



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/737,787	03/08/2022	11272535	HANN007-US-PAT	8326

7590 02/16/2022
Hannibal IP LLC
c/o Longhorn IP LLC
8105 Rasor Blvd.
Suite 210
Plano, TX 75024

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 39 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.

INVENTOR(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional inventors):

HUNG-CHEN CHEN, Hsinchu, TAIWAN;
CHIE-MING CHOU, Hsinchu, TAIWAN;
CHIA-HUNG WEI, Hsinchu, TAIWAN;
MEI-JU SHIH, Hsinchu, TAIWAN;

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Hannibal IP LLC, Frisco, TX;

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.

IR 103 (Rev. 10/09)

CHANGE OF CORRESPONDENCE ADDRESS Application			
Application Number	16737787	Art Unit	2415
Filing Date	08-Jan-2020	Examiner Name	
First Name Inventor	HUNG-CHEN CHEN	Attorney Doc. Number	HANN007-US-PAT

Please change the correspondence address for the above-identified patent application to:

☐ The address associated with Customer Number:	
---	--

OR

☒ Firm or Individual Name:		Hannibal IP LLC c/o Longhorn IP LLC			
Address		8105 Razor Blvd.			
		Suite 210			
City	Plano	State	TEXAS	Postal Code	75024
Country		UNITED STATES			
Telephone			Email	do@longhornip.com	

Signature :

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application.

Signature	/Do Hyung Kim/	Date	02-01-2022
Name	Do Hyung Kim	Registration Number	66487

Electronic Patent Application Fee Transmittal				
Application Number:		16737787		
Filing Date:		08-Jan-2020		
Title of Invention:		METHOD AND APPARATUS FOR LBT FAILURE DETECTION		
First Named Inventor/Applicant Name:		HUNG-CHEN CHEN		
Filer:		Do Hyung Kim/Julie Mcleod		
Attorney Docket Number:		HANN007-US-PAT		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPL ISSUE FEE	2501	1	600	600
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
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 (\$)				600

Electronic Acknowledgement Receipt	
EFS ID:	44886702
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	116201
Filer:	Do Hyung Kim/Julie Mcleod
Filer Authorized By:	Do Hyung Kim
Attorney Docket Number:	HANN007-US-PAT
Receipt Date:	01-FEB-2022
Filing Date:	08-JAN-2020
Time Stamp:	11:10:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 600
RAM confirmation Number	E202221B10012369
Deposit Account	602766
Authorized User	Julie Mcleod
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.20 (Post Issuance fees) 37 CFR 1.21 (Miscellaneous fees and charges)	

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)	Web85b.pdf	62910	no	2
			22eee7b217948925d6975ea6bb0fbb9712da89f2		
Warnings:					
Information:					
2	Change of Address	web85correspondenceaddress.pdf	47604	no	1
			5bf32f4745f9811689411479bc2031361e4e057a		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	40137	no	2
			2463404bfad0e6977cf26c0b6b2846d8ae650030		
Warnings:					
Information:					
Total Files Size (in bytes):			150651		
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>					

Document Description: Issue Fee Payment (PTO-85B)

Issue Fee Transmittal Form

Application Number	Filing Date	First Named Inventor	Atty. Docket No.	Confirmation No.
16737787	08-Jan-2020	HUNG-CHEN CHEN	HANN007-US-PAT	8326

TITLE OF INVENTION :

METHOD AND APPARATUS FOR LBT FAILURE DETECTION

Entity Status	Application Type	Art Unit	Class - Subclass	EXAMINER
Small	Utility under 35 USC 111(a)	2415	221000	
Issue Fee Due	Publication Due	Total Fee(s) Due	Date Due	Prev. Paid Fee
\$600	\$0	\$600	01-Feb-2022	\$0

1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

Current Correspondence Address:	Current Indicated Fee Address :
116201 Sul Lee 3030 Lyndon B Johnson Fwy Suite 1130 Dallas TX 75234 UNITED STATES 214-206-4064 IP@sulleelaw.com	
☒ Change of correspondence address requested, system generated AIA/122-EFS form attached	☐ Fee Address indication requested, system generated SB/47-EFS form attached

2.Entity Status**Change in Entity Status**

Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.

- ☐ Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.

- ☒ Applicant asserting small entity status. See 37 CFR 1.27.
Note: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

- ☐ Applicant changing to regular undiscounted fee status.
Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

WEB IFEE 1.0

Document Description: Issue Fee Payment (PTO-85B)

3.The Following Fee(s) Are Submitted:☒ Issue Fee

I authorize USPTO to apply my previously paid issue fee to the current fees due

☐ Publication Fee

The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number _____

☐ Advance Order - # of copies _____If **in addition to** the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency or credit any overpayment, to Deposit Account Number 602/86.**The issue fee must be submitted with this form. If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.****4.Firm and/or Attorney Names To Be Printed****NOTE: If no name is listed, no name will be printed**

For printing on the patent front page, list to be displayed as entered

1. DO HYUNG KIM

2.

3.

5.Assignee Name(s) and Residence Data To Be Printed

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

Name	City	State	Country	Category
Hannibal IP LLC	Frisco	TEXAS	UNITED STATES	corporation

6.Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

Signature	/Do Hyung Kim/	Date	02-01-2022
Name	Do Hyung Kim	Registration Number	66487

WEB IFEE 1.0



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/737,787	01/08/2020	HUNG-CHEN CHEN	HANN007-US-PAT	8326
116201	7590	12/17/2021	EXAMINER	
Sul Lee 3030 Lyndon B Johnson Fwy Suite 1130 Dallas, TX 75234			SIDDIQUI, KASHIF	
			ART UNIT	PAPER NUMBER
			2415	
			NOTIFICATION DATE	DELIVERY MODE
			12/17/2021	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):

sul@sulleelaw.com
jmcleod@sulleelplc.com
IP@sulleelaw.com



United States Patent and Trademark Office

Office of the Chief Financial Officer

December 14, 2021

Sul Lee Law Firm PLLC
Attn: DO HYUNG KIM
3030 Lyndon B Johnson Fwy,
Suite 1130
Dallas, TX 75234

Dear Sir/Madam,

The United States Patent and Trademark Office (USPTO) has reviewed your refund request for Reference Number 16737787 - Refund Request ID REFND-20211207-11835. Below is the current status of your refund request assigned to the following processing area: Office of Patent Examination Support Services

Fee code	Decision	Decision Reason(s)	Refund Amount
1801	Approved	Entity Status Change	\$680.00

Generally, approved refunds will be issued in the form that the original payment was provided. You will receive a separate decision letter for any additional fee codes assigned to other processing areas, if applicable. Decisions may be subject to change if an error is identified.

For questions related to this decision, contact the Case Resolution Team at (571) 272-1720 or case.resolution@USPTO.GOV.

Thank you,
Refund Branch

1



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :70837

Sale Accounting Date:12/14/2021

Sale Item Reference Number	Effective Date
16737787	10/21/2021

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I2021BDM40342927	2801	RCE- 1ST REQUEST	\$680.00	Salea



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE	REQUEST ID
16/737,787	01/08/2020	HUNG-CHEN CHEN	HANN007-US-PAT	153720

Acknowledgement of Change to Small Entity Status

The entity status change request below filed through Private PAIR on 12/06/2021 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

☒ Applicant asserting small entity status. See 37 CFR 1.27.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Do Hyung Kim/
Name:	Do Hyung Kim
Registration Number:	66487

REQUEST FOR REFUND

Reference # <i>(Patent #, Application #, Trademark Serial #, Registration #, etc.)</i>		Title of Invention or Mark Information	
16/737,787		METHOD AND APPARATUS FOR LBT FAILURE DETECTION	
Attorney Docket # <i>(if applicable)</i>		Payment Date <i>(mm/dd/yyyy)</i>	Refund Request Amount
HANN007-US-PAT		10/12/2021	\$ 680.00
Refund Option <i>(Select one)</i>			
☒ If approved, issue the refund to the account associated with the original payment. ☐ If approved, and the original payment was a check, issue the refund to deposit account # _____. ☐ If approved, and the original payment was a check, issue the refund as a U.S. Treasury check.			
Reason for Refund Request <i>Refund requests must generally be filed within 2 years of payment date (37 CFR 1.26 and 2.209)</i>			
<div style="display: flex; justify-content: space-between;"> <div> ☐ Duplicate Payment ☐ Small Entity Later Established* <small>(*must be filed within 3 months of payment date, 37 CFR 1.28)</small> </div> <div> ☐ No Fee Due ☒ Other Clerical Error </div> <div> ☐ Office Error </div> </div>			
Rationale <i>(Supporting documentation may be submitted with this form)</i>			
Due to a clerical error, the fees were submitted as large entity but the applicant is designated as small.			

Requester's Information

Company or Firm Name <i>(if applicable)</i>		
Sul Lee Law Firm PLLC		
Address Line 1	City	State/Region
3030 LBJ Fwy	Dallas	TX
Address Line 2 <i>(if applicable)</i>	Country	Zip/Postal Code
Suite 220	US	75234
Email Address <small><i>(You will receive an acknowledgment of receipt only if you provide a valid email address)</i></small>		Phone Number
ip@sulleelaw.com		214-206-4064
Requester's Name		Registration Number <small><i>(if applicable)</i></small>
Do Hyung Kim		66487
Signature		Date <i>(mm/dd/yyyy)</i>
/Do Hyung Kim/		12/06/2021

Submit online: [EFS-Web](#) *(registered users only; select "Request for Refund" from the document description menu)*, or
Fax to: 571-273-6500, or
Mail to: Mail Stop 16, Director of the U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450

Electronic Acknowledgement Receipt	
EFS ID:	44444047
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	116201
Filer:	Do Hyung Kim/Julie Mcleod
Filer Authorized By:	Do Hyung Kim
Attorney Docket Number:	HANN007-US-PAT
Receipt Date:	06-DEC-2021
Filing Date:	08-JAN-2020
Time Stamp:	16:26:12
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	Refund Request	2021_12_06_Refund_Request_Form.pdf	679723 bc4ab070110582f37a6ec29a76a4573b670b4f5	no	1

Warnings:

Information:	
Total Files Size (in bytes):	679723
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>	



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

116201 7590 11/01/2021
Sul Lee
3030 Lyndon B Johnson Fwy
Suite 1130
Dallas, TX 75234

EXAMINER

SIDDIQUI, KASHIF

ART UNIT

PAPER NUMBER

2415

DATE MAILED: 11/01/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/737,787	01/08/2020	HUNG-CHEN CHEN	HANN007-US-PAT	8326

TITLE OF INVENTION: METHOD AND APPARATUS FOR LBT FAILURE DETECTION

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	02/01/2022

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.

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)

116201 7590 11/01/2021
Sul Lee
3030 Lyndon B Johnson Fwy
Suite 1130
Dallas, TX 75234

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.
16/737,787	01/08/2020	HUNG-CHEN CHEN	HANN007-US-PAT	8326

TITLE OF INVENTION: METHOD AND APPARATUS FOR LBT FAILURE DETECTION

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	02/01/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
SIDDIQUI, KASHIF	2415	370-221000

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,

1 _____

(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.

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)

☐ 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 _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/737,787	01/08/2020	HUNG-CHEN CHEN	HANN007-US-PAT	8326
116201	7590	11/01/2021	EXAMINER	
Sul Lee			SIDDIQUI, KASHIF	
3030 Lyndon B Johnson Fwy			ART UNIT	
Suite 1130			PAPER NUMBER	
Dallas, TX 75234			2415	
DATE MAILED: 11/01/2021				

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. 16/737,787	Applicant(s) CHEN et al.	
	Examiner KASHIF SIDDIQUI	Art Unit 2415	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 10/11/2021.
☐ 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 1-9, 11-19 and 21-22. 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)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date ____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material ____.	7. ☐ Other ____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date ____.	

/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
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Notice of Pre-AIA or AIA Status

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

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. 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 10/11/2021 has been entered.

Allowable Subject Matter

2. In view of amended claims and further search, Claims 1-9, 11-19, 21, 22 are allowed.

3. The following is an examiner's statement of reasons for allowance:

The reasons for Allowance are the same as those presented by the Applicant in the Remarks submitted on 10/11/2021.

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 KASHIF SIDDIQUI whose telephone number is (571)270-3188. The examiner can normally be reached on M-R 6:00 EST to 16:00 EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Rutkowski can be reached on 571-270-1215. 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.

Application/Control Number: 16/737,787
Art Unit: 2415

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/Kashif Siddiqui/
Primary Examiner, Art Unit 2415

Issue Classification 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

CPC						
Symbol					Type	Version
H04W	/	74	/	008	F	2013-01-01
H04W	/	74	/	0808	I	2013-01-01
H04W	/	72	/	044	I	2013-01-01
H04W	/	36	/	0069	I	2018-08-01
H04W	/	36	/	0058	I	2018-08-01
H04W	/	36	/	00835	I	2018-08-01
H04W	/	36	/	305	I	2018-08-01

CPC Combination Sets						
Symbol			Type	Set	Ranking	Version
	/		/			

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	22 October 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20211022

Issue Classification 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H04W74/00	/	74	/ 00
H04W74/08	/	74	/ 08
H04W72/04	/	72	/ 04
H04W36/00	/	36	/ 00
H04W36/30	/	36	/ 30
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	22 October 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

☒ 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 (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/Kashif Siddiqui/ Primary Examiner, Art Unit 2415 (Primary Examiner) _____ (Date) _____		O.G. Print Claim(s) 1	O.G. Print Figure 1

Search Notes 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

CPC - Searched*		
Symbol	Date	Examiner
H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808	04/13/2021	KS
Updated	07/22/2021	KS
Updated	10/22/2021	KS

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* 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
Searched EAST (US-PGPUB; USPAT)	04/13/2021	KS
Searched EPO/WIPO	04/13/2021	KS
Searched Inventor/Assignee	04/13/2021	KS
Searched Google Patents	04/13/2021	KS
Searched Global Dossier	04/13/2021	KS
Searched NPL	04/13/2021	KS
Updated	07/22/2021	KS
Updated	10/22/2021	KS

/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
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<i>Search Notes</i> 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	Keyword search of the claims	10/22/2021	KS

/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"16737787"	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
S2	18,835	((H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808).CPC.)	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
S3	169	(FG near innovation).as.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
S4	44,077	(chen-h\$ chou-c\$ wei-c\$ shih-m\$).in.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:11
S5	1	("20180176961").PN.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:11
S6	138	((listen adj before adj talk) (LBT)) with (fail\$4) with (counter)	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:55
S7	71	(MAC with ((lower physical) adj2 (layer))) and S6	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:56
S8	40	S7 and S2	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:57
S9	27	(reset\$4) same S6	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:32
S10	1,440	((listen adj before adj talk) (LBT)) with (fail\$4)	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:44
S11	3	((PCell) with (RRC with (re\$1establishment near2 request))) and S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:45
S12	4	(RLF near4 (procedure process)) same S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:48
S13	1	(LBT same MENB) and S5	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:03

S14	3	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
S15	787	((PCell MCG MeNB)) and S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
S16	383	S2 and S15	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
S17	15	((RRC with (re\$1establishment near2 request))) and S15	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:08
S18	2	"20180124825"	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:23
S19	11,460	((listen adj before adj talk) (LBT))	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:26
S20	1	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) same S19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:27
S21	3	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and S19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:27
S22	893	((PCell MCG MeNB)) same S19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:28
S23	10	((RRC with (re\$1establishment near2 request))) and S22	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:28
S24	1	"16737787"	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S25	19,843	((H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808).CPC.)	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S26	233	(FG near innovation).as.	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S27	45,320	(chen-h\$ chou-c\$ wei-c\$ shih-m\$).in.	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S28	1	("20180176961").PN.	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51

S29	161	((listen adj before adj talk) (LBT)) with (fail\$4) with (counter)	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S30	87	(MAC with ((lower physical) adj2 (layer))) and S29	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S31	55	S30 and S25	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S32	37	(reset\$4) same S29	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S33	1,645	((listen adj before adj talk) (LBT)) with (fail\$4)	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S34	4	((PCell) with (RRC with (re\$1establishment near2 request))) and S33	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S35	7	(RLF near4 (procedure process)) same S33	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S36	1	(LBT same MENB) and S28	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S37	4	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and S33	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S38	880	((PCell MCG MeNB)) and S33	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S39	432	S25 and S38	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S40	18	((RRC with (re\$1establishment near2 request))) and S38	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S41	2	"20180124825"	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S42	12,394	((listen adj before adj talk) (LBT))	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S43	1	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) same S42	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51

S44	4	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and S42	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S45	993	((PCell MCG MeNB)) same S42	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S46	10	((RRC with (re\$1establishment near2 request))) and S45	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
S47	15	(active with (BWP bandwidth\$1part)) and S32	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:09
S48	348	(switch\$3 chang\$3 mov\$3) near3 ((another second\$3 other) near2 BWP)	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:14
S49	3,318	((listen adj before adj talk) (LBT)) with (fail\$4 busy occup\$3)	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:15
S50	61	((reset\$4 restart\$3) near3 (counter timer)) same S49	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:16
S51	14	S48 and S50	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:16
S52	713	((listen adj before adj talk) (LBT)) with (counter)	US-PGPUB; USPAT	OR	OFF	2021/10/21 19:25
S53	3	((reset\$5) with ((upper higher RRC) adj3 (layer))) same S52	US-PGPUB; USPAT	OR	OFF	2021/10/21 19:26

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	40	((listen adj before adj talk) (LBT)) with (counter)).clm.	USPAT	OR	OFF	2021/10/22 11:45
L2	54	((reset\$5) with ((upper higher RRC) adj3 (layer))).clm.	USPAT	OR	OFF	2021/10/22 11:45
L3	0	1 and 2	USPAT	OR	OFF	2021/10/22 11:45

10/22/2021 11:46:18 AM

C:\Users\ksiddiqui\Documents\EAST\Workspaces\16737787.wsp

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/737,787		Filing Date 01/08/2020		☐ 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), (l), or (m))		N/A	N/A	N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A					
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =	*	x \$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	10/11/2021	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))	* 2	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	
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.						SLIE			
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/DESHONNE T. MARTINO-RAY/			
*** 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.**

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

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

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	16/737,787	Filing Date	2020-01-08	Docket Number (if applicable)	HANN007-US-PAT	Art Unit	2415
First Named Inventor	HUNG-CHEN, Chen			Examiner Name	SIDDIQUI, Kashif		
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 <u>602766</u>							
SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED							
☒ Patent Practitioner Signature							
☐ Applicant Signature							

EFS - Web 2.1.16

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

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.

Signature of Registered U.S. Patent Practitioner			
Signature	/Do Hyung Kim/	Date (YYYY-MM-DD)	2021-10-11
Name	Do Hyung Kim	Registration Number	66487

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.

Electronic Patent Application Fee Transmittal				
Application Number:		16737787		
Filing Date:		08-Jan-2020		
Title of Invention:		METHOD AND APPARATUS FOR LBT FAILURE DETECTION		
First Named Inventor/Applicant Name:		HUNG-CHEN CHEN		
Filer:		Do Hyung Kim/Julie Mcleod		
Attorney Docket Number:		HANN007-US-PAT		
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:	43998560
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	116201
Filer:	Do Hyung Kim/Julie Mcleod
Filer Authorized By:	Do Hyung Kim
Attorney Docket Number:	HANN007-US-PAT
Receipt Date:	11-OCT-2021
Filing Date:	08-JAN-2020
Time Stamp:	16:25:00
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	E20210AG25303850
Deposit Account	602766
Authorized User	Julie Mcleod
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)					
37 CFR 1.20 (Post Issuance fees)					
37 CFR 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2021_10_11_Response_Filed.pdf	60634	yes	10
			a8bfa3ab6d4e4c3c8e443276546e3880d48c6f58		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment Submitted/Entered with Filing of CPA/RCE		1	1	
	Claims		2	6	
	Applicant Arguments/Remarks Made in an Amendment		7	10	
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	2021_10_11_RCE_Request_File d.pdf	74562	no	3
			1cf0f81a602a13eba8283c95f8f41182dc8d8e3d		
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	37775	no	2
			5dcbc60276b872847d0ad266a0b34d15ba5383b6		
Warnings:					
Information:					
Total Files Size (in bytes):			172971		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: HUNG-CHEN, Chen
Serial No.: 16/737,787
Filing Date: January 8, 2020
Group Art Unit: 2415
Examiner: SIDDIQUI, Kashif
Confirmation No.: 8326
Title: METHOD AND APPARATUS FOR LBT FAILURE
DETECTION

Dear Commissioner:

**Mail Stop: RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450**

REQUEST FOR CONTINUED EXAMINATION

In response to the Final Office Action dated July 27, 2021 (the "Final Office Action") and the Advisory Action dated October 7, 2021, Applicants respectfully request that the Examiner reconsider the rejection of the claims in view of the following amendments and remarks. Please amend the Application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Amendments to Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A user equipment (UE) comprising:
 - one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and
 - at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor is configured to execute the computer-executable instructions to:
 - receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;
 - increase an LBT failure counter when the MAC entity receives the LBT failure indication;
 - determine that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and
 - reset the LBT failure counter when ~~at least one of:~~
 - ~~after the MAC entity has not received the LBT failure indication for a time period, and~~
 - ~~a reset of the MAC entity is requested by an upper layer of the UE.~~
2. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
 - switch an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.
3. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

indicate, by the MAC entity of the UE, to the upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred.

4. (Original) The UE of claim 3, wherein the at least one processor is further configured to execute the computer-executable instructions to:

perform a Radio Link Failure (RLF) recovery procedure.

5. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

perform a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).

6. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

transmit, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).

7. (Currently Amended) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

receive a configuration that indicates ~~at least one of the time period and the~~ threshold.

8. (Currently Amended) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

reset the LBT failure counter when ~~at least one of the time period and the~~ threshold is reconfigured.

9. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

reset the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.

10. (Canceled)

11. (Currently Amended) A method for Listen-Before-Talk (LBT) failure detection performed by a User Equipment (UE), the method comprising:

receiving, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;

increasing an LBT failure counter when the MAC entity receives the LBT failure indication;

determining that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and

resetting the LBT failure counter when ~~at least one of:~~

~~_____the MAC entity has not received the LBT failure indication for a time period, and~~

~~_____a reset of the MAC entity is requested by an upper layer of the UE.~~

12. (Previously Presented) The method of claim 11, further comprising:

switching an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.

13. (Previously Presented) The method of claim 11, further comprising:

indicating, by the MAC entity of the UE, to the upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred.

14. (Original) The method of claim 13, further comprising:

performing a Radio Link Failure (RLF) recovery procedure.

15. (Previously Presented) The method of claim 11, further comprising:
performing a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).
16. (Previously Presented) The method of claim 11, further comprising:
transmitting, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).
17. (Currently Amended) The method of claim 11, further comprising:
receiving a configuration that indicates ~~at least one of the time period and the~~ threshold.
18. (Currently Amended) The method of claim 11, further comprising:
resetting the LBT failure counter when ~~at least one of the time period and the~~ threshold is reconfigured.
19. (Previously Presented) The method of claim 11, further comprising:
resetting the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.
20. (Canceled)
21. (New) The user equipment (UE) of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
reset the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.
22. (New) The method of claim 11, further comprising:

resetting the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.

REMARKS

Applicant replies within 3 months to the Final Office Action dated July 27, 2021 ("FOA").

Claims 1, 7, 8, 11, 17, and 18 are hereby amended.

Claims 21 and 22 are hereby added.

Claims 1-9, and 11-19, 21, and 22 remain pending in the present application.

Reconsideration of the claims is respectfully requested. The Applicant makes the aforementioned amendments and subsequent arguments to place this application in condition for allowance. Alternatively, the Applicant makes these amendments and offers these arguments to properly frame the issues for appeal. In this Response, the Applicant makes no admission concerning any now moot rejection or objection, and affirmatively denies any position, statement or averment of the Examiner that is not specifically addressed herein.

Section 102 Rejection

The Examiner rejects Claims 1, 3, 4, 7, 11, 13, 14 and 17 under 35 U.S.C. §102(b) over U.S. Patent Publication No. 2020-0077446 ("*Agiwal*").

Applicants thanks the Examiner for finding that the cited art does not disclose resetting the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE. See FOA, page 2. As such, Applicant is amending the claim to only address one of the conditions for resetting the LBT failure counter (i.e. when a reset of the MAC entity is requested)

Consequently, Claim 1 is amended to recite:

1. A user equipment (UE) comprising:
 - one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and
 - at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor is configured to execute the computer-executable instructions to:
 - receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;
 - increase an LBT failure counter when the MAC entity receives the LBT failure indication;
 - determine that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and
 - reset the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE.

Applicant thanks the Examiner for finding that *Agiwal* does not teach “reset[ting] the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE”.

For at least these reasons, independent Claim 1 is allowable under 35 U.S.C. §102. Similarly, independent Claim 11, which has been amended to recite the same or similar patentable features as Claim 1, is also allowable under 35 U.S.C. §102. Dependent claims 3, 4, 7, 13, 14 and 17 variously depend from independent claims 1 and 11 and are, therefore, patentable at least by virtue of dependence. Accordingly, Applicant respectfully requests that the rejection of Claims 1, 3, 4, 7, 11, 13, 14 and 17 under 35 U.S.C. §102 be withdrawn.

Section 103 Rejection

The Examiner also rejects 2 and 12 under 35 U.S.C. §103(a) over *Agiwal* in view of U.S. Patent Publication No. 2020-0154480 (“*Jose*”). The Examiner also rejects Claims 5 and 15 under 35 U.S.C. §103(a) over *Agiwal* in view of U.S. Patent Publication No. 2018-0184362 (“*Babaei* ‘362’”). The Examiner also rejects Claims 6 and 16 under 35 U.S.C. §102(b) over *Agiwal* in view of U.S. Patent Publication No. 2018-0176961 (“*Babaei* ‘961’”). The Examiner rejects Claims 8 and 18 under 35 U.S.C. §102(b) over *Agiwal* in view of U.S. Patent Publication No. 2017-0231005 (“*Babaei* ‘005’”). Applicant respectfully traverses this rejection for the reasons discussed below.

As discussed above, *Agiwal* and *Babaei* ‘005 do not disclose “reset[ting] the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE”, as recited in independent claims 1 and 11. There is also no disclosure in *Agiwal* and *Babaei* ‘005 that would suggest such a teaching to a person of ordinary skill in the art.

Babaei ‘362 and *Babaei* ‘961 fail to provide disclosures that remedy the deficiencies of *Agiwal* and *Babaei* ‘005.

For at least these reasons, independent Claims 1 and 11 are allowable under 35 U.S.C. §103. Dependent claims 2, 5, 6, 8, 12, 15, 16, and 18 variously depend from independent claims 1 and 11 and are, therefore, patentable at least by virtue of dependence. Accordingly, Applicant respectfully requests that the rejection of Claims 2, 5, 6, 8, 12, 15, 16, and 18 under 35 U.S.C. §103 be withdrawn.

Allowable Subject Matter

Applicant thanks the Examiner for finding allowable in independent Claims 1 and 11 and also dependent claims 9 and 19.

New Claims

Applicant adds new claims 21 and 22 which depend from Independent Claims 1 and 11, respectively. As such, Applicant respectfully submits that the new Claims are in condition for allowance at least by virtue of dependency.

CONCLUSION

Applicant's arguments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicant does not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicant reserves the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

With respect to the Examiner's assertions and reasons for obviousness, Applicant does not consider any included statements have sufficiently put the Applicant on notice of the Examiner asserting Official Notice. If the Examiner intended to take Official Notice with respect to the any of the statements, Applicant traverses and respectfully requests that the Examiner specifically make such an assertion so that proper consideration may be given to the Notice.

In view of the above remarks, Applicant respectfully requests withdrawal of all rejections of the pending claims. Accordingly, Applicant respectfully requests allowance of the pending claims. The Examiner is invited to telephone the undersigned at the Examiner's convenience, if that would help further prosecution of the subject application. The Commissioner is authorized to charge any fees due to Deposit Account No. 602766.

Respectfully submitted,

Dated: October 11, 2021

/Do Hyung Kim/

Do Hyung Kim
Attorney of Applicant
Reg. No. 66487

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/737,787	01/08/2020	HUNG-CHEN CHEN	HANN007-US-PAT	8326
116201	7590	10/07/2021	EXAMINER	
Sul Lee			SIDDIQUI, KASHIF	
3030 Lyndon B Johnson Fwy			ART UNIT	
Suite 1130			PAPER NUMBER	
Dallas, TX 75234			2415	
			NOTIFICATION DATE	
			DELIVERY MODE	
			10/07/2021	
			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):

IP@sulleelaw.com
jmcleod@sulleepllc.com
sul@sulleelaw.com

Advisory Action Before the Filing of an Appeal Brief	Application No. 16/737,787	Applicant(s) CHEN et al.	
	Examiner KASHIF SIDDIQUI	Art Unit 2415	AIA (FITF) Status Yes

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 27 September 2021 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:

a) ☐ The period for reply expires ____ months from the mailing date of the final rejection.

b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires ____ months from the mailing date of the prior Advisory Action or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANTS FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because:

a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);

b) ☐ They raise the issue of new matter (see NOTE below);

c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: See Continuation Sheet (See 37CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☐ Applicants reply has overcome the following rejection(s): _____

6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____

9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____

13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____

14. ☐ Other: _____

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: _____

Claim(s) objected to: 9 and 19.

Claim(s) rejected: 1-8 and 11-18.

Claim(s) withdrawn from consideration: _____

/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
--	--

Continuation of 3. NOTE: Applicant's amendment to the claim removes the alternative previously considered by the Examiner. By omitting said alternative, the currently amended claims present a narrower scope than what was previously examined by the Office. Further search and consideration would be necessary in order to determine patentability.

ATTORNEY'S DOCKET NO.
HANN007-US-PAT

10/03/2021
PATENT APPLICATION
SERIAL NO. 16/737,787

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: HUNG-CHEN, Chen
Serial No.: 16/737,787
Filing Date: January 8, 2020
Group Art Unit: 2415
Examiner: SIDDIQUI, Kashif
Confirmation No.: 8326
Title: METHOD AND APPARATUS FOR LBT FAILURE
DETECTION

Dear Commissioner:

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

AMENDMENT AFTER FINAL

In response to the Final Office Action dated July 27, 2021, Applicants respectfully request that the Examiner reconsider the rejection of the claims in view of the following amendments and remarks. Please amend the Application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.



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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
16/737,787	01/08/2020	2415	1720	HANN007-US-PAT	20	2

CONFIRMATION NO. 8326
CORRECTED FILING RECEIPT



0000000128747756

116201
Sul Lee
3030 Lyndon B Johnson Fwy
Suite 1130
Dallas, TX 75234

Date Mailed: 09/30/2021

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.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

HUNG-CHEN CHEN, Hsinchu, TAIWAN;
CHIE-MING CHOU, Hsinchu, TAIWAN;
CHIA-HUNG WEI, Hsinchu, TAIWAN;
MEI-JU SHIH, Hsinchu, TAIWAN;

Applicant(s)

Hannibal IP LLC, Frisco, TX;

Power of Attorney: The patent practitioners associated with Customer Number 116201

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/790,099 01/09/2019

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: 01/29/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/737,787**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR LBT FAILURE DETECTION

Preliminary Class

370

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

page 2 of 4

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

**LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15**

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/737,787	01/08/2020	HUNG-CHEN CHEN	US78684

CONFIRMATION NO. 8326

POWER OF ATTORNEY NOTICE



54000
ScienBiziP, PC
550 South Hope Street
Suite 2825
Los Angeles, CA 90071

Date Mailed: 09/30/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/27/2021.

- 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/



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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/737,787	01/08/2020	HUNG-CHEN CHEN	HANN007-US-PAT

CONFIRMATION NO. 8326

POA ACCEPTANCE LETTER



OC000000128747711

116201
Sul Lee
3030 Lyndon B Johnson Fwy
Suite 1130
Dallas, TX 75234

Date Mailed: 09/30/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/27/2021.

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/

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	US78684- HANN007-US-PAT
		Application Number	16/737,787
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		
<p>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.</p> <p>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.</p>			

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				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	HUNG-CHEN		CHEN			
Residence Information (Select One) US Residency • Non US Residency Active US Military Service						
City	Hsinchu		Country of Residence ⁱ	TW		
Mailing Address of Inventor:						
Address 1	4F., No.87, Ln. 28, Sec. 1, Tiedao Rd., East Dist.					
Address 2						
City	Hsinchu		State/Province			
Postal Code	300		Country ⁱ	TW		
Inventor	2				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	CHIE-MING		CHOU			
Residence Information (Select One) US Residency • Non US Residency Active US Military Service						
City	Hsinchu		Country of Residence ⁱ	TW		
Mailing Address of Inventor:						
Address 1	5F-1, NO. 5, HSIN-AN RD.					
Address 2	HSINCHU SCIENCE-BASED INDUSTRIAL PARK, TAIWAN					
City	Hsinchu		State/Province			
Postal Code	300		Country ⁱ	TW		
Inventor	3				Remove	
Legal Name						

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
		Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

Prefix	Given Name	Middle Name	Family Name	Suffix
	CHIA-HUNG		WEI	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Hsinchu	Country of Residence ⁱ	TW	

Mailing Address of Inventor:

Address 1	5F-1, NO. 5, HSIN-AN RD.,			
Address 2	HSINCHU SCIENCE-BASED INDUSTRIAL PARK, TAIWAN			
City	Hsinchu	State/Province		
Postal Code	300	Country ⁱ	TW	
Inventor	4			<input type="button" value="Remove"/>

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	MEI-JU		SHIH	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Hsinchu	Country of Residence ⁱ	TW	

Mailing Address of Inventor:

Address 1	5F-1, NO. 5, HSIN-AN RD.,			
Address 2	HSINCHU SCIENCE-BASED INDUSTRIAL PARK			
City	Hsinchu	State/Province		
Postal Code	300	Country ⁱ	TW	

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

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	54000 <u>116201</u>		
Email Address	coa-proce@scienbizip.com <u>ip@sulleelaw.com</u>	<input type="button" value="Add Email"/>	<input type="button" value="Remove Email"/>
Email Address	coa-cbd@scienbizip.com	<input type="button" value="Add Email"/>	<input type="button" value="Remove Email"/>
Email Address	coa-proce@scienbizip.com		<input type="button" value="Remove Email"/>

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 HANN007-US-PAT
		Application Number	16/737,787
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

Application Information:

Title of the Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		
Attorney Docket Number	US78684 HANN007-US-PAT	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	Suggested Figure for Publication (if any)	1

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	54000 — 116201		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 HANN007-US-PAT
		Application Number	16/737,787
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

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	<input type="button" value="Remove"/>	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	62/790099	2019-01-09
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			<input type="button" value="Add"/>

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)ⁱ 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 ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	<input type="button" value="Remove"/>
Additional Foreign Priority Data may be generated within this form by selecting the Add button.				<input type="button" value="Add"/>

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

<p>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.</p> <p>☐ 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.</p>
--

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
	Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION	

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
	Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION	

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	<input type="button" value="Remove"/>	
<p>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.</p> <p style="text-align: right;"><input type="button" value="Clear"/></p>		
☒ 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	FG Innovation Company Limited <u>Hannibal IP LLC</u>	
Mailing Address Information For Applicant:		
Address 1	Flat 2623, 26/F Tuen Mun Central Square <u>5204 Bluewater Dr.</u>	
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City	Tuen Mun <u>Frisco</u>	State/Province <u>Texas</u>
Country	HK <u>U.S.A.</u>	Postal Code <u>75036</u>
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. <input type="button" value="Add"/>		

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
		Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

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.				
<input type="button" value="Remove"/>				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1		<input type="text"/>		
Address 2		<input type="text"/>		
City	<input type="text"/>	State/Province	<input type="text"/>	
Country i	<input type="text"/>	Postal Code	<input type="text"/>	
Phone Number	<input type="text"/>	Fax Number	<input type="text"/>	
Email Address	<input type="text"/>			
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. <input type="button" value="Add"/>				

Signature:					<input type="button" value="Remove"/>
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	/Alvin Koan/ <u>/Do Hyung Kim/</u>		Date (YYYY-MM-DD)	<u>2021-09-27</u> 2020-01-08	
First Name	Alvin <u>Do Hyung</u>	Last Name	Koan <u>Kim</u>	Registration Number	68468 <u>66487</u>
Additional Signature may be generated within this form by selecting the Add button. <input type="button" value="Add"/>					

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
		Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

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

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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.
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EFS ID:	43880228
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	54000
Filer:	Do Hyung Kim/Julie Mcleod
Filer Authorized By:	Do Hyung Kim
Attorney Docket Number:	US78684
Receipt Date:	27-SEP-2021
Filing Date:	08-JAN-2020
Time Stamp:	20:43:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	2021_09_27_Amended_ADS.pdf	422879 079b29325f25d65baab2f99de59c28eba097fca46	no	9

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: HUNG-CHEN, Chen
Serial No.: 16/737,787
Filing Date: January 8, 2020
Group Art Unit: 2415
Examiner: SIDDIQUI, Kashif
Confirmation No.: 8326
Title: METHOD AND APPARATUS FOR LBT FAILURE
DETECTION

Dear Commissioner:

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

AMENDMENT AFTER FINAL

In response to the Final Office Action dated July 27, 2021, Applicants respectfully request that the Examiner reconsider the rejection of the claims in view of the following amendments and remarks. Please amend the Application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Amendments to Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A user equipment (UE) comprising:
 - one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and
 - at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor is configured to execute the computer-executable instructions to:
 - receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;
 - increase an LBT failure counter when the MAC entity receives the LBT failure indication;
 - determine that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and
 - reset the LBT failure counter when ~~at least one of:~~
 - ~~after the MAC entity has not received the LBT failure indication for a time period, and~~
 - ~~a reset of the MAC entity is requested by an upper layer of the UE.~~
2. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
 - switch an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.
3. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

indicate, by the MAC entity of the UE, to the upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred.

4. (Original) The UE of claim 3, wherein the at least one processor is further configured to execute the computer-executable instructions to:

perform a Radio Link Failure (RLF) recovery procedure.

5. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

perform a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).

6. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

transmit, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).

7. (Currently Amended) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

receive a configuration that indicates ~~at least one of the time period and the~~ threshold.

8. (Currently Amended) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

reset the LBT failure counter when ~~at least one of the time period and the~~ threshold is reconfigured.

9. (Previously Presented) The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

reset the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.

10. (Canceled)

11. (Currently Amended) A method for Listen-Before-Talk (LBT) failure detection performed by a User Equipment (UE), the method comprising:

receiving, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;

increasing an LBT failure counter when the MAC entity receives the LBT failure indication;

determining that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and

resetting the LBT failure counter when ~~at least one of:~~

~~_____the MAC entity has not received the LBT failure indication for a time period, and~~

~~_____a reset of the MAC entity is requested by an upper layer of the UE.~~

12. (Previously Presented) The method of claim 11, further comprising:

switching an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.

13. (Previously Presented) The method of claim 11, further comprising:

indicating, by the MAC entity of the UE, to the upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred.

14. (Original) The method of claim 13, further comprising:

performing a Radio Link Failure (RLF) recovery procedure.

15. (Previously Presented) The method of claim 11, further comprising:
performing a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).
16. (Previously Presented) The method of claim 11, further comprising:
transmitting, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).
17. (Currently Amended) The method of claim 11, further comprising:
receiving a configuration that indicates ~~at least one of the time period and the~~ threshold.
18. (Currently Amended) The method of claim 11, further comprising:
resetting the LBT failure counter when ~~at least one of the time period and the~~ threshold is reconfigured.
19. (Previously Presented) The method of claim 11, further comprising:
resetting the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.
20. (Canceled)
21. (New) The user equipment (UE) of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
reset the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.
22. (New) The method of claim 11, further comprising:

resetting the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.

REMARKS

Applicant replies within 2 months to the Final Office Action dated July 27, 2021 ("FOA").

Claims 1, 7, 8, 11, 17, and 18 are hereby amended.

Claims 21 and 22 are hereby added.

Claims 1-9, and 11-19, 21, and 22 remain pending in the present application.

Reconsideration of the claims is respectfully requested. The Applicant makes the aforementioned amendments and subsequent arguments to place this application in condition for allowance. Alternatively, the Applicant makes these amendments and offers these arguments to properly frame the issues for appeal. In this Response, the Applicant makes no admission concerning any now moot rejection or objection, and affirmatively denies any position, statement or averment of the Examiner that is not specifically addressed herein.

Section 102 Rejection

The Examiner rejects Claims 1, 3, 4, 7, 11, 13, 14 and 17 under 35 U.S.C. §102(b) over U.S. Patent Publication No. 2020-0077446 ("*Agiwal*").

Applicants thanks the Examiner for finding that the cited art does not disclose resetting the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE. See FOA, page 2. As such, Applicant is amending the claim to only address one of the conditions for resetting the LBT failure counter (i.e. when a reset of the MAC entity is requested)

Consequently, Claim 1 is amended to recite:

1. A user equipment (UE) comprising:
 - one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and
 - at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor is configured to execute the computer-executable instructions to:
 - receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;
 - increase an LBT failure counter when the MAC entity receives the LBT failure indication;
 - determine that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold; and
 - reset the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE.

Applicant thanks the Examiner for finding that *Agiwal* does not teach “reset[ting] the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE”.

For at least these reasons, independent Claim 1 is allowable under 35 U.S.C. §102. Similarly, independent Claim 11, which has been amended to recite the same or similar patentable features as Claim 1, is also allowable under 35 U.S.C. §102. Dependent claims 3, 4, 7, 13, 14 and 17 variously depend from independent claims 1 and 11 and are, therefore, patentable at least by virtue of dependence. Accordingly, Applicant respectfully requests that the rejection of Claims 1, 3, 4, 7, 11, 13, 14 and 17 under 35 U.S.C. §102 be withdrawn.

Section 103 Rejection

The Examiner also rejects 2 and 12 under 35 U.S.C. §103(a) over *Agiwal* in view of U.S. Patent Publication No. 2020-0154480 (“*Jose*”). The Examiner also rejects Claims 5 and 15 under 35 U.S.C. §103(a) over *Agiwal* in view of U.S. Patent Publication No. 2018-0184362 (“*Babaei* ‘362’”). The Examiner also rejects Claims 6 and 16 under 35 U.S.C. §102(b) over *Agiwal* in view of U.S. Patent Publication No. 2018-0176961 (“*Babaei* ‘961’”). The Examiner rejects Claims 8 and 18 under 35 U.S.C. §102(b) over *Agiwal* in view of U.S. Patent Publication No. 2017-0231005 (“*Babaei* ‘005’”). Applicant respectfully traverses this rejection for the reasons discussed below.

As discussed above, *Agiwal* and *Babaei* ‘005 do not disclose “reset[ting] the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE”, as recited in independent claims 1 and 11. There is also no disclosure in *Agiwal* and *Babaei* ‘005 that would suggest such a teaching to a person of ordinary skill in the art.

Babaei ‘362 and *Babaei* ‘961 fail to provide disclosures that remedy the deficiencies of *Agiwal* and *Babaei* ‘005.

For at least these reasons, independent Claims 1 and 11 are allowable under 35 U.S.C. §103. Dependent claims 2, 5, 6, 8, 12, 15, 16, and 18 variously depend from independent claims 1 and 11 and are, therefore, patentable at least by virtue of dependence. Accordingly, Applicant respectfully requests that the rejection of Claims 2, 5, 6, 8, 12, 15, 16, and 18 under 35 U.S.C. §103 be withdrawn.

Allowable Subject Matter

Applicant thanks the Examiner for finding allowable in independent Claims 1 and 11 and also dependent claims 9 and 19.

New Claims

Applicant adds new claims 21 and 22 which depend from Independent Claims 1 and 11, respectively. As such, Applicant respectfully submits that the new Claims are in condition for allowance at least by virtue of dependency.

CONCLUSION

Applicant's arguments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicant does not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicant reserves the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

With respect to the Examiner's assertions and reasons for obviousness, Applicant does not consider any included statements have sufficiently put the Applicant on notice of the Examiner asserting Official Notice. If the Examiner intended to take Official Notice with respect to the any of the statements, Applicant traverses and respectfully requests that the Examiner specifically make such an assertion so that proper consideration may be given to the Notice.

In view of the above remarks, Applicant respectfully requests withdrawal of all rejections of the pending claims. Accordingly, Applicant respectfully requests allowance of the pending claims. The Examiner is invited to telephone the undersigned at the Examiner's convenience, if that would help further prosecution of the subject application. The Commissioner is authorized to charge any fees due to Deposit Account No. 602766.

Respectfully submitted,

Dated: September 27, 2021

/Do Hyung Kim/

Do Hyung Kim
Attorney of Applicant
Reg. No. 66487

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Electronic Acknowledgement Receipt	
EFS ID:	43880178
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	54000
Filer:	Do Hyung Kim/Julie Mcleod
Filer Authorized By:	Do Hyung Kim
Attorney Docket Number:	US78684
Receipt Date:	27-SEP-2021
Filing Date:	08-JAN-2020
Time Stamp:	20:35:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2021_09_27_Response_Filed. pdf	60153 f2ccb4ee1e8e9ff04c48dd1653b5c16176d45b99	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Response After Final Action	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	10
Warnings:			
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Total Files Size (in bytes):			60153
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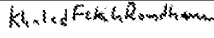
Assignee name and address:

Hannibal IP LLC, 5204 Bluewater Dr., Frisco, Texas 75036 U.S.A.

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SIGNATURE of Assignee of Record

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

Signature 	Date Sept 3, 2021
Name Khalad Fekih-Romdhane	Telephone
Title Manager	

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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 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.

Electronic Acknowledgement Receipt	
EFS ID:	43874729
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	54000
Filer:	Do Hyung Kim/Julie Mcleod
Filer Authorized By:	Do Hyung Kim
Attorney Docket Number:	US78684
Receipt Date:	27-SEP-2021
Filing Date:	08-JAN-2020
Time Stamp:	15:11:02
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	Transmittal_Ltr.pdf	23025 149868ef965676c5b2b1d3d26b9fb9c3d7f8afd7	no	1

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	2021_09_27_373C.pdf	262795	no	3
			f4bf5ea9bb7c3ced3a991d1ab2f4c50345e2761f		
Warnings:					
Information:					
3	Application Data Sheet	2021_09_27_Amended_ADS.pdf	409741	no	9
			6639fca38bf6f2329a14685d1701c2a8dbe27f53		
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
4	Power of Attorney	Executed_POA-signed.pdf	424726	no	2
			1bb8c625420d9f9359a1aee50de638db722fca81		
Warnings:					
Information:					
Total Files Size (in bytes):			1120287		
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: CHEN, HUNG-CHEN
Serial No.: 16/737,787
Filing Date: January 8, 2020
Group Art Unit: 2415
Examiner: SIDDIQUI, KASHIF
Confirmation No.: 8326
Title: METHOD AND APPARATUS FOR LBT FAILURE
DETECTION

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

Dear Commissioner:

SUBMISSION OF NEW APPLICATION DATA SHEET

Applicant submits a new Application Data Sheet in order to update the name of the Applicant from FG Innovation Company Limited to Hannibal IP LLC. The Applicant also requests an updated filing receipt listing Hannibal IP LLC as the Applicant.

No fee is believed due. However, the Commissioner is hereby authorized to charge any fees and credit any over payments to Deposit Account No. 602766.

Respectfully submitted,

/Do Hyung Kim/

Dated: September 27, 2021

Do Hyung Kim
Attorney of Applicant
Reg. No. 66487

SUL LEE Law Firm PLLC
3030 LBJ Fwy, Ste 1130
Dallas, Texas 75234
Tel.: 214-206-4064
Fax.: 214-206-4068
E-mail: dkim@sulleelaw.com

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: Hannibal IP LLCApplication No./Patent No.: 16/737,787 Filed/Issue Date: January 8, 2020Titled: METHOD AND APPARATUS FOR LBT FAILURE DETECTIONHannibal IP LLC, 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 _____, Frame _____, 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: CHEN, Hung-Chen; CHOU, Chia-Ming; WEI, Chia-Hung; SHIH, Mei-Ju To: FG Innovation Company LimitedThe document was recorded in the United States Patent and Trademark Office at
Reel 056500, Frame 0788, or for which a copy thereof is attached.2. From: FG Innovation Company Limited To: Hannibal IP LLCThe document was recorded in the United States Patent and Trademark Office at
Reel 057487, Frame 0504, or for which a copy thereof is attached.

[Page 1 of 2]

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

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

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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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

4. 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.

5. 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.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.☐ Additional documents in the chain of title are listed on a supplemental sheet(s).☒ As required by 37 CFR 3.73(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.

/Do Hyung Kim/

Signature

Do Hyung Kim

Printed or Typed Name

September 27, 2021

Date

66487

Title or Registration Number

[Page 2 of 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.

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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.

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	US78684- HANN007-US-PAT
		Application Number	16/737,787
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		
<p>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.</p> <p>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.</p>			

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				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	HUNG-CHEN		CHEN		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Hsinchu	Country of Residence ⁱ		TW	
Mailing Address of Inventor:					
Address 1	4F., No.87, Ln. 28, Sec. 1, Tiedao Rd., East Dist.				
Address 2					
City	Hsinchu	State/Province			
Postal Code	300	Country ⁱ	TW		
Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	CHIE-MING		CHOU		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Hsinchu	Country of Residence ⁱ		TW	
Mailing Address of Inventor:					
Address 1	5F-1, NO. 5, HSIN-AN RD.				
Address 2	HSINCHU SCIENCE-BASED INDUSTRIAL PARK, TAIWAN				
City	Hsinchu	State/Province			
Postal Code	300	Country ⁱ	TW		
Inventor	3				Remove
Legal Name					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
		Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

Prefix	Given Name	Middle Name	Family Name	Suffix
	CHIA-HUNG		WEI	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Hsinchu	Country of Residence ⁱ	TW	

Mailing Address of Inventor:

Address 1	5F-1, NO. 5, HSIN-AN RD.,			
Address 2	HSINCHU SCIENCE-BASED INDUSTRIAL PARK, TAIWAN			
City	Hsinchu	State/Province		
Postal Code	300	Country ⁱ	TW	
Inventor	4			<input type="button" value="Remove"/>

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	MEI-JU		SHIH	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Hsinchu	Country of Residence ⁱ	TW	

Mailing Address of Inventor:

Address 1	5F-1, NO. 5, HSIN-AN RD.,			
Address 2	HSINCHU SCIENCE-BASED INDUSTRIAL PARK			
City	Hsinchu	State/Province		
Postal Code	300	Country ⁱ	TW	

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

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	54000 <u>116201</u>		
Email Address	coa-proce@scienbizip.com <u>ip@sulleelaw.com</u>	<input type="button" value="Add Email"/>	<input type="button" value="Remove Email"/>
Email Address	coa-cbd@scienbizip.com	<input type="button" value="Add Email"/>	<input type="button" value="Remove Email"/>
Email Address	coa-proce@scienbizip.com		<input type="button" value="Remove Email"/>

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 HANN007-US-PAT
		Application Number	16/737,787
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

Application Information:

Title of the Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		
Attorney Docket Number	US78684 HANN007-US-PAT	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	Suggested Figure for Publication (if any)	1

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	54000 — 116201		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	US78684 HANN007-US-PAT
	Application Number	16/737,787
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION	

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	62/790099	2019-01-09
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

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)ⁱ 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).

			Remove
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐	<p>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.</p> <p>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.</p>
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
	Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION	

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
	Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION	

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		<input type="button" value="Remove"/>
<p>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.</p>			
		<input type="button" value="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. ☒			
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Country	HK <u>U.S.A.</u>	Postal Code	<u>75036</u>
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			<input type="button" value="Add"/>

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
		Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

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.				
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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	/Alvin Koan/ <u>/Do Hyung Kim</u>		Date (YYYY-MM-DD)	<u>2021-09-27</u> 2020-01-08
First Name	Alvin <u>Do Hyung</u>	Last Name	Koan <u>Kim</u>	Registration Number <u>68468 66487</u>
Additional Signature may be generated within this form by selecting the Add button. <input type="button" value="Add"/>				

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	US78684 <u>HANN007-US-PAT</u>
		Application Number	<u>16/737,787</u>
Title of Invention	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		

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

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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.

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**Courtesy Reminder for
Application Serial No: 16/737,787**

Attorney Docket No: US78684

Customer Number: 54000

Date of Electronic Notification: 07/27/2021

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/737,787	01/08/2020	HUNG-CHEN CHEN	US78684	8326
54000	7590	07/27/2021	EXAMINER	
ScienBiziP, PC 550 South Hope Street Suite 2825 Los Angeles, CA 90071			SIDDIQUI, KASHIF	
			ART UNIT	PAPER NUMBER
			2415	
			NOTIFICATION DATE	DELIVERY MODE
			07/27/2021	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):

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Notice of Pre-AIA or AIA Status

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

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 07/06/2021 have been fully considered but they are not persuasive. Applicant asserts:

a. That neither **Agiwal** nor **Babaei '005** disclose resetting the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE as now presented in amended claims 1 and 11.

i. The Examiner very kindly points out that per the amended claims, the aforementioned limitation is presented as one alternative for triggering whether to reset the LBT failure counter. The other alternative is when the MAC entity has not received the LBT failure indication for a time period, which is taught by **Agiwal** (see 0163). Thus, since "at least one" of the trigger conditions is taught by **Agiwal**, the limitations of the claims have been met.

ii. The Examiner suggests that Applicant amend the claims to require that the LBT failure counter is reset based on an upper layer of the UE requesting a MAC entity reset.

Allowable Subject Matter

2. Claims 9, 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

(a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

4. **Claim(s) 1, 3, 4, 7, 11, 13, 14, 17 is/are rejected under 35 U.S.C. 102(a)(2) as being anticipated by US 20200077446 A1 to Agiwal; Anil**

Re: Claim(s) 1, 11

Agiwal discloses a user equipment (UE) (Fig. 9)

comprising: one or more non-transitory computer-readable media having computer-executable instructions embodied thereon (0191 and Fig. 9 – 930);

and at least one processor coupled to the one or more non-transitory computer-readable media (Fig. 9 – 920),

the at least one processor is configured to execute the computer-executable instructions to: receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions (0160 - PHY checks the channel status (based on LBT) . 0163 - 0163 - If MAC entity receives indication N consecutive times or N times within a configured time (as in Embodiment 1), indicating that PHY failed to transmit PRACH preamble due to LBT failure ... A counter (LBT_FAIL_COUNTER) can be maintained to count the LBT failures within an LBTFailureTimer. If MAC receives the indication that PHY failed to perform UL transmission due to LBT failure, UE (re-)starts the LBTFailureTimer, MAC also increments LBT_FAIL_COUNTER);

increase an LBT failure counter when the MAC entity receives the LBT failure indication (0163 – see last citation);

determine that an LBT failure event has occurred when the LBT failure counter is greater than or equal to a threshold (0163 - If MAC entity receives indication N consecutive times or N times within a configured time (as in Embodiment 1), indicating that PHY failed to transmit PRACH preamble due to LBT failure, MAC entity may indicate RA problem to higher layer (i.e., RRC) or indicate LBT problem to higher layer);

and reset the LBT failure counter when at least one of: the MAC entity has not received the LBT failure indication for a time period, and a reset of the MAC entity is requested by an upper layer of the UE (0163 - If MAC receives the indication that PHY failed to perform UL transmission due to LBT failure, UE (re-)starts the LBTFailureTimer ... If LBTFailureTimer expires, UE resets the LBT_FAIL_COUNTER, i.e., sets LBT_FAIL_COUNTER to 0).

Agiwal further discloses a method performed by a user equipment (see at least Abstract) as required by claim 11.

Re: Claim(s) 3, 13

Agiwal discloses wherein the at least one processor is further configured to execute the computer-executable instructions to: indicate, by the MAC entity of the UE, to an upper layer of the UE an LBT failure problem after determining that the LBT failure event has occurred (0163 - MAC entity may indicate RA problem to higher layer (i.e., RRC) or indicate LBT problem to higher layer).

Re: Claim(s) 4, 14

Agiwal discloses wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a Radio Link Failure (RLF) recovery procedure (0163 - MAC entity may indicate RA problem to higher layer (i.e., RRC) or indicate LBT problem to higher layer. RRC may declare RLF and/or perform cell reselection upon receiving this indication from MAC).

Re: Claim(s) 7, 17

Agiwal discloses wherein the at least one processor is further configured to execute the computer-executable instructions to: receive a configuration that indicates at least one of the time period and the threshold (0163 - LBTFailureTimer and MAX_COUNT are configured by gNB via RRC signaling).

Claim Rejections - 35 USC § 103

5. 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, 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.

6. **Claim(s) 2, 12 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20200154480 A1 to Jose; Pradeep et al.**

Re: Claim(s) 2, 12

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: switch an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event has occurred.

However, attention is directed to **Jose** which discloses said limitation (0049 - in an event that the consistent LBT failure is declared/determined on a channel, the UE may be configured to perform some actions. The channel may comprise a bandwidth part (BWP) or a sub-band. For example, in an event that the consistent LBT failure event is determined on a BWP, the UE may be configured to initiate a switch to a different BWP in an event that there is another BWP with configured RACH resources).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Jose** to provide a fallback procedure upon detecting an LBT failure event. The motivation for the combination is given by **Jose** (0008 - it is needed to provide proper mechanisms to detect consistent LBT failures and proper recovery procedures to establish a link successfully).

7. Claim(s) 5, 15 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20180184362 A1 to Babaei; Alireza et al. (hereinafter Babaei '362)

Re: Claim(s) 5, 15

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal further discloses initiating a RLF procedure upon detecting a LBT failure event (0163).

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).

However, attention is directed to **Babaei '362** which discloses a procedure after detecting an RLF (0208 - In an example the UE may apply such parameters to meet the radio link monitoring requirements on LAA SPcells or standalone unlicensed PCells ... If

the UE determines that the Radio Link fails, the UE may try to reconnect with an RRC Connection Reestablishment Request message).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '362** to provide the ability to implement reconnection with a standalone PCell via an RRC connection reestablishment request message. The motivation for the combination is given by **Babaei '362** (0027 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

8. Claim(s) 6, 16 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20180176961 A1 to Babaei; Alireza et al. (hereinafter Babaei '961)

Re: Claim(s) 6, 16

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: transmit, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).

However, attention is directed to **Babaei '961** which discloses said limitation (0183-0187 - the UE may perform a random access process on an LAA cell of the SCG

... the SCG for a user may comprise of one or more LAA cell. In an example, the PSCell for a UE may be an LAA cell. The transmissions on LAA cells are subject to LBT ... the UE may increment the counter in response to the LBT indicating that the channel is occupied ... The LBT indicating that the channel is occupied may be called LBT failure ... The wireless device may determine that the random access process is failed in response to the counter reaching a first value ... The wireless may transmit one or more messages to a master base station (e.g., MeNB) in response to the failure of the random access process. In an example, the one or more message may indicate that the random access failure is due at least one LBT failure during the random access process. In an example, the one or more messages may indicate that the random access failure is due to a predetermined (e.g., a first number) of LBT failures during the random access process).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '961** to provide the ability to report an LBT failure event associated with a PSCell of an SCG to a PCell of an MCG. The motivation for the combination is given by **Babaei '961** (0030 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

9. **Claim(s) 8, 18 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20170231005 A1 to Babaei; Alireza et al. (hereinafter Babaei '005).**

Re: Claim(s) 8, 18

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when at least one of the time period and the threshold is reconfigured.

However, the Examiner points out that it would have been obvious to one of ordinary skill in the art at the time of the filing of the invention to have surmised through common sense that resetting the LBT failure counter would be necessary upon reconfiguration of the counter threshold. For example, when reconfiguring the threshold to a smaller value than the current value of the counter, a failure event would unnecessarily be triggered without any additional LBT failures actually occurring. Resetting the counter would avoid such a problem.

However, attention is directed to **Babaei '005** which discloses various reasons by example for resetting the counter (0222 - a UE may maintain the number of and/or the percentage of transmission attempts that failed due to LBT blocking. A UE may update the value stored in the counter(s) after a transmission attempt fails due to LBT blocking. In an example implementation, a UE may update the value stored in the counter(s) after a configurable number of transmission attempts. In an example, the counter and/or the parameter may be reset when certain conditions are met, for example, when a timer expires, when a UE receives a specific signal from the eNB, when the counter is transmitted, when some certain conditions are met and/or when a cell is deactivated). **Agiwal** further discloses that the counter is configured by gNB via RRC signaling (0163)

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '005** to provide the ability to reset a LBT failure counter upon receiving a reconfiguration message from an eNB/gNB. The motivation for the combination is given by **Babaei '005** (0028 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **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 or earlier communications from the examiner should be directed to KASHIF SIDDIQUI whose telephone number is (571)270-3188. The examiner can normally be reached on M-R 6:00 EST to 16:00 EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Rutkowski can be reached on 571-270-1215. 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.

/KASHIF SIDDIQUI/
Primary Examiner, Art Unit 2415

<i>Index of Claims</i> 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

✓	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	04/13/2021	07/22/2021						
	1	✓	✓						
	2	✓	✓						
	3	✓	✓						
	4	✓	✓						
	5	✓	✓						
	6	✓	✓						
	7	✓	✓						
	8	✓	✓						
	9	✓	O						
	10	✓	-						
	11	✓	✓						
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	15	✓	✓						
	16	✓	✓						
	17	✓	✓						
	18	✓	✓						
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	20	✓	-						

Search Notes 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

CPC - Searched*		
Symbol	Date	Examiner
H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808	04/13/2021	KS
Updated	07/22/2021	KS

CPC Combination Sets - Searched*		
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US Classification - Searched*			
Class	Subclass	Date	Examiner

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Search Notes		
Search Notes	Date	Examiner
Searched EAST (US-PGPUB; USPAT)	04/13/2021	KS
Searched EPO/WIPO	04/13/2021	KS
Searched Inventor/Assignee	04/13/2021	KS
Searched Google Patents	04/13/2021	KS
Searched Global Dossier	04/13/2021	KS
Searched NPL	04/13/2021	KS
Updated	07/22/2021	KS

/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
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<i>Search Notes</i> 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

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

/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"16737787"	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L2	19,843	((H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808).CPC.)	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L3	233	(FG near innovation).as.	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L4	45,320	(chen-h\$ chou-c\$ wei-c\$ shih-m\$).in.	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L5	1	("20180176961").PN.	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L6	161	((listen adj before adj talk) (LBT)) with (fail\$4) with (counter)	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L7	87	(MAC with ((lower physical) adj2 (layer))) and L6	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L8	55	L7 and L2	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L9	37	(reset\$4) same L6	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L10	1,645	((listen adj before adj talk) (LBT)) with (fail\$4)	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L11	4	((PCell) with (RRC with (re\$1establishment near2 request))) and L10	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L12	7	(RLF near4 (procedure process)) same L10	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L13	1	(LBT same MENB) and L5	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51

L14	4	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and L10	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L15	880	((PCell MCG MeNB)) and L10	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L16	432	L2 and L15	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L17	18	((RRC with (re\$1establishment near2 request))) and L15	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L18	2	"20180124825"	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L19	12,394	((listen adj before adj talk) (LBT))	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L20	1	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) same L19	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L21	4	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and L19	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L22	993	((PCell MCG MeNB)) same L19	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L23	10	((RRC with (re\$1establishment near2 request))) and L22	US-PGPUB; USPAT	OR	OFF	2021/07/22 13:51
L24	15	(active with (BWP bandwidth\$1part)) and 9	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:09
L25	348	(switch\$3 chang\$3 mov\$3) near3 ((another second\$3 other) near2 BWP)	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:14
L26	3,318	((listen adj before adj talk) (LBT)) with (fail\$4 busy occup\$3)	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:15
L27	61	((reset\$4 restart\$3) near3 (counter timer)) same 26	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:16
L28	14	25 and 27	US-PGPUB; USPAT	OR	OFF	2021/07/22 14:16

S1	1	"16737787"	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
S2	18,835	((H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808).CPC.)	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
S3	169	(FG near innovation).as.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
S4	44,077	(chen-h\$ chou-c\$ wei-c\$ shih-m\$).in.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:11
S5	1	("20180176961").PN.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:11
S6	138	((listen adj before adj talk) (LBT)) with (fail\$4) with (counter)	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:55
S7	71	(MAC with ((lower physical) adj2 (layer))) and S6	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:56
S8	40	S7 and S2	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:57
S9	27	(reset\$4) same S6	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:32
S10	1,440	((listen adj before adj talk) (LBT)) with (fail\$4)	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:44
S11	3	((PCell) with (RRC with (re\$1establishment near2 request))) and S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:45
S12	4	(RLF near4 (procedure process)) same S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:48
S13	1	(LBT same MENB) and S5	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:03
S14	3	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
S15	787	((PCell MCG MeNB)) and S10	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07

S16	383	S2 and S15	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
S17	15	((RRC with (re\$1establishment near2 request))) and S15	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:08
S18	2	"20180124825"	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:23
S19	11,460	((listen adj before adj talk) (LBT))	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:26
S20	1	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) same S19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:27
S21	3	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and S19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:27
S22	893	((PCell MCG MeNB)) same S19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:28
S23	10	((RRC with (re\$1establishment near2 request))) and S22	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:28

EAST Search History (Interference)

<This search history is empty>

7/22/2021 2:35:42 PM

C:\Users\ksiddiqui\Documents\EAST\Workspaces\16737787.wsp

Electronic Acknowledgement Receipt	
EFS ID:	43172454
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	54000
Filer:	Amir Bahrami
Filer Authorized By:	
Attorney Docket Number:	US78684
Receipt Date:	06-JUL-2021
Filing Date:	08-JAN-2020
Time Stamp:	12:10:51
Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	US78684210705R1.pdf	141467 dbe9b068018eb42503eeaac27a8513b7f0ef5259	no	9

Warnings:

Information:	
Total Files Size (in bytes):	141467
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 16/737,787
Application Filing Date : January 8, 2020
Examiner : SIDDIQUI, KASHIF
Art Unit : 2415
Confirmation No. : 8326
Attorney Docket No. : US78684
First Inventor : HUNG-CHEN CHEN
Customer No. : 54000

AMENDMENT AND RESPONSE TO *NON-FINAL* OFFICE ACTION

Mail Stop Amendment

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

Dear Sir/Madam:

This is in response to the *Non-Final* Office Action dated April 16, 2021, in the above-referenced patent application. Please kindly consider the following:

A Listing of Claims begins on page **2** of this paper. This listing of claims will replace all prior versions, and listings, of claims in the application.

Remarks begin on page **6** of this paper.

Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. **(Currently Amended)** A user equipment (UE) comprising:
one or more non-transitory computer-readable media having computer-executable instructions embodied thereon; and
at least one processor coupled to the one or more non-transitory computer-readable media, the at least one processor is configured to execute the computer-executable instructions to:
receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;
increase an LBT failure counter when the MAC entity receives the LBT failure indication;
determine that an LBT failure event ~~occurs~~ has occurred when the LBT failure counter is greater than or equal to a threshold; and
reset the LBT failure counter when at least one of:
after the MAC entity has not received the LBT failure indication for a time period,
and
a reset of the MAC entity is requested by an upper layer of the UE.
2. **(Currently Amended)** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
switch an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event ~~occurs~~ has occurred.
3. **(Currently Amended)** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:
indicate, by the MAC entity of the UE, to ~~an~~ the upper layer of the UE an LBT failure problem after determining that the LBT failure event ~~occurs~~ has occurred.
4. **(Original)** The UE of claim 3, wherein the at least one processor is further configured to execute the computer-executable instructions to:
perform a Radio Link Failure (RLF) recovery procedure.
5. **(Currently Amended)** The UE of claim ~~4~~, 1, wherein the at least one processor is further

configured to execute the computer-executable instructions to:

perform a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).

6. **(Currently Amended)** The UE of claim 4~~, 1~~, wherein the at least one processor is further configured to execute the computer-executable instructions to:

transmit, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).

7. **(Original)** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

receive a configuration that indicates at least one of the time period and the threshold.

8. **(Original)** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

reset the LBT failure counter when at least one of the time period and the threshold is reconfigured.

9. **(Currently Amended)** The UE of claim 1, wherein the at least one processor is further configured to execute the computer-executable instructions to:

reset the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.

10. **(Canceled)**

11. **(Currently Amended)** A method for Listen-Before-Talk (LBT) failure detection performed by a User Equipment (UE), the method comprising:

receiving, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer of the UE for all uplink (UL) transmissions;

increasing an LBT failure counter when the MAC entity receives the LBT failure indication;

determining that an LBT failure event ~~occurs~~ has occurred when the LBT failure counter is greater than or equal to a threshold; and

resetting the LBT failure counter when at least one of:

~~after~~ the MAC entity has not received the LBT failure indication for a time period, and a reset of the MAC entity is requested by an upper layer of the UE.

12. **(Currently Amended)** The method of claim 11, further comprising:
switching an active Bandwidth Part (BWP) of the UE to another BWP after determining that the LBT failure event ~~occurs~~ has occurred.

13. **(Currently Amended)** The method of claim 11, further comprising:
indicating, by the MAC entity of the UE, to ~~an~~ the upper layer of the UE an LBT failure problem after determining that the LBT failure event ~~occurs~~ has occurred.

14. **(Original)** The method of claim 13, further comprising:
performing a Radio Link Failure (RLF) recovery procedure.

15. **(Currently Amended)** The method of claim ~~14~~ 11, further comprising:
performing a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).

16. **(Currently Amended)** The method of claim ~~14~~ 11, further comprising:
transmitting, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).

17. **(Original)** The method of claim 11, further comprising:
receiving a configuration that indicates at least one of the time period and the threshold.

18. **(Original)** The method of claim 11, further comprising:
resetting the LBT failure counter when at least one of the time period and the threshold is reconfigured.

19. **(Currently Amended)** The method of claim 11, further comprising:
resetting the LBT failure counter when the UE switches from an active Bandwidth Part (BWP) of the UE to another BWP.

20. **(Canceled)**

REMARKS

Prior to the present Amendment and Response, claims 1-20 were pending in the present application. By the present Amendment and Response, claims 1-3, 5, 6, 9, 11-13, 15, 16, and 19 are amended, and claims 10 and 20 are canceled without prejudice or disclaimer. No new matter has been introduced. After the present Amendment and Response, claims 1-9 and 11-19 remain pending in the present application.

Applicant respectfully requests reconsideration and allowance of these claims in view of the above amendments and the following remarks. As Applicant's amendments and remarks with respect to the Examiner's rejections are sufficient to overcome these rejections, Applicant's silence as to assertions by the Examiner in the Office Action or certain requirements that may be applicable to such rejections (for example, assertions regarding dependent claims, whether a reference constitutes prior art, whether references are legally combinable for obviousness purposes) is not a concession by Applicant that such assertions are accurate or such requirements have been met, and Applicant reserves the right to analyze and dispute such in the future.

A. Rejection of Claims 1, 3, 4, 7, 11, 13, 14, and 17 under 35 U.S.C. § 102(a)(2)

In the *Non-Final* Office Action dated April 16, 2021 (hereinafter "Office Action"), the Examiner rejects claims 1, 3, 4, 7, 11, 13, 14, and 17 under 35 U.S.C. § 102(a)(2) as being unpatentable for purported anticipation by U.S. Patent Application Publication No. 2020/0077446 to Agiwal (hereinafter "Agiwal"). *See* the Office Action at page 2, item 2. For the reasons discussed below, Applicant respectfully submits that claims 1, 3, 4, 7, 11, 13, 14, and 17 are patentably novel and inventive over Agiwal.

Applicant is not conceding in this application that the previously pending claims are not patentable. Rather, any alterations are without conceding to the Examiner's positions, and being made only to expedite prosecution of the present application, and are without prejudice to the presentation or assertion, in the future, of claims relating to the same or similar subject matter as the previously pending claims. As such, by the present Amendment and Response, Applicant has amended independent claims 1 and 11 to recite, *inter alia*, "resetting the LBT failure counter when a reset of the MAC entity is requested by an upper layer of the UE". Support for the amendment can be found in the originally filed application, such as at original claims 10 and 20, and at least at paragraph [0043] of the present application.

Applicant respectfully submits that Agiwal fails to teach, disclose, or suggest all features recited by amended independent claims 1 and 11. More specifically, the Examiner asserts that Agiwal does not appear to explicitly disclose the subject matter of claims 10 and 20. *See* page 11 of

the Office Action. Consequently, Applicant respectfully submits that independent claims 1 and 11, as amended herein, are not anticipated by Agiwal. The Examiner also asserts that U.S. Patent Application Publication No. 2017/0231005 to Babaei (hereinafter “Babaei”) discloses, in paragraph [0222] various reasons by example for resetting the counter. *Id.* Babaei, in the cited section, as the Office Action pointed out, describes “the counter and/or the parameter may be reset when certain conditions are met, for example, when a timer expires, when a UE receives *a specific signal from the eNB*, when the counter is transmitted, when some certain conditions are met and/or when a cell is deactivated.” Applicant respectfully submits that, as shown above, nowhere does Babaei describe “reset the LBT failure counter when at least one of [...] a reset of the MAC entity is requested,” as recited in amended independent claim 1. Even if, *ad arguendo*, Babaei describes resetting of the counter when a reset of the MAC entity is request (e.g., by receiving a specific signal), based on the teachings of Babaei (as shown above), the specific signal is received from the eNB, and not from “an upper layer of the UE,” as recited in amended independent claim 1. Withdrawal of the pending rejection is therefore respectfully requested.

Independent claim 11 includes features similar to those recited in amended independent claim 1. Therefore, for at least similar reasons presented above with regard to independent claim 1, Applicant respectfully submits that independent claim 11 is also patentably distinguishable over Agiwal, singly or in combination with Babaei. Withdrawal of the pending rejection is therefore respectfully requested.

As discussed above, amended independent claims 1 and 11 are patentably distinguishable over Agiwal. As such, claims 3, 4, and 7 depending from and further limiting independent claim 1, and claims 13, 14, and 17 depending from and further limiting independent claim 11, are, *a fortiori*, also patentably distinguishable over Agiwal for at least the reasons presented above, and also for additional limitations contained in the dependent claims. Withdrawal of the pending rejection is therefore respectfully requested.

B. Rejection of Claims 2, 5, 6, 8-10, 12, 15, 16, and 18-20 under 35 U.S.C. § 103(a)

In the Office Action, the Examiner rejects claims 2 and 12 under 35 U.S.C. § 103(a) as being unpatentable for purported obviousness over Agiwal in view of U.S. Patent Application Publication No. 2020/0154480 to Pradeep et al. (hereinafter “Pradeep”). *See* the Office Action at page 5, item 4. The Examiner also rejects claims 5 and 15 under 35 U.S.C. § 103(a) as being unpatentable for purported obviousness over Agiwal in view of U.S. Patent Application Publication No. 2018/0184362 to Babaei et al. (hereinafter “Babaei ‘362”). *See id.* at page 6, item 5. Further, the Examiner rejects claims 6 and 16 under 35 U.S.C. § 103(a) as being unpatentable for purported

obviousness over Agiwal in view of U.S. Patent Application Publication No. 2018/0176961 to Babaei et al. (hereinafter “Babaei ‘961”). *See id.* at page 7, item 6. In addition, the Examiner rejects claims 8-10 and 18-20 under 35 U.S.C. § 103(a) as being unpatentable for purported obviousness over Agiwal in view of U.S. Patent Application Publication No. 2017/0231005 to Babaei et al. (hereinafter “Babaei ‘005”). *See id.* at page 8, item 7. For the reasons discussed below, Applicant respectfully submits that independent claims 1 and 11, as amended herein, are patentably distinguishable over Agiwal in view of Babaei ‘005 and the remaining cited references, either singly or in any combination thereof.

As discussed above, amended independent claims 1 and 11 are patentably distinguishable over Agiwal in view of Babaei ‘005 and the remaining cited references. As such, claims 2, 5, 6, 8, and 9 depending from and further limiting patentable independent claim 1, and claims 12, 15, 16, 18, and 19 depending from and further limiting patentable independent claim 11, are, *a fortiori*, also patentably distinguishable over Agiwal, Babaei ‘005, and the remaining references, for at least the reasons presented above, and also for additional limitations contained in the dependent claims.

For example, in rejecting claims 9 and 19, the Examiner asserts that “Agiwal does/do not appear to explicitly disclose herein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when the UE switches to another BWP.” *See* Office Action at page 10. However, the Examiner asserts that “it would have been obvious ... to have surmised through common sense that resetting the LBT failure counter would be necessary upon switching to another BWP.” *Id.* The Examiner then refers to “Babaei ‘005 which discloses various reasons by example for resetting the counter,” specifically citing paragraph [0222] therein. *Id.*

Applicant respectfully submits that none of the reasons for resetting a counter for LBT blocking that are listed in paragraph [0222] of Babaei ‘005 involve a BWP (Bandwidth Part), much less including switching from a current active BWP of the UE to another BWP, as recited in amended dependent claims 9 and 19. Further, Applicant respectfully submits that while the Examiner appeals to common sense, a reason as to why “resetting the LBT failure counter would be necessary upon switching to another BWP” is not provided. *See id.* Accordingly, Applicant respectfully submits that claims 9 and 19 are patentably distinguishable over Agiwal, Babaei ‘005, and the remaining cited references for at least these additional reasons.

In view of at least the foregoing remarks, Applicant respectfully requests withdrawal of the pending rejections.

CONCLUSION

In view of the above, the undersigned representative respectfully submits that the foregoing Amendment and Response places this application in condition for allowance and a Notice to that effect is earnestly solicited. If the Examiner believes that there are any issues that can be resolved by a telephone conference, or that there are any informalities that can be corrected by an Examiner's amendment, please call the undersigned representative at the number given below.

The undersigned representative requests any extension of time that may be deemed necessary to further the prosecution of this application.

The undersigned representative authorizes the Commissioner to charge any additional fees under 37 C.F.R. 1.16 or 1.17 that may be required, or credit any overpayment, to Deposit Account No. 602615, referencing Attorney Docket No.: US78684.

Respectfully submitted,

By / Amir Bahrami /

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**Courtesy Reminder for
Application Serial No: 16/737,787**

Attorney Docket No: US78684

Customer Number: 54000

Date of Electronic Notification: 04/16/2021

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/737,787	01/08/2020	HUNG-CHEN CHEN	US78684	8326
54000	7590	04/16/2021		
ScienBiziP, PC 550 South Hope Street Suite 2825 Los Angeles, CA 90071			EXAMINER SIDDQUI, KASHIF	
			ART UNIT 2415	PAPER NUMBER
			NOTIFICATION DATE 04/16/2021	DELIVERY MODE 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):

eoabcd@scienbizip.com
eoaprocc@scienbizippc.com
eoaproce@scienbizip.com

Notice of Pre-AIA or AIA Status

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

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

(a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

2. **Claim(s) 1, 3, 4, 7, 11, 13, 14, 17 is/are rejected under 35 U.S.C. 102(a)(2) as being anticipated by US 20200077446 A1 to Agiwal; Anil**

Re: Claim(s) 1, 11

Agiwal discloses a user equipment (UE) (Fig. 9)

comprising: one or more non-transitory computer-readable media having computer-executable instructions embodied thereon (0191 and Fig. 9 – 930);

and at least one processor coupled to the one or more non-transitory computer-readable media (Fig. 9 – 920),

the at least one processor is configured to execute the computer-executable instructions to: receive, by a Medium Access Control (MAC) entity of the UE, a Listen-Before-Talk (LBT) failure indication from a lower layer for all uplink (UL) transmissions (0160 - PHY checks the channel status (based on LBT) . 0163 - 0163 - If MAC entity receives indication N consecutive times or N times within a configured time (as in Embodiment 1), indicating that PHY failed to transmit PRACH preamble due to LBT failure ... A counter (LBT_FAIL_COUNTER) can be maintained to count the LBT failures within an LBTFailureTimer. If MAC receives the indication that PHY failed to perform UL transmission due to LBT failure, UE (re-)starts the LBTFailureTimer, MAC also increments LBT_FAIL_COUNTER);

increase an LBT failure counter when the MAC entity receives the LBT failure indication (0163 – see last citation);

determine an LBT failure event occurs when the LBT failure counter is greater than or equal to a threshold (0163 - If MAC entity receives indication N consecutive times or N times within a configured time (as in Embodiment 1), indicating that PHY failed to transmit PRACH preamble due to LBT failure, MAC entity may indicate RA problem to higher layer (i.e., RRC) or indicate LBT problem to higher layer);

and reset the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period (0163 - If MAC receives the indication that PHY failed to perform UL transmission due to LBT failure, UE (re-)starts the LBTFailureTimer ... If LBTFailureTimer expires, UE resets the LBT_FAIL_COUNTER, i.e., sets LBT_FAIL_COUNTER to 0).

Agiwal further discloses a method performed by a user equipment (see at least Abstract) as required by claim 11.

Re: Claim(s) 3, 13

Agiwal discloses wherein the at least one processor is further configured to execute the computer-executable instructions to: indicate, by the MAC entity of the UE, to an upper layer an LBT failure problem after determining the LBT failure event occurs (0163 - MAC entity may indicate RA problem to higher layer (i.e., RRC) or indicate LBT problem to higher layer).

Re: Claim(s) 4, 14

Agiwal discloses wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a Radio Link Failure (RLF) recovery procedure (0163 - MAC entity may indicate RA problem to higher layer (i.e., RRC) or indicate LBT problem to higher layer. RRC may declare RLF and/or perform cell reselection upon receiving this indication from MAC).

Re: Claim(s) 7, 17

Agiwal discloses wherein the at least one processor is further configured to execute the computer-executable instructions to: receive a configuration that indicates at least one of the time period and the threshold (0163 - LBTFailureTimer and MAX_COUNT are configured by gNB via RRC signaling).

Claim Rejections - 35 USC § 103

3. 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, 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.

4. **Claim(s) 2, 12 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20200154480 A1 to Jose; Pradeep et al.**

Re: Claim(s) 2, 12

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: switch an active Bandwidth Part (BWP) of the UE to another BWP after determining the LBT failure event occurs.

However, attention is directed to **Jose** which discloses said limitation (0049 - in an event that the consistent LBT failure is declared/determined on a channel, the UE may be configured to perform some actions. The channel may comprise a bandwidth part (BWP) or a sub-band. For example, in an event that the consistent LBT failure event is determined on a BWP, the UE may be configured to initiate a switch to a different BWP in an event that there is another BWP with configured RACH resources).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Jose** to provide a fallback procedure upon detecting an LBT failure event. The motivation for the combination is given by **Jose** (0008 - it is needed to provide proper mechanisms to detect consistent LBT failures and proper recovery procedures to establish a link successfully).

5. Claim(s) 5, 15 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20180184362 A1 to Babaei; Alireza et al. (hereinafter Babaei '362)

Re: Claim(s) 5, 15

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal further discloses initiating a RLF procedure upon detecting a LBT failure event (0163).

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: perform a re-establishment procedure by transmitting a Radio Resource Control (RRC) re-establishment request message indicating a re-establishment cause as LBT failure, when the LBT failure event occurs in a Primary Cell (PCell).

However, attention is directed to **Babaei '362** which discloses a procedure after detecting an RLF (0208 - In an example the UE may apply such parameters to meet the radio link monitoring requirements on LAA SPcells or standalone unlicensed PCells ... If

the UE determines that the Radio Link fails, the UE may try to reconnect with an RRC Connection Reestablishment Request message).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '362** to provide the ability to implement reconnection with a standalone PCell via an RRC connection reestablishment request message. The motivation for the combination is given by **Babaei '362** (0027 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

6. Claim(s) 6, 16 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20180176961 A1 to Babaei; Alireza et al. (hereinafter Babaei '961)

Re: Claim(s) 6, 16

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: transmit, to a master node, a Secondary Cell Group (SCG) failure report indicating the LBT failure problem when the LBT failure event occurs in a Primary Secondary Cell (PSCell).

However, attention is directed to **Babaei '961** which discloses said limitation (0183-0187 - the UE may perform a random access process on an LAA cell of the SCG

... the SCG for a user may comprise of one or more LAA cell. In an example, the PSCell for a UE may be an LAA cell. The transmissions on LAA cells are subject to LBT ... the UE may increment the counter in response to the LBT indicating that the channel is occupied ... The LBT indicating that the channel is occupied may be called LBT failure ... The wireless device may determine that the random access process is failed in response to the counter reaching a first value ... The wireless may transmit one or more messages to a master base station (e.g., MeNB) in response to the failure of the random access process. In an example, the one or more message may indicate that the random access failure is due at least one LBT failure during the random access process. In an example, the one or more messages may indicate that the random access failure is due to a predetermined (e.g., a first number) of LBT failures during the random access process).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '961** to provide the ability to report an LBT failure event associated with a PSCell of an SCG to a PCell of an MCG. The motivation for the combination is given by **Babaei '961** (0030 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

7. **Claim(s) 8-10, 18-20 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Agiwal as applied to claim 1 above, and further in view of US 20170231005 A1 to Babaei; Alireza et al. (hereinafter Babaei '005).**

Re: Claim(s) 8, 18

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when at least one of the time period and the threshold is reconfigured.

However, the Examiner points out that it would have been obvious to one of ordinary skill in the art at the time of the filing of the invention to have surmised through common sense that resetting the LBT failure counter would be necessary upon reconfiguration of the counter threshold. For example, when reconfiguring the threshold to a smaller value than the current value of the counter, a failure event would unnecessarily be triggered without any additional LBT failures actually occurring. Resetting the counter would avoid such a problem.

However, attention is directed to **Babaei '005** which discloses various reasons by example for resetting the counter (0222 - a UE may maintain the number of and/or the percentage of transmission attempts that failed due to LBT blocking. A UE may update the value stored in the counter(s) after a transmission attempt fails due to LBT blocking. In an example implementation, a UE may update the value stored in the counter(s) after a configurable number of transmission attempts. In an example, the counter and/or the parameter may be reset when certain conditions are met, for example, when a timer expires, when a UE receives a specific signal from the eNB, when the counter is transmitted, when some certain conditions are met and/or when a cell is deactivated). **Agiwal** further discloses that the counter is configured by gNB via RRC signaling (0163)

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '005** to provide the ability to reset a LBT failure counter upon receiving a reconfiguration message from an eNB/gNB. The motivation for the combination is given by **Babaei '005** (0028 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

Re: Claim(s) 9, 19

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose herein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when the UE switches to another BWP.

However, the Examiner points out that it would have been obvious to one of ordinary skill in the art at the time of the filing of the invention to have surmised through common sense that resetting the LBT failure counter would be necessary upon switching to another BWP. LBT procedures are specific for a particular channel/BWP and thus switching to another channel/BWP would necessitate a different LBT failure count, otherwise LBT failure events would be subject to false alarms.

However, attention is directed to **Babaei '005** which discloses various reasons by example for resetting the counter (0222 - a UE may maintain the number of and/or the percentage of transmission attempts that failed due to LBT blocking. A UE may update

the value stored in the counter(s) after a transmission attempt fails due to LBT blocking. In an example implementation, a UE may update the value stored in the counter(s) after a configurable number of transmission attempts. In an example, the counter and/or the parameter may be reset when certain conditions are met, for example, when a timer expires, when a UE receives a specific signal from the eNB, when the counter is transmitted, when some certain conditions are met and/or when a cell is deactivated).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '005** to provide the ability to condition resetting an LBT failure counter upon switching to another BWP. The motivation for the combination is given by **Babaei '005** (0028 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

Re: Claim(s) 10, 20

Agiwal discloses those limitations as set forth in the rejection of claim(s) 1 above.

Agiwal does/do not appear to explicitly disclose wherein the at least one processor is further configured to execute the computer-executable instructions to: reset the LBT failure counter when a reset of the MAC entity is requested.

However, attention is directed to **Babaei '005** which discloses various reasons by example for resetting the counter (0222 - a UE may maintain the number of and/or the percentage of transmission attempts that failed due to LBT blocking. A UE may update the value stored in the counter(s) after a transmission attempt fails due to LBT blocking.

In an example implementation, a UE may update the value stored in the counter(s) after a configurable number of transmission attempts. In an example, the counter and/or the parameter may be reset when certain conditions are met, for example, when a timer expires, when a UE receives a specific signal from the eNB, when the counter is transmitted, when some certain conditions are met and/or when a cell is deactivated).

Therefore it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the **Agiwal** invention by employing the teaching as taught by **Babaei '005** to provide the ability to reset an LBT failure counter upon being requested to do so by the eNB. The motivation for the combination is given by **Babaei '005** (0028 - Example embodiments of the present disclosure enable operation of carrier aggregation. Embodiments of the technology disclosed herein may be employed in the technical field of multicarrier communication systems).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KASHIF SIDDIQUI whose telephone number is (571)270-3188. The examiner can normally be reached on M-R 6:00 EST to 16:00 EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Rutkowski can be reached on 571-270-1215. 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.

/KASHIF SIDDIQUI/
Primary Examiner, Art Unit 2415

Notice of References Cited	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.	
	Examiner KASHIF SIDDIQUI	Art Unit 2415	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-20170006641-A1	01-2017	Dinan; Esmael Hejazi	H04W74/0833	1/1
*	B	US-20180124831-A1	05-2018	Dinan; Esmael Hejazi	H04L41/0813	1/1
*	C	US-20190363843-A1	11-2019	Gordaychik; Brian	H04L1/1854	1/1
*	D	US-20200077446-A1	03-2020	AGIWAL; Anil	H04W16/14	1/1
*	E	US-20200267763-A1	08-2020	Deogun; Pravjyot Singh	H04W74/0808	1/1
*	F	US-20170231005-A1	08-2017	Babaei; Alireza	H04L5/001	1/1
*	G	US-20200154480-A1	05-2020	Jose; Pradeep	H04W76/19	1/1
*	H	US-20200221309-A1	07-2020	OZTURK; Ozcan	H04L5/0092	1/1
*	I	US-20180176961-A1	06-2018	Babaei; Alireza	H04W74/0833	1/1
*	J	US-20180124825-A1	05-2018	LEE; Youngdae	H04W74/006	1/1
*	K	US-20180184362-A1	06-2018	Babaei; Alireza	H04W48/16	1/1
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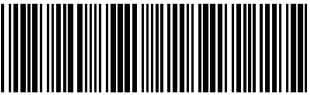
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PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20210413

<i>Index of Claims</i> 	Application/Control No. 16/737,787	Applicant(s)/Patent Under Reexamination CHEN et al.
	Examiner KASHIF SIDDIQUI	Art Unit 2415

✓	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	04/13/2021								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
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	19	✓								
	20	✓								

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CPC - Searched*		
Symbol	Date	Examiner
H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808	04/13/2021	KS

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Search Notes		
Search Notes	Date	Examiner
Searched EAST (US-PGPUB; USPAT)	04/13/2021	KS
Searched EPO/WIPO	04/13/2021	KS
Searched Inventor/Assignee	04/13/2021	KS
Searched Google Patents	04/13/2021	KS
Searched Global Dossier	04/13/2021	KS
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/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
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	Examiner KASHIF SIDDIQUI	Art Unit 2415

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

/Kashif Siddiqui/ Primary Examiner, Art Unit 2415	
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"16737787"	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
L2	18,835	((H04W36/0058 OR H04W36/0069 OR H04W36/00835 OR H04W36/06 OR H04W36/305 OR H04W36/36 OR H04W72/044 OR H04W74/008 OR H04W74/0808).CPC.)	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
L3	169	(FG near innovation).as.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:10
L4	44,077	(chen-h\$ chou-c\$ wei-c\$ shih-m\$).in.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:11
L5	1	("20180176961").PN.	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:11
L6	138	((listen adj before adj talk) (LBT)) with (fail\$4) with (counter)	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:55
L7	71	(MAC with ((lower physical) adj2 (layer))) and 6	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:56
L8	40	7 and 2	US-PGPUB; USPAT	OR	OFF	2021/04/13 09:57
L9	27	(reset\$4) same 6	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:32
L10	1,440	((listen adj before adj talk) (LBT)) with (fail\$4)	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:44
L11	3	((PCell) with (RRC with (re\$1establishment near2 request))) and 10	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:45
L12	4	(RLF near4 (procedure process)) same 10	US-PGPUB; USPAT	OR	OFF	2021/04/13 11:48
L13	1	(LBT same MENB) and 5	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:03

L14	3	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and 10	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
L15	787	((PCell MCG MeNB)) and 10	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
L16	383	2 and 15	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:07
L17	15	((RRC with (re\$1establishment near2 request))) and 15	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:08
L18	2	"20180124825"	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:23
L19	11,460	((listen adj before adj talk) (LBT))	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:26
L20	1	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) same 19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:27
L21	3	((PCell MCG MeNB) with (RRC with (re\$1establishment near2 request))) and 19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:27
L22	893	((PCell MCG MeNB)) same 19	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:28
L23	10	((RRC with (re\$1establishment near2 request))) and 22	US-PGPUB; USPAT	OR	OFF	2021/04/13 12:28

EAST Search History (Interference)

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Application No: 16/737,787

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35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged:

/Kashif Siddiqui/

Examiner's Signature

Initials

Title:

METHOD AND APPARATUS FOR LBT FAILURE DETECTION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
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MEI-JU SHIH, Hsinchu, TAIWAN

CONTINUING DATA

This application has PRO of 62790099 01/09/2019

FOREIGN APPLICATIONS

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01/29/2020

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Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16737787
	Filing Date	2020-01-08
	First Named Inventor	HUNG-CHEN CHEN
	Art Unit	
	Examiner Name	
	Attorney Docket Number	US78684

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	1	107371168	CN	A	2017-11-21	CHINA ACADEMY TELECOMMUNICATIONS TECHNOLOGY	At least the Abstract	×
	2	107770868	CN	A	2018-03-06	ZTE CORP	At least the Abstract	☒
	3	108633097	CN	A	2018-10-09	BEIJING SAMSUNG TELECOM R&D CT et al.	At least the Abstract	☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16737787	
	Filing Date		2020-01-08	
	First Named Inventor	HUNG-CHEN CHEN		
	Art Unit			
	Examiner Name			
Attorney Docket Number		US78684		

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16737787
	Filing Date	2020-01-08
	First Named Inventor	HUNG-CHEN CHEN
	Art Unit	
	Examiner Name	
	Attorney Docket Number	US78684

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Alvin Koan/	Date (YYYY-MM-DD)	2020-06-04
Name/Print	Alvin Koan	Registration Number	68468

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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 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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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/737,787	01/08/2020	HUNG-CHEN CHEN	US78684

CONFIRMATION NO. 8326

PUBLICATION NOTICE



OC000000118339088

54000
ScienBiziP, PC
550 South Hope Street
Suite 2825
Los Angeles, CA 90071

Title:METHOD AND APPARATUS FOR LBT FAILURE DETECTION

Publication No.US-2020-0221495-A1

Publication Date:07/09/2020

NOTICE OF PUBLICATION OF APPLICATION

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	Art Unit	
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	2	107770868	CN	A	2018-03-06	ZTE CORP	At least the Abstract	☒
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	Filing Date		2020-01-08	
	First Named Inventor	HUNG-CHEN CHEN		
	Art Unit			
	Examiner Name			
Attorney Docket Number		US78684		

4	2017193843	WO	A1	2017-11-16	JRD COMMUNICATION INC	the whole document	☐
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Signature	/Alvin Koan/	Date (YYYY-MM-DD)	2020-06-04
Name/Print	Alvin Koan	Registration Number	68468

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EFS ID:	39661628
Application Number:	16737787
International Application Number:	
Confirmation Number:	8326
Title of Invention:	METHOD AND APPARATUS FOR LBT FAILURE DETECTION
First Named Inventor/Applicant Name:	HUNG-CHEN CHEN
Customer Number:	54000
Filer:	Alvin Sean Koan
Filer Authorized By:	
Attorney Docket Number:	US78684
Receipt Date:	08-JUN-2020
Filing Date:	08-JAN-2020
Time Stamp:	22:18:53
Application Type:	Utility under 35 USC 111(a)

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New International Application Filed with the USPTO as a Receiving Office

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English Translation of Abstract of China Patent Application No.
CN107770868A

The embodiment of the invention discloses one kind to control cell canceling method, including : When a triggering condition is met, the control cell MAC CE of media control Access Layer are generated ; Listen-before-talk LBT is performed to the unauthorized carrier cell of base station ; After obtaining the implementing result of the LBT, cancel the MAC CE. The embodiment of the present invention further simultaneously discloses a kind of control cell and cancels device and terminal.



(21)申请号 201610695897.3

(22)申请日 2016.08.19

(71)申请人 中兴通讯股份有限公司

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产业园科技南路中兴通讯大厦法务
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(72)发明人 陈中明

(74)专利代理机构 北京派特恩知识产权代理有
限公司 11270

代理人 张颖玲 张振伟

(51)Int.Cl.

H04W 72/04(2009.01)

H04W 16/14(2009.01)

H04W 74/08(2009.01)

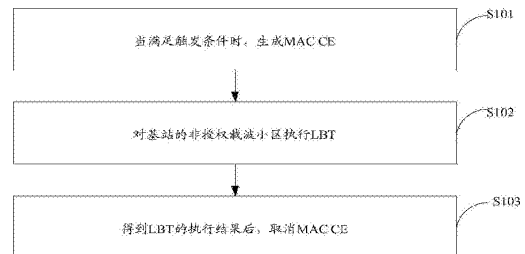
权利要求书4页 说明书12页 附图2页

(54)发明名称

一种控制信元取消方法、装置及终端

(57)摘要

本发明实施例公开了一种控制信元取消方法,包括:当满足触发条件时,生成媒体控制接入层的控制信元MAC CE;对基站的非授权载波小区执行LBT;得到所述LBT的执行结果后,取消所述MAC CE。本发明实施例还同时公开了一种控制信元取消装置及终端。



1. 一种控制信元取消方法,其特征在于,包括:
当满足触发条件时,生成媒体控制接入层的控制信元MAC CE;
对基站的非授权载波小区执行先听后说LBT;
得到所述LBT的执行结果后,取消所述MAC CE。
2. 根据权利要求1所述的方法,其特征在于,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:
对所述基站的非授权载波小区进行LBT过程;
确定所述LBT过程成功时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。
3. 根据权利要求2所述的方法,其特征在于,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:
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确定所述LBT过程成功、且更新后的失败次数不超过所述预设次数时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。
4. 根据权利要求1所述的方法,其特征在于,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:
对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;
更新后的失败次数不超过预设次数时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数的步骤;
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对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;
记录的失败时间不超过预设时间时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间的步骤;
确定所述LBT过程成功、且记录的成功时间不超过所述预设时间时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。
6. 根据权利要求1所述的方法,其特征在于,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:
对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;
记录的失败时间不超过预设时间时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间的步骤;
确定到达所述预设时间时所述LBT过程未成功时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。
7. 根据权利要求1所述的方法,其特征在于,所述MAC CE包括缓冲区状态报告BSR和/或功率余量报告PHR。

8. 根据权利要求1所述的方法, 其特征在于, 所述触发条件包括以下任意一项或者多项:

当到达的上行数据比当前准备好的数据具有更高优先级或者当上行数据到达时当前没有准备好的数据, 收到上行资源分配且填充的字节大于或等于BSR, BSR周期定时器超时, 重传BSR定时器超时且当前有准备好的数据, 周期上报定时器超时, PHR的配置发生改变, 激活辅服务小区Sce11, 功率控制导致的功率回退超过指定门限。

9. 一种控制信元取消装置, 其特征在于, 包括:

生成模块, 用于当满足触发条件时, 生成媒体控制接入层的控制信元MAC CE;

执行模块, 用于对基站的非授权载波小区执行先听后说LBT;

取消模块, 用于得到所述LBT的执行结果后, 取消所述MAC CE。

10. 根据权利要求9所述的装置, 其特征在于,

所述执行模块, 具体用于: 对所述基站的非授权载波小区进行LBT过程;

相应地, 所述取消模块, 具体用于: 确定所述LBT过程成功时, 通过所述非授权载波小区发送所述MAC CE至所述基站, 取消所述MAC CE。

11. 根据权利要求10所述的装置, 其特征在于,

所述执行模块, 包括:

第一执行子模块, 用于对所述基站的非授权载波小区进行LBT过程, 及在所述LBT过程失败时更新失败次数;

第一触发子模块, 用于更新后的失败次数不超过预设次数时, 触发所述第一执行子模块执行所述对所述基站的非授权载波小区进行一次LBT过程, 及在所述LBT过程失败时更新失败次数;

相应地, 所述取消模块, 具体用于: 确定所述LBT过程成功、且更新后的失败次数不超过所述预设次数时, 通过所述非授权载波小区发送所述MAC CE至所述基站, 取消所述MAC CE。

12. 根据权利要求9所述的装置, 其特征在于,

所述执行模块, 包括:

第二执行子模块, 用于对所述基站的非授权载波小区进行LBT过程, 及在所述LBT过程失败时更新失败次数;

第二触发子模块, 用于更新后的失败次数不超过预设次数时, 触发所述第二执行子模块执行所述对所述基站的非授权载波小区进行LBT过程, 及在所述LBT过程失败时更新失败次数;

相应地, 所述取消模块, 具体用于确定所述LBT过程的失败次数超过所述预设次数时, 取消所述MAC CE, 通过授权载波小区发送通知消息至所述基站。

13. 根据权利要求10所述的装置, 其特征在于,

所述执行模块, 包括:

第三执行子模块, 用于对所述基站的非授权载波小区进行LBT过程, 及在所述LBT过程失败时记录失败时间;

第三触发子模块, 用于记录的失败时间不超过预设时间时, 触发所述第三执行子模块执行所述对所述基站的非授权载波小区进行LBT过程, 及在所述LBT过程失败时记录失败时间;

相应地,所述取消模块,具体用于:确定所述LBT过程成功、且记录的失败时间不超过所述预设时间时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

14.根据权利要求9所述的装置,其特征在于,

所述执行模块,包括:

第四执行子模块,用于对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;

第四触发子模块,用于记录的失败时间不超过预设时间时,触发所述第四执行子模块执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;

相应地,所述取消模块,具体用于:确定到达所述预设时间时所述LBT过程未成功时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。

15.根据权利要求9所述的装置,其特征在于,所述MAC CE包括缓冲区状态报告BSR和/或功率余量报告PHR。

16.根据权利要求9所述的装置,其特征在于,所述触发条件包括以下任意一项或者多项:

当到达的上行数据比当前准备好的数据具有更高优先级或者当上行数据到达时当前没有准备好的数据,收到上行资源分配且填充的字节大于或等于BSR,BSR周期定时器超时,重传BSR定时器超时且当前有准备好的数据,周期上报定时器超时,PHR的配置发生改变,激活辅服务小区Sce11,功率控制导致的功率回退超过指定门限。

17.一种终端,其特征在于,包括存储器和处理器,

所述处理器中存储有计算机可执行指令,

所述处理器,用于执行所述计算机可执行指令,以实现以下操作:

当满足触发条件时,生成媒体控制接入层的控制信元MAC CE;

对基站的非授权载波小区执行先听后说LBT;

得到所述LBT的执行结果后,取消所述MAC CE。

18.根据权利要求17所述的终端,所述对基站的非授权载波小区执行先听后说LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:

对所述基站的非授权载波小区进行LBT过程;

确定所述LBT过程成功时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

19.根据权利要求18所述的终端,所述对基站的非授权载波小区执行先听后说LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:

对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;

更新后的失败次数不超过预设次数时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数的步骤;

确定所述LBT过程成功、且更新后的失败次数不超过所述预设次数时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

20.根据权利要求17所述的终端,所述对基站的非授权载波小区执行先听后说LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:

对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;
记录的失败时间不超过预设时间时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间的步骤;

确定到达所述预设时间时所述LBT过程未成功时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。

一种控制信元取消方法、装置及终端

技术领域

[0001] 本发明涉及通信领域,尤其涉及一种控制信元取消方法、装置及终端。

背景技术

[0002] 在长期演进系统(LTE,Long Term Evolution)中,媒体接入控制(MAC,Media Access Control)层主要通过逻辑信道提供数据传输和负责无线资源分配,完成混合自动重传请求(HARQ,Hybrid ARQ)、调度(SCH,Scheduling)、优先级处理和复用解复用(MUX,Multiplexing)等功能;MAC层发送的内容包含高层的数据,MAC层的控制信元(MAC CE,MAC Control Element),或者填充padding;MAC CE有上行和下行,上行主要包含缓冲区状态报告(BSR,Buffer Status Report),功率余量报告(PHR,Power Headroom Report)等。

[0003] 处于连接态的终端需要发送上行数据时,如果没有上行资源或授权,会先给基站发送BSR,携带准备好的缓冲数据大小对应的索引值,基站收到后根据收到的索引值,获知缓冲数据大小,给终端配置相应的上行授权,终端收到上行授权就可以发送上行数据;当终端收到的上行授权足够发送准备好的所有数据(不包含BSR),或者终端在BSR组包好准备发送,则触发的BSR会被取消。

[0004] 用户终端(UE,User Equipment)当前的发射功率不能超过UE最大发射功率,一般的,UE通过PHR过程将UE最大发射功率与当前上行共享信道(UL-SCH,Uplink Shared Channel)和物理上行控制信道(PUCCH,Physical Uplink Control Channel)的发射功率的差别通知基站(eNB,Evolved Node B),eNB根据这个差别进行上行调度和链路适配,进一步决定是否进行功率控制(如减小发射功率或增加发射功率,以及需要进行调整的功率大小)以满足UE当前发射功率不能超过UE最大发射功率,同时达到最优接收效果的要求;当终端将PHR组包好准备提交给物理层后,则触发的PHR就会被取消。

[0005] 随着数据业务的快速增长,授权频谱将不能承受如此巨大的数据量;所以,LTE运营商考虑在非授权频谱资源(Unlicensed Carrier)中部署LTE,通过非授权频谱来分担授权载波中的数据流量;非授权载波(免授权频谱)是指在满足政府部门(如,国家无线电管理委员会)有关规定(无线电管制)下,不需要授权就能直接使用的频谱(或载波);例如,微波炉、遥控玩具飞机、无线鼠标、无线键盘、高保真无线上网(WiFi,Wireless Fidelity)等都使用了非授权载波。非授权载波和授权载波可以通过载波聚合的方式使用,也可以通过双连接的方式使用,非授权载波一般作为数据传输的补充,即授权载波作为主服务小区,非授权载波作为辅服务小区,然而,虽然MAC CE可以通过非授权载波发送,但是由于非授权载波资源需要通过先听后说(LBT,Listen before talk)竞争才能使用,在此场景下,MAC CE组包完成提交给终端中的物理层后,取消MAC CE,那么,当LBT的执行结果失败时,终端无法及时发送MAC CE至基站,导致基站无法获知终端的实际情况。

发明内容

[0006] 有鉴于此,本发明实施例期望提供一种控制信元取消方法、装置及终端,在通过非

授权频谱进行数据通信时,当LBT失败时终端能及时发送MAC CE,使得基站能够获知终端当前的实际情况,并根据终端的当前MAC CE能够进行合理地调度。

[0007] 为达到上述目的,本发明的技术方案是这样实现的:

[0008] 第一方面,本发明实施例中提供了一种控制信元取消方法,包括:当满足触发条件时,生成媒体控制接入层的控制信元MAC CE;对基站的非授权载波小区执行先听后说LBT;得到所述LBT的执行结果后,取消所述MAC CE。

[0009] 在上述方案中,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程;确定所述LBT过程成功时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0010] 在上述方案中,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;更新后的失败次数不超过预设次数时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数的步骤;确定所述LBT过程成功、且更新后的失败次数不超过所述预设次数时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0011] 在上述方案中,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;更新后的失败次数不超过预设次数时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数的步骤;确定所述LBT过程的失败次数超过所述预设次数时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。

[0012] 在上述方案中,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;记录的失败时间不超过预设时间时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间的步骤;确定所述LBT过程成功、且记录的成功时间不超过所述预设时间时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0013] 在上述方案中,所述对基站的非授权载波小区执行LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;记录的失败时间不超过预设时间时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间的步骤;确定到达所述预设时间时所述LBT过程未成功时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。

[0014] 在上述方案中,所述MAC CE包括缓冲区状态报告BSR和/或功率余量报告PHR。

[0015] 在上述方案中,所述触发条件包括以下任意一项或者多项:当到达的上行数据比当前准备好的数据具有更高优先级或者当上行数据到达时当前没有准备好的数据,收到上行资源分配且填充的字节大于或等于BSR,BSR周期定时器超时,重传BSR定时器超时且当前有准备好的数据,周期上报定时器超时,PHR的配置发生改变,激活辅服务小区Sce11,功率控制导致的功率回退超过指定门限。

[0016] 第二方面,本发明实施例中提供了一种控制信元取消装置,包括:生成模块,用于当满足触发条件时,生成媒体控制接入层的控制信元MAC CE;执行模块,用于对基站的非授权载波小区执行先听后说LBT;取消模块,用于得到所述LBT的执行结果后,取消所述MAC CE。

[0017] 在上述方案中,所述执行模块,具体用于:对所述基站的非授权载波小区进行LBT过程;相应地,所述取消模块,具体用于:确定所述LBT过程成功时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0018] 在上述方案中,所述执行模块,包括:第一执行子模块,用于对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;第一触发子模块,用于更新后的失败次数不超过预设次数时,触发所述第一执行子模块执行所述对所述基站的非授权载波小区进行一次LBT过程,及在所述LBT过程失败时更新失败次数;相应地,所述取消模块,具体用于:确定所述LBT过程成功、且更新后的失败次数不超过所述预设次数时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0019] 在上述方案中,所述执行模块,包括:第二执行子模块,用于对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;第二触发子模块,用于更新后的失败次数不超过预设次数时,触发所述第二执行子模块执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;相应地,所述取消模块,具体用于确定所述LBT过程的失败次数超过所述预设次数时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。

[0020] 在上述方案中,所述执行模块,包括:第三执行子模块,用于对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;第三触发子模块,用于记录的失败时间不超过预设时间时,触发所述第三执行子模块执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;相应地,所述取消模块,具体用于:确定所述LBT过程成功、且记录的失败时间不超过所述预设时间时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0021] 在上述方案中,所述执行模块,包括:第四执行子模块,用于对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;第四触发子模块,用于记录的失败时间不超过预设时间时,触发所述第四执行子模块执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;相应地,所述取消模块,具体用于:确定到达所述预设时间时所述LBT过程未成功时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。

[0022] 在上述方案中,所述MAC CE包括缓冲区状态报告BSR和/或功率余量报告PHR。

[0023] 在上述方案中,所述触发条件包括以下任意一项或者多项:当到达的上行数据比当前准备好的数据具有更高优先级或者当上行数据到达时当前没有准备好的数据,收到上行资源分配且填充的字节大于或等于BSR,BSR周期定时器超时,重传BSR定时器超时且当前有准备好的数据,周期上报定时器超时,PHR的配置发生改变,激活辅服务小区Sce11,功率控制导致的功率回退超过指定门限。

[0024] 第三方面,本发明实施例中提供了一种终端,包括存储器和处理器,所述处理器中存储有计算机可执行指令,所述处理器,用于执行所述计算机可执行指令,以实现以下操

作:当满足触发条件时,生成媒体控制接入层的控制信元MAC CE;对基站的非授权载波小区执行先听后说LBT;得到所述LBT的执行结果后,取消所述MAC CE。

[0025] 在上述方案中,所述对基站的非授权载波小区执行先听后说LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程;确定所述LBT过程成功时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0026] 在上述方案中,所述对基站的非授权载波小区执行先听后说LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数;更新后的失败次数不超过预设次数时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时更新失败次数的步骤;确定所述LBT过程成功、且更新后的失败次数不超过所述预设次数时,通过所述非授权载波小区发送所述MAC CE至所述基站,取消所述MAC CE。

[0027] 在上述方案中,所述对基站的非授权载波小区执行先听后说LBT,得到所述LBT的执行结果后,取消所述MAC CE,包括:对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间;记录的失败时间不超过预设时间时,重复执行所述对所述基站的非授权载波小区进行LBT过程,及在所述LBT过程失败时记录失败时间的步骤;确定到达所述预设时间时所述LBT过程未成功时,取消所述MAC CE,通过授权载波小区发送通知消息至所述基站。

[0028] 本发明实施例所提供的控制信元取消方法、装置及终端,当满足触发条件时,终端生成MAC CE,然后对非授权载波小区执行LBT,得到LBT的执行结果之后,取消MAC CE,这样,不管执行结果为成功或者失败,使得终端的MAC CE都可以发送至基站,避免了在执行结果为失败时,终端无法发送MAC CE,致使基站无法获知终端当前的实际情况,通过上述方法,在得到LBT的执行结果之后,取消MAC CE,那么,在通过非授权频谱进行数据通信时,当LBT失败时终端能及时发送MAC CE,使得基站能够获知终端当前的实际情况,并根据MAC CE能够进行合理地调度。

附图说明

[0029] 图1为本发明实施例中控制信元取消方法的流程示意图;

[0030] 图2为本发明实施例中控制信元取消方法的一种可选的流程示意图;

[0031] 图3为本发明实施例中控制信元取消方法的另一种可选的流程示意图;

[0032] 图4为本发明实施例中控制信元取消方法的又一种可选的流程示意图;

[0033] 图5为本发明实施例中控制信元取消方法的再一种可选的流程示意图;

[0034] 图6为本发明实施例中控制信元取消装置的结构示意图;

[0035] 图7为本发明实施例中终端的结构示意图。

具体实施方式

[0036] 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。

[0037] 实施例一

[0038] 本发明实施例提供一种控制信元取消方法,图1为本发明实施例中的控制信元取

消方法的流程图示意图,如图1所示,该方法包括:

[0039] S101:当满足触发条件时,生成MAC CE;

[0040] 其中,上述触发条件包括以下任意一项或者多项:当到达的上行数据比当前准备好的数据具有更高优先级或者当上行数据到达时当前没有准备好的数据,收到上行资源分配且填充的字节大于或等于BSR,BSR周期定时器超时,重传BSR定时器超时且当前有准备好的数据,周期上报定时器超时,PHR的配置发生改变,激活辅服务小区(Scell,Secondary cell),功率控制导致的功率回退超过指定门限;

[0041] 在满足该触发条件时,终端的MAC层生成MAC CE,并将所生成的MAC CE提交给终端中非授权载波小区的物理层,其中,MAC CE包括BSR和/或PHR,BSR中携带有终端中缓冲数据大小对应的索引值,PHR中携带有功率余量PH。

[0042] S102:对基站的非授权载波小区执行LBT;

[0043] 这里,上述基站中有非授权载波小区和授权载波小区,终端将MAC CE提交给终端中非授权载波小区的物理层之后,为了使用基站的非授权载波,对基站的非授权载波小区执行LBT,需要说明的是,对基站的非授权载波小区执行LBT包括对基站的非授权载波小区进行一次或者多次LBT过程,并且每完成一次LBT过程,记录本次过程结果及得到本次过程结果的时间;另外,每次进行LBT过程所间隔的时间可以相同也可以不同,这里,本发明不做具体限定。

[0044] S103:得到LBT的执行结果后,取消MAC CE。

[0045] 其中,终端得到LBT的执行结果之后,终端可以通过非授权载波小区发送MAC CE至基站,也可以通过授权载波小区发送通知消息至基站,再取消终端MAC层中的MAC CE,其中,该通知消息用于通知基站终端取消了MAC CE;也就是说,即使当LBT的执行结果失败,终端仍然可以及时将通知消息发送至基站,使得基站及时获知终端当前的实际情况。这样,使得基站能够及时获知终端当前的实际情况,完成合理的调度。

[0046] 本发明实施例所提供的控制信元取消方法,当满足触发条件时,终端生成MAC CE,然后对非授权载波小区执行LBT,得到LBT的执行结果之后,取消MAC CE,这样,不管执行结果为成功或者失败,使得终端的MAC CE都可以发送至基站,避免了在执行结果为失败时,终端无法发送MAC CE,致使基站无法获知终端当前的实际情况,通过上述方法,在得到LBT的执行结果之后,取消MAC CE,那么,在通过非授权频谱进行数据通信时,当LBT失败时终端能及时发送MAC CE,使得基站能够获知终端当前的实际情况,并根据终端的当前MAC CE能够进行合理地调度。

[0047] 实施例二

[0048] 基于上述实施例一,为了适时地取消MAC CE,可以通过以下方式实现:

[0049] 在一种可选的实施例中,S102和S103可以包括:对基站的非授权载波小区进行LBT过程;确定LBT过程成功时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0050] 其中,终端对基站的非授权载波小区进行一次LBT过程,完成本次LBT过程,确定LBT过程成功时,将非授权载波小区的物理层中的MAC CE通过非授权载波小区发送至基站,然后取消终端中MAC层中的MAC CE;也就是说,进行LBT过程得到LBT过程成功时,使得MAC CE及时地发送至基站之后再取消MAC CE,使得基站能够准确地获得终端当前的实际情况,基于准确地信息进行调度和控制,避免了不合理的调度发生,提高用户体验。

[0051] 举例来说,对于基站1有3个小区,小区1是授权载波小区,小区2和小区3是非授权载波小区,双连接场景,存在多个基站,对于每个基站,终端都是进行载波聚合的,因此对于每个基站的过程都跟下面步骤一致;

[0052] 当终端与小区1建立了连接,由于业务量增加,基站1根据测量报告,给终端增加小区2;图2为本发明实施例中的控制信元取消方法的一种可选的流程示意图,如图2所示,带箭头的横线表示时间轴,时间轴上标出了T1时刻和T2时刻,则上述控制信元取消的方法包括:

[0053] S201:终端接收到上行数据满足触发条件,终端计算当前的缓冲数据大小,比如1100,组成BSR的MAC CE,其中,BSR中包含当前缓冲数据大小为1100对应的索引值,终端将BSR提交给终端中小区2的物理层,此时记为T1时刻,不取消或删除该BSR;

[0054] S202:终端进行小区2的LBT过程,结果是成功,此时,可以删除或取消BSR,此时为T2时刻,将终端中小区2的物理层中的BSR通过小区2发送至基站;

[0055] S203:基站收到终端上报的BSR,根据缓冲数据大小,配置上行授权。

[0056] S204:终端收到上行授权,发送上行数据。

[0057] 实施例三

[0058] 基于上述实施例二,进一步地,终端为了保障发送至基站的MAC CE的准确性,可以通过以下方式来实现:

[0059] 在一种可选的实施例中,S102和S103可以包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;更新后的失败次数不超过预设次数时,重复执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数的步骤;确定LBT过程成功、且更新后的失败次数不超过预设次数时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0060] 其中,终端对基站的非授权载波小区进行一次LBT过程,得到本次LBT过程失败,更新失败次数,比较更新后的失败次数是否超过预设次数,若不超过预设次数,间隔一段时间,返回重复执行对基站的非授权载波小区进行LBT过程,得到本次LBT过程失败,更新失败次数;直到得到LBT过程成功;只有当更新后的失败次数不超过预设次数时,将终端中非授权载波小区的物理层中的MAC CE通过非授权载波小区发送至基站,再取消终端中MAC层中的MAC CE;其中,上述每次LBT过程之间间隔的时间可以相同也可以不同;这样,通过限制在成功之前的失败次数,只有在不超过预设次数时LBT过程成功,MAC CE才能反映出当前终端的实际情况,那么,此时将MAC CE发送至基站,然后取消MAC CE,使得基站能够基于准确地进行调度,避免了不合理的调度发生,提高用户体验。

[0061] 举例来说,对于基站1有3个小区,小区1是授权载波小区,小区2和小区3是非授权载波小区,双连接场景,存在多个基站,对于每个基站,终端都是进行载波聚合的,因此对于每个基站的过程都跟下面步骤一致;

[0062] 终端与小区1建立了连接,由于业务量增加,基站1根据测量报告,给终端增加小区2,图3为本发明实施例中的控制信元取消方法中另一种可选的流程示意图,如图3所示,带箭头的横线表示时间轴,时间轴上标出了T1时刻、T2时刻和T3时刻,则上述控制信元取消方法包括:

[0063] S301:终端接收到的上行数据满足触发条件时,终端计算当前的缓冲数据大小,比

如1100,组成BSR的MAC CE,其中,BSR中包含当前缓冲数据大小为1100对应的索引值,终端将BSR提交给终端中小区2的物理层,此时为T1时刻,不取消或删除该触发的BSR;

[0064] S302:终端进行小区2的LBT过程(LBT1),结果是失败,记录下发送BSR的失败次数为1,此时为T2时刻;

[0065] S303:经过一定的时间间隔,终端再次进行小区2的LBT过程(LBT2),结果是成功,尚未达到预设的失败次数2,此时为T3时刻,取消或删除该触发的BSR,且将终端中小区2的物理层中的BSR通过小区2发送至基站;

[0066] S304:基站收到终端上报的BSR,根据缓冲数据大小,配置上行授权。

[0067] S305:终端收到上行授权,发送上行数据。

[0068] 实施例四

[0069] 基于上述实施例一,当LBT失败时,终端为了及时地取消MAC CE,可以通过以下方式来实现:

[0070] 在一种可选的实施例中,S102和S103可以包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;更新后的失败次数不超过预设次数时,重复执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数的步骤;确定LBT过程的失败次数超过预设次数时,取消MAC CE,通过授权载波小区发送通知消息至基站。

[0071] 其中,终端对基站的非授权载波小区进行一次LBT过程,得到本次LBT过程失败,更新失败次数,比较更新后的失败次数是否超过预设次数,若不超过预设次数,间隔一段时间,返回重复执行对基站的非授权载波小区进行LBT过程,得到本次LBT过程失败,更新失败次数;当更新后的失败次数超过预设次数时,则取消终端中MAC层中的MAC CE,通过授权载波小区发送通知消息至基站,该通知消息用于通知基站终端取消了MAC CE;其中,上述每次LBT过程之间间隔的时间可以相同也可以不同;这样,通过限制在成功之前的失败次数,在超过预设次数时LBT仍然失败,先取消MAC CE,然后发送取消MAC CE的通知消息至基站,使得基站及时获知终端已经取消了MAC CE,使得基站能够及时获知终端当前的实际情况,避免了不合理的调度发生,提高用户体验。

[0072] 实施例五

[0073] 基于上述实施例二,终端为了保障取消MAC CE的时机的准确性,可以通过以下方式来实现:

[0074] 在一种可选的实施例中,S102和S103可以包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;记录的失败时间不超过预设时间时,重复执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间的步骤;确定LBT过程成功、且记录的成功时间不超过预设时间时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0075] 这里,终端可以以生成MAC CE并将MAC CE提交给终端中非授权载波小区的物理层的时刻为初始时间,也可以以执行LBT的起始时间为初始时间,这里,本发明实施例对初始时间不做具体限定;

[0076] 终端对基站的非授权载波小区进行LBT过程,得到本次LBT过程失败,记录本次失败时间,在失败时间不超过预设时间的情况下,间隔一段时间,返回重复执行对基站的非授权载波小区进行LBT过程,得到本次LBT过程失败,记录本次失败时间;直到LBT过程成功时,

记录成功时间,只有当记录到的成功时间不超过预设时间时,将终端中非授权载波小区的物理层中的MAC CE通过非授权载波小区发送至基站,则取消终端中MAC层中的MAC CE;其中,上述每次LBT过程之间间隔的时间可以相同也可以不同;这样,通过限制每次失败时间和成功时间不能超过预设时间,尽可能地保障了MAC CE的有效性,再取消MAC CE,使得MAC CE能够准确地反映出终端当前的实际情况,进而使得基站基于准确地信息进行调度和控制,避免了不合理的调度发生,提高用户体验。

[0077] 举例来说,对于基站1有3个小区,小区1是授权载波小区,小区2和小区3是非授权载波小区,双连接场景,存在多个基站,对于每个基站,终端都是进行载波聚合的,因此对于每个基站的过程都跟下面步骤一致;

[0078] 终端与小区1建立了连接,由于业务量增加,基站1根据测量报告,给终端增加小区2,图4为本发明实施例中的控制信元取消方法中又一种可选的流程示意图,如图4所示,带箭头的横线表示时间轴,时间轴上标出了T1时刻、T2时刻和T3时刻,则上述控制信元取消方法包括:

[0079] S401:当路损变化超过指定门限,终端计算当前的PH,比如是39,组成PHR的MAC CE,其中,PHR中包含当前的PH为39,终端将PHR提交给小区2的物理层,记下开始时间T1,不取消或删除该触发的PHR;

[0080] S402:终端进行小区2的LBT过程(LBT1),结果是失败,当前时间为T2,距离T1为3ms,小于10ms;

[0081] S403:经过一定的时间间隔,终端再次进行小区2的LBT过程(LBT2),结果是成功,记录当前时间为T3,距离T1为9ms,小于10ms,取消该BSR、PHR,且将终端中小区2的物理层中的PHR通过小区2发送至基站;

[0082] S404:基站收到终端上报的PHR,根据功率余量的大小,调整发送功率,通知终端。

[0083] S405:终端收到功率调整命令,根据命令调整发送功率。

[0084] 实施例六

[0085] 基于上述实施例一,终端为了避免MAC CE超时发送至基站,可以通过以下方式来实现:

[0086] 在一种可选的实施例中,S102和S103可以包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;记录的失败时间不超过预设时间时,重复执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间的步骤;确定到达预设时间时LBT过程失败时,取消MAC CE,通过授权载波小区发送MAC CE至基站。

[0087] 具体来说,终端可以以生成MAC CE并将MAC CE提交给终端中非授权载波小区的物理层的时刻为初始时间,也可以以执行LBT的起始时间为初始时间,这里本发明实施例对初始时间不做具体限定;

[0088] 终端对基站的非授权载波小区进行LBT过程,得到本次LBT过程失败,记录本次失败时间,在失败时间不超过预设时间的情况下,间隔一段时间,返回重复执行对基站的非授权载波小区进行LBT过程,得到本次LBT过程失败,记录本次失败时间;直到终端检测到达预设时间时,LBT过程仍未成功时,先取消终端中MAC层中的MAC CE,然后将通知消息通过授权载波小区发送至基站,则;这样,通过限制执行LBT过程成功的时间不能超过预设时间,如果在预设时间内没有成功,先取消MAC CE,然后将MAC CE提交给终端中授权载波小区的物理

层,将终端中授权载波小区的物理层中的MAC CE发送至基站;其中,上述每次LBT过程之间间隔的时间可以相同也可以不同;这样,此时保障了MAC CE的有效性,先取消MAC CE,再及时地将取消MAC CE的通知消息通过授权载波小区发送至基站,使得基站可以及时地获知终端已经取消了MAC CE,使得基站能够进行合理地调度和控制,避免了不合理的调度发生,提高用户体验。

[0089] 举例来说,对于基站1有3个小区,小区1是授权载波小区,小区2和小区3是非授权载波小区,双连接场景,存在多个基站,对于每个基站,终端都是进行载波聚合的,因此对于每个基站的过程都跟下面步骤一致;

[0090] 终端与小区1建立了连接,由于业务量增加,基站1根据测量报告,给终端增加小区2,图5为本发明实施例中的控制信元取消方法中又一种可选的流程示意图,如图5所示,带箭头的横线表示时间轴,时间轴上标出了T1时刻、T2时刻和T3时刻,则上述控制信元取消方法包括:

[0091] S501:当路损变化超过指定门限,终端计算当前的PH比如是39,组成PHR的MAC CE,其中,MAC CE中包含当前的PH为39,提交给小区2的物理层,记录下当前时间T1;

[0092] S502:终端进行小区2的LBT过程,结果是失败(LBT1),记录下当前时间为T2,距离T1为3ms,小于10ms;

[0093] S503:终端在检测距离T1为10ms的T3时间,T3时间到,取消该PHR,通过授权载波通知基站。

[0094] 基于同一发明构思,本发明实施例提供一种控制信元取消装置,图6为本发明实施例中控制信元取消装置的结构示意,如图6所示,该装置包括:生成模块61、执行模块62和取消模块63;

[0095] 其中,生成模块61,用于当满足触发条件时,生成MAC CE;执行模块62,用于对基站的非授权载波小区执行LBT;取消模块63,用于得到LBT的执行结果后,取消MAC CE。

[0096] 其中,上述MAC CE包括缓冲区状态报告BSR和/或功率余量报告PHR;上述触发条件包括以下任意一项或者多项:当到达的上行数据比当前准备好的数据具有更高优先级或者当上行数据到达时当前没有准备好的数据,收到上行资源分配且填充的字节大于或等于BSR,BSR周期定时器超时,重传BSR定时器超时且当前有准备好的数据,周期上报定时器超时,PHR的配置发生改变,激活辅服务小区Sce11,功率控制导致的功率回退超过指定门限。

[0097] 在一种可选的实施例中,上述装置为了及时地发送MAC CE至基站,执行模块62,具体用于:对基站的非授权载波小区进行LBT过程;相应地,取消模块63,具体用于:确定LBT过程成功时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0098] 在一种可选的实施例中,为了保障发送至基站的MAC CE的准确性,执行模块62,包括:第一执行子模块,用于对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;第一触发子模块,用于更新后的失败次数不超过预设次数时,触发第一执行子模块执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;相应地,取消模块63具体用于:确定LBT过程成功、且更新后的失败次数不超过预设次数时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0099] 在一种可选的实施例中,执行模块62,具体用于:第二执行子模块,用于对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;第二触发子模块,用于更

新后的失败次数不超过预设次数时,触发第二执行子模块执行对所述基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;相应地,取消模块63,具体用于:确定LBT过程的失败次数超过预设次数时,取消MAC CE,通过授权载波小区发送通知消息至基站。

[0100] 在一种可选的实施例中,为了保障发送至基站的MAC CE的有效性,执行模块62,包括:第三执行子模块,用于对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;第三触发子模块,用于记录的失败时间不超过预设时间时,触发第三执行子模块执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;相应地,取消模块63,具体用于:确定LBT过程成功、且记录的失败时间不超过预设时间时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0101] 在一种可选的实施例中,为了避免MAC CE超时发送至基站,执行模块62,包括:第四执行子模块,用于对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;第四触发子模块,用于记录的失败时间不超过预设时间时,触发第四执行子模块执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;相应地,取消模块63,具体用于:确定到达预设时间时LBT过程失败时,取消MAC CE,通过授权载波小区发送MAC CE至基站。

[0102] 在实际应用中,生成模块61、执行模块62和取消模块63均可由位于装置的中央处理器(CPU,Central Processing Unit)、微处理器(MPU,Microprocessor Unit)、专用集成电路(ASIC,Application Specific Integrated Circuit)或现场可编程门阵列(FPGA,Field-Programmable Gate Array)等实现。

[0103] 基于同一发明构思,本发明实施例提供一种终端,图7为本发明实施例中终端的结构示意,如图7所示,该终端包括:存储器71和处理器72,处理器72中存储有计算机可执行指令,处理器72,用于执行计算机可执行指令,以实现以下操作:当满足触发条件时,生成MAC CE;对基站的非授权载波小区执行LBT;得到LBT的执行结果后,取消MAC CE。

[0104] 在一种可选的实施例中,为了适时地取消MAC CE,上述对基站的非授权载波小区执行先听后说LBT,得到LBT的执行结果后,取消MAC CE,包括:对基站的非授权载波小区进行LBT过程;确定LBT过程成功时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0105] 在一种可选的实施例中,进一步地,终端为了保障发送至基站的MAC CE的准确性,上述对基站的非授权载波小区执行先听后说LBT,得到LBT的执行结果后,取消MAC CE,包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;更新后的失败次数不超过预设次数时,重复执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数的步骤;确定LBT过程成功、且更新后的失败次数不超过预设次数时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0106] 在一种可选的实施例中,当LBT失败时,终端为了及时地取消MAC CE,上述对基站的非授权载波小区执行先听后说LBT,得到LBT的执行结果后,取消MAC CE,包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数;更新后的失败次数不超过预设次数时,重复执行对所述基站的非授权载波小区进行LBT过程,及在LBT过程失败时更新失败次数的步骤;确定LBT过程的失败次数超过预设次数时,取消MAC CE,通过授权载波小区发送通知消息至基站。

[0107] 在一种可选的实施例中,终端为了保障取消MAC CE的时机的准确性,上述对基站的非授权载波小区执行先听后说LBT,得到LBT的执行结果后,取消MAC CE,包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;记录的失败时间不超过预设时间时,重复执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间的步骤;确定LBT过程成功、且记录的失败时间不超过预设时间时,通过非授权载波小区发送MAC CE至基站,取消MAC CE。

[0108] 在一种可选的实施例中,终端为了避免MAC CE超时发送至基站,上述对基站的非授权载波小区执行先听后说LBT,得到LBT的执行结果后,取消MAC CE,包括:对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间;记录的失败时间不超过预设时间时,重复执行对基站的非授权载波小区进行LBT过程,及在LBT过程失败时记录失败时间的步骤;确定到达预设时间时LBT过程失败时,取消MAC CE,通过授权载波小区发送MAC CE至基站。

[0109] 本实施例记载一种计算机可读介质,可以为ROM(例如,只读存储器、FLASH存储器、转移装置等)、磁存储介质(例如,磁带、磁盘驱动器等)、光学存储介质(例如,CD-ROM、DVD-ROM、纸卡、纸带等)以及其他熟知类型的程序存储器;计算机可读介质中存储有计算机可执行指令,当执行指令时,引起至少一个处理器执行包括以下的操作:

[0110] 当满足触发条件时,生成MAC CE;对基站的非授权载波小区执行先听后说LBT;得到LBT的执行结果后,取消MAC CE。

[0111] 本发明实施例所提供的控制信元取消方法,当满足触发条件时,终端生成MAC CE,然后对非授权载波小区执行LBT,得到LBT的执行结果之后,取消MAC CE,这样,不管执行结果为成功或者失败,此时终端中存在MAC CE,使得终端的MAC CE可以发送至基站,避免了在执行结果为失败时,终端无法发送MAC CE,致使基站无法获知终端当前的实际情况,通过上述方法,在得到LBT的执行结果之后,取消MAC CE,那么,在通过非授权频谱进行数据通信时,当LBT失败时终端能及时发送MAC CE,使得基站能够获知终端当前的实际情况,并根据终端的当前MAC CE能够进行合理地调度。

[0112] 这里需要指出的是:以上装置和终端实施例项的描述,与上述方法描述是类似的,具有同方法实施例相同的有益效果,因此不做赘述。对于本发明装置和终端实施例中未披露的技术细节,本领域的技术人员请参照本发明方法实施例的描述而理解,为节约篇幅,这里不再赘述。

[0113] 这里需要指出的是:

[0114] 应理解,说明书通篇中提到的“一个实施例”或“一实施例”意味着与实施例有关的特定特征、结构或特性包括在本发明的至少一个实施例中。因此,在整个说明书各处出现的“在一个实施例中”或“在一实施例中”未必一定指相同的实施例。此外,这些特定的特征、结构或特性可以任意适合的方式结合在一个或多个实施例中。应理解,在本发明的各种实施例中,上述各过程的序号的大小并不意味着执行顺序的先后,各过程的执行顺序应以其功能和内在逻辑确定,而不应对本发明实施例的实施过程构成任何限定。上述本发明实施例序号仅仅为了描述,不代表实施例的优劣。

[0115] 需要说明的是,在本文中,术语“包括”、“包含”或者其任何其他变体意在涵盖非排他性的包含,从而使得包括一系列要素的过程、方法、物品或者装置不仅包括那些要素,而

且还包括没有明确列出的其他要素,或者是还包括为这种过程、方法、物品或者装置所固有的要素。在没有更多限制的情况下,由语句“包括一个……”限定的要素,并不排除在包括该要素的过程、方法、物品或者装置中还存在另外的相同要素。

[0116] 在本申请所提供的几个实施例中,应该理解到,所揭露的设备和方法,可以通过其它的方式实现。以上所描述的设备实施例仅仅是示意性的,例如,所述单元的划分,仅仅为一种逻辑功能划分,实际实现时可以有另外的划分方式,如:多个单元或组件可以结合,或可以集成到另一个系统,或一些特征可以忽略,或不执行。另外,所显示或讨论的各组成部分相互之间的耦合、或直接耦合、或通信连接可以是通过一些接口,设备或单元的间接耦合或通信连接,可以是电性的、机械的或其它形式的。

[0117] 上述作为分离部件说明的单元可以是、或也可以不是物理上分开的,作为单元显示的部件可以是、或也可以不是物理单元;既可以位于一个地方,也可以分布到多个网络单元上;可以根据实际的需要选择其中的部分或全部单元来实现本实施例方案的目的。

[0118] 另外,在本发明各实施例中的各功能单元可以全部集成在一个处理单元中,也可以是各单元分别单独作为一个单元,也可以两个或两个以上单元集成在一个单元中;上述集成的单元既可以采用硬件的形式实现,也可以采用硬件加软件功能单元的形式实现。

[0119] 本领域普通技术人员可以理解:实现上述方法实施例的全部或部分步骤可以通过程序指令相关的硬件来完成,前述的程序可以存储于计算机可读取存储介质中,该程序在执行时,执行包括上述方法实施例的步骤;而前述的存储介质包括:移动存储设备、只读存储器(Read Only Memory,ROM)、磁碟或者光盘等各种可以存储程序代码的介质。

[0120] 或者,本发明上述集成的单元如果以软件功能模块的形式实现并作为独立的产品销售或使用,也可以存储在一个计算机可读取存储介质中。基于这样的理解,本发明实施例的技术方案本质上或者说对现有技术做出贡献的部分可以以软件产品的形式体现出来,该计算机软件产品存储在一个存储介质中,包括若干指令用以使得一台计算机设备(可以是个人计算机、服务器、或者网络设备)执行本发明各个实施例所述方法的全部或部分。而前述的存储介质包括:移动存储设备、ROM、磁碟或者光盘等各种可以存储程序代码的介质。

[0121] 以上所述,仅为本发明的具体实施方式,但本发明的保护范围并不局限于此,任何熟悉本技术领域的技术人员在本发明揭露的技术范围内,可轻易想到变化或替换,都应涵盖在本发明的保护范围之内。因此,本发明的保护范围应以所述权利要求的保护范围为准。

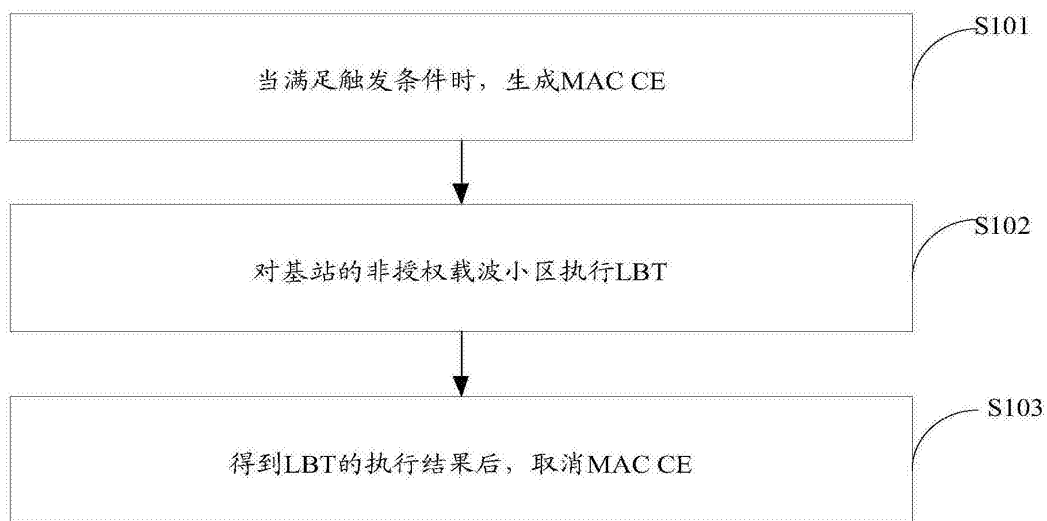


图1

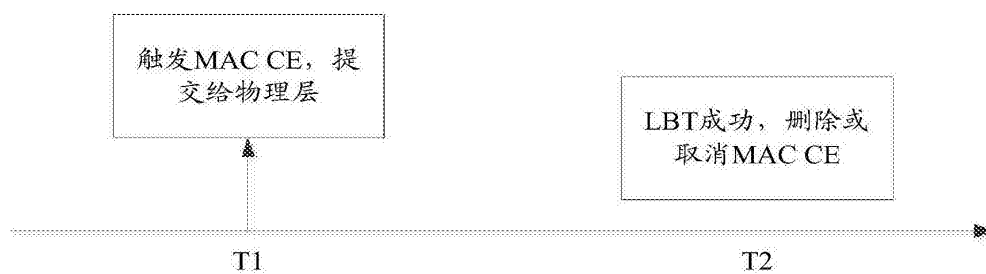


图2

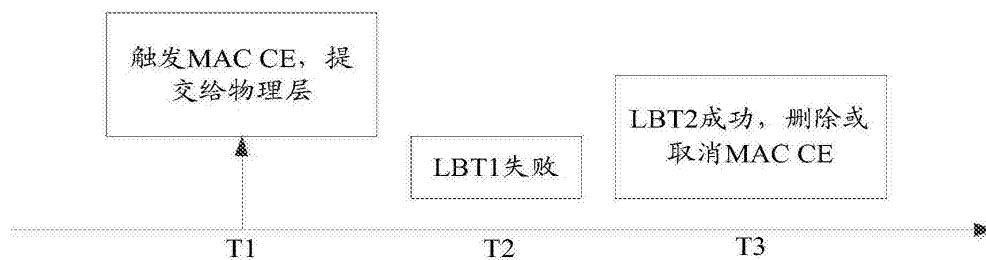


图3

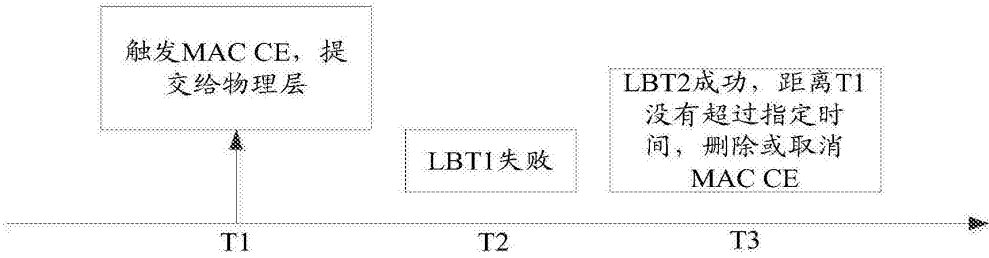


图4

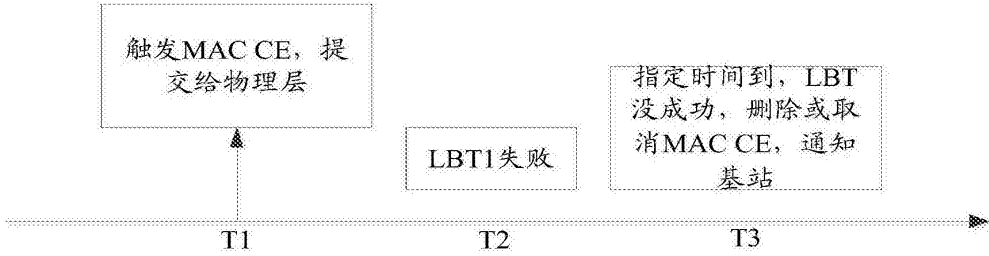


图5



图6

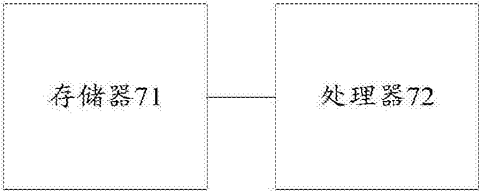


图7

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501	UL SUBFRAME #	4	5	6	7	8	9
502	MULTIPLE_UES_BITMAP	0	1	0	0	0	0
503	SUBFRAMES SCHEDULED TO UE1						
504	LBT RESULTS	X	X		X	V	V
505	TRANSMISSION OR NOT	No	YES	YES	No	YES	
506	REMAINING MCOT DURATION	3	2	1	1	0	
507	LBT CATEGORY	25μs	25μs		25μs	25μs	CAT.4

FIG. 5

(57) Abstract: A method for supporting access to an unlicensed communications channel using a Listen Before Talk (LBT) procedure in a LTE system includes parameters in a Downlink Control Information message sent from an eNB (101) to a User Equipment (103a) for assisting the User Equipment to access the unlicensed channel more efficiently. One parameter relates to the remaining MCOT (Maximum Channel Occupied Time) duration. In one embodiment, the User Equipment has the capability of determining if a Category 4 Listen Before Talk procedure can be postponed following a previous Listen Before Talk procedure failure.

[Continued on nextpage]

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**Methods and Devices for Supporting Access to Unlicensed Radio Resources in
Wireless Communication Systems**

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Technical Field

Embodiments of the present invention generally relate to wireless communication systems and in particular to devices and methods for supporting access to an
10 unlicensed communications channel using a Listen Before Talk (LBT) procedure. The invention has particular application, though is not limited to, enhanced Licensed Assisted Access (eLAA) technologies in an LTE (Long Term Evolution) advanced wireless communication system.

15 Background

Wireless communication systems, such as the third-generation (3G) of mobile telephone standards and technology are well known. Such 3G standards and technology have been developed by the Third Generation Partnership Project (3GPP). The 3rd generation of wireless communications has generally been
20 developed to support macro-cell mobile phone communications. Such macro cells utilise high power base stations (NodeBs) to communicate with wireless communication devices within a relatively large geographical coverage area. Typically, wireless communication devices, or User Equipment (UEs) as they are often referred to, communicate with a Core Network (CN) of the 3G wireless
25 communication system via a Radio Network Subsystem (RNS). A wireless communication system typically comprises a plurality of radio network subsystems, each radio network subsystem comprising one or more cells to which UEs may attach, and thereby connect to the network. Each macro-cellular RNS further comprises a controller, in a form of a Radio Network Controller (RNC), operably
30 coupled to the one or more NodeBs. Communications systems and networks have developed towards a broadband and mobile system. The 3rd Generation Partnership Project has developed the so-called Long Term Evolution (LTE) and LTE advanced solutions, namely, an Evolved Universal Mobile Telecommunication System Territorial Radio Access Network, (E-UTRAN), for a mobile access network, and a
35 System Architecture Evolution (SAE) solution, namely, an Evolved Packet Core (EPC), for a mobile core network. A macrocell in an LTE system is supported by a base station known as an eNodeB or eNB (evolved NodeB).

Current wireless communications networks operate using licensed radio spectrum in
40 which multiple accesses to the communications resources of the licensed radio spectrum is strictly controlled. Each user of the network is essentially provided a "slice" of the spectrum using a variety of multiple access techniques such as, by way

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of example only but not limited to, frequency division multiplexing, time division multiplexing, code division multiplexing, and space division multiplexing or a combination of one or more of these techniques. Even with a combination of these techniques, with the popularity of mobile telecommunications, the capacity of current and future networks is still very limited, especially when using licensed radio spectrum.

The use of unlicensed radio spectrum may also be used by network operators in order to increase or supplement capacity. For example, a network based on the Long Term Evolution (LTE)/LTE advanced standards has an enhanced downlink that uses a Licensed-Assisted-Access (LAA) procedure to operate on unlicensed spectrum. All communication devices need to complete a LBT (Listen Before Talk) procedure before accessing an unlicensed channel.

Some LAA techniques use a clear channel assessment (CCA) check on channels of the unlicensed spectrum to determine the presence or absence of other signals prior to using the channel. The base stations (eNBs) can start the downlink transmissions on the carriers which are clear and the user equipment or terminals need to monitor the downlink carriers indicated by the base station with signalling. Typically, a UE performs a CAA check by using energy detection to determine the presence or absence of other signals on a particular carrier, resource block and/or channel to determine if that carrier, resource block and/or channel is occupied or clear to use. The LBT procedure may be used for LAA carriers from the unlicensed spectrum. Normally carriers from the licensed spectrum are specifically reserved for each UE and thus typically do not require the LBT procedure and/or CCA check.

Currently, for LAA in LTE, DL (downlink) and UL (uplink) are implemented in different ways, and an eNB can start a DL transmission anytime on any channel while UEs can only start an UL transmission on specific subframes of specific channels allocated by the eNB with UL Grant messages. Hence, a UE has comparatively fewer chances to access unlicensed carriers and UL performance may also be disadvantaged as a result.

It would be advantageous to provide a means for improving the efficiency of a UE's access to an unlicensed wireless communications channel.

35 Summary

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter,

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nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

According to a first aspect of the present invention there is provided a network element for supporting communications in a wireless communication system, the network element comprising a transmitter circuit arranged to transmit a message, for reception by a wireless communication device in the wireless communication system, comprising information for assisting the wireless communication device to access an unlicensed radio resource, wherein the network element is arranged to configure a Licensed Assisted Access (LAA) uplink channel comprising subframes, each subframe having "n" OFDM symbols, where "n" is an integer, and wherein at least one symbol is blanked to create a gap during which the wireless communication device can perform a Listen Before Talk procedure and wherein the network element is further arranged to configure a Maximum Channel Occupied Time (MCOT) period during which a channel of the unlicensed radio resource may be occupied, and wherein said message includes information relating to at least one of: the position of the gap; a remaining duration of the MCOT period which is available to the wireless communication device; an instruction for the wireless communication device to switch from a Category 4 to a Category 2 Listen Before Talk procedure; an instruction for the wireless communication device to postpone a Category 4 Listen Before Talk procedure following a previous Listen Before Talk procedure failure.

The network element may be an eNB.

The message may be included in Downlink Control Information.

In one embodiment, the network element and wireless communication device are arranged to support a Listen Before Talk (LBT) procedure. In one particular embodiment, the wireless communication system is an LTE advanced system in which Licensed Assisted Access is supported and which uses a Listen Before Talk procedure. It has been agreed that Listen Before Talk will be classified into four categories. Category 1 has no LBT; Category 2 has LBT without random back-off, Category 3 has LBT with random back-off with fixed size of contention window, Category 4 has LBT with random back-off with variable size of contention window. In 3GPP Release 13, Category 4 has been adopted as the only LBT type for downlink.

The instruction for the wireless communication device to switch from a Category 4 to a Category Listen Before Talk procedure may comprise a single bit indicator per subframe.

The instruction to postpone a Category 4 Listen Before Talk procedure following a previous Listen Before Talk procedure failure may be indicated by a single bit per subframe.

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In some embodiments, the message transmitted by the network element may include information relating to at least one of an uplink subframe size and an uplink subframe location.

- 5 The message may include information indicating in which subframe a gap needs to be blanked for LBT procedures for a plurality of wireless communication devices multiplexed onto the LAA uplink channel.
- 10 According to a second aspect of the invention, there is provided a wireless communication device adapted to perform a Listen Before Talk (LBT) procedure and having a receiver circuit for receiving a message from a network element supporting communication in a wireless communication system, wherein the message includes information for assisting the wireless communication device to access an unlicensed
- 15 radio resource using a Licensed Assisted Access (LAA) uplink channel comprising subframes, each subframe having "n" OFDM symbols, where "n" is an integer, and wherein at least one symbol is blanked to create a gap during which the wireless communication device can perform a Listen Before Talk procedure, and wherein said message includes information relating to at least one of: (i) the position of the gap; (ii)
- 20 a remaining duration of a Maximum Channel Occupied Time MCOT period which is available to the wireless communication device; (iii) an instruction for the wireless communication device to switch from a Category 4 to a Category Listen Before Talk procedure; (iv) an instruction for the wireless communication device to postpone a Category 4 Listen Before Talk procedure following a previous Listen before talk
- 25 procedure failure.

The wireless communication device may be a User Equipment or similar mobile communications device.

- 30 In one embodiment, the message further includes information indicating in which subframe a gap needs to be blanked for LBT procedure for a plurality of wireless communication devices multiplexed onto the LAA uplink channel.
- 35 The wireless communication device may include a signal processor for determining whether a Category 4 Listen Before Talk procedure can be postponed following a previous Listen Before Talk procedure failure on receipt of a message from the network element including information relating to the position of the gap and a remaining duration of the Maximum Channel Occupation Time.
- 40 In one embodiment, the signal processor is arranged to determine if such a a Category 4 Listen Before Talk procedure can be postponed on a subframe by subframe basis.

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In one embodiment the signal processor is arranged to postpone the Category 4 Listen before talk procedure by one subframe if a Listen Before Talk procedure failed on a previous subframe with a single UE indicated.

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In another embodiment, the wireless communication device includes a signal processor for determining whether the wireless communication device can switch from a Category 4 Listen Before Talk procedure to a Category 2 Listen Before Talk procedure depending on information received from the network element relating to a remaining duration of an Maximum Channel Occupation Time and, optionally, the position of the gap.

10

According to a third aspect of the invention, there is provided a method for enabling communications in a wireless communication device in a wireless communication system, the method comprising, at a network element of the wireless communication system, transmitting to the wireless communication device, a message comprising information for assisting the wireless communication device to access an unlicensed radio resource; configuring a Licensed Assisted Access (LAA) uplink channel comprising subframes, each subframe having "n" OFDM symbols, where "n" is an integer, and wherein at least one symbol is blanked to create a gap during which the wireless communication device can perform a Listen Before Talk procedure, configuring a Maximum Channel Occupied Time (MCOT) period during which a channel of the unlicensed radio resource can be occupied, and including in said message information relating to at least one of: (i) the position of the gap; (ii) a remaining duration of the MCOT period which is available to the wireless communication device; (iii) an instruction for the wireless communication device to switch from a Category 4 to a Category 2 Listen Before Talk procedure; (iv) an instruction for the wireless communication device to postpone a Category 4 Listen Before Talk procedure following a previous Listen Before Talk procedure failure.

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The method may also include, at the wireless communication device, determining if a Category 4 Listen Before Talk procedure can be postponed following a previous Listen Before Talk procedure failure.

According to a fourth aspect of the invention, there is provided a non-transitory computer readable medium having computer readable instructions stored thereon for execution by a processor to perform the method according to the third aspect.

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The non-transitory computer readable medium may comprise at least one from a group consisting of: a hard disk, a CD-ROM, an optical storage device, a magnetic storage device, a Read Only Memory, a Programmable Read Only Memory, an

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Erasable Programmable Read Only Memory, EPROM, an Electrically Erasable Programmable Read Only Memory and a Flash memory.

5

Brief description of the drawings

Further details, aspects and embodiments of the invention will be described, by way of example only, with reference to the drawings. Elements in the figures are
10 illustrated for simplicity and clarity and have not necessarily been drawn to scale. Like reference numerals have been included in the respective drawings to ease understanding.

Figure 1 is a simplified block diagram of a part of a cellular communication system and operating in accordance with an example embodiment;

15 Figure 2 is a first timing diagram illustrating an example of a Licensed Assisted Access method utilising Listen Before Talk procedures;

Figures 3 and 4 are second and third timing diagrams illustrating an example of a Licensed Assisted Access method for multiple User Equipments; and

20 Figure 5 is a table illustrating relevant parameters utilised by a User Equipment when accessing unlicensed spectrum.

25

Detailed description of the preferred embodiments

Those skilled in the art will recognise and appreciate that the specifics of the examples described are merely illustrative of some embodiments and that the teachings set forth herein are applicable in a variety of alternative settings.

30 Referring now to FIG.1, an example of part of an LTEcellular communication system operating in accordance with embodiments of the invention is illustrated and indicated generally at 100 and comprises an evolved Node B (eNB) 101 supporting an LTE cell 102. In other embodiments, the eNB 101 may support a multiplicity of cells. The evolved Node B 101 comprises a part of a radio access network which in
35 this example is an E-UTRAN. User Equipments 103a, 103b, 103c are located within the area of coverage of the cell 102. Just three User Equipments are shown in FIG. 1 but more or fewer User Equipments may be located in the cell 102 and be in a connected mode at any given time. An evolved packet core (EPC) of the Wireless Communications System of FIG.1 includes a Packet Gateway P-GW 104 and a
40 Serving GPRS (General Packet Radio System) Support Node (SGSN) 105. The P-GW 104 is responsible for interfacing the radio access network with a packet data network, eg. a Packet Switched Data Network (PSDN) (such as the Internet). The SSGN 105 performs a routing and tunnelling function for traffic to and from the cell

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102, while the P-GW 104 links with external packet networks. The EPC also comprises a Mobility Management Entity 106. The eNB 101 is linked to the SSGN 105 through the Mobility Management Entity (MME) 106. The eNB 101 is also connected with the P-GW 104 through the MME 106 and a Service Gateway S-GW 5 107. The MME 106 handles signalling control and mobility while the S-GW 107 is a local anchor point for user data. The eNB 101 is provided with a receiver circuit 108 and also a transmitter circuit 109 for transmitting messages to one or more User Equipments 103a, 103b, 103c. The messages transmitted include certain information (to be described in further detail below) for assisting a User Equipment to access an 10 unlicensed radio resource which is provided by the eNB in addition to licensed carriers. Unlicensed carriers work together with licensed carriers in Carrier Aggregation. The messages may be included in Downlink Control Information. Each User Equipment 103a, 103b and 3B, 103c includes a receiver 110 for receiving messages from the eNB 101 and a signal processor 111 for determining certain 15 factors, to be described below, based on the information contained in the received messages.

As mentioned above, downlink and uplink LBT procedures are implemented in different ways. A downlink LBT has been specified in 3GPP TS 36.213 and defines 20 four priority classes. A contention window is also defined for each priority and a random value is chosen and used to determine the number of CCAs to be done within one LBT procedure. Choosing a random value minimises the chances of collisions between different eNBs attempting to access the same unlicensed channel. The contention window size can depend on loading of the channel and although a 25 small contention window size can help an eNB to grab a channel quickly, it also limits the time available to the eNB for transmission of data to a comparatively short period. In accordance with currently proposed downlink LBT procedures, the eNB 101 listens to the unlicensed channel to determine if the channel is already in use by some other device. Once the channel is detected to be free, the eNB 101 starts a defer period 30 followed by a CCA countdown. If, during the countdown period, a signal is detected, then the eNB suspends the countdown until the signal has gone whereupon the countdown procedure is resumed after expiry of another defer period. When the countdown value is equal to zero, the eNB can start its transmission but for no more than a certain number of milliseconds as permitted by the prevailing priority class. 35 The downlink LBT is Category 4.

An LBT procedure as agreed by the 3GPP defines a Maximum Channel Occupied Time (MCOT) which identifies a maximum length of a downlink burst that an eNB can transmit on an unlicensed channel. In practice, however, the eNB 101 may not use 40 all of this MCOT period and so it has also been agreed that the remaining part can be shared by one or more of the UEs 103a, 103b, 103c in a so-called one-shot or Category 2 LBT procedure. Unlike the downlink, the uplink requires multiplexing of multiple UEs and so the eNB 101 needs to coordinate these multiple devices to

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access the same channel at the same time. In order to support multi-UE multiplexing, all UEs must start transmission exactly at the same time otherwise signals from a UE that starts earliest will cause all other UE LBT procedure to fail. A Licensed Assisted Access uplink transmission in this example is arranged in subframes. Each subframe has "n" OFDM symbols and at least one symbol is blanked to create a gap. In these gaps, UEs may perform an LBT procedure and start transmission immediately after the gap. In one embodiment, each subframe is 1ms long with 14 symbols and either the first and/or second symbol are blanked. In accordance with one embodiment of the invention, the eNB indicates the position of the gaps to the UEs 103a, 103b, 103c. During the gaps, a UE may either perform a Category 2 LBT when its following transmission burst lies within an existing MCOT, or a Category 4 LBT when its following transmission burst cannot be finished within an existing MCOT. If the Category 4 LBT cannot be completed within one gap, it has to continue its LBT procedure in the next gap which will be at least 1 ms later and so on.

In order for a UE to select the more appropriate LBT procedure (for example, Category 2 as opposed to Category 4) it is advantageous for a UE to know how much of the MCOT is remaining. For example, a UE will know how long it requires to transmit its data and therefore if it also knows the duration of the remaining MCOT it will be able to deduce if the transmission can be completed within the remaining MCOT window or not. For example, if the UE determines that the transmission would not fall outside the MCOT window then it can perform a Category 2 LBT procedure. If on the other hand the UE determines that its transmission would fall outside the MCOT window, then the UE can choose to perform a Category 4 LBT. A Category 4 LBT may be postponed after a Category 2 LBT fail and under certain circumstances to be explained in more detail below.

In one embodiment, the remaining MCOT is signalled to the UE by the eNB 101. This information may comprise, for example, 3 bits and is included in the message sent from the eNB in Downlink Control Information. Alternatively, the remaining MCOT can be inferred by the signal processor 111 in the UE by counting down one subframe from the predefined MCOT value whenever the UE detects a downlink transmission. This alternative has a drawback however in the case of a missed detection of a downlink transmission. In such a case, the remaining MCOT would not be decremented. This could result in the UE occupying the unlicensed channel time with an improper LBT.

A Category 2 LBT procedure is always preferred for LAA uplink as it helps a UE to grab an unlicensed channel with a higher probability compared with other categories. In one example of the invention, the eNB 101 sends an instruction to a UE instructing the UE to switch from a Category 4 to a Category 2 LBT procedure under certain circumstances. The instruction can be included in the message transmitted by the

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eNB in Downlink Control Information. A single bit indication per subframe can be used. If such bit is not sent, then the UE continues to use Category 4 LBT. Alternatively, the UE can deduce whether or not to switch from a Category 4 to a Category 2 LBT procedure from other signalling fields.

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Reference will now be made to the timing diagram of figure 2. It will be understood that gaps between transmissions during the same MCOT period which are larger than 25 microseconds need not be included in the total transmission duration.

10 Therefore it can be said that the subframes for which a UE performed an LBT but failed do not form part of the MCOT.

In the example of figure 2, for one frame 201 having a total duration of 10 ms, there are 4 downlink subframes (0 to 3) and six uplink subframes (4 to 9) which are allocated to only one UE and a downlink LBT initiates a MCOT of 8 ms. The single UE needs to finish a 25 μ s LBT (that is a one shot/Category 2 LBT) before its uplink transmission commences and if the first 25 μ s LBT fails, the UE needs to wait until the beginning of the next subframe before it can perform another LBT.

20 Two cases are illustrated in figure 2. Case 1 illustrates how a Category 4 LBT can be postponed following an LBT failure. In case 1, a UE (such as 103a of figure 1) has failed its first LBT at the commencement of subframe 4 but succeeded in its second LBT one subframe later. So it starts its uplink transmissions from subframe number 5 and keeps transmitting without a break up to the start of subframe 9 whereupon the eNB-initiated MCOT expires. In case 2, the UE succeeded in its first LBT and so it can start uplink transmissions from subframe number 4 and keep transmitting up to the start of subframe 8 where the eNB MCOT expires. In both case 1 and case 2, the total transmission duration is no more than the MCOT which has been initiated by the eNB. So a UE can continue another transmission after successful category 4 LBT at the beginning of either subframe 9 for case 1 or subframe 8 for case 2. A Category 4 LBT must be performed in order to comply with regulations. Hence, a category 4 LBT can be deferred in such circumstances such as that in case 1.

35 A signalling indicator is transmitted in a message from the eNB to the UEs to indicate, for each uplink subframe, if a Category 4 LBT can be postponed by one subframe when an LBT failed on this subframe. Alternatively, the signal processing capability of the UE can determine by how many subframes a category 4 LBT can be postponed following an LBT failure by receiving the message indicating the remaining MCOT duration and knowing the number of subframes which have been allocated and their location.

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In one example, the eNB sends to the UEs in a broadcast manner, one or more parameters indicating how many uplink subframes are allocated and where they are. Such an indicator could be designated "subframe's size" and could comprise 3 to 4 bits. The allocated subframes for a particular UE do not have to be contiguous. The size of a subframe has to be known to the UE so it can correctly configure the uplink channel. For multiple UEs, an information field designated "multiple UEs bitmap (one bit per scheduled uplink subframe) is used to indicate to the UEs in which subframes a gap needs to be blanked for an LBT procedure.

- 10 In another example, the eNB sends to the UE one or more parameters in a unicast manner indicating how many uplink subframes are allocated and where they are. The allocated subframes for a particular UE do not have to be contiguous. For multiple UEs, and information field designated "multiple UEs bitmap (one bit per scheduled uplink subframe) is used to indicate to the UE in which subframes a gap needs to be blanked for an LBT procedure.

A further information field designated "MCOT remaining duration" which may comprise 3 bits is used to send information relating to the remaining MCOT duration which can be utilised by UEs after an eNB has completed its downlink transmissions.

- 20 In one example, this remaining duration is indicated in units of subframe and indicates the remaining duration of the MCOT which was initiated by the eNB. If an uplink transmission can be completed within this remaining period, a category 2 LBT is required. Otherwise, a category 4 LBT is required. This information field could be sent in either a broadcast manner or a unicast manner and if it is sent in the unicast manner to a UE, the eNB can adjust its value according to which subframes the specific UE is scheduled on.

- Reference will now be made to the timing diagrams of figures 3 and 4 which consider the case of multiple UEs. In figures 3 and 4, for one frame 301 having a total duration of 10 ms, there are 4 downlink subframes (0 to 3) and six uplink subframes (4 to 9) which are allocated to two UEs, UE1 and UE2, (such as 103a and 103b of figure 1) and a downlink LBT initiates a MCOT of 8 ms. Each UE needs to finish a 25 μ s LBT (that is a one shot/Category 2 LBT) before its uplink transmission commences and if the first 25 μ s LBT fails, the UE needs to wait until the beginning of the next subframe before it can perform another LBT. If a subframe is not used by either UE, then it is not included in the remaining MCOT duration. If a subframe is used by either UE, then it is included in the remaining MCOT duration. In figure 3, subframes 4 to 9 are allocated for use by UE1 and subframes 6 to 8 are allocated for use by UE2. In figure 4, subframes 4 to 9 are allocated to UE1 and subframes 4 to 6 are allocated to UE2. Both UEs can use the same subframe but are allocated different resource blocks. In case 1 illustrated in figure 3, following failure of a Category 2 LBT by UE1 at subframe 4, the category 4 LBT can be postponed by one subframe because subframe number 4 is unused by either UE and therefore is not included in

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the MCOT. In case 1 of figure 4 on the other hand, the category 4 LBT for UE1 cannot be postponed because subframe 4 is allocated to (and therefore assumed to be used by) UE2 and so must be included in the MCOT.

- 5 Information fields for figures 3 and 4 can be as follows. A first information field is the 'uplink subframe size' and in these examples of figures 3 and 4, has a value of 6 meaning that a total number of 6 subframes are allocated. A second information field is 'multiple UEs bitmap' which identifies location of subframes used by one or multiple UEs. In the case of figure 3, this has the value 001110 meaning that the third, fourth and fifth subframes are allocated to multiple UEs (and the first, second and sixth subframes to one UE only). In the case of figure 4, the 'multiple UEs bitmap' has the value 111000 meaning that the first, second and third subframes are allocated to multiple UEs (and the fourth, fifth and sixth subframes are allocated to only one). A third information field is 'MCOT remaining duration' and has a value of 4 meaning that the remaining MCOT duration (after downlink transmissions have finished) comprises four subframes. These information fields can be sent from the eNB to the UEs with the uplink grant message or alternatively can be broadcast at the same time the uplink grant is sent.
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- 20 Referring to figure 3 again, since the first two uplink subframes are allocated (or scheduled) to UE 1 only, the signal processing functionality of UE1 can deduce that the Category 4 LBT can be postponed by a least two successive subframes if LBT failure occurs. Referring to figure 4 again, since the first subframe is scheduled to multiple UEs, the signal processing functionality of both UE1 and UE2 can deduce that the Category 4 LBT cannot be postponed following an earlier LBT failure.
- 25

- Referring now to the table of figure 5, a method describing how a UE can deduce whether or not it can postpone a category 4 LBT based on indicators from the eNB will now be described. In the example of figure 5, a remaining MCOT duration (after the eNB has completed its downlink transmissions) is equal to 3 (that is 3 ms or three subframes) and this value is transmitted to a UE by the eNB with the uplink grant. Uplink subframes are configured by the eNB and represented by row 501 in figure 5 and numbered 4 to 9. The 'multiple UEs bitmap' of 010000 shown in row 502 means that only subframe number 5 is used by more than one UE with the rest being used by one UE only (but not necessarily the same UE each time). In row 503 the shaded subframes 4, 5, 7, 8 and 9 are allocated to UE1. Row 503 represents LBT results with an 'x' signifying a Category 2 failure and a 'V' signifying a pass. Row 505 states whether or not a particular subframe is counted as a transmission as far as the remaining MCOT is concerned. Row 506 states the remaining MCOT duration at the end of each subframe as deduced by the UE1. Row 507 states the category of LBT carried out at a particular subframe.
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At subframe 4 the UE1 performs a Category 2 (25 microsecond) LBT. This LBT fails. However, subframe 4 is scheduled to a single UE, (bitmap value 0) and UE 1 knows it is the only one scheduled on this subframe. So when the LBT fails, because the UE1 knows that this subframe is not used by any other UE, it can be excluded from the remaining MCOT duration. Hence, at the end of subframe 4 the remaining MCOT duration value has not changed and still remains at 3.

Subframe number 5 is scheduled to multiple UEs (bitmap value equal to 1) and the UE1 knows it is just one of the several UEs scheduled. So when the LBT fails, UE1 cannot know if this subframe is used by any other UE or not. Hence this subframe must be counted in the transmission duration. Therefore after subframe 5 the remaining MCOT duration is reduced by one and now equals 2.

Subframe number 6 is scheduled to a single UE and UE1 is not scheduled on this subframe (blank). So UE1 cannot know if this subframe is used by another UE or not. This subframe must be counted in the transmission duration. So after subframe 6, the MCOT remaining duration is reduced by 1 down to a value of 1.

Subframe number 7 is similar to subframe number 4 in that it is only scheduled to UE1 and UE1 failed its LBT on subframe 7 in this example and so this frame is not counted in the transmission duration. So after subframe 7 the remaining MCOT duration is not reduced and remains at 1.

Subframe number 8 is only scheduled to UE1 and UE1 passed its LBT (indicated by the letter V in the table) and occupied this subframe. After subframe 8 the remaining MCOT duration is reduced by 1 down to 0 which means from the beginning of subframe number 9 a Category 4 LBT is required.

Thus it can be seen from the above that the UE can determine when to perform a category 4 LBT. This determination can be performed by the signal processor in the UE.

In another embodiment, the UE is not configured to deduce remaining MCOT durations on a subframe by subframe basis as described above with reference to figure 5, but instead relies on signalling from the eNB. For example, a 'remaining MCOT duration parameter' can be included in one common DCI message to multiple UEs. In this embodiment, a UE monitors the downlink signalling. If no downlink signalling is received then the UE defaults to a Category 4 LBT. If downlink signalling is received and the 'remaining MCOT duration parameter' indicates a remaining duration of zero, then the UE must perform a Category 4 LBT. If downlink signalling is received and the 'remaining MCOT duration' parameter indicates a remaining duration of 1, then the UE performs a Category 2 LBT in the first subframe and a Category 4 LBT in the next subframe. If downlink signalling is received and

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theremaining MCOT duration parameter is of 2 or more, then a Category 2 LBT can be performed in the first two and/or the following subframes.

In another embodiment, the UE is not configured to determine whether a Category 4 LBT can be postponed or not but instead relies on signalling from the eNB. An additional field equalling either 0 or 1, where a 0 means that a postponement is permitted if LBT fails on this subframe and a 1 means that it is not permitted, can be used. Taking the example of Figure 5, the table below illustrates this.

Scheduled UE sub frames	4	5	6	7	8	9
Postponing is permitted or not	0	1	1	0	0	0

Subframe number 5 is a no because another UE is multiplexed and may use this subframe. Subframe 6 is also a no because this subframe is scheduled to another UE. All the other subframes are yes, the Category 4 LBT can be postponed once the 25 μ s LBT fails. The same number of subframes can be postponed as the number of subframes which have a failed LBT and a 'yes' at the same time. Alternatively, subframe number 6 can be removed from the above signalling as it is not scheduled to UE1 and UE1 knows that. This option uses more downlink signalling but keeps everything and under the control of the eNB.

The signal processing functionality of the embodiments of the invention may be achieved using computing systems or architectures known to those who are skilled in the relevant art. Computing systems such as, a desktop, laptop or notebook computer, hand-held computing device (PDA, cell phone, palmtop, etc.), mainframe, server, client, or any other type of special or general purpose computing device as may be desirable or appropriate for a given application or environment can be used. The computing system can include one or more processors which can be implemented using a general or special-purpose processing engine such as, for example, a microprocessor, microcontroller or other control module.

The computing system can also include a main memory, such as random access memory (RAM) or other dynamic memory, for storing information and instructions to be executed by a processor. Such a main memory also may be used for storing temporary variables or other intermediate information during execution of instructions to be executed by the processor. The computing system may likewise include a read only memory (ROM) or other static storage device for storing static information and instructions for a processor.

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The computing system may also include an information storage system which may include, for example, a media drive and a removable storage interface. The media drive may include a drive or other mechanism to support fixed or removable storage media, such as a hard disk drive, a floppy disk drive, a magnetic tape drive, an optical disk drive, a compact disc (CD) or digital video drive (DVD) read or write drive (R or RW), or other removable or fixed media drive. Storage media may include, for example, a hard disk, floppy disk, magnetic tape, optical disk, CD or DVD, or other fixed or removable medium that is read by and written to by media drive. The storage media may include a computer-readable storage medium having particular computer software or data stored therein.

In alternative embodiments, an information storage system may include other similar components for allowing computer programs or other instructions or data to be loaded into the computing system. Such components may include, for example, a removable storage unit and an interface, such as a program cartridge and cartridge interface, a removable memory (for example, a flash memory or other removable memory module) and memory slot, and other removable storage units and interfaces that allow software and data to be transferred from the removable storage unit to computing system.

The computing system can also include a communications interface. Such a communications interface can be used to allow software and data to be transferred between a computing system and external devices. Examples of communications interfaces can include a modem, a network interface (such as an Ethernet or other NIC card), a communications port (such as for example, a universal serial bus (USB) port), a PCMCIA slot and card, etc. Software and data transferred via a communications interface are in the form of signals which can be electronic, electromagnetic, and optical or other signals capable of being received by a communications interface medium.

In this document, the terms 'computer program product', 'computer-readable medium' and the like may be used generally to refer to tangible media such as, for example, a memory, storage device, or storage unit. These and other forms of computer-readable media may store one or more instructions for use by the processor comprising the computer system to cause the processor to perform specified operations. Such instructions, generally referred to as 'computer program code' (which may be grouped in the form of computer programs or other groupings), when executed, enable the computing system to perform functions of embodiments of the present invention. Note that the code may directly cause a processor to perform specified operations, be compiled to do so, and/or be combined with other software, hardware, and/or firmware elements (e.g., libraries for performing standard functions) to do so.

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In an embodiment where the elements are implemented using software, the software may be stored in a computer-readable medium and loaded into computing system using, for example, removable storage drive. A control module (in this example, software instructions or executable computer program code), when
5 executed by the processor in the computer system, causes a processor to perform the functions of the invention as described herein.

Furthermore, the inventive concept can be applied to any circuit for performing signal processing functionality within a network element. It is further envisaged that, for
10 example, a semiconductor manufacturer may employ the inventive concept in a design of a stand-alone device, such as a microcontroller of a digital signal processor (DSP), or application-specific integrated circuit (ASIC) and/or any other sub-system element.

It will be appreciated that, for clarity purposes, the above description has described
15 embodiments of the invention with reference to a single processing logic. However, the inventive concept may equally be implemented by way of a plurality of different functional units and processors to provide the signal processing functionality. Thus, references to specific functional units are only to be seen as references to suitable
20 means for providing the described functionality, rather than indicative of a strict logical or physical structure or organisation.

Aspects of the invention may be implemented in any suitable form including hardware, software, firmware or any combination of these. The invention may
25 optionally be implemented, at least partly, as computer software running on one or more data processors and/or digital signal processors or configurable module components such as FPGA devices. Thus, the elements and components of an embodiment of the invention may be physically, functionally and logically implemented in any suitable way. Indeed, the functionality may be implemented in a
30 single unit, in a plurality of units or as part of other functional units.

Although the present invention has been described in connection with some embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the scope of the present invention is limited only by the accompanying claims.
35 Additionally, although a feature may appear to be described in connection with particular embodiments, one skilled in the art would recognize that various features of the described embodiments may be combined in accordance with the invention. In the claims, the term 'comprising' does not exclude the presence of other elements or steps.

40 Furthermore, although individually listed, a plurality of means, elements or method steps may be implemented by, for example, a single unit or processor. Additionally, although individual features may be included in different claims, these may possibly

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be advantageously combined, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. Also, the inclusion of a feature in one category of claims does not imply a limitation to this category, but rather indicates that the feature is equally applicable to other claim categories, as appropriate.

Furthermore, the order of features in the claims does not imply any specific order in which the features must be performed and in particular the order of individual steps in a method claim does not imply that the steps must be performed in this order. Rather, the steps may be performed in any suitable order. In addition, singular references do not exclude a plurality. Thus, references to 'a', 'an', 'first', 'second', etc. do not preclude a plurality.

Although the present invention has been described in connection with some embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the scope of the present invention is limited only by the accompanying claims. Additionally, although a feature may appear to be described in connection with particular embodiments, one skilled in the art would recognise that various features of the described embodiments may be combined in accordance with the invention. In the claims, the term 'comprising' or "including" does not exclude the presence of other elements.

Claims

- 5
1. A network element for supporting communications in a wireless communication system, the network element comprising a transmitter circuit arranged to transmit a message, for reception by a wireless communication device in the wireless communication system,
- 10 comprising information for assisting the wireless communication device to access an unlicensed radio resource, wherein the network element is arranged to configure a Licensed Assisted Access (LAA) uplink channel comprising subframes, each subframe having "n" OFDM symbols, where "n" is an integer, and wherein at least one symbol is blanked to create a gap during which the wireless communication device can perform a Listen Before Talk procedure and wherein the network element is further arranged to configure a Maximum Channel Occupied Time (MCOT) period during which a channel of the unlicensed radio resource may be occupied, and wherein said message includes information relating to at least one of:
- 15 (i) the position of the gap;
- (ii) a remaining duration of the MCOT period which is available to the wireless communication device;
- (iii) an instruction for the wireless communication device to switch from a Category 4 to a Category 2 Listen Before Talk procedure;
- 20 (iv) an instruction for the wireless communication device to postpone a Category 4 Listen Before Talk procedure following a previous Listen Before Talk procedure failure.
- 25
2. The network element of claim 1 wherein said message is included in Downlink Control Information.
- 30
3. The network element of claim 1 or claim 2 wherein the instruction for the wireless communication device to switch from a Category 4 to a Category 2 Listen Before Talk procedure comprises a single bit indicator per subframe.
- 35
4. The network element of any preceding claim wherein the instruction to postpone a Category 4 Listen Before Talk procedure following a
- 40

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previous Listen Before Talk procedure failure is indicated by a single bit per subframe.

- 5 5. The network element of any preceding claim wherein said message further includes information relating to at least one of; an uplink subframe size and an uplink subframe location.
- 10 6. The network element of any preceding claim wherein said message further includes information indicating in which subframe a gap needs to be blanked for LBT procedure for a plurality of wireless communication devices multiplexed onto the LAA uplink channel.
- 15 7. A wireless communication device adapted to perform a Listen Before Talk procedure and having a receiver circuit for receiving a message from a network element supporting communication in a wireless communication system, wherein the message includes information for assisting the wireless communication device to access an unlicensed radio resource using a Licensed Assisted Access (LAA) uplink channel comprising subframes, each subframe having "n" OFDM symbols, where "n" is an integer, and wherein at least one symbol is blanked to create a gap during which the wireless communication device can perform a Listen Before Talk procedure, and wherein said message includes information relating to at least one of: (i) the position of the gap; (ii) a remaining duration of a Maximum Channel Occupied Time MCOT period which is available to the wireless communication device; (iii) an instruction for the wireless communication device to switch from a Category 4 to a Category Listen Before Talk procedure; (iv) an instruction for the wireless communication device to postpone a Category 4 Listen Before Talk procedure following a previous Listen Before Talk failure.
- 20 25 30 35 8. The wireless communication device of claim 7 wherein said message further includes information indicating in which subframe a gap needs to be blanked for an LBT procedure for a plurality of wireless communication devices multiplexed onto the LAA uplink channel.
- 40 9. The wireless communication device of claim 7 or 8 including a signal processor for determining whether a Category 4 Listen Before Talk procedure can be postponed following a previous Listen Before Talk procedure failure on receipt of a message from the network element including information relating to the position of the gap and a remaining duration of a Maximum Channel Occupation Time.

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- 5 10. The wireless communication device of claim 9 wherein the signal processor is arranged to determine if a Category 4 Listen Before Talk procedure can be postponed following a previous Listen Before Talk procedure failure on a subframe by subframe basis.
- 10 11. The wireless communication device of claim 10 wherein the signal processor is arranged to postpone the Category 4 Listen Before Talk procedure by one subframe if an LBT failed on a previous subframe with a single UE indicated.
- 15 12. The wireless communication device of claim 7 including a signal processor for determining whether the wireless communication device can switch from a Category 4 Listen Before Talk procedure to a Category 2 Listen Before Talk procedure depending on information received from the network element relating to a remaining duration of a Maximum Channel Occupation Time.
- 20 13. The wireless communication device of claim 12 wherein the signal processor determines whether the wireless communication device can switch from a Category 4 Listen Before Talk procedure to a Category 2 Listen Before Talk procedure depending on information received from the network element relating to the position of the gap.
- 25 14. A method for enabling communications in a wireless communication device in a wireless communication system, the method comprising, at a network element of the wireless communication system, transmitting to the wireless communication device, a message comprising information for assisting the wireless communication device to access an unlicensed radio resource; configuring a Licensed Assisted Access (LAA) uplink channel comprising subframes, each subframe having "n" OFDM symbols, where "n" is an integer, and wherein at least one symbol is blanked to create a gap during which the wireless communication device can perform a Listen Before Talk procedure, configuring a Maximum Channel Occupied Time (MCOT) period during which a channel of the unlicensed radio resource can be occupied, and including in said message information relating to at least one of: (i) the position of the gap; (ii) a remaining duration of the MCOT period which is available to the wireless communication device; (iii) an instruction for the wireless communication device to switch from a Category 4 to a Category 2 Listen Before Talk procedure; (iv) an instruction for the wireless
- 30
- 35
- 40

- 20 -

communication device to postpone a Category 4 Listen Before Talk procedure following a previous Listen Before Talk procedure failure.

5 15. The method of claim 14 comprising including said message in Downlink Control Information.

10 16. The method of either of claims 14 or 15 comprising, at the wireless communication device, determining if a Category 4 Listen before Talk procedure can be postponed following a previous Listen Before Talk procedure failure.

15 17. A non-transitory computer readable medium having computer readable instructions stored thereon for execution by a processor to perform the method according to claim 14.

20 18. The non-transitory computer readable medium of claim 17 comprising at least one from a group consisting of: a hard disk, a CD-ROM, an optical storage device, a magnetic storage device, a Read Only Memory, a Programmable Read Only Memory, an Erasable Programmable Read Only Memory, EPROM, an Electrically Erasable Programmable Read Only Memory and a Flash memory.

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1 of 5

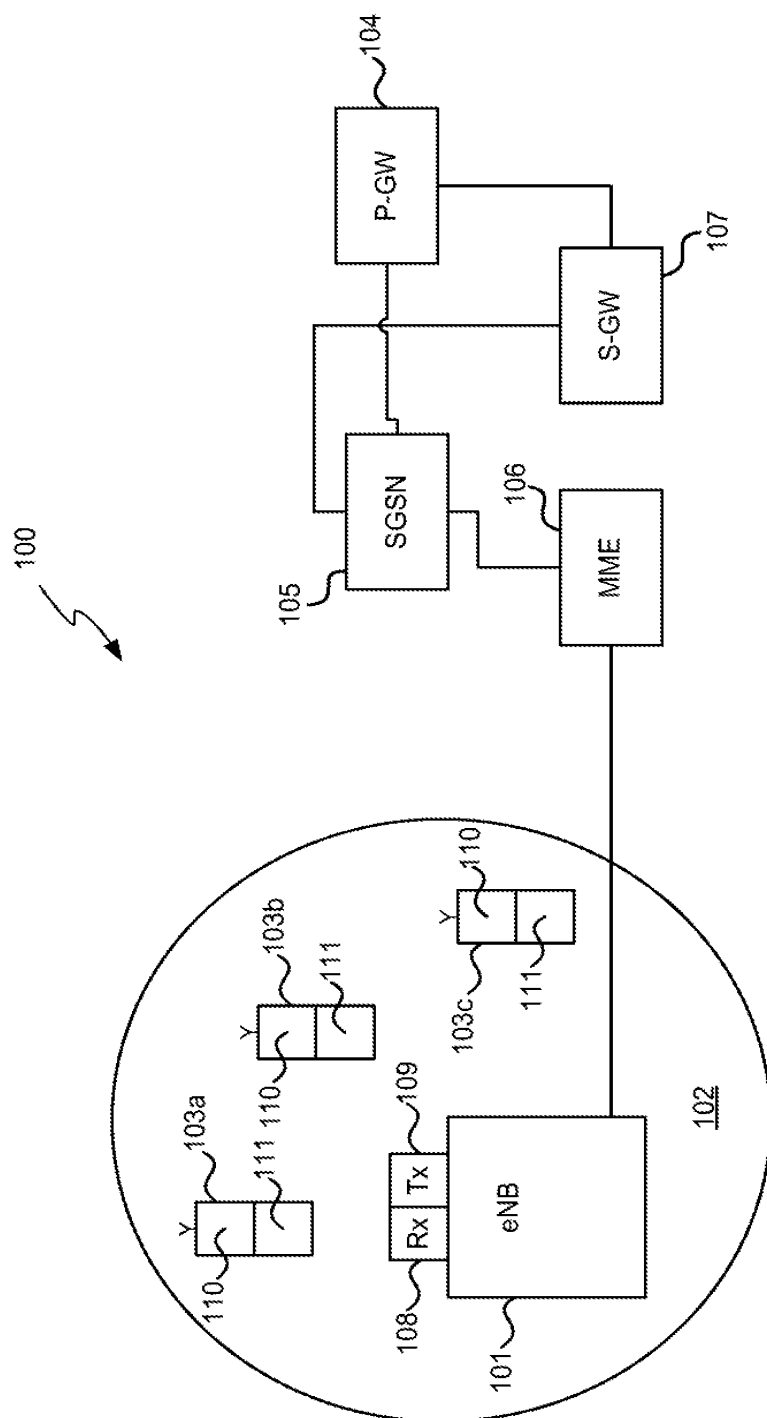


FIG. 1

2 of 5

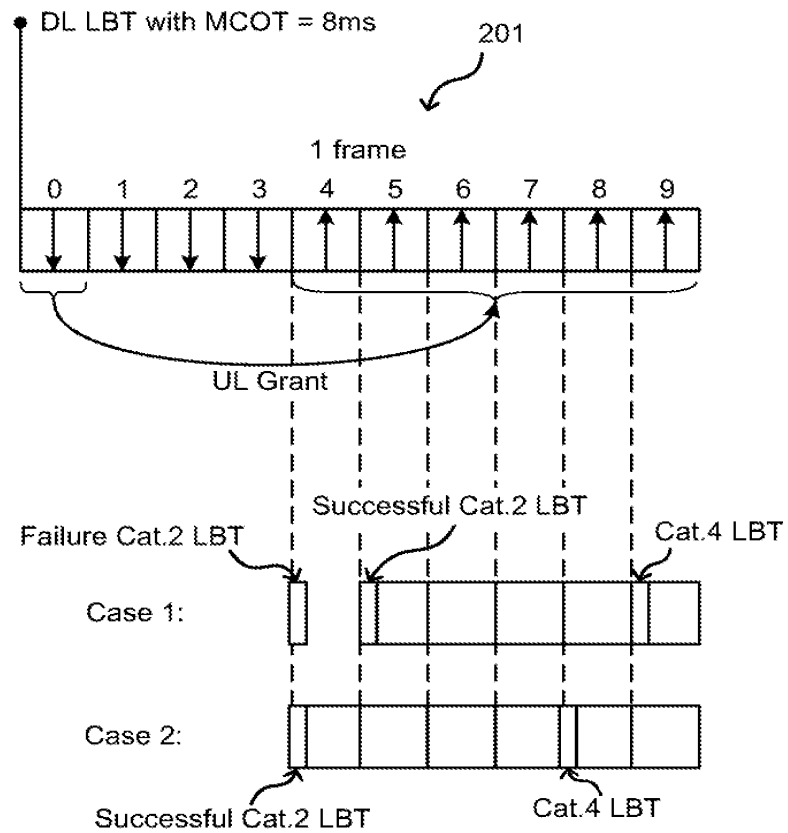


FIG. 2

3 of 5

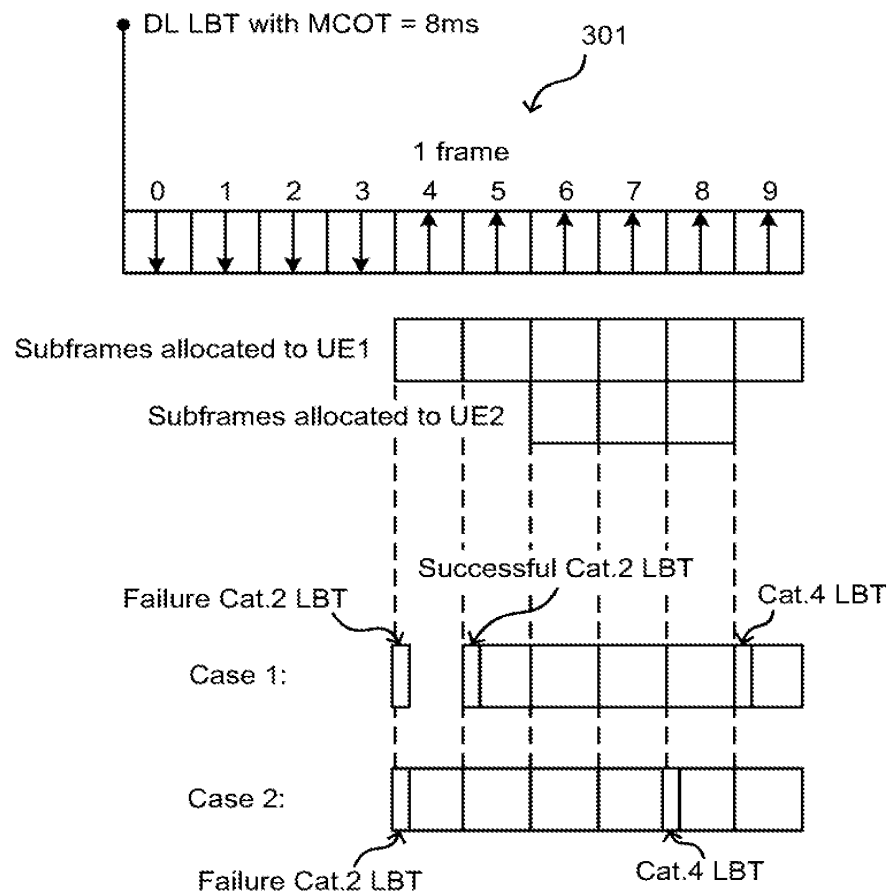


FIG. 3

4 of 5

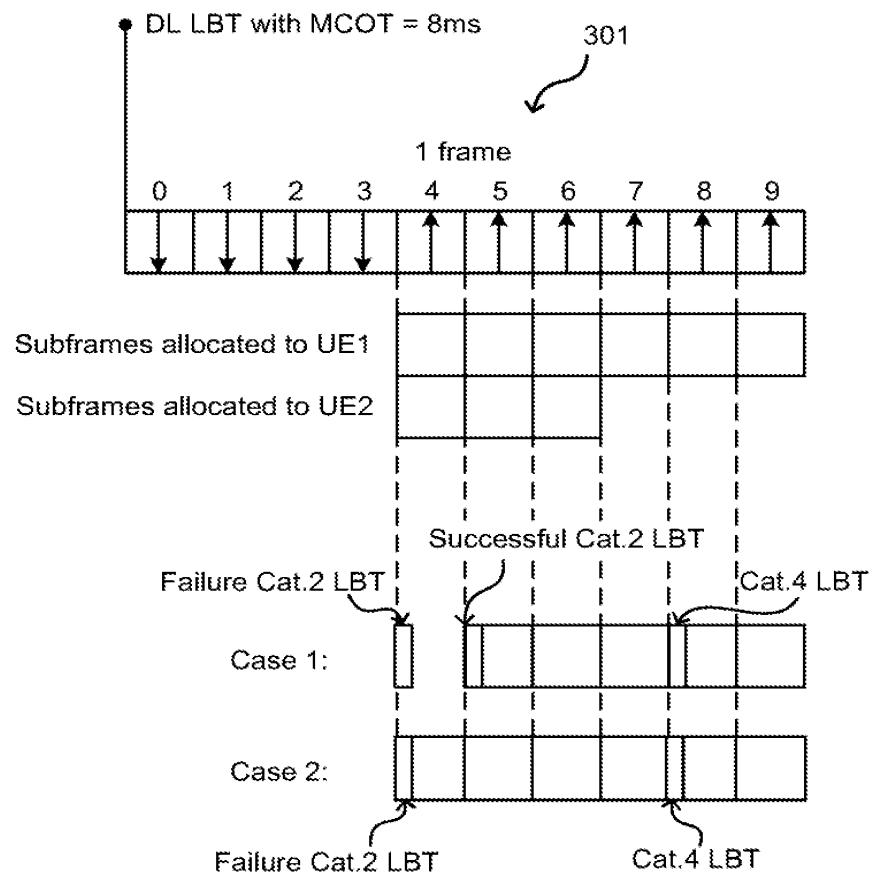


FIG. 4

5 of 5

501	UL SUBFRAME #	4	5	6	7	8	9
502	MULTIPLE_UEs_BITMAP	0	1	0	0	0	0
503	SUBFRAMES SCHEDULED TO UE1						
504	LBT RESULTS	x	x		x	V	V
505	TRANSMISSION OR NOT	No	YES	YES	No	YES	
506	REMAINING MCOT DURATION	3	2	1	1	0	
507	LBT CATEGORY	25μs	25μs		25μs	25μs	CAT.4

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/082804

A. CLASSIFICATION OF SUBJECT MATTER

H04W 72/04(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)

H04W H04L H04Q

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)

CNABS;CNTXT;VEN;USTXT;EPTXT;WOTXT;CNKI: unlicensed, LAA, LBT, CCA, position, symbol, subframe, MCOT, Category,insruct+, notif+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 105578573 A (YULONG COMPUTER TELECOM SCI SHENZHEN CO) 11 May 2016 (2016-05-11) description, paragraphs [0094] and [0105]-[0187]	1-18
A	CN 105578580 A (BEIJING SAMSUNG COMMUNICATION TECHNOLOGY ET AL.) 11 May 2016 (2016-05-11) the whole document	1-18
A	EP 3012994 A2 (HTC CORP) 27 April 2016 (2016-04-27) the whole document	1-18

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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Information on patent family members

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Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	105578573	A	11 May 2016	WO	2016187954	A1	01 December 2016
CN	105578580	A	11 May 2016	WO	2016072704	A1	12 May 2016
EP	3012994	A2	27 April 2016	EP	3174236	A1	31 May 2017
				US	2016119949	A1	28 April 2016
				CN	105554801	A	04 May 2016
				JP	2017069991	A	06 April 2017
				EP	3012994	A3	13 July 2016
				JP	6096860	B2	15 March 2017
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[Continued on next page]

(54) Title: PHYSICAL RANDOM ACCESS CHANNEL DESIGN FOR LICENSED ASSISTED ACCESS

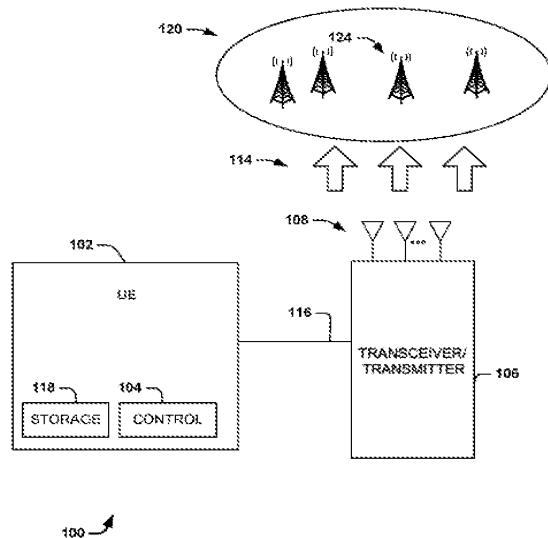
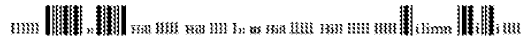


FIG. 1

(57) Abstract: An apparatus is configured to be em-
ployed within one or more user equipment (UE). The
apparatus includes control circuitry and a transceiver.
The control circuitry is configured to generate a
physical random access channel (PRACH), wherein
the PRACH includes a preamble for PRACH trans-
mission using a license assisted access (LAA) sec-
ondary cell. The transceiver is coupled to the control
circuitry and is configured to retry transmission of
the PRACH on a listen before talk (LBT) failure
based of the secondary cell.

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001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049 050 051 052 053 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071 072 073 074 075 076 077 078 079 080 081 082 083 084 085 086 087 088 089 090 091 092 093 094 095 096 097 098 099 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000

Published:

-----with international search report (Art. 21(3))

Declarations under Rule 4.17:

--- of inventorship (Rule 4.17(iv))

PHYSICAL RANDOM ACCESS CHANNEL DESIGN FOR LICENSED ASSISTED ACCESS

FIELD

[0001] The present disclosure relates to mobile communication and, more particularly to licensed assisted access (LAA) for mobile communications.

RELATED APPLICATIONS

[0002] This application claims the benefit of U.S. Provisional Application No. 62/316,092, filed March 31, 2016.

BACKGROUND

[0003] Mobile communication, including cellular communication, involves the transfer of data between mobile devices. The use of mobile communication is continuously increasing. Additionally, the bandwidth or data rate used and needed for mobile communications is continuously increasing.

[0004] One technique for improving the data rate is to improve spectral efficiency. However, the increases available by improving spectral efficiency are limited. Additionally, the amount of available licensed spectrum is also limited.

[0005] Another technique for improving the data rate for cellular communication is to increase the bandwidth by utilizing unlicensed bands or spectrums. The unlicensed bands are portions of the frequency spectrum used by other technologies and/or services, such as WiFi and the like. The unlicensed bands cannot be restricted for use by only cellular devices, unlike the licensed bands. Thus, the use of the unlicensed bands can be problematic. For example, the use can interfere with the other technologies and/or services.

[0006] Techniques are needed to improve the bandwidth or data rate for telecommunication by utilizing unlicensed bands without interfering with other technologies and/or services.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is a diagram illustrating an arrangement for mobile communications utilizing unlicensed frequency bands.

[0008] Fig. 2 is a diagram illustrating establishment of communications for a user equipment (UE) using a PRACH preamble

[0009] Fig. 3 is a diagram illustrating establishment of communications for a user equipment (UE) where RAR is transmitted using a primary cell.

[0010] Fig. 4 is a diagram illustrating establishment of communications for a user equipment (UE) where RAR is transmitted using a secondary cell.

[0011] Fig. 5 is a diagram illustrating establishment of communications for a user equipment (UE) where multiple secondary cells are used.

[0012] Fig. 6 is a diagram illustrating establishment of communications for a user equipment (UE) utilizing retries with a secondary cell and fallbacks to a primary cell.

[0013] Fig. 7 is a flow diagram illustrating a method of operating a user equipment and utilizing unlicensed frequency bands in accordance with an embodiment.

[0014] Fig. 8 illustrates example components of a User Equipment (UE) device.

DETAILED DESCRIPTION

[0015] The present disclosure will now be described with reference to the attached drawing figures, wherein like reference numerals are used to refer to like elements throughout, and wherein the illustrated structures and devices are not necessarily drawn to scale. As utilized herein, terms "component," "system," "interface," and the like are intended to refer to a computer-related entity, hardware, software (e.g., in execution), and/or firmware. For example, a component can be a processor (e.g., a microprocessor, a controller, or other processing device), a process running on a processor, a controller, an object, an executable, a program, a storage device, a computer, a tablet PC, an electronic circuit and/or a mobile phone with a processing device. By way of illustration, an application running on a server and the server can also be a component. One or more components can reside within a process, and a component can be localized on one computer and/or distributed between two or more computers. A set of elements or a set of other components can be described herein, in which the term "set" can be interpreted as "one or more."

[0016] Further, these components can execute from various computer readable storage media having various data structures stored thereon such as with a module, for example. The components can communicate via local and/or remote processes such as in accordance with a signal having one or more data packets (e.g., data from one component interacting with another component in a local system, distributed system,

and/or across a network, such as, the Internet, a local area network, a wide area network, or similar network with other systems via the signal).

[0017] As another example, a component can be an apparatus with specific functionality provided by mechanical parts operated by electric or electronic circuitry, in which the electric or electronic circuitry can be operated by a software application or a firmware application executed by one or more processors. The one or more processors can be internal or external to the apparatus and can execute at least a part of the software or firmware application. As yet another example, a component can be an apparatus that provides specific functionality through electronic components without mechanical parts; the electronic components can include one or more processors therein to execute software and/or firmware that confer(s), at least in part, the functionality of the electronic components.

[0018] Use of the word exemplary is intended to present concepts in a concrete fashion. As used in this application, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or". That is, unless specified otherwise, or clear from context, "X employs A or B" is intended to mean any of the natural inclusive permutations. That is, if X employs A; X employs B; or X employs both A and B, then "X employs A or B" is satisfied under any of the foregoing instances. In addition, the articles "a" and "an" as used in this application and the appended claims should generally be construed to mean "one or more" unless specified otherwise or clear from context to be directed to a singular form. Furthermore, to the extent that the terms "including", "includes", "having", "has", "with", or variants thereof are used in either the detailed description and the claims, such terms are intended to be inclusive in a manner similar to the term "comprising".

[0019] As used herein, the term "circuitry" may refer to, be part of, or include an Application Specific Integrated Circuit (ASIC), an electronic circuit, a processor (shared, dedicated, or group), and/or memory (shared, dedicated, or group) that execute one or more software or firmware programs, a combinational logic circuit, and/or other suitable hardware components that provide the described functionality. In some embodiments, the circuitry may be implemented in, or functions associated with the circuitry may be implemented by, one or more software or firmware modules. In some embodiments, circuitry may include logic, at least partially operable in hardware.

[0020] A technique for improving the data rate for cellular communication is to utilize unlicensed bands or spectrums. The unlicensed bands are portions of the frequency

spectrum used by other technologies and/or services, such as WiFi and the like. The unlicensed bands cannot be restricted for use by only cellular devices or licensees, unlike the licensed bands. Thus, the use of the unlicensed bands can be problematic. For example, the use can interfere with the other technologies and/or services.

[0021] With mature physical layer techniques, further improvement in the spectral efficiency may be marginal. The scarcity of licensed spectrum in low frequency band prevents substantial increases in the data rate. Thus, there are emerging interests in the operation of LTE systems in unlicensed spectrum.

[0022] One enhancement for LTE in 3GPP Release 13 is enable its operation in the unlicensed spectrum via Licensed-Assisted Access (LAA), which expands the system bandwidth by utilizing the flexible carrier aggregation (CA) framework introduced by the LTE-Advanced system.

[0023] Potential LTE operation in unlicensed spectrum includes, but is not limited to, the LTE operation in the unlicensed spectrum via dual connectivity (DC) - called DC based LAA, and the standalone LTE system in the unlicensed spectrum, where LTE-based technology solely operates in unlicensed spectrum without requiring an "anchor" in licensed spectrum, referred to as MulteFire.

[0024] An unlicensed frequency band of interest in 3GPP is the 5 GHz band, which has wide spectrum with global common availability. The 5 GHz band in the US is governed by Unlicensed National Information Infrastructure (U-NII) rules by the Federal Communications Commission (FCC). The main incumbent system in the 5 GHz band is the Wireless Local Area Networks (WLAN), specifically those based on the IEEE 802.11 a/n/ac technologies. Since WLAN systems are widely deployed both by individuals and operators for carrier-grade access service and data offloading, suitable techniques should be employed. Listen-Before-Talk (LBT) is a feature of Rel-13 LAA system for coexistence with other systems. LBT is a procedure whereby radio transmitters first sense the medium and transmit only if the medium is sensed to be idle.

[0025] UEs can establish communications by following a random access procedure. This procedure includes a UE using an LTE physical random access channel (PRACH). The UE transmits a PRACH preamble, which includes a cyclic prefix (CP), a sequence and a guard time.

[0026] A UE can utilize an unlicensed frequency band to transmit the PRACH preamble. However, using an unlicensed frequency band requires that the UE performs a listen before talk (LBT) before transmitting. If the LBT indicates that the unlicensed

frequency band is unavailable, transmission of the PRACH preamble is blocked and the attempted establishment of communications are delayed.

[0027] Embodiments and variations thereof are disclosed that include suitable approaches for using unlicensed frequency bands that mitigate and/or reduce blocking of transmissions. The embodiments also facilitate utilization of unlicensed frequency bands. The approaches include retrying transmissions on unlicensed frequency bands, using multiple cells located in unlicensed frequency bands, identifying unlicensed cells prior to transmission, and using licensed frequencies as a fallback.

[0028] Fig. 1 is a diagram illustrating an arrangement 100 for mobile communications utilizing unlicensed frequency bands. The arrangement enhances transmission probabilities by incorporation approaches including retrying transmissions, using multiple unlicensed frequency bands (or SCells) simultaneously, using a licensed frequency band as a fallback, and the like. The arrangement 100, can also be an apparatus, and facilitates communications utilizing unlicensed frequency bands.

[0029] The arrangement 100 includes a user equipment (UE) device 102, a transceiver 106, and network entities 120. The network entities 120 include components such as, but not limited to, a packet gateway (PGW), a secondary gateway (SGW), a mobility management entity (MME), a packet data network (PDN), UEs, evolved Node Bs (eNodeB), and the like. For illustrative purposes, an eNodeB 124 is shown as one of the network entities.

[0030] The UE 102 includes the transceiver 106, a storage component 118, and control circuitry or controller 104. The storage component 118 includes a memory, storage element and the like and is configured to store information for the UE 102. The controller 104 is configured to perform various operations associated with the UE 102. The controller 104 can include logic, components, circuitry, one or more processors and the like. The transceiver 106 includes transmitter functionality and receiver functionality. The UE 102 also includes one or more antenna 108 for communications with the network entities 120.

[0031] The eNodeB 124 includes a transceiver, a storage component, and control circuitry or controller. The storage component includes a memory, storage element and the like and is configured to store information for the eNodeB 124. The controller is configured to perform various operations associated with the eNodeB 124. The controller can include logic, components, circuitry, one or more processors and the like. The transceiver 106 includes transmitter functionality and receiver functionality. The

eNodeB 124 can also include one or more antenna for communications with the network entities 120 and/or other UEs.

[0032] The UE 102 is configured to establish uplink communications with the evolved node B (eNodeB) 124 of the network entity using an unlicensed frequency band. The eNodeB generates and transmits a physical downlink control channel (PDCCH) that includes a PDCCH order. The PDCCH includes control information and resource assignments for the UE 102. The PDCCH also includes the PDCCH order, which specifies an order or procedure to a random access procedure (RACH) for the UE 102 with the eNodeB 124. The UE 102 responds to the PDCCH order from the eNodeB 124 by generating and transmitting a physical resource allocation channel (PRACH) preamble. The preamble is a random access preamble for a random access procedure. The PRACH preamble includes a cyclical prefix (CP), a sequence, a guard time and the like. The PRACH preamble is transmitted by the UE 102. The eNodeB 124 decodes the PRACH preamble and generates a random access response (RAR) based on the PRACH preamble. The eNodeB 124 transmits the RAR, which is expected to be received by the UE 102 within a RAR window. The RAR window is a period of time or duration in which the UE 102 expects to receive the RAR from the eNodeB 124. It is appreciated that the UE 102 can establish communications with other network entities.

[0033] Cell aggregation (CA) is used to arrange and utilize secondary cells with primary cells. A primary cell is a cell that uses a licensed frequency band. A secondary cell can use a license frequency band or an unlicensed frequency band. Cells can also be co-located and non-collocated. The co-located cells are located next to each other. Non-collocated cells are cells that are not located next to each other.

[0034] The non-collocated cells use a different timing advance (TA). Thus, multiple TA groups (TAGs) are supported, where the TAG refers to a group of serving cells that is configured by radio resource control (RRC) protocols to use the same timing reference cell and the same TA value. A TAG containing the primary cell is called a primary TAG (pTAG) and a TAG not containing the primary cell is called a secondary TAG (sTAG), which contains at least one secondary cell with a configured uplink.

[0035] The CA can be used to aggregate unlicensed frequency bands with licensed frequency bands by aggregating a PCell with one or more SCells. The UE 102 and/or the eNodeB 124 utilize the CA to utilize unlicensed frequency bands with licensed frequency bands and improve or enhance data rates. The CA can aggregate licensed

and/or unlicensed frequency bands into component carriers (CC). The PCell and the SCells can be referenced by an index referred to as a Cell index.

[0036] The eNodeB 124 can be configured to utilize SCells to transmit the PDCCH order. The eNodeB 124 performs a listen before talk (LBT) process to determine if an SCell is available. The eNodeB 124 is configured to retry transmission with the SCell until transmission is successful, or a selected number of attempts have been made. Once the selected number of attempts have been made, the transmission can be blocked. Alternately, a PCell can be used as a fallback to perform the transmission. Of course, the eNodeB 124 can also be configured to initially use the PCell.

[0037] The LBT or LBT process includes sensing the unlicensed frequency band or channel associated with the SCell. If the energy is sensed above a threshold, the frequency band is considered not available. The LBT process is considered failed. If the sensed signal is below the threshold, the frequency band is considered available and idle. The LBT can be single interval LBT or Cat-4 LBT. If Cat-4 LBT is used, PDCCH order can be followed by PDSCH within the same subframe, and the multiplexing rule follows the Cat-4 LBT multiplexing rule.

[0038] The eNodeB 124 can be configured to utilize SCells to transmit the RAR within a time period so that the RAR is received at the UE 102 within the RAR window. The eNodeB 124 performs an LBT process to determine if an SCell is available. The eNodeB 124 is configured to retry transmission with the SCell until transmission is successful, or a selected number of attempts has been made. Once the selected number of attempts have been made, the transmission can be blocked. A PCell can be used as a fallback to perform the transmission. The eNodeB 124 can also be configured to initially use the PCell. In another example, the RAR window is extended to accommodate extra processing time for using the SCell.

[0039] The UE 102 can be configured to utilize SCells to transmit the PRACH preamble in response to a PDCCH. The UE 102 performs an LBT process to determine if an SCell is available. The SCell can be the same as the SCell transmitting the corresponding PDCCH order. Alternatively, the SCell can be a different SCell, which can be indicated explicitly in PDCCH order, or be indicated via RRC signaling by defining a mapping from SCell transmitting PDCCH order to set of SCells to transmit PRACH preamble, or can be any SCells configured to the UE. The UE 102 is configured to retry transmission with the SCell until transmission is successful, or a selected number of attempts has been made. Once the selected number of attempts

have been made, the transmission can be blocked. A PCell can be used as a fallback to perform the transmission and is used based on a fallback condition. The fallback condition includes a number of LBT failures on the SCell, a number of continuous LBT failures, a number of LBT failures within a time window, configured by layer 1 signaling, configured by higher layer signaling, and the like. The UE 102 can also be configured to initially use the PCell.

[0040] In another example, the UE 102 is configured to monitor a common search space (CSS) over a licensed assisted access (LAA) secondary cell (SCell). By monitoring the CSS, the UE 102 can receive RAR from these SCells. As a result, the identified SCell can be used for transmitting the RAR. Thus, an unlicensed frequency band associated with the SCell is used in place of the licensed frequency band associated with the PCell for RAR transmission. The RAR can be transmitted in the same SCell as where the PRACH preamble is transmitted. Alternatively, the RAR can be transmitted in a different SCell. In one example, a RAR window for receiving the PRACH preamble is widened or extended if RAR is transmitted on unlicensed spectrum. In another example, the RAR window may only count a valid downlink subframe, if RAR is transmitted over unlicensed spectrum.

[0041] Other examples and variations for enhancing communications for unlicensed frequency bands are shown below and in subsequent figures.

[0042] The performed LBT can be single interval LBT or **Cat-4** LBT. If **Cat-4** LBT is used, PDCCH order can be followed by PDSCH within the same subframe, and the multiplexing rule follows the **Cat-4** LBT multiplexing rule.

[0043] PRACH preamble: single interval LBT can be used, for both within and outside transmission opportunity (TxOP).

[0044] **Cat-4** LBT with higher priority can be used if RAR is transmitted on unlicensed spectrum. RAR can be multiplexed with other traffic, and the multiplexing rule follows the **Cat-4** LBT multiplexing rule.

[0045] Periodic resources can be semi-statically configured by higher layer signaling (e.g. RRC signaling) for PRACH preamble transmission.

[0046] The PRACH transmission can be scheduled via PDCCH order. The timing relationship between PDCCH order and the PRACH preamble transmission can be predefined, semi-statically configured (e.g. via radio resource control (RRC) signaling), or dynamical configured via downlink control information (DCI).

[0047] A timing window can be configured and the PRACH preamble can be transmitted in one subframe within the timing window, depending on channel availability. The scheduling coordination of different PRACH preamble transmissions by eNodeB implementation avoids the ambiguity of random access-radio network temporary identifier (RA-RNTI) for RAR corresponding to different preamble transmissions. The configuration of timing window length can take into account the RAR window size.

[0048] One PDCCH order can indicate multiple PRACH resources, each on separate LAA SCells within the same sTAG. The UE 102 performs LBT over all these configured SCells and the PRACH preamble can be transmitted on any one or multiple of the configured SCell(s) if its channel is sensed to be idle/available. The configuration of the SCells to reserve PRACH resources can be semi-statistical via RRC-signaling, or dynamical via L1 signaling (e.g. DCI). Similarly, the PDCCH order and/or RAR (if transmitted on SCell) resources can be allocated to multiple SCells, and PDCCH order and/or RAR would be transmitted on any one of these SCells if its channel is sensed to be idle/available.

[0049] Alternatively, a **Cat-4** LBT can be performed prior to PDCCH order, and downlink (DL) data or reservation signal if no data can be transmitted until the time for the UE 102 to perform a single-interval or no LBT prior to PRACH preamble transmission. The channel can be held within the duration between PDCCH order and PRACH preamble transmissions, and thus the transmission probability for PRACH preamble is improved.

[0050] If the PDCCH order and/or RAR is transmitted on LAA SCells, PDCCH order and/or RAR can be transmitted over PCell as a fallback, if the transmission was not successful for a duration of X ms or the SCell failed to transmit Y consecutive PUCCH transmission opportunities due to LBT failure, where X and Y can be set by L1/L2 signaling.

[0051] When the PRACH preamble is transmitted over unlicensed carrier, the UE does not increase preamble counter when LBT fails. Thus, there is no power ramping when the PRACH preamble fails to transmit due to LBT.

[0052] Fig. 2 is a diagram illustrating establishment of communications for a user equipment (UE) using a PRACH preamble.

[0053] In this example, uplink communications between a UE and eNodeB are established using a primary cell (PCell) 201 and a secondary cell (SCell) 202. The

primary cell 201 is a cell operating on a primary frequency within a licensed frequency band. The secondary cell 202 can use an unlicensed or licensed frequency band. In this example, the secondary cell 202 is assumed to use an unlicensed frequency band.

[0054] An eNodeB generates a PDCCH, which includes a PDCCH order and transmits the PDCCH order using the SCell 202. The eNodeB performs a LBT process to determine if the unlicensed frequency band is available, or the PDCCH order is not transmitted. The UE receives the PDCCH and generates a PRACH preamble using the SCell 202. However, before the UE transmits the PRACH preamble, the UE performs a LBT process to determine if the unlicensed frequency band is available. If the unlicensed frequency band is available, the PRACH preamble is transmitted using the SCell 202. If the unlicensed frequency band is unavailable, transmission of the PRACH preamble is blocked.

[0055] An eNodeB receives the PRACH preamble, assuming it was transmitted. The eNodeB generates RAR using the PCell 201. The RAR is then received by the UE within the RAR window and the PCell 201 and/or the SCell 202 can be utilized for uplink communications.

[0056] Fig. 3 is a diagram illustrating establishment of communications for a user equipment (UE) where RAR is transmitted using a PCell. In this example, retries after LBT failures are performed to increase probability of PRACH preamble transmission.

[0057] In this example, uplink communications between a UE and eNodeB are established using a primary cell (PCell) and a secondary cell (SCell). The primary cell is a cell operating on a primary frequency within a licensed frequency band. The secondary cell can use an unlicensed or licensed frequency band. In this example, the secondary cell is assumed to use an unlicensed frequency band.

[0058] An eNodeB generates a PDCCH, which includes a PDCCH order and transmits the PDCCH order using the SCell. The eNodeB performs a LBT process to determine if the unlicensed frequency band is available. On a first attempt 301, the LBT process results in a failure as the energy above a threshold value is detected. However, a retry is performed, where the LBT process results in success as a detected energy is below the threshold value. The eNodeB is configured to retry transmitting the PDCCH until the PDCCH is transmitted and/or a selected number of failed LBT processes are obtained.

[0059] The UE receives the PDCCH and generates a PRACH preamble using the SCell. Before the UE transmits the PRACH preamble, the UE performs a LBT process

to determine if the unlicensed frequency band is available. In this example, the LBT process for the first attempt 302 results in failure. However, the UE is configured to retry transmitting the PRACH preamble. In the second attempt at transmission, the LBT is successful and the PRACH preamble is transmitted by the UE using the SCell. Had the second attempt resulted in an LBT failure, the UE is configured to retry transmission using LBT until the PRACH preamble is transmitted and/or a selected number of retries of failed LBT processes have occurred and/or the time window if configured for this PRACH preamble expires. The PRACH can be transmitted only on available resources for PRACH transmission, where the available resources may be indicated implicitly/explicitly via downlink control information (DCI), or configured via RRC signaling.

[0060] An eNodeB receives the PRACH preamble. The eNodeB generates RAR using the PCell. The RAR is then received by the UE within the RAR window and the PCell and the SCell can be utilized for uplink communications.

[0061] Fig. 4 is a diagram illustrating establishment of communications for a user equipment (UE) where RAR is transmitted using a SCell. In this example, retries after LBT failures are performed to increase probability of PRACH preamble transmission.

[0062] In this example, uplink communications between a UE and eNodeB are established using only a secondary cell (SCell). The primary cell is a cell operating on a primary frequency within a licensed frequency band. The secondary cell can use an unlicensed or licensed frequency band. In this example, the secondary cell is assumed to use an unlicensed frequency band.

[0063] An eNodeB generates a PDCCH, which includes a PDCCH order and transmits the PDCCH order using the SCell. The eNodeB performs a LBT process to determine if the unlicensed frequency band is available. On a first attempt 301, the LBT process results in a failure as the energy above a threshold value is detected. A retry is performed, where the LBT process results in success as a detected energy is below the threshold value. The eNodeB can retry transmitting the PDCCH until the PDCCH is transmitted and/or a selected number of failed LBT processes are obtained.

[0064] The UE receives the PDCCH and generates a PRACH preamble based on the PDCCH order and using the SCell. Before the UE transmits the PRACH preamble, the UE performs a LBT process to determine if the unlicensed frequency band is available. In this example, the LBT process for the first attempt 302 results in failure. However, the UE is configured to retry transmitting the PRACH preamble. In the

second attempt at transmission, the LBT is successful and the PRACH preamble is transmitted by the UE using the SCell. Had the second attempt resulted in an LBT failure, the UE is configured to retry transmission using LBT until the PRACH preamble is transmitted and/or a selected number of retries of failed LBT processes have occurred and/or the time window if configured for this PRACH preamble expires. The PRACH can be transmitted only on available resources for PRACH transmission, where the available resources may be indicated implicitly/explicitly via DCI, or configured via RRC signaling.

[0065] An eNodeB receives the PRACH preamble. The eNodeB generates RAR using the SCell. Because the SCell utilizes an unlicensed frequency band, the eNodeB performs LBT. If the LBT results in failure as shown at 403, a retry is performed. In this example, the retry is successful and the SCell is utilized. The RAR is then received by the UE within the RAR window.

[0066] Fig. 5 is a diagram illustrating establishment of communications for a user equipment (UE) where multiple secondary cells are used. In this example, a plurality of secondary cells (SCells) are used for PRACH preamble transmission.

[0067] The secondary cell can use an unlicensed or licensed frequency band. In this example, the secondary cell is assumed to use an unlicensed frequency band and uses LBT before transmissions.

[0068] In this example, the UE has already received and processed the PDCCH order and generated a PRACH preamble. The plurality of secondary cells includes SCell 1, SCell2, and SCell3, however it is appreciated that other suitable numbers of secondary cells can be utilized.

[0069] A LBT is performed prior to each transmission attempt. A first attempt using SCell 1 is tried, but results in LBT failure. A first attempt using SCell2 is tried, but results in LBT failure. A first attempt using SCell3 is tried, but also results in LBT failure. However, the UE is configured to retry transmission of the PRACH preamble until successful transmission or a selected number of attempts have been tried.

[0070] A second attempt using SCell 1 is tried, but results in LBT failure. A second attempt using SCell2 is tried, but results in LBT failure. A second attempt using SCell3 is tried, but also results in LBT failure. At this point, the UE has not been able to transmit the PRACH preamble.

[0071] A third attempt using SCellM is tried, but results in LBT failure. A third attempt using SCell2 is tried, and results in LBT success. The UE uses the SCell2 to transmit

the PRACH preamble at 501. A third attempt using SCell3 is also tried. The LBT process is successful at 502, however the UE has already transmitted the PRACH preamble and the PRACH preamble is not retransmitted. In one example, when multiple cells have channels idle, UE can select one of these cells for PRACH transmission, and a selection rule can be predefined, e.g. select the SCell with smallest cell index. Alternatively, UE may transmit PRACH on multiple cells.

[0072] As a result, the probability of successful PRACH preamble transmission is increased and unlicensed frequency bands are utilized.

[0073] Fig. 6 is a diagram illustrating establishment of communications for a user equipment (UE) utilizing retries with a secondary cell and fallbacks to a primary cell. Transmissions blocked due to LBT failure are retried a number of times using a secondary cell. Then, the retransmission is performed using the primary cell as a fallback.

[0074] The primary cell is a cell operating on a primary frequency within a licensed frequency band. The secondary cell can use an unlicensed or licensed frequency band. In this example, the secondary cell is assumed to use an unlicensed frequency band.

[0075] An eNodeB generates a PDCCH, which includes a PDCCH order. The eNodeB attempts to transmit the PDCCH order using the SCell. However, the attempt results in LBT failure. The eNodeB again attempts to transmit the PDCCH order using the SCell, which again results in LBT failure. The eNodeB can retry transmission using the SCell a selected number of times. In this example, the selected number is 2. Thus, instead of using the SCell, the eNodeB performs transmission of the PDCCH order using the PCell 601. No LBT is required for the PCell, thus the transmission is performed.

[0076] The UE receives the PDCCH and generates a PRACH preamble based on the PDCCH order. The UE performs a LBT process to determine if the unlicensed frequency band is available prior to transmission. In this example, the LBT process for the first attempt results in failure. However, the UE is configured to retry transmitting the PRACH preamble. In the second attempt at transmission 602, the LBT is successful and the PRACH preamble is transmitted by the UE using the SCell. Had the second attempt resulted in an LBT failure, the UE is configured to fallback to using the PCell based on a fallback condition. The fallback condition can include a selected number of LBT failures, a selected number of continuous LBT failures within a time window, configured by layer 1 signaling, configured by higher layer signaling, and the

like. It is appreciated that other numbers of retries can be utilized. The number of retries can be predefined, configured via RRC signaling and the like.

[0077] An eNodeB receives the PRACH preamble. The eNodeB generates RAR based on the PRACH preamble. The eNodeB attempts to use the SCell for transmission of the RAR, however the LBT results in failure. Because the SCell utilizes an unlicensed frequency band, the eNodeB performs LBT. In this example, the eNodeB falls back to the PCell for transmission. The RAR is transmitted using the PCell at 603 within the RAR window.

[0078] The retries using the SCell facilitate use of the unlicensed frequency band and improves the probability of transmission. Using the PCell as a fallback further improves the probability of transmission, but can result in utilizes licensed frequency bands.

[0079] An eNodeB generates a PDCCH, which includes a PDCCH order and transmits the PDCCH order, using the SCell. The eNodeB performs a LBT process to determine if the unlicensed frequency band is available. On a first attempt 301, the LBT process results in a failure as a signal above a threshold value is detected. A retry is performed, where the LBT process results in success as a detected signal is below the threshold value. The eNodeB is configured to retry transmitting the PDCCH until the PDCCH is transmitted and/or a selected number of failed LBT processes are obtained.

[0080] The UE receives the PDCCH and generates a PRACH preamble based on the PDCCH order and using the SCell. Before the UE transmits the PRACH preamble, the UE performs a LBT process to determine if the unlicensed frequency band is available. In this example, the LBT process for the first attempt 302 results in failure. However, the UE is configured to retry transmitting the PRACH preamble. In the second attempt at transmission, the LBT is successful and the PRACH preamble is transmitted by the UE using the SCell. Had the second attempt resulted in an LBT failure, the UE is configured to retry transmission using LBT until the PRACH preamble is transmitted and/or a selected number of retries of failed LBT processes have occurred, and/or the time window if configured for this PRACH preamble expires. The PRACH can be transmitted only on available resources for PRACH transmission, where the available resources may be indicated implicitly/explicitly via DCI, or configured via RRC signaling.

[0081] An eNodeB receives the PRACH preamble within a RAR window. The eNodeB generates RAR using the SCell. Because the SCell utilizes an unlicensed

frequency band, the eNodeB performs LBT. If the LBT results in failure as shown at 403, a retry is performed. In this example, the retry is successful and the SCell is utilized. The RAR is then received by the UE within the RAR window.

[0082] Fig. 7 is a flow diagram illustrating a method 700 of operating a user equipment and utilizing unlicensed frequency bands in accordance with an embodiment. The method 700 facilitates communications utilizing unlicensed frequencies.

[0083] The method 700 can be used with the arrangement 100 and variations thereof.

[0084] The method 700 begins at block 702, wherein a PDCCH order is received. An eNodeB, such as the eNodeB 124 can generate a PDCCH that includes the PDCCH order. A UE device, such as the UE 102, can be configured to receive the PDCCH order.

[0085] The UE generates a PRACH preamble at block 704.

[0086] The UE transmits the PRACH preamble using an unlicensed frequency band at block 706 according to transmission approaches or conditions. The unlicensed frequency band can be associated with a secondary cell (SCell). The transmission conditions include retrying the transmission a selected number of times. For each transmission, an LBT is performed to determine if the transmission can proceed.

[0087] Alternately, the transmission falls back to being performed on a licensed frequency band. The licensed frequency band is associated with a primary cell (PCell).

[0088] The UE receives a RAR at block 708. The RAR specifies the resources that can be used for communications involving the UE and the eNodeB.

[0089] The UE and the eNodeB establish uplink communications at block 710. The communications are established based on the RAR and utilize the secondary cell.

[0090] While the methods described within this disclosure are illustrated in and described herein as a series of acts or events, it will be appreciated that the illustrated ordering of such acts or events are not to be interpreted in a limiting sense. For example, some acts may occur in different orders and/or concurrently with other acts or events apart from those illustrated and/or described herein. In addition, not all illustrated acts may be required to implement one or more aspects or embodiments of the description herein. Further, one or more of the acts depicted herein may be carried out in one or more separate acts and/or phases.

[0091] Embodiments described herein can be implemented into a system using any suitably configured hardware and/or software. FIG. 8 illustrates, for one embodiment,

example components of a User Equipment (UE) device 800. In some embodiments, the UE device 800 (e.g., the wireless communication device) can include application circuitry 802, baseband circuitry 804, Radio Frequency (RF) circuitry 806, front-end module (FEM) circuitry 808 and one or more antennas 810, coupled together at least as shown.

[0092] The application circuitry 802 can include one or more application processors. For example, the application circuitry 802 can include circuitry such as, but not limited to, one or more single-core or multi-core processors. The processor(s) can include any combination of general-purpose processors and dedicated processors (e.g., graphics processors, application processors, etc.). The processors can be coupled with and/or can include memory/storage and can be configured to execute instructions stored in the memory/storage to enable various applications and/or operating systems to run on the system.

[0093] The baseband circuitry 804 can include circuitry such as, but not limited to, one or more single-core or multi-core processors. The baseband circuitry 804 can include one or more baseband processors and/or control logic to process baseband signals received from a receive signal path of the RF circuitry 806 and to generate baseband signals for a transmit signal path of the RF circuitry 806. Baseband processing circuitry 804 can interface with the application circuitry 802 for generation and processing of the baseband signals and for controlling operations of the RF circuitry 806. For example, in some embodiments, the baseband circuitry 804 can include a second generation (2G) baseband processor 804a, third generation (3G) baseband processor 804b, fourth generation (4G) baseband processor 804c, and/or other baseband processor(s) 804d for other existing generations, generations in development or to be developed in the future (e.g., fifth generation (5G), 6G, etc.). The baseband circuitry 804 (e.g., one or more of baseband processors 804a-d) can handle various radio control functions that enable communication with one or more radio networks via the RF circuitry 806. The radio control functions can include, but are not limited to, signal modulation/demodulation, encoding/decoding, radio frequency shifting, etc. In some embodiments, modulation/demodulation circuitry of the baseband circuitry 804 can include Fast-Fourier Transform (FFT), precoding, and/or constellation mapping/demapping functionality. In some embodiments, encoding/decoding circuitry of the baseband circuitry 804 can include convolution, tail-biting convolution, turbo, Viterbi, and/or Low Density Parity Check (LDPC) encoder/decoder functionality.

Embodiments of modulation/demodulation and encoder/decoder functionality are not limited to these examples and can include other suitable functionality in other embodiments.

[0094] In some embodiments, the baseband circuitry 804 can include elements of a protocol stack such as, for example, elements of an evolved universal terrestrial radio access network (EUTRAN) protocol including, for example, physical (PHY), media access control (MAC), radio link control (RLC), packet data convergence protocol (PDCP), and/or radio resource control (RRC) elements. A central processing unit (CPU) 804e of the baseband circuitry 804 can be configured to run elements of the protocol stack for signaling of the PHY, MAC, RLC, PDCP and/or RRC layers. In some embodiments, the baseband circuitry can include one or more audio digital signal processor(s) (DSP) 804f. The audio DSP(s) 804f can include elements for compression/decompression and echo cancellation and can include other suitable processing elements in other embodiments. Components of the baseband circuitry can be suitably combined in a single chip, a single chipset, or disposed on a same circuit board in some embodiments. In some embodiments, some or all of the constituent components of the baseband circuitry 804 and the application circuitry 802 can be implemented together such as, for example, on a system on a chip (SOC).

[0095] In some embodiments, the baseband circuitry 804 can provide for communication compatible with one or more radio technologies. For example, in some embodiments, the baseband circuitry 804 can support communication with an evolved universal terrestrial radio access network (EUTRAN) and/or other wireless metropolitan area networks (WMAN), a wireless local area network (WLAN), a wireless personal area network (WPAN). Embodiments in which the baseband circuitry 804 is configured to support radio communications of more than one wireless protocol can be referred to as multi-mode baseband circuitry.

[0096] RF circuitry 806 can enable communication with wireless networks using modulated electromagnetic radiation through a non-solid medium. In various embodiments, the RF circuitry 806 can include switches, filters, amplifiers, etc. to facilitate the communication with the wireless network. RF circuitry 806 can include a receive signal path which can include circuitry to down-convert RF signals received from the FEM circuitry 808 and provide baseband signals to the baseband circuitry 804. RF circuitry 806 can also include a transmit signal path which can include circuitry to up-

convert baseband signals provided by the baseband circuitry 804 and provide RF output signals to the FEM circuitry 808 for transmission.

[0097] In some embodiments, the RF circuitry 806 can include a receive signal path and a transmit signal path. The receive signal path of the RF circuitry 806 can include mixer circuitry 806a, amplifier circuitry 806b and filter circuitry 806c. The transmit signal path of the RF circuitry 806 can include filter circuitry 806c and mixer circuitry 806a. RF circuitry 806 can also include synthesizer circuitry 806d for synthesizing a frequency for use by the mixer circuitry 806a of the receive signal path and the transmit signal path. In some embodiments, the mixer circuitry 806a of the receive signal path can be configured to down-convert RF signals received from the FEM circuitry 808 based on the synthesized frequency provided by synthesizer circuitry 806d. The amplifier circuitry 806b can be configured to amplify the down-converted signals and the filter circuitry 806c can be a low-pass filter (LPF) or band-pass filter (BPF) configured to remove unwanted signals from the down-converted signals to generate output baseband signals. Output baseband signals can be provided to the baseband circuitry 804 for further processing. In some embodiments, the output baseband signals can be zero-frequency baseband signals, although this is not a requirement. In some embodiments, mixer circuitry 806a of the receive signal path can comprise passive mixers, although the scope of the embodiments is not limited in this respect.

[0098] In some embodiments, the mixer circuitry 806a of the transmit signal path can be configured to up-convert input baseband signals based on the synthesized frequency provided by the synthesizer circuitry 806d to generate RF output signals for the FEM circuitry 808. The baseband signals can be provided by the baseband circuitry 804 and can be filtered by filter circuitry 806c. The filter circuitry 806c can include a low-pass filter (LPF), although the scope of the embodiments is not limited in this respect.

[0099] In some embodiments, the mixer circuitry 806a of the receive signal path and the mixer circuitry 806a of the transmit signal path can include two or more mixers and can be arranged for quadrature downconversion and/or upconversion respectively. In some embodiments, the mixer circuitry 806a of the receive signal path and the mixer circuitry 806a of the transmit signal path can include two or more mixers and can be arranged for image rejection (e.g., Hartley image rejection). In some embodiments, the mixer circuitry 806a of the receive signal path and the mixer circuitry 806a can be arranged for direct downconversion and/or direct upconversion, respectively. In some

embodiments, the mixer circuitry 806a of the receive signal path and the mixer circuitry 806a of the transmit signal path can be configured for super-heterodyne operation.

[00100] In some embodiments, the output baseband signals and the input baseband signals can be analog baseband signals, although the scope of the embodiments is not limited in this respect. In some alternate embodiments, the output baseband signals and the input baseband signals can be digital baseband signals. In these alternate embodiments, the RF circuitry 806 can include analog-to-digital converter (ADC) and digital-to-analog converter (DAC) circuitry and the baseband circuitry 804 can include a digital baseband interface to communicate with the RF circuitry 806.

[00101] In some dual-mode embodiments, a separate radio IC circuitry can be provided for processing signals for each spectrum, although the scope of the embodiments is not limited in this respect.

[00102] In some embodiments, the synthesizer circuitry 806d can be a fractional-N synthesizer or a fractional $N/N+8$ synthesizer, although the scope of the embodiments is not limited in this respect as other types of frequency synthesizers can be suitable. For example, synthesizer circuitry 806d can be a delta-sigma synthesizer, a frequency multiplier, or a synthesizer comprising a phase-locked loop with a frequency divider.

[00103] The synthesizer circuitry 806d can be configured to synthesize an output frequency for use by the mixer circuitry 806a of the RF circuitry 806 based on a frequency input and a divider control input. In some embodiments, the synthesizer circuitry 806d can be a fractional $N/N+8$ synthesizer.

[00104] In some embodiments, frequency input can be provided by a voltage controlled oscillator (VCO), although that is not a requirement. Divider control input can be provided by either the baseband circuitry 804 or the applications processor 802 depending on the desired output frequency. In some embodiments, a divider control input (e.g., N) can be determined from a look-up table based on a channel indicated by the applications processor 802.

[00105] Synthesizer circuitry 806d of the RF circuitry 806 can include a divider, a delay-locked loop (DLL), a multiplexer and a phase accumulator. In some embodiments, the divider can be a dual modulus divider (DMD) and the phase accumulator can be a digital phase accumulator (DPA). In some embodiments, the DMD can be configured to divide the input signal by either N or N+8 (e.g., based on a carry out) to provide a fractional division ratio. In some example embodiments, the DLL can include a set of cascaded, tunable, delay elements, a phase detector, a charge

pump and a D-type flip-flop. In these embodiments, the delay elements can be configured to break a VCO period up into N_d equal packets of phase, where N_d is the number of delay elements in the delay line. In this way, the DLL provides negative feedback to help ensure that the total delay through the delay line is one VCO cycle.

[00106] In some embodiments, synthesizer circuitry 806d can be configured to generate a carrier frequency as the output frequency, while in other embodiments, the output frequency can be a multiple of the carrier frequency (e.g., twice the carrier frequency, four times the carrier frequency) and used in conjunction with quadrature generator and divider circuitry to generate multiple signals at the carrier frequency with multiple different phases with respect to each other. In some embodiments, the output frequency can be a LO frequency (f_{LO}). In some embodiments, the RF circuitry 806 can include an IQ/polar converter.

[00107] FEM circuitry 808 can include a receive signal path which can include circuitry configured to operate on RF signals received from one or more antennas 880, amplify the received signals and provide the amplified versions of the received signals to the RF circuitry 806 for further processing. FEM circuitry 808 can also include a transmit signal path which can include circuitry configured to amplify signals for transmission provided by the RF circuitry 806 for transmission by one or more of the one or more antennas 810.

[00108] In some embodiments, the FEM circuitry 808 can include a TX/RX switch to switch between transmit mode and receive mode operation. The FEM circuitry can include a receive signal path and a transmit signal path. The receive signal path of the FEM circuitry can include a low-noise amplifier (LNA) to amplify received RF signals and provide the amplified received RF signals as an output (e.g., to the RF circuitry 806). The transmit signal path of the FEM circuitry 808 can include a power amplifier (PA) to amplify input RF signals (e.g., provided by RF circuitry 806), and one or more filters to generate RF signals for subsequent transmission (e.g., by one or more of the one or more antennas 880).

[00109] In some embodiments, the UE device 800 can include additional elements such as, for example, memory/storage, display, camera, sensor, and/or input/output (I/O) interface.

[00110] It is appreciated that the described application circuitry 802, baseband circuitry 804, Radio Frequency (RF) circuitry 806, front-end module (FEM) circuitry 808 and one or more antennas 810 can also be utilized with an evolved Node B (eNodeB).

[001 11] Examples herein can include subject matter such as a method, means for performing acts or blocks of the method, at least one machine-readable medium including executable instructions that, when performed by a machine (e.g., a processor with memory or the like) cause the machine to perform acts of the method or of an apparatus or system for concurrent communication using multiple communication technologies according to embodiments and examples described.

[001 12] Example 1 is an apparatus configured to be employed within one or more user equipment (UE). The apparatus includes control circuitry and a transceiver. The control circuitry is configured to generate a physical random access channel (PRACH), wherein the PRACH includes a preamble for PRACH transmission using a license assisted access (LAA) secondary cell. The transceiver is coupled to the control circuitry and is configured to retry transmission of the PRACH on a listen before talk (LBT) failure based of the secondary cell.

[001 13] Example 2 includes the subject matter of Example 1, including or omitting optional elements, where the PRACH is generated in response to a physical downlink control channel (PDCCH) order, where the PDCCH order identifies an unlicensed frequency band for a PRACH preamble transmission.

[001 14] Example 3 includes the subject matter of any of Examples 1-2, including or omitting optional elements, wherein the transceiver is configured to receive a physical downlink control channel (PDCCH) order from an evolved Node B (eNodeB) on a primary cell, wherein the primary cell uses a licensed frequency band.

[001 15] Example 4 includes the subject matter of any of Examples 1-3, including or omitting optional elements, wherein the transceiver is configured to receive the PDCCH order and a random access response (RAR) on the secondary cell.

[001 16] Example 5 includes the subject matter of any of Examples 1-4, including or omitting optional elements, where the UE further includes a transceiver and the transceiver is configured to receive a PDCCH order and a random access response (RAR) using at least one of a primary cell and the secondary cell.

[001 17] Example 6 includes the subject matter of any of Examples 1-5, including or omitting optional elements, where a PDCCH order transmission and a random access response (RAR) transmission are subject to one of a single interval LBT and **Cat-4** LBT.

[001 18] Example 7 includes the subject matter of any of Examples 1-6, including or omitting optional elements, where a higher priority cell is used for the PDCCH order transmission and/or the RAR transmission when **Cat-4** LBT is performed for PDCCH

order and/or RAR transmission, and the PDCCH order is multiplexed with a physical downlink shared channel (PDSCH) in a same subframe according to a Cat-4 LBT multiplexing rule.

[00119] Example 8 includes the subject matter of any of Examples 1-7, including or omitting optional elements, where the control circuitry receives a physical downlink control channel (PDCCH) order that identifies an unlicensed frequency band for the preamble for PRACH transmission.

[00120] Example 9 includes the subject matter of any of Examples 1-6, including or omitting optional elements, where the control circuitry is configured to receive a random access response (RAR) from a serving cell, wherein the serving cell is a LAA secondary cell.

[00121] Example 10 includes the subject matter of any of Examples 1-9, including or omitting optional elements, where wherein the control circuitry is configured to receive a random access response (RAR) within a random access response (RAR) window.

[00122] Example 11 includes the subject matter of any of Examples 1-10, including or omitting optional elements, where the control circuitry is configured to extend the RAR window on the RAR being associated with the secondary cell.

[00123] Example 12 includes the subject matter of any of Examples 1-11, including or omitting optional elements, where resources are allocated for the PRACH, a physical downlink control channel (PDCCH) order and/or a random access response (RAR), each on separate LAA secondary cells within a secondary timing advance group (sTAG), and the PRACH preamble, the PDCCH order, and/or the RAR are transmitted on one or more configured secondary cells, wherein the one or more configured secondary cells are sensed as being idle before the transmission.

[00124] Example 13 includes the subject matter of any of Examples 1-12, including or omitting optional elements, where when multiple component carriers are sensed to be idle by the control circuitry, a selection rule for the secondary cell is defined based on a cell index.

[00125] Example 14 is an apparatus configured to be employed within one or more evolved Node Bs (eNodeBs). The apparatus includes control circuitry and a transceiver. The control circuitry is configured generate a physical downlink control channel (PDCCH), wherein the PDCCH includes a PDCCH order for contention free PRACH transmission using a license assisted access (LAA) secondary cell, and generate a random access response (RAR) within a RAR window using the secondary

cell. The transceiver is configured to retry transmission of the RAR on a listen before talk (LBT) failure based on the secondary cell.

[00126] Example 15 includes the subject matter of Example 14, including or omitting optional elements, where the RAR is generated based on a received physical random access channel (PRACH) preamble.

[00127] Example 16 includes the subject matter of any of Examples 14-15, including or omitting optional elements, where the transceiver is configured to transmit the PDCCH order on a primary cell.

[00128] Example 17 includes the subject matter of any of Examples 14-16, including or omitting optional elements, where the transceiver is configured to perform a listen before talk (LBT) process prior to transmitting the PDCCH order and/or RAR on the secondary cell using unlicensed spectrum.

[00129] Example 18 includes the subject matter of any of Examples 14-17, including or omitting optional elements, where the transceiver is configured to perform a listen before talk (LBT) process prior to transmitting the PDCCH order on the secondary cell.

[00130] Example 19 includes the subject matter of any of Examples 14-18, including or omitting optional elements, where the transceiver is further configured to retry the transmission of the PDCCH order on the LBT process resulting in failure.

[00131] Example 20 includes the subject matter of any of Examples 14-19, including or omitting optional elements, wherein the transceiver is configured to fall back to using a primary cell using a licensed frequency band after a number of retries of the transmission of the PDCCH order using the secondary cell.

[00132] Example 21 includes the subject matter of any of Examples 14-20, including or omitting optional elements, where the transceiver of the eNodeB is configured to fall back to a primary cell for the transmission of the RAR based on a fallback condition, wherein the fallback condition includes continuous LBT failures within a time window, where the number of LBT failures or the time window is predefined, configured by layer 1 signaling, and/or higher layer signaling.

[00133] Example 22 is one or more computer-readable media having instructions that, when executed, cause one or more user equipment (UE) to generate a physical random access channel (PRACH) for contention free PRACH transmission using a license assisted access (LAA) secondary cell, wherein the PRACH includes a PRACH preamble; perform a listen before talk (LBT) on the secondary cell; transmit the PRACH

preamble using the secondary cell on a success of the LBT; and retry transmission of the PRACH preamble using the secondary cell on a failure of LBT.

[00134] Example 23 includes the subject matter of Example 2, including or omitting optional elements, further comprising one or more computer-readable media having instructions that, when executed, further cause the one or more UEs to establish a predefined timing relationship between a PDCCH order the PRACH preamble transmission.

[00135] Example 24 includes the subject matter of any of Examples 22-23, including or omitting optional elements, further comprising one or more computer-readable media having instructions that, when executed, further cause the one or more UEs to transmit the PRACH preamble using a primary cell based on the fallback condition.

[00136] Example 25 is an apparatus configured to be employed within one or more user equipment (UE). The apparatus includes a means to configure and generate a physical random access channel (PRACH) for contention free PRACH transmission using a license assisted access (LAA) secondary cell, wherein the PRACH includes a preamble; a means to transmit the PRACH preamble using the secondary cell; a means to perform a listen before talk (LBT) on the secondary cell; a means to retry transmission of the PRACH preamble on the secondary cell on an LBT failure; and a means to retry transmission of the PRACH preamble on a secondary cell on the LBT failure of the secondary cell.

[00137] The above description of illustrated embodiments of the subject disclosure, including what is described in the Abstract, is not intended to be exhaustive or to limit the disclosed embodiments to the precise forms disclosed. While specific embodiments and examples are described herein for illustrative purposes, various modifications are possible that are considered within the scope of such embodiments and examples, as those skilled in the relevant art can recognize.

[00138] In this regard, while the disclosed subject matter has been described in connection with various embodiments and corresponding Figures, where applicable, it is to be understood that other similar embodiments can be used or modifications and additions can be made to the described embodiments for performing the same, similar, alternative, or substitute function of the disclosed subject matter without deviating therefrom. Therefore, the disclosed subject matter should not be limited to any single embodiment described herein, but rather should be construed in breadth and scope in accordance with the appended claims below.

[00139] In particular regard to the various functions performed by the above described components or structures (assemblies, devices, circuits, systems, *etc.*), the terms (including a reference to a "means") used to describe such components are intended to correspond, unless otherwise indicated, to any component or structure which performs the specified function of the described component (e.g., that is functionally equivalent), even though not structurally equivalent to the disclosed structure which performs the function in the herein illustrated exemplary implementations of the invention. In addition, while a particular feature may have been disclosed with respect to only one of several implementations, such feature may be combined with one or more other features of the other implementations as may be desired and advantageous for any given or particular application.

CLAIMS

What is claimed is:

1. An apparatus configured to be employed within one or more user equipment (UE), the apparatus comprising:
 - control circuitry configured to generate a physical random access channel (PRACH), wherein the PRACH includes a preamble for PRACH transmission using a license assisted access (LAA) secondary cell; and
 - a transceiver coupled to the control circuitry and configured to retry transmission of the PRACH on a listen before talk (LBT) failure of the secondary cell.
2. The apparatus of claim 1, wherein the PRACH is generated in response to a physical downlink control channel (PDCCH) order, wherein the PDCCH order identifies an unlicensed frequency band for a PRACH preamble transmission.
3. The apparatus of claim 1, wherein the transceiver is configured to receive a physical downlink control channel (PDCCH) order from an evolved Node B (eNodeB) on a primary cell, wherein the primary cell uses a licensed frequency band.
4. The apparatus of claim 1, wherein the transceiver is configured to receive the PDCCH order and a random access response (RAR) on the secondary cell.
5. The apparatus of any one of claims 1-4, wherein the transceiver is configured to receive a PDCCH order and a random access response (RAR) using at least one of a primary cell and the secondary cell.
6. The apparatus of any one of claims 1-4, wherein a PDCCH order transmission and a random access response (RAR) transmission are subject to one of a single interval LBT and Cat-4 LBT.
7. The apparatus of claim 1-4, wherein a higher priority cell is used for the PDCCH order transmission and/or the RAR transmission when Cat-4 LBT is performed for PDCCH order and/or RAR transmission, and the PDCCH order is multiplexed with a

physical downlink shared channel (PDSCH) in a same subframe according to a Cat-4 LBT multiplexing rule.

8. The apparatus of any one of claims 1-4, wherein the transceiver receives a physical downlink control channel (PDCCH) order that identifies an unlicensed frequency band for the preamble for PRACH transmission.
9. The apparatus of any one of claims 1-4, wherein the transceiver is configured to receive a random access response (RAR) from a serving cell, wherein the serving cell is a LAA secondary cell.
10. The apparatus of claim 1, wherein the transceiver is configured to receive a random access response (RAR) within a random access response (RAR) window.
11. The apparatus of claim 10, wherein the control circuitry is configured to extend the RAR window on the RAR being associated with the secondary cell.
12. The apparatus of any one of claims 1-4, wherein resources are allocated for the PRACH, a physical downlink control channel (PDCCH) order and/or a random access response (RAR), each on separate LAA secondary cells within a secondary timing advance group (sTAG), and the PRACH preamble, the PDCCH order, and/or the RAR are transmitted on one or more configured secondary cells, wherein the one or more configured secondary cells are sensed as being idle before the transmission.
13. The apparatus of claim 12, wherein when multiple component carriers are sensed to be idle by the control circuitry, a selection rule for the secondary cell is defined based on a cell index.
14. An apparatus configured to be employed within one or more evolved Node Bs (eNodeBs), the apparatus comprising:
 - control circuitry configured to generate a physical downlink control channel (PDCCH), wherein the PDCCH includes a PDCCH order for contention free PRACH transmission using a license assisted access (LAA) secondary cell, and generate a random access response (RAR) within a RAR window using the secondary cell; and

a transceiver configured to retry transmission of the RAR on a listen before talk (LBT) failure based on the secondary cell.

15. The apparatus of claim 14, wherein the RAR is generated based on a received physical random access channel (PRACH) preamble.

16. The apparatus of any one of claims 14-15, wherein the transceiver is configured to transmit the PDCCH order on a primary cell.

17. The apparatus of any one of claims 14-15, wherein the transceiver is configured to perform a listen before talk (LBT) process prior to transmitting the PDCCH order and/or RAR on the secondary cell using unlicensed spectrum.

18. The apparatus of claim 14, wherein the transceiver is configured to perform a listen before talk (LBT) process prior to transmitting the PDCCH order on the secondary cell.

19. The apparatus of claim 18, wherein the transceiver is further configured to retry the transmission of the PDCCH order on the LBT process resulting in failure.

20. The apparatus of claim 19, wherein the transceiver is configured to fall back to using a primary cell using a licensed frequency band after a number of retries of the transmission of the PDCCH order using the secondary cell.

21. The apparatus of claim 14, wherein the transceiver of the eNodeB is configured to fall back to a primary cell for the transmission of the RAR based on a fallback condition, wherein the fallback condition includes continuous LBT failures within a time window, where the number of LBT failures or the time window is predefined, configured by layer 1 signaling, and/or higher layer signaling.

22. One or more computer-readable media having instructions that, when executed, cause one or more user equipment (UE) to:

generate a physical random access channel (PRACH) for contention free PRACH transmission using a license assisted access (LAA) secondary cell, wherein the PRACH includes a PRACH preamble;
perform a listen before talk (LBT) on the secondary cell;
transmit the PRACH preamble using the secondary cell on a success of the LBT;
and
retry transmission of the PRACH preamble using the secondary cell on a failure of LBT.

23. The computer-readable media of claim 22, comprising one or more computer-readable media having instructions that, when executed, further cause the one or more UEs to:

establish a predefined timing relationship between a PDCCH order the PRACH preamble transmission.

24. The computer-readable media of claim 22, comprising one or more computer-readable media having instructions that, when executed, further cause the one or more UEs to:

transmit the PRACH preamble using a primary cell based on a fallback condition.

25. An apparatus configured to be employed within one or more user equipment (UE), the apparatus comprising:

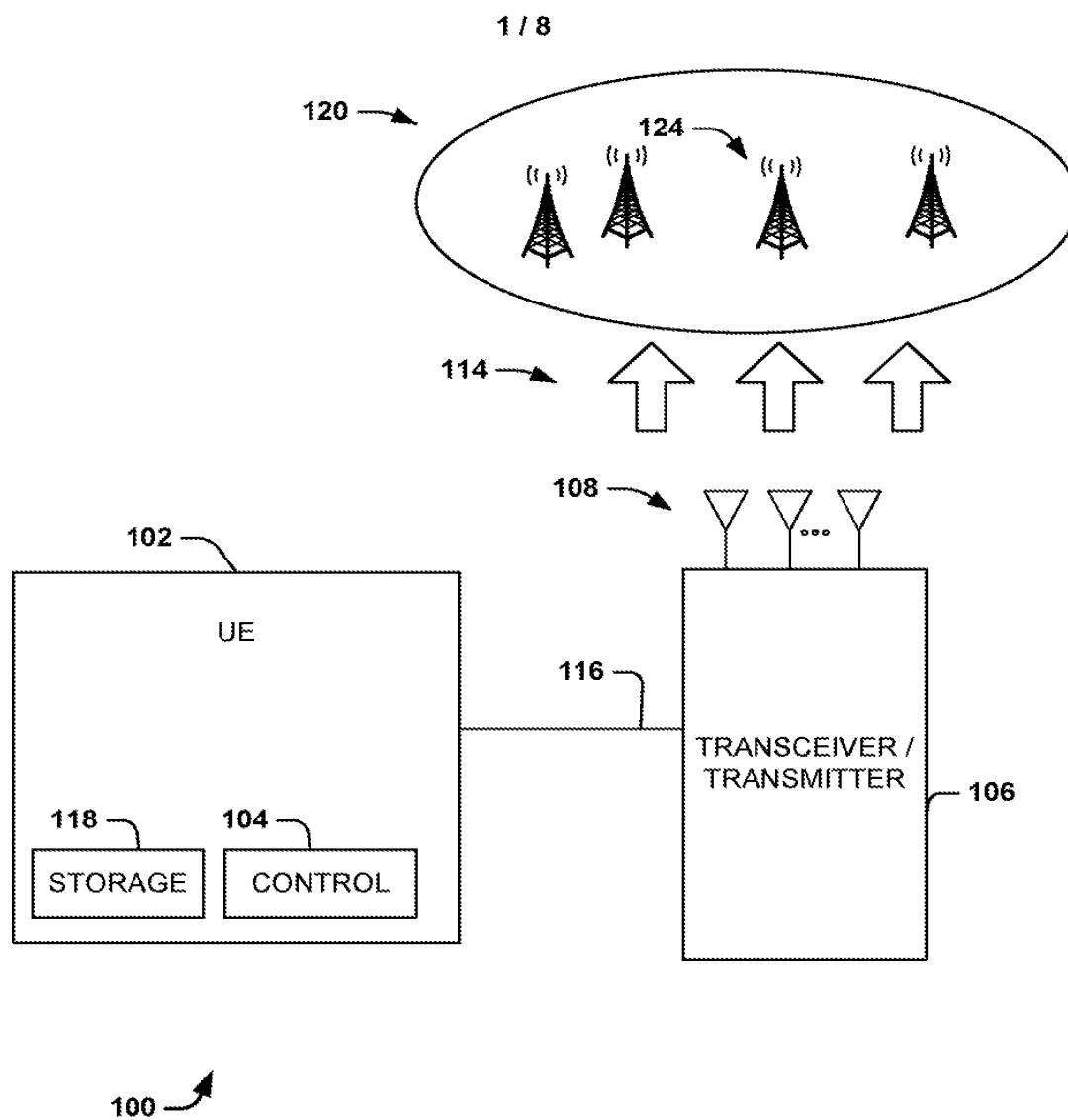
a means to configure and generate a physical random access channel (PRACH) for contention free PRACH transmission using a license assisted access (LAA) secondary cell, wherein the PRACH includes a preamble;

a means to transmit the PRACH preamble using the secondary cell;

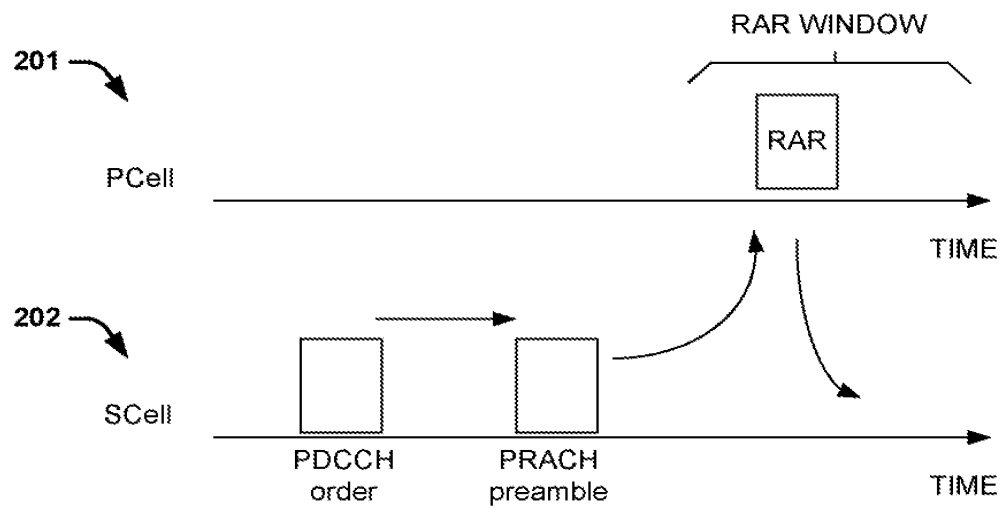
a means to perform a listen before talk (LBT) on the secondary cell;

a means to retry transmission of the PRACH preamble on the secondary cell on an LBT failure; and

a means to retry transmission of the PRACH preamble on a secondary cell on the LBT failure of the secondary cell.

**FIG. 1**

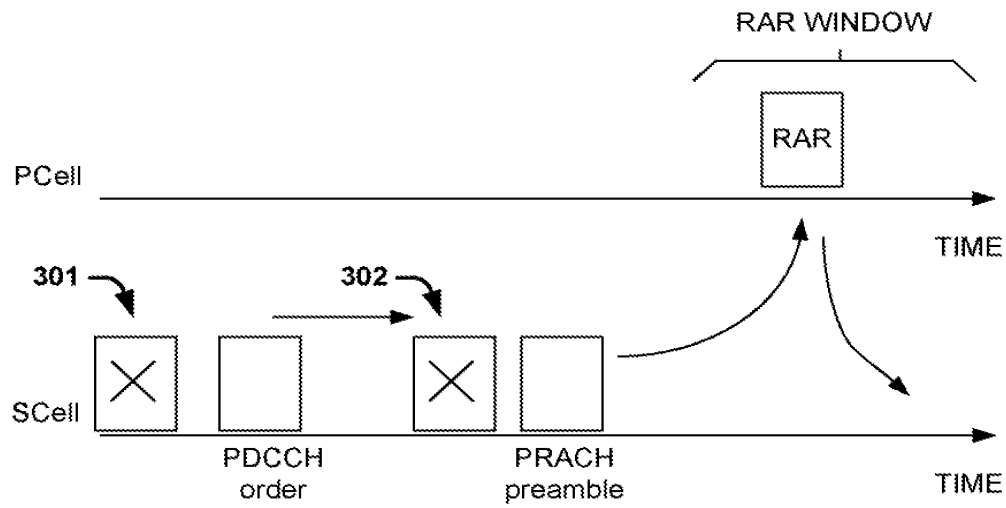
2 / 8



200 ↗

FIG. 2

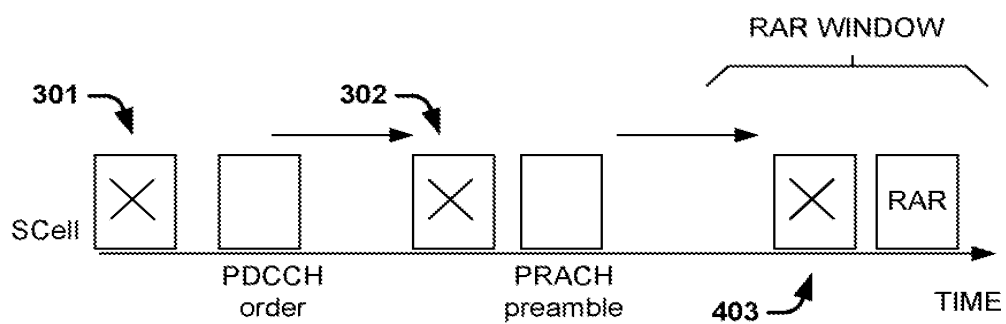
3 / 8



300 ↗

FIG. 3

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400 ↗

FIG. 4

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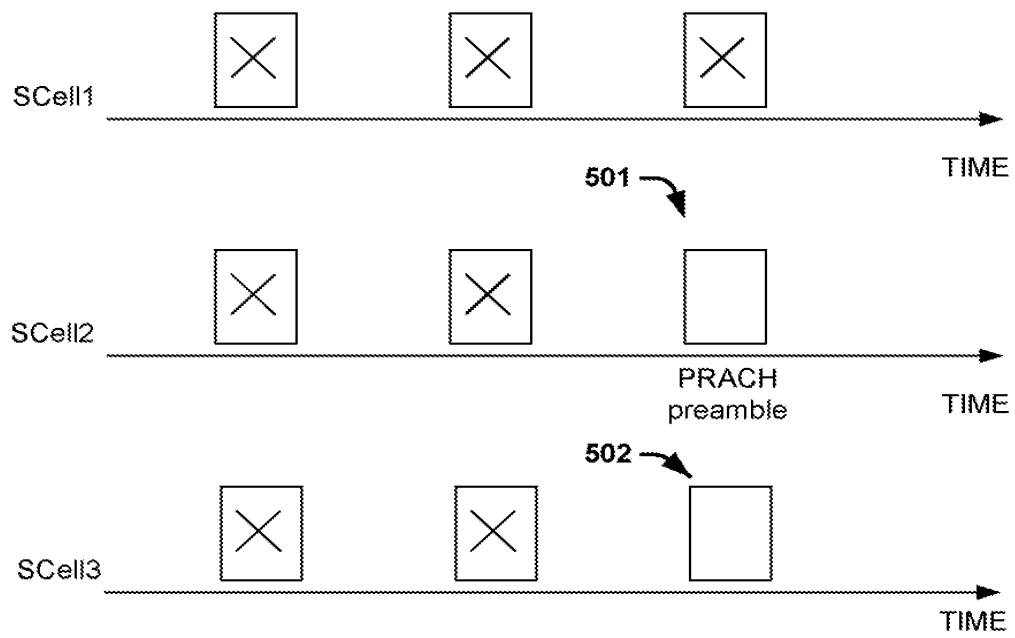
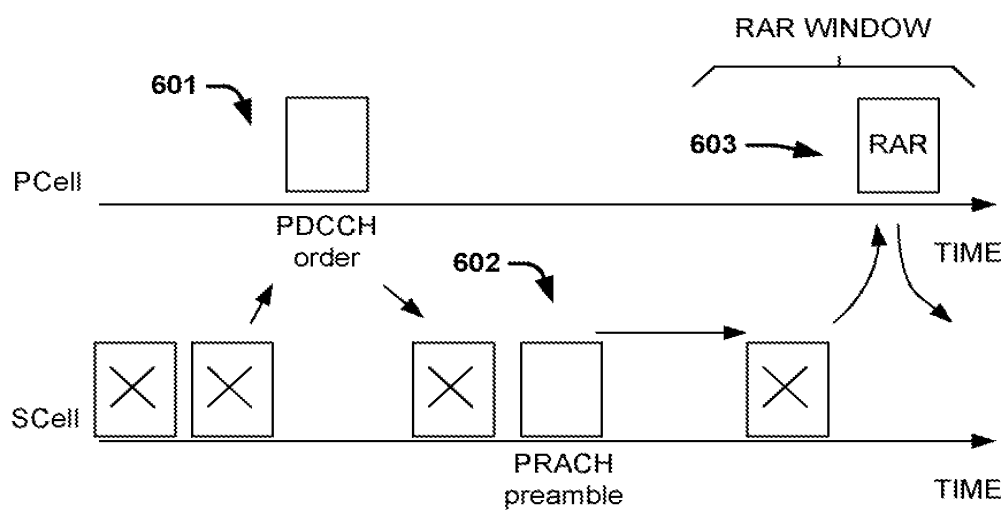


FIG. 5

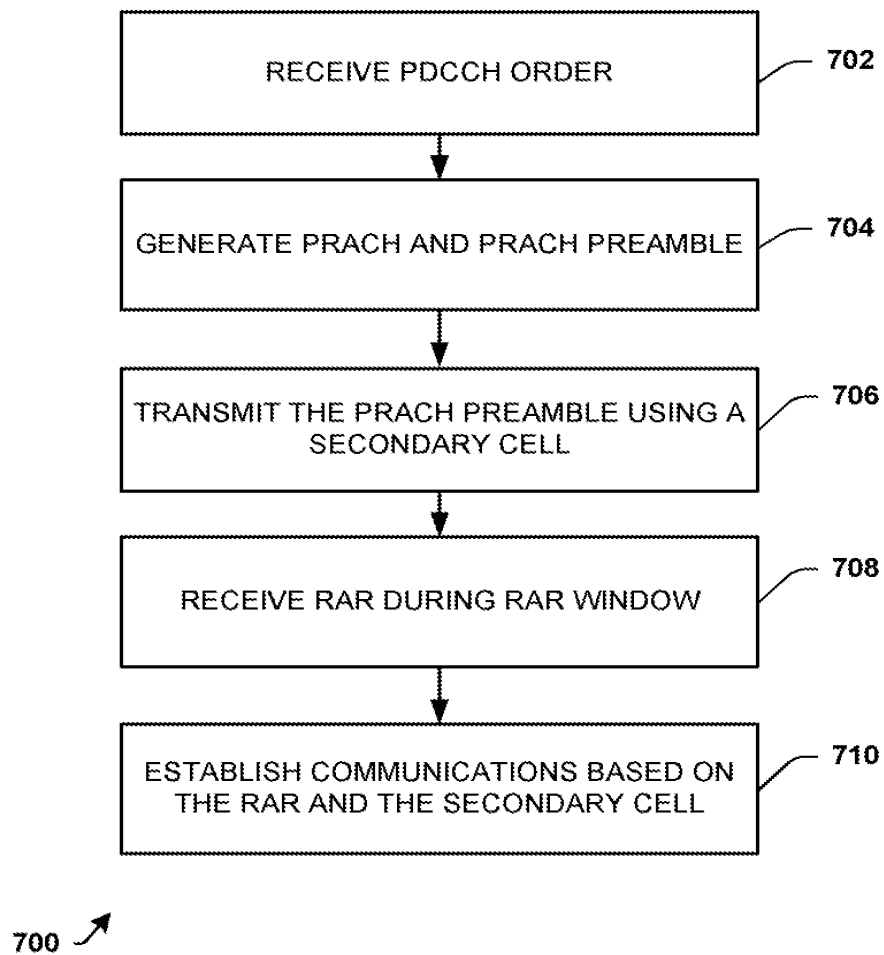
6 / 8



600 ↗

FIG. 6

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**Fig. 7**

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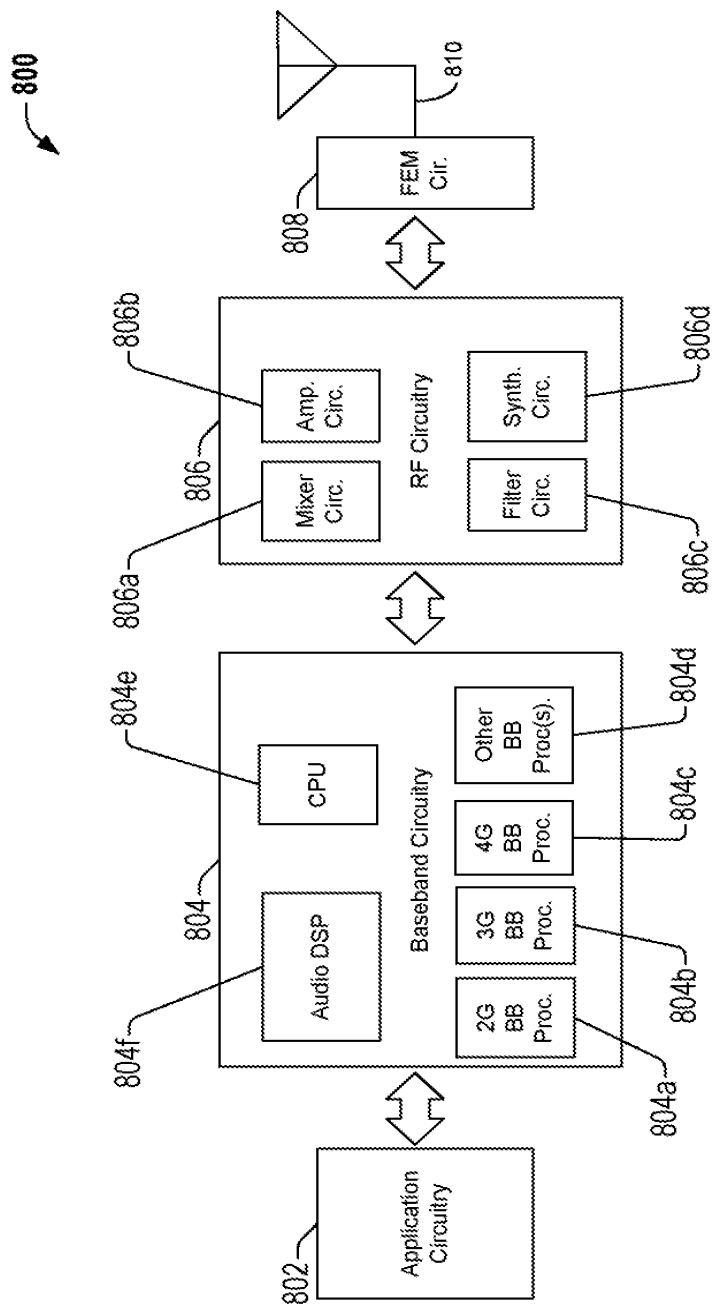


Fig. 8

International application No
PCT/US2017/014855

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/014855

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>Secti on 1; agreement 2</p> <p>Secti on 2.2;</p> <p>sentence 1</p> <p>Secti on 4;</p> <p>sentence 1</p> <p>Secti on 5</p> <p>-----</p> <p>ZTE: "Initial Thoughts on LAA DL+UL Data Transmi ssi on",</p> <p>3GPP DRAFT; R2-161358 INITIAL THOUGHTS ON LAA DL+UL DATA TRANSMISSION, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTI POLIS CEDEX ;</p> <p>,</p> <p>vol . RAN Wg2, no. St Jul ian's, Malta;</p> <p>20160215 - 20160219</p> <p>14 February 2016 (2016-02-14) ,</p> <p>XP051055258,</p> <p>Retri eved from the Internet:</p> <p>URL: http ://www. 3gpp .org/f tp/Meeti ngs_3GPP_ SYNC/RAN2/Docs/</p> <p>[retri eved on 2016-02-14]</p> <p>page 3, lines 12-30</p> <p>-----</p>	6,7
	<p>A</p> <p>FUJITSU: "MAC impact for supporti ng UL transmi ssi on on LAA SCell",</p> <p>3GPP DRAFT; R2-151455 MAC IMPACT FOR SUPPORTING UL TRANSMISSION ON LAA SCELL, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTI POLIS C</p> <p>,</p> <p>vol . RAN Wg2, no. Brati slava, Slovaki a;</p> <p>20150420 - 20150424</p> <p>19 April 2015 (2015-04-19) , XP050936382 ,</p> <p>Retri eved from the Internet:</p> <p>URL: http ://www. 3gpp .org/f tp/Meeti ngs_3GPP_ SYNC/RAN2/Docs/</p> <p>[retri eved on 2015-04-19]</p> <p>Secti on 2.1</p> <p>-----</p>	1-25

Form PCT/ISA/210 (continuation of second sheet) (April 2003)

English Translation of Abstract of China Patent Application No. CN108633097A

Present disclose provides a kind of carrier monitorings in unauthorized frequency range and the method for sending signal. This method includes : When modes of the UE based on automatic uplink being operated on unauthorized frequency range carrier wave sends signal, and when use first kind LBT, determining and LBT priority relevant informations need to be indicated according to signaling, so that it is determined that with the relevant transmission parameter of LBT priority. The disclosure further includes : When selection sends resource, resource is determined according to LBT information, and the CWS methods of adjustment of LBT are determined according to scheduling mode. By the disclosure, LAA UE can be made to be coexisted with other UE close friends, and ensure that the close friend between LAA UE coexists.



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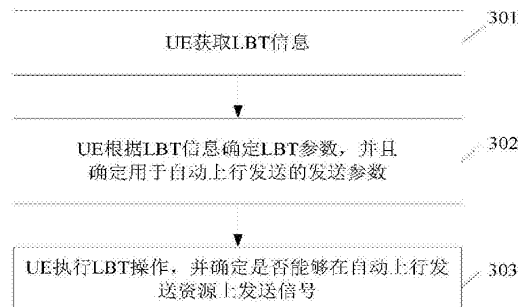
权利要求书2页 说明书15页 附图3页

(54)发明名称

无线通信方法和用户设备

(57)摘要

本公开提供了一种在非授权频段上的载波监测和发送信号的方法。该方法包括：当工作在非授权频段载波上的UE基于自动上行传输的方式发送信号时，且采用第一类LBT时，需根据信令指示确定与LBT优先级相关信息，从而确定与LBT优先级相关的发送参数。本公开还包括：在选择发送资源时，根据LBT信息确定资源，以及根据调度方式确定LBT的CWS调整方法。通过本公开，可以使得LAA UE与其他UE友好共存，并且保证LAA UE之间的友好共存。



1. 一种自动上行发送的方法,包括:
获取先听后发LBT信息;
根据LBT信息来确定LBT参数,并确定用于自动上行发送的发送参数;以及
根据所确定的LBT参数来执行LBT操作,并基于所述发送参数来确定是否能够在自动上行发送资源上发送信号。
2. 根据权利要求1所述的方法,其中,确定LBT参数包括:针对自动上行发送与基于调度的上行发送,分别确定能量检测门限值。
3. 根据权利要求1所述的方法,其中,确定LBT参数包括:针对自动上行发送与基于调度的上行发送,独立地或者部分独立地确定冲突窗大小CWS。
4. 根据权利要求3所述的方法,其中,独立地或者部分独立地确定冲突窗大小CWS包括以下至少一种:
 - 对于同一个混合自动重传请求HARQ处理的上行发送,分别确定针对自动上行发送与基于调度的上行发送的CWS;
 - 对于同一个混合自动重传请求HARQ处理的上行发送,与自动上行发送对应的ACK/NACK用于基于调度的上行发送的CWS调整,与基于调度的上行发送对应的ACK/NACK不用于自动上行发送的上行发送的CWS调整;以及
 - 对于同一个混合自动重传请求HARQ处理的上行发送,与自动上行发送对应的ACK/NACK不用于基于调度的上行发送的CWS调整,与基于调度的上行发送对应的ACK/NACK用于自动上行发送的CWS调整。
5. 根据权利要求1所述的方法,其中,确定LBT参数包括:针对自动上行发送与基于调度的上行发送,分别确定连续使用冲突窗CW的最大值 $CW_{max,p}$ 的次数K。
6. 根据权利要求1所述的方法,其中,所述发送参数包括:用于自动上行发送的资源的时间参数、频域参数、是否可执行发送的指示或者上行发送的业务类型。
7. 根据权利要求1所述的方法,其中,确定是否能够在自动上行发送资源上发送信号包括:根据LBT的类型,确定是否可以在所选择的自动上行发送资源上发送信号。
8. 根据权利要求7所述的方法,其中,为第一类LBT配置门限值Thr1,并且为第二类LBT配置门限值Thr2, Thr1小于Thr2,使得所述UE产生的随机数大于Thr1的概率比所述UE产生的随机数大于Thr2的概率要大。
9. 根据权利要求1所述的方法,其中,确定发送参数包括:根据LBT优先级分类,确定是否可以在所选择的自动上行发送资源上发送信号。
10. 根据权利要求9所述的方法,其中,为不同的LBT优先级分类分别配置门限值,使得较高LBT优先级的业务以较大的概率发送。
11. 根据权利要求1所述的方法,其中,所述自动上行发送的参数是针对不同的LBT优先级分类而配置的,所述UE根据LBT优先级分类来选择自动上行发送资源。
12. 根据权利要求1所述的方法,其中,确定LBT参数包括:针对自动上行传输的上行发送,仅采用第一类LBT。
13. 根据权利要求1所述的方法,其中,确定LBT参数包括:当接收到最大信道占用时间MCOT指示信息时,如果要进行自动上行发送的上行子帧位于所述MCOT指示信息所指示的上行子帧集合内,则采用第二类LBT。

14. 根据权利要求1所述的方法, 其中, 确定自动上行发送的发送参数包括: 在自动上行发送采用第二类LBT的情况下, 根据小区公共指示信息C-PDCCH指示的LBT信息, 确定当前最大信道占用时间MCOT的下行传输采用的LBT优先级分类, 并且根据所述LBT优先级分类来确定自动上行发送的时间长度, 和/或根据所述LBT优先级分类来确定自动上行发送的业务类型QCI。

15. 一种用户设备UE, 包括:

获取单元, 被配置为获取先听后发LBT信息;

确定单元, 被配置为根据LBT信息来确定LBT参数, 并确定用于自动上行发送的发送参数; 以及

LBT操作单元, 被配置为根据所确定的LBT参数来执行LBT操作, 并基于所述发送参数来确定是否能够在自动上行发送资源上发送信号。

无线通信方法和用户设备

技术领域

[0001] 本公开涉及移动通信技术领域。具体而言,本公开涉及一种在非授权频段上的载波监测和信号发送方法与相应的设备。

背景技术

[0002] 随着用户对高宽带无线业务需求的爆发与频谱资源稀缺的矛盾日益尖锐,移动运营商开始考虑将免许可频段(也可称为非授权频段)作为许可频段的补充。3GPP已开始研究在非授权频段上部署LTE(将在非授权频段上部署的LTE系统称为授权载波辅助接入LAA系统),通过非授权频段与授权频段的有效载波聚合,如何在保证不对非授权频段其它技术不造成明显影响的前提下,有效提高全网频谱利用率。如图1所示,同时有两个发送节点为UE服务,一个通过授权频段载波提供较大的覆盖或者较稳定的连接,另一个通过非授权频段载波提供热点服务。这两个发送节点均属于一个基站,这两个发送节点可以是同站点的,也可以是不同站点的。另一种实现方式,这两个发送节点可以属于不同的基站,即通过双连接(DC,Dual connectivity)方式工作。。

[0003] 非授权频段一般已经分配用于某种其他用途,例如,雷达或者802.11系列的无线保真(WiFi,Wireless Fidelity)。在非授权频段上,如何避免LAA系统和雷达或者WiFi等其他无线系统的相互干扰,是一个关键的问题。载波监听(CCA)是在非授权频段上普遍采用的一种避免冲突机制。一个移动台(STA)在发送信号之前必须要检测无线信道,只有在检测到该无线信道空闲时才可以占用该无线信道发送信号,这种先听后发的机制称为LBT(Listen before talk)。LAA也需要遵循LBT机制,对信道进行能量检测。

[0004] LAA UE在发送信号之前,需先接收到eNB发送的UL grant,并在UL grant所指示的上行子帧之前进行LBT。如果eNB在非授权频段的载波上发送UL grant,需要先进行下行LBT,成功才可发送UL grant。UE在UL grant调度的上行子帧发送之前,需进行上行LBT,成功才可以发送被UL grant调度的PUSCH。UE进行的上行LBT分为两种。一种称为第一类LBT,即通常所说的Category 4 LBT(TS 36.213 15.2.1.1),确定冲突窗大小(CWS),随机产生退避因子X。如果X个CCA时隙均空闲,则可发送信号。第一类LBT分为四个LBT优先级分类(LBT priority class),分别对应不同的QCI(Quality criterion indicator)。不同的LBT priority class,CWS大小不同,回退时间单位不同(defer period),最大信道占用时间MCOT(maximum channel occupancy time)也是不同的,如图2所示。由基站决定LAA UE发送时采用的LBT类型,以及LBT priority class,并且由基站确保调度的LAA UE上行发送所占用的子帧时间不超过指示的LBT priority class或者比指示的LBT priority class的优先级更高的(LBT priority class标号更小的)业务所需的时间。而UE实际发送的业务类型(与QCI对应)并不受限,UE仅简单的根据eNB的指示,在分配的时间内发送即可。

[0005] 另一种称为第二类LBT(TS 36.213 15.2.1.2),UE仅需在标准定义的发送信号开始之前进行一次25us CCA检测,若信道空闲,则可发送信号。

[0006] 由于基于UL grant调度的上行发送,需要eNB进行的下行LBT以及UE进行的上行

LBT均成功,UE才可发送PUSCH,大大的降低了发送概率。因此,3GPP开始考虑在非授权频段上进行自动上行传输(autonomous uplink access)的上行发送。

发明内容

[0007] 在基于UL grant调度的上行发送中,LBT priority class在UL grant中指示,并且由基站保证调度时间满足要求。然而,自动上行传输的上行发送没有这个信息,无法判断所需信息,因此亟需新的解决方案。

[0008] 此外,由于自动上行传输和基于调度的上行发送的抢占信道的能力不同,LBT参数应该考虑两者的差异化。

[0009] 根据本公开的一个方面,提供了一种自动上行发送的方法,包括:获取先听后发LBT信息;根据LBT信息来确定LBT参数,并确定用于自动上行发送的发送参数;以及根据所确定的LBT参数来执行LBT操作,并基于所述发送参数来确定是否能够在自动上行发送资源上发送信号。

[0010] 在一个实施例中,确定LBT参数包括:针对自动上行发送与基于调度的上行发送,分别确定能量检测门限值。

[0011] 在一个实施例中,确定LBT参数包括:针对自动上行发送与基于调度的上行发送,独立地或者部分独立地确定冲突窗大小CWS。

[0012] 在一个实施例中,独立地或者部分独立地确定冲突窗大小CWS包括以下至少一种:

[0013] -对于同一个混合自动重传请求HARQ处理的上行发送,分别维护针对自动上行发送与基于调度的上行发送的CWS;

[0014] -对于同一个混合自动重传请求HARQ处理的上行发送,与自动上行发送对应的显示的或者隐式的ACK/NACK用于基于调度的上行发送的CWS调整,与基于调度的上行发送对应的ACK/NACK不用于自动上行发送的上行发送的CWS调整;以及

[0015] -对于同一个混合自动重传请求HARQ处理的上行发送,与自动上行发送对应的显示的或者隐式的ACK/NACK不用于基于调度的上行发送的CWS调整,与基于调度的上行发送对应的ACK/NACK用于自动上行发送的CWS调整。

[0016] 在一个实施例中,确定LBT参数包括:针对自动上行发送与基于调度的上行发送,分别确定连续使用冲突窗CW的最大值 $CW_{max,p}$ 的次数K。

[0017] 在一个实施例中,所述发送参数包括:用于自动上行发送的资源的时间参数、频域参数、是否可执行发送的指示或者上行发送的业务类型。

[0018] 在一个实施例中,确定是否能够在自动上行发送资源上发送信号包括:根据LBT的类型,确定是否可以在所选择的自动上行发送资源上发送信号。

[0019] 在一个实施例中,为第一类LBT配置门限值Thr1,并且为第二类LBT配置门限值Thr2,Thr1小于Thr2,使得所述UE产生的随机数大于Thr1的概率比所述UE产生的随机数大于Thr2的概率要大。

[0020] 在一个实施例中,确定发送参数包括:根据LBT优先级分类,确定是否可以在所选择的自动上行发送资源上发送信号。

[0021] 在一个实施例中,为不同的LBT优先级分类分别配置门限值,使得较高LBT优先级的业务以较大的概率发送。

[0022] 在一个实施例中,通过小区公共指示信息C-PDCCH和/或高层信令来获取所述LBT指示信息。

[0023] 在一个实施例中,所述自动上行发送的参数是针对不同的LBT优先级分类而配置的,所述UE根据LBT优先级分类来选择自动上行发送资源。

[0024] 在一个实施例中,确定LBT参数包括:针对自动上行传输的上行发送,仅采用第一类LBT。

[0025] 在一个实施例中,确定LBT参数包括:当接收到最大信道占用时间MCOT指示信息时,如果要进行自动上行发送的上行子帧位于所述MCOT指示信息所指示的上行子帧集合内,则采用第二类LBT。

[0026] 在一个实施例中,确定自动上行发送的发送参数包括:在自动上行发送采用第二类LBT的情况下,根据小区公共指示信息C-PDCCH指示的LBT信息,确定当前最大信道占用时间MCOT的下行传输采用的LBT优先级分类,并且根据所述LBT优先级分类来确定自动上行发送的时间长度,和/或根据所述LBT优先级分类来确定自动上行发送的业务类型QCI。

[0027] 在一个实施例中,确定自动上行发送的参数包括:在自动上行发送采用第二类LBT的情况下,根据小区公共指示信息C-PDCCH指示的LBT信息,确定在当前最大信道占用时间MCOT内进行自动上行发送可采用的LBT优先级分类,和/或根据所述LBT优先级分类来确定自动上行发送的时间长度。

[0028] 根据本公开的另一个方面,提供了一种用户设备UE,包括:获取单元,被配置为获取先听后发LBT信息;确定单元,被配置为根据LBT信息来确定LBT参数,并确定用于自动上行发送的发送参数;以及LBT操作单元,被配置为根据所确定的LBT参数来执行LBT操作,并基于所述发送参数来确定是否能够在自动上行发送资源上发送信号。

[0029] 根据本公开的另一个方面,提供了一种由基站执行的方法。该方法包括:为用户设备UE配置先听后发LBT信息和/或用于自动上行发送的资源;以及向用户设备UE发送LBT信息。优选地,可以通过小区公共指示信息C-PDCCH或者通过高层信令向UE发送LBT信息。

[0030] 在一个实施例中,基站为UE的自动上行发送与基于调度的上行发送,独立配置能量检测门限值。

[0031] 在一个实施例中,基站为UE的自动上行发送与基于调度的上行发送,独立地或者部分独立地配置冲突窗大小CWS。

[0032] 在一个实施例中,基站为UE的自动上行发送与基于调度的上行发送,独立配置连续使用冲突窗CW的最大值 $CW_{max,p}$ 的次数K。

[0033] 在一个实施例中,UE的上行发送的冲突窗大小CWS根据参考上行子帧对应的ACK/NACK指示确定。

[0034] 在一个实施例中,UE的自动上行发送的冲突窗大小CWS调整的参考上行子帧为根据UE拟发送的上行子帧往前至少X个子帧的第一个基于第一类LBT的上行突发中的第一个子帧。

[0035] 在一个实施例中,基站为UE配置用于自动上行发送的资源,并且配置所述发送资源对应的LBT优先级分类信息。

[0036] 在一个实施例中,基站指示UE,当前最大信道占用时间MCOT的下行传输采用的LBT优先级分类。

[0037] 在一个实施例中,基站指示UE,当前最大信道占用时间MCOT内进行自动上行发送可采用的LBT优先级分类。

[0038] 在一个实施例中,基站通过激活的下行控制信令指示UE,用于自动上行发送的所有HARQ进程的LBT优先级分类信息。

[0039] 在一个实施例中,基站通过调度自动上行发送的UL grant,或者通过动态调度的UL grant,或者通过指示ACK/NACK的下行控制信息,指示UE相应的自动上行发送的HARQ进程的LBT优先级分类信息。

[0040] 在一个实施例中,基站通过激活/去激活的下行控制信令触发/去触发自动上行发送,UE将根据接收到的激活/去激活信令,在预定义的时间窗内,尝试在可用于自动上行发送的第一个上行子帧成功完成LBT发送激活/去激活确定信令。

[0041] 在本公开的技术方案中,当进行信号发送前的载波监测时,进行方向性的载波监测,从而避免对非授权频段的其他节点造成干扰,提高了系统增益。

[0042] 根据本公开的又一个方面,提供了一种配置以及激活或者去激活自动上行发送的方法。基站在特定类型的载波上发送自动上行发送激活/去激活指示信令,和/或在特定类型的载波上接收自动上行发送激活/去激活确认指示信令。

[0043] 在一个实施例中,所述自动上行发送激活/去激活指示信令可以激活/去激活与发送所述信令在同一个载波,或者不同载波上的自动上行发送。

[0044] 在一个实施例中,所述自动上行发送激活/去激活确认指示信令在一个预定义的时间窗内的一个上行子帧发送。

[0045] 在一个实施例中,所述自动上行发送激活/去激活确认指示信令采用比承载数据的PUSCH更快的LBT类型。

[0046] 本公开的技术方案保证了自动上行传输LAA UE之间的公平性,以及自动上行传输和基于调度的LAA UE之间的公平性。同时,本公开的技术方案保证了LAAUE与其他接入技术的UE(例如WiFi终端)的友好共存。

附图说明

[0047] 通过下文结合附图的详细描述,本申请的上述和其它特征将会变得更加明显,其中:

[0048] 图1是示出了授权频段与非授权频段以载波聚合的方式联合布网的场景的示意图;

[0049] 图2是示出了LBT优先级分类对应的冲突窗、可占用最大时间以及回退参数的示意图;

[0050] 图3是示出了根据本申请一个实施例的自动上行发送的方法的流程图;

[0051] 图4是示出了根据本申请一个实施例的配置自动上行发送的流程图;

[0052] 图5是示出了根据本申请一个实施例的用户设备的框图;

[0053] 图6是示出了根据本申请一个实施例调整竞争窗口尺寸的两个示意图;

[0054] 图7是示出了根据本申请一个实施例调整竞争窗口尺寸的一个示意图。

具体实施方式

[0055] 下面结合附图和具体实施方式对本公开进行详细阐述。应当注意,本公开不应局限于下文所述的具体实施方式。另外,为了简便起见,省略了对与本公开没有直接关联的公开技术的详细描述,以防止对本公开的理解造成混淆。

[0056] 在本公开的下述实施例中,UE在非授权频段上进行信号发送前,可以不等待上行调度信令UL-grant,而是在用于自动上行发送的资源上选择发送资源,以发送上行信号。在UE发送上行信号之前,需要进行LBT。如果LBT成功,则可以发送,否则不能发送。

[0057] 所述用于自动上行发送的资源,由基站配置。例如,通过高层信令配置用于自动上行发送的时间资源。其中,时间资源的配置可以包含周期,例如现有LTE系统的半静态传输SPS的配置。

[0058] UE在非授权频段上进行信号发送前,需要接收激活信令(activation)。所述激活信令可以为物理层信令,例如LTE系统中的SPS激活信令。激活信令中指示自动上行发送的频域资源,以及时间资源的起点。

[0059] 如果UE发送了上行信号,但基站未正确解调,那么UE将再次发送所述上行信号。为描述方便,称为重传。但是本实施例不限定UE在重传时,标识当次传输为重传或者新传,也不限定UE采用的RV版本。所述重传也需要进行LBT。所述重传可以通过自动上行传输的方式进行发送。

[0060] 图3是示出了根据本申请一个实施例的自动上行发送的方法的流程图。

[0061] 在步骤301,UE获取先听后发LBT信息。

[0062] 例如,UE可以通过小区公共指示信息C-PDCCH获取LBT信息。备选地,UE也可以通过激活自动上行发送的信令获取LBT信息。备选地,UE也可以通过高层信令获取LBT信息。备选地,小区公共指示信息C-PDCCH和高层信令可以均包括LBT信息的一部分,而UE从小区公共指示信息C-PDCCH和高层信令两者获得LBT信息。

[0063] 在步骤302,UE根据LBT信息来确定LBT参数,并确定用于自动上行发送的发送参数。下面,详细讨论UE确定LBT参数的若干示例。

[0064] 由于自动上行发送与基于调度的上行发送所受到的干扰可能不同,例如,自动上行发送发生碰撞的概率大于基于调度的上行发送。并且,自动上行发送和基于调度的上行发送确定是否被基站成功接收的机制也可能是不同的,例如自动上行发送可以基于显示的ACK/NACK指示,因此,这两种调度方式的LBT参数的确定方式可能是不同的。例如,可根据以下方式中的一种或者多种,确定LBT参数:

[0065] (1.1) 自动上行发送与基于调度的上行发送的能量检测门限值是独立配置的。

[0066] LAAUE上行发送进行CCA检测时,根据检测到的信道能量是否超过门限 X_{Thresh} 确定信道是否空闲。其中, X_{Thresh} 不超过最大能量检测门限 $X_{\text{Thresh_max}}$ 。一种方式是,所述 $X_{\text{Thresh_max}}$ 由高层信令配置。那么,基站为自动上行发送与基于调度的上行发送分别配置 $X_{\text{Thresh_max}}$ 。另一种方式是,所述 $X_{\text{Thresh_max}}$ 由通过UE最大发送功率计算获得的 $X'_{\text{Thresh_max}}$ 以及高层信令配置的相对于 $X'_{\text{Thresh_max}}$ 的偏移量确定。那么,基站为自动上行发送与基于调度的上行发送分别配置所述偏移量。

[0067] (1.2) 自动上行发送与基于UL-grant的上行发送时,CWS的调整是完全独立的或者部分独立的。例如,可以是以下多种方式中的一种:

[0068] -对于同一个HARQ处理的上行发送,如果存在自动上行发送与基于UL-grant的混

合使用,则发送端和/或接收端分别维护CWS。

[0069] 例如,同一个数据,初始发送为自动发送的,而重传为基于UL-grant的,则自动发送与基于UL-grant的发送分别维护CWS。自动发送的PUSCH的ACK/NACK(可以通过显示的指示ACK/NACK,或者与现有技术一样,通过UL-grant的NDI来隐示的指示ACK/NACK。为描述方便,统一称为ACK/NACK)不用于调整基于UL-grant的上行发送的CWS调整,反之亦然。即,这两种上行发送所在子帧不能作为对方调整CWS的参考子帧。

[0070] 基于UL-grant调度,又可以细分为,基于动态UL-grant调度,例如通过C-RNTI加扰的DCI,以及用于自动上行发送的UL-grant调度,例如通过X-RNTI加扰的DCI,其中自动上行发送的激活DCI就是采用X-RNTI加扰。X-RNTI可以是新定义的,也可以重用半静态调度SPS C-RNTI。较优的,对于自动上行发送与基于动态UL-grant调度的上行发送分别维护CWS,但是用于自动上行发送的UL-grant调度的上行与自动上行发送维护同一套CWS。

[0071] -对于同一个HARQ处理的上行发送,如果存在自动上行发送与基于UL-grant的混合使用,则自动上行发送对应的ACK/NACK可用于基于UL-grant调度的上行发送的CWS调整,但基于UL-grant调度的上行发送对应的ACK/NACK不可用于自动上行发送的CWS调整。进一步的,基于第一类LBT的自动上行发送对应的ACK/NACK可用于基于UL-grant调度的上行发送的CWS调整,但基于UL-grant调度的上行发送对应的ACK/NACK不可用于自动上行传输的上行发送的CWS调整。

[0072] 较优的,基于第一类LBT的自动上行发送和/或用于自动上行发送的UL-grant调度的上行发送对应的ACK/NACK可用于基于动态UL-grant调度的上行发送的CWS调整,但基于UL-grant调度的上行发送对应的ACK/NACK不可用于自动上行传输的上行发送和/或用于自动上行发送的UL-grant调度的上行发送对应的CWS调整。

[0073] -对于同一个HARQ处理的上行发送,如果存在自动上行发送与基于UL-grant的混合使用,则自动上行发送对应的ACK/NACK不可用于基于UL-grant调度的上行发送的CWS调整,但基于UL-grant调度的上行发送对应的ACK/NACK可用于自动上行发送的CWS调整。进一步的,自动上行发送对应的ACK/NACK不可用于基于UL-grant调度的上行发送的CWS调整,但基于UL-grant调度的并且基于第一类LBT的上行发送对应的ACK/NACK可用于自动上行发送的CWS调整。

[0074] 较优的,自动上行发送和/或用于自动上行发送的UL-grant调度的上行发送对应的ACK/NACK不可用于基于动态UL-grant调度的上行发送的CWS调整,但基于UL-grant调度的并且基于第一类LBT的上行发送对应的ACK/NACK可用于自动上行发送和/或用于自动上行发送的UL-grant调度的上行发送对应的CWS调整。

[0075] -对于同一个HARQ处理的上行发送,如果存在自动上行发送与基于UL-grant的混合使用,自动上行发送或者用于自动上行发送的UL-grant调度的上行发送(X-RNTI加扰)的CWS与基于Y-RNTI加扰的UL grant调度的动态传输的CWS是独立或者部分独立的。自动上行发送的激活采用X-RNTI加扰(X-RNTI可以是新定义的,也可以重用现有标准的SPS C-RNTI),自动上行发送的重传由X-RNTI加扰的UL grant调度,或者自动上行发送的重传由承载ACK/NACK指示的DCI(可以同时包含HARQ进程信息)触发。显然,确定X-RNTI加扰的UL grant调度的PUSCH的CWS时,可以根据UL grant的NDI的值确定,例如NDI=1表示重传,则CWS增加,又例如,如果DCI指示为NACK,则自动上行发送的重传的PUSCH的CWS增加,如果是

ACK,则自动上行发送的重传的PUSCH的CW重置。但是对于一个HARQ处理基于Y-RNTI加扰的UL grant调度的PUSCH,例如Y-RNTI为用于动态调度的C-RNTI,并且这个HARQ处理进程的上一次传输是由X-RNTI加扰调度的,或者是自动上行传输的,那么Y-RNTI加扰的UL grant调度的PUSCH的LBT的CWS的调整,不参考上一次传输是否成功。例如,不根据Y-RNTI加扰的UL grant的NDI的值确定CWS的调整。一种实现方式,上一次传输是由X-RNTI加扰调度的,或者是自动上行传输的,不作为Y-RNTI加扰的UL grant调度的PUSCH的CWS调整的参考子帧。可以继续往前找到上一次由Y-RNTI加扰的UL grant调度的PUSCH,比较上一次UL grant的NDI与当前UL grant的NDI,如果翻转,则重置CWS,否则增加CWS。这样做的好处是,在实际系统中,如果前一次调度是自动上行传输或者基于X-RNTI加扰的传输,当前出现Y-RNTI加扰的UL grant无论NDI指示的值是多少,均认为这个HARQ处理调度了一个新的传输块。但很可能这个HARQ处理的上一次传输并未成功。并且,Y-RNTI加扰的UL grant,NDI值的确定方式,往往与X-RNTI的UL grant的NDI值确定方式不同。因此,无法通过比较这两者的值,确定上一次传输是否成功。

[0076] (1.3) 自动上行发送与基于调度的上行发送的连续使用冲突窗(CW)的最大值 $CW_{\max,p}$ 的次数K是独立配置的。

[0077] LAA UE上行发送进行第一类LBT时,根据LBT优先级分类来确定CW的最大值和最小值,分别记为 $CW_{\max,p}$ 和 $CW_{\min,p}$ 。其中,如果连续K次,冲突窗的长度 $CW_p = CW_{\max,p}$,则冲突窗的长度 CW_p 重置, $CW_p = CW_{\min,p}$ 。基站为自动上行传输的上行发送与基于调度的上行发送分别配置K,分别记为K1和K2。

[0078] 例如,UE有两个HARQ处理。其中HARQ处理1为基于UL-grant调度的,另一个HARQ处理2为自动上行发送。那么,这两个HARQ处理的CWS是独立维护的,并且,K1和K2是分别配置的。

[0079] (1.4) 上行发送的CWS,根据参考子帧的上行发送的ACK/NACK,确定CWS的大小。

[0080] 较优的,所述ACK/NACK为通过物理层信令承载的显示指示的ACK/NACK。例如基于用户组的(UE-group based)DCI指示多个UE的ACK/NACK。

[0081] 所述上行发送可以仅为自动上行发送和/或者用于自动上行发送的UL-grant调度的上行发送,或者,所述上行发送可以为自动上行发送,用于自动上行发送的UL-grant调度的上行发送,也可以为基于动态UL-grant调度的上行发送。

[0082] 较优的,如果所述参考子帧的上行发送至少有一个是ACK,那么上行发送的所有LBT优先级的CWS重置。否则,例如所述参考子帧的上行发送都是NACK,或者UE没有收到任何ACK/NACK指示(可以为指示ACK/NACK的DCI,或者是调度所述参考子帧的上行发送的重传或者新传的UL-grant),那么,所有LBT优先级的CWS增大。其中,参考子帧为需确定CWS调整的上行发送的上一次传输对应的ACK/NACK指示所在的子帧 n_0 再往前至少4个子帧的最近的一次基于第一类LBT的上行发送突发(上行突发的结束子帧不晚于子帧 n_0-4)的第一个子帧。

[0083] 较优的,所述参考子帧的ACK/NACK指示早于基于所述参考子帧确定CWS调整的上行子帧,并且与基于所述参考子帧确定CWS调整的上行子帧的时间差不小于X子帧。

[0084] 如图6(a)所示,假设上行HARQ进程#1与上行HARQ进程#3在子帧 $n-9$ 和子帧 $n-7$ 发送,分别采用的是第二类LBT和第一类LBT。在子帧 n 和子帧 $n+1$,UE分别收到了HARQ进程#1的NACK和进程#3的ACK。UE尝试在对应于HARQ进程#1的位置重传,在HARQ进程#3的位置新传。

那么, HARQ进程#1的上行发送的CWS可以根据HARQ进程#1的ACK/NACK指示所在下行子帧n往前找到的第一个基于第一类LBT发送的上行子帧确定参考子帧。所述参考子帧为子帧n-7, 其中发送的HARQ进程#3成功发送, 基站在子帧n+1发送了ACK。因此, 子帧n+7的上行发送的CWS重置。

[0085] 又如图6 (b) 所示, 假设上行HARQ进程#1与上行HARQ进程#3在子帧n-9和子帧n-7发送, 分别采用的是第二类LBT和第一类LBT。在子帧n, UE收到了HARQ进程#1的NACK。UE尝试在对应于HARQ进程#1的位置重传。那么, HARQ进程#1的上行发送的CWS可以根据HARQ进程#1的ACK/NACK指示所在下行子帧n往前找到的第一个基于第一类LBT发送的上行子帧确定参考子帧。所述参考子帧为子帧n-7。由于UE一直未收到子帧n-7发送的HARQ进程#3的ACK/NACK指示, UE将子帧n+7的上行发送的CWS增加。可以看出, 虽然HARQ进程#3的上行发送被基站成功接收, 但是由于基站未及时反馈ACK, 而是在下行子帧n+8才反馈ACK, UE只能增加CWS。

[0086] (1.5) 自动上行发送的CWS调整的参考子帧为早于UE拟进行自动上行发送的上行子帧 n_0 , 并且与所述上行子帧的时间差至少不小于X子帧的第一个通过第一类LBT占用信道的上行突发(上行突发的结束子帧不晚于子帧 n_0-X)的第一个上行子帧。

[0087] 与基于UL-grant调度, 或者基于ACK/NACK反馈的DCI触发的上行发送不同, 这里描述的自动上行发送是指, 在一段时间内并未收到UL-grant调度或者ACK/NACK反馈的DCI。例如, 当基站激活了SPS发送时, UE并没有业务需要发送, 则UE不发送上行数据。过了一段时间, 当有新的数据包到来, UE可以在激活的SPS资源上进行自动上行发送。或者, 当UE成功发送完一组数据包后, 缓存中没有需发送的数据, UE将停止发送。过了一段时间, 当有新的数据包到来, UE可以在激活的SPS资源上进行自动上行发送。又或者, 基于定时器的新传或重传中, UE在预定义的时间窗内未收到任何用于触发UE进行新传或重传的下行控制信令, 则UE可以在时间窗结束后, 在相应的SPS资源上进行自动上行发送。

[0088] 对于以上描述的自动上行发送, UE需确定CWS的大小。那么, 参考子帧为UE拟进行自动上行发送的子帧 n_0 往前至少X个子帧的第一个通过第一类LBT占用信道的上行突发(上行突发的结束子帧不晚于子帧 n_0-X)的第一个上行子帧。较优的, X为预定义的值, 例如X=4。

[0089] (1.6) 如果参考子帧所在的上行突发中, UE尝试上行发送却无法在至少一个上行子帧中进行发送, 则CWS不变。

[0090] 所述第一个上行突发, 可以包含一个或者多个连续的上行子帧。

[0091] 所述第一个上行突发, 只能是基于动态UL-grant调度的上行突发, 或者, 只能是基于动态UL-grant调度或者用于自动上行发送的UL-grant调度的上行突发, 或者, 可以是任何上行突发, 其中包括可以是自动上行发送的上行突发。

[0092] (1.7) 如果有至少两个基于自动上行发送的上行子帧的CWS的调整对应于同一个参考子帧, 则将第一个上行子帧的CWS根据参考子帧是否被基站正确接收调整, 而后面的上行子帧的CWS的取值, 和第一个上行子帧的取值相同。

[0093] 如图7所示, 假设自动上行发送的周期是2ms, 有两个HARQ进程。假设上行HARQ进程#1与上行HARQ进程#2在子帧n-9和子帧n-7发送, 分别采用的是第二类LBT和第一类LBT。在子帧n和子帧n+1, UE收到了HARQ进程#1的ACK, 和HARQ进程#2的NACK。UE尝试在对应于HARQ进程#1的位置新传, 对应于HARQ进程#2的位置重传。那么, HARQ进程#1的上行发送的

CWS可以根据HARQ进程#1的ACK/NACK指示所在下行子帧 n 往前找到的第一个基于第一类LBT发送的上行子帧确定参考子帧。所述参考子帧为子帧 $n-7$ 。HARQ进程#2的上行发送的CWS可以根据HARQ进程#2的ACK/NACK指示所在下行子帧 $n+1$ 往前找到的第一个基于第一类LBT发送的上行子帧确定参考子帧。所述参考子帧也是子帧 $n-7$ 。那么,由于子帧 $n-7$ 的上行发送对应的NACK子帧 $n+1$ 收到,所以,子帧 $n+7$ 的上行发送的CWS增加,而子帧 $n+9$ 的CWS和子帧 $n+7$ 的CWS一样。

[0094] (1.8) 自动上行发送,或者基于用于自动上行发送的UL-grant调度的上行发送的LBT优先级可以由以下几种方式中的一种或者多种确定:

[0095] -当有多个HARQ进程可用时,可以通过一个激活DCI指示所有进程的LBT优先级。所述LBT优先级由所有HARQ进程中最低的LBT优先级(LBT priority class的索引编号最高的)确定。

[0096] -当有多个HARQ进程可用时,可以通过一个激活DCI指示所有进程的LBT优先级。所述指示的LBT优先级由所有HARQ进程中最高的LBT优先级(LBT priority class的索引编号最低的)确定。在各个HARQ进程中采用的LBT优先级,可以不限于所述指示的LBT优先级,但不能更高。

[0097] -基于用于自动上行发送的UL-grant在调度重传或者新传时,可以指示新的LBT优先级,覆盖激活DCI中指示的LBT优先级。

[0098] -指示ACK/NACK的DCI中,不仅指示HARQ进程索引,所述进程的ACK/NACK,还可以指示所述HARQ进程的新的LBT优先级,覆盖激活DCI中指示的LBT优先级。

[0099] -基于动态UL-grant调度的新传或者重传时,可以指示新的LBT优先级,覆盖激活DCI中指示的LBT优先级。

[0100] 优选地,基于自动的上行发送只采用第一类LBT,而不采用第二类LBT。当UE接收到MCOT指示信息,且UE拟进行自动上行发送的上行子帧位于所述MCOT指示信息指示的上行子帧集合内,UE仍然只采用第一类LBT。所述MCOT指示信息指示的上行子帧集合,可以根据Rel-14LAA的C-PDCCH中的“LAA上行配置”比特域确定,即通过“上行偏移UL offset”以及“上行持续时间UL duration”确定。

[0101] 优选地,基于自动上行传输的上行发送可以采用第一类LBT,也可以采用第二类LBT。

[0102] 当UE接收到MCOT指示信息,且UE拟进行自动上行发送的上行子帧位于所述MCOT指示信息指示的上行子帧集合内,UE可以采用第二类LBT。

[0103] 优选地,若UE的自动上行发送采用第二类LBT,当LBT成功后,若UE连续发送 k 个子帧,且各个子帧间无间隔,那么这 k 个子帧必须均位于所述MCOT指示信息指示的上行子帧集合内。如果这 k 个子帧有部分位于所述MCOT指示信息指示的上行子帧集合之外,则只能进行第一类LBT,或者位于所述MCOT指示信息指示的上行子帧集合外的子帧,需要重新进行第一类LBT。

[0104] 优选地,若UE的自动上行发送采用第一类LBT,当LBT成功后,若UE连续发送 k 个子帧,这 k 个子帧在子帧维度是连续的,但是子帧间有间隔,例如,UE连续发送4个子帧,但每个子帧的最后一个符号和/或第一个符号是空出的。那么,在由UE进行第一类LBT所确定的MCOT内的这些子帧,可以进行第二类LBT。

[0105] 在另一个实施例中,当UE拟进行自动上行传输时,UE可根据以下方式中的一种或者多种,基于LBT的类型和/或LBT优先级分类来确定发送参数。所述发送参数可以为新传的发送参数,也可以为重传的发送参数。例如,所述发送参数可以为用于上行发送的资源的时间参数,或者频域参数,或者是否可进行上行发送的指示,或者上行发送的业务类型等等。

[0106] 当所述发送参数为是否可进行上行发送的指示时,可以根据以下两种方式确定是否可进行上行发送:

[0107] (2.1) 根据LBT的类型,确定是否可以在用于自动传输的资源上发送信号。

[0108] 假设UE是否在所述用于自动传输的资源上发送信号,是根据UE产生的随机数与设定的门限进行比较。如果所述随机数超过预定义的门限,则可以发送,否则不可以发送(当然,如果LBT失败,也无法发送)。那么,可以通过为第一类LBT和第二类LBT分别配置门限Thr1和Thr2,且Thr1低于Thr2,使得UE产生的随机数大于Thr1的概率大于随机数大于Thr2的概率。因此,在同一个子帧内,尝试发送自动上行传输的上行信号的基于第一类LBT的UE数大于尝试发送自动上行传输的上行信号的基于第二类LBT的UE数。或者,对于第一类LBT和第二类LBT均采用相同的门限,但UE在产生随机数时,将LBT类型作为加权因子,使得第一类LBT的UE以更大的概率产生更大的随机数。本方法也适用于通过其他方式确定拟进行自动上行发送的资源。

[0109] 本方法可以降低可能选择在同一个资源上拟进行自动上行发送,且基于第二类LBT UE的数量,从而降低第二类LBT的UE间的碰撞概率。因为选择在同一个子帧内尝试发送自动上行传输的上行信号的各个基于第二类LBT的UE,均在相同位置进行25us LBT,无法发现对方,因此各个UE间的碰撞概率较大。而选择在同一个子帧内尝试发送自动上行传输的上行信号的各个基于第一类LBT的UE可以进一步通过不同的CWS,减少各个UE间的碰撞。

[0110] (2.2) 根据LBT优先级分类,确定是否可以在用于自动传输的资源上发送信号。

[0111] 假设UE是否在所述用于自动传输的资源上发送信号,是根据UE产生的随机数与设定的门限进行比较,如果所述随机数超过预定义的门限,则可以发送,否则不可以发送(当然,如果LBT失败,也无法发送)。那么,可以通过为不同的LBT priority class分别配置门限,例如,为表1中的4个LBT优先级分类分别设定门限,或者设定k($k < 4$)个门限分别对应一个或者多个LBT优先级分类,将较高的LBT优先级对应的门限设得较低,使得较高LBT优先级的业务以更大的概率可以发送,以保证具有较高QCI的业务以更低的碰撞及时传输。或者,仅有一个门限,但UE在产生所述随机数时,将LBT优先级分类作为加权因子,使得较高的LBT优先级的UE以更大的概率产生更大的随机数。

[0112] 本方法尤其适用于采用第二类LBT的UE。由于第二类LBT,不区分LBT优先级分类,均在相同位置进行25us LBT。因此,可能出现QCI较高的业务与QCI较低的业务发生碰撞。本方法通过为QCI较高的业务(即LBT优先级分类取值较小)设定较低的门限,QCI较低的业务设定较高的门限,减少了QCI较低的业务对QCI较高的业务的影响。

[0113] 同理,也可以根据(2.1)或者(2.2)的方式确定用于自动上行发送的资源的时间参数。

[0114] 当所述发送参数为自动上行发送的资源的时间或者频域参数时,UE根据基站的配置信息确定。其中,所述配置信息可以包含所述自动上行发送的资源对应的LBT优先级分类信息。UE可以根据要发送的自动上行传输的LBT优先级分类,确定自动上行发送的资源。

[0115] 当所述发送参数为自动上行发送的时间长度和/或业务类型时,可根据以下几种方式中的一种确定发送参数:

[0116] (3.1) 若UE的自动上行发送采用第二类LBT,UE可通过基站的指示信息,确定基站发送当前MCOT内的下行传输时采用的LBT优先级分类,并且UE根据所述LBT优先级分类,确定UE上行发送参数(例如可发送的子帧长度),UE实际发送的业务的QCI由UE决定。在确定所述子帧长度时,UE需保证,所述子帧长度不超过传输所有与所述LBT优先级分类相同或者比所述LBT优先级分类的索引更低的(即LBT优先级更高的)的业务所需的最少子帧数。或者,UE根据所述LBT优先级分类,确定UE上行发送参数:可发送的子帧长度,以及UE实际发送的业务的QCI。即UE实际发送的业务的QCI对应的LBT优先级分类索引不能超过所述LBT优先级分类索引。所述基站的指示信息,可通过小区公共信令C-PDCCH承载,即在C-PDCCH中指示送当前MCOT内的下行传输时采用的LBT优先级分类。

[0117] (3.2) 若UE的自动上行发送采用第二类LBT,UE可通过基站的指示信息,确定在当前MCOT内的上行传输时可采用的LBT优先级分类,并且UE根据所述LBT优先级分类,确定可发送的子帧长度,或者进一步确定采用第二类LBT的自动上行发送可用的LBT优先级分类。在确定所述子帧长度时,UE需保证,所述子帧长度不超过传输所有与所述LBT优先级分类相同或者比所述LBT优先级分类的索引更低的(即LBT优先级更高的)的业务所需的最少子帧数。

[0118] (3.3) 当UE接收到MCOT_1指示信息,以及指示下行传输的截止符号信息,且UE拟进行自动上行发送的上行子帧位于MCOT_1内,并且UE拟进行自动上行发送的上行子帧紧临所述指示下行传输的截止子帧或者与所述指示下行传输的截止子帧为同一个子帧,那么,如果UE可以在所述指示下行传输的截止符号后完成第二类LBT,UE就可以从所述下行传输的截止符号后的25us处开始发送自动上行发送,否则只能进行第一类LBT。如果是连续多子帧发送,则连续发送的上行子帧应该属于所述MCOT_1内。

[0119] 例如,基站在多个下行载波中,选择一个下行载波X进行Cat-4LBT,并且在其他载波Y,Z上进行25us LBT(即多载波的Type B LBT,如TS 36.213 15.1.5.2)。假设在子帧0,下行载波X的LBT成功,以及下行载波Y的LBT成功,那么,基站可以在载波X与Y上,与被基站服务的UE共享MCOT,假设MCOT=4ms,也就是说,在子帧0~3之间,如果存在上行子帧,所述上行子帧属于MCOT内。对于载波Y,我们称共享的MCOT为MCOT_1(MCOT_1和MCOT长度相同)。在载波X上,在MCOT内的所有上行传输,均可以采用第二类LBT。在载波Y上,当且仅当上行传输与MCOT内的下行传输的间隔小于等于25us时,上行传输才可采用第二类LBT,否则即使在MCOT内,上行传输也必须采用第一类LBT。假设基站从子帧0开始发送下行传输,直到子帧2的第3个符号截止。MCOT_1长度为4。假设子帧2为自动上行发送资源子帧。那么,UE可以根据下行时间(DL timing),从第4个符号开始进行第二类LBT,即25us CCA,如果信道空闲,则UE可以从子帧2的第4个符号的25us之后开始发送自动上行传输上行信号,即根据上行时间(UL timing),从子帧2的第4个符号的(25+TA)us开始,其中TA(timing advance)为上行时间提前量。

[0120] 在步骤303,UE根据所确定的LBT参数来执行LBT操作,并基于发送参数来确定是否能够在自动上行发送资源上发送信号。如果LBT成功,则UE可以在自动上行发送资源上发送上行信号。如果LBT失败,UE放弃发送。

[0121] 优选地,所述自动上行发送资源可以是基站配置的。例如,可以通过高层信令来配置和/或通过物理层触发信令来配置。所述自动上行发送资源可以包括:上行发送的时频资源(例如周期,时间偏移量,PRB资源,或者带宽部分BWP)、调制编码方式(MCS)、参考符号参数(例如参考符号序列,或者正交码字OCC,或者循环位移Cyclic shift)。此外,所述自动上行发送资源还可以包括其他的必要信息,例如冗余版本信息(RV)、重复发送次数K等。可参见步骤401,402中的配置。

[0122] 优选地,UE根据步骤303进行自动上行发送后,在特定类型的下行载波上,接收针对所述自动上行发送的HARQ-ACK反馈。

[0123] 优选地,所述特定类型的下行载波为Pcell或者pSCell。

[0124] 优选地,所述特定类型的下行载波为授权频段载波,并且所述授权频段载波由基站配置。例如,所述授权频段载波为步骤402中发送用于触发自动上行发送或指示自动上行发送失效的指示信息所在的载波。例如,基站在授权频段载波CC₂上发送触发自动上行发送的指示,触发UE可以在非授权频段载波CC₃上进行自动上行发送,则UE在CC₃上进行自动上行发送后,将在CC₂上接收HARQ-ACK反馈。

[0125] 优选地,所述特定类型的下行载波为激活自动上行传输的载波。

[0126] 优选地,接收所述HARQ-ACK反馈的时间,由所述自动上行发送的时间以及预定义的时间偏移确定。

[0127] 优选地,所述HARQ-ACK反馈由PHICH信道承载,或者由PDCCH承载。所述PDCCH可不包含调度信息,仅包含HARQ-ACK信息,并且这个PDCCH是多个UE公用的,不同UE的HARQ-ACK在PDCCH中占用不同的比特位。优选地,所述PDCCH包含各个UE的HARQ进程信息。

[0128] 优选地,UE根据接收到的所述HARQ-ACK反馈,确定自动上行发送的重传或者发送新的数据。

[0129] 优选地,UE进行自动上行发送的重传或者发送新的数据的时间根据接收到的所述HARQ-ACK反馈的时间以及预定义的时间偏移来确定。

[0130] 优选地,UE进行自动上行发送的重传或者发送新的数据的时间根据接收到的所述HARQ-ACK反馈的时间以及预定义的时间偏移来确定时间窗的起点,根据预定义的时间窗的长度,确定时间窗的终点。UE在这个时间窗内,进行LBT,尝试在自动上行发送资源上进行自动上行发送的重传或者发送新的数据。进一步的,有多个HARQ进程时,UE尝试在对应的HARQ进程的自动上行发送资源上进行自动上行发送的重传或者发送新的数据。

[0131] 优选地,对于同一个HARQ进程,如果UE既收到了所述HARQ-ACK反馈,又收到了UL grant,则UE根据UL grant的指示,确定PUSCH的发送。

[0132] 优选的,UE自动上行发送的PUSCH中,包含与HARQ process相关的信息,例如HARQ ID。可以通过显示的比特指示,或者通过DMRS来间接的指示。

[0133] 图4是示出了根据本申请一个实施例的配置自动上行发送的流程图。

[0134] 在步骤401,基站配置用于自动上行发送的资源。

[0135] 所述用于自动上行发送的资源至少包含时间资源。其中,时间资源的配置可以包含周期。时间资源的配置,可以是比特映射的形式。

[0136] 优选的,所述用于自动上行发送的资源还可以包含频域资源,例如上行载波信息。

[0137] 优选的,用于自动上行发送的资源还可以包含所述自动上行发送资源所对应的

HARQ过程的相关信息,例如HARQ process ID等。

[0138] 优选的,用于自动上行发送的资源还可以包含LBT相关信息,例如所述自动上行发送可采用的LBT优先级,或者LBT类型信息等等。

[0139] 所述配置用于自动上行发送资源的信令为RRC信令,或者MAC层控制元素CE,或者物理层控制信息,或者多种信息的结合。所述物理层控制信息,可以包含于步骤402中,基站发送的用于触发自动上行发送的指示信息。所述物理层控制信息,可以为C-PDCCH。

[0140] 在步骤402,基站发送用于激活自动上行发送或指示自动上行发送失效的指示信息。

[0141] 优选的,所述指示信息通过物理层信令承载,例如LTE系统中的SPS激活信令,或者SPS去激活信令。

[0142] 优选的,所述指示信息还可以包含LBT相关信息,例如所述自动上行发送可采用的LBT优先级,或者LBT类型信息等等。

[0143] 优选的,所述指示信息包含指示自动上行发送频域资源的信息,例如占用的物理资源块PRB信息,或者对应的上行载波的索引信息。

[0144] 优选的,所述指示信息包含指示步骤403中自动上行发送确认或者自动上行发送失效确认信息的频域资源,例如所述信息占用的物理资源块PRB信息,或者对应的上行载波的索引信息。

[0145] 优选的,所述自动上行发送频域资源的PRB信息与自动上行发送确认或者自动上行发送失效确认信息的PRB信息相同。

[0146] 优选的,所述指示信息包含指示自动上行发送失效对应的上行载波的索引信息,即哪一个上行载波的自动上行发送失效。

[0147] 优选的,所述指示信息包含指示可用于自动上行发送的时间资源的起点。

[0148] 优选的,基站只能在授权频段发送所述指示信息。

[0149] 优选的,基站只能在主载波Pcell或者主辅载波Pscell上发送所述指示信息。

[0150] 例如,当基站发送用于触发在非授权频段载波CC₂上的自动上行发送指示信令时,基站只能在Pcell CC₁上发送所述指示信令。所述指示信令包含载波指示信息,例如3比特的CIF,触发CC₂上的自动上行发送。

[0151] 优选的,当基站在非授权频段载波发送自动上行发送或者自动上行发送失效的指示时,并所述指示所在的下行传输突发中不包含其他的下行传输,则基站可采用与承载普通数据的PDSCH或者调度普通数据的PDCCH不同类型的LBT。例如,可以采用25us的LBT,或者,可以采用最高的优先级别的Cat 4 LBT,例如竞争窗长度CWS可以设定为[3,7]。

[0152] 在步骤403,基站在特定类型的上行载波上接收来自UE的自动上行发送确认或者自动上行发送失效确认的指示。

[0153] 优选的,所述特定类型的上行载波为授权频段的上行载波。

[0154] 优选的,所述特定类型的上行载波为Pcell或者Pscell。

[0155] UE在授权频段上发送自动上行发送确认或者自动上行发送失效确认的指示的好处是,可以保证及时的发送所述指示。如果在非授权频段上发送自动上行发送确认或者自动上行发送失效确认的指示,可能由于信道忙,UE无法在指定时间或指定之内成功完成LBT,从而无法发送自动上行发送确认或者自动上行发送失效确认的指示,导致基站不清楚

UE是因为没有收到触发自动上行发送或指示自动上行发送失效的指示信息,还是未成功占用信道。

[0156] 优选的,所述特定类型的上行载波为步骤402中发送用于触发自动上行发送或指示自动上行发送失效的指示信息的下行载波对应的上行载波。其对应关系,由高层信令配置,或者定义为UE发送的自动上行发送确认或者自动上行发送失效确认的指示信息所在的载波与UE接收到用于触发自动上行发送或指示自动上行发送失效的指示信息所在的载波为同一个载波。

[0157] 优选的,所述自动上行发送确认或者自动上行发送失效确认的指示信息包含载波索引信息,即可以指示所述确认指示信息是哪一个上行载波的确定指示信息。例如,在上面这个例子中,所述确认指示信息包含上行载波CC₂的信息。

[0158] 优选的,在所述所述特定类型的载波上发送自动上行发送确认或者自动上行发送失效确认的指示信息所占用的时频资源通过步骤402中的用于触发自动上行发送或指示自动上行发送失效的指示信息确定。例如,发送所述自动上行发送确认信息占用的时频资源为所述自动上行发送的时频资源,但所在载波可以不同。又例如,发送所述自动上行发送确认信息占用的频域资源是高层半静态配置的,时间资源通过所述自动上行发送指示信息确定,例如时间资源为相对于收到自动上行发送指示信息的子帧之后的第X个子帧。

[0159] 优选的,所述特定类型的上行载波为自动上行发送所在的载波,即可以为非授权频段载波。一种实现方式,根据步骤402中发送用于触发自动上行发送或指示自动上行发送失效的指示信息的发送时间,确定自动上行发送确认或者自动上行发送失效确认的指示信息的唯一发送子帧。所述发送子帧为用于自动上行发送的子帧,例如,根据触发自动上行发送的指示信息,确定的第一个可用的自动上行发送的子帧。另一种实现方式,为了提高发送所述确认指示信息的概率,在一个时间窗口内,UE将进行CCA检测,尝试在上行子帧发送自动上行发送确认或者自动上行发送失效确认的指示。如果在所述时间窗内UE无法发送自动上行发送确认或者自动上行发送失效确认的指示,UE放弃发送所述指示。优选的,所述时间窗口以步骤402中发送用于触发自动上行发送或指示自动上行发送失效的指示信息所在的子帧,或者根据步骤402中触发自动上行发送的指示信息确定的第一个可用的自动上行发送的子帧为参考点,连续X_r个帧为所述时间窗。在所述时间窗内,UE需根据基站指示的上下行信息,确定可用于自动上行传输的上行子帧。

[0160] 优选的,UE在非授权频段载波发送自动上行发送确认或者自动上行发送失效确认的指示时,可采用与承载普通数据的PUSCH不同类型的LBT。例如,可以采用25us的LBT,或者,可以采用最高的优先级别的Cat 4LBT,例如竞争窗长度CWS可以设定为[3,7]。

[0161] 图5是示出了根据本申请一个实施例的用户设备的框图。如图5所示,用户设备UE 500包括获取单元510、确定单元520和LBT操作单元530。

[0162] 获取单元510被配置为获取先听后发LBT信息。例如,获取单元510可以通过小区公共指示信息C-PDCCH获取LBT信息。备选地,获取单元510也可以通过高层信令获取LBT信息。备选地,获取单元510也可以通过小区公共指示信息C-PDCCH和高层信令两者来获取LBT信息。

[0163] 确定单元520被配置为根据LBT信息来确定LBT参数,并确定用于自动上行发送的发送参数。具体地,确定单元520可以执行上文针对图3中的步骤302所描述的详细操作,此

处不再赘言。

[0164] LBT操作单元530被配置为根据所确定的LBT参数来执行LBT操作,并基于发送参数来确定是否能够在自动上行发送资源上发送信号。具体地,LBT操作单元530可以执行上文针对图3中的步骤303所描述的详细操作,此处不再赘言。

[0165] 用于实现本公开各实施例功能的程序可以记录在计算机可读记录介质上。可以通过使计算机系统读取记录在所述记录介质上的程序并执行这些程序来实现相应的功能。此处的所谓“计算机系统”可以是嵌入在该设备中的计算机系统,可以包括操作系统或硬件(如外围设备)。“计算机可读记录介质”可以是半导体记录介质、光学记录介质、磁性记录介质、短时动态存储程序的记录介质、或计算机可读的任何其他记录介质。

[0166] 用在上述实施例中的设备的各种特征或功能模块可以通过电路(例如,单片或多片集成电路)来实现或执行。设计用于执行本说明书所描述的功能的电路可以包括通用处理器、数字信号处理器(DSP)、专用集成电路(ASIC)、现场可编程门阵列(FPGA)、或其他可编程逻辑器件、分立的门或晶体管逻辑、分立的硬件组件、或上述器件的任意组合。通用处理器可以是微处理器,也可以是任何现有的处理器、控制器、微控制器、或状态机。上述电路可以是数字电路,也可以是模拟电路。因半导体技术的进步而出现了替代现有集成电路的新的集成电路技术的情况下,本公开的一个或多个实施例也可以使用这些新的集成电路技术来实现。

[0167] 此外,本公开并不局限于上述实施例。尽管已经描述了所述实施例的各种示例,但本公开并不局限于此。安装在室内或室外的固定或非移动电子设备可以用作终端设备或通信设备,如AV设备、厨房设备、清洁设备、空调、办公设备、自动贩售机、以及其他家用电器等。

[0168] 如上,已经参考附图对本公开的实施例进行了详细描述。但是,具体的结构并不局限于上述实施例,本公开也包括不偏离本公开主旨的任何设计改动。另外,可以在权利要求的范围内对本公开进行多种改动,通过适当地组合不同实施例所公开的技术手段所得到的实施例也包含在本公开的技术范围内。此外,上述实施例中所描述的具有相同效果的组件可以相互替代。

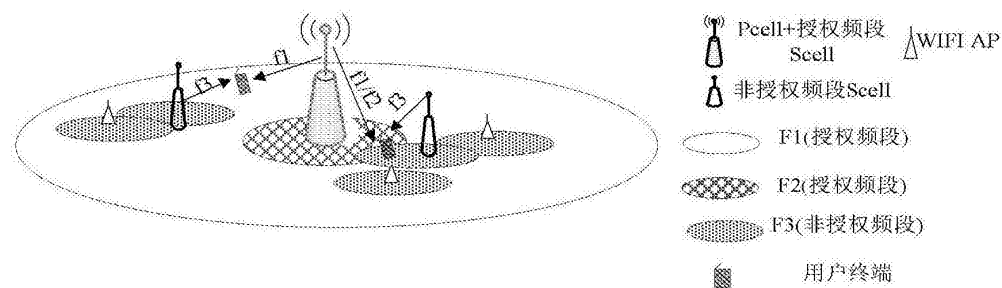


图1

LBT 优先级分类	n	CW _{最小}	CW _{最大}	MCOT	CWS 的集合
1	2	3	7	2 ms	{3,7}
2	2	7	15	4 ms	{7,15}
3	3	15	1023	6ms 或 10 ms	{15,31,63,127,255,511,1023}
4	7	15	1023	6ms 或 10 ms	{15,31,63,127,255,511,1023}

LBT 优先级分类对应的冲突窗，可占用最大时间以及回退参数

图2

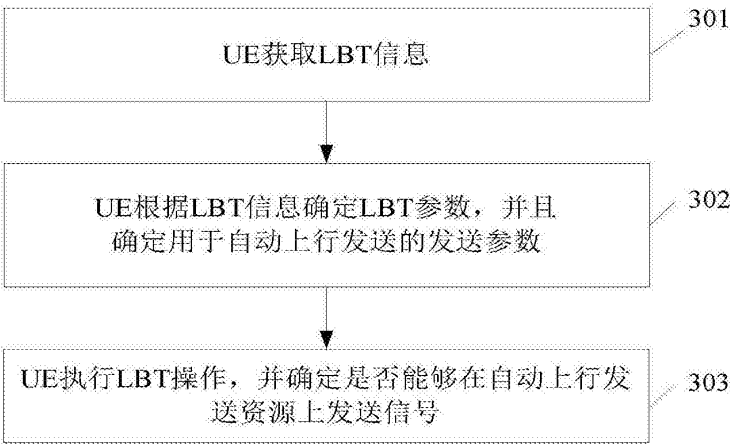


图3

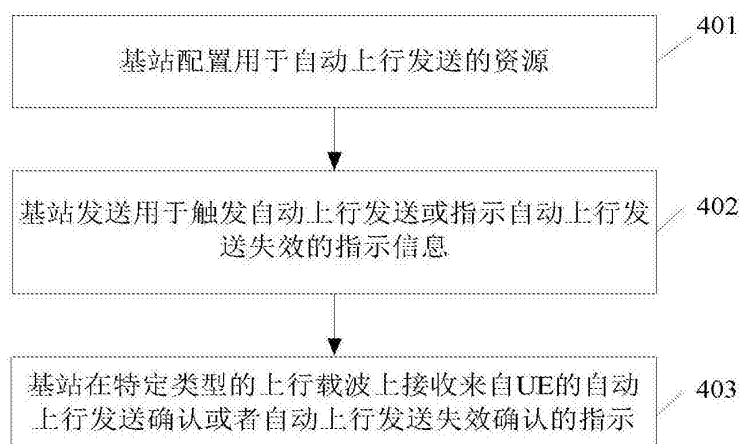


图4

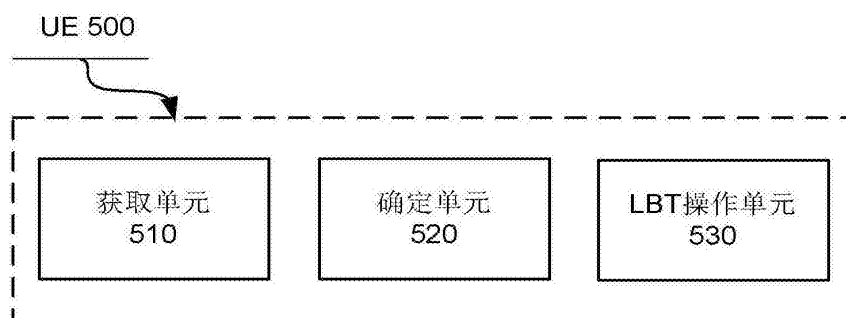


图5

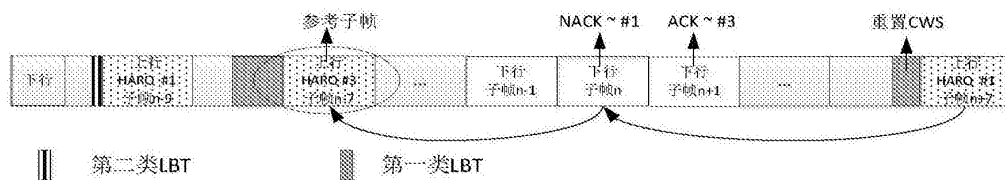


图6 (a)

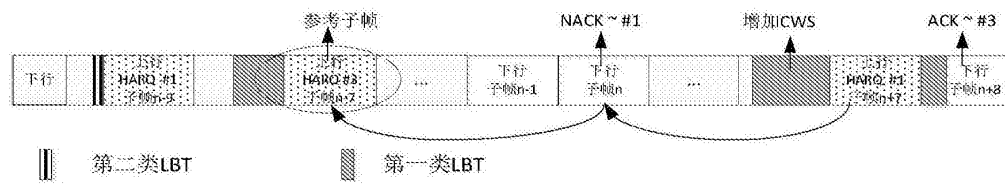


图6 (b)

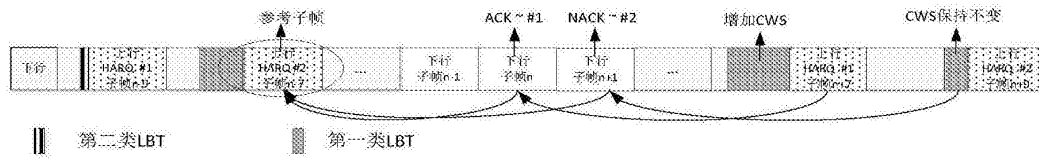


图7

English Translation of Abstract of China Patent Application No. CN107371168A

The invention discloses the measuring method in a kind of unlicensed spectrum and equipment, for solving due in unlicensed spectrum, LTE UE need to share frequency spectrum with other wireless communication technology timesharing, and network can not accurately dispatch LTE UE the data transfer on unauthorized carrier wave the problem of. Method includes : UE carries out LBT, and count LBT results when it is determined that needing to carry out uplink in unlicensed spectrum : When it is determined that meeting report condition, send with the UE count LBT results it is related report information. Due to UE by the LBT results counted to the UE it is related report information to be sent to the network equipment so that the network equipment can according to the UE count LBT results, determine that UE is operated if appropriate in corresponding unlicensed spectrum cell.



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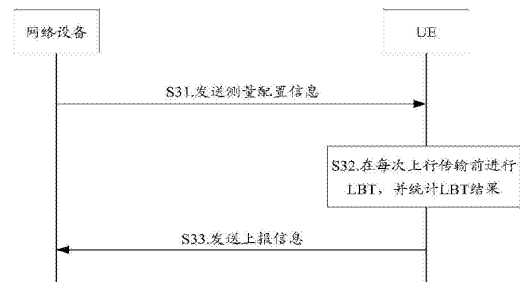
权利要求书4页 说明书16页 附图4页

(54)发明名称

一种非授权频谱中的测量方法和设备

(57)摘要

本发明公开了一种非授权频谱中的测量方法和设备,用于解决由于在非授权频谱上,LTE UE需要与其他无线通信技术分时共享频谱,网络无法准确调度LTE UE在非授权载波上的数据传输的问题。方法包括:UE在确定需要进行上行传输时,在非授权频谱上进行LBT,并统计LBT结果;在确定满足上报条件时,发送与所述UE统计的LBT结果相关的上报信息。由于UE将与所述UE统计的LBT结果相关的上报信息发送给网络设备,以使网络设备能够根据所述UE统计的LBT结果,确定UE是否适合在对应的非授权频谱小区进行工作。



1. 一种非授权频谱中的测量方法,其特征在于,所述方法包括:
用户设备UE在确定需要进行上行传输时,在非授权频谱上进行先听后说LBT,并统计LBT结果;
所述UE在确定满足上报条件时,发送与所述UE统计的LBT结果相关的上报信息。
2. 如权利要求1所述的方法,其特征在于,所述UE发送与所述UE统计的LBT相关结果的上报信息之前,所述方法还包括:
所述UE接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
3. 如权利要求2所述的方法,其特征在于,所述测量配置信息中包括:用于表示所述上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。
4. 如权利要求3所述的方法,其特征在于,所述测量配置信息中还包括:用于指示是否上报所述UE的位置信息的指示信息、测量时间段的长度信息、待测量的频点信息或频点列表、待测量小区的标识信息或标识信息列表中的至少一项。
5. 如权利要求1~4任一项所述的方法,其特征在于,所述上报条件包括:
事件触发上报、周期性上报、在预设或配置的测量时间段结束时上报、在LBT失败时上报、或者在接收到上报命令时上报。
6. 如权利要求5所述的方法,其特征在于,触发上报的事件包括以下至少一种:
所统计的LBT的总次数大于或等于第一次数阈值;
所统计的LBT失败的次数大于或等于第二次数阈值;
所统计的LBT成功的次数大于或等于第三次数阈值;
所统计的LBT失败的概率大于或等于第一上限值;
所统计的LBT失败的概率小于或等于第一下限值;
所统计的LBT成功的概率大于或等于第二上限值;
所统计的LBT成功的概率小于或等于第二下限值。
7. 如权利要求1~4任一项所述的方法,其特征在于,所述上报信息包括以下至少一种信息项:
所统计的LBT结果对应的工作频点;
所统计的LBT结果对应的小区的标识信息;
所统计的LBT结果对应的LBT优先级;
所统计的LBT结果;
所述UE的位置信息;
用于表示单次LBT失败的指示信息;
所统计的LBT结果对应的信道的信息;
用于标识触发上报的事件的信息。
8. 如权利要求7所述的方法,其特征在于,所述LBT结果包括:
所统计的LBT的总次数、所统计的LBT失败的次数、以及所统计的LBT成功的次数中的至少两种信息;或者
所统计的LBT失败的概率和所统计的LBT成功的概率中的至少一种信息。
9. 如权利要求1~4任一项所述的方法,其特征在于,所述UE发送与所述UE统计的LBT相

关结果的上报信息,包括:

所述UE通过无线资源控制RRC测量报告发送所述上报信息;或者
所述UE通过媒体接入控制控制单元MAC CE发送所述上报信息;或者
所述UE通过L1信令发送所述上报信息。

10.一种非授权频谱中的测量方法,其特征在于,所述方法包括:
网络设备接收用户设备UE发送的与所述UE统计的LBT结果相关的上报信息;
所述网络设备根据所述上报信息,确定出所述UE所统计的LBT结果。

11.如权利要求10所述的方法,其特征在于,网络设备接收UE发送上报信息之前,所述方法还包括:

所述网络设备发送配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。

12.如权利要求11所述的方法,其特征在于,所述测量配置信息中包括:用于表示上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。

13.如权利要求12所述的方法,其特征在于,所述测量配置信息中还包括:用于指示是否上报所述UE的位置信息的指示信息、测量时间段的长度信息、待测量的频点信息或频点列表、待测量小区的标识信息或标识信息列表中的至少一项。

14.如权利要求12所述的方法,其特征在于,所述上报条件包括:

事件触发上报、周期性上报、在预设或配置的测量时间段结束时上报、在LBT失败时上报、或者在接收到上报命令时上报。

15.如权利要求14所述的方法,其特征在于,触发上报的事件包括以下至少一种:

所统计的LBT的总次数大于或等于第一次数阈值;
所统计的LBT失败的次数大于或等于第二次数阈值;
所统计的LBT成功的次数大于或等于第三次数阈值;
所统计的LBT失败的概率大于或等于第一上限值;
所统计的LBT失败的概率小于或等于第一下限值;
所统计的LBT成功的概率大于或等于第二上限值;
所统计的LBT成功的概率小于或等于第二下限值。

16.如权利要求10~15任一项所述的方法,其特征在于,所述上报信息包括以下至少一种信息项:

所统计的LBT结果对应的工作频点;
所统计的LBT结果对应的小区的标识信息;
所统计的LBT结果对应的LBT优先级;
所统计的LBT结果;
所述UE的位置信息;
用于表示单次LBT失败的指示信息;
所统计的LBT结果对应的信道的信息;
用于标识触发上报的事件的信息。

17.如权利要求16所述的方法,其特征在于,所统计的LBT结果包括:

所统计的LBT的总次数、所统计的LBT失败的次数、以及所统计的LBT成功的次数中的至

少两种信息;或者

所统计的LBT失败的概率和所统计的LBT成功的概率中的至少一种信息。

18.如权利要求10~13任一项所述的方法,其特征在于,网络设备接收UE发送上报信息,包括:

所述网络设备通过无线资源控制RRC测量报告接收所述上报信息;或者

所述网络设备通过媒体接入控制控制单元MAC CE接收所述上报信息;或者

所述网络设备通过L1信令接收所述上报信息。

19.一种用户设备,其特征在于,所述用户设备包括:

处理模块,用于在确定需要进行上行传输时,在非授权频谱上进行先听后说LBT,并统计LBT结果;

上报模块,用于在确定满足上报条件时,发送与所述处理模块统计的LBT结果相关的上报信息。

20.如权利要求19所述的用户设备,其特征在于,所述用户设备还包括:

接收模块,用于接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。

21.如权利要求20所述的用户设备,其特征在于,所述测量配置信息中包括:用于表示所述上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。

22.如权利要求19~21任一项所述的用户设备,其特征在于,所述上报条件包括:

事件触发上报、周期性上报、在预设或配置的测量时间段结束时上报、在LBT失败时上报、或者在接收到上报命令时上报。

23.如权利要求19~21任一项所述的用户设备,其特征在于,所述上报信息包括以下至少一种信息项:

所统计的LBT结果对应的工作频点;

所统计的LBT结果对应的小区的标识信息;

所统计的LBT结果对应的LBT优先级;

所统计的LBT结果;

所述UE的位置信息;

用于表示单次LBT失败的指示信息;

所统计的LBT结果对应的信道的信息;

用于标识触发上报的事件的信息。

24.一种网络设备,其特征在于,所述网络设备包括:

接收模块,用于接收用户设备UE发送的与所述UE统计的LBT结果相关的上报信息;

确定模块,用于根据所述上报信息,确定出所述UE所统计的LBT结果。

25.如权利要求24所述的网络设备,其特征在于,所述网络设备还包括:

发送模块,用于发送配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。

26.如权利要求25所述的网络设备,其特征在于,所述测量配置信息中包括:用于表示上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。

27.如权利要求26所述的网络设备,其特征在于,所述上报条件包括:

事件触发上报、周期性上报、在预设或配置的测量时间段结束时上报、在LBT失败时上报、或者在接收到上报命令时上报。

28. 如权利要求24~27任一项所述的网络设备, 其特征在于, 所述上报信息包括以下至少一种信息项:

所统计的LBT结果对应的工作频点;

所统计的LBT结果对应的小区的标识信息;

所统计的LBT结果对应的LBT优先级;

所统计的LBT结果;

所述UE的位置信息;

用于表示单次LBT失败的指示信息;

所统计的LBT结果对应的信道的信息;

用于标识触发上报的事件的信息。

一种非授权频谱中的测量方法和设备

技术领域

[0001] 本发明涉及通信技术领域,特别涉及一种非授权频谱中的测量方法和设备。

背景技术

[0002] 对于移动运营商来说,授权频谱(Licensed Bands)一直以来都是其核心资产,是提供高质量无线通信服务的基础,并在可以预见的未来举足轻重。但是,随着移动互联网的蓬勃发展,公众对高带宽无线业务需求的爆发与频谱资源稀缺的矛盾日益尖锐,非授权频谱(Unlicensed Bands)作为授权频谱的补充还存在丰富的资源以及极大的发展空间。以5GHz频段为例,目前全球各国已分配的非授权频谱资源总计超过500MHz。

[0003] 授权辅助接入(Licensed-Assisted Access,简称LAA)是一项基于非授权频谱开展长期演进(Long Term Evolution,简称LTE)业务的技术。在LAA系统中,LTE UE以载波聚合(Carrier Aggregation,简称CA)方式同时工作在多个载波(频段)上,其中,至少有一个载波的工作频段为授权频谱;其他载波中,可以有一个或多个工作在非授权频谱。其中,LTE UE的主载波(Primary Carrier),对应于CA技术中的主小区(Primary Cell,简称PCell),工作在授权频谱上;LTE UE的辅载波(Secondary Carrier),对应于CA技术中的辅小区(Secondary Cell,简称SCell),可以工作在授权频谱或非授权频谱。

[0004] 众所周知,目前已经有众多无线通信技术,如无线保真(WIFI),蓝牙等,工作在非授权频谱上。所以,当LTE引入到非授权频谱时,其需要与其他无线通信技术分时共享频谱,LTE系统不能长时间持续占用频段,而需要非连续工作,这将对LTE UE的测量产生影响。举例来说:在授权频谱上,LTE在时间上是连续工作的,LTE UE可以基于网络的调度进行上行信号的发送;但在非授权频谱上,由于LTE与其他无线通信技术共享频谱,所以,在网络调度的基础上,LTE UE还需要在被调度的发送时刻先进行先听后说(Listen Before Talk,简称LBT),成功后才可以进行信号或数据的发送。如果LTE UE LBT失败,网络需要再次调度UE进行数据发送。

[0005] 综上所述,由于在非授权频谱上,LTE UE需要与其他无线通信技术分时共享频谱,在网络调度UE进行数据发送的时频资源上,UE仅在LBT成功的情况下,才能发送数据。

[0006] 因此,网络无法准确判断UE未在所分配的资源上进行传输是由于调度信令发送失败还是UE LBT失败,导致网络无法根据非授权频谱上的资源共享情况动态调整对LTE UE在非授权载波上的调度策略。

发明内容

[0007] 本发明实施例提供了一种非授权频谱中的测量方法和设备,用于解决网络无法根据非授权频谱上的资源共享情况动态调整对LTE UE在非授权载波上的调度策略的问题。

[0008] 第一方面,一种非授权频谱中的测量方法,所述方法包括:

[0009] 用户设备UE在确定需要进行上行传输时,在非授权频谱上进行先听后说LBT,并统计LBT结果;

- [0010] 所述UE在确定满足上报条件时,发送与所述UE统计的LBT结果相关的上报信息。
- [0011] 一种可能的实现方式中,所述UE发送与所述UE统计的LBT相关结果的上报信息之前,所述方法还包括:
- [0012] 所述UE接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0013] 一种可能的实现方式中,所述测量配置信息中包括:用于表示所述上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。
- [0014] 一种可能的实现方式中,所述测量配置信息中还包括:用于指示是否上报所述UE的位置信息的指示信息、测量时间段的长度信息、待测量的频点信息或频点列表、待测量小区的标识信息或标识信息列表中的至少一项。
- [0015] 一种可能的实现方式中,所述上报条件包括:
- [0016] 事件触发上报、周期性上报、在预设或配置的测量时间段结束时上报、在LBT失败时上报、或者在接收到上报命令时上报。
- [0017] 一种可能的实现方式中,触发上报的事件包括以下至少一种:
- [0018] 所统计的LBT的总次数大于或等于第一次数阈值;
- [0019] 所统计的LBT失败的次数大于或等于第二次数阈值;
- [0020] 所统计的LBT成功的次数大于或等于第三次数阈值;
- [0021] 所统计的LBT失败的概率大于或等于第一上限值;
- [0022] 所统计的LBT失败的概率小于或等于第一下限值;
- [0023] 所统计的LBT成功的概率大于或等于第二上限值;
- [0024] 所统计的LBT成功的概率小于或等于第二下限值。
- [0025] 一种可能的实现方式中,所述上报信息包括以下至少一种信息项:
- [0026] 所统计的LBT结果对应的工作频点;
- [0027] 所统计的LBT结果对应的小区的标识信息;
- [0028] 所统计的LBT结果对应的LBT优先级;
- [0029] 所统计的LBT结果;
- [0030] 所述UE的位置信息;
- [0031] 用于表示单次LBT失败的指示信息;
- [0032] 所统计的LBT结果对应的信道的信息;
- [0033] 用于标识触发上报的事件的信息。
- [0034] 一种可能的实现方式中,所述LBT结果包括:
- [0035] 所统计的LBT的总次数、所统计的LBT失败的次数、以及所统计的LBT成功的次数中的至少两种信息;或者
- [0036] 所统计的LBT失败的概率和所统计的LBT成功的概率中的至少一种信息。
- [0037] 一种可能的实现方式中,所述UE发送与所述UE统计的LBT相关结果的上报信息,包括:
- [0038] 所述UE通过无线资源控制RRC测量报告发送所述上报信息;或者
- [0039] 所述UE通过媒体接入控制控制单元MAC CE发送所述上报信息;或者
- [0040] 所述UE通过L1信令发送所述上报信息。

- [0041] 第二方面,一种非授权频谱中的测量方法,所述方法包括:
- [0042] 网络设备接收用户设备UE发送的与所述UE统计的LBT结果相关的上报信息;
- [0043] 所述网络设备根据所述上报信息,确定出所述UE所统计的LBT结果。
- [0044] 一种可能的实现方式中,网络设备接收UE发送上报信息之前,所述方法还包括:
- [0045] 所述网络设备发送配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0046] 一种可能的实现方式中,所述测量配置信息中包括:用于表示上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。
- [0047] 一种可能的实现方式中,所述测量配置信息中还包括:用于指示是否上报所述UE的位置信息的指示信息、测量时间段的长度信息、待测量的频点信息或频点列表、待测量小区的标识信息或标识信息列表中的至少一项。
- [0048] 一种可能的实现方式中,所述上报条件包括:
- [0049] 事件触发上报、周期性上报、在预设或配置的测量时间段结束时上报、在LBT失败时上报、或者在接收到上报命令时上报。
- [0050] 一种可能的实现方式中,触发上报的事件包括以下至少一种:
- [0051] 所统计的LBT的总次数大于或等于第一次数阈值;
- [0052] 所统计的LBT失败的次数大于或等于第二次数阈值;
- [0053] 所统计的LBT成功的次数大于或等于第三次数阈值;
- [0054] 所统计的LBT失败的概率大于或等于第一上限值;
- [0055] 所统计的LBT失败的概率小于或等于第一下限值;
- [0056] 所统计的LBT成功的概率大于或等于第二上限值;
- [0057] 所统计的LBT成功的概率小于或等于第二下限值。
- [0058] 一种可能的实现方式中,所述上报信息包括以下至少一种信息项:
- [0059] 所统计的LBT结果对应的工作频点;
- [0060] 所统计的LBT结果对应的小区的标识信息;
- [0061] 所统计的LBT结果对应的LBT优先级;
- [0062] 所统计的LBT结果;
- [0063] 所述UE的位置信息;
- [0064] 用于表示单次LBT失败的指示信息;
- [0065] 所统计的LBT结果对应的信道的信息;
- [0066] 用于标识触发上报的事件的信息。
- [0067] 一种可能的实现方式中,所统计的LBT结果包括:
- [0068] 所统计的LBT的总次数、所统计的LBT失败的次数、以及所统计的LBT成功的次数中的至少两种信息;或者
- [0069] 所统计的LBT失败的概率和所统计的LBT成功的概率中的至少一种信息。
- [0070] 一种可能的实现方式中,网络设备接收UE发送上报信息,包括:
- [0071] 所述网络设备通过无线资源控制RRC测量报告接收所述上报信息;或者
- [0072] 所述网络设备通过媒体接入控制控制单元MAC CE接收所述上报信息;或者
- [0073] 所述网络设备通过L1信令接收所述上报信息。

- [0074] 第三方面,提供了一种计算机可读存储介质,其中存储有可执行的程序代码,该程序代码用以实现第一方面所述的方法。
- [0075] 第四方面,提供了一种计算机可读存储介质,其中存储有可执行的程序代码,该程序代码用以实现第二方面所述的方法。
- [0076] 第五方面,一种用户设备,所述用户设备包括:
- [0077] 处理模块,用于在确定需要进行上行传输时,在非授权频谱上进行先听后说LBT,并统计LBT结果;
- [0078] 上报模块,用于在确定满足上报条件时,发送与所述处理模块统计的LBT结果相关的上报信息。
- [0079] 其中,所述上报条件和所述上报信息具体参见第一方面中的相关描述,此处不再赘述。
- [0080] 一种可能的实现方式中,所述用户设备还包括:
- [0081] 接收模块,用于接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0082] 其中,所述测量配置信息具体参见第一方面中的相关描述,此处不再赘述。
- [0083] 一种可能的实现方式中,所述上报模块具体用于:
- [0084] 通过无线资源控制RRC测量报告发送所述上报信息;或者
- [0085] 通过媒体接入控制控制单元MAC CE发送所述上报信息;或者
- [0086] 通过L1信令发送所述上报信息。
- [0087] 第六方面,一种用户设备,包括:收发机、以及与所述收发机连接的至少一个处理器,其中:
- [0088] 处理器,用于读取存储器中的程序,执行下列过程:
- [0089] 在确定需要进行上行传输时,在非授权频谱上进行LBT,并统计LBT结果;在确定满足上报条件时,控制发送与所述统计的LBT结果相关的上报信息;
- [0090] 收发机,用于在控制器的控制下接收和发送数据。
- [0091] 其中,所述上报条件和所述上报信息具体参见第一方面中的相关描述,此处不再赘述。
- [0092] 一种可能的实现方式中,所述收发机还用于:接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0093] 其中,所述测量配置信息具体参见第一方面中的相关描述,此处不再赘述。
- [0094] 可选的,所述处理器读取存储器中的程序,还执行:
- [0095] 控制所述收发机,通过RRC测量报告发送所述上报信息;或者
- [0096] 控制所述收发机,通过MAC CE发送所述上报信息;或者
- [0097] 控制所述收发机,通过L1信令发送所述上报信息。
- [0098] 第七方面,一种网络设备,所述网络设备包括:
- [0099] 接收模块,用于接收用户设备UE发送的与所述UE统计的LBT结果相关的上报信息;
- [0100] 确定模块,用于根据所述上报信息,确定出所述UE所统计的LBT结果。
- [0101] 其中,所述上报信息具体参见第二方面中的相关描述,此处不再赘述。
- [0102] 一种可能的实现方式中,所述网络设备还包括:

- [0103] 发送模块,用于发送测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0104] 其中,所述测量配置信息具体参见第二方面中的相关描述,此处不再赘述。
- [0105] 一种可能的实现方式中,所述测量配置信息中包括:用于表示上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。
- [0106] 其中,所述上报条件具体参见第二方面中的相关描述,此处不再赘述。
- [0107] 第六方面,一种网络设备,包括:收发机、以及与该收发机连接的至少一个处理器,其中:
- [0108] 处理器,用于读取存储器中的程序,执行下列过程:
- [0109] 通过收发机接收UE发送的与所述UE统计的LBT结果相关的上报信息;用于根据所述上报信息,确定出所述UE所统计的LBT结果;
- [0110] 收发机,用于在控制器的控制下接收和发送数据。
- [0111] 其中,所述上报信息具体参见第二方面中的相关描述,此处不再赘述。
- [0112] 一种可能的实现方式中,处理器读取存储器中的程序,还执行:
- [0113] 控制收发机发送配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0114] 其中,所述测量配置信息具体参见第二方面中的相关描述,此处不再赘述。
- [0115] 一种可能的实现方式中,所述测量配置信息中包括:用于表示上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。
- [0116] 其中,所述上报条件具体参见第二方面中的相关描述,此处不再赘述。
- [0117] 一种可能的实现方式中,所述收发机具体用于:
- [0118] 通过RRC测量报告接收所述上报信息;或者
- [0119] 通过MAC CE接收所述上报信息;或者
- [0120] 通过L1信令接收所述上报信息。
- [0121] 本发明实施例提供的方法和设备中,UE在确定需要进行上行传输时,在非授权频谱上进行LBT,并统计LBT结果;在确定满足上报条件时,控制发送与所统计的LBT结果相关的上报信息,以使网络设备能够根据所述UE统计的LBT结果,准确判断UE未在所分配的资源上进行传输是由于调度信令发送失败还是UE LBT失败,进而可以确定UE是否适合在对应的非授权频谱小区进行工作;还可以使网络设备根据非授权频谱上的资源共享情况动态调整对LTE UE在非授权载波上的调度策略。例如,若UE在某个小区内LBT失败概率过高,则网络设备可以避免继续使用该小区为UE进行服务(如将该小区调出UE的服务小区集合);若UE在某个小区内LBT失败概率较低,则网络设备可以更多的调度UE在该非授权小区工作,从而能够更效利用非授权频谱资源,提升非授权频谱系统的服务质量。

附图说明

- [0122] 图1为本发明实施例中的一种非授权频谱中的测量方法的流程示意图;
- [0123] 图2为本发明实施例中的另一种非授权频谱中的测量方法的流程示意图;
- [0124] 图3为本发明实施例中的再一种非授权频谱中的测量方法的流程示意图;
- [0125] 图4为本发明实施例中的一种用户设备的示意图;

[0126] 图5为本发明实施例中的另一种用户设备的示意图；

[0127] 图6为本发明实施例中的一种网络设备的示意图；

[0128] 图7为本发明实施例中的另一种网络设备的示意图。

具体实施方式

[0129] 为使本发明实施例的目的、技术方案和优点更加清楚，下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述，显然，所描述的实施例是本发明一部分实施例，而不是全部的实施例。基于本发明中的实施例，本领域普通技术人员在没有作出创造性劳动前提下所获得的所有其他实施例，都属于本发明保护的范围。

[0130] 下面结合说明书附图对本发明实施例作进一步详细描述。应当理解，此处所描述的实施例仅用于说明和解释本发明，并不用于限定本发明。

[0131] 图1所示的实施例中，提供了用户设备侧的一种非授权频谱中的测量方法，该方法包括：

[0132] S11、UE在确定需要进行上行传输时，在非授权频谱上进行先听后说LBT，并统计LBT结果。

[0133] 其中，LBT的基本原理：在非授权频谱上发送数据前，UE先对信道进行侦听，如果信道为空，UE确定本次LBT成功，并将本次LBT结果记为成功，此时，UE可以进行数据发送；否则，UE确定本次LBT失败，并将本次LBT结果记为失败。

[0134] 本步骤中，所述上行传输包括：基于网络动态调度的上行传输，基于网络的半持续调度的上行传输，基于随机接入信道(Random Access Channel，简称RACH)前导码的上行传输，设备到设备(Device to Device，简称D2D)直接传输。

[0135] S12、所述UE在确定满足上报条件时，发送与所述UE统计的LBT结果相关的上报信息。

[0136] 本发明实施例中，UE会将与所述UE统计的LBT结果相关的上报信息发送给网络设备，以使网络设备能够根据所述UE统计的LBT结果，准确判断UE未在所分配的资源上进行传输是由于调度信令发送失败还是UE LBT失败，进而可以确定UE是否适合在对应的非授权频谱小区进行工作；还可以使网络设备根据非授权频谱上的资源共享情况动态调整对LTE UE在非授权载波上的调度策略。例如，若UE在某个小区内LBT失败概率过高，则网络设备可以避免继续使用该小区为UE进行服务(如将该小区调出UE的服务小区集合)；若UE在某个小区内LBT失败概率较低，则网络设备可以更多的调度UE在该非授权小区工作，从而能够更高效利用非授权频谱资源，提升非授权频谱系统的服务质量。

[0137] 本发明实施例中，所述上报条件包括以下五种可能的实现方式：

[0138] 方式A、事件触发上报方式，即在测量时间段内，若满足触发上报的事件，则触发上报所述测量时间段内得到的上报信息。

[0139] 该方式中，所述触发事件包括以下事件中的至少一种：

[0140] 所统计的LBT的总次数大于或等于第一次数阈值；

[0141] 所统计的LBT失败的次数大于或等于第二次数阈值；

[0142] 所统计的LBT成功的次数大于或等于第三次数阈值；

[0143] 所统计的LBT失败的概率大于或等于第一上限值；

- [0144] 所统计的LBT失败的概率小于或等于第一下限值；
- [0145] 所统计的LBT成功的概率大于或等于第二上限值；
- [0146] 所统计的LBT成功的概率小于或等于第二下限值。
- [0147] 其中，第一次数阈值、第二次数阈值、第三次数阈值、第一上限值、第一下限值、第二上限值、第二下限值均可以根据经验或仿真或应用环境进行设定。
- [0148] 可选的，上述触发上报的事件可以单独使用，即在测量时间段内，只要满足上述任一事件，即触发上报。
- [0149] 可选的，上述触发上报的事件也可以组合使用。例如，在测量时间段内，满足所统计的LBT的总次数大于或等于第一次数阈值，且满足所统计的LBT失败的次数大于或等于第二次数阈值时，触发上报；又如，在测量时间段内，满足所统计的LBT的总次数大于或等于第一次数阈值，且满足所统计的LBT失败的概率小于或等于第一下限值时，触发上报。等等。
- [0150] 可选的，所述测量时间段的长度信息可以由UE与网络设备协商确定，也可以由网络设备通过测量配置信息配置给UE，还可以在标准或协议中规定。
- [0151] 该方式中，所述上报信息包括：所统计的LBT结果。
- [0152] 可选的，所统计的LBT结果包括：
- [0153] 所统计的LBT的总次数、所统计的LBT失败的次数、以及所统计的LBT成功的次数中的至少两种信息；或者
- [0154] 所统计的LBT失败的概率和所统计的LBT成功的概率中的至少一种信息。
- [0155] 可选的，所述UE发送的所述上报信息还包括以下至少一种信息项：
- [0156] a)所统计的LBT结果对应的工作频点，即所述上报信息是针对哪个频段进行统计的；
- [0157] b)所统计的LBT结果对应的小区的标识信息，即所述上报信息是针对哪个小区进行统计的；
- [0158] c)所统计的LBT结果对应的LBT优先级，所述上报信息是针对哪个LBT优先级的业务进行统计的；
- [0159] d)所述UE的位置信息；位置信息可以使网络设备知道覆盖区域中的不同部分的所统计的LBT成功的概率，以便在后继为UE服务时，基于UE的位置信息调整UE的服务小区/频点集合。
- [0160] e)所统计的LBT结果对应的信道的信息，即所述上报信息是针对哪个特定信道进行统计的；
- [0161] 具体的，UE的统计可以是基于特定信道的统计（如RACH信道和物理上行共享信道（Physical Uplink Shared Channel，简称PUSCH）信道，分别进行统计，也可以基于UE整体传输进行统计。若基于特定信道的统计，则还需要上报所统计的LBT结果对应的信道的信息。
- [0162] f)用于标识触发上报的事件的信息。
- [0163] 可选的，若UE针对至少两个频段进行LBT统计，则每个频段上统计出的上报信息可以单独上报。
- [0164] 可选的，若UE针对至少两个小区进行LBT统计，则每个小区内统计出的上报信息可以单独上报。

[0165] 可选的,若UE针对至少两个LBT优先级的业务进行LBT统计,则每个LBT优先级的业务统计出的上报信息可以单独上报。

[0166] 需要说明的是,不同业务有不同的LBT优先级,可以采用不同的LBT参数(如回退窗口),例如,高优先级的业务会使用较高的LBT优先级,以较大的概率获得传输机会。为了避免多个UE在信道变空的瞬间同时发送数据,还引入了随机回退机制,UE在信道变空后,随机回退一段时间后,如果检测到信道为空,则进行数据发送,其中,随机回退的时间段称为回退窗口。

[0167] 方式B、周期性上报,即在上报周期内统计LBT结果,在上报周期结束后,触发上报该上报周期内得到的上报信息。

[0168] 该方式中,上报周期可以由UE与网络设备协商确定,也可以由网络设备通过测量配置信息配置给UE,还可以在标准或协议中规定。

[0169] 该方式中,所述上报信息包括:所统计的LBT结果。

[0170] 可选的,所统计的LBT结果包括:

[0171] 所统计的LBT的总次数、所统计的LBT失败的次数、以及所统计的LBT成功的次数中的至少两种信息;或者

[0172] 所统计的LBT失败的概率和所统计的LBT成功的概率中的至少一种信息。

[0173] 可选的,所述UE发送的所述上报信息还包括以下至少一种信息项:

[0174] 所统计的LBT结果对应的工作频点;

[0175] 所统计的LBT结果对应的小区的标识信息;

[0176] 所统计的LBT结果对应的LBT优先级;

[0177] 所述UE的位置信息;

[0178] 所统计的LBT结果对应的信道的信息。

[0179] 方式C、一次上报,即在测量时间段结束时上报,触发上报该测量时间段内测量得到的上报信息。

[0180] 该方式中,所述UE发送的所述上报信息包括的信息项与方式B类似,具体参见方式B中的相关描述,此处不再赘述。

[0181] 方式D、在接收到上报命令时上报,即在接收到上报命令时,触发上报最近一次测量时间段内测量得到的上报信息。

[0182] 该方式中,所述UE发送的所述上报信息包括的信息项与方式B类似,具体参见方式B中的相关描述,此处不再赘述。

[0183] 方式E、在LBT失败时上报,即每次LBT失败时,均触发上报。

[0184] 该方式中,所述上报信息包括用于表示单次LBT失败的指示信息。例如,所述UE通过1比特信息,指示单次LBT失败。

[0185] 基于上述任一实施例,测量配置信息,即用于配置统计所需的信息和/或上报所需的信息,可以采用如下方式获取到:

[0186] 方式1、由UE与网络设备协商确定。

[0187] 方式2、在标准或协议中规定。

[0188] 方式3、由网络设备确定后通知给UE。

[0189] 该方式3中,S12中所述UE发送与所述UE统计的LBT结果相关的上报信息

息之前,所述方法还包括:所述UE接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。

[0190] 具体的,所述UE接收到测量配置信息后,开启LBT结果统计。

[0191] 可选的,所述UE接收到测量配置信息之后,还包括:所述UE返回测量配置完成消息,以通知网络设备所述UE已完成测量配置。

[0192] 该方式中,所述测量配置信息中包括:用于表示所述上报条件的第一信息、和/或用于表示所述上报信息包含的信息项的第二信息。

[0193] 具体的,第一信息可以是所述上报条件本身,也可以是所述上报条件的编号,如使用E1~E7表示上述七种触发事件,又如,使用3比特信息表示上述七种触发事件,等等。第二信息可以是所述上报信息中包含的具体信息项,也可以是所述上报信息包含的信息项的编号。

[0194] 该方式中,测量配置信息中可以配置上述七种触发事件中全部,则只要满足任一种触发事件即触发上报;测量配置信息中也可以仅配置部分触发事件,则在满足该部分触发事件中的任一种触发事件或全部触发事件才触发上报。

[0195] 可选的,所述测量配置信息中还包括:用于指示上报所述UE的位置信息的指示信息、测量时间段的长度信息、待测量的频点信息或频点列表、待测量小区的标识信息或标识信息列表中的至少一项。

[0196] 该方式中,网络设备可以通过RRC专用信令发送所述测量配置信息,具体的:可以通过扩展现有的RRC消息发送所述上报信息,也可以定义新的RRC消息发送所述上报信息;还可以通过系统消息(即广播消息)发送所述测量配置信息。

[0197] 基于上述任一实施例,S12中所述UE发送与所述UE统计的LBT结果相关的上报信息,包括以下三种可能的实现方式:

[0198] 方式一、所述UE通过无线资源控制(Radio Resource Control,简称RRC)测量报告的形式,发送所述上报信息。

[0199] 该方式尤其适用于上述方式A至方式E。

[0200] 方式二、所述UE通过媒体接入控制控制单元(MAC Control Element,简称MAC CE; Media Access Control,简称MAC),发送所述上报信息。

[0201] 该方式尤其适用于上述方式E。

[0202] 方式三、所述UE通过L1(层1)信令发送所述上报信息。

[0203] 该方式尤其适用于上述方式E。

[0204] 基于同一发明构思,图2所示的实施例中,提供了网络设备侧的一种非授权频谱中的测量方法,该方法包括:

[0205] S21、网络设备接收UE发送的与所述UE统计的LBT结果相关的上报信息;

[0206] S22、所述网络设备根据所述上报信息,确定出所述UE所统计的LBT结果。

[0207] 进一步,所述网络设备可以根据所述上报信息,调整UE的服务小区集合或调整在对应频点小区的调度次数。

[0208] 本发明实施例中,网络设备根据UE发送的上报信息,确定出所述UE所统计的LBT结果,进而可以根据所统计的LBT结果,确定UE是否适合在对应的非授权频谱小区进行工作。例如,若UE在某个小区内LBT失败概率过高,则网络设备可以避免继续使用该小区为UE进行

服务(如将该小区调出UE的服务小区集合);若UE在某个小区内LBT失败概率较低,则网络设备可以更多的调度UE在该非授权小区工作,从而能够更高效利用非授权频谱资源,提升非授权频谱系统的服务质量。

[0209] 本发明实施例中,所述上报条件和所述上报信息包含的信息项具体参见图1所示实施例中的相关描述,此处不再赘述。

[0210] 可选的,S21之前,所述方法还包括:

[0211] 所述网络设备发送配置信息,所述网络设备发送配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。

[0212] 其中,所述测量配置信息具体参见图1所示实施例中的相关描述,此处不再赘述

[0213] 可选的,S21中网络设备接收UE发送的上报信息,包括:

[0214] 所述网络设备通过RRC测量报告接收所述上报信息;或者

[0215] 所述网络设备通过MAC CE接收所述上报信息;或者

[0216] 所述网络设备通过L1信令接收所述上报信息。

[0217] 下面从网络设备与UE交互的角度,对本发明实施例提供的一种非授权频谱中的测量方法进行详细说明。

[0218] 图3所示的实施例中,提供了一种非授权频谱中的测量方法,包括:

[0219] S31、网络设备发送测量配置信息,其中,所述测量配置信息具体参见上述方式3中的相关描述。

[0220] S32、UE接收到测量配置信息后,在每次上行传输前进行LBT,并统计LBT结果。

[0221] S33、UE发送上报信息。

[0222] 具体的,UE根据所述测量配置信息中配置的用于表示所述上报信息包含的信息项的第二信息,生成相应的上报信息。

[0223] 下面通过六个具体实施例,对本发明实施例提供的一种非授权频谱中的测量方法进行详细说明。

[0224] 实施例1:本实施例中通过专用信令配置测量配置信息,且采用事件触发上报,具体过程如下:

[0225] 1、eNB通过RRC专用信令配置UE上报LBT结果,其中,RRC专用信令中的测量配置信息如下:

[0226] a)待测量小区所在频点或频点列表:如F1,F2;

[0227] b)预设的测量时间段D;

[0228] c)上报条件为事件触发上报;其中,触发上报的事件如下:

[0229] 触发事件E1:所统计的LBT失败概率大于或等于第一上限值;和/或

[0230] 触发事件E2:所统计的LBT的总次数大于或等于第一次数阈值。

[0231] 预设参数:第一上限值和第一次数阈值。

[0232] d)上报内容(即上报信息包含的信息项):对应频点的LBT失败的次数和LBT成功的次数、或者LBT失败的概率等。

[0233] e)是否上报辅助信息:上报统计结果的同时是否上报UE的位置信息。

[0234] 例如,可以用1比特信息表示是否上报辅助信息,1表示上报UE的位置信息,0表示不上报UE的位置信息。

- [0235] 2、UE在收到测量配置信息后,返回配置完成消息,并开启测量和统计。
- [0236] 3、UE对每次上行传输前的LBT的结果进行统计,即如果在预定传输时刻,LBT结果显示信道可占用则记为成功;否则,记为失败。
- [0237] 4、如果在预定测量时间段D内,UE确定满足eNB配置的事件,则UE进行上报,上报信息中包括:
- [0238] a)触发上报条件的频点,如:F1。
- [0239] b)触发上报的事件编号,如E1。
- [0240] c)LBT结果:LBT失败的次数和LBT成功的次数、或对应频点的LBT失败的概率。可选的,可以将不同LBT优先级对应的LBT结果分别上报。
- [0241] d)在配置上报辅助信息的情况下:上报UE的位置信息,如上报UE的坐标信息。
- [0242] 5、eNB向UE返回确认消息,并根据UE的上报信息,调整UE的服务小区集合或增减在对应频点小区的调度次数。
- [0243] 实施例2:本实施例中通过专用信令配置测量配置信息,采用周期触发方式,具体过程如下:
- [0244] 1:eNB通过RRC专用信令配置UE上报LBT结果,其中,RRC专用信令中的测量配置信息如下:
- [0245] a)待测量小区的标识或标识列表:如Cell ID1,Cell ID2;
- [0246] b)需要进行统计的LBT优先级;
- [0247] c)上报条件:周期触发;
- [0248] 触发周期T;
- [0249] 上报内容:对应频点的LBT失败的概率,和/或LBT失败的次数/成功次数等。
- [0250] d)是否上报辅助信息:上报统计结果的同时是否上报UE的位置信息。
- [0251] 2:UE在收到测量配置信息后,返回配置完成消息,并开启测量和统计。
- [0252] 3:UE对每次上行传输前的LBT结果进行统计,即如果在预定传输时刻,LBT结果显示信道可占用则记为成功;否则,记为失败。
- [0253] 4:如果在触发周期T期满后,UE进行上报,上报信息包括:
- [0254] a)触发上报条件的小区标识,如:Cell ID1;
- [0255] b)LBT结果:对应LBT优先级的LBT失败的概率,或LBT失败的次数/LBT成功的次数等;对应小区的LBT失败的概率,或LBT失败的次数/LBT成功的次数等。
- [0256] c)在配置上报辅助信息的情况下:上报UE的位置信息。
- [0257] 5:eNB向UE返回确认消息,并根据UE的上报信息,调整UE的服务小区集合或增减在对应频点小区的调度次数。
- [0258] 实施例3:本实施例中通过系统消息(广播消息)配置测量配置信息,采用事件触发方式,具体过程如下:
- [0259] 1:eNB通过RRC系统消息配置特定小区(即待测量小区)内所有UE上报LBT结果,其中,RRC系统消息中的测量配置信息如下:
- [0260] a)预设的测量时间段D;
- [0261] b)上报条件:事件触发;其中,触发事件如下:
- [0262] 触发事件E1:所统计的LBT失败概率大于或等于第一上限值;和/或

- [0263] 触发事件E2:所统计的LBT的总次数大于或等于第一次数阈值。
- [0264] 预设参数:第一上限值和第一次数阈值。
- [0265] d)上报内容:对应频点的LBT失败的次数和LBT成功的次数、或者LBT失败的概率等。
- [0266] e)是否上报辅助信息:上报统计结果的同时是否上报UE的位置信息。
- [0267] 2:UE对每次上行传输前的LBT结果进行统计,即如果在预定传输时刻,LBT结果显示信道可占用则记为成功;否则,记为失败。
- [0268] 3:如果在预定时间段D内,UE确定满足eNB配置的触发事件,则UE进行上报,上报信息中包括:
- [0269] a)触发上报条件的小区标识,如:Cell ID1;
- [0270] b)触发上报的事件编号,如E1;
- [0271] c)对应小区的LBT失败的概率;
- [0272] d)在配置上报辅助信息的情况下:上报UE的位置信息。
- [0273] 4:eNB向UE返回确认消息,并根据UE的上报信息,调整UE的服务小区集合或增减在对应频点小区的调度次数。
- [0274] 实施例4:本实施例中通过系统消息(广播消息)配置测量配置信息,采用周期触发方式,具体过程如下:
- [0275] 1:eNB通过RRC系统消息配置特定小区(即待测量小区)内所有UE上报LBT结果,其中,RRC专用信令中的测量配置信息如下:
- [0276] a)上报条件:周期触发:
- [0277] 触发周期T;
- [0278] 上报内容:对应频点的LBT失败的概率,和/或LBT失败的次数/成功次数等。
- [0279] b)是否上报辅助信息:上报统计结果的同时是否上报UE的位置信息。
- [0280] 2:UE对每次上行传输前的LBT结果进行统计,即如果在预定传输时刻,LBT结果显示信道可占用则记为成功;否则,记为失败。
- [0281] 3:在触发周期T期满后,UE进行上报,上报信息包括:
- [0282] a)触发上报条件的小区标识,如:Cell ID1;
- [0283] b)LBT结果:对应小区的LBT实际失败概率,或LBT的实际失败次数/成功次数等。
- [0284] c)在配置上报辅助信息的情况下:上报UE的位置信息。
- [0285] 4:eNB向UE返回确认消息,并根据UE的上报信息,调整UE的服务小区集合或增减在对应频点小区的调度次数。
- [0286] 实施例5:本实施例中通过专用信令配置测量配置信息,采用每次LBT失败都上报的方式,具体过程如下:
- [0287] 1:eNB通过RRC专用信令配置UE上报LBT结果,配置信息如下
- [0288] a)待测量小区所在频点或频点列表:如F1,F2;
- [0289] b)上报条件:每次LBT失败都上报;
- [0290] 2:UE在收到测量配置信息后,返回配置完成消息,并开启测量;
- [0291] 3:UE对每次上行传输前的LBT结果进行统计,即如果在预定传输时刻,LBT结果显示信道可占用则记为成功;否则,记为失败。

[0292] 4:如果LBT失败,UE向eNB进行上报,上报可以是预先配置的物理层信号(即L1信令)或者MAC CE。物理层信令和MAC CE均只需传递1bit信息,即当UE发送特定物理层信号或特定格式的MAC CE,eNB获知UE发送了LBT失败的指示信息。

[0293] 5:eNB根据UE上报的信息进行统计,如果在预设测量时间段D内,LBT失败的概率或LBT失败的次数达到预设门限,则eNB调整UE的服务小区集合或增减在对应频点小区的调度次数。

[0294] 实施例6:本实施例中通过专用信令配置测量配置信息,采用即时上报方式,具体过程如下:

[0295] 1:eNB通过RRC专用信令配置UE上报LBT结果,其中,RRC专用信令中的测量配置信息如下:

[0296] a)待测量小区所在频点或频点列表:如F1,F2;

[0297] b)预设的测量时间段D;

[0298] c)上报条件:即时上报;

[0299] d)上报内容:对应频点的LBT失败的次数和LBT成功次数、或者LBT失败的概率等。

[0300] e)是否上报辅助信息:上报统计结果的同时是否上报UE的位置信息。

[0301] 2:UE在收到配置信息后,返回配置完成消息,并开启测量。

[0302] 3:UE对每次上行传输前的LBT结果进行统计,即如果在预定传输时刻,LBT结果显示信道可占用则记为成功;否则,记为失败。

[0303] 4:eNB可以在任意时刻发送上报命令给对应UE。

[0304] 5:UE接收到上报命令后,根据上报内容配置,将最近一次测量时间段D内得到的上报信息,进行上报。

[0305] 6:eNB向UE返回确认消息,并根据UE的上报信息,调整UE的服务小区集合或增减在对应频点小区的调度次数。

[0306] 上述方法处理流程可以用软件程序实现,该软件程序可以存储在存储介质中,当存储的软件程序被调用时,执行上述方法步骤。

[0307] 基于同一发明构思,图4所示的实施例中,提供了一种用户设备,包括:

[0308] 处理模块41,用于在确定需要进行上行传输时,在非授权频谱上进行先听后说LBT,并统计LBT结果;

[0309] 上报模块42,用于在确定满足上报条件时,发送与所述处理模块统计的LBT结果相关的上报信息。

[0310] 可选的,所述用户设备还包括:

[0311] 接收模块43,用于接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。

[0312] 可选的,所述上报模块具体用于:

[0313] 通过RRC测量报告发送所述上报信息;或者

[0314] 通过MAC CE发送所述上报信息;或者

[0315] 通过L1信令发送所述上报信息。

[0316] 本实施例中,所述测量配置信息请参见图1所示实施例中的相关描述,此处不再赘述。

- [0317] 本实施例中,所述上报条件请参见图1所示实施例中的相关描述,此处不再赘述。
- [0318] 本实施例中,所述上报信息请参见图1所示实施例中的相关描述,此处不再赘述。
- [0319] 基于同一发明构思,图5所示的实施例中,提供了另一种用户设备,包括:收发机610、以及与该收发机610连接的至少一个处理器600,其中:
- [0320] 处理器600,用于读取存储器620中的程序,执行下列过程:
- [0321] 在确定需要进行上行传输时,在非授权频谱上进行LBT,并统计LBT结果;在确定满足上报条件时,控制发送与所统计的LBT结果相关的上报信息;
- [0322] 收发机610,用于在处理器600的控制下接收和发送数据。
- [0323] 其中,在图5中,总线架构可以包括任意数量的互联的总线和桥,具体由处理器600代表的一个或多个处理器和存储器620代表的存储器的各种电路链接在一起。总线架构还可以将诸如外围设备、稳压器和功率管理电路等之类的各种其他电路链接在一起,这些都是本领域所公知的,因此,本文不再对其进行进一步描述。总线接口提供接口。收发机610可以是多个元件,即包括发送机和接收机,提供用于在传输介质上与各种其他装置通信的单元。针对不同的用户设备,用户接口630还可以是能够外接内接需要设备的接口,连接的设备包括但不限于小键盘、显示器、扬声器、麦克风、操纵杆等。
- [0324] 处理器600负责管理总线架构和通常的处理,存储器620可以存储处理器600在执行操作时所使用的数据。
- [0325] 可选的,处理器可以是CPU(中央处理器)、ASIC(Application Specific Integrated Circuit,专用集成电路)、FPGA(Field-Programmable Gate Array,现场可编程门阵列)或CPLD(Complex Programmable Logic Device,复杂可编程逻辑器件)。
- [0326] 可选的,所述收发机还用于:接收到测量配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0327] 可选的,所述处理器读取存储器中的程序,还执行:
- [0328] 控制所述收发机,通过RRC测量报告发送所述上报信息;或者
- [0329] 控制所述收发机,通过MAC CE发送所述上报信息;或者
- [0330] 控制所述收发机,通过L1信令发送所述上报信息。
- [0331] 本实施例中,所述测量配置信息请参见图1所示实施例中的相关描述,此处不再赘述。
- [0332] 本实施例中,所述上报条件请参见图1所示实施例中的相关描述,此处不再赘述。
- [0333] 本实施例中,所述上报信息请参见图1所示实施例中的相关描述,此处不再赘述。
- [0334] 基于同一发明构思,图6所示的实施例中,提供了一种网络设备,包括:
- [0335] 接收模块61,用于接收用户设备UE发送的与所述UE统计的LBT结果相关的上报信息;
- [0336] 确定模块62,用于根据所述上报信息,确定出所述UE所统计的LBT结果。
- [0337] 可选的,所述网络设备还包括:
- [0338] 发送模块63,用于发送配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0339] 可选的,所述接收模块具体用于:
- [0340] 通过RRC测量报告接收所述上报信息;或者

- [0341] 通过MAC CE接收所述上报信息;或者
- [0342] 通过L1信令接收所述上报信息。
- [0343] 本实施例中,所述测量配置信息请参见图1所示实施例中的相关描述,此处不再赘述。
- [0344] 本实施例中,所述上报条件请参见图1所示实施例中的相关描述,此处不再赘述。
- [0345] 本实施例中,所述上报信息请参见图1所示实施例中的相关描述,此处不再赘述。
- [0346] 基于同一发明构思,图7所示的实施例中,提供了另一种网络设备,包括:收发机510、以及与该收发机510连接的至少一个处理器500,其中:
- [0347] 处理器500,用于读取存储器520中的程序,执行下列过程:
- [0348] 通过收发机接收UE发送的与所述UE统计的LBT结果相关的上报信息;用于根据所述上报信息,确定出所述UE所统计的LBT结果;
- [0349] 收发机510,用于在处理器500的控制下接收和发送数据。
- [0350] 其中,在图7中,总线架构可以包括任意数量的互联的总线和桥,具体由处理器500代表的一个或多个处理器和存储器520代表的存储器的各种电路链接在一起。总线架构还可以将诸如外围设备、稳压器和功率管理电路等之类的各种其他电路链接在一起,这些都是本领域所公知的,因此,本文不再对其进行进一步描述。总线接口提供接口。收发机510可以是多个元件,即包括发送机和收发机,提供用于在传输介质上与各种其他装置通信的单元。处理器500负责管理总线架构和通常的处理,存储器520可以存储处理器500在执行操作时所使用的数据。
- [0351] 可选的,处理器可以是CPU(中央处理器)、ASIC(Application Specific Integrated Circuit,专用集成电路)、FPGA(Field-Programmable Gate Array,现场可编程门阵列)或CPLD(Complex Programmable Logic Device,复杂可编程逻辑器件)。
- [0352] 可选的,处理器读取存储器中的程序,还执行:
- [0353] 控制收发机发送配置信息,所述测量配置信息用于配置统计所需的信息和/或上报所需的信息。
- [0354] 可选的,所述收发机具体用于:
- [0355] 通过RRC测量报告接收所述上报信息;或者
- [0356] 通过MAC CE接收所述上报信息;或者
- [0357] 通过L1信令接收所述上报信息。
- [0358] 本实施例中,所述测量配置信息请参见图1所示实施例中的相关描述,此处不再赘述。
- [0359] 本实施例中,所述上报条件请参见图1所示实施例中的相关描述,此处不再赘述。
- [0360] 本实施例中,所述上报信息请参见图1所示实施例中的相关描述,此处不再赘述。
- [0361] 本领域内的技术人员应明白,本发明的实施例可提供为方法、系统、或计算机程序产品。因此,本发明可采用完全硬件实施例、完全软件实施例、或结合软件和硬件方面的实施例的形式。而且,本发明可采用在一个或多个其中包含有计算机可用程序代码的计算机可用存储介质(包括但不限于磁盘存储器、CD-ROM、光学存储器等)上实施的计算机程序产品的形式。
- [0362] 本发明是参照根据本发明实施例的方法、设备(系统)、和计算机程序产品的流程

图和/或方框图来描述的。应理解可由计算机程序指令实现流程图和/或方框图中的每一流程和/或方框、以及流程图和/或方框图中的流程和/或方框的结合。可提供这些计算机程序指令到通用计算机、专用计算机、嵌入式处理机或其他可编程数据处理设备的处理器以产生一个机器,使得通过计算机或其他可编程数据处理设备的处理器执行的指令产生用于实现在流程图一个流程或多个流程和/或方框图一个方框或多个方框中指定的功能的装置。

[0363] 这些计算机程序指令也可存储在能引导计算机或其他可编程数据处理设备以特定方式工作的计算机可读存储器中,使得存储在该计算机可读存储器中的指令产生包括指令装置的制造品,该指令装置实现在流程图一个流程或多个流程和/或方框图一个方框或多个方框中指定的功能。

[0364] 这些计算机程序指令也可装载到计算机或其他可编程数据处理设备上,使得在计算机或其他可编程设备上执行一系列操作步骤以产生计算机实现的处理,从而在计算机或其他可编程设备上执行的指令提供用于实现在流程图一个流程或多个流程和/或方框图一个方框或多个方框中指定的功能的步骤。

[0365] 尽管已描述了本发明的优选实施例,但本领域内的技术人员一旦得知了基本创造性概念,则可对这些实施例作出另外的变更和修改。所以,所附权利要求意欲解释为包括优选实施例以及落入本发明范围的所有变更和修改。

[0366] 显然,本领域的技术人员可以对本发明进行各种改动和变型而不脱离本发明的精神和范围。这样,倘若本发明的这些修改和变型属于本发明权利要求及其等同技术的范围之内,则本发明也意图包含这些改动和变型在内。

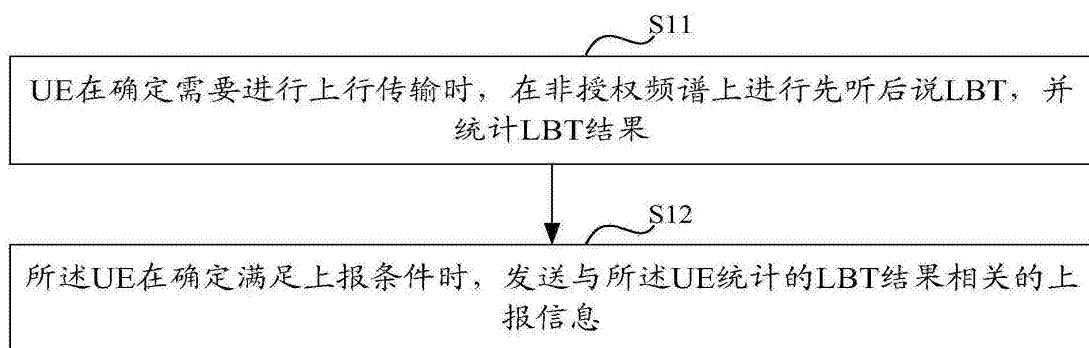


图1

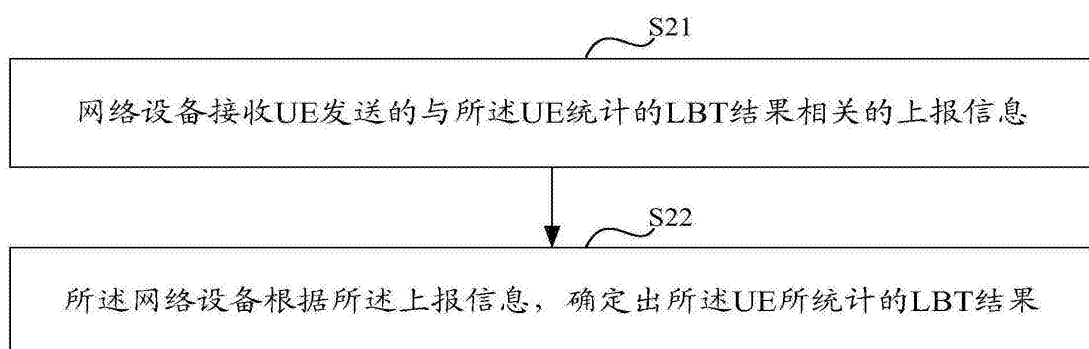


图2



图3

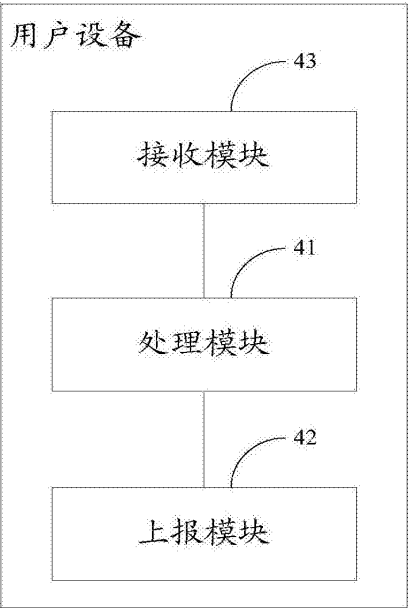


图4

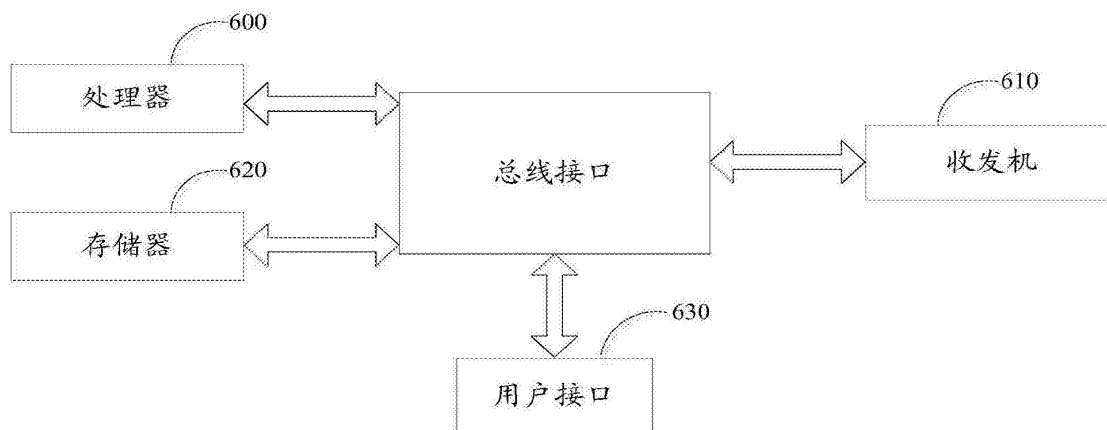


图5

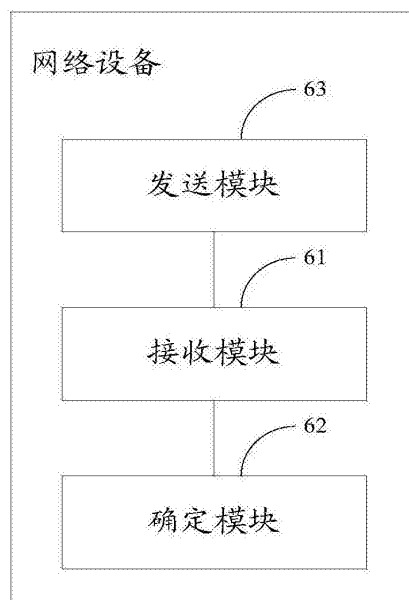


图6



图7



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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
16/737,787	01/08/2020		1720	US78684	20	2

CONFIRMATION NO. 8326

FILING RECEIPT



0000000114301560

54000
ScienBiziP, PC
550 South Hope Street
Suite 2825
Los Angeles, CA 90071

Date Mailed: 01/31/2020

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Inventor(s)

HUNG-CHEN CHEN, Hsinchu, TAIWAN;
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Applicant(s)

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Power of Attorney: The patent practitioners associated with Customer Number 54000

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/790,099 01/09/2019

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

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If Required, Foreign Filing License Granted: 01/29/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/737,787**

Projected Publication Date: 07/09/2020

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND APPARATUS FOR LBT FAILURE DETECTION

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/737,787				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300			
SEARCH FEE (37 CFR 1.16(k), (l), 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 = *				x 100 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	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			
			TOTAL			TOTAL	1720			
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE				TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE				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 Date			
First Named Inventor	HUNG-CHEN CHEN		
Title	METHOD AND APPARATUS FOR LBT FAILURE DETECTION		
Art Unit			
Examiner Name			
Attorney Docket Number	US78684		
SIGNATURE of Applicant or Patent Practitioner			
Signature	/Alvin Koan/	Date (Optional)	2020-01-08
Name	Alvin Koan	Registration Number	68468
Title (if Applicant is a juristic entity)	Patent Practitioner		
Applicant Name (if Applicant is a juristic entity)	FG Innovation Company Limited		
<p>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.</p>			
☐ *Total of _____ forms are submitted.			

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Application Number	Filing Date

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I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

FG Innovation Company Limited

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

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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

Chie-Ming Chou

Date (Optional)

2018-11-29

Name

CHIE-MING CHOU

Title

CEO

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METHOD AND APPARATUS FOR LBT FAILURE DETECTION

CROSS-REFERENCE TO RELATED APPLICATION(S)

5 [0001] The present application claims the benefit of and priority to a provisional U.S. Patent Application Serial No. 62/790,099, filed on January 9, 2019, entitled “Lower Layer Indications for LBT Results,” with Attorney Docket No. US76297 (hereinafter referred to as “US76297 application”). The disclosure of the US76297 application is hereby incorporated fully by reference into the present application.

10 FIELD

[0002] The present disclosure generally relates to wireless communication, and more particularly, to Listen-Before-Talk (LBT) failure indication and LBT failure event determination in the next generation wireless communication networks.

15 BACKGROUND

[0003] Various efforts have been made to improve different aspects of wireless communications, such as data rate, latency, reliability and mobility, for the next generation (e.g., fifth generation (5G) New Radio (NR)) wireless communication systems. LBT is a mechanism by which a wireless device applies Clear Channel Assessment (CCA) before using the channel. The 20 3rd Generation Partnership Project (3GPP) specifies a conservative LBT scheme similar to that used by Wi-Fi nodes to ensure coexistence of Licensed Assisted Access (LAA) with Wi-Fi. LAA uses carrier aggregation in downlink transmission to combine LTE in an unlicensed spectrum (e.g., 5 GHz) with LTE in a licensed band. In NR, LBT may be required prior to any transmission when operating on an unlicensed spectrum. There is a need in the industry for an improved and efficient 25 mechanism for a UE to handle LBT failure that may take place in the physical layer.

SUMMARY

[0004] The present disclosure is directed to a method for LBT failure detection performed by a UE in the next generation wireless communication networks.

30 [0005] According to an aspect of the present disclosure, a UE is provided. The UE includes one or more non-transitory computer-readable media having computer-executable instructions

embodied thereon and at least one processor coupled to the one or more non-transitory computer-readable media. The at least one processor is configured to execute the computer-executable instructions to: receive, by a Medium Access Control (MAC) entity of the UE, an LBT failure indication from a lower layer for all UL transmissions; increase an LBT failure counter when the
 5 MAC entity receives the LBT failure indication; determine an LBT failure event occurs when the LBT failure counter is greater than or equal to a threshold; and reset the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.

[0006] According to another aspect of the present disclosure, a method for LBT failure detection performed by a UE is provided. The method includes: receiving, by a MAC entity of the
 10 UE, an LBT failure indication from a lower layer for all UL transmissions; increasing an LBT failure counter when the MAC entity receives the LBT failure indication; determining an LBT failure event occurs when the LBT failure counter is greater than or equal to a threshold; and resetting the LBT failure counter after the MAC entity has not received the LBT failure indication for a time period.

15

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Aspects of the example disclosure are best understood from the following detailed description when read with the accompanying figures. Various features are not drawn to scale. Dimensions of various features may be arbitrarily increased or reduced for clarity of discussion.

20 **[0008]** Fig. 1 is a flowchart of an example method for LBT failure detection performed by a UE, according to an example implementation of the present application.

[0009] Fig. 2 is a flowchart of an example method for updating an LBT failure counter performed by a UE, according to an example implementation of the present application.

25 **[0010]** Fig. 3 is a flowchart of an example method performed by a UE after determining an LBT failure event occurs, according to an example implementation of the present application.

[0011] Fig. 4 is a flowchart of an example method performed by a UE when an LBT failure problem is indicated to an upper layer, according to an example implementation of the present application.

30 **[0012]** Fig. 5 is a block diagram illustrating a node for wireless communication according to various aspects of the present application.

DETAILED DESCRIPTION

[0013] The following description contains specific information pertaining to example implementations in the present disclosure. The drawings in the present disclosure and their accompanying detailed description are directed to merely example implementations. However, the present disclosure is not limited to merely these example implementations. Other variations and implementations of the present disclosure will occur to those skilled in the art. Unless noted otherwise, like or corresponding elements among the figures may be indicated by like or corresponding reference numerals. Moreover, the drawings and illustrations in the present disclosure are generally not to scale, and are not intended to correspond to actual relative dimensions.

[0014] For the purpose of consistency and ease of understanding, like features may be identified (although, in some examples, not shown) by the same numerals in the example figures. However, the features in different implementations may be differed in other respects, and thus shall not be narrowly confined to what is shown in the figures.

[0015] The description uses the phrases “in one implementation,” or “in some implementations,” which may each refer to one or more of the same or different implementations. The term “coupled” is defined as connected, whether directly or indirectly through intervening components, and is not necessarily limited to physical connections. The term “comprising,” when utilized, means “including, but not necessarily limited to”; it specifically indicates open-ended inclusion or membership in the so-described combination, group, series and the equivalent. The expression “at least one of A, B and C” or “at least one of the following: A, B and C” means “only A, or only B, or only C, or any combination of A, B and C.”

[0016] Additionally, for the purposes of explanation and non-limitation, specific details, such as functional entities, techniques, protocols, standard, and the like are set forth for providing an understanding of the described technology. In other examples, detailed description of well-known methods, technologies, systems, architectures, and the like are omitted so as not to obscure the description with unnecessary details.

[0017] Persons skilled in the art will immediately recognize that any network function(s) or algorithm(s) described in the present disclosure may be implemented by hardware, software or a combination of software and hardware. Described functions may correspond to modules which may be software, hardware, firmware, or any combination thereof. The software implementation

may comprise computer executable instructions stored on computer readable medium such as memory or other type of storage devices. For example, one or more microprocessors or general-purpose computers with communication processing capability may be programmed with corresponding executable instructions and carry out the described network function(s) or algorithm(s). The microprocessors or general-purpose computers may be formed of Applications Specific Integrated Circuitry (ASIC), programmable logic arrays, and/or using one or more Digital Signal Processor (DSPs). Although some of the example implementations described in this specification are oriented to software installed and executing on computer hardware, nevertheless, alternative example implementations implemented as firmware or as hardware or combination of hardware and software are well within the scope of the present disclosure.

[0018] The computer readable medium includes but is not limited to Random Access Memory (RAM), Read Only Memory (ROM), Erasable Programmable Read-Only Memory (EPROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), flash memory, Compact Disc Read-Only Memory (CD-ROM), magnetic cassettes, magnetic tape, magnetic disk storage, or any other equivalent medium capable of storing computer-readable instructions.

[0019] A radio communication network architecture (e.g., a Long Term Evolution (LTE) system, an LTE-Advanced (LTE-A) system, an LTE-Advanced Pro system, or a 5G NR Radio Access Network (RAN)) typically includes at least one base station, at least one UE, and one or more optional network elements that provide connection towards a network. The UE communicates with the network (e.g., a Core Network (CN), an Evolved Packet Core (EPC) network, an Evolved Universal Terrestrial Radio Access network (E-UTRAN), a 5G Core (5GC), or an internet), through a RAN established by one or more base stations.

[0020] It should be noted that, in the present application, a UE may include, but is not limited to, a mobile station, a mobile terminal or device, a user communication radio terminal. For example, a UE may be a portable radio equipment, which includes, but is not limited to, a mobile phone, a tablet, a wearable device, a sensor, a vehicle, or a Personal Digital Assistant (PDA) with wireless communication capability. The UE is configured to receive and transmit signals over an air interface to one or more cells in a radio access network.

[0021] A base station may be configured to provide communication services according to at least one of the following Radio Access Technologies (RATs): Worldwide Interoperability for Microwave Access (WiMAX), Global System for Mobile communications (GSM, often referred

to as 2G), GSM Enhanced Data rates for GSM Evolution (EDGE) Radio Access Network (GERAN), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS, often referred to as 3G) based on basic wideband-code division multiple access (W-CDMA), high-speed packet access (HSPA), LTE, LTE-A, eLTE (evolved LTE, e.g., LTE
5 connected to 5GC), NR (often referred to as 5G), and/or LTE-A Pro. However, the scope of the present application should not be limited to the above-mentioned protocols.

[0022] A base station may include, but is not limited to, a node B (NB) as in the UMTS, an evolved node B (eNB) as in the LTE or LTE-A, a radio network controller (RNC) as in the UMTS, a base station controller (BSC) as in the GSM/GERAN, a ng-eNB as in an E-UTRA base station
10 in connection with the 5GC, a next generation Node B (gNB) as in the 5G-RAN, and any other apparatus capable of controlling radio communication and managing radio resources within a cell. The base station may serve one or more UEs through a radio interface.

[0023] The base station is operable to provide radio coverage to a specific geographical area using a plurality of cells forming the radio access network. The base station supports the operations
15 of the cells. Each cell is operable to provide services to at least one UE within its radio coverage. More specifically, each cell (often referred to as a serving cell) provides services to serve one or more UEs within its radio coverage (e.g., each cell schedules the downlink and optionally uplink resources to at least one UE within its radio coverage for downlink and optionally uplink packet transmissions). The base station can communicate with one or more UEs in the radio
20 communication system through the plurality of cells. A cell may allocate sidelink (SL) resources for supporting Proximity Service (ProSe) or Vehicle to Everything (V2X) service. Each cell may have overlapped coverage areas with other cells.

[0024] As discussed above, the frame structure for NR is to support flexible configurations for accommodating various next generation (e.g., 5G) communication requirements, such as
25 Enhanced Mobile Broadband (eMBB), Massive Machine Type Communication (mMTC), Ultra-Reliable and Low-Latency Communication (URLLC), while fulfilling high reliability, high data rate and low latency requirements. The Orthogonal Frequency-Division Multiplexing (OFDM) technology as agreed in 3GPP may serve as a baseline for NR waveform. The scalable OFDM numerology, such as the adaptive sub-carrier spacing, the channel bandwidth, and the Cyclic Prefix
30 (CP) may also be used. Additionally, two coding schemes are considered for NR: (1) Low-Density Parity-Check (LDPC) code and (2) Polar Code. The coding scheme adaption may be configured

based on the channel conditions and/or the service applications.

[0025] Moreover, it is also considered that in a transmission time interval TX of a single NR frame, a downlink (DL) transmission data, a guard period, and an uplink (UL) transmission data should at least be included, where the respective portions of the DL transmission data, the guard
 5 period, the UL transmission data should also be configurable, for example, based on the network dynamics of NR. In addition, sidelink resources may also be provided in an NR frame to support ProSe services or V2X services.

[0026] The next-generation (e.g., 5G NR) wireless network is envisioned to support more capacity, data, and services. A UE configured with multi-connectivity may be connected to a
 10 Master Node (MN) as an anchor and one or more Secondary Nodes (SNs) for data delivery. Each one of these nodes may be formed by a cell group that includes one or more cells. For example, an MN may be formed by a Master Cell Group (MCG), and an SN may be formed by a Secondary Cell Group (SCG). In other words, for a UE configured with dual connectivity (DC), the MCG may be a set of one or more serving cells including the Primary Cell (PCell) and zero or more
 15 Secondary Cells (SCells), and the SCG may be a set of one or more serving cells including the Primary Secondary Cell (PSCell) and zero or more Secondary Cells (SCells).

[0027] As described above, the PCell may be an MCG cell that operates on the primary frequency, in which the UE either performs the initial connection establishment procedure or initiates the connection reestablishment procedure. In the Multi-Radio Dual Connectivity (MR-
 20 DC) mode, the PCell may belong to the MN. The PSCell may be an SCG cell in which the UE performs random access (e.g., when performing reconfiguration with a sync procedure). In MR-DC, the PSCell may belong to the SN. A Special Cell (SpCell) may refer to a PCell of the MCG or a PSCell of the SCG, depending on whether the MAC entity is associated with the MCG or the SCG. Otherwise the term Special Cell may refer to the PCell. A Special Cell may support a
 25 Physical Uplink Control Channel (PUCCH) transmission and contention-based Random Access, and may always be activated. Additionally, for a UE in an RRC_CONNECTED state that is not configured with carrier aggregation/dual connectivity (CA/DC), the UE may communicate with only one serving cell which may be the primary cell. Conversely, for a UE in the RRC_CONNECTED state that is configured with CA/DC, a set of serving cells including the
 30 special cell(s) and all of the secondary cells may communicate with the UE.

[0028] In addition, the terms “system” and “network” herein may be used interchangeably.

The term “and/or” herein is only an association relationship for describing associated objects, and represents that three relationships may exist. For example, A and/or B may indicate that: A exists alone, A and B exist at the same time, or B exists alone. In addition, the character “/” herein generally represents that the former and latter associated objects are in an “or” relationship.

- 5 **[0029]** In a Random Access (RA) procedure, two UE variables, including a counter for preamble transmission (e.g., *PREAMBLE_TRANSMISSION_COUNTER*) and a counter for power ramping (e.g., *PREAMBLE_POWER_RAMPING_COUNTER*), may be increased with every attempt. In NR-Unclicensed (NR-U) operations, power ramping may not be applied (e.g., the UE variable *PREAMBLE_POWER_RAMPING_COUNTER* does not increase) since a preamble is not
- 10 transmitted due to LBT failure. If the preamble is not transmitted due to LBT failure, the UE may perform the random access resource selection procedure again, and, the UE variable *PREAMBLE_TRANSMISSION_COUNTER* may not increase accordingly. As such, an indication of LBT failure from a physical layer to a MAC layer may be required (e.g., to maintain the counters).
- 15 **[0030]** Moreover, given that a Scheduling Request (SR) counter may not be updated depending on the LBT outcome, it may be beneficial to consider an additional mechanism where an SR procedure may be determined to be unsuccessful due to a systematic uplink LBT failure. This mechanism may be generally applicable to other uplink transmissions for determining a radio link problem.
- 20 **[0031]** When operating on an unlicensed spectrum, if a UE wants to transmit a preamble, a msg3 in a 4-Step RA procedure, a msgA in a 2-Step RA procedure, data on uplink configured grants, or an SR on a PUCCH resource, the UE may need to pass LBT first to occupy an LBT channel, a sub-band, a Bandwidth Part (BWP), a carrier, or a cell. Since the RA procedure, the SR procedure, or the transmission on configured grants may be mainly handled by the MAC layer, an
- 25 LBT failure indication or an LBT success indication from a lower layer (that is in charge of LBT mechanism) may be required for those operations.
- 30 **[0032]** In one implementation, an upper layer (e.g., a MAC layer) may instruct a lower layer (e.g., a PHY layer) to transmit a Random Access Preamble using a selected Physical Random Access Channel (PRACH) occasion, a corresponding Random Access Radio Network Temporary Identifier (RA-RNTI), a preamble index (e.g., a UE variable *PREAMBLE_INDEX* as described in Technical Standard (TS) 38.321) and a preamble received target power (e.g., a UE variable

PREAMBLE_RECEIVED_TARGET_POWER as described in TS 38.321). In one implementation, the upper layer (e.g., the MAC layer) may instruct the lower layer (e.g., the PHY layer) to transmit a msgA (of a 2-step RA procedure) using a selected PRACH occasion, an associated PUSCH resource, a corresponding RA-RNTI (if available), a corresponding MSGB-RNTI (if available), a selected preamble index (e.g., *PREAMBLE_INDEX*) and a preamble received target power (e.g., *PREAMBLE_RECEIVED_TARGET_POWER*). In one implementation, the upper layer (e.g., the MAC layer) may instruct the lower layer (e.g., the PHY layer) to transmit a msg3 (of a 4-step RA procedure) using the received uplink grant. In one implementation, the upper layer (e.g., the MAC layer) may instruct the lower layer (e.g., the PHY layer) to signal an SR on one valid PUCCH resource. In one implementation, the upper layer (e.g., the MAC layer) may instruct the lower layer (e.g., the PHY layer) to transmit UL data using configured grants which are configured by a Radio Resource Control (RRC) layer per serving cell and per BWP.

[0033] Fig. 1 is a flowchart of an example method 100 for LBT failure detection performed by a UE, according to an example implementation of the present application. In action 102, a MAC entity of the UE may receive an LBT failure indication from a lower layer (e.g., a PHY layer) for all UL transmissions. The LBT failure indication may be regardless of UL transmission types. For example, the PHY layer may provide a common LBT failure indication to the MAC entity when LBT fails for different UL transmission operations. In one implementation, the PHY layer may send an LBT failure indication to the MAC entity when the PHY layer determines that an LBT procedure of an UL transmission (e.g., regardless of UL transmission types) fails. In one implementation, the PHY layer may drop the UL transmission when it determines that the LBT procedure fails.

[0034] In action 104, the UE (e.g., the MAC entity of the UE) may increase an LBT failure counter when the MAC entity receives the LBT failure indication. In one implementation, the LBT failure counter is increased by a step value (e.g., 1) whenever the MAC entity receives the LBT failure indication.

[0035] In action 106, the UE (e.g., the MAC entity of the UE) may determine an LBT failure event occurs when the LBT failure counter is greater than or equal to a threshold. In one implementation, the threshold may be a parameter (e.g., *lbt-FailureInstanceMaxCount*) configured by a configuration (e.g., an RRC configuration). In one implementation, the threshold may be broadcast in system information.