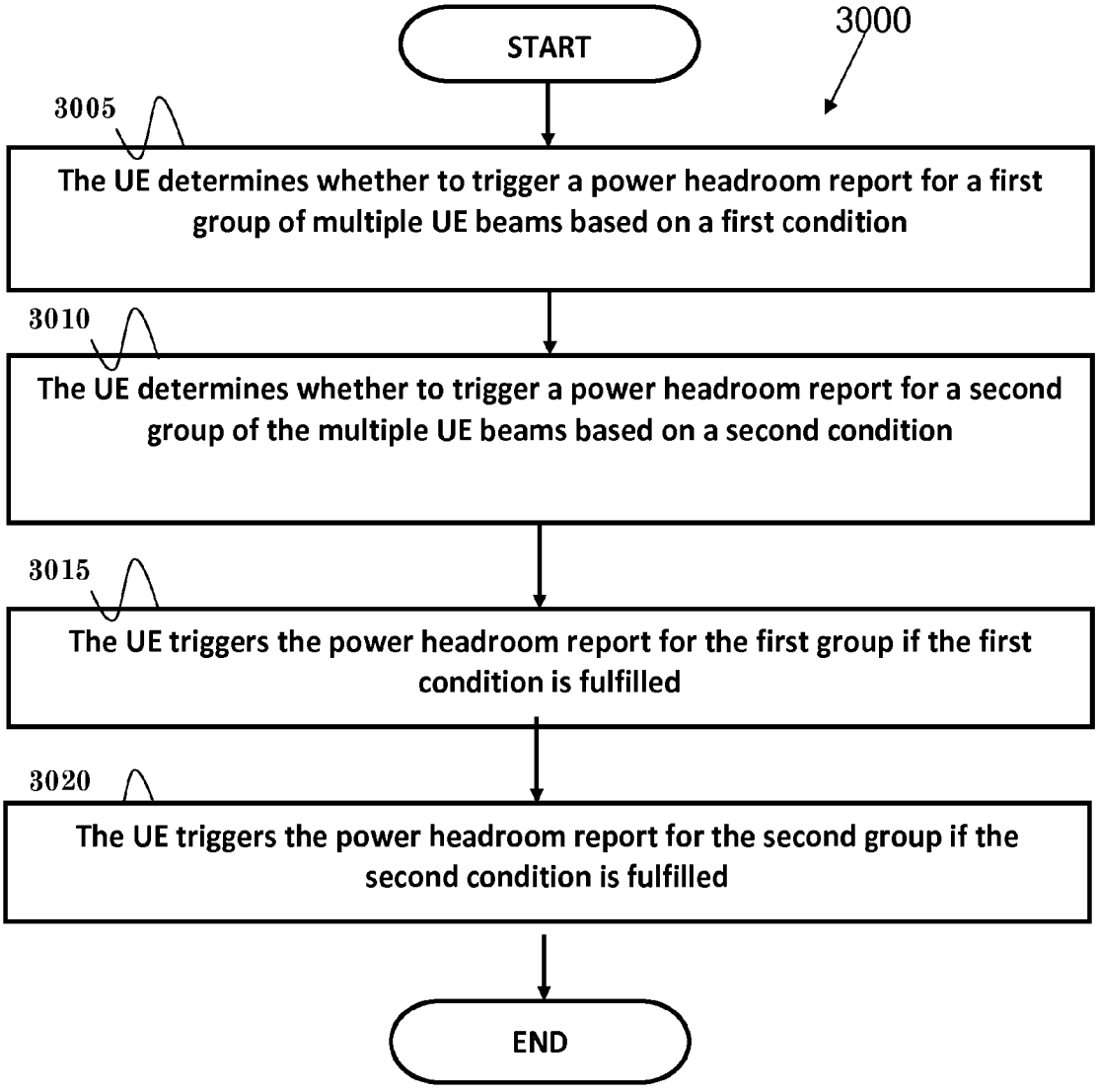


FIG. 30

Samsung Electronics v. Asus Tech Licensing EX-1003, 514 of 673

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(54) METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR BEAM OPERATION IN A WIRELESS COMMUNICATION SYSTEM

(57) Methods and apparatuses for triggering a power headroom report for beam operation in a wireless communication system are disclosed herein. In one method, a user equipment (UE) uses multiple beams for transmission (2805). The UE triggers a power headroom report due to a change of a pathloss being larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams (2810).

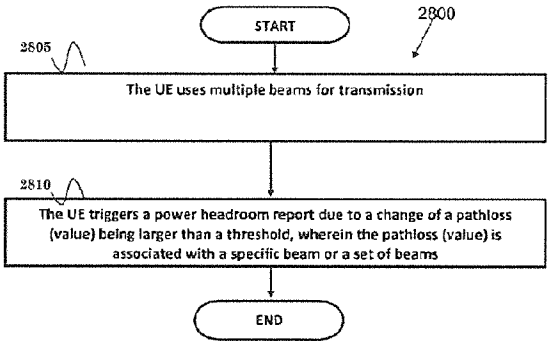


FIG. 28

Printed by Jouve, 75001 PARIS (FR)

EP 3 319 376 A3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 20 0507

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2014/116928 A1 (INTERDIGITAL PATENT HOLDINGS [US]) 31 July 2014 (2014-07-31) * paragraphs [0004], [0093] - [0099], [0111] - [0112], [0185] - [0191] *	1-8,13	INV. H04W52/36
X	US 2010/272046 A1 (GUO YU-HSUAN [TW]) 28 October 2010 (2010-10-28) * paragraphs [0011] - [0014] *	1-8,13	
X	US 2015/282150 A1 (NIGAM ANSHUMAN [IN] ET AL) 1 October 2015 (2015-10-01) * paragraphs [0004], [0039] - [0050] *	1-8,13	

TECHNICAL FIELDS SEARCHED (IPC)
H04W

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	9 February 2018	Lustrini, Donato

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ISDOCID: <EP 3319376A3 I >
Samsung Electronics v. Asus Tech Licensing
EX-1003, 516 of 673

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 17 20 0507

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-8, 13

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

BNSDOCID: <EP_____3319376A3_I_>
Samsung Electronics v. Asus Tech Licensing EX-1003, 517 of 673

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 17 20 0507

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-8, 13

A method for a user equipment, in the following also referred to as UE, the method comprising:
using multiple beams for transmission; and
triggering, by the UE, a power headroom report due to a change of a pathloss being larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams.

---

2. claims: 9-13

A method for a user equipment, in the following also referred to as UE, the method comprising:
determining, by the UE, whether to trigger a power headroom report for a first group of multiple UE beams based on a first condition;
determining, by the UE, whether to trigger a power headroom report for a second group of the multiple UE beams based on a second condition;
triggering, by the UE, the power headroom report for the first group if the first condition is fulfilled; and
triggering, by the UE, the power headroom report for the second group if the second condition is fulfilled.

ISDOCID: <EP 3319376A3 I >
Samsung Electronics v. Asus Tech Licensing
EX-1003, 518 of 673

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 0507

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-02-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014116928 A1	31-07-2014	CN 104956606 A	30-09-2015
		EP 2949055 A1	02-12-2015
		TW 201445896 A	01-12-2014
		US 2015382205 A1	31-12-2015
		US 2017359734 A1	14-12-2017
		WO 2014116928 A1	31-07-2014
US 2010272046 A1	28-10-2010	TW 201039665 A	01-11-2010
		US 2010272046 A1	28-10-2010
US 2015282150 A1	01-10-2015	KR 20150111323 A	05-10-2015
		US 2015282150 A1	01-10-2015

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

BNSDOCID: <EP 3319376A3 | >
Samsung Electronics v. Asus Tech Licensing EX-1003, 519 of 673

Electronic Acknowledgement Receipt

EFS ID:	37285772
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	106622
Filer:	Sang N. Dang/Sandy Kim
Filer Authorized By:	Sang N. Dang
Attorney Docket Number:	1426-343.101
Receipt Date:	26-SEP-2019
Filing Date:	26-APR-2019
Time Stamp:	13:52:30
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)	1426-343-101--IDSasfiled09262019.pdf	56278 9f021fd7f35a2cd004f367df6e10d671cbc45371	no	2

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Foreign Reference	EP3319376.pdf	5969723 5cea6f6ddc5d85acf84faa5d01b0104985baf3c0	no	72
Warnings:					
Information:					
3	Non Patent Literature	R2-1804289.pdf	512444 cb6066182bb75cf5eefeb9e426f9b8e0b838db7c	no	3
Warnings:					
Information:					
4	Non Patent Literature	R2-1801043.pdf	757639 8eb1da9aab355e92e2b814c5fb408143f47d4f15	no	4
Warnings:					
Information:					
5	Non Patent Literature	R2-1806917.pdf	1239001 5b3a06e7d3cab46333de4396d4d22765fcd0cb7f	no	8
Warnings:					
Information:					
6	Non Patent Literature	NPL-EPSearchReport.pdf	2326656 cb20460174239f5607e4b585eef135cbefecc9db	no	10
Warnings:					
Information:					
			Total Files Size (in bytes):	10861741	

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

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/395,760

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	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 460 =	0.00
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	1720

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	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/395,760	04/26/2019		1720	1426-343.101	20	3

CONFIRMATION NO. 4258

106622
Blue Capital Law Firm, P.C.
650 Town Center Drive, Suite 1530
Costa Mesa, CA 92626

FILING RECEIPT

OC000000108038802

Date Mailed: 05/10/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

Ko-Chiang Lin, Taipei City, TAIWAN;
Yu-Hsuan Guo, Taipei City, TAIWAN;
Ming-Che Li, Taipei City, TAIWAN;
Hsin-Hsi Tsai, Taipei City, TAIWAN;

Applicant(s)

ASUSTek Computer Inc., Taipei City, TAIWAN;

Power of Attorney: The patent practitioners associated with Customer Number 106622

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/669,461 05/10/2018

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 05/09/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/395,760**

Projected Publication Date: 11/14/2019

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
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Application Number	Not Yet Assigned
Filing Date	April 26, 2019
First Named Inventor	Ko-Chiang Lin
Title	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
Art Unit	Not Yet Assigned
Examiner Name	Not Yet Assigned
Attorney Docket Number	1426-343.101

SIGNATURE of Applicant or Patent Practitioner

Signature	/Sang N. Dang/	Date (Optional)	April 26, 2019
Name	Sang N. Dang	Registration Number	51186
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 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.**

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 106622

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

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OR

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I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	MING-HSIU HSU	Date (Optional)	Aug. 26, 2015
Name	MING-HSIU HSU		
Title	Director of ASUSTek Computer Inc.		

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	
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Art Unit	
Examiner Name	
Attorney Docket Number	1426-343.001

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
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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	20100273515		2010-10-28	Jean-Aicard Fabien	

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FOREIGN PATENT DOCUMENTS

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	1	2012145974	WO		2012-11-01	LIU YANG et al.		☐

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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)**		
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	Art Unit	
	Examiner Name	
	Attorney Docket Number	1426-343.001

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Ko-Chiang Lin; Yu-Hsuan Guo; Ming-Che Li; Hsin-Hsi Tsai	
Title:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	
Serial No.:	TBD	Filed: Herewith
Examiner:	TBD	Group Art Unit: TBD
Attorney Docket No.:	1426-343.101 (1070170-US)	

CERTIFICATE OF EFS-WEB TRANSMISSION
UNDER 37 CFR § 1.8

I hereby certify that the enclosed 1 Page Utility Transmittal; 1 Page Fee Transmittal; 8 Page Application Data Sheet; 69 Page Specification; 27 Page Drawings; 4 Page executed Declaration; 2 Page Power of Attorney; and 2 Page Information Disclosure Statement by Applicant with 1 reference are being transmitted to the United States Patent and Trademark Office via EFS-Web on April 26, 2019.

Date: April 26, 2019 /Sandy Kim/
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Bibliographic data: WO2012145974 (A1) — 2012-11-01

METHOD AND DEVICE FOR TRIGGERING POWER HEADROOM REPORT

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Abstract of WO2012145974 (A1)

The present invention provides a method and device for triggering a power headroom report. The method comprises: upon expiring of a power headroom report timer, a user equipment, according to user equipment power management influence, triggering the user equipment to submit a power headroom report. The user equipment power management influence is a power variation caused by the user equipment power management. In the present invention, the user equipment power headroom report is triggered according to the user equipment power management influence, which solves the problem in the prior art that the power headroom report is inaccurate, so that a base station side can perform correct power adjustment according to the reported power headroom, thereby achieving the effect of reducing the overheads of the power adjustment.



图 1 /Fig. 1

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(81) 指定国 (除另有指明，要求每一种可提供的国家保护)：AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW。

[见续页]

(54) Title: METHOD AND DEVICE FOR TRIGGERING POWER HEADROOM REPORT

(54) 发明名称 :功率余量报告触发方法及装置

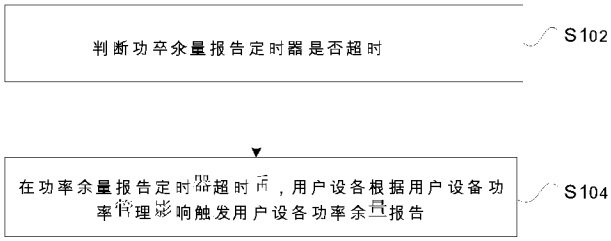


图 1 /Fig.1

S102 DETERMINATION OF WHETHER A POWER HEADROOM REPORT TIMER EXPIRES
S104 UPON EXPIRING OF THE POWER HEADROOM REPORT TIMER, A USER EQUIPMENT, ACCORDING TO USER EQUIPMENT POWER MANAGEMENT INFLUENCE, TRIGGERS REPORT OF USER EQUIPMENT POWER HEADROOM

(57) Abstract: The present invention provides a method and device for triggering a power headroom report. The method comprises: upon expiring of a power headroom report timer, a user equipment, according to user equipment power management influence, triggering the user equipment to submit a power headroom report. The user equipment power management influence is a power variation caused by the user equipment power management. In the present invention, the user equipment power headroom report is triggered according to the user equipment power management influence, which solves the problem in the prior art that the power headroom report is inaccurate, so that a base station side can perform correct power adjustment according to the reported power headroom, thereby achieving the effect of reducing the overheads of the power adjustment.

(57) 摘要：本发明提供了一种功率余量报告触发方法及装置，该方法包括：在功率余量报告定时器超时后，用户设备根据用户设备功率管理影响触发用户设备上报功率余量报告；其中，用户设备功率管理影响为用户设备功率管理所造成的功率变化值。在本发明中，根据用户设备功率管理影响来触发用户设备功率余量报告，解决了现有技术中功率余量报告不准确的问题，使得基站侧能够根据上报的功率余量作出正确的功率调整，进而达到了节省功率调整开销的效果。

WO 2012/145974 A1

(84) 指定国(除另有指明，要求每一种可提供的地区保护)：ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), 政亚(AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ¾洲(AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)。

本国际公布：

- 包括国际检索报告(条约第21条(3))。

功率余量报告触发方法及装置

技术领域

本发明涉及通信领域，具体而言，涉及一种功率余量报告触发方法及装置。

背景技术

目前，无线通信系统使用电磁波与固定的或者移动的无线通信用户设备 (例如，无线电话或附有无线通信卡的笔记本、电脑等设备均可被称为用户设备) 进行通信。一般来说，在进行无线通信时，用户设备 (User Equipment, 简称 UE) 位于系统的无线覆盖范围之内，并通过无线通信信道与系统进行通信。具体的，无线通信信道将电磁波频率分成多个载波频率 ,一个载波频率或多个载波频率可以构成一个无线服务区。用户设备可以通过一个或多个载波同系统中的其他设备 (例如控制网元或其他用户设备) 联系。

无线通信系统的控制网元可以根据系统约定的通信协议/技术控制其他设备。控制网元包括控制站和网络。控制站包括但不限于基站 (Base Station, 简称 BS) 、中继站 (Relay Station, 简称 RS) 和用户设备，当用户设备用做控制站时，该用户设备可以是根据预定规则在用户设备中挑选的作为临时的控制站。通信协议/技术包括但不限于 GSM (Global System for Mobile Communications, 全球移动通信系统)、CDMA (Code Division Multiple Access, 码分多址)、EDGE (Enhanced Data Rate for GSM Evolution, 增强型数据速率 GSM 演进技术)、CDMA2000 、TD-SCDMA(Time Division-Synchronous Code Division Multiple Access, 时分同步码分多址)、HSPA (High Speed Packet Access, 高速分组接入)、WCDMA (Wideband Code Division Multiple Access, 宽带码分多址)、EVDO (Evolution Data Only, 仅演进数据)、HSOPA (High Speed OFDM Packet Access, 高速正交频分复用分组接入)、WiMAX (World Interoperability for Microwave Access, 微波存取全球互通)、LTE (Long Term Evolution, 长期演进)和 LTE- A (LTE- Advanced, 长期演进 - 高级)。

无线通信系统可以通过基站利用指定的无线信道在一定地理范围内提供无线覆盖，这个地理范围称为小区。通常，从理论上来说，基站应该位于小区的中央。按照基站覆盖范围的大小 ,基站可以分成宏 (Macro) 基站、微 (Pico) 基站和微微 (Femto) 基站。在 LTE/LTE-A 系统中，基站也称为增强 B 节点 (eNodeB), 微微基站也称为家庭基站或者家庭增强 B 节点 (Home eNodeB, 简称 HeNodeB) 。

Samsung Electronics v. Asus Tech Licensing EX-1003, 537 of 673

此外，为了扩展覆盖或者扩展容量，一个或多个中继站可以放置在用户设备和基站之间。对于用户设备来说，中继站就相当于一个基站。或者，在用户设备数量极多的网络中，用户设备也可以自行组成 ad hoc 网络 (或者称为 cluster)，由 ad hoc 网络中的某个用户设备作为临时控制站，协助系统进行管理，临时控制站可以接受原有控制站控制，管理下属的用户设备。

LTE 的上行功率控制的主要过程为：

(1) UE 接收到 TPC (transmitting power control, 功率控制命令)；

(2) UE (用户设备)进行下行无线信道导频接收功率的测量，计算路径损耗 Pathless, UE 以 Pathloss 、上行共享信道带宽、传输块格式和 TPC 等参数计算发射功率 P；如果用户设备触发了 PHR (power headroom report, 功率余量报告)，并满足发送条件，那么 UE 还需要在上行共享信道上发送 PHR 。

(3) eNodeB (演进型基站)收到物理上行共享信道和/或 PHR 后，通过 DCI Format 0/3/3A 的物理下行控制信道向 UE 发送 TPC；返回执行步骤 (1)。

系统中 UE 采用动态的资源分配方式，并且采用自适应的信道编码调制方式 (adaptive modulation and coding, AMC)，LTE UE 上行发射功率与资源分配、编码调制方式相关，因此单独的功率控制方式还不足以完成 LTE UE 的功率控制任务，通过 UE 向 eNodeB 发送的 PHR 作为 PUSCH 的资源预算信息，为 eNodeB 进行上行链路资源分配提供依据。如果 PHR 反映出 UE 有较大的功率余量，那么 eNodeB 可以分配较多的无线资源块给 UE; 如果 PHR 反映出 UE 已经没有功率余量，或者没有较多的功率余量，那么 eNodeB 只能分配较少的无线资源块或者低阶调制命令给 UE。

LTE 系统中 UE 向 eNodeB 的 PHR 发送频率低于 eNodeB 向 UE 的 TPC 发送频率。PHR 的发送需要有两个步骤：首先是触发，然后是上报。UE 在周期 PHR 定时器到期时或者路损变化较大或者 PHR 配置/重配置时触发 PHR 上报，当 UE 获得了足够用于 PHR 的 PUSCH 资源后，UE 向 eNodeB 上报 PHR 。

PHR 的计算为 $PH(i) = P_{CMAX} - P_{ue,fx}$，$P_{CMAX}$ 为 UE 配置最大发射功率 (configured maximum output power)，PCMAX_L ≤PCMAX<PCMAX_H, PCMAX 的取值范围主要有 2 种受限因素：1) 受限于 eNodeB 的控制，比如在微基站的小覆盖场景，eNodeB 会控制 UE 的最大发射功率，以减少 UE 对邻区的干扰；2) UE 的无用带外辐射 (Out of band emission)，如为了满足 SEM (Spectmm emission mask, 频谱发射屏蔽)和 ACLR (Adjacent Channel Leakage Ratio，邻带泄露比)等要求，UE 可以设计负责的滤波器，

Samsung Electronics v. Asus Tech Licensing EX-1003, 538 of 673

用来减少带外辐射，或者 UE 降低最大发射功率，前者会增加 UE 的成本，后者降低了UE 的上行能力。由于降低发射功率 (也称为功率回退，power reduce, PR) 的方法简单有效，大量 UE 在实现时会采用该方法来达到带外辐射的要求。不过为了保证 UE 的上行发送能力，不允许 UE 无限制的降低功率，以至于不能进行基本的上行业务，协议中定义允许的 MPR (Maximum Power Reduction, 最大功率回退值)，由于带外辐射的大小跟发送数据的调制解调配置，以及占用的带宽都有关系，如 LTE 在协议 36. 101 中，按不同的发送带宽和调制解调模式设置了不同的 MPR，如下表 1 所示：各 UE 可以按自身的实现设置实际的 PR 值，只要满足 PR≤MPR 即可。

表 1

Modulation（调制方式）	Channel bandwidth / Transmission bandwidth configuration (RB)（信道带宽/传输带宽）						MPR (dB)
	1.4 MHz	3.0 MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

所以考虑到功率回退后，UE 在额定的发射功率 Ppowerclass 的基础上减去实际的功率回退值，并且还需要考虑上述的网络允许的最大发射功率后，取两者中的最小值为实际的 PCMAX。$P_{ue,tx}$ 为 UE 上行理论发射功率。在 LTE 中，PHR 中只考虑 PUSCH 的发射功率，所以 $P_{ue,tx} = P_{ue,pusch}$，$P_{ue,sch}$ 在 LTE 中为 PUSCH 的发射功率，定义为 $P_{ue,pusch} = 10\log_{10}(M_{PUSCH}(i)) + P_{O\_PUSCH}(t) + \alpha(t) \cdot PL + \Delta_{TF}(i) + f(i)$，其中的 $M_{PUSCH}(i)$ 为 PUSCH 的发送带宽由调度的 MCS (Modulation and Coding Scheme, 调制编码格式)配置决定、$P_{O\_PUSCH}(t)$ 为开环功控调整值、$\alpha(t)$ 为部分路损补偿值、t 为半静态变量、化 为路损、$\Delta_{TF}(i)$ 为传输格式补偿值、$f(i)$ 为闭环功控调整值，即 PUSCH 的发射功率跟 PUSCH 的占用资源的带宽，UE 和基站间的路损以及开环功控和闭环功控的配置相关。所以 PHR 计算公式为 $PH(i) = P_{CMAX} - \{ 10\log_{10}(M_{PUSCH}(i)) + P_{O\_PUSCH}(t) + \alpha(t) \cdot PL + \Delta_{TF}(i) + f(i) \}$。

PHR 的以 dB 为单位，公式中功率以 dBm 为单位。

在 LTE 中，PHR 上报的触发 (trigger) 主要有以下三种情况：

1) PHR 禁止定时器 (prohibitPHR-Timer) 超时，并且路损相对于上一次 PHR 上报的变化量大于预定门限值 dl-PathlossChange (单位是分贝 dB) 时；

2) PHR 周期定时器 (periodicPHR-Timer) 超时;

3) PHR 功能实体的配置或重配置;

当 PHR 被触发后，当 UE 有上行调度资源可以容纳 PHR 时，UE 将 PHR 发送给 eNB。

随着通信技术的发展，由于用户设备功率管理造成的 P_{CMAX} 变化也需要考虑到 PHR 的计算中。具体的，这种功率调整的要求来源可以是区域吸收率要求(regional SAR, Specific Absorption Rate), SAR requirement 场景包括用户设备靠近人体时功率需要下调或者双发射机工作时之前工作的发射机功率需要调整等。

由于用户设备功率管理造成 P_{CMAX} 变化，相应的，有可能造成 PH 变化，这种新情况下，eNodeB 和用户设备如何进行功率余量的评估，用户设备如何进行 PHR 上报，都是亟需解决的问题。

对于上述所存在的问题，目前有技术认为，应该单独设置一个触发条件，PHR 禁止定时器 (prohibitPHR-Timer) 超时，并且用户设备功率管理值相对于上一次 PHR 上报的变化量大于 dl-PathlossChange 时就需要触发 PHR。

这样做的问题是：由于上报变化量的门限和现有路损变化量门限一样，但是功率管理值的变化实际上和路损变化无关，因此触发的 PHR 很容易造成虚报或者漏报，从而导致功率调整上的资源浪费或者估计错误。

此外，对于 SAR 场景中的功率变化量变化如果过于频繁，可能会造成相关的 PHR 上报太多，由于 PHR 的调整需要时间，太频繁的 PHR 不仅不能达到迅速功率调整的目的，而且会浪费用于功率调整的开销的资源。

发明内容

本发明的主要目的在于提供一种功率余量报告触发方法及装置，以至少解决上述现有技术中的功率余量报告不准确的问题。

根据本发明的一个方面，提供了一种功率余量报告触发方法，包括：在功率余量报告定时器超时后，用户设备根据用户设备功率管理影响触发用户设备的功率余量报告；其中，用户设备功率管理影响为用户设备功率管理造成的功率变化量。

Samsung Electronics v. Asus Tech Licensing EX-1003, 540 of 673

优选地，用户设备功率管理造成的功率变化量为：当前时刻相对于上一次上报虚拟功率余量报告时刻，所发生的由于功率管理导致的功率变化量。

优选地，用户设备功率管理造成的功率变化量为：当前时刻相对于上一次上报非虚拟功率余量报告时刻，所发生的由于功率管理导致的功率变化量。

优选地，根据用户设备功率管理影响触发用户设备的功率余量报告之前，还包括：对用户设备功率管理影响进行滤波处理。

优选地，滤波处理为层三滤波处理或者用触发时刻 TTT 的方法进行滤波处理。

优选地，用户设备根据用户设备功率管理影响触发用户设备的功率余量报告，包括：判断用户设备功率管理影响是否大于预定门限值，其中，预定门限值不等于下行路损变化门限值；如果是，则触发用户设备的功率余量报告。

优选地，预定门限值小于下行路损变化门限值。

优选地，功率余量报告定时器的超时时间不等于功率余量报告禁止定时器 prohibitPHR-Timer 的超时时间。

优选地，功率余量报告定时器为功率余量报告禁止定时器 prohibitPHR-Timer 。

根据本发明的另一方面，提供了一种功率余量报告触发装置，包括：功率余量报告定时器；触发模块，设置为在功率余量报告定时器超时后，根据用户设备功率管理影响和路损影响触发用户设备上报功率余量报告。

优选地，功率余量报告触发还包括：滤波模块，设置为对用户设备功率管理影响进行滤波处理。

优选地，触发模块包括：判断子模块，设置为判断用户设备功率管理影响是否大于预定门限值，其中，预定门限值不等于下行路损变化门限值；触发子模块，设置为在用户设备功率管理影响大于预定门限值的情况下，触发用户设备的功率余量报告。

在本发明中，根据用户设备功率管理影响来触发用户设备功率余量报告，解决了现有技术中功率余量报告不准确的问题，使得基站侧能够根据上报的功率余量作出正确的功率调整，进而达到了节省功率调整开销的效果。

Samsung Electronics v. Asus Tech Licensing EX-1003, 541 of 673

附图说明

此处所说明的附图用来提供对本发明的进一步理解，构成本申请的一部分，本发明的示意性实施例及其说明用于解释本发明，并不构成对本发明的不当限定。在附图中：

图 1 是根据本发明实施例一的功率余量报告触发方法流程图；

图 2 是根据本发明实施例二的功率余量报告触发方法流程图；

图 3 是根据本发明实施例三的功率余量报告触发方法流程图；

图 4 是根据本发明实施例四的功率余量报告触发装置结构框图；

图 5 是根据本发明实施例五的功率余量报告触发装置结构框图。

具体实施方式

下文中将参考附图并结合实施例来详细说明本发明。需要说明的是，在不冲突的情况下，本申请中的实施例及实施例中的特征可以相互组合。

实施例一

图 1 是根据本发明实施例一的功率余量报告触发方法流程图，如图 1 所示，包括以下步骤：

步骤 S102，判断功率余量报告定时器超时是否超时。

步骤 S104，在功率余量报告定时器超时后，用户设备根据用户设备功率管理影响触发用户设备上报功率余量报告；其中，用户设备功率管理影响为用户设备功率管理所造成的功率变化值；

在实施例一中，根据用户设备功率管理影响来触发用户设备功率余量报告，解决了现有技术中功率余量报告不准确的问题，使得基站侧能够根据上报的功率余量作出正确的功率调整，进而达到了节省功率调整开销的效果。

其中，步骤 S102 中的功率余量报告定时器可以是现有技术中的定时器，例如 PHR 禁止定时器（prohibitPHR-Timer），也可以是和现有技术不同的定时器，定时器设置的超时时间小于等于 prohibitPHR-Timer 超时时间。

Samsung Electronics v. Asus Tech Licensing EX-1003, 542 of 673

其中，在步骤 S104 中，可以对瞬间的用户设备功率管理影响加上滤波，过滤掉频繁变化的用户设备功率影响。用户设备功率管理影响为用户设备功率管理造成的功率变化量，例如，受限于 P-MPR 的功率回退量，或者就是 P-MPR 的变化量。

其中，步骤 S104 中的预定门限值为不同于现有下行路损变化门限值 dlPathlossChange 的门限值。该门限值可以独立于下行路损变化门限值设置，也可以和下行路损变化门限值相关，例如，该门限为 dlPathlossChange 减去或加上一个偏移值。

其中，触发用户设备功率余量报告完成后，重新启动功率余量报告定时器。

实施例二

图 2 是根据本发明实施例二的功率余量报告触发方法流程图，如图 2 所示，包括以下步骤：

步骤 S202, 启动功率余量报告定时器。

步骤 S204, 判断功率余量定时器是否超时。

步骤 S206, 如果功率余量报告的定时器超时，进一步判断用户设备功率管理影响是否大于预定门限值。

步骤 S208, 如果是，则触发用户设备功率余量报告并且重新启动功率余量报告定时器。

其中，用户设备功率管理影响为用户设备功率管理造成的功率变化量，例如，受限于 P-MPR 的功率回退量，或者就是 P-MPR 的变化量。

其中，功率余量报告的定时器可以是现有技术中的 PHR 禁止定时器 (prohibitPHR-Timer)。在本发明的另一实施例中，定时器是与现有技术不同的定时器，定时器的超时时间小于同时期的 PHR 禁止定时器。

其中，预定门限值不同于现有技术中的下行路损变化门限值 (例如 dl-PathlossChange)。在本实施例中，可以设定该预定门限值为现有技术中的预定门限的相对值。例如，现有下行路损变化门限值加上一个预定负值或正值参数值或者现有下行路损变化门限值乘以一个小于或大于 1 的参数或者直接设定一个比现有下行路损变化门限值小或大的独立的门限值。

实施例三

图 3 是根据本发明实施例三的功率余量报告触发方法流程图，如图 3 所示，实施例三与实施例二的步骤基本相同，区别仅在于：在触发功率余量上报前增加了对于功率变化量的滤波步骤，即步骤 S306, 以过滤掉频繁变化的用户设备功率影响。

其中，滤波的方法可以是采用现有的技术，例如 L3 滤波方式，按一定周期采样瞬间的用户设备功率管理值功率变化量，如 20ms。计算公式为：P-MPR_L=a*P-MPR_L_old+(1-a) *P-MPR_new ，其中 a<l ，P-MPR_new 为新采样瞬间的用户设备功率管理值，P-MPR——L 为滤波后的用户设备功率管理值，P-MPR_L_old 为本次采样前用户设备功率管理值。或者是用触发时刻 (time to trigger, TTT) 的方法进行滤波，即在原有的触发机制上再加一个指定的时段 TTT，功率变化量变化超过预定门限时，TTT 开始启动。如果所述条件持续了一个 TTT 周期，用户设备进行 PHR。特别的对于功率变化量上升超过预定门限时，可以不使用上述滤波。

实施例四

图 4 是根据本发明实施例四的功率余量报告触发装置结构框图。如图 4 所示，该装置包括：功率余量报告定时器 20 和触发模块 30。功率余量报告定时器 20 和触发模块 30 相连接。

其中，触发模块 30，设置为在功率余量报告定时器超时后，根据用户设备功率管理影响触发用户设备上报功率余量报告。

在实施例四中，通过在触发用户设备功率余量报告时考虑用户设备功率管理影响的门限，从而解决了现有技术中功率余量报告不准确的问题，使得基站侧能够根据上报的功率余量作出正确的功率调整，进而达到了节省功率调整开销的效果。

其中，上述功率余量报告触发装置还可包括：滤波模块 40，设置为对用户设备功率管理影响进行滤波处理。功率余量报告定时器 20 也可采用现有的功率余量报告禁止定时器 prohibitPHR-Timer 。

实施例五

图 5 是根据本发明实施例五的功率余量报告触发装置结构框图。如图 5 所示，该装置除包括实施例四中的各功能模块外，触发模块 30 进一步包括：判断子模块 301 和触发子模块 302。

Samsung Electronics v. Asus Tech Licensing EX-1003, 544 of 673

其中，判断子模块 301，设置为判断用户设备功率管理影响是否大于预定门限值，其中，所述预定门限值大于或小于下行路损变化门限值。触发子模块 302，设置为在用户设备功率管理影响大于预定门限值的情况下，触发用户设备的功率余量报告。

实施例六

本实施的处理流程与实施例一相同，即：在功率余量报告定时器超时后，用户设备根据功率管理影响触发用户设备上报功率余量报告；其中，用户设备功率管理影响为用户设备功率管理造成的功率变化值。

其中，预定门限值为不同于现有下行路损变化门限值 dlPathlossChange 的新门限值。新门限值可以独立于所述下行路损变化门限值设置，也可以和所述下行路损变化门限值相关，如新门限为 dlPathlossChange 减去或加上一个偏移值。

其中，触发用户设备功率余量报告完成后，重新启动功率余量报告定时器。

在上述实施例中，用户设备功率管理影响为当前时刻相对于之前上报虚拟功率余量时刻，实际发生的由于功率管理导致的功率变化值。即当在载波聚合场景时，在 n 时刻上报的功率余量是虚拟时，P-MPR 被人为设定为 0，在 n'时刻，仍然使用实际的 n 时刻实际发生的 P-MPR 判断 n 到 n'的变化。或者用户设备功率管理影响为当前时刻相对于之前上报非虚拟功率余量时刻 (有 P-MPR 并且不被人为设定为 0 时)实际发生的由于功率管理导致的功率变化值。

在本发明的上述各实施例中，为了满足用户设备功率管理带来的功率控制要求，根据用户设备功率管理影响来触发用户设备功率余量报告，解决了现有技术中功率余量报告不准确的问题，使得基站侧能够根据上报的功率余量作出正确的功率调整，进而达到了节省功率调整开销的效果。

显然，本领域的技术人员应该明白，上述的本发明的各模块或各步骤可以用通用的计算装置来实现，它们可以集中在单个的计算装置上，或者分布在多个计算装置所组成的网络上，可选地，它们可以用计算装置可执行的程序代码来实现，从而，可以将它们存储在存储装置中由计算装置来执行，并且在某些情况下，可以以不同于此处的顺序执行所示出或描述的步骤，或者将它们分别制作成各个集成电路模块，或者将它们中的多个模块或步骤制作成单个集成电路模块来实现。这样，本发明不限制于任何特定的硬件和软件结合。

Samsung Electronics v. Asus Tech Licensing EX-1003, 545 of 673

以上所述仅为本发明的优选实施例而已，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保护范围之内。

Samsung Electronics v. Asus Tech Licensing EX-1003, 546 of 673

权 利 要 求 书

1. 一种功率余量报告触发方法，包括：

在功率余量报告定时器超时后，用户设备根据用户设备功率管理影响触发所述用户设备的功率余量报告；

其中，所述用户设备功率管理影响为所述用户设备功率管理造成的功率变化量。

2. 根据权利要求 1 所述的方法，其中，所述用户设备功率管理造成的功率变化量为：

当前时刻相对于上一次上报虚拟功率余量报告时刻，所发生的由于功率管理导致的功率变化量。

3. 根据权利要求 1 所述的方法，其中，所述用户设备功率管理造成的功率变化量为：

当前时刻相对于上一次上报非虚拟功率余量报告时刻，所发生的由于功率管理导致的功率变化量。

4. 根据权利要求 1 所述的方法，其中，根据用户设备功率管理影响触发所述用户设备的功率余量报告之前，还包括：

对所述用户设备功率管理影响进行滤波处理。

5. 根据权利要求 4 所述的方法，其中，所述滤波处理为层三滤波处理或者用触发时刻 TTT 的方法进行滤波处理。

6. 根据权利要求 1 至 5 任一项所述的方法，其中，用户设备根据用户设备功率管理影响触发所述用户设备的功率余量报告，包括：

判断所述用户设备功率管理影响是否大于预定门限值；

如果是，则触发所述用户设备的功率余量报告。

7. 根据权利要求 6 所述的方法，其中，所述预定门限值等于下行路损变化门限值。

8. 根据权利要求 6 所述的方法，其中，所述预定门限值大于或小于下行路损变化门限值。

9. 根据权利要求 6 所述的方法，其中，所述功率余量报告定时器的超时时间不等于功率余量报告禁止定时器 prohibitPHR-Timer 的超时时间。

10. 根据权利要求 6 所述的方法，其中，所述功率余量报告定时器为功率余量报告禁止定时器 prohibitPHR-Timer 。

11. 一种功率余量报告触发装置，包括：

功率余量报告定时器；

触发模块，设置为在所述功率余量报告定时器超时后，根据用户设备功率管理影响和路损影响触发用户设备上报功率余量报告。

12. 根据权利要求 11 所述的装置，其中，还包括：

滤波模块，设置为对用户设备功率管理影响进行滤波处理。

13. 根据权利要求 11 或 12 所述的装置，其中，所述触发模块包括：

判断子模块，设置为判断所述用户设备功率管理影响是否大于预定门限值；

触发子模块，设置为在所述用户设备功率管理影响大于所述预定门限值的情况下，触发所述用户设备的功率余量报告。

Samsung Electronics v. Asus Tech Licensing EX-1003, 548 of 673

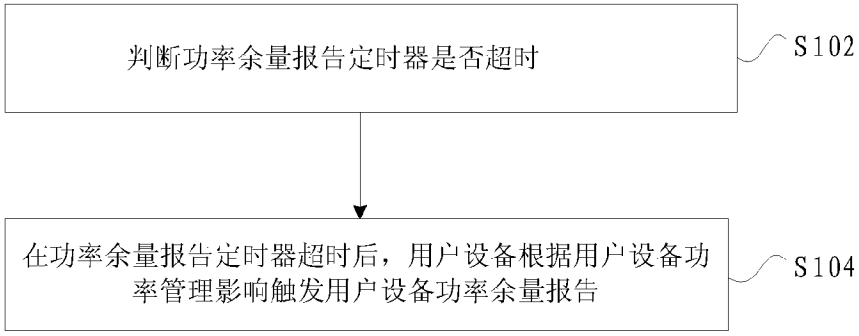

判断功率余量报告定时器是否超时
S102
在功率余量报告定时器超时后，用户设备根据用户设备功率管理影响触发用户设备功率余量报告
S104

图 1

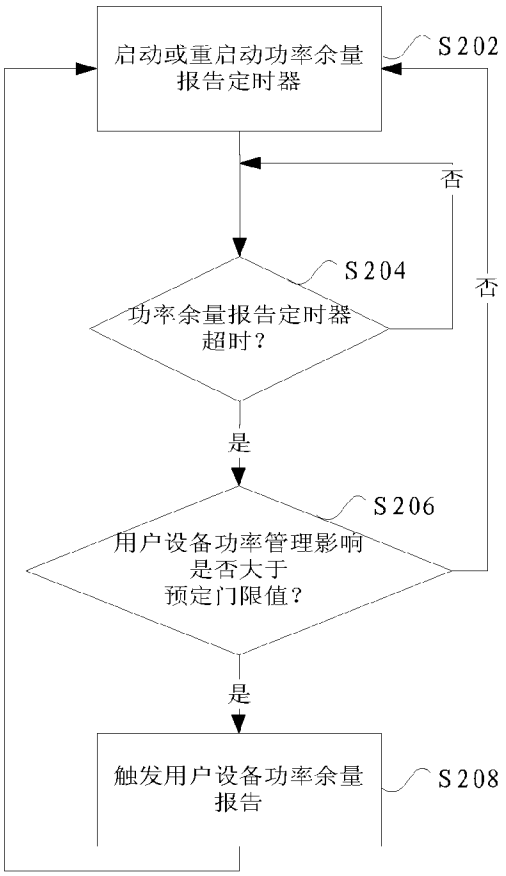

启动或重启动功率余量报告定时器
S202
否
S204
功率余量报告定时器超时？
否
是
S206
用户设备功率管理影响是否大于预定门限值？
是
触发用户设备功率余量报告
S208

图 2

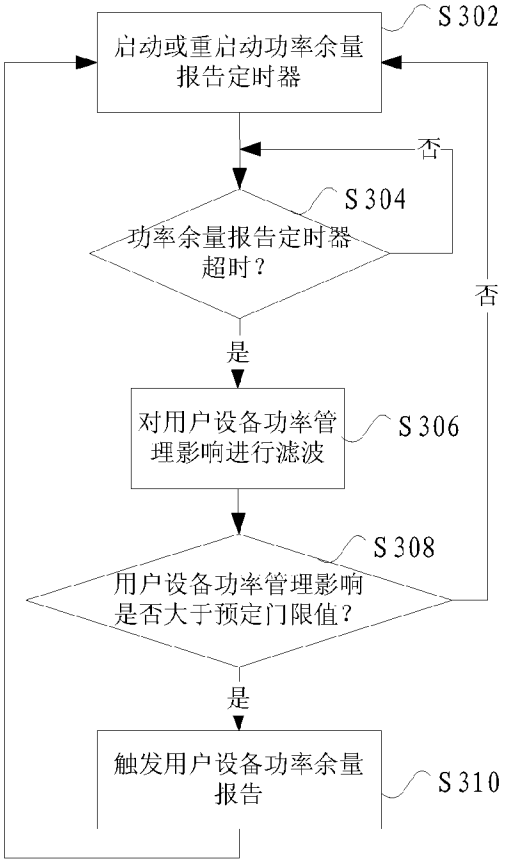

S 302
启动或重启动功率余量报告定时器
否
S 304
功率余量报告定时器超时？
否
是
对用户设备功率管埋影响进行滤波
S 306
S 308
用户设备功率管埋影响是否大于预定门限值？
是
触发用户设备功率余量报告
S 310

图 3

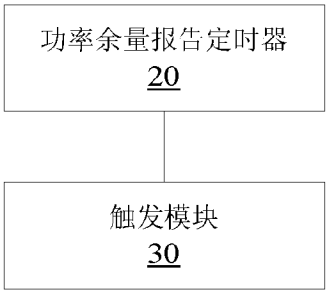

功率余量报告定时器
20
触发模块
30

图 4

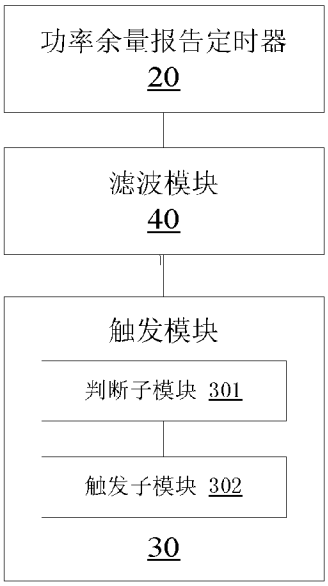


图 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/077886

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

According to International Patent Classification (PC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04W, H04Q, H04L, H04B

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)

CPRSABS, CNTXT, CNKI, VEN: power w headroom w report/PHR, trigger, power w management, user w equipment.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Qualcomm Incorporated: "PHR Trigger for Power Reduction Due to Power Management", 3GPP TSG-RAN2 Meeting #73, R2-110797, 18 Mar. 2011 (18.03.2011), see paragraphs 2 ,3 and 8 in section 5.4.6 , [Online] URL: http://www.3gpp.org/ftp/Specs/html-info/36321-CRs.htm ,	1-13
A	CN101932087A (DATANG MOBILE COMMUNICATION EQUIP CO LTD:) 29 Dec. 2010(29.12.2010) , see the whole document	1-13
A	CN101925105A (DATANG MOBILE COMMUNICATION EQUIP CO LTD:) 22 Dec. 2010(22.12.2010) , see the whole document	1-13
A	US2009175 187A1 (JERSENIUS K ET-AL) 09 Jul. 2009(09.07.2009) , see the whole document	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 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
10 Jan. 2012 (10.01.2012)	19 Jan. 2012 (10.01.2012)

[Name and mailing address of the ISA
State Intellectual Property Office of the P.R.China
No. 6, Xitucheng Road, Jimenqiao
Haidian District, Beijing 100088, China
[Facsimile No. (86-10)62019451

Authorized officer
HU ,Xiangli
Telephone No. (86-10)62411489

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2011/077886

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN101932087A	29.12.2010	WO2010145508A1	23.12.2010
CN101925105A	22.12.2010	NONE	
US2009 175187 A I	09 .07 .2009	NONE	

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/077886

Continue of A. CLASSIFICATION OF SUBJECT MATTER

H04W 52/04(2009.01)1
H04W 88/02(2009.01)1
H04B 7/005(2006.01)1

Form PCT/ISA/210 (extra sheet) (July 2009)

国际检索报告

国际申请号
PCT/CN2011/077886

A. 主题的分类

参加附加页

按照国际专利分类(IPC)或者同时按照国家分类和IPC两种分类

B. 检索领域

检索的最低限度文献(标明分类系统和分类号)

IPC: H04W, H04Q, H04L, H04B

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称，和使用的检索词(如使用))

CPRSABS, CNTXT, CNKI: 功率余量报告/功率空间报告/PHR，触发，功率管理，用户设备/UE。

VEN: power w headroom w report/PHR, trigger, power w management, user w equipment.

C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求
X	Qualcomm Incorporated: "PHR Trigger for Power Reduction Due to Power Management", 3GPP TSG-RAN2 Meeting #73, R2-110797, 18. 3月 2011 (18.03.2011), 参见第5.4.6节第2、3、8段, [Online] URL: http://www.3gpp.org/ftp/Specs/html-info/3632-CRs.htm,	1-13
A	CN101932087A (大唐移动通信设备有限公司)29. 12月2010(29.12.2010), 见全文	1-13
A	CN101925105A (大唐移动通信设备有限公司)22. 12月2010(22.12.2010), 见全文	
A	US2009175187A1 (JERSENIUS K 等)09. 7月2009(09.07.2009), 见全文	1-13

☐ 其余文件在C栏的续页中列出。

☒ 见同族专利附件。

* 引用文件的具体类型：

"A" 认为不特别相关的表示了现有技术一般状态的文件

"E" 在国际申请日的当天或之后公布的在先申请或专利

"L" 可能对优先权要求构成怀疑的文件，或为确定另一篇引用文件的公布日而引用的或者因其他特殊理由而引用的文件(如具体说明的)

"O" 涉及口头公开、使用、展览或其他方式公开的文件

"P" 公布日先于国际申请日但迟于所要求的优先权日的文件

"T" 在申请日或优先权日之后公布，与申请不相抵触，但为了理解发明之理论或原理的在后文件

"X" 特别相关的文件，单独考虑该文件，认定要求保护的发明不是新颖的或不具有创造性

"Y" 特别相关的文件，当该文件与另一篇或者多篇该类文件结合并且这种结合对于本领域技术人员为显而易见时，要求保护的发明不具有创造性

"&" 同族专利的文件

国际检索实际完成的日期	国际检索报告邮寄日期
10. 1月 2012 (10.01.2012)	19.1月 2012 (19.01.2012)
ISA/CN的名称和邮寄地址： 中华人民共和国国家知识产权局 中国北京市海淀区蓟门桥西土城路6号 100088 传真号：(86-10)62019451	受权官员 胡向莉 电话号码：(86-10) 62411489

PCT/ISA/210 表(第2页)(2009年7月)

国际检索报告

关于同族专利的信息

国际申请号
PCT/CN2011/077886

检索报告中引用的专利文件	公布日期	同族专利	公布日期
CN101932087A	29. 12.2010	WO2010145508A1	23. 12.2010
CN101925 105A	22. 12.2010	无	
US2009175 187A1	09.07.2009	无	

续：A. 主题的分类

H04W 52/04(2009.01)i
H04W 88/02(2009.01)i
H04B 7/005(2006.01)i

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Filer:	Sang N. Dang/Sandy Kim
Attorney Docket Number:	1426-343.101

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1720**

Electronic Acknowledgement Receipt

EFS ID:	35832660
Application Number:	16395760
International Application Number:	
Confirmation Number:	4258
Title of Invention:	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Ko-Chiang Lin
Customer Number:	106622
Filer:	Sang N. Dang/Sandy Kim
Filer Authorized By:	Sang N. Dang
Attorney Docket Number:	1426-343.101
Receipt Date:	26-APR-2019
Filing Date:	
Time Stamp:	14:16:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	042919INTEFSW14162200
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	WebADS.pdf	144794 ab73553041fa9b7760a7df71712d2c6b8b9b88a1	no	8
Warnings:					
Information:					
2		1426-343-101--PackageAsfiled.pdf	3596691 0f847270c9793beb65d71f4e47d72b1c7e7603c5	yes	107

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal of New Application	1	1
Fee Worksheet (SB06)	2	2
Specification	3	66
Claims	67	70
Abstract	71	71
Drawings-only black and white line drawings	72	98
Oath or Declaration filed	99	102
Power of Attorney	103	104
Information Disclosure Statement (IDS) Form (SB08)	105	106
Miscellaneous Incoming Letter	107	107

Warnings:

Information:

3	Foreign Reference	WO2012145974v2.pdf	731216 9178a85d71951154ee59d83cfbf8f5d65032c5ee	no	25
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	34744 c425339b24ee98f66bb778fca8f86613dd22df9c	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	4507445	

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1426-343.101
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	

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.)

Inventor Information:

Inventor 1

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ko-Chiang		Lin	

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

City	Taipei City	Country of Residence i	TW

Mailing Address of Inventor:

Address 1	No. 15, Lite Rd., Peitou District		
Address 2			
City	Taipei City 112	State/Province	OT
Postal Code		Country i	TW

Inventor 2

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yu-Hsuan		Guo	

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

City	Taipei City	Country of Residence i	TW

Mailing Address of Inventor:

Address 1	No. 15, Lite Rd., Peitou District		
Address 2			
City	Taipei City 112	State/Province	OT
Postal Code		Country i	TW

Inventor 3

Legal Name

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1426-343.101
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Ming-Che		Li	

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

City	Taipei City	Country of Residence i	TW

Mailing Address of Inventor:

Address 1	No. 15, Lite Rd., Peitou District		
Address 2			
City	Taipei City 112	**State/Province**	OT
Postal Code		**Country** i	TW

Inventor 4

Legal Name

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Hsin-Hsi		Tsai	

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

City	Taipei City	Country of Residence i	TW

Mailing Address of Inventor:

Address 1	No. 15, Lite Rd., Peitou District		
Address 2			
City	Taipei City 112	**State/Province**	OT
Postal Code		**Country** i	TW

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.**

Customer Number	106622		
Email Address		Add Email	Remove Email

PTO/AIA/14 (08-15)
Approved for use through 04/30/2017. OMB 0651-0032
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1426-343.101
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	

Application Information:

Title of the Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM		
Attorney Docket Number	1426-343.101	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	27	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

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).
Either enter 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	106622		

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix	
					Remove
Registration Number					

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1426-343.101
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix	Remove

Registration Number	

Additional Representative Information blocks may be generated within this form by selecting the **Add** button.

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim 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.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	62/669461	2018-05-10

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

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. 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. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Filing Date (YYYY-MM-DD)	Access Code (if applicable)

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

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1426-343.101
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is 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 State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

PTO/AIA/14 (08-15)
Approved for use through 04/30/2017. OMB 0651-0032
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1426-343.101
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	

Applicant Information:

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

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	ASUSTek Computer Inc.		
Mailing Address Information For Applicant:			
Address 1	No. 15, Lite Rd., Peitou District		
Address 2			
City	Taipei City 112	**State/Province**	OT
Country[i]	TW	Postal Code	
Phone Number		Fax Number	
Email Address			

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

PTO/AIA/14 (08-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	1426-343.101
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM	

Assignee Information including Non-Applicant Assignee Information:

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

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

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Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e. g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Sang N. Dang/			Date (YYYY-MM-DD)	
First Name	Sang N.	Last Name	Dang	Registration Number	51186

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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	1426-343.101
First Named Inventor	Ko-Chiang Lin
Title	Method and Apparatus for Triggering Power Headroom Report for...
Priority Mail Express® Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✓] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✓] **Specification** [*Total Pages* 69] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [✓] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 27]
6. **Inventor's Oath or Declaration** [*Total Pages* 4] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [✓] Newly executed (original or copy)
   b. [ ] A copy from a prior application (37 CFR 1.63(d))
7. [✓] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

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ACCOMPANYING APPLICATION PAPERS

10. [ ] **Assignment Papers** (cover sheet & document(s))
    Name of Assignee _____
11. [ ] **37 CFR 3.73(c) Statement** (*when there is an assignee*) [✓] **Power of Attorney**
12. [ ] **English Translation Document** (*if applicable*)
13. [✓] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [✓] Copies of citations attached
14. [ ] **Preliminary Amendment**
15. [ ] **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. [ ] **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. [ ] **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. [✓] **Other:** 1 Foreign Reference

***Note**: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS

[✓] The address associated with Customer Number: 106622 **OR** [ ] Correspondence address below

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Country		Telephone		Email	

Signature	/Sang N. Dang/	Date	April 26, 2019
Name (Print/Type)	Sang N. Dang	Registration No. (Attorney/Agent)	51186

This collection of information is required by 37 CFR 1.53(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.**

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FEE TRANSMITTAL

Complete if known	
Application Number	Not Yet Assigned
Filing Date	April 26, 2019
First Named Inventor	Ko-Chiang Lin
Examiner Name	Not Yet Assigned
Art Unit	Not Yet Assigned
Practitioner Docket No.	1426-343.101

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

TOTAL AMOUNT OF PAYMENT ($) 1720

METHOD OF PAYMENT (check all that apply)

☐ Check ■ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☐ Deposit Account Deposit Account Number: _____ Deposit Account Name: _____

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☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES (U = undiscounted fee; S = small entity fee; M = micro entity fee)

	FILING FEES			SEARCH FEES			EXAMINATION FEES			
Application Type	**U ($)**	**S ($)**	**M ($)**	**U ($)**	**S ($)**	**M ($)**	**U ($)**	**S ($)**	**M ($)**	**Fees Paid ($)**
Utility	300	150*	75	660	330	165	760	380	190	1720
Design	200	100	50	160	80	40	600	300	150	
Plant	200	100	50	420	210	105	620	310	155	
Reissue	300	150	75	660	330	165	2,200	1,100	550	
Provisional	280	140	70	0	0	0	0	0	0	

* The $150 small entity status filing fee for a utility application is further reduced to $75 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

Fee Description	**Undiscounted Fee ($)**	**Small Entity Fee ($)**	**Micro Entity Fee ($)**
Each claim over 20 (including Reissues)	100	50	25
Each independent claim over 3 (including Reissues)	460	230	115
Multiple dependent claims	820	410	205

Total Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
20	-20 or HP =	_____	x _____	=	_____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
3	-3 or HP =	_____	x _____	=	_____

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Multiple Dependent Claims	
Fee ($)	**Fee Paid ($)**
_____	_____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $400 ($200 for small entity) ($100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		**Extra Sheets**		**Number of each additional 50 or fraction thereof**		**Fee ($)**		**Fee Paid ($)**
96	- 100 =	_____	/ 50 =	_____ (round **up** to a whole number)	x	_____	=	_____

4. OTHER FEE(S) **Fees Paid ($)**

Non-English specification, $130 fee (no small or micro entity discount) _____

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, $400 fee ($200 small or micro entity) _____

Other (e.g., late filing surcharge): _____ _____

SUBMITTED BY

Signature	/Sang N. Dang/	Registration No. (Attorney/Agent) 51186	Telephone (714) 839-3800
Name (Print/Type)	Sang N. Dang		Date April 26, 2019

This collection of information is required by 37 CFR 1.136. 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 30 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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METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present Application claims the benefit of U.S. Provisional Patent Application Serial No. 62/669,461 filed on May 10, 2018, the entire disclosure of which is incorporated herein in its entirety by reference.

FIELD

[0002] This disclosure generally relates to wireless communication networks, and more particularly, to a method and apparatus for triggering power headroom report for multiple pathloss reference a wireless communication system.

BACKGROUND

[0003] With the rapid rise in demand for communication of large amounts of data to and from mobile communication devices, traditional mobile voice communication networks are evolving into networks that communicate with Internet Protocol (IP) data packets. Such IP data packet communication can provide users of mobile communication devices with voice over IP, multimedia, multicast and on-demand communication services.

[0004] An exemplary network structure is an Evolved Universal Terrestrial Radio Access Network (E-UTRAN). The E-UTRAN system can provide high data throughput in order to realize the above-noted voice over IP and multimedia services. A new radio technology for the next generation (e.g., 5G) is currently being discussed by the 3GPP standards organization. Accordingly, changes to the current body of 3GPP standard are currently being submitted and considered to evolve and finalize the 3GPP standard.

SUMMARY

[0005] A method and apparatus are disclosed from the perspective of an User Equipment (UE). In one embodiment, the method includes the UE deriving a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report. The method also includes the UE deriving a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell. The method further includes the UE deriving the pathloss change based on the first pathloss value and the second pathloss value. In addition, the method includes the UE determining whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 shows a diagram of a wireless communication system according to one exemplary embodiment.

[0007] FIG. 2 is a block diagram of a transmitter system (also known as access network) and a receiver system (also known as user equipment or UE) according to one exemplary embodiment.

[0008] FIG. 3 is a functional block diagram of a communication system according to one exemplary embodiment.

[0009] FIG. 4 is a functional block diagram of the program code of FIG. 3 according to one exemplary embodiment.

[0010] FIGS. 5A-5C provide exemplary illustrations of three types of beamforming.

[0011] FIGS. 6A and 6B are a reproduction of Table 6.2.2-1 of 3GPP TS 36.101 V14.1.0.

[0012] FIG. 7 is a reproduction of Figure 6.1.3.6-1 of 3GPP TS 36.321 V14.0.0.

[0013] FIG. 8 is a reproduction of Table 6.1.3.6-1 of 3GPP TS 36.321 V14.0.0.

[0014] FIG. 9 is a reproduction of Figure 6.1.3.6a-2 of 3GPP TS 36.321 V14.0.0.

[0015] FIG. 10 is a reproduction of Figure 6.1.3.6a1-3 of 3GPP TS 36.321 V14.0.0.

[0016] FIG. 11 is a reproduction of Figure 6.1.3.6a2-4 of 3GPP TS 36.321 V14.0.0.

[0017] FIG. 12 is a reproduction of Figure 6.1.3.6a3-5 of 3GPP TS 36.321 V14.0.0.

[0018] FIG. 13 is a reproduction of Table 6.1.3.6a-1 of 3GPP TS 36.321 V14.0.0.

[0019] FIG. 14 is a reproduction of Table 7.1.1-1 of 3GPP R1-1805795.

[0020] FIG. 15 is a diagram according to one exemplary embodiment.

[0021] FIG. 16 is a diagram according to one exemplary embodiment.

[0022] FIG. 17 is a diagram according to one exemplary embodiment.

[0023] FIG. 18 is a diagram according to one exemplary embodiment.

[0024] FIG. 19 is a diagram according to one exemplary embodiment.

[0025] FIG. 20 is a diagram according to one exemplary embodiment.

[0026] FIG. 21 is a flow chart according to one exemplary embodiment.

[0027] FIG. 22 is a flow chart according to one exemplary embodiment.

[0028] FIG. 23 is a flow chart according to one exemplary embodiment.

[0029] FIG. 24 is a flow chart according to one exemplary embodiment.

[0030] FIG. 25 is a flow chart according to one exemplary embodiment.

[0031] FIG. 26 is a flow chart according to one exemplary embodiment.

[0032] FIG. 27 is a flow chart according to one exemplary embodiment.

DETAILED DESCRIPTION

[0033] The exemplary wireless communication systems and devices described below employ a wireless communication system, supporting a broadcast service. Wireless communication systems are widely deployed to provide various types of communication such as voice, data, and so on. These systems may be based on code division multiple access (CDMA), time division multiple access (TDMA), orthogonal frequency division multiple access (OFDMA), 3GPP LTE (Long Term Evolution) wireless access, 3GPP LTE-A or LTE-Advanced

(Long Term Evolution Advanced), 3GPP2 UMB (Ultra Mobile Broadband), WiMax, 3GPP NR (New Radio), or some other modulation techniques.

[0034] In particular, the exemplary wireless communication systems devices described below may be designed to support one or more standards such as the standard offered by a consortium named "3rd Generation Partnership Project" referred to herein as 3GPP, including: R2-162366, "Beam Forming Impacts", Nokia, Alcatel-Lucent; R2-163716, "Discussion on terminology of beamforming based high frequency NR", Samsung; R2-162709, "Beam support in NR", Intel; TS 36.213 v14.0.0, "E-UTRA Physical layer procedures (Release 14)"; TS 36.101 v14.1.0, "E-UTRA User Equipment (UE) radio transmission and reception (Release 14)"; TS 36.321 v14.0.0, "E-UTRA Medium Access Control (MAC) protocol specification(Release 14)"; R1-1805795, "CR to TS 38.213 capturing the RAN1#92bis meeting agreements", Samsung; TS 38.321 v.15.1.0, "MAC layer specification (Release 15)". The standards and documents listed above are hereby expressly incorporated by reference in their entirety.

[0035] FIG. 1 shows a multiple access wireless communication system according to one embodiment of the invention. An access network 100 (AN) includes multiple antenna groups, one including 104 and 106, another including 108 and 110, and an additional including 112 and 114. In FIG. 1, only two antennas are shown for each antenna group, however, more or fewer antennas may be utilized for each antenna group. Access terminal 116 (AT) is in communication with antennas 112 and 114, where antennas 112 and 114 transmit information to access terminal 116 over forward link 120 and receive information from access terminal 116 over reverse link 118. Access terminal (AT) 122 is in communication with antennas 106 and 108, where antennas 106 and 108 transmit information to access terminal (AT) 122 over forward link 126 and receive information from access terminal (AT) 122 over reverse link 124. In a FDD system, communication links 118, 120, 124 and 126 may use different frequency for communication. For example, forward link 120 may use a different frequency then that used by reverse link 118.

[0036] Each group of antennas and/or the area in which they are designed to communicate is often referred to as a sector of the access network. In the embodiment, antenna groups each are designed to communicate to access terminals in a sector of the areas covered by access network 100.

[0037] In communication over forward links 120 and 126, the transmitting antennas of access network 100 may utilize beamforming in order to improve the signal-to-noise ratio of forward links for the different access terminals 116 and 122. Also, an access network using beamforming to transmit to access terminals scattered randomly through its coverage causes less interference to access terminals in neighboring cells than an access network transmitting through a single antenna to all its access terminals.

[0038] An access network (AN) may be a fixed station or base station used for communicating with the terminals and may also be referred to as an access point, a Node B, a base station, an enhanced base station, an evolved Node B (eNB), or some other terminology. An access terminal (AT) may also be called user equipment (UE), a wireless communication device, terminal, access terminal or some other terminology.

[0039] FIG. 2 is a simplified block diagram of an embodiment of a transmitter system 210 (also known as the access network) and a receiver system 250 (also known as access terminal (AT) or user equipment (UE)) in a MIMO system 200. At the transmitter system 210, traffic data for a number of data streams is provided from a data source 212 to a transmit (TX) data processor 214.

[0040] In one embodiment, each data stream is transmitted over a respective transmit antenna. TX data processor 214 formats, codes, and interleaves the traffic data for each data stream based on a particular coding scheme selected for that data stream to provide coded data.

[0041] The coded data for each data stream may be multiplexed with pilot data using OFDM techniques. The pilot data is typically a known data pattern that is processed in a known manner and may be used at the receiver system to estimate the channel response. The multiplexed pilot and coded data for each data stream is then modulated (i.e., symbol mapped) based on a particular modulation scheme (e.g., BPSK, QPSK, M-PSK, or M-QAM) selected for that data stream to provide modulation symbols. The data rate, coding, and modulation for each data stream may be determined by instructions performed by processor 230.

[0042] The modulation symbols for all data streams are then provided to a TX MIMO processor 220, which may further process the modulation symbols (e.g., for OFDM). TX MIMO processor 220 then provides N_T modulation symbol streams to N_T transmitters (TMTR) 222a

through 222t. In certain embodiments, TX MIMO processor 220 applies beamforming weights to the symbols of the data streams and to the antenna from which the symbol is being transmitted.

[0043] Each transmitter 222 receives and processes a respective symbol stream to provide one or more analog signals, and further conditions (e.g., amplifies, filters, and upconverts) the analog signals to provide a modulated signal suitable for transmission over the MIMO channel. N_T modulated signals from transmitters 222a through 222t are then transmitted from N_T antennas 224a through 224t, respectively.

[0044] At receiver system 250, the transmitted modulated signals are received by N_R antennas 252a through 252r and the received signal from each antenna 252 is provided to a respective receiver (RCVR) 254a through 254r. Each receiver 254 conditions (e.g., filters, amplifies, and downconverts) a respective received signal, digitizes the conditioned signal to provide samples, and further processes the samples to provide a corresponding "received" symbol stream.

[0045] An RX data processor 260 then receives and processes the N_R received symbol streams from N_R receivers 254 based on a particular receiver processing technique to provide N_T "detected" symbol streams. The RX data processor 260 then demodulates, deinterleaves, and decodes each detected symbol stream to recover the traffic data for the data stream. The processing by RX data processor 260 is complementary to that performed by TX MIMO processor 220 and TX data processor 214 at transmitter system 210.

[0046] A processor 270 periodically determines which pre-coding matrix to use (discussed below). Processor 270 formulates a reverse link message comprising a matrix index portion and a rank value portion.

[0047] The reverse link message may comprise various types of information regarding the communication link and/or the received data stream. The reverse link message is then processed by a TX data processor 238, which also receives traffic data for a number of data streams from a data source 236, modulated by a modulator 280, conditioned by transmitters 254a through 254r, and transmitted back to transmitter system 210.

[0048] At transmitter system 210, the modulated signals from receiver system 250 are received by antennas 224, conditioned by receivers 222, demodulated by a demodulator 240, and processed by a RX data processor 242 to extract the reserve link message transmitted by the receiver system 250. Processor 230 then determines which pre-coding matrix to use for determining the beamforming weights then processes the extracted message.

[0049] Turning to FIG. 3, this figure shows an alternative simplified functional block diagram of a communication device according to one embodiment of the invention. As shown in FIG. 3, the communication device 300 in a wireless communication system can be utilized for realizing the UEs (or ATs) 116 and 122 in FIG. 1 or the base station (or AN) 100 in FIG. 1, and the wireless communications system is preferably the NR system. The communication device 300 may include an input device 302, an output device 304, a control circuit 306, a central processing unit (CPU) 308, a memory 310, a program code 312, and a transceiver 314. The control circuit 306 executes the program code 312 in the memory 310 through the CPU 308, thereby controlling an operation of the communications device 300. The communications device 300 can receive signals input by a user through the input device 302, such as a keyboard or keypad, and can output images and sounds through the output device 304, such as a monitor or speakers. The transceiver 314 is used to receive and transmit wireless signals, delivering received signals to the control circuit 306, and outputting signals generated by the control circuit 306 wirelessly. The communication device 300 in a wireless communication system can also be utilized for realizing the AN 100 in FIG. 1.

[0050] FIG. 4 is a simplified block diagram of the program code 312 shown in FIG. 3 in accordance with one embodiment of the invention. In this embodiment, the program code 312 includes an application layer 400, a Layer 3 portion 402, and a Layer 2 portion 404, and is coupled to a Layer 1 portion 406. The Layer 3 portion 402 generally performs radio resource control. The Layer 2 portion 404 generally performs link control. The Layer 1 portion 406 generally performs physical connections.

[0051] As described in 3GPP R2-162366, in lower frequency bands (e.g. current LTE bands < 6GHz) the required cell coverage may be provided by forming a wide sector beam for transmitting downlink common channels. However, utilizing wide sector beam on higher

frequencies (>> 6GHz) the cell coverage is reduced with same antenna gain. Thus, in order to provide required cell coverage on higher frequency bands, higher antenna gain is needed to compensate the increased path loss. To increase the antenna gain over a wide sector beam, larger antenna arrays (number of antenna elements ranging from tens to hundreds) are used to form high gain beams.

[0052] As a consequence, the high gain beams are narrow compared to a wide sector beam so multiple beams for transmitting downlink common channels are needed to cover the required cell area. The number of concurrent high gain beams that access point is able to form may be limited by the cost and complexity of the utilized transceiver architecture. In practice, on higher frequencies, the number of concurrent high gain beams is much less than the total number of beams required to cover the cell area. In other words, the access point is able to cover only part of the cell area by using a subset of beams at any given time.

[0053] As described in 3GPP R2-163716, beamforming is a signal processing technique used in antenna arrays for directional signal transmission or reception. With beamforming, a beam can be formed by combining elements in a phased array of antennas in such a way that signals at particular angles experience constructive interference while others experience destructive interference. Different beams can be utilized simultaneously using multiple arrays of antennas.

[0054] Beamforming can be categorized into three types of implementation: digital beamforming, hybrid beamforming, and analog beamforming. For digital beamforming, the beam is generated on the digital domain, i.e. the weighting of each antenna element can be controlled by baseband (e.g. connected to a TXRU). Therefore it is very easy to tune the beam direction of each subband differently across the system bandwidth. Also, to change beam direction from time to time does not require any switching time between Orthogonal Frequency Division Multiplexing (OFDM) symbols. All beams whose directions cover the whole coverage can be generated simultaneously. However, this structure requires (almost) one-to-one mapping between TXRU (transceiver/RF chain) and antenna element and is quite complicated as the number of antenna element increases and system bandwidth increases (also heat problem exists). For Analog beamforming, the beam is generated on the analog domain, i.e. the weighting of each

antenna element can be controlled by an amplitude or phase shifter in the Radio Frequency (RF) circuit. Since the weighing is purely controlled by the circuit, the same beam direction would apply on the whole system bandwidth. Also, if beam direction is to be changed, switching time is required. The number of beam generated simultaneous by an analog beamforming depends on the number of TXRU. Note that for a given size of array, the increase of TXRU may decrease the antenna element of each beam, such that wider beam would be generated. In short, analog beamforming could avoid the complexity and heat problem of digital beamforming, while is more restricted in operation. Hybrid beamforming can be considered as a compromise between analog and digital beamforming, where the beam can come from both analog and digital domain. The three types of beamforming are shown in FIGS. 5A-5C.

[0055] As discussed in 3GPP R2-162709, an eNB may have multiple TRPs (either centralized or distributed). Each TRP can form multiple beams. The number of beams and the number of simultaneous beams in the time/frequency domain depend on the number of antenna array elements and the RF at the TRP.

[0056] With the support of beam operation and TRP, a cell may have multiple choices to schedule a UE. For example, there may be multiple beams from a TRP transmitting the same data to the UE, which can provide more reliability for the transmission. Alternatively, multiple beams from multiple TRPs transmit the same data to the UE. To increase the throughput, it is also possible for a single TRP to transmit different data on different beams for the UE. Also, multiple TRPs can transmit different data on different beams to the UE.

[0057] To maintain the balance between the UL transmission performance and UE power consumption as well as interference mitigation, UE transmission power is properly controlled. The power may be controlled by some open loop parameter, e.g. the required received power, pathloss between UE and base station. It may also be controlled based on some close loop parameter, e.g. the power control command sent from the base station to the UE.

[0058] Power headroom report is provided by the UE to the base station to allow base station realize how much extra transmission power is available in the UE and how to schedule resource to the UE properly, e.g. is it proper to schedule more resource to the UE (e.g. UE has more power headroom). A power headroom may be calculated from the difference between a

current calculated transmission UE power (if there is transmission) and a maximum transmission power of the UE. In some circumstances, e.g. multiple carrier operation, it is also possible that a power headroom is reported while there is no current transmission, e.g. reporting power headroom for a carrier without ongoing transmission with another carrier. In such a case, a difference between a reference power (calculated based on some reference parameter(s)) and a UE maximum power is reported as power headroom, as known as virtual power headroom (PH).

[0059] A UE maximum power mentioned above for power headroom derivation is determined by the capability of the UE and may also be controlled by the configuration of base station or cell. Also due to the linear range of power amplifier (PA) in UE's RF, the maximum power may be affected by the peak-to-average power ratio (PAPR) of the transmission. For example, if a transmission has a high PAPR, power back-off may be performed if the peak power would exceed the linear region when the average power is around the maximum power. A range of power back-off is allowed to balance the cost of UE PA and the UL transmission performance or coverage, which is known as maximum power reduction (MPR). Different modulation schemes (e.g. QPSK/16QAM) or different resource allocation (e.g. contiguous/non-contiguous or narrow band/ wide band resource allocation) would result in different PAPR, and thus may have different MPRs. More details may be found in 3GPP TS 36.101 V14.1.0 as follows:

6.2.2 UE maximum output power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration and UL-MIMO unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

[Table 6.2.2-1 of 3GPP TS 36.101 V14.1.0, entitled "UE Power Class", is reproduced as FIGS. 6A and 6B]

[...]

6.2.5 Configured transmitted power

The UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell *c*. The configured maximum output power $P_{CMAX,c}$ is set within the following bounds:

$P_{CMAX\_L,c} \leq P_{CMAX,c} \leq P_{CMAX\_H,c}$ with

$$P_{CMAX\_L,c} = \text{MIN}\{P_{EMAX,c} - \Delta T_{C,c},\ P_{PowerClass} - \text{MAX}(MPR_c + \text{A-MPR}_c + \Delta T_{IB,c} + \Delta T_{C,c} + \Delta T_{ProSe},\ \text{P-MPR}_c)\}$$

$$P_{CMAX\_H,c} = \text{MIN}\{P_{EMAX,c},\ P_{PowerClass}\}$$

where

- $P_{EMAX,c}$ is the value given by IE *P-Max* for serving cell *c,* defined in [7];
- $P_{PowerClass}$ is the maximum UE power specified in Table 6.2.2-1 without taking into account the tolerance specified in the Table 6.2.2-1;
- MPR_c and A-MPR_c for serving cell *c* are specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $\Delta T_{IB,c}$ is the additional tolerance for serving cell *c* as specified in Table 6.2.5-2; $\Delta T_{IB,c}$ = 0 dB otherwise;
- $\Delta T_{C,c}$ = 1.5 dB when NOTE 2 in Table 6.2.2-1 applies;
- $\Delta T_{C,c}$ = 0 dB when NOTE 2 in Table 6.2.2-1 does not apply;
- ΔT_{ProSe} = 0.1 dB when the UE supports ProSe Direct Discovery and/or ProSe Direct Communication on the corresponding E-UTRA ProSe band; ΔT_{ProSe} = 0 dB otherwise.

P-MPR_c is the allowed maximum output power reduction for

- a) ensuring compliance with applicable electromagnetic energy absorption requirements and addressing unwanted emissions / self desense requirements in case of simultaneous transmissions on multiple RAT(s) for scenarios not in scope of 3GPP RAN specifications;
- b) ensuring compliance with applicable electromagnetic energy absorption

requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

The UE shall apply P-MPR $_c$ for serving cell c only for the above cases. For UE conducted conformance testing P-MPR shall be 0 dB

NOTE 1: P-MPR$_c$ was introduced in the $P_{CMAX,c}$ equation such that the UE can report to the eNB the available maximum output transmit power. This information can be used by the eNB for scheduling decisions.

For each subframe, the $P_{CMAX\_L,c}$ for serving cell c is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum $P_{CMAX\_L,c}$ over the two slots is then applied for the entire subframe. $P_{PowerClass}$ shall not be exceeded by the UE during any period of time.

[...]

6.2.5A Configured transmitted power for CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell c and its total configured maximum output power P_{CMAX}.

The configured maximum output power $P_{CMAX,c}$ on serving cell c shall be set as specified in subclause 6.2.5.

For uplink inter-band carrier aggregation, MPR$_c$ and A-MPR$_c$ apply per serving cell c and are specified in subclause 6.2.3 and subclause 6.2.4, respectively. P-MPR $_c$ accounts for power management for serving cell c. $P_{CMAX,c}$ is calculated under the assumption that the transmit power is increased independently on all component carriers.

For uplink intra-band contiguous and non-contiguous carrier aggregation, MPR$_c$ = MPR and A-MPR$_c$ = A-MPR with MPR and A-MPR specified in subclause 6.2.3A and subclause 6.2.4A

respectively. There is one power management term for the UE, denoted P-MPR, and P-MPR $_c$ = P-MPR. $P_{CMAX,c}$ is calculated under the assumption that the transmit power is increased by the same amount in dB on all component carriers.

The total configured maximum output power P_{CMAX} shall be set within the following bounds:

$$P_{CMAX\_L} \leq P_{CMAX} \leq P_{CMAX\_H}$$

For uplink inter-band carrier aggregation with one serving cell c per operating band,

$$P_{CMAX\_L} = \text{MIN}\{10\log_{10}\sum \text{MIN}[\, p_{EMAX,c}/(\Delta t_{C,c}),\ p_{PowerClass}/(mpr_c \cdot a\text{-}mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c} \cdot \Delta t_{ProSe}),\ p_{PowerClass}/pmpr_c],\ P_{PowerClass}\}$$

$$P_{CMAX\_H} = \text{MIN}\{10\log_{10}\sum p_{EMAX,c},\ P_{PowerClass}\}$$

where

- $p_{EMAX,c}$ is the linear value of $P_{EMAX,c}$ which is given by IE *P-Max* for serving cell *c* in [7];
- $P_{PowerClass}$ is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1; $p_{PowerClass}$ is the linear value of $P_{PowerClass}$;
- mpr $_c$ and a-mpr $_c$ are the linear values of MPR $_c$ and A-MPR $_c$ as specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $pmpr_c$ is the linear value of P-MPR $_c$;
- $\Delta t_{C,c}$ is the linear value of $\Delta T_{C,c}$ $\Delta t_{C,c}$ = 1.41 when NOTE 2 in Table 6.2.2-1 applies for a serving cell *c*, otherwise $\Delta t_{C,c}$ = 1;
- $\Delta t_{IB,c}$ is the linear value of the inter-band relaxation term $\Delta T_{IB,c}$ of the serving cell *c* as specified in Table 6.2.5-2; otherwise $\Delta t_{IB,c}$ = 1;
- Δt_{ProSe} is the linear value of ΔT_{ProSe} and applies as specified in subclause 6.2.5.

[0060] Also, to avoid excessive reporting of power headroom, power headroom report would be triggered under some conditions, e.g. when the pathloss or power headroom value change a lot or the previously reporting is too far from now, e.g. a timer has expired since last report. More details can be found in 3GPP TS 36.321 V14.0.0 as follows:

5.4.6 Power Headroom Reporting

The Power Headroom reporting procedure is used to provide the serving eNB with information about the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission per activated Serving Cell and also with information about the difference between the nominal UE maximum power and the estimated power for UL-SCH and PUCCH transmission on SpCell and PUCCH SCell.

The reporting period, delay and mapping of Power Headroom are defined in subclause 9.1.8 of [9]. RRC controls Power Headroom reporting by configuring the two timers *periodicPHR-Timer* and *prohibitPHR-Timer*, and by signalling *dl-PathlossChange* which sets the change in measured downlink pathloss and the required power backoff due to power management (as allowed by P-MPR_c [10]) to trigger a PHR [8].

A Power Headroom Report (PHR) shall be triggered if any of the following events occur:

- *prohibitPHR-Timer* expires or has expired and the path loss has changed more than *dl-PathlossChange* dB for at least one activated Serving Cell of any MAC entity which is used as a pathloss reference since the last transmission of a PHR in this MAC entity when the MAC entity has UL resources for new transmission;
- *periodicPHR-Timer* expires;
- upon configuration or reconfiguration of the power headroom reporting functionality by upper layers [8], which is not used to disable the function;
- activation of an SCell of any MAC entity with configured uplink;
- addition of the PSCell;

- *prohibitPHR-Timer* expires or has expired, when the MAC entity has UL resources for new transmission, and the following is true in this TTI for any of the activated Serving Cells of any MAC entity with configured uplink:
  - there are UL resources allocated for transmission or there is a PUCCH transmission on this cell, and the required power backoff due to power management (as allowed by $P\text{-}MPR_c$ [10]) for this cell has changed more than *dl-PathlossChange* dB since the last transmission of a PHR when the MAC entity had UL resources allocated for transmission or PUCCH transmission on this cell.

NOTE: The MAC entity should avoid triggering a PHR when the required power backoff due to power management decreases only temporarily (e.g. for up to a few tens of milliseconds) and it should avoid reflecting such temporary decrease in the values of $P_{CMAX,c}$/PH when a PHR is triggered by other triggering conditions.

If the MAC entity has UL resources allocated for new transmission for this TTI the MAC entity shall:

- if it is the first UL resource allocated for a new transmission since the last MAC reset, start *periodicPHR-Timer*;
- if the Power Headroom reporting procedure determines that at least one PHR has been triggered and not cancelled, and;
- if the allocated UL resources can accommodate the MAC control element for PHR which the MAC entity is configured to transmit, plus its subheader, as a result of logical channel prioritization:
  - if *extendedPHR* is configured:
    - for each activated Serving Cell with configured uplink:
      - obtain the value of the Type 1 power headroom;

- if the MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI:
  - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
- if *simultaneousPUCCH-PUSCH* is configured:
  - obtain the value of the Type 2 power headroom for the PCell;
  - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer (see subclause 5.1.1.2 of [2]);
- instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element for *extendedPHR* as defined in subclause 6.1.3.6a based on the values reported by the physical layer;

- else if *extendedPHR2* is configured:
  - for each activated Serving Cell with configured uplink:
    - obtain the value of the Type 1 power headroom;
    - if the MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI:
      - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
  - if a PUCCH SCell is configured and activated:
    - obtain the value of the Type 2 power headroom for the PCell and PUCCH SCell;
    - obtain the values for the corresponding $P_{CMAX,c}$ fields from the physical layer (see subclause 5.1.1.2 of [2]);
  - else:
    - if *simultaneousPUCCH-PUSCH* is configured for the PCell:

- obtain the value of the Type 2 power headroom for the PCell;
- obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer (see subclause 5.1.1.2 of [2]);

- instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element for *extendedPHR2* according to configured *ServCellIndex* and the PUCCH(s) for the MAC entity as defined in subclause 6.1.3.6a based on the values reported by the physical layer;

- else if *dualConnectivityPHR* is configured:
  - for each activated Serving Cell with configured uplink associated with any MAC entity:
    - obtain the value of the Type 1 power headroom;
    - if this MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI or if the other MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI and *phr-ModeOtherCG* is set to *real* by upper layers:
      - obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;
  - if *simultaneousPUCCH-PUSCH* is configured:
    - obtain the value of the Type 2 power headroom for the SpCell;
    - obtain the value for the corresponding $P_{CMAX,c}$ field for the SpCell from the physical layer (see subclause 5.1.1.2 of [2]);
  - obtain the value of the Type 2 power headroom for the SpCell of the other MAC entity;
  - if *phr-ModeOtherCG* is set to *real* by upper layers:

- obtain the value for the corresponding $P_{CMAX,c}$ field for the SpCell of the other MAC entity from the physical layer (see subclause 5.1.1.2 of [2]);

- instruct the Multiplexing and Assembly procedure to generate and transmit a Dual Connectivity PHR MAC control element as defined in subclause 6.1.3.6b based on the values reported by the physical layer;

- else:

- obtain the value of the Type 1 power headroom from the physical layer;

- instruct the Multiplexing and Assembly procedure to generate and transmit a PHR MAC control element as defined in subclause 6.1.3.6 based on the value reported by the physical layer;

- start or restart *periodicPHR-Timer*;

- start or restart *prohibitPHR-Timer*;

- cancel all triggered PHR(s).

[...]

6.1.3.6 Power Headroom Report MAC Control Element

The Power Headroom Report (PHR) MAC control element is identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. It has a fixed size and consists of a single octet defined as follows (figure 6.1.3.6-1):

- R: reserved bit, set to "0";

- Power Headroom (PH): this field indicates the power headroom level. The length of the field is 6 bits. The reported PH and the corresponding power headroom levels are shown in Table 6.1.3.6-1 below (the corresponding measured values in dB can be found in subclause 9.1.8.4 of [9]).

[Figure 6.1.3.6-1 of 3GPP TS 36.321 V14.0.0, entitled "PHR MAC control element", is reproduced as FIG. 7]

[Table 6.1.3.6-1 of 3GPP TS 36.321 V14.0.0, entitled "Power Headroom levels for PHR", is reproduced as FIG. 8]

6.1.3.6a Extended Power Headroom Report MAC Control Elements

For *extendedPHR*, the Extended Power Headroom Report (PHR) MAC control element is identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. It has a variable size and is defined in Figure 6.1.3.6a-2. When Type 2 PH is reported, the octet containing the Type 2 PH field is included first after the octet indicating the presence of PH per SCell and followed by an octet containing the associated $P_{CMAX,c}$ field (if reported). Then follows in ascending order based on the *ServCellIndex* [8] an octet with the Type 1 PH field and an octet with the associated $P_{CMAX,c}$ field (if reported), for the PCell and for each SCell indicated in the bitmap.

For *extendedPHR2*, the Extended Power Headroom Report (PHR) MAC control elements are identified by a MAC PDU subheader with LCID as specified in table 6.2.1-2. They have variable sizes and are defined in Figure 6.1.3.6a-3, Figure 6.1.3.6a-4 and Figure 6.1.3.6a-5. One octet with C fields is used for indicating the presence of PH per SCell when the highest *SCellIndex* of SCell with configured uplink is less than 8, otherwise four octets are used. When Type 2 PH is reported for the PCell, the octet containing the Type 2 PH field is included first after the octet(s) indicating the presence of PH per SCell and followed by an octet containing the associated $P_{CMAX,c}$ field (if reported). Then follows the Type 2 PH field for the PUCCH SCell (if PUCCH on SCell is configured and Type 2 PH is reported for the PUCCH SCell), followed by an octet containing the associated $P_{CMAX,c}$ field (if reported). Then follows in ascending order based on

the *ServCellIndex* [8] an octet with the Type 1 PH field and an octet with the associated $P_{CMAX,c}$ field (if reported), for the PCell and for each SCell indicated in the bitmap.

The Extended PHR MAC Control Elements are defined as follows:

- C_i: this field indicates the presence of a PH field for the SCell with *SCellIndex* i as specified in [8]. The C_i field set to "1" indicates that a PH field for the SCell with *SCellIndex* i is reported. The C_i field set to "0" indicates that a PH field for the SCell with *SCellIndex* i is not reported;

- R: reserved bit, set to "0";

- V: this field indicates if the PH value is based on a real transmission or a reference format. For Type 1 PH, V=0 indicates real transmission on PUSCH and V=1 indicates that a PUSCH reference format is used. For Type 2 PH, V=0 indicates real transmission on PUCCH and V=1 indicates that a PUCCH reference format is used. Furthermore, for both Type 1 and Type 2 PH, V=0 indicates the presence of the octet containing the associated $P_{CMAX,c}$ field, and V=1 indicates that the octet containing the associated $P_{CMAX,c}$ field is omitted;

- Power Headroom (PH): this field indicates the power headroom level. The length of the field is 6 bits. The reported PH and the corresponding power headroom levels are shown in Table 6.1.3.6-1 (the corresponding measured values in dB can be found in subclause 9.1.8.4 of [9]);

- P: this field indicates whether the MAC entity applies power backoff due to power management (as allowed by $P\text{-}MPR_c$ [10]). The MAC entity shall set P=1 if the corresponding $P_{CMAX,c}$ field would have had a different value if no power backoff due to power management had been applied;

- $P_{CMAX,c}$: if present, this field indicates the $P_{CMAX,c}$ or $\tilde{P}_{CMAX,c}$ [2] used for calculation of the preceding PH field. The reported $P_{CMAX,c}$ and the corresponding nominal UE transmit power levels are shown in Table 6.1.3.6a-1 (the corresponding measured values in dBm

can be found in subclause 9.6.1 of [9]).

[Figure 6.1.3.6a-2 of 3GPP TS 36.321 V14.0.0, entitled "Extended PHR MAC Control Element", is reproduced as FIG. 9]

[Figure 6.1.3.6a1-3 of 3GPP TS 36.321 V14.0.0, entitled "Extended PHR MAC Control Element supporting PUCCH on Scell", is reproduced as FIG. 10]

[Figure 6.1.3.6a2-4 of 3GPP TS 36.321 V14.0.0, entitled "Extended PHR MAC Control Element supporting 32 serving cells with configured uplink", is reproduced as FIG. 11]

[Figure 6.1.3.6a3-5 of 3GPP TS 36.321 V14.0.0, entitled "Extended PHR MAC Control Element supporting 32 serving cells with configured uplink and PUCCH on Scell", is reproduced as FIG. 12]

[Table 6.1.3.6a-1 of 3GPP TS 36.321 V14.0.0, entitled "Nominal UE transmit power level for Extended PHR and for Dual Connectivity PHR", is reproduced as FIG. 13]

[0061] Multiple pathloss references are introduced to facilitate power control for beam operation. Multiple reference signals can be configured for a UE as pathloss reference candidate. A base station could transmit different reference signals (on different beams or for different sounding reference signal resource index (SRI) or with different spatial precoder), such that pathloss for a beam or a SRI or a spatial precoder could be reflected by measuring a reference

signal associated with the beam or SRI o spatial precoder. With properly compensation of different pathloss for different transmission [on different beam or with different SRI or with different spatial precoder], per beam, SRI, or spatial precoder power control can be achieved with properly setting different transmission powers for transmissions on different beams or differet SRIs or different spatial precdoder.

[0062] Note that in this application, beam, SRI, and precoder could mean the same thing and could be used inter-changeably.

[0063] Which pathloss reference is used for deriving pathloss value for power control or power headroom derivation could be indicated by a base station for a transmission. For example, each value of SRI would be associated with a pathloss reference via RRC configuration and pathloss reference for a PUSCH (Physical Uplink Shared Channel) could be selected or used for power control according to a SRI field in a DCI (Downlink Control Information) format scheduling the PUSCH transmission, e.g a pathloss reference associated with the SRI is selected or used. When such SRI is not indicated (e.g. if the DCI dose not comprise SRI or the is no DCI for a PUSCH, e.g. grant-free transmission or transmission with configured UL grant), or there is no PUSCH transmitted while virtual power headroom for a cell, some rule would be defined for determining a pathloss reference, by a UE or a base station. More details can be found in the following discussions.

[0064] In RAN1#89, RAN1 recognizes the necessity to take into account the pathloss differences among different beams in power control and made the following agreement:

Agreements:

- Support beam specific pathloss for ULPC

[0065] In RAN1#90bis meeting, details of implementing the above agreement were agreed in RAN1 by defining a power control formula with addition of pathloss reference indication:

Agreement

Support the following PUSCH power control in NR:

$$P_{\mathrm{PUSCH},c}(i) = \min\left\{\begin{array}{l} P_{\mathrm{CMAX},c}(i), \\ 10\log_{10}(M_{\mathrm{PUSCH},c}(i)) + P_{0,c}(j) + \alpha_c(j)\cdot PL_c(k) + \Delta_{TF,c}(i) + f_c(i,l) \end{array}\right\}$$

- For the pathloss measurement RS indication.
- k is indicated by beam indication for PUSCH (if present)
- A linkage between PUSCH beam indication and *k* which is index of downlink RS resource for PL measurement is pre-configured via high layer signal
- Only one value k is RRC configured in UE specific way if PUSCH beam indication is not present

[0066] In RAN1#91, RAN1 further clarifies beam indication for PUSCH is equivalent to SRI field in UL grant and it was agreed to configure up to 4 pathloss reference:

Agreement:

- For PUSCH PC, when SRI field is configured, confirm the agreed expression of "PUSCH beam indication (if present)" is the same as "indication by SRI field in UL grant (if present)", aligning to MIMO agreements at least for grant-based PUSCH.
- FFS: The case where SRI field is not configured

Agreement:

- The maximum total number of PL estimates for PUSCH, PUCCH, and SRS that can be configured to a UE is limited to 4 per cell

[0067] In RAN1#1801Adhoc, RAN1 agreed mapping between value in SRI field and pathloss reference are configured by RRC for grant based PUSCH. For configured grant type 1 PUSCH, pathloss reference is directly configured by RRC. For configured grant type 2 PUSCH:

Agreement:

Define RRC parameter SRI-PUSCHPowerControl-Mapping which contains the following, where Ns is the number of valid values for the SRI field in the DCI (as defined in 38.212)

- SRI-PathlossReferenceIndex-Mapping contains Ns pathloss reference ID values (Note: Maximum of four pathloss reference IDs can be configured) with the first value corresponding to SRI state 0, second value corresponding to SRI state 1 etc.

Agreement:

Add RRC parameter PathlossReferenceIndex at least for *UL-TWG-type1*

[0068] In RAN1#92, RAN1 agreed pathloss reference would be indicated by activation DCI for configured grant type 2 PUSCH:

Agreement:

For the indication of {k} for PUSCH UL-TWG-type2:

- Do NOT introduce one new RRC parameter *PathlossReferenceIndex* into *UL-TWG-type2* and the pathloss reference index will be based on activation DCI for UL-TWG-type2

[0069] In RAN1#92 bis, RAN1 agreed there would be default pathloss reference for the case of virtual PHR and Msg3:

Agreement

Default parameter setting for virtual PHR

How to set $\{j, q_d, l\}$

- For j, *P0alphasetindex* = 0 of *p0-pusch-alpha-setconfig*
- For q_d, *pusch-pathlossreference-index* = 0 of *pusch-pathloss-Reference-rs*
- For l, l =0
- Note: If the UE is configured with multiple UL BWPs, j, qd, l corresponding to lowest BWP ID are used

Agreement

For PUSCH Msg3 in the RRC_CONNECTED state, UE shall use the SSB or CSI-RS associated with the PRACH for the pathloss measurement

[0070] More detail could be found in 3GPP R1-1805795 as follows:

7 Uplink Power control

Uplink power control determines the transmit power of the different uplink physical channels or signals.

7.1 Physical uplink shared channel

For PUSCH, a UE first scales a linear value $\hat{P}_{\text{PUSCH},b,f,c}(i,j,q_d,l)$ of the transmit power $P_{\text{PUSCH},b,f,c}(i,j,q_d,l)$ on UL BWP b, as described in Subclause 12, of carrier f of serving cell c, with parameters as defined in Subclause 7.1.1, by the ratio of the number of antenna ports with a non-zero PUSCH transmission to the number of configured antenna ports for the transmission scheme. The resulting scaled power is then split equally across the antenna ports on which the non-zero PUSCH is transmitted. The UL BWP b is the active UL BWP.

7.1.1 UE behaviour

If a UE transmits a PUSCH on UL BWP b of carrier f of serving cell c using parameter set configuration with index j and PUSCH power control adjustment state with index l, the UE determines the PUSCH transmission power $P_{\text{PUSCH},b,f,c}(i,j,q_d,l)$ in PUSCH transmission period i as

$$P_{\text{PUSCH},b,f,c}(i,j,q_d,l) = \min\left\{\begin{array}{l} P_{\text{CMAX},f,c}(i), \\ P_{\text{O\_PUSCH},b,f,c}(j) + 10\log_{10}(2^{\mu}\cdot M^{\text{PUSCH}}_{\text{RB},b,f,c}(i)) + \alpha_{b,f,c}(j)\cdot PL_{b,f,c}(q_d) + \Delta_{\text{TF},b,f,c}(i) + f_{b,f,c}(i,l) \end{array}\right\} \quad \text{[dBm]}$$

where,

- $P_{\text{CMAX},f,c}(i)$ is the configured UE transmit power defined in [8-1, TS 38.101-1] and [8-2, TS38.101-2] for carrier f of serving cell c in PUSCH transmission period i.

- $P_{\text{O\_PUSCH},b,f,c}(j)$ is a parameter composed of the sum of a component $P_{\text{O\_NOMINAL\_PUSCH},f,c}(j)$ and a component $P_{\text{O\_UE\_PUSCH},b,f,c}(j)$ where $j \in \{0,1,...,J-1\}$.

  - If a UE is not provided with higher layer parameter *P0-PUSCH-AlphaSet* or for a Msg3

PUSCH transmission as described in Subclause 8.3, $j = 0$, $P_{\text{O\_UE\_PUSCH},b,f,c}(0) = 0$, and $P_{\text{O\_NOMINAL\_PUSCH},f,c}(0) = P_{\text{O\_PRE}} + \Delta_{PREAMBLE\_Msg3}$, where the parameter *preambleReceivedTargetPower* [11, TS 38.321] (for $P_{\text{O\_PRE}}$) and *msg3-DeltaPreamble* (for $\Delta_{PREAMBLE\_Msg3}$) are provided by higher layers for carrier f of serving cell c.

- For a PUSCH (re)transmission configured by higher layer parameter *ConfiguredGrantConfig*, $j = 1$, $P_{\text{O\_NOMINAL\_PUSCH},f,c}(1)$ is provided by higher layer parameter *p0-NominalWithoutGrant*, and $P_{\text{O\_UE\_PUSCH},b,f,c}(1)$ is provided by higher layer parameter *p0* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that provides an index *P0-PUSCH-AlphaSetId* to a set of higher layer parameters *P0-PUSCH-AlphaSet* for UL BWP b of carrier f of serving cell c.

- For $j \in \{2, ..., J-1\} = S_J$, a $P_{\text{O\_NOMINAL\_PUSCH},f,c}(j)$ value, applicable for all $j \in S_J$, is provided by higher layer parameter *p0-NominalWithGrant* for each carrier f of serving cell c and a set of $P_{\text{O\_UE\_PUSCH},b,f,c}(j)$ values are provided by a set of higher layer parameters *p0* in *P0-PUSCH-AlphaSet* indicated by a respective set of higher layer parameters *p0-PUSCH-AlphaSetId* for UL BWP b of carrier f of serving cell c

  - If the UE is provided by higher layer parameter *SRI-PUSCH-PowerControl* more than one values of *p0-PUSCH-AlphaSetId* and if DCI format 0_1 includes a SRI field, the UE obtains a mapping from higher layer parameter *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0_1 [5, TS 38.212] and a set of indexes provided by higher layer parameter *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values. If the PUSCH transmission is scheduled by a DCI format 0_1, the UE determines the values of $P_{\text{O\_UE\_PUSCH},b,f,c}(j)$ from the *p0alphasetindex* value that is mapped to the SRI field value. - If the PUSCH transmission is scheduled by a DCI format 0_0 or by a DCI format 0_1 that does not include a SRI field, or if a higher layer parameter *SRI-P0AlphaSetIndex-Mapping* is not provided to the UE, the UE determines

$P_{\text{O\_UE\_PUSCH},b,f,c}(j)$ from the first *p0-pusch-alpha-set* in *p0-pusch-alpha-setconfig* for all $j \in S_J$.

- For $\alpha_{b,f,c}(j)$

  - For $j=0$, $\alpha_{b,f,c}(0)$ is a value of higher layer parameter *msg3-Alpha*, when provided; otherwise, $\alpha_{b,f,c}(0)=1$.

  - For $j=1$, $\alpha_{b,f,c}(1)$ is provided by higher layer parameter *alpha* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* providing an index *P0-PUSCH-AlphaSetId* to a set of higher layer parameters *P0-PUSCH-AlphaSet* for UL BWP b of carrier f of serving cell c.

  - For $j \in S_J$, a set of $\alpha_{b,f,c}(j)$ values are provided by a set of higher layer parameters *p0-NominalWithGrant* for each carrier f of serving cell c and a set of the UE does not accumulate corresponding values are provided by a set of higher layer parameters *alpha* in *P0-PUSCH-AlphaSet* indicated by a respective set of higher layer parameters *p0-PUSCH-AlphaSetId* for UL BWP b of carrier f of serving cell c.

    - If the UE is provided a higher layer parameter *SRI-PUSCH-PowerControl* and more than one values of *p0-PUSCH-AlphaSetId*, DCI format 0_1 includes a SRI field and the UE obtains a mapping from higher layer parameter *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0_1 [5, TS 38.212] and a set of indexes provided by higher layer parameter *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet*values. If the PUSCH transmission is scheduled by a DCI format 0_1, the UE determines the values of $\alpha_{b,f,c}(j)$ from the *p0alphasetindex* value that is mapped to the SRI field value. -

      If the PUSCH transmission is scheduled by a DCI format 0_0 or by a DCI format 0_1 that does not include a SRI field, or if a higher layer parameter *SRI-P0AlphaSetIndex-Mapping* is not provided to the UE, the UE determines

$\alpha_{b,f,c}(j)$ from the first *p0-pusch-alpha-set* in *p0-pusch-alpha-setconfig* for all $j \in S_J$.

- $M_{\mathrm{RB},b,f,c}^{\mathrm{PUSCH}}(i)$ is the bandwidth of the PUSCH resource assignment expressed in number of resource blocks for PUSCH transmission period i on UL BWP b of carrier f of serving cell c and μ is defined in [4, TS 38.211].

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) index q_d for a DL BWP that is paired with UL BWP b of carrier f of serving cell c.

  - If the UE is not provided with higher layer parameter *PUSCH-PathlossReferenceRS* and before the UE is provided with dedicated higher layer parameters, the UE identifies a RS index from the SS/PBCH block index that the UE obtains higher layer parameter *MasterInformationBlock*.

  - If the UE is configured with a number of RS resource indexes up to the value of higher layer parameter *maxNrofPUSCH-PathlossReferenceRS*s and a respective set of RS configurations for the number of RS resource indexes by higher layer parameter *PUSCH-PathlossReferenceRS*. The set of RS resource indexes can include one or both of a set of SS/PBCH block indexes, each provided by higher layer parameter *ssb-Index* when a value of a corresponding higher layer parameter pusch-*PathlossReferenceRS-Id* maps to a SS/PBCH block index, and a set of CSI-RS resource indexes, each provided by higher layer parameter *csi-RS-Index* when a value of a corresponding higher layer parameter *pusch-PathlossReferenceRS-Id* maps to a CSI-RS resource index. The UE identifies a RS resource index in the set of RS resource indexes to correspond either to a SS/PBCH block index or to a CSI-RS resource index as provided by higher layer parameter *pusch-PathlossReferenceRS-Id* in *PUSCH-PathlossReferenceRS*.

  - If the PUSCH is an Msg3 PUSCH, the UE uses the same RS resource index as for a corresponding PRACH transmission.

- If the UE is provided a higher layer parameter *SRI-PUSCH-PowerControl* and more than one values of *PUSCH-PathlossReferenceRS-Id*, the UE obtains a mapping from higher layer parameter *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0_1 and a set of *PUSCH-PathlossReferenceRS-Id* values. If the PUSCH transmission is scheduled by a DCI format 0_1, DCI format 0_1 includes a SRI field and the UE determines the RS resource q_d from the value of *pusch-pathlossreference-index* that is mapped to the SRI field value.

- If the PUSCH transmission is scheduled by a DCI format 0_0 or by a DCI format 0_1 that does not include a SRI field, or if a higher layer parameter *SRI-PathlossReferenceIndex-Mapping* is not provided to the UE, the UE determines a RS resource with a respective higher layer parameter *pusch-pathlossreference-index* value being equal to zero.

- For a PUSCH transmission configured by higher layer parameter *ConfiguredGrantConfig,* if higher layer parameter *rrc-ConfiguredUplinkGrant* in *ConfiguredGrantConfig* includes higher layer parameter *pathlossReferenceIndex*, a RS resource index q_d is provided by a value of higher layer parameter *pathlossReferenceIndex*.

- For a PUSCH transmission configured by higher layer parameter *ConfiguredGrantConfig,* if higher layer parameter *rrc-ConfiguredUplinkGrant* in *ConfiguredGrantConfig* does not include higher layer parameter *pathlossReferenceIndex*, the UE determines the RS resource q_d from the value of *PUSCH-PathlossReferenceRS-Id* that is mapped to the SRI field value in the DCI format activating the PUSCH transmission. If the DCI format activating the PUSCH transmission does not include a SRI field, the UE determines a RS resource with a respective higher layer parameter *PUSCH-PathlossReferenceRS-Id* value being equal to zero.

$PL_{b,f,c}(q_d)$ = *referenceSignalPower* – higher layer filtered RSRP, where *referenceSignalPower* is provided by higher layers and RSRP is defined in [7, TS 38.215] for

the reference serving cell and the higher layer filter configuration is defined in [12, TS 38.331] for the reference serving cell.

For $j=0$, *referenceSignalPower* is provided by higher layer parameter *ss-PBCH-BlockPower*. For $j>0$, *referenceSignalPower* is configured by either higher layer parameter *ss-PBCH-BlockPower* or, when periodic CSI-RS transmission is configured, by higher layer parameter *powerControlOffsetSS* providing an offset of the CSI-RS transmission power relative to the SS/PBCH block transmission power [6, TS 38.214].

- $\Delta_{\mathrm{TF},b,f,c}(i)=10\log_{10}\left(\left(2^{\mathrm{BPRE}\cdot K_s}-1\right)\cdot\beta_{\mathrm{offset}}^{\mathrm{PUSCH}}\right)$ for $K_S=1.25$ and $\Delta_{\mathrm{TF},b,f,c}(i)=0$ for $K_S=0$ where K_S is provided by higher layer parameter *deltaMCS* provided for each UL BWP b of each carrier f and serving cell c. If the PUSCH transmission is over more than one layer [6, TS 38.214], $\Delta_{\mathrm{TF},b,f,c}(i)=0$. BPRE and $\beta_{\mathrm{offset}}^{\mathrm{PUSCH}}$, for each UL BWP b of each carrier f and each serving cell c, are computed as below.

  - $\mathrm{BPRE}=\sum_{r=0}^{C-1}K_r/N_{\mathrm{RE}}$ for PUSCH with UL-SCH data and $\mathrm{BPRE}=O_{\mathrm{CSI}}/N_{\mathrm{RE}}$ for CSI transmission in a PUSCH without UL-SCH data, where

    - C is the number of code blocks, K_r is the size for code block r, O_{CSI} is the number of CSI part 1 bits including CRC bits, and N_{RE} is the number of resource elements determined as $N_{\mathrm{RE}}=M_{\mathrm{RB}b,f,c}^{\mathrm{PUSCH}}(i)\cdot\sum_{j=0}^{N_{\mathrm{symb},b,f,c}^{\mathrm{PUSCH}}(i)-1}N_{\mathrm{sc,data}}^{\mathrm{RB}}(i,j)$, where $N_{\mathrm{symb},b,f,c}^{\mathrm{PUSCH}}(i)$ is the number of symbols for PUSCH transmission period i on UL BWP b of carrier f of serving cell c, $N_{\mathrm{sc,data}}^{\mathrm{RB}}(i,j)$ is a number of subcarriers excluding DM-RS subcarriers in PUSCH symbol j, $0\le j<N_{\mathrm{symb},b,f,c}^{\mathrm{PUSCH}}(i)$, and C, K_r are defined in [5, TS 38.212].

  - $\beta_{\mathrm{offset}}^{\mathrm{PUSCH}}=1$ when the PUSCH includes UL-SCH data and $\beta_{\mathrm{offset}}^{\mathrm{PUSCH}}=\beta_{\mathrm{offset}}^{\mathrm{CSI,1}}$, as described in Subclause 9.3, when the PUSCH includes CSI and does not include UL-SCH data.

- For the PUSCH power control adjustment state for UL BWP b of carrier f of serving cell

c in PUSCH transmission period i

- $\delta_{\text{PUSCH},b,f,c}(i-K_{\text{PUSCH}},l)$ is a correction value, also referred to as a TPC command, and is included in a DCI format 0_0 or DCI format 0_1 that schedules the PUSCH transmission period i on UL BWP b of carrier f of serving cell c or jointly coded with other TPC commands in a DCI format 2_2 having CRC parity bits scrambled by TPC-PUSCH-RNTI, as described in Subclause 11.3, that is last received by the UE prior to the PUSCH transmission;
  - $l\in\{0,1\}$ if the UE is configured with higher layer parameter *twoPUSCH-PC-AdjustmentStates*, and $l=0$ if the UE is not configured with higher layer parameter *twoPUSCH-PC-AdjustmentStates* or if the PUSCH is a Msg3 PUSCH.
    - For a PUSCH (re)transmission configured by higher layer parameter *ConfiguredGrantConfig*, the value of $l\in\{0,1\}$ is provided to the UE by higher layer parameter *powerControlLoopToUse*
    - If the UE is provided a higher layer parameter *SRI-PUSCH-PowerControl*, the UE obtains a mapping between a set of values for the SRI field in DCI format 0_1 and the l value(s) provided by higher layer parameter *sri-PUSCH-ClosedLoopIndex*. If the PUSCH transmission is scheduled by a DCI format 0_1 and if DCI format 0_1 includes a SRI field, the UE determines the l value that is mapped to the SRI field value
    - If the PUSCH transmission is scheduled by a DCI format 0_0 or by a DCI format 0_1 that does not include a SRI field, or if a higher layer parameter *SRI-PUSCH-PowerControl* is not provided to the UE, $l=0$
- $f_{b,f,c}(i,l)=f_{b,f,c}(i-1,l)+\delta_{\text{PUSCH},b,f,c}(i-K_{\text{PUSCH}},l)$ is the PUSCH power control adjustment state for UL BWP b of carrier f of serving cell c and PUSCH transmission period i if accumulation is enabled based on higher layer parameter *tpc-Accumulation*, where

- $\delta_{\text{PUSCH},b,f,c}(i-K_{\text{PUSCH}},l)=0$ dB if the UE does not detect a TPC command for UL BWP b of carrier f of serving cell c.

- If the PUSCH transmission is in response to a PDCCH decoding with DCI format 0_0 or DCI format 0_1, or 2_2 having CRC parity bits scrambled by TPC-PUSCH-RNTI, the respective $\delta_{\text{PUSCH},b,f,c}$ accumulated values are given in Table 7.1.1-1.

- If the UE has reached $P_{\text{CMAX},f,c}(i)$ for UL BWP b of carrier f of serving cell c, the UE does not accumulate positive TPC commands for UL BWP b of carrier f of serving cell c.

- If UE has reached minimum power for UL BWP b of carrier f of serving cell c, the UE does not accumulate negative TPC commands for UL BWP b of carrier f of serving cell c.

- A UE resets accumulation for UL BWP b of carrier f of serving cell c

  - When $P_{\text{O\_UE\_PUSCH},b,f,c}(j)$ value is changed by higher layers;

  - When $P_{\text{O\_UE\_PUSCH},b,f,c}(j)$ value is received by higher layers and serving cell c is a secondary cell;

  - When $\alpha_{f,b,c}(j)$ value is changed by higher layers;

  - If $j>1$, the PUSCH transmission is scheduled by a DCI format 0_1 that includes a SRI field, and the UE is provided higher layer parameter *SRI-PUSCH-PowerControl*, the UE determines the value of l from the value of j based on an indication by the SRI field for a *sri-PUSCH-PowerControlId* value associated with the *sri-P0-PUSCH-AlphaSetId* value corresponding to j and with the *sri-PUSCH-ClosedLoopIndex* value corresponding to l

  - If $j>1$ and the PUSCH transmission is scheduled by a DCI format 0_0 or by a DCI

format 0_1 that does not include a SRI field or the UE is not provided higher layer parameter *SRI-PUSCH-PowerControl*, $l = 0$

- If $j = 1$, l is provided by the value of higher layer parameter *powerControlLoopToUse*

- $f_{b,f,c}(0,l) = 0$ is the first value after reset of accumulation.

- $f_{b,f,c}(i,l) = \delta_{\text{PUSCH}b,f,c}(i - K_{\text{PUSCH}}, l)$ is the PUSCH power control adjustment state for UL BWP b of carrier f of serving cell c and PUSCH transmission period i if accumulation is not enabled based on higher layer parameter *tpc-Accumulation*, where

  - If the PUSCH transmission is in response to a PDCCH decoding with DCI format 0_0 or DCI format 0_1, or 2_2 having CRC parity bits scrambled by TPC-PUSCH-RNTI, the respective $\delta_{\text{PUSCH},b,f,c}$ absolute values are given in Table 7.1.1-1.

  - $f_{b,f,c}(i,l) = f_{b,f,c}(i-1,l)$ for a PUSCH transmission period where the UE does not detect a DCI format 0_0 or DCI format 0_1, or 2_2 having CRC parity bits scrambled by TPC-PUSCH-RNTI UL BWP b of for carrier f of serving cell c.

- If the UE receives the random access response message for UL BWP b of carrier f of serving cell c

  - $f_{b,f,c}(0,l) = \Delta P_{rampupb,f,c} + \delta_{msg2,b,f,c}$, where $l = 0$ and

    - $\delta_{msg\,2,b,f,c}$ is the TPC command indicated in the random access response grant of the random access response message corresponding to the random access preamble transmitted on UL BWP b of carrier f in the serving cell c, and

    -

$$\Delta P_{rampup,b,f,c} = \min\left[\left\{\max\left(0, P_{\text{CMAX},f,c} - \begin{pmatrix} 10\log_{10}(2^{\mu}\cdot M^{\text{PUSCH}}_{\text{RB},b,f,c}(0)) \\ + P_{\text{O\_PUSCH},b,f,c}(0) + \alpha_{b,f,c}(0)\cdot PL_{c} \\ + \Delta_{\text{TF},b,f,c}(0) + \delta_{msg2,b,f,c} \end{pmatrix}\right)\right\}, \quad \Delta P_{rampuprequested,b,f,c}\right]$$

and $\Delta P_{rampuprequested,b,f,c}$ is provided by higher layers and corresponds to the total power ramp-up requested by higher layers from the first to the last random access preamble for carrier f in the serving cell c, $M^{\text{PUSCH}}_{\text{RB},b,f,c}(0)$ is the bandwidth of the PUSCH resource assignment expressed in number of resource blocks for the first PUSCH transmission on UL BWP b of carrier f of serving cell c, and $\Delta_{TF,b,f,c}(0)$ is the power adjustment of first PUSCH transmission on UL BWP b of carrier f of serving cell c.

[Table 7.1.1-1 of 3GPP R1-1805795, entitled "Mapping of TPC Command Field in DCI format 0_0, DCI format 0_1, or DCI format 2_2, having CRC parity bits scrambled by TPC-PUSCH-RNTI, or DCI format 2_3, to absolute and accumulated $\delta_{\text{PUSCH},b,f,c}$ values or $\delta_{\text{SRS},b,f,c}$ values", is reproduced as FIG. 14]

7.2 Physical uplink control channel

[...]

7.2.1 UE behaviour

If a UE transmits a PUCCH on active UL BWP b of carrier f in the primary cell c using PUCCH power control adjustment state with index l, the UE determines the PUCCH transmission power $P_{\text{PUCCH},b,f,c}(i,q_u,q_d,l)$ in PUCCH transmission period i as

$$P_{\text{PUCCH},b,f,c}(i,q_u,q_d,l) = \min\begin{Bmatrix} P_{\text{CMAX},f,c}(i), \\ P_{\text{O\_PUCCH},b,f,c}(q_u) + 10\log_{10}(2^{\mu}\cdot M^{\text{PUCCH}}_{\text{RB},b,f,c}(i)) + PL_{b,f,c}(q_d) + \Delta_{\text{F\_PUCCH}}(F) + \Delta_{\text{TF},b,f,c}(i) + g_{b,f,c}(i,l) \end{Bmatrix}$$

[dBm]

where

- $P_{\mathrm{CMAX},f,c}(i)$ is the configured UE transmit power defined in [8-1, TS 38.101-1] and [8-2, TS38.101-2] for carrier f of serving cell c in PUCCH transmission period i.

<...>

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) index q_d for a DL BWP that is paired with UL BWP b of carrier f of serving cell c.

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) index q_d for a DL BWP that is paired with UL BWP b of carrier f of the primary cell c.

    - If the UE is not provided higher layer parameter *pathlossReferenceRSs* and before the UE is provided with dedicated higher layer parameters, the UE calculates $PL_{b,f,c}(q_d)$ using a RS resource obtained from the SS/PBCH block that the UE obtains higher layer parameter *MasterInformationBlock*.

    - If the UE is provided a number of RS resource indexes, the UE calculates $PL_{b,f,c}(q_d)$ using RS resource q_d, where $0 \le q_d < Q_d$. Q_d is a size for a set of RS resources provided by higher layer parameter *maxNrofPUCCH-PathlossReferenceRSs*. The set of RS resources is provided by higher layer parameter *pathlossReferenceRSs*. The set of RS resources can include one or both of a set of SS/PBCH block indexes, each provided by higher layer parameter *ssb-Index* in *PUCCH-PathlossReferenceRS* when a value of a corresponding higher layer parameter pucch-*PathlossReferenceRS-Id* maps to a SS/PBCH block index, and a set of CSI-RS resource indexes, each provided by higher layer parameter *csi-RS-Index* when a value of a corresponding higher layer parameter *pucch-PathlossReferenceRS-Id* maps to a CSI-RS resource index. The UE identifies a RS resource in the set of RS resources to correspond either to a SS/PBCH

block index or to a CSI-RS resource index as provided by higher layer parameter *pucch-PathlossReferenceRS-Id* in *PUCCH-PathlossReferenceRS*.

- If the UE is provided higher layer parameter *PUCCH-SpatialRelationInfo*, the UE obtains a mapping, by indexes provided by corresponding higher layer parameters *pucch-PathlossReferenceRS-Id*, between a set of *pucch-SpatialRelationInfoId* values and a set of *referencesignal* values provided by higher layer parameter *PUCCH-PathlossReferenceRS*. If the UE is provided more than one values for *pucch-SpatialRelationInfoId* and the UE receives an activation command [11, TS 38.321] indicating a value of *pucch-SpatialRelationInfoId*, the UE determines the *referencesignal* value in *PUCCH-PathlossReferenceRS* through the link to a corresponding *pucch-PathlossReferenceRS-Id* index. The UE applies the activation command 3 msec after a slot where the UE transmits HARQ-ACK information for the PDSCH providing the activation command.
- If the UE is not provided higher layer parameter *PUCCH-SpatialRelationInfo*, the UE obtains the *referencesignal* value in *PUCCH-PathlossReferenceRS* from the *pucch-PathlossReferenceRS-Id* with index 0 in *PUCCH-PathlossReferenceRSs*.

- The parameter $\Delta_{\text{F\_PUCCH}}(F)$ is provided by higher layer parameter *deltaF-PUCCH-f0* for PUCCH format 0, *deltaF-PUCCH-f1* for PUCCH format 1, *deltaF-PUCCH-f2* for PUCCH format 2, *deltaF-PUCCH-f3* for PUCCH format 3, and *deltaF-PUCCH-f4* for PUCCH format 4.

7.3 Sounding reference signals

For SRS, the linear value $\hat{P}_{\text{SRS},b,f,c}(i,q_s,l)$ of the transmit power $P_{\text{SRS},b,f,c}(i,q_s,l)$ on UL BWP b of carrier f of serving cell c is split equally across the configured antenna ports for SRS. The UL BWP b is the active UL BWP.

7.3.1 UE behaviour

If a UE transmits SRS on UL BWP b of carrier f of serving cell c using SRS power control adjustment state with index l, the UE determines the SRS transmission power $P_{\text{SRS},b,f,c}(i,q_s,l)$ in SRS transmission period i as

$$P_{\text{SRS},b,f,c}(i,q_s,l) = \min\begin{Bmatrix} P_{\text{CMAX},f,c}(i), \\ P_{\text{O\_SRS},b,f,c}(q_s) + 10\log_{10}(2^{\mu}\cdot M_{\text{SRS},b,f,c}(i)) + \alpha_{\text{SRS},b,f,c}(q_s)\cdot PL_{b,f,c}(q_d) + h_{b,f,c}(i,l) \end{Bmatrix} \text{ [dBm]}$$

where,

- $P_{\text{CMAX},f,c}(i)$ is the configured UE transmit power defined in [8, TS 38.101-1] and [8-2, TS38.101-2] for carrier f of serving cell c in SRS transmission period i.

<..>

- $PL_{b,f,c}(q_d)$ is a downlink path-loss estimate in dB calculated by the UE using reference signal (RS) index q_d for a DL BWP that is paired with UL BWP b of carrier f of serving cell c and SRS resource set q_s [6, TS 38.214]. The RS index q_d is provided by higher layer parameter *pathlossReferenceRS* associated with the SRS resource set q_s and is either a higher layer parameter *ssb-Index* providing a SS/PBCH block index or a higher layer parameter *csi-RS-Index* providing a CSI-RS resource index.

- For the SRS power control adjustment state for UL BWP b of carrier f of serving cell c and SRS transmission period i

  - $h_{b,f,c}(i,l) = f_{b,f,c}(i,l)$, where $f_{b,f,c}(i,l)$ is the current PUSCH power control adjustment state as described in Subclause 7.1.1, if higher layer parameter *srs-PowerControlAdjustmentStates* indicates a same power control adjustment state for SRS transmissions and PUSCH transmissions; or

  - $h_{b,f,c}(i) = h_{b,f,c}(i-1) + \delta_{\text{SRS},b,f,c}(i-K_{\text{SRS}})$ if the UE is not configured for PUSCH transmissions on UL BWP b of carrier f of serving cell c, or if higher layer parameter *srs-PowerControlAdjustmentStates* indicates a separate power control adjustment state

between SRS transmissions and PUSCH transmissions, and if accumulation is enabled based on the parameter *tpc-Accumulation* provided by higher layers, where $\delta_{\text{SRS},b,f,c}(i-K_{\text{SRS}})$ is jointly coded with other TPC commands in a PDCCH with DCI format 2_3, as described in Subclause 11.4, that is last received by the UE prior to the SRS transmission and accumulative values of $\delta_{\text{SRS},b,f,c}(i-K_{\text{SRS}})$ are provided in Table 7.1.1-1, where

- $\delta_{\text{SRS},b,f,c}(i-K_{\text{SRS}})=0$ dB if the UE does not detect a TPC command for serving cell c.
- If the UE has reached $P_{\text{CMAX},f,c}(i)$ for UL BWP b of carrier f of serving cell c, the UE does not accumulate corresponding positive TPC commands.
- If UE has reached minimum power for UL BWP b of carrier f of serving cell c, the UE does not accumulate corresponding negative TPC commands.
- A UE resets accumulation for UL BWP b of carrier f of serving cell c
  - When $P_{\text{O\_SRS},b,f,c}(q_s)$ value is changed by higher layers;
  - When $\alpha_{\text{SRS},b,f,c}(q_s)$ value is changed by higher layers.
- $h_{b,f,c}(0)=0$ is the first value after reset of accumulation.
  - If $P_{\text{O\_SRS},b,f,c}(q_s)$ value is received by higher layers,
    - $h_{b,f,c}(0)=0$
  - Else,
    - $h_{b,f,c}(0)=\Delta P_{rampup b,f,c}+\delta_{msg2,b,f,c}$, where

      $\delta_{msg2,b,f,c}$ is the TPC command indicated in the random access response grant corresponding to the random access preamble transmitted on UL BWP b of carrier f of the serving cell c, and

$$\Delta P_{rampup,b,f,c} = \min\left[\begin{array}{l}\max\left(\begin{array}{l}0,\\ P_{\mathrm{CMAX},f,c} - \left(P_{\mathrm{O\_SRS},b,f,c}(q_s) + 10\log_{10}(2^{\mu}\cdot M_{\mathrm{SRS},b,f,c}(i)) + \alpha_{\mathrm{SRS},b,f,c}(q_s)\cdot PL_{b,f,c}(q_d)\right)\end{array}\right),\\ \Delta P_{rampuprequested,b,f,c}\end{array}\right]$$

;

and $\Delta P_{rampuprequested,b,f,c}$ is provided by higher layers and corresponds to the total power ramp-up requested by higher layers from the first to the last preamble for UL BWP b of carrier f of serving cell c.

- $h_{b,f,c}(i) = \delta_{\mathrm{SRS},b,f,c}(i - K_{\mathrm{SRS}})$ if the UE is not configured for PUSCH transmissions on UL BWP b of carrier f of serving cell c, or if higher layer parameter *srs-PowerControlAdjustmentStates* indicates a separate power control adjustment state between SRS transmissions and PUSCH transmissions, and if accumulation is not enabled based on the higher layer parameter *tpc-Accumulation*, and the UE detects a DCI format 2_3 for a SRS transmission period i, where absolute values of $\delta_{\mathrm{SRS},b,f,c}(i - K_{\mathrm{SRS}})$ are provided in Table 7.1.1-1

- $h_{b,f,c}(i) = h_{b,f,c}(i-1)$ for a SRS transmission period i where the UE does not detect a DCI format 2_3 for UL BWP b of carrier f of serving cell c.

- if higher layer parameter *srs-PowerControlAdjustmentStates* indicates a same power control adjustment state for SRS transmissions and PUSCH transmissions, the update of the power control adjustment state for SRS transmission period i occurs at the beginning of each SRS resource in the SRS resource set q_s; otherwise, the update of the power control adjustment state SRS transmission period i occurs at the beginning of the first transmitted SRS resource in the SRS resource set q_s

[...]

7.7 Power headroom report

The types of UE power headroom reports are the following. A type 1 UE power headroom PH that is valid for PUSCH transmission period i on UL BWP b of carrier f of serving cell c. A type

3 UE power headroom PH that is valid for SRS transmission period i on UL BWP b of carrier f of serving cell c.

If the UE is configured with a SCG,

- For computing power headroom for cells belonging to MCG, the term 'serving cell' in this subclause refers to serving cell belonging to the MCG.
- For computing power headroom for cells belonging to SCG, the term 'serving cell' in this subclause refers to serving cell belonging to the SCG. The term 'primary cell' in this subclause refers to the PSCell of the SCG.

If the UE is configured with a PUCCH-SCell,

- For computing power headroom for cells belonging to primary PUCCH group, the term 'serving cell' in this subclause refers to serving cell belonging to the primary PUCCH group.
- For computing power headroom for cells belonging to secondary PUCCH group, the term 'serving cell' in this subclause refers to serving cell belonging to the secondary PUCCH group. The term 'primary cell' in this subclause refers to the PUCCH-SCell of the secondary PUCCH group.

7.7.1 Type 1 PH Report

If a UE transmits PUSCH in PUSCH transmission period i on active UL BWP b of carrier f of serving cell c, the UE computes a power headroom for a Type 1 report as

$$PH_{\text{type1},b,f,c}(i,j,q_d,l) = P_{\text{CMAX},f,c}(i) - \left\{ P_{\text{O\_PUSCH},b,f,c}(j) + 10\log_{10}(2^{\mu} \cdot M^{\text{PUSCH}}_{\text{RB},b,f,c}(i)) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + \Delta_{\text{TF},b,f,c}(i) + f_{b,f,c}(i,l) \right\} \text{ [dB]}$$

where $P_{\text{CMAX},f,c}(i)$, $P_{\text{O\_PUSCH},b,f,c}(j)$, $M^{\text{PUSCH}}_{\text{RB},b,f,c}(i)$, $\alpha_{b,f,c}(j)$, $PL_{b,f,c}(q_d)$, $\Delta_{\text{TF},b,f,c}(i)$ and $f_{b,f,c}(i,l)$ are defined in Subclause 7.1.1.

If the UE does not transmit PUSCH in PUSCH transmission period i on UL BWP b of carrier f of serving cell c, the UE computes a power headroom for a Type 1 report as

$$PH_{\text{type1},b,f,c}(i,j,q_d,l) = \tilde{P}_{\text{CMAX},f,c}(i) - \left\{ P_{\text{O\_PUSCH}b,f,c}(j) + \alpha_{b,f,c}(j) \cdot PL_{b,f,c}(q_d) + f_{b,f,c}(i,l) \right\} \text{ [dB]}$$

where $\tilde{P}_{\text{CMAX},f,c}(i)$ is computed assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB. ΔT_C =0dB. MPR, A-MPR, P-MPR and ΔT_C are defined in [8-1, TS 38.101-1] and [8-2, TS38.101-2]. The remaining parameters are defined in Subclause 7.1.1 where $P_{\text{O\_PUSCH},b,f,c}(j)$ and $\alpha_{b,f,c}(j)$ are provided from *p0-PUSCH-AlphaSetId = 0* for the UL BWP b of carrier f of serving cell c, $PL_{b,f,c}(q_d)$ is obtained using *PathlossReferenceRS-Id = 0*, and $l=0$.

7.7.2 Type 2 PH report

This subclause is reserved.

7.7.3 Type 3 PH Report

If a UE transmits SRS in a SRS transmission period i on active UL BWP b of carrier f of serving cell c and the UE is not configured for PUSCH transmissions on carrier f of serving cell c, the UE computes a power headroom for a Type 3 report as

$$PH_{\text{type3},b,f,c}(i,q_s,l) = P_{\text{CMAX},f,c}(i) - \left\{ P_{\text{O\_SRS},b,f,c}(q_s) + 10\log_{10}(2^{\mu}\cdot M_{\text{SRS},b,f,c}(i)) + \alpha_{\text{SRS},b,f,c}(q_s)\cdot PL_{b,f,c}(q_d) + h_{b,f,c}(i,l) \right\} \text{ [dB]}$$

where $P_{\text{CMAX},f,c}(i)$, $P_{\text{O\_SRS},b,f,c}(q_s)$, $M_{\text{SRS},b,f,c}(i)$, $\alpha_{\text{SRS},b,f,c}(q_s)$, $PL_{b,f,c}(q_d)$ and $h_{b,f,c}(i,l)$ are defined in Subclause 7.3.1.

If the UE does not transmit SRS in SRS transmission period i on UL BWP b of carrier f of serving cell c, and the UE is not configured for PUSCH transmissions on UL BWP b of carrier f of serving cell c, the UE computes power headroom for a Type 3 report as

$$PH_{\text{type3},b,f,c}(i,q_s,l) = \tilde{P}_{\text{CMAX},f,c}(i) - \left\{ P_{\text{O\_SRS}b,f,c}(q_s) + \alpha_{\text{SRS},b,f,c}(q_s)\cdot PL_{b,f,c}(q_d) + h_{f,c}(i,l) \right\} \text{ [dB]}$$

where q_s is a SRS resource set corresponding to *SRS-ResourceSetId = 0* and $P_{\text{O\_SRS},b,f,c}(q_s)$, $\alpha_{\text{SRS},f,c}(q_s)$, $PL_{b,f,c}(q_d)$ and $h_{b,f,c}(i,l)$ are defined in Subclause 7.3.1 with corresponding values obtained from *SRS-ResourceSetId = 0* and $l=0$. $\tilde{P}_{\text{CMAX},f,c}(i)$ is computed assuming MPR=0dB, A-MPR=0dB, P-MPR=0dB and ΔT_C =0dB. MPR, A-MPR, P-MPR and ΔT_C are defined in [8-1, TS 38.101-1] and [8-2, TS38.101-2].

[0071] More detail about PHR triggering and reporting are included in 3GPP TS 38.321 V15.1.0 as follows:

5.4.6 Power Headroom Reporting

The Power Headroom reporting procedure is used to provide the serving gNB with information about the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission per activated Serving Cell and also with information about the difference between the nominal UE maximum power and the estimated power for UL-SCH and PUCCH transmission on SpCell and PUCCH SCell.

RRC controls Power Headroom reporting by configuring the following parameters:

- *phr-PeriodicTimer*;
- *phr-ProhibitTimer*;
- *phr-Tx-PowerFactorChange*;
- *phr-Type2PCell*;
- *phr-Type2OtherCell*;
- *phr-ModeOtherCG*;
- *multiplePHR*.

A Power Headroom Report (PHR) shall be triggered if any of the following events occur:

- *phr-ProhibitTimer* expires or has expired and the path loss has changed more than *phr-Tx-PowerFactorChange* dB for at least one activated Serving Cell of any MAC entity which is used as a pathloss reference since the last transmission of a PHR in this MAC entity when the MAC entity has UL resources for new transmission;
- *phr-PeriodicTimer* expires;
- upon configuration or reconfiguration of the power headroom reporting functionality by upper layers, which is not used to disable the function;

- activation of an SCell of any MAC entity with configured uplink;

- addition of the PSCell;

- *phr-ProhibitTimer* expires or has expired, when the MAC entity has UL resources for new transmission, and the following is true for any of the activated Serving Cells of any MAC entity with configured uplink:

  - there are UL resources allocated for transmission or there is a PUCCH transmission on this cell, and the required power backoff due to power management (as allowed by $P\text{-}MPR_c$ as specified in TS 38.101 [10]) for this cell has changed more than *phr-Tx-PowerFactorChange* dB since the last transmission of a PHR when the MAC entity had UL resources allocated for transmission or PUCCH transmission on this cell.

NOTE: The MAC entity should avoid triggering a PHR when the required power backoff due to power management decreases only temporarily (e.g. for up to a few tens of milliseconds) and it should avoid reflecting such temporary decrease in the values of $P_{CMAX,c}$/PH when a PHR is triggered by other triggering conditions.

If the MAC entity has UL resources allocated for new transmission the MAC entity shall:

1> if it is the first UL resource allocated for a new transmission since the last MAC reset:

2> start *periodicPHR-Timer*;

1> if the Power Headroom reporting procedure determines that at least one PHR has been triggered and not cancelled, and;

1> if the allocated UL resources can accommodate the MAC CE for PHR which the MAC entity is configured to transmit, plus its subheader, as a result of logical channel prioritization:

2> if *multiplePHR* is configured:

3> for each activated Serving Cell with configured uplink associated with any MAC entity:

4> obtain the value of the Type 1 or Type 3 power headroom for the corresponding uplink carrier;

4> if this MAC entity has UL resources allocated for transmission on this Serving Cell; or

4> if the other MAC entity, if configured, has UL resources allocated for transmission on this Serving Cell and *phr-ModeOtherCG* is set to real by upper layers:

5> obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer.

3> if *phr-Type2PCell* is configured:

4> obtain the value of the Type 2 power headroom for the PCell;

4> obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer.

3> if *phr-Type2OtherCell* is configured:

4> if PUCCH SCell is configured:

5> obtain the value of the Type 2 power headroom for the PUCCH SCell.

4> else (i.e. other CG is configured):

5> obtain the value of the Type 2 power headroom for the SpCell of the other MAC entity.

4> obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer.

3> instruct the Multiplexing and Assembly procedure to generate and transmit a PHR MAC CE according to configured *ServCellIndex* and the PUCCH(s) for the MAC entity as defined in subclause 6.1.3.9 based on the values reported by the physical layer.

2> else (i.e. Single Entry PHR format is used):

3> obtain the value of the Type 1 or Type 3 power headroom from the physical layer for the corresponding uplink carrier of the PCell;

3> obtain the value for the corresponding $P_{CMAX,c}$ field from the physical layer;

3> instruct the Multiplexing and Assembly procedure to generate and transmit a PHR MAC CE as defined in subclause 6.1.3.8 based on the value reported by the physical layer.

2> start or restart *periodicPHR-Timer*;

2> start or restart *prohibitPHR-Timer*;

2> cancel all triggered PHR(s).

[0072] As discussed above, there are several trigger of power headroom report, e.g. pathloss change, timer expiring. When transmissions are performed with narrow, the beam(s) used for transmission may be changed frequently, e.g., due to blockage or scheduling flexibility. However, if the triggering is too frequent while the power situation is unchanged, unnecessary power headroom report would be generated and included without providing base station additional information than what has been provided. On the other hand, if the power status has changed while no power headroom report is triggered, base station may not make correct decision for scheduling since up-to date information is not provided. For example, pathloss derived from different beam may be different such that when the scheduled beam changes from one beam to another beam, pathloss difference may exceed the threshold and a power headroom report is triggered. However, the channel condition within each beam may be similar and the report may not be very helpful.

[0073] On the other hand, even if the pathloss is kept similar, it is possible that channel condition for a beam has been changing a lot while a report would not be triggered. The above analysis can also be applied to the case where UE use more than one beam for transmission. Another factor which may have impact on power headroom triggering is power control

algorithm. It is possible that the power control is applied on a per UE basis, e.g. UE would transmits on different beams with similar power level and one control loop is maintained. Alternatively, power control can apply on a per UE beam, TRP beam, or TRP basis, e.g. power control for each UE beam is controlled independently and multiple control loops are maintained. Alternatively, it is also possible that power control for certain UE beams is controlled in a similar way, e.g. as a group, and power control for some other UE beams is controlled in another way, e.g. as another group. An example of group is that UE beams associated with a same TRP belong to the same group. Another example of group is that UE beams associated with a same base station beam or TRP beam belong to the same group. The triggering of power headroom would need to take the aspects into account as well.

[0074] When there are multiple pathloss references configured for a UE, so that there would be multiple pathloss values available (for a given time or for a given slot). How to design properly regarding choosing pathloss values for pathloss change comparison need to be taken care. With properly design, PHR trigger results from pathloss change comparison could be more efficient.

[0075] The above issue could be described as: How to determine "a previous pathloss value, e.g. associated with a PHR" and/or how to determine a current pathloss value when UE determine PHR is triggered due to pathloss or not. Note that determine a previous pathloss value, e.g. associated with a PHR" may comprise determine pathloss value and/or determine which PHR is the associated PHR. For example, the issue could be illustrated by FIG. 15. Assume 4 RSs (including RS a, RS b, RS c, and RS d) are configured as pathloss reference in FIG. 15. As shown in FIG. 15, which of a3, b3, c3, d3 is used as a pathloss value for pathloss change determination (e.g. served as x) need to be solved. For example, how to select x from a3, b3, c3, and d3? Besides, as PHR 2 is the last PHR after PHR1, is PHR1 or PHR2 considered as a PHR with pathloss value which is used for pathloss comparison?

[0076] If PHR 2 is considered as the PHR for pathloss comparison, e.g. x-y is considered as pathloss change, which of a2, b2, c2, d2 are used as pathloss change determination, e.g. served as y. If PHR 1 is considered as the PHR for pathloss comparison, e.g. x-z is considered as

pathloss change, which of a1, b1, c1, d1 are used as pathloss change determination, e.g. served as z.

[0077] In one embodiment, this application is applicable for a case when UE is not configured with a secondary cell (SCell), e.g. for single cell.

[0078] In one embodiment, this application is applicable for a case when UE is configured with at least one secondary cell (SCell), e.g. for the case of multiple cells, for the case of carrier aggregation or for the case of dual connectivity

[0079] In one embodiment, the pathloss reference could be configured for PUSCH and/or PUCCH and/or SRS. In one embodiment, the PHR is for PUSCH and/or PUSCH+PUCCH and/or SRS.

[0080] **Solution** – A first general concept of this invention is that a power headroom report would be triggered due to change of pathloss for a specific UE beam or a set of UE beams larger than a threshold. The UE may determine whether the pathloss of the specific UE beam or the set of UE beams has changed if the specific UE beam or the set of UE beams is scheduled for transmission. The UE does not determine whether the pathloss of the specific UE beam or the set of UE beams has changed if the specific beam or the set of beams is not scheduled for transmission. Change of the pathloss is derived from comparison between current pathloss for the specific UE beam or the set of UE beams and previous pathloss for the specific UE beam or the set of UE beams. Comparison for pathloss change may be done for a same UE beam or a same set of UE beam.

[0081] A second general concept of this invention is that a power headroom report would be triggered due to change of pathloss associated with a TRP beam, a set of TRP beams, or a TRP larger than a threshold. The UE may determine whether the pathloss has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is scheduled. The UE does not determine whether the pathloss has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is not scheduled. Change of the pathloss is derived from comparison between current pathloss associated with the TRP beam, the set of TRP beams, or the TRP and previous pathloss associated with the TRP beam, the set of TRP beams, or the TRP.

[0082] A third general concept of this invention is that a power headroom report would be triggered due to change (or addition or activation) of serving TRP(s), change (or addition or activation) of serving TRP beam(s), change (or addition or activation) of candidate TRP beam(s), or activation (or addition) of a UE beam.

[0083] In one example, if pathloss of a specific UE beam or a set of UE beams has changed more than a threshold, a power headroom report would be triggered. Power headroom report may not be triggered if pathloss change is due to change of UE beam or set of UE beams.

[0084] The power headroom report may include power headroom for the specific UE beam or the set of UE beams. Alternatively, the power headroom report would include power headroom for all UE beams. Alternatively, the power headroom report would include power headroom for any combination of UE beam(s) within all UE beams. More specifically, a subset of combination of UE beam(s) can be configured to report. The subset of combination of UE beam(s) can be linked to the specific UE beam or set of UE beams. The subset of combination of UE beam(s) could incude UE beam which is not the specific UE beam. Furthermore, the subset of combination of UE beam(s) could include UE beam which is not within the subset of UE beams.

[0085] The set of UE beams may be UE beams associated with a TRP. Alternatively, the set of UE beams may be UE beams associated with a TRP or base station beam. In one embodiment, the set of UE beams is configured by a base station.

[0086] In one example, power headroom for a specific UE beam could be derived based on UE power status of transmission on the specific UE beam. More specifically, the power headroom for the specific UE beam could be a difference between a UE calculated transmission power for the specific beam and a maximum transmission power on the specific beam.

[0087] In one example, power headroom for a set of UE beams could be derived based on UE power status of transmission on the set of UE beams. More specifically, the power headroom for the set of UE beams could be a difference between a UE calculated transmission power for the set of beams and a maximum transmission power on the set of beams.

[0088] In one embodiment, the power control could be per UE. Alternatively, the power control could be per beam, per beam group/beam set, or per beam combination.

[0089] In another embodiment, the UE could trigger power headroom report for a group of UE beams based on a same first condition. The group of UE beams could be a subset of UE beams that can be generated by the UE. In one embodiment, triggering of power headroom report for another group of UE beams would be based on a second condition. The power headroom report could include power headroom of each UE beam within the group. The power headroom report could also include power headroom of any combination of UE beam(s) within the group.

[0090] More specifically, a subset of the any combinations of UE beam(s) could be configured to be included in the power headroom report. In one embodiment, the first condition could be pathloss of a UE beam within the group has changed more than a threshold. Furthermore, the first condition could be pathloss of a combination of UE beams within the group has changed more than a threshold. The power headroom report may not triggered if pathloss change is due to change of UE beam or set of UE beams. The comparison for pathloss change could be done for a same UE beam or a same set of UE beam. The first condition could be checked if at least one UE beam within the group of UE beams is scheduled for transmission. In one embodiment, the first condition may not be checked if none of UE beam within the group of UE beams is scheduled for transmission. The first condition may be checked if a specific UE beam or a specific beam combination within the group of UE beams is scheduled for transmission. In one embodiment, the first condition may not be checked if a specific UE beam or a specific beam combination within the group of UE beams is not scheduled for transmission. In one embodiment, the group of UE beams could be UE beams associated with a TRP. The group of UE beams could be UE beams associated with a TRP or base station beam. The group of UE beams could also be configured by a base station.

[0091] In one embodiment, power headroom for the specific UE beam could be derived based on UE power status of transmission on the specific UE beam. More specifically, the power headroom for the specific UE beam could be a difference between a UE calculated

transmission power for the specific beam and a maximum transmission power on the specific beam.

[0092] In one embodiment, power headroom for a set of UE beams could be derived based on UE power status of transmission on the set of UE beams. The power headroom for the set of UE beams could be a difference between a UE calculated transmission power for the set of beams and a maximum transmission power on the set of beams. In one embodiment, the power control could be per UE, per beam, per beam group or beam set, or per beam combination.

[0093] Per beam and/or per beam combination power headroom could be reported from a UE to a base station. More specifically, UE could calculate power headroom for each beam and/or each beam combination. In one embodiment, power headroom of a beam and/or beam combination used to carry the power headroom could be calculated based on real transmission power. Power headroom of a beam and/or beam combination which is not used to carry the power headroom could be calculated assuming a same transmission is performed on the beam and/or beam combination.

[0094] In one embodiment, power headroom of a beam and/or beam combination which is not used to carry the power headroom could be calculated assuming some predefined parameter, e.g. virtual PH is reported. Base station could indicate power headroom of which beam is reported. Base station could also indicate power headroom of which beam combination is reported. In one embodiment, UE could select power headroom of which beam is reported. More specifically, UE could select beam(s) with largest power headroom(s) to report power headroom. More specifically, the UE reports power headroom together with an indicator associated with a corresponding beam.

[0095] In one embodiment, UE could select power headroom of which beam combination is reported. More specifically, UE could select beam combination(s) with largest power headroom(s) to report power headroom. More specifically, the UE reports power headroom together with an indicator associated with a corresponding beam combination.

[0096] In any of the above embodiment, pathloss of a UE beam could be derived from DL signal measured on the UE beam. In one embodiment, the DL signal is transmitted on

multiple TRP or base station beam(s). More specifically, the multiple TRP or base station beam(s) could be associated with the UE beam.

[0097] In any of the above embodiment, pathloss of a set of UE beams could be derived from DL signal measured on the set of UE beams. In one embodiment, the DL signal could be transmitted on multiple TRP or base station beam(s). The multiple TRP or base station beam(s) could be associated with the set of UE beams.

[0098] In one embodiment, any or any combinations of following can be the DL signal for pathloss measurement:

- Reference signal for pathloss measurement.
- Reference signal for beam management.
- Reference signal for channel state information measurement.
- Reference signal for mobility management.
- Reference signal for demodulation.
- Beam reference signal.
- Demodulation reference signal for a control channel (e.g. an uplink grant for reporting power headroom).
- Demodulation reference signal for a data channel.
- Channel state information reference signal.
- Synchronization signal.

[0099] For determining a current pathloss value, e.g. x in FIG. 15, the following alternative are listed:

1. a pathloss value derived from pathloss reference used for power control and/or deriving power headroom value, e.g. using c3 in FIG. 15 as RS c is used as reference
2. a pathloss value derived from pathloss reference which is used for power control and/or

deriving power headroom value in the last PHR, e.g. b3 as RS b is used as reference in the last PHR

3. a largest pathloss value

4. a smallest pathloss value

5. a pathloss value derived from pathloss reference which is used for deriving a previous pathloss value for pathloss change determination

6. a pathloss value derived from a specific pathloss reference

7. a pathloss value derived from a pathloss reference configured or indicated for pathloss comparison

8. a pathloss value derived from a pathloss reference with a smallest or largest RS id

9. a pathloss value derived from a pathloss reference with a smallest entry(e.g. 0) or largest entry (e.g. 3) of pathloss reference configuration

[00100] For determining a previous pathloss value, e.g. y or z in FIG. 15, the following alternative are listed:

a. a pathloss value derived from pathloss reference used for power control and/or deriving power headroom value for last PHR, e.g. using b2 in FIG. 15 as RS b is used as reference for last PHR

b. a pathloss value derived from pathloss reference used for power control and/or deriving power headroom value for last PHR which is derived based on a pathloss reference which is used for PUSCH when pathloss change comparison is done (for), e.g. using c1 in FIG. 15 as RS c is used as reference for PUSCH1 and PHR 1 has the same used pathloss reference as PUSCH1

c. a pathloss value derived from pathloss reference which is used for power control and/or deriving power headroom value for PUSCH when pathloss change comparison is done (for), e.g. c2 in FIG. 15 as RS c is used as reference in the PUSCH 1

d. a largest pathloss value

e. a smallest pathloss value

f. a pathloss value derived from pathloss reference which is used for deriving a current pathloss value for pathloss change determination

g. a pathloss value derived from a specific pathloss reference

h. a pathloss value derived from a pathloss reference configured or indicated for pathloss comparison

i. a pathloss value derived from a pathloss reference with a smallest or largest RS id

j. a pathloss value derived from a pathloss reference with a smallest entry(e.g. 0) or largest entry (e.g. 3) of pathloss reference configuration

[00101] Any of alternatives 1 - 9 and alternatives a - j above can form a new embodiment. The embodiments determine a previous pathloss vale and a current pathloss value. Pathloss change can be perfomed by comparison between the previous pathloss vale and the current pathloss value.

[00102] In any of alternatives 1 - 9 or alternatives a - j, the UE may use a different pathloss reference for power control and/or deriving power headroom than a pathloss reference for pathloss change comparison. The UE may not use a pathloss value which is used for power control and/or deriving power headroom for pathloss change comparison. The UE may use another pathloss value derived from another pathloss reference for pathloss change.

[00103] In any of alternatives 1 - 9 or alternatives a - j, the UE may compare pathloss value between a first pathloss value and a second pathloss value, wherein the first pathloss is used for a PUSCH transmission where pathloss change comparison is done for and the second pathloss value is used for a PHR wherein the PHR and the PUSCH use a same pathloss reference. The UE may not use pathloss value from the last PHR, while use pathloss value from earlier PHR.

[00104] A first pathloss value from alternativev 1 - 9 and a second pathloss value from alternatives a - j are used to derive a pathloss change. A UE could determine whether a PHR is triggered based on whether the pathloss change is more than a threshold. The UE could decide whether to report PHR accordingly, e.g. subject to whether UL resource is sufficient or not. The

UE could be configured with a single cell, e.g. Primary cell (PCell).

[00105] *Alt. 1 as illustrated in FIG. 16* - Pathloss reference(s) used for pathloss change same as pathloss reference for power control or power headroom. For example, pathloss change is compared between c3 and b2. In this alternative, the pathloss reference(s) used for pathloss change determination follows the pathloss reference for power control or power headroom. This alternative is less preferable as pathloss change can be compared among different pathloss references such that the resulting pathloss change does not reflect the real channel quality change for the UE, which means the original design principle of detecting pathloss change borrowed from LTE is violated.

[00106] *Alt. 2 as illustrated in FIG. 17* - Pathloss reference during last PHR transmission is determined based on "currently used reference". For example, pathloss change is compared between c3 and c2. In this alternative, x is not a constant pathloss reference while would depend on what is a currently used reference when the pathloss comparison is made. For this alternative, pathloss change is compared among pathloss values from a same pathloss reference, such the pathloss change could capture the real channel variation.

[00107] *Alt. 3 as illustrated in FIG. 18* - "last PHR transmission " is PHR using the same reference as "currently used reference". For example, pathloss change is compared between c3 and c1. In this alternative, to use pathloss value in the last PHR with the same pathloss reference as what is a currently used reference when the pathloss comparison is made for pathloss change determination. Although the basis for comparison is not pathloss reference from a fixed time occasion, this alternative allows pathloss comparison to be done for a same pathloss reference similar as Alt. 2.

[00108] *Alt. 4 as illustrated in FIG. 19* - Pathloss references used for pathloss change determination same as that in last PHR transmission. For example, pathloss change is compared between b3 and b2. For this alternative, the pathloss reference used for pathloss change determination is the same one used in the last PHR transmission. Similar to Alt 2, pathloss change is compared among pathloss values from a same pathloss reference, such the pathloss change could capture the real channel variation.

[00109] *Alt. 5 as illustrated in FIG. 20* - Specify a predefined rule to select pathloss

references used for pathloss change determination. One example of predefined rule could be the strongest pathloss reference for a given instance, i.e. the pathloss reference with least pathloss value. Similar to Alt. 1, this alternative suffers from comparing pathloss among different pathloss references. One potential drawback of this alternative is that pathloss reference for power control/PHR and pathloss reference for pathloss change are totally decoupled.

[00110] Any parts of Alt. 1 through Alt. 5 could be combined to form a new embodiment or method.

[00111] FIG. 21 is a flow chart 2100 according to one exemplary embodiment from the perspective of a UE. In step 2105, a UE derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report. In step 2110, the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell. In step 2115, the UE derives the pathloss change based on the first pathloss value and the second pathloss value. In step 2120, the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

[00112] In one embodiment, the second power headroom report could be transmitted via the first PUSCH transmission if the second power headroom report is triggered. The first pathloss value could be used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission.

[00113] In one embodiment, a second downlink control information (DCI) scheduling the second PUSCH transmission could indicate the first pathloss reference. The second PUSCH transmission could be configured by a parameter ConfiguredGrantConfig, and the ConfiguredGrantConfig could indicate the first pathloss reference.

[00114] In one embodiment, a first DCI scheduling the first PUSCH transmission could indicate the second pathloss reference. The first PUSCH transmission could be configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference. The first pathloss reference could be a pathloss reference with the smallest entry of a

pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report. The pathloss reference configuration could be *PUSCH-PathlossReferenceRS*.

[00115] Referring back to FIGS. 3 and 4, in one exemplary embodiment of a UE, the device 300 includes a program code 312 stored in the memory 310. The CPU 308 could execute program code 312 to enable the UE (i) to derive a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report, (ii) to derive a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first PUSCH transmission on the serving cell, (iii) to derive the pathloss change based on the first pathloss value and the second pathloss value, and (iv) to determine whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold. Furthermore, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or others described herein.

[00116] FIG. 22 is a flow chart 2200 according to one exemplary embodiment from the perspective of a UE. In step 2205, a UE derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a first power headroom value included in a first power headroom report. In step 2210, the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for deriving a second power headroom value. In step 2215, the UE derives the pathloss change based on the first pathloss value and the second pathloss value. In step 2220, the UE determines whether a second power headroom report to include the second power headroom value is triggered based on whether the pathloss change is more than a threshold.

[00117] In one embodiment, the second pathloss value may not be used for power control for a PUSCH transmission on the serving cell. The smallest entry of a pathloss reference configuration of the serving cell could be the second pathloss reference.

[00118] In one embodiment, the first pathloss value could be used for power control for a PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the PUSCH transmission. A downlink control information (DCI) scheduling the PUSCH transmission could indicate the first pathloss reference. The PUSCH transmission could be configured by a parameter ConfiguredGrantConfig, and the ConfiguredGrantConfig could indicate the first pathloss reference.

[00119] In one embodiment, the first pathloss reference could be a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

[00120] Referring back to FIGS. 3 and 4, in one exemplary embodiment of a UE, the device 300 includes a program code 312 stored in the memory 310. The CPU 308 could execute program code 312 to enable the UE (i) to derive a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a first power headroom value included in a first power headroom report, (ii) to derive a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for deriving a second power headroom value, (iii) to derive the pathloss change based on the first pathloss value and the second pathloss value, and (iv) to determine whether a second power headroom report to include the second power headroom value is triggered based on whether the pathloss change is more than a threshold. Furthermore, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or others described herein.

[00121] FIG. 23 is a flow chart 2300 according to one exemplary embodiment from the perspective of a UE. In step 2305, a UE performs uplink transmission with UE beam(s). In step 2310, a power headroom report is triggered due to change of pathloss for a specific UE beam or a set of UE beams larger than a threshold.

[00122] In one embodiment, the UE could determine whether the pathloss for the specific UE beam or the set of UE beams has changed if the specific UE beam or the set of UE beams is scheduled for transmission. Alternatively, the UE may not determine whether the pathloss for

the specific UE beam or the set of UE beams has changed if the specific beam or the set of beams is not scheduled for transmission.

[00123] In one embodiment, the change of the pathloss could be derived from comparison between current pathloss for the specific UE beam or the set of UE beams and previous pathloss for the specific UE beam or the set of UE beams. Comparison for the change of the pathloss could be done for a same UE beam or a same set of UE beam.

[00124] In one embodiment, the power headroom report could be triggered if the change of the pathloss is due to change of UE beam or set of UE beams. The power headroom report could comprise power headroom for the specific UE beam or the set of UE beams.

[00125] Referring back to FIGS. 3 and 4, in one exemplary embodiment of a UE, the device 300 includes a program code 312 stored in the memory 310. The CPU 308 could execute program code 312 to enable the UE (i) to perform uplink transmission with UE beam(s), and (ii) to trigger a power headroom report to change of pathloss for a specific UE beam or a set of UE beams larger than a threshold. Furthermore, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or others described herein.

[00126] FIG. 24 is a flow chart 2400 according to one exemplary embodiment from the perspective of a UE. In step 2405, a power headroom report is triggered due to change (or addition or activation) of serving TRP(s), change (or addition or activation) of serving TRP beam(s), change (or addition or activation) of candidate TRP beam(s), and/or activation (or addition) of a UE beam.

[00127] In one embodiment, the UE could perform uplink transmission with UE beam(s). The UE could determine whether the pathloss has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is scheduled. The UE may not determine whether the pathloss has changed if a transmission associated with the TRP beam, the set of TRP beams, or the TRP is not scheduled.

[00128] In one embodiment, change of the pathloss could be derived from comparison between current pathloss associated with the TRP beam, the set of TRP beams, or the TRP and previous pathloss associated with the TRP beam, the set of TRP beams, or the TRP. The power

headroom report could comprise power headroom for a specific UE beam or a set of UE beams. More specifically, the power headroom report could comprise power headroom for all UE beams. The power headroom report could also comprise power headroom for any combination of UE beam(s) within all UE beams.

[00129] In one embodiment, a subset of combination of UE beam(s) could be configured to report. The set of UE beams could be UE beams associated with a TRP or base station beam.

[00130] In one embodiment, the set of UE beams could be configured by a base station. The power headroom for the specific UE beam could be derived based on UE power status of transmission on the specific UE beam. The power headroom for the specific UE beam could be a difference between a UE calculated transmission power for the specific beam and a maximum transmission power on the specific beam. The power headroom for the set of UE beams could be derived based on UE power status of transmission on the set of UE beams. The power headroom for the set of UE beams could be a difference between a UE calculated transmission power for the set of beams and a maximum transmission power on the set of beams.

[00131] In one embodiment, power control could be per UE, per beam, per beam group or beam set, or per beam combination.

[00132] Referring back to FIGS. 3 and 4, in one exemplary embodiment of a UE, the device 300 includes a program code 312 stored in the memory 310. The CPU 308 could execute program code 312 to enable the UE to trigger a power headroom report due to change (or addition or activation) of serving TRP(s), change (or addition or activation) of serving TRP beam(s), change (or addition or activation) of candidate TRP beam(s), and/or activation (or addition) of a UE beam. Furthermore, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or others described herein.

[00133] FIG. 25 is a flow chart 2500 according to one exemplary embodiment from the perspective of a UE. In step 2505, the UE performs uplink transmission with UE beam(s). In step 2510, the UE determines whether to trigger power headroom report for a first group of UE beam(s) based on a first condition. In step 2515, the UE determines whether to trigger power headroom report for a second group of UE beam(s) based on a second condition.

[00134] In one embodiment, the first group of UE beams is a subset of UE beams that can be generated by the UE. The power headroom report could comprise power headroom of each UE beam or any combination of UE beam(s) within the group. A subset of the any combinations of UE beam(s) could be configured to be included in the power headroom report.

[00135] In one embodiment, the first condition could be pathloss of a UE beam within the first group has changed more than a threshold. The second condition could be pathloss of a UE beam within the second group has changed more than a threshold.

[00136] In one embodiment, the first condition could be checked if at least one UE beam within the first group of UE beams is scheduled for transmission. The first condition may not be checked if none of UE beam within the first group of UE beams is scheduled for transmission.

[00137] In one embodiment, the first condition could be checked if a specific UE beam or a specific beam combination within the first group of UE beams is scheduled for transmission. The first condition may not be checked if a specific UE beam or a specific beam combination within the first group of UE beams is not scheduled for transmission.

[00138] In one embodiment, the first group of UE beams could be UE beams associated with a TRP or base station beam. The first group of UE beams could be configured by a base station.

[00139] Referring back to FIGS. 3 and 4, in one exemplary embodiment of a UE, the device 300 includes a program code 312 stored in the memory 310. The CPU 308 could execute program code 312 to enable the UE (i) to perform uplink transmission with UE beam(s), (ii) to determine whether to trigger power headroom report for a first group of UE beam(s) based on a first condition, and (iii) to determine whether to trigger power headroom report for a second group of UE beam(s) based on a second condition. Furthermore, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or others described herein.

[00140] FIG. 26 is a flow chart 2600 according to one exemplary embodiment from the perspective of a UE. In step 2605, the UE uses multiple beams for transmission. In step 2610,

the UE triggers a power headroom report in response to a change of a pathloss is larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams.

[00141] In one embodiment, the UE could determine whether the pathloss has changed if a transmission associated with the specific beam or the set of beams is scheduled. The specific beam could be a specific UE beam or a specific transmission or reception point (TRP) beam. The set of beams could be a set of UE beams or a set of TRP beams. The set of beams could be associated with a same TRP beam, a same set of TRP beams, or a same TRP.

[00142] In one embodiment, the change of the pathloss could be derived from a comparison of a same UE beam or a same set of UE beams. The change of the pathloss could also be derived from a comparison between a current pathloss value, associated with the specific beam or the set of beams, and a previous pathloss value, associated with the specific beam or the set of beams. The pathloss could be derived from a downlink signal measured on the specific beam or measured on the set of beams.

[00143] Referring back to FIGS. 3 and 4, in one exemplary embodiment of a UE, the device 300 includes a program code 312 stored in the memory 310. The CPU 308 could execute program code 312 to enable the UE (i) to use multiple beams for transmission, and (ii) to trigger a power headroom report in response to a change of a pathloss is larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams. Furthermore, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or others described herein.

[00144] FIG. 27 is a flow chart 2700 according to one exemplary embodiment from the perspective of a UE. In step 2705, the UE determines whether to trigger a power headroom report for a first group of multiple UE beams based on a first condition. In step 2710, the UE determines whether to trigger a power headroom report for a second group of the multiple UE beams based on a second condition. In step 2715, the UE triggers the power headroom report for the first group if the first condition is fulfilled. In step 2720, the UE triggers the power headroom report for the second group if the second condition is fulfilled.

[00145] In one embodiment, the first condition could be a pathloss having changed more than a threshold for a UE beam within the first group or a combination of UE beams within the

first group. The second condition could be a pathloss having changed more than a threshold for a UE beam within the second group or a combination of UE beams within the second group. The first group and the second group could be configured by a base station.

[00146] Referring back to FIGS. 3 and 4, in one exemplary embodiment of a UE, the device 300 includes a program code 312 stored in the memory 310. The CPU 308 could execute program code 312 to enable the UE (i) to determine whether to trigger a power headroom report for a first group of multiple UE beams based on a first condition, (ii) to determine whether to trigger a power headroom report for a second group of the multiple UE beams based on a second condition, (iii) to trigger the power headroom report for the first group if the first condition is fulfilled, and (iv) to trigger the power headroom report for the second group if the second condition is fulfilled. Furthermore, the CPU 308 can execute the program code 312 to perform all of the above-described actions and steps or others described herein.

[00147] Various aspects of the disclosure have been described above. It should be apparent that the teachings herein may be embodied in a wide variety of forms and that any specific structure, function, or both being disclosed herein is merely representative. Based on the teachings herein one skilled in the art should appreciate that an aspect disclosed herein may be implemented independently of any other aspects and that two or more of these aspects may be combined in various ways. For example, an apparatus may be implemented or a method may be practiced using any number of the aspects set forth herein. In addition, such an apparatus may be implemented or such a method may be practiced using other structure, functionality, or structure and functionality in addition to or other than one or more of the aspects set forth herein. As an example of some of the above concepts, in some aspects concurrent channels may be established based on pulse repetition frequencies. In some aspects concurrent channels may be established based on pulse position or offsets. In some aspects concurrent channels may be established based on time hopping sequences. In some aspects concurrent channels may be established based on pulse repetition frequencies, pulse positions or offsets, and time hopping sequences.

[00148] Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced

throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[00149] Those of skill would further appreciate that the various illustrative logical blocks, modules, processors, means, circuits, and algorithm steps described in connection with the aspects disclosed herein may be implemented as electronic hardware (e.g., a digital implementation, an analog implementation, or a combination of the two, which may be designed using source coding or some other technique), various forms of program or design code incorporating instructions (which may be referred to herein, for convenience, as "software" or a "software module"), or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

[00150] In addition, the various illustrative logical blocks, modules, and circuits described in connection with the aspects disclosed herein may be implemented within or performed by an integrated circuit ("IC"), an access terminal, or an access point. The IC may comprise a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, electrical components, optical components, mechanical components, or any combination thereof designed to perform the functions described herein, and may execute codes or instructions that reside within the IC, outside of the IC, or both. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[00151] It is understood that any specific order or hierarchy of steps in any disclosed process is an example of a sample approach. Based upon design preferences, it is understood that the specific order or hierarchy of steps in the processes may be rearranged while remaining within the scope of the present disclosure. The accompanying method claims present elements of the various steps in a sample order, and are not meant to be limited to the specific order or hierarchy presented.

[00152] The steps of a method or algorithm described in connection with the aspects disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module (e.g., including executable instructions and related data) and other data may reside in a data memory such as RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, a hard disk, a removable disk, a CD-ROM, or any other form of computer-readable storage medium known in the art. A sample storage medium may be coupled to a machine such as, for example, a computer/processor (which may be referred to herein, for convenience, as a "processor") such the processor can read information (e.g., code) from and write information to the storage medium. A sample storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in user equipment. In the alternative, the processor and the storage medium may reside as discrete components in user equipment. Moreover, in some aspects any suitable computer-program product may comprise a computer-readable medium comprising codes relating to one or more of the aspects of the disclosure. In some aspects a computer program product may comprise packaging materials.

[00153] While the invention has been described in connection with various aspects, it will be understood that the invention is capable of further modifications. This application is intended to cover any variations, uses or adaptation of the invention following, in general, the principles of the invention, and including such departures from the present disclosure as come within the known and customary practice within the art to which the invention pertains.

CLAIMS

1. A method for deriving a pathloss change, comprising:

a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report;

the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell;

the UE derives the pathloss change based on the first pathloss value and the second pathloss value; and

the UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

2. The method of claim 1, wherein the second power headroom report is transmitted via the first PUSCH transmission if the second power headroom report is triggered.

3. The method of claim 1, wherein the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission.

4. The method of claim 3, wherein a second downlink control information (DCI) scheduling the second PUSCH transmission indicates the first pathloss reference.

5. The method of claim 3, wherein the second PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

6. The method of claim 1, wherein a first DCI scheduling the first PUSCH transmission indicates the second pathloss reference.

7. The method of claim 1, wherein the first PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the second pathloss reference.

8. The method of claim 1, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

9. The method of claim 8, wherein the pathloss reference configuration is *PUSCH-PathlossReferenceRS*.

10. A method for deriving a pathloss change, comprising:

a UE (User Equipment) derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a first power headroom value included in a first power headroom report;

the UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for deriving a second power headroom value;

the UE derives the pathloss change based on the first pathloss value and the second pathloss value; and

the UE determines whether a second power headroom report to include the second power headroom value is triggered based on whether the pathloss change is more than a threshold.

11. The method of claim 10, wherein the second pathloss value is not used for power control for a Physical Uplink Shared Channel (PUSCH) transmission on the serving cell.

12. The method of claim 10, wherein the smallest entry of a pathloss reference configuration of the serving cell is the second pathloss reference.

13. The method of claim 10, wherein the first pathloss value is used for power control for a PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the PUSCH transmission.

14. The method of claim 13, wherein a downlink control information (DCI) scheduling the PUSCH transmission indicates the first pathloss reference.

15. The method of claim 13, wherein the PUSCH transmission is configured by a parameter ConfiguredGrantConfig and the ConfiguredGrantConfig indicates the first pathloss reference.

16. The method of claim 10, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

17. A User Equipment (UE) for deriving a pathloss change, comprising:
a control circuit;
a processor installed in the control circuit; and
a memory installed in the control circuit and operatively coupled to the processor;
wherein the processor is configured to execute a program code stored in the memory to:

derive a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report;

derive a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell;

derive the pathloss change based on the first pathloss value and the second pathloss value; and

determine whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

18. The UE of claim 17, wherein the second power headroom report is transmitted via the first PUSCH transmission if the second power headroom report is triggered.

19. The UE of claim 17, wherein the first pathloss value is used for power control for a second PUSCH transmission on the serving cell, wherein the first power headroom report is transmitted via the second PUSCH transmission.

20. The UE of claim 17, wherein the first pathloss reference is a pathloss reference with the smallest entry of a pathloss reference configuration of the serving cell if the UE does not transmit any PUSCH transmission on the serving cell when transmitting the first power headroom report.

ABSTRACT

A method and apparatus are disclosed from the perspective of an User Equipment (UE). In one embodiment, the method includes the UE deriving a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report. The method also includes the UE deriving a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first Physical Uplink Shared Channel (PUSCH) transmission on the serving cell. The method further includes the UE deriving the pathloss change based on the first pathloss value and the second pathloss value. In addition, the method includes the UE determining whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold.

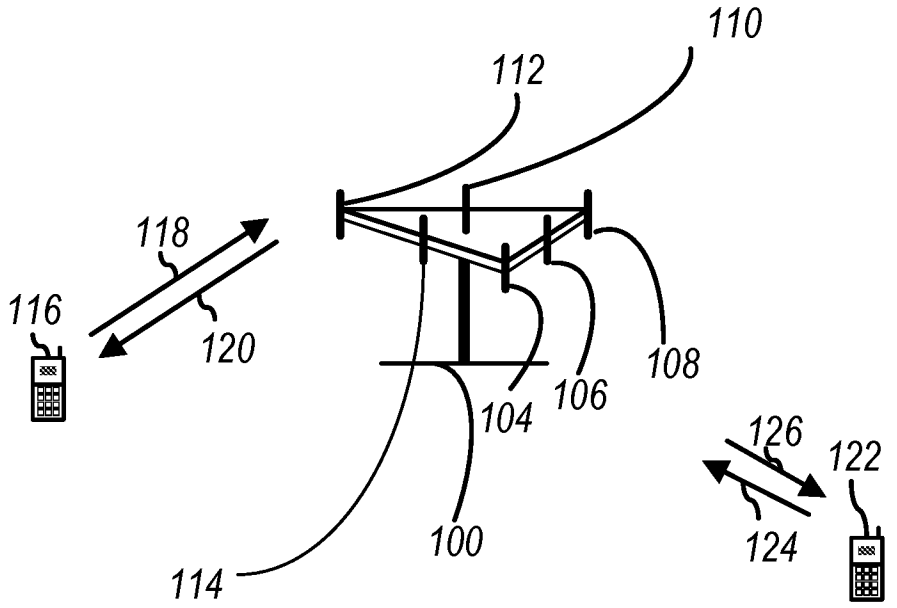


FIG. 1

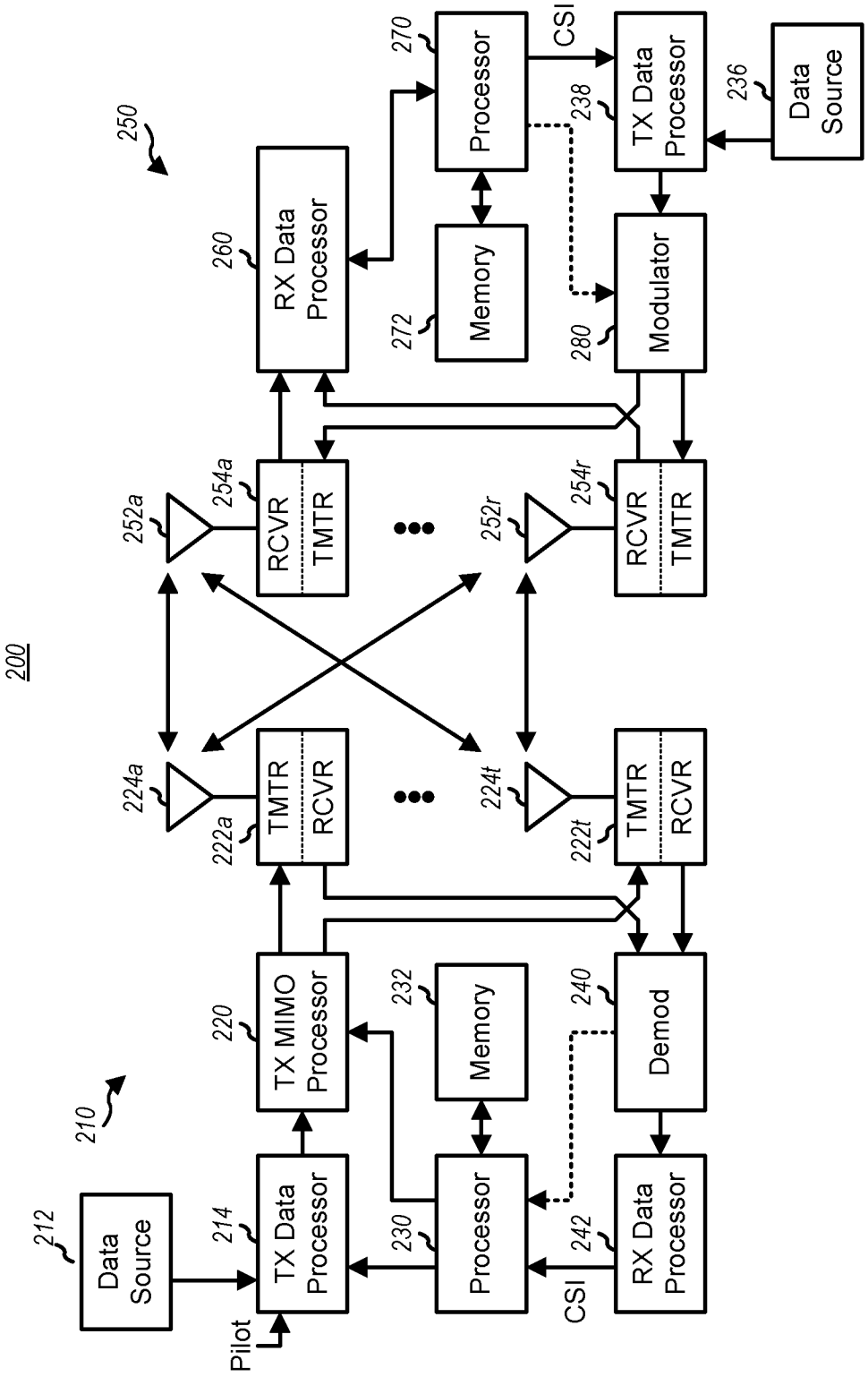

200
210
212
Data Source
214
TX Data Processor
Pilot
220
TX MIMO Processor
222a
TMTR
RCVR
224a
224t
222t
230
Processor
232
Memory
240
Demod
242
RX Data Processor
CSI
250
252a
252r
254a
254r
RCVR
TMTR
260
RX Data Processor
270
Processor
272
Memory
280
Modulator
238
CSI
TX Data Processor
236
Data Source

FIG. 2

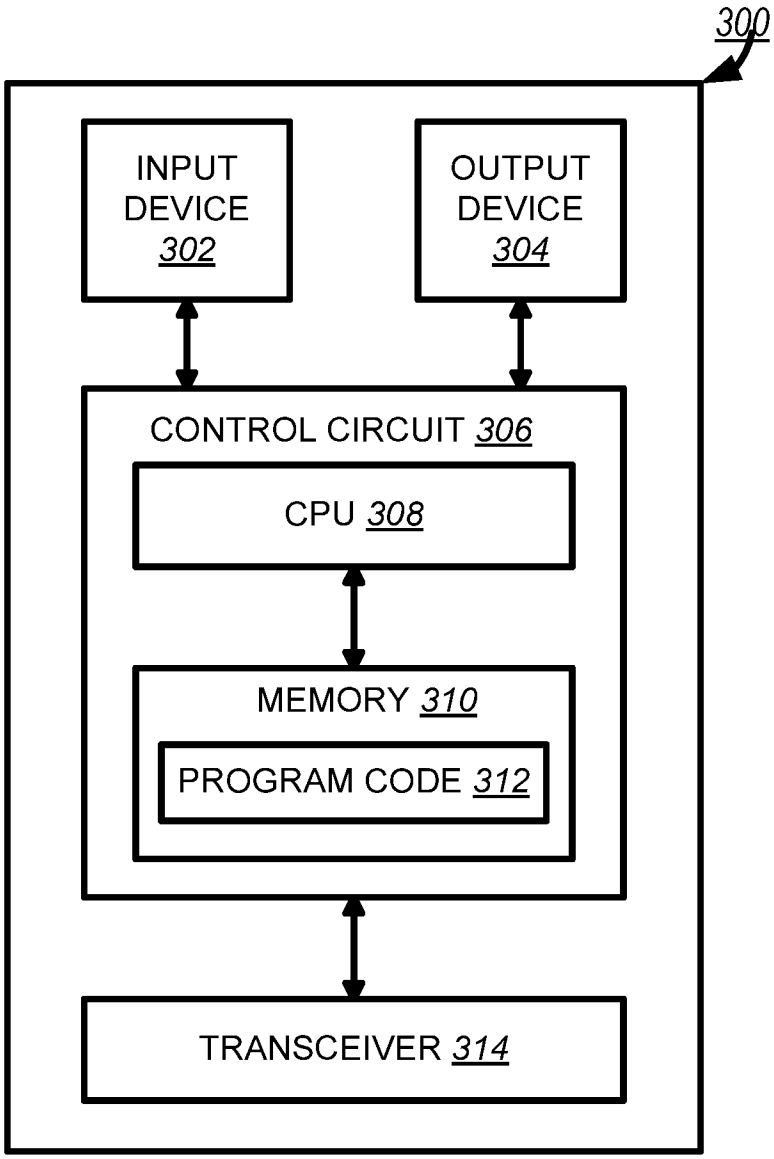

300
INPUT DEVICE 302
OUTPUT DEVICE 304
CONTROL CIRCUIT 306
CPU 308
MEMORY 310
PROGRAM CODE 312
TRANSCEIVER 314

FIG. 3

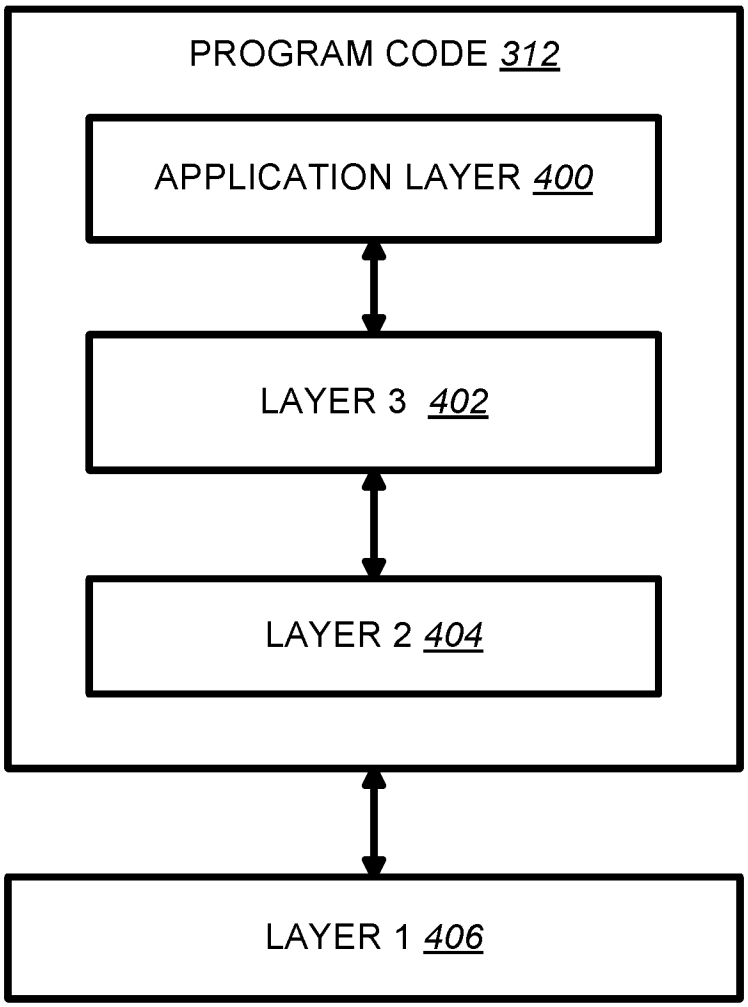
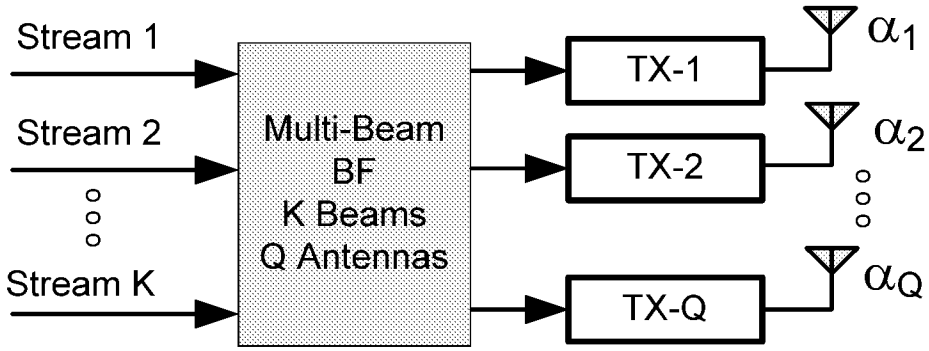
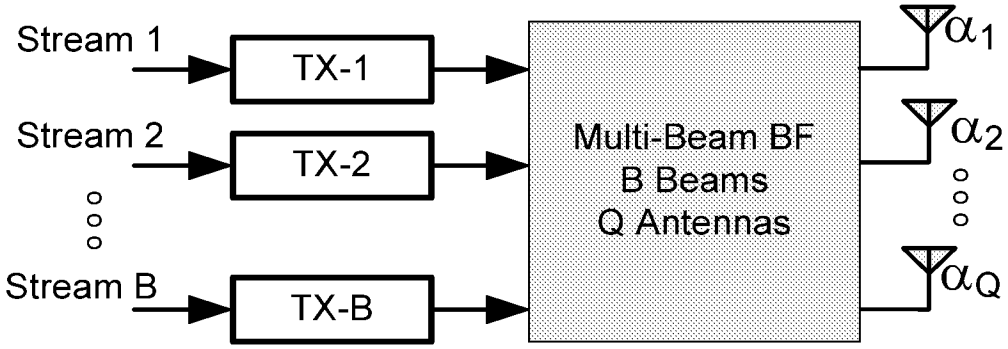

PROGRAM CODE 312
APPLICATION LAYER 400
LAYER 3 402
LAYER 2 404
LAYER 1 406

FIG. 4



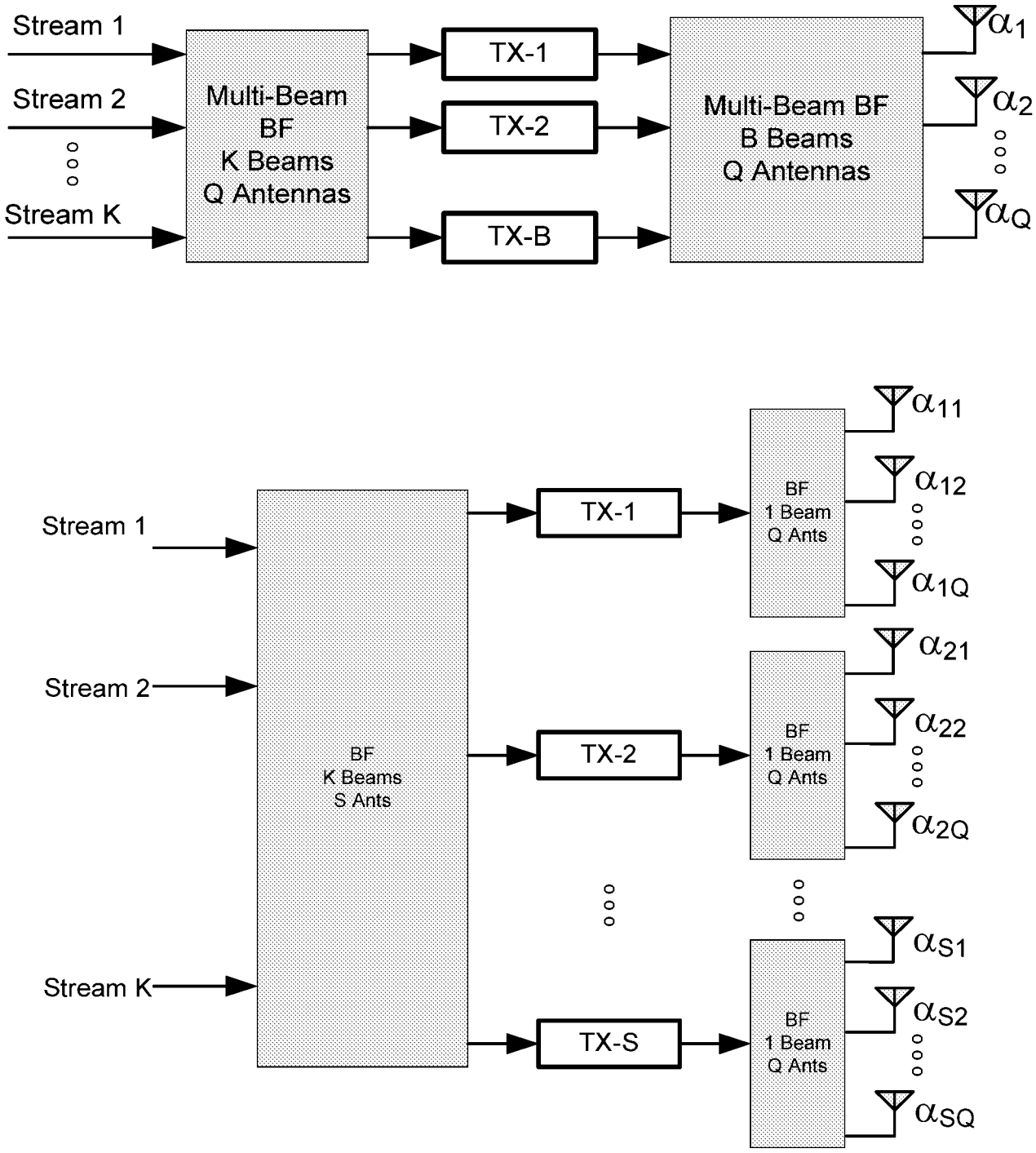
(a) Digital beamforming

FIG. 5A



(b) Analogue beamforming

FIG. 5B



(c) Hybrid beamforming: Left = fully connected, Right = sub-array

FIG. 5C

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	±2		
2					23	±2[2]		
3					23	±2[2]		
4					23	±2		
5					23	±2		
6					23	±2		
7					23	±2[2]		
8					23	±2[2]		
9					23	±2		
10					23	±2		
11					23	±2		
12					23	±2[2]		
13					23	±2		
14	31	+2/-3			23	±2		
17					23	±2		
18					23	±2[5]		
19					23	±2		
20					23	±2[2]		
21					23	±2		
22					23	+2/-3.5[2]		
23					23[6]	±2[6]		
24					23	±2		
25					23	±2[2]		
26					23	±2[2]		
27					23	±2		
28					23	+2/-2.5		
30					23	±2		
31					23	±2		
...								

FIG. 6A (PRIOR ART)

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
…								
33					23	±2		
34					23	±2		
35					23	±2		
36					23	±2		
37					23	±2		
38					23	±2		
39					23	±2		
40					23	±2		
41					23	±2[2]		
42					23	+2/-3		
43					23	+2/-3		
44					23	+2/[-3]		
45					23	±2		
…								
47					23	±2		
65					23	±2		
66					23	±2		
68					23	±2		
…								
70					23	±2		

1. NOTE 1: Void
2. NOTE 2: [2] refers to the transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB
3. NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.
4. NOTE 4: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance
5. NOTE 5: For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and 818 MHz.
6. NOTE 6: When NS_20 is signalled, the total output power within 2000-2005 MHz shall be limited to 7 dBm.

FIG. 6B (PRIOR ART)

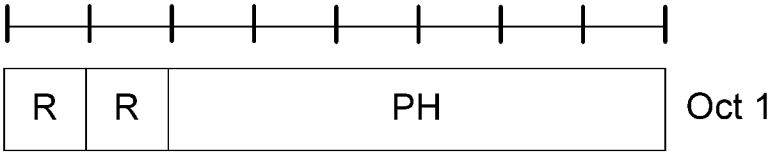
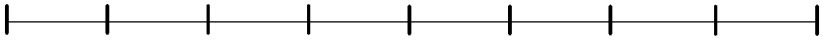


FIG. 7 (PRIOR ART

PH	Power Headroom Level
0	POWER_HEADROOM_0
1	POWER_HEADROOM_1
2	POWER_HEADROOM_2
3	POWER_HEADROOM_3
…	…
60	POWER_HEADROOM_60
61	POWER_HEADROOM_61
62	POWER_HEADROOM_62
63	POWER_HEADROOM_63

FIG. 8 (PRIOR ART)

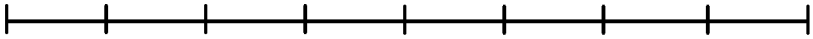


C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 3					

...

P	V	PH (Type 1, SCell n)
R	R	$P_{CMAX,c}$ m

FIG. 9 (PRIOR ART)



C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 2, PUCCH SCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 3					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 4					

...

P	V	PH (Type 1, SCell n)
R	R	$P_{CMAX,c}$ m

FIG. 10 (PRIOR ART)

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 3					

...

P	V	PH (Type 1, SCell n)
R	R	$P_{CMAX,c}$ m

FIG. 11 (PRIOR ART)

C_7	C_6	C_5	C_4	C_3	C_2	C_1	R
C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8
C_{23}	C_{22}	C_{21}	C_{20}	C_{19}	C_{18}	C_{17}	C_{16}
C_{31}	C_{30}	C_{29}	C_{28}	C_{27}	C_{26}	C_{25}	C_{24}
P	V	PH (Type 2, PCell)					
R	R	$P_{CMAX,c}$ 1					
P	V	PH (Type 2, PUCCH SCell)					
R	R	$P_{CMAX,c}$ 2					
P	V	PH (Type 1, PCell)					
R	R	$P_{CMAX,c}$ 3					
P	V	PH (Type 1, SCell 1)					
R	R	$P_{CMAX,c}$ 4					

...

P	V	PH (Type 1, SCell n)
R	R	$P_{CMAX,c}$ m

FIG. 12 (PRIOR ART)

$P_{CMAX,c}$	Nominal UE transmit power level
0	PCMAX_C_00
1	PCMAX_C_01
2	PCMAX_C_02
…	…
61	PCMAX_C_61
62	PCMAX_C_62
63	PCMAX_C_63

FIG. 13 (PRIOR ART)

TPC Command Field	Accumulated $\delta_{PUSCH,b,f,c}$ or $\delta_{SRS,b,f,c}$ [dB]	Absolute $\delta_{PUSCH,b,f,c}$ or $\delta_{SRS,b,f,c}$ [dB]
0	-1	-4
1	0	-1
2	1	1
3	3	4

FIG. 14 (PRIOR ART)

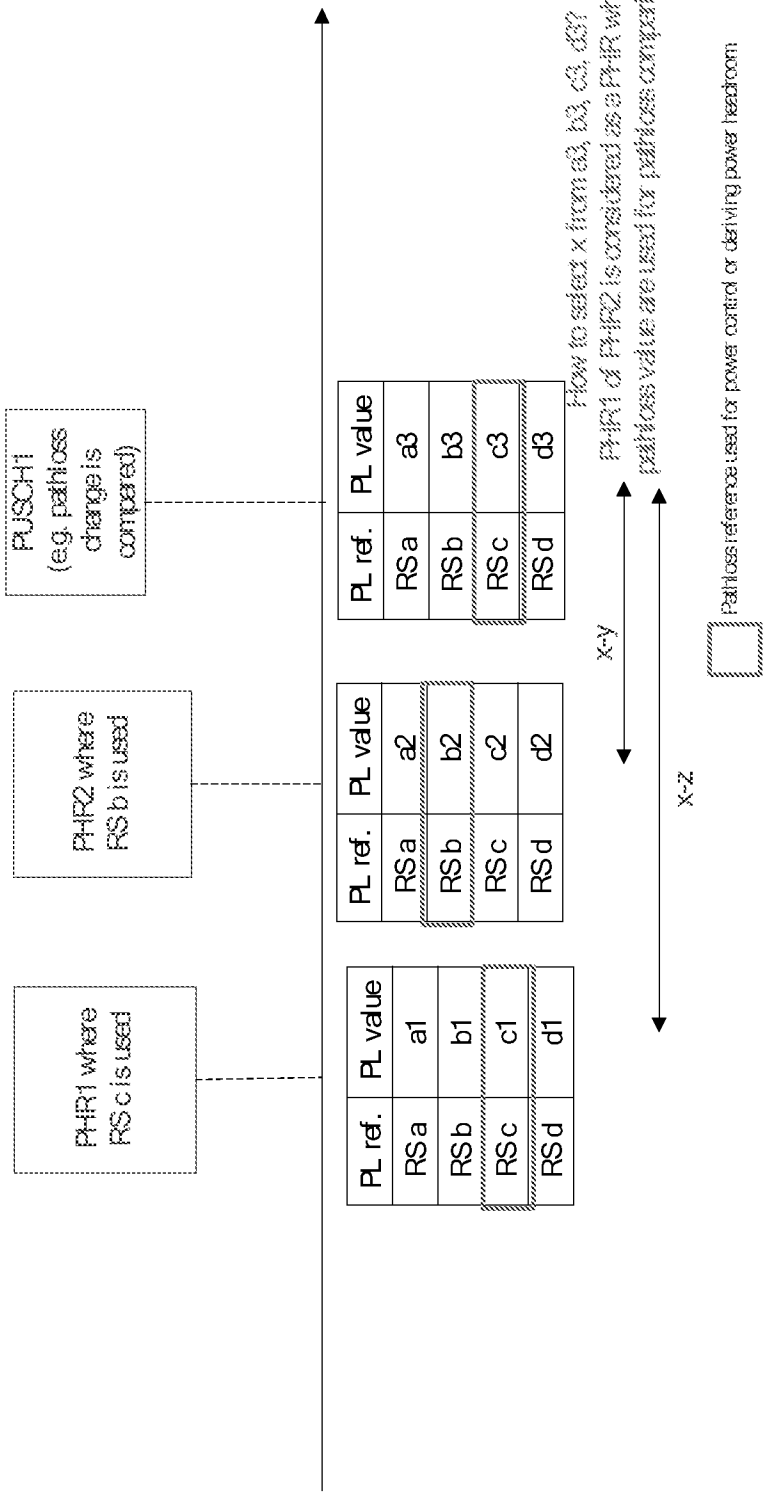

PUSCH1
(e.g. pathloss
change is
compared)
PHR2 where
RS b is used
PHR1 where
RS c is used
PL ref.
PL value
RSa
a3
RSb
b3
RSc
c3
RSd
d3
RSa
a2
RSb
b2
RSc
c2
RSd
d2
RSa
a1
RSb
b1
RSc
c1
RSd
d1
How to select x from a3, b3, c3, d3?
PHR1 of PHR2 is considered as a PHR whose
pathloss value are used for pathloss comparison?
x-y
x-z
Pathloss reference used for power control or deriving power headroom

FIG. 15

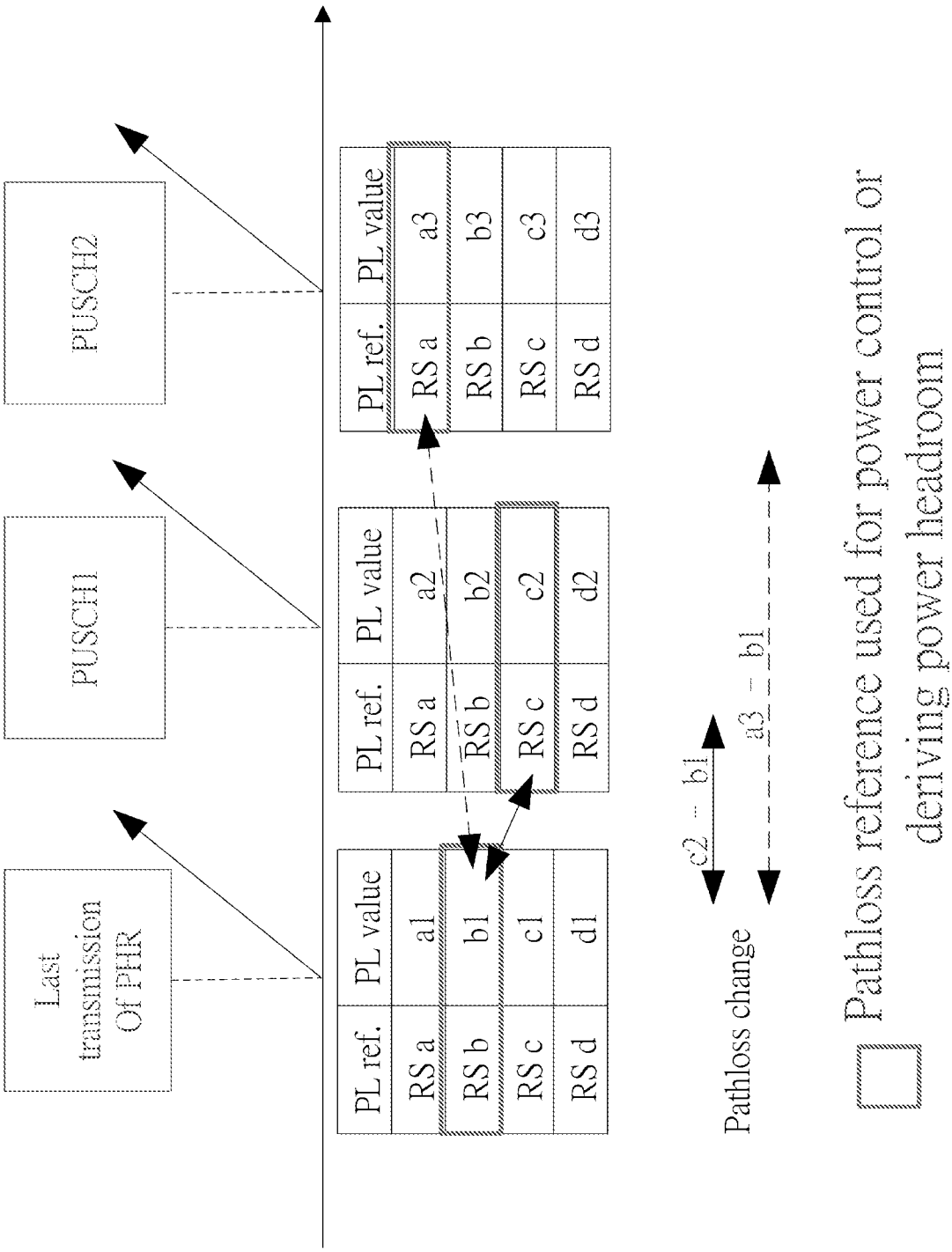

Last transmission Of PHR
PUSCH1
PUSCH2
PL ref.
PL value
RS a
a1
RS b
b1
RS c
c1
RS d
d1
a2
b2
c2
d2
a3
b3
c3
d3
c2 − b1
a3 − b1
Pathloss change
Pathloss reference used for power control or deriving power headroom

FIG. 16

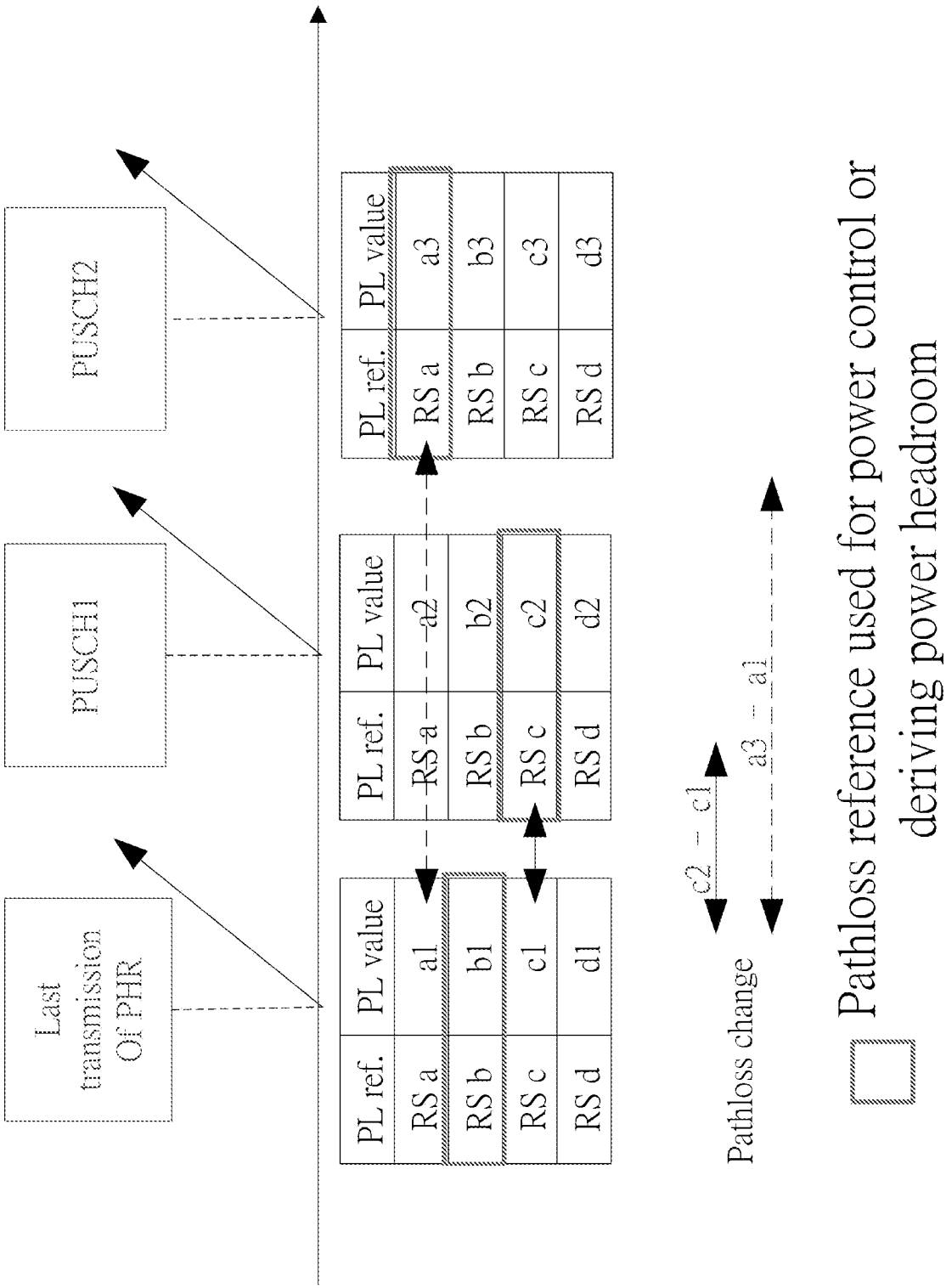

Last transmission Of PHR
PUSCH1
PUSCH2
PL ref.
PL value
RS a
a1
RS b
b1
RS c
c1
RS d
d1
RS a
a2
RS b
b2
RS c
c2
RS d
d2
RS a
a3
RS b
b3
RS c
c3
RS d
d3
c2 - c1
a3 - a1
Pathloss change
Pathloss reference used for power control or deriving power headroom

FIG. 17

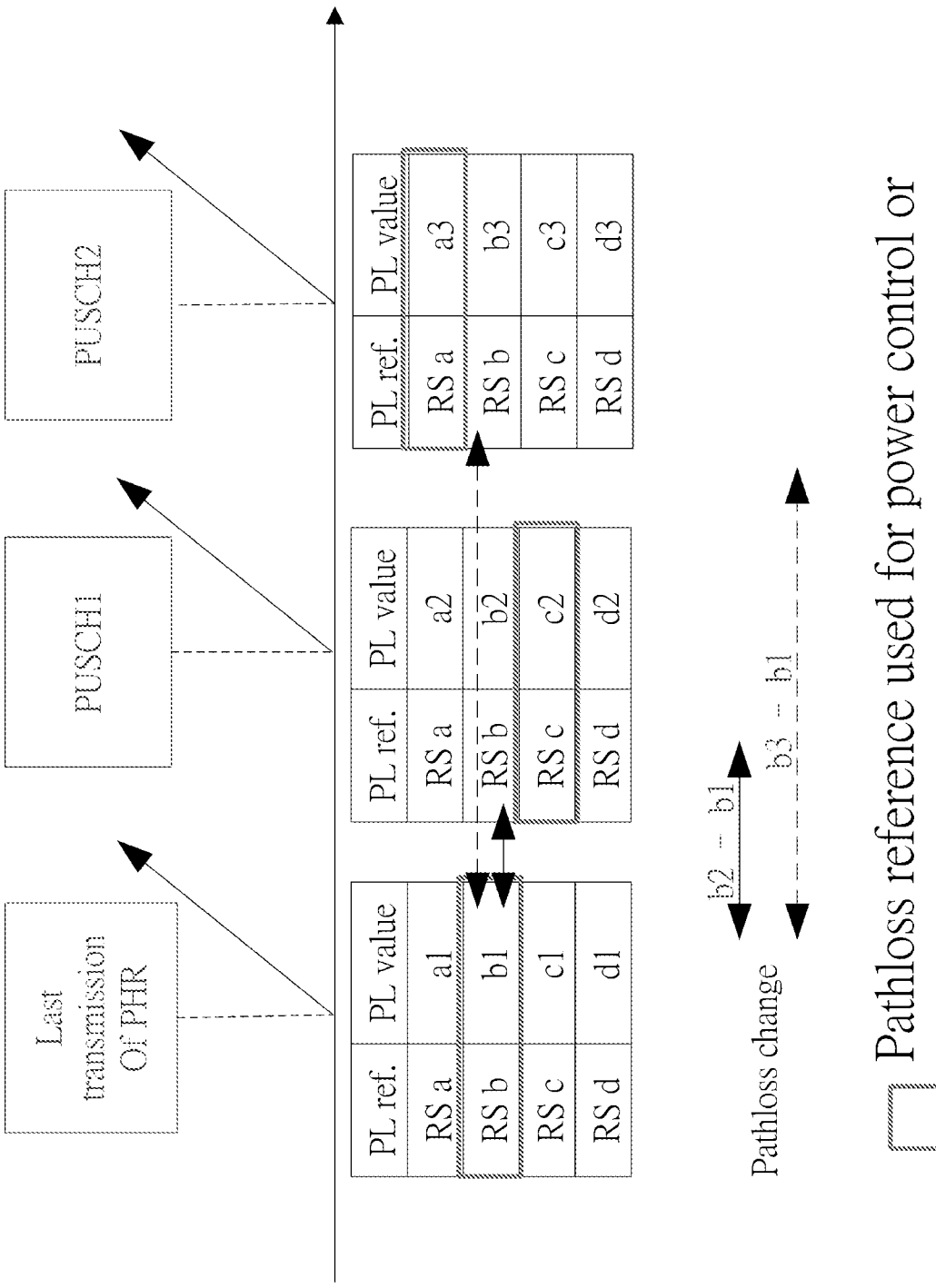

Last transmission Of PHR
PUSCH1
PUSCH2
PL ref.
PL value
RS a
a1
RS b
b1
RS c
c1
RS d
d1
PL ref.
PL value
RS a
a2
RS b
b2
RS c
c2
RS d
d2
PL ref.
PL value
RS a
a3
RS b
b3
RS c
c3
RS d
d3
b2 - b1
b3 - b1
Pathloss change
Pathloss reference used for power control or deriving power headroom

FIG. 18

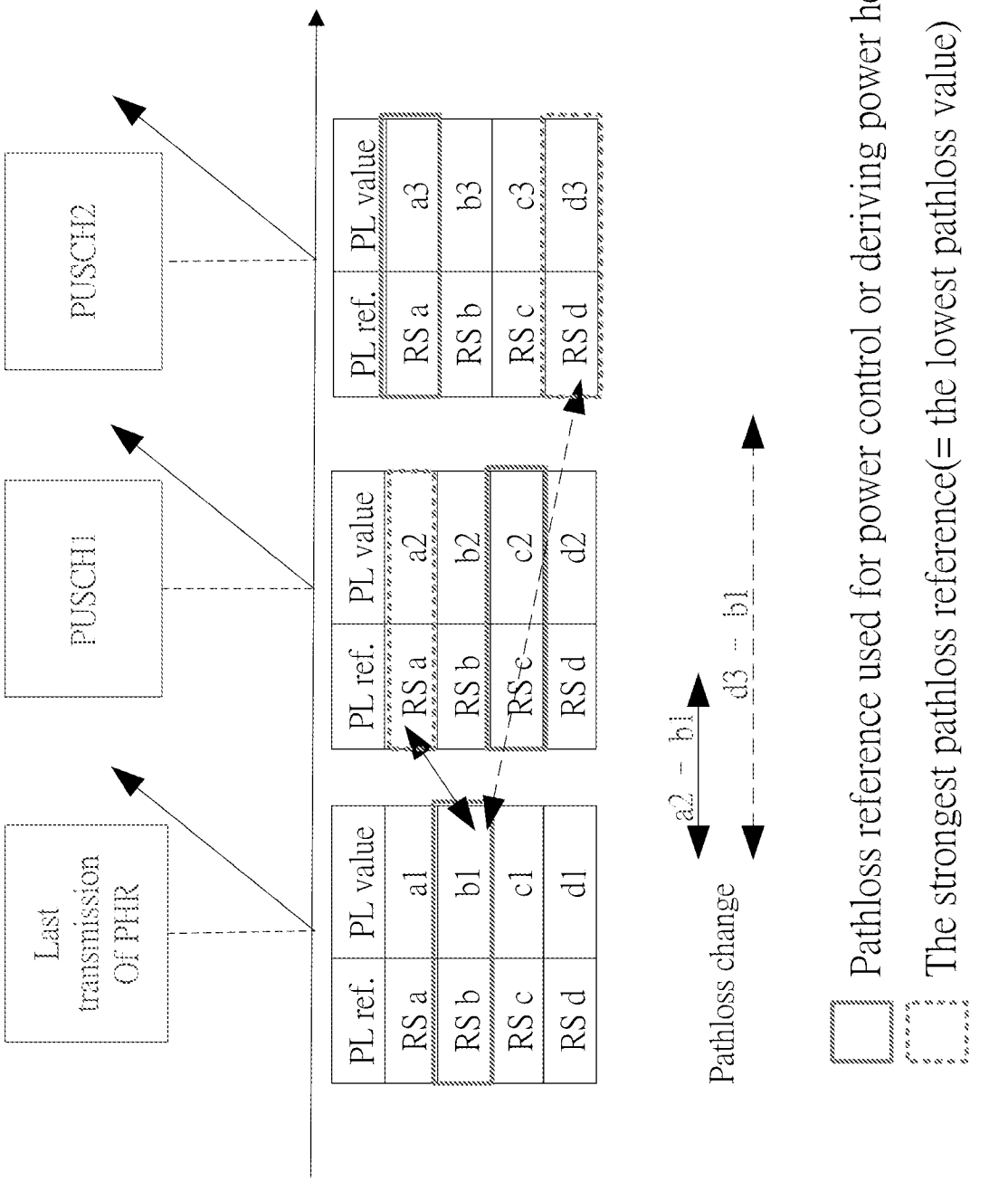

Last transmission Of PHR
PUSCH1
PUSCH2
PL ref.
PL value
RS a
a1
RS b
b1
RS c
c1
RS d
d1
RS a
a2
RS b
b2
RS c
c2
RS d
d2
RS a
a3
RS b
b3
RS c
c3
RS d
d3
a2 - b1
d3 - b1
Pathloss change
Pathloss reference used for power control or deriving power headroom
The strongest pathloss reference(= the lowest pathloss value)

FIG. 19

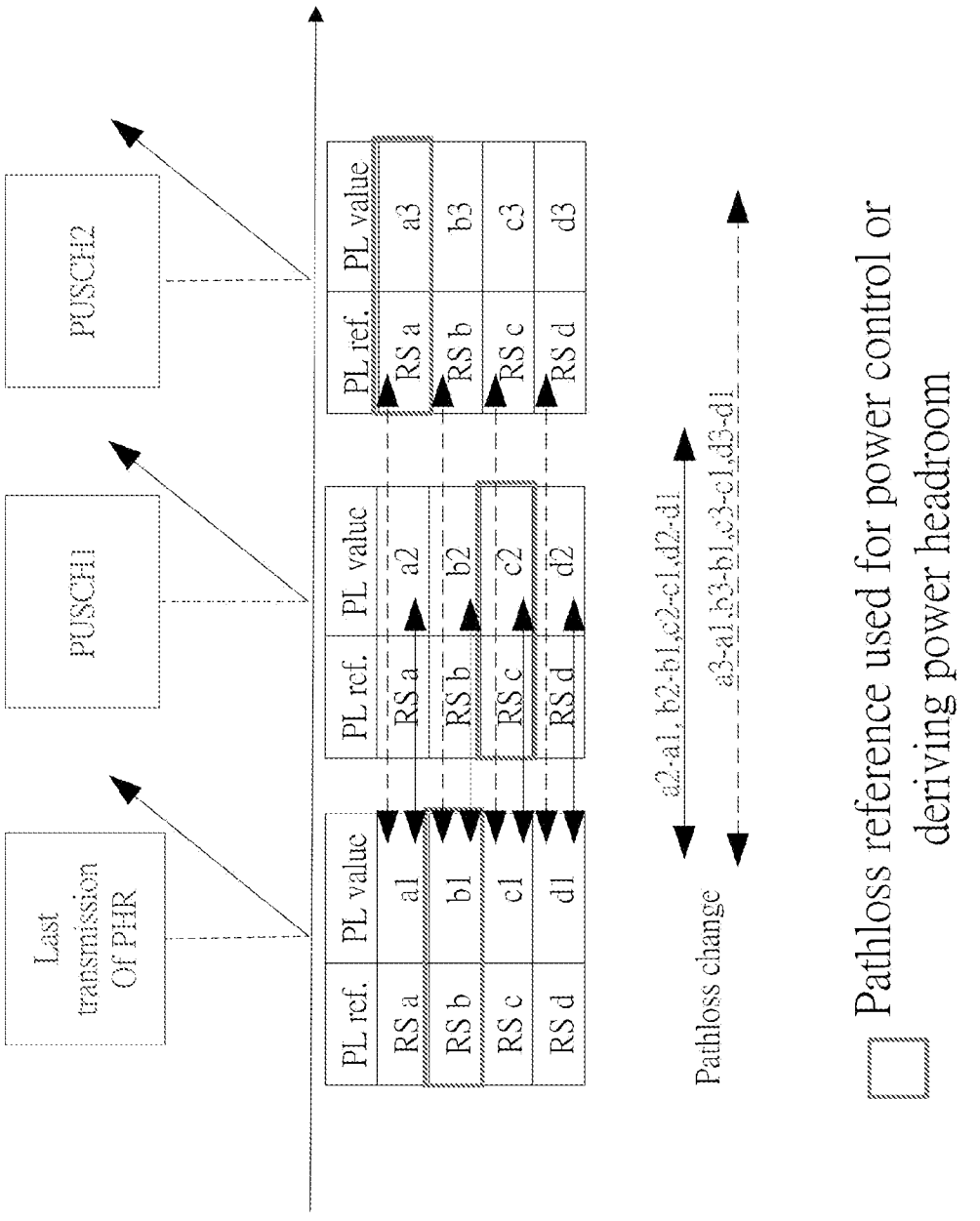

Last transmission Of PHR
PUSCH1
PUSCH2
PL rcf.
PL value
RS a
a1
RS b
b1
RS c
c1
RS d
d1
RS a
a2
RS b
b2
RS c
c2
RS d
d2
RS a
a3
RS b
b3
RS c
c3
RS d
d3
a2-a1, b2-b1,c2-c1,d2-d1
a3-a1,b3-b1,c3-c1,d3-d1
Pathloss change
Pathloss reference used for power control or deriving power headroom

FIG. 20

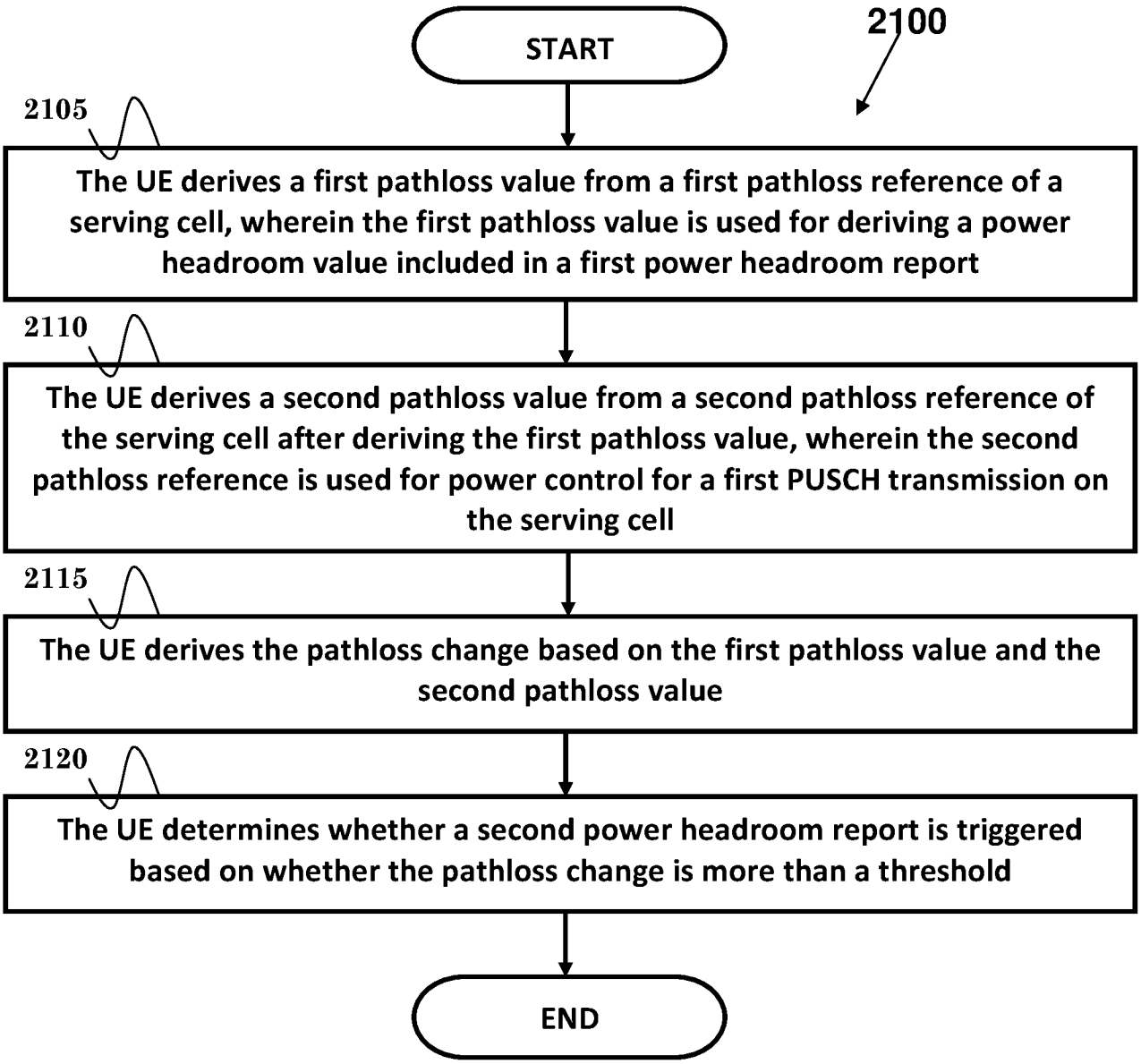

2100
START
2105
The UE derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a power headroom value included in a first power headroom report
2110
The UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for power control for a first PUSCH transmission on the serving cell
2115
The UE derives the pathloss change based on the first pathloss value and the second pathloss value
2120
The UE determines whether a second power headroom report is triggered based on whether the pathloss change is more than a threshold
END

FIG. 21

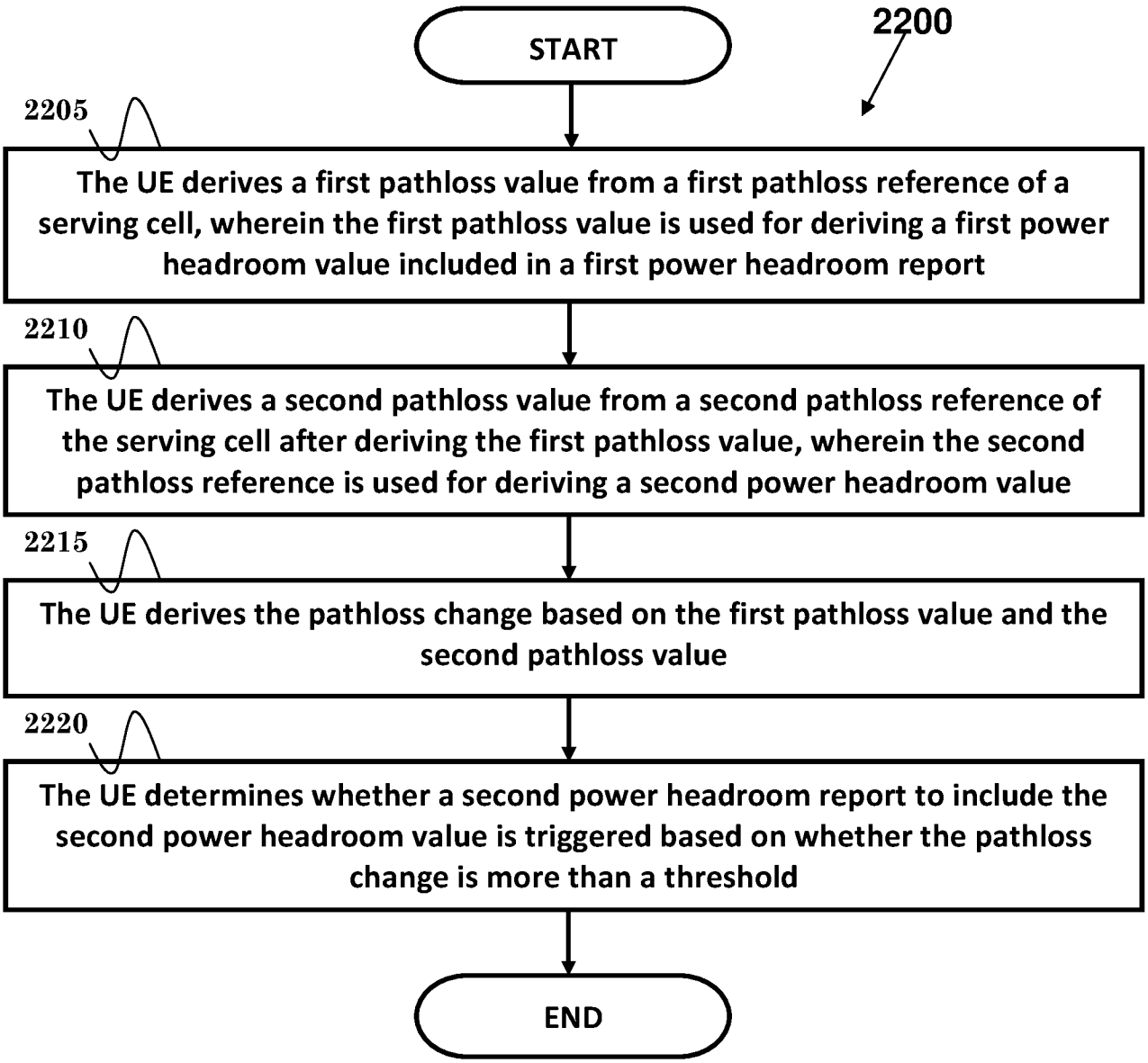

2200
START
2205
The UE derives a first pathloss value from a first pathloss reference of a serving cell, wherein the first pathloss value is used for deriving a first power headroom value included in a first power headroom report
2210
The UE derives a second pathloss value from a second pathloss reference of the serving cell after deriving the first pathloss value, wherein the second pathloss reference is used for deriving a second power headroom value
2215
The UE derives the pathloss change based on the first pathloss value and the second pathloss value
2220
The UE determines whether a second power headroom report to include the second power headroom value is triggered based on whether the pathloss change is more than a threshold
END

FIG. 22

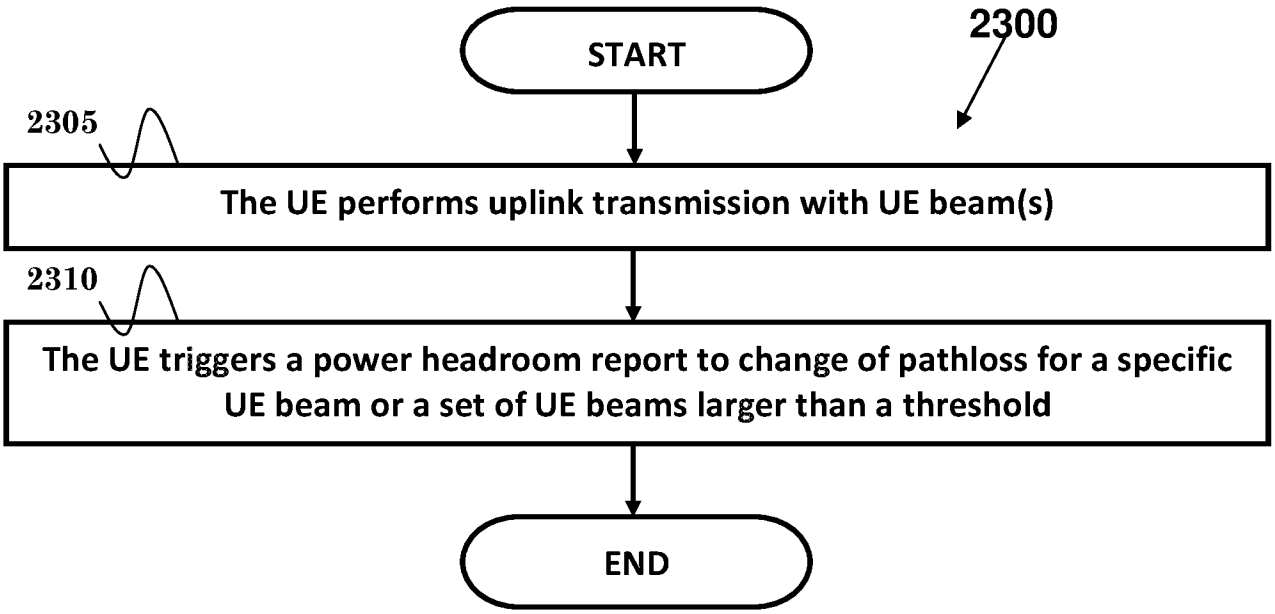

START
2300
2305
The UE performs uplink transmission with UE beam(s)
2310
The UE triggers a power headroom report to change of pathloss for a specific UE beam or a set of UE beams larger than a threshold
END

FIG. 23

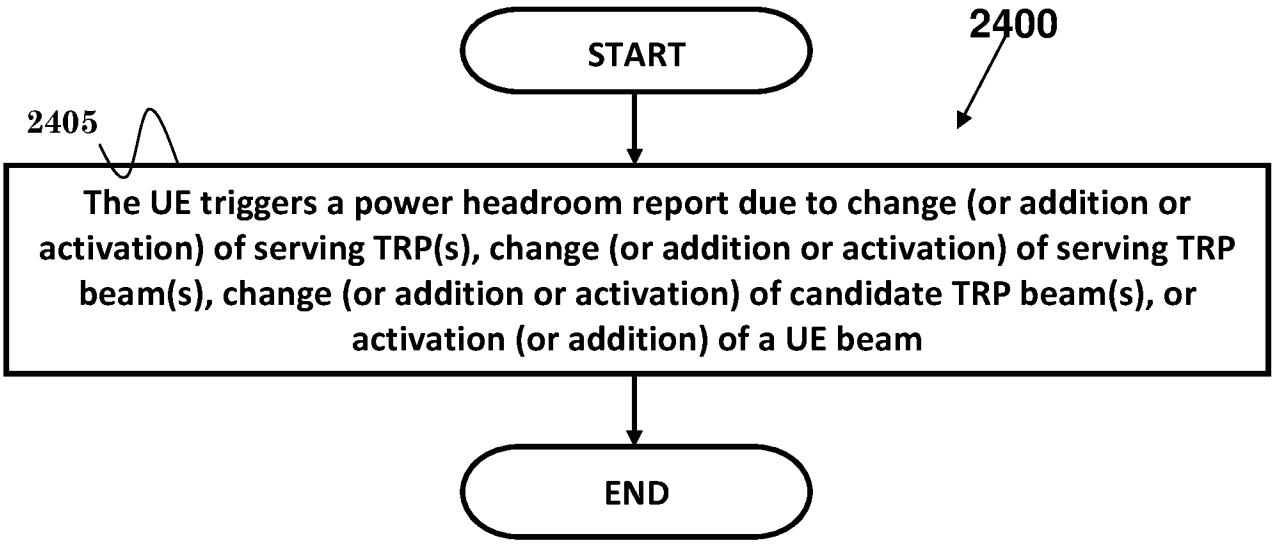

START
2400
2405
The UE triggers a power headroom report due to change (or addition or activation) of serving TRP(s), change (or addition or activation) of serving TRP beam(s), change (or addition or activation) of candidate TRP beam(s), or activation (or addition) of a UE beam
END

FIG. 24

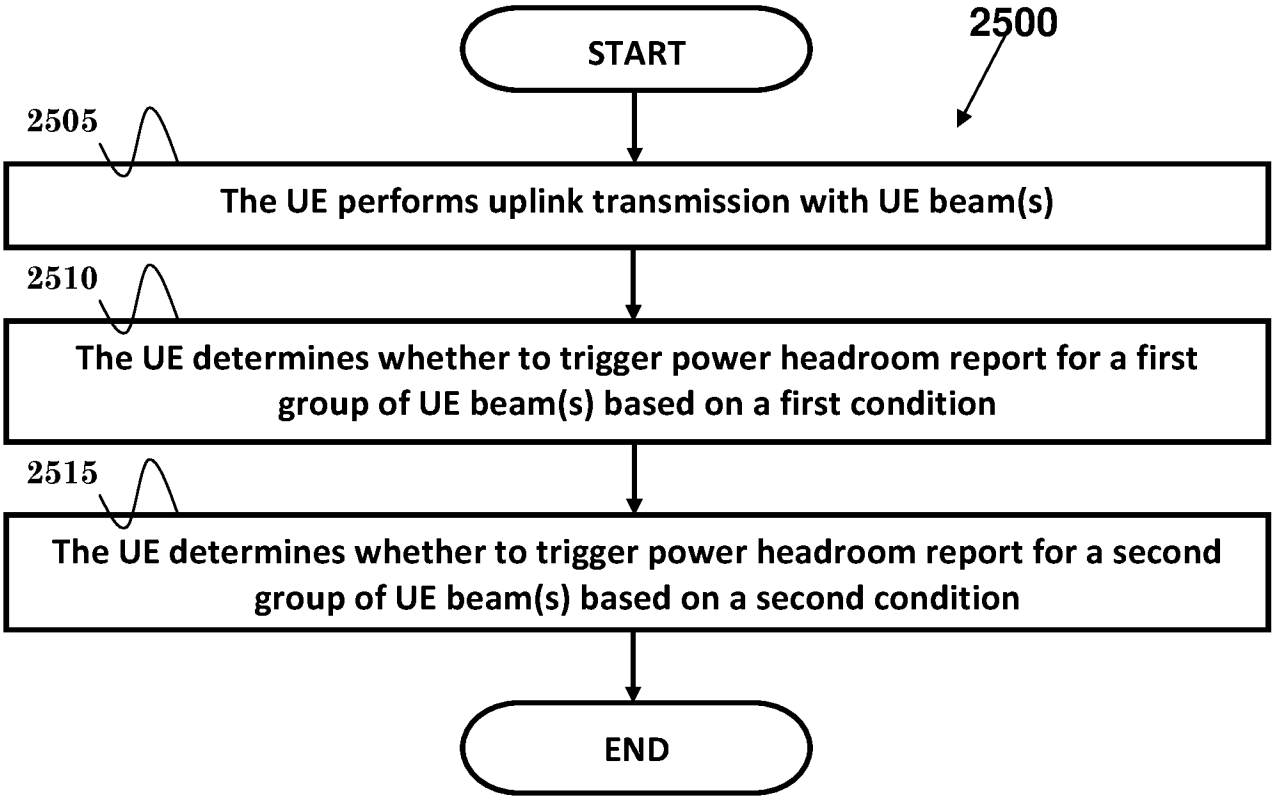

START
2500
2505
The UE performs uplink transmission with UE beam(s)
2510
The UE determines whether to trigger power headroom report for a first group of UE beam(s) based on a first condition
2515
The UE determines whether to trigger power headroom report for a second group of UE beam(s) based on a second condition
END

FIG. 25

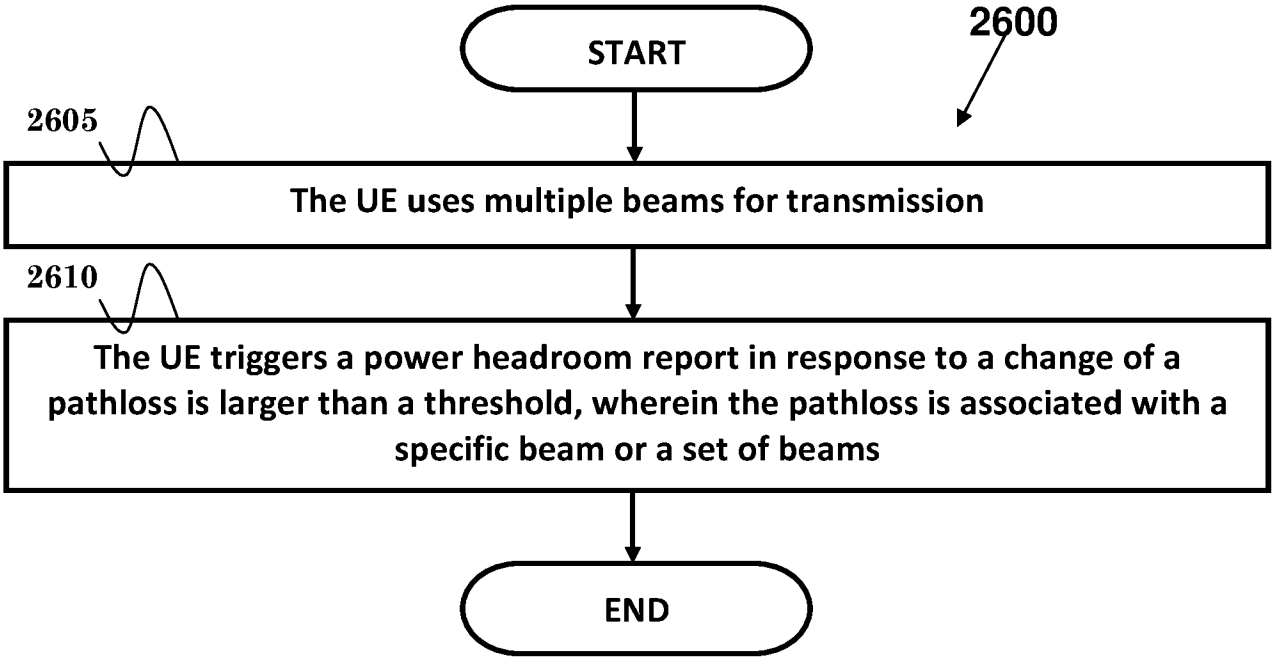

START
2600
2605
The UE uses multiple beams for transmission
2610
The UE triggers a power headroom report in response to a change of a pathloss is larger than a threshold, wherein the pathloss is associated with a specific beam or a set of beams
END

FIG. 26

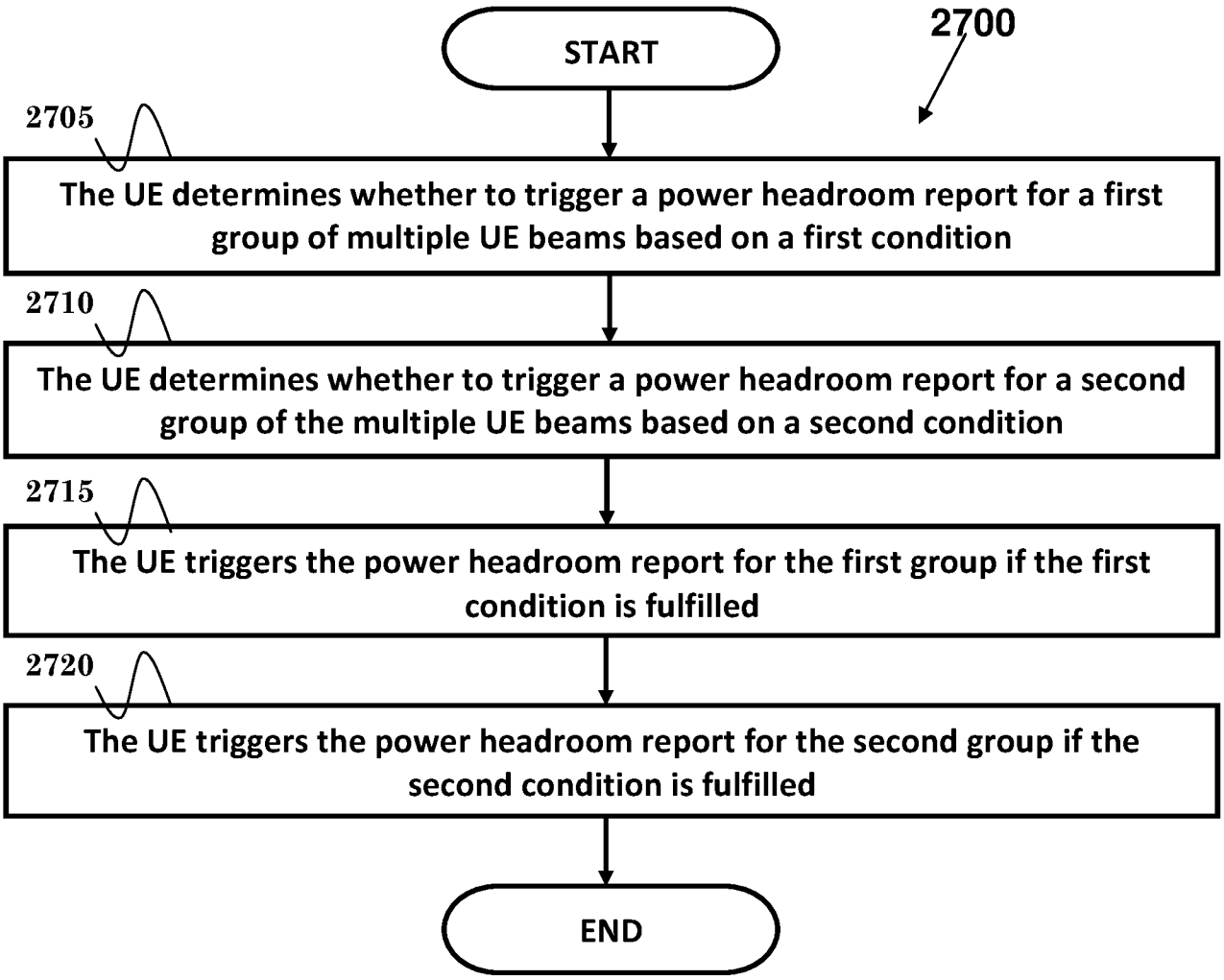

START
2700
2705
The UE determines whether to trigger a power headroom report for a first group of multiple UE beams based on a first condition
2710
The UE determines whether to trigger a power headroom report for a second group of the multiple UE beams based on a second condition
2715
The UE triggers the power headroom report for the first group if the first condition is fulfilled
2720
The UE triggers the power headroom report for the second group if the second condition is fulfilled
END

FIG. 27

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____

  filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

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.

LEGAL NAME OF INVENTOR

Inventor: Lin, Ko-Chiang Date (Optional): 2019.3.18.

Signature: Lin, Ko-Chiang

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

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 1 minute 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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This declaration is directed to:

- [✓] The attached application, or
- [ ] United States application or PCT international application number _____

  filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

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.

LEGAL NAME OF INVENTOR

Inventor: Guo, Yu-Hsuan Date (Optional): 2019. 3. 18

Signature: Guo, Yu-Hsuan

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

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 1 minute 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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Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____

  filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Li, Ming-Che Date (Optional): 2019.3.18

Signature: Li, Ming-Che

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD AND APPARATUS FOR TRIGGERING POWER HEADROOM REPORT FOR MULTIPLE PATHLOSS REFERENCE IN A WIRELESS COMMUNICATION SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [✓] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Tsai, Hsin-Hsi Date (Optional): 2019. 3. 18

Signature: Tsai, Hsin-Hsi

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

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 1 minute 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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