发明内容

本发明的目的是提供一种MAC-e信令的传输的方法。

为实现上述目的，一种MAC-e信令的传输方法，包括步骤：

1）RNC对MAC-e信令配置QoS属性，并通知UE；

2）UE在进行数据传输时，如果MAC-e PDU中包含了MAC-e信令信息，UE根据MAC-e信令的QoS和数据的QoS属性确定整个MAC-e PDU的QoS；

3）UE根据确定后的QoS决定MAC-e PDU的发射功率,从而进行MAC-e PDU传输。

在本发明中，当MAC-e PDU中包含MAC-e Signalling时，UE能够根据MAC-e Signalling的需要，准确的确定整个MAC-e PDU的QoS属性，从而能合理的使用发射功率，有效的对MAC-e Signalling进行传输。

附图说明

图1是EUDCH新增的MAC实体的示意图；

图2是MAC-e PDU的结构图；

图3是含有多个MAC-d Flow的MAC-e PDU的PayLoad部分；

图4是EUDCH的物理信道。

具体实施方式

本发明的基本原理是，当MAC-e PDU中包含MAC-e信令时，UE能够根据MAC-e信令的需要，准确的确定整个MAC-e PDU的QoS属性，从而能合理的使用发射功率，有效的对MAC-e信令进行传输。

在本发明中，术语”基站”与3GPP英文规范中的词汇”Cell”具有相同的含义。

本发明包含下面的内容：

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RNC对MAC-e信令配置QoS属性，并通知UE该属性。

UE在进行数据传输时，如果MAC-e PDU中包含了MAC-e信令，在确定整个MAC-e PDU的QoS时要考虑MAC-e信令的QoS，然后根据确定后的QoS确定MAC-e PDU的发射功率，从而进行MAC-e PDU传输。

UE结合基站对MAC-e PDU的确认信息和其它信息，确定是否结束MAC-e信令的传输。

下面详细描述RNC对MAC-e信令配置QoS属性，并通知UE该属性。

QoS属性包含的参数是功率偏移量(PO)和最大重传次数。

QoS中功率偏移量PO的大小由网络来决定，并通过RRC信令或者系统信息广播等办法通知UE，如果Node B需要该信息，可以通过Iub/Iur接口信令通知Node B。

而对于QoS中最大重传次数，有两种方法：1）不给MAC-e信令配置最大重传次数；2）为MAC-e信令配置一个固定值。

当使用方法1,即不给MAC-e信令配置最大重传次数时，MAC-e信令的最大重传次数是0，即整个MAC-e PDU的最大重传次数由数据部分决定，但是MAC-e信令的传输次数不受MAC-e PDU的最大重传次数的限制。即MAC-e信令的(重新)传输可以一直进行直到它被成功接收或者MAC-e信令的内容发生了变化，放弃该MAC-e信令的传输。

当使用方法2,即为MAC-e信令的最大重传次数配置一个固定值时，该固定值可以由UTRAN来决定，并通知UE和Node B(如果Node B需要)；也可以在标准中指定。

为了便于描述UE确定MAC-e PDU的QoS时如何考虑MAC-e信令的QoS，先将MAC-e PDU中含有MAC-e信令的情况进行分类：情形1）MAC-e PDU中只有MAC-e 信令，没有其它数据；情形2）MAC-e PDU中同时含有数据和MAC-e信令，MAC-e信令的长度比较大，而且传输的频率也不频繁，可以称之为“长度大但频率低”的MAC-e信令。比如所有优先级

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队列中Buffer状况的汇报，可能每200毫秒传输一次，但每次会有几十个甚至上百个比特的信息；情形3）MAC-e PDU中同时含有数据和MAC-e信令，MAC-e信令的长度比较小，但传输的频率却比较高，可以称之为“长度小但频率高”的MAC-e信令。比如一个比特的RR(Rate Request)，每个TTI或者每两三个TTI就进行一次传输。

下面，针对上面三中情形分别描述UE如何确定MAC-e PDU的QoS。

在情形1，当UE在进行MAC-e PDU的传输时， MAC-e信令的QoS就是整个MAC-e PDU的QoS，即MAC-e信令的功率偏移量PO将被用于MAC-e PDU的功率调整。

在情形2和3，UE可以有两种方法确定MAC-e PDU的QoS。方法一：不论情形2和情形3，MAC-e PDU的QoS都由其中的数据部分决定。方法二：对于情形2，MAC-e PDU的QoS由MAC-e信令和数据共同决定；对于情形3，MAC-e PDU的QoS仅由其中的数据部分决定。

下面描述UE确定是否结束MAC-e信令的传输。具体的过程是：

首先，UE确定必须接收该MAC-e信令的基站，为了描述方便，称为“必收基站”。然后,将MAC-e信令放入某个MAC-e PDU中进行传输，并按如下方式处理：1）当MAC-e PDU没有被任何一个基站收到且没有达到MAC-e PDU的最大重传次数时，整个MAC-e PDU进行重传；2）当MAC-e PDU被某个(些)基站收到，但没有被所有的必收基站收到，或者传输次数已经达到MAC-e PDU的最大重传次数，MAC-e PDU中的数据部分不需要重新传输，而MAC-e 信令部分需要重新进行传输（即把MAC-e信令放入后面的MAC-e PDU中进行传输）；3）当MAC-e PDU被所有的必收基站成功接收后，停止该MAC-e信令的传输；4）当MAC-e信令被所有的必收基站成功接收之前，MAC-e信令内容发生了变化时，停止传输旧的MAC-e信令，开始传输更新后的MAC-e信令。

对于大多数的MAC-e信令，必收基站只是主调度基站(Serving Cell)；对于某些特殊的MAC-e信令，必收基站可能包含一个以上的基站。

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假定某个UE有三个QoS不同的MAC-d Flow（见图3），MAC-d Flow的PO和MAC-e 信令的PO见表1。

	功率偏移量PO
MAC-d Flow1	PO1 = 6
MAC-d Flow2	PO2 = 2
MAC-d Flow3	PO3 = 10
MAC-e信令	POs = 15

表 1

因为每个MAC-d Flow和MAC-e信令的QoS要求都不相同，因此表1中给出了四个功率偏移量PO，对应三个MAC-d Flow和MAC-e信令的QoS要求。

为了确定MAC-e PDU的发射功率，系统需要配置在参考QoS下不同的MAC-e PDU大小(E-TFI)所对应的增益因子。表2中给出了不同的E-TFI的对应的ß。

E-TFI	E-TFI1	E-TFI2	…	E-TFIx	…
增益因子ß	ß1	ß2	…	ßx	…

表 2

参见图2，某个MAC-e PDU包含了MAC-e信令，同时也包含三种QoS属性不同的MAC-d PDU。假定该MAC-e PDU的大小是E-TFIx，并且在MAC-e信令和三个MAC-d Flow中，MAC-e信令的QoS要求最高，那么传输该数据包时需要的发射功率是：

$$P_{E\text{-}DPDCH} = P_{DPCCH} * ßx + POs$$

$P_{E\text{-}DPDCH}$是MAC-e PDU所在的E-DPDCH信道的发射功率；P_{DPCCH}表示DPCCH信道的发射功率。

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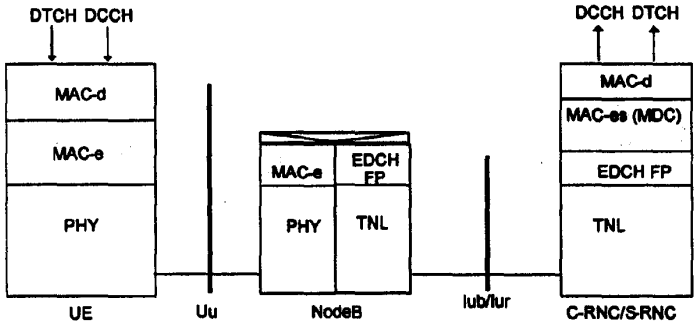


图 1

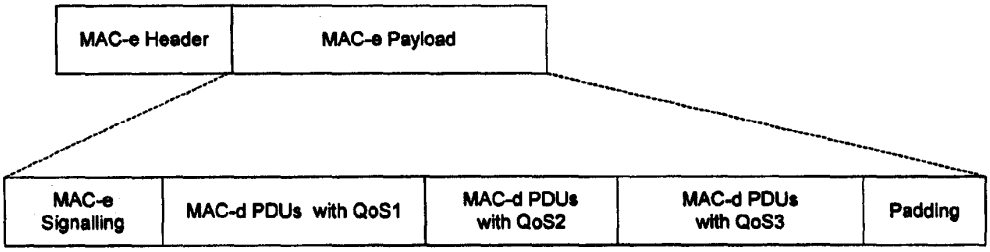


图 2

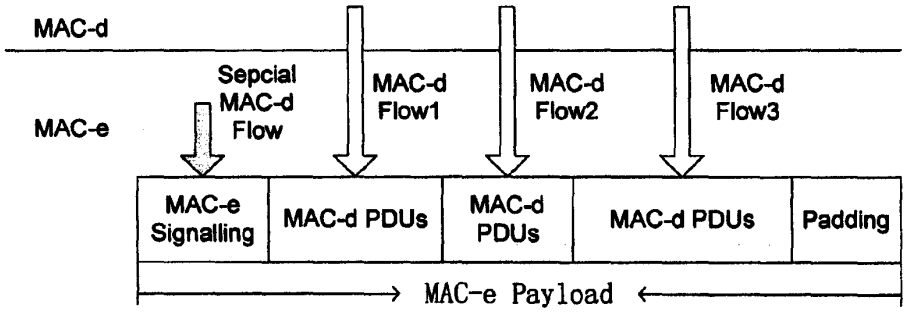


图 3

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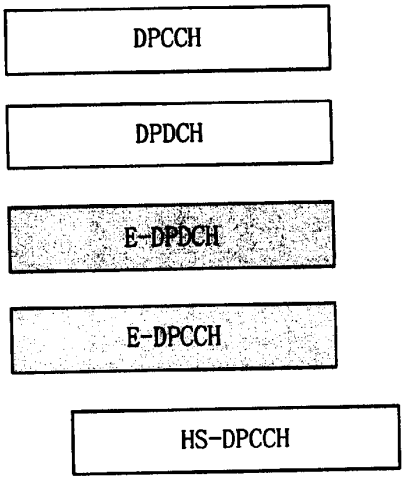


图 4

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Electronic Acknowledgement Receipt

EFS ID:	40716331
Application Number:	16421019
International Application Number:	
Confirmation Number:	9820
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Joseph P. Gushue/Margaret Ferello
Filer Authorized By:	Joseph P. Gushue
Attorney Docket Number:	SIG-2-1853US06
Receipt Date:	30-SEP-2020
Filing Date:	23-MAY-2019
Time Stamp:	15:53:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	SIG_2_1853US06_IDS_Form_SB08_20200930.pdf	1185045 b90a8661f8e1e39a847b770307b868a6c2733e72	no	4

Warnings:

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Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Transmittal Letter	SIG_2_1853US06_IDS_Transmittal-20200930.pdf	89353 6e23ed30408204f187d44dcff07b97d11229863f	no	4
Warnings:					
Information:					
3	Foreign Reference	a_SIG_2_1853US06_CN1777080A_EFS.pdf	2294312 c71b90ab56cb1cf5084165b0af3c2eefe1a7ac18	no	16
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	OA01_SIG_2_1853CN03_OA_20200828_EFS.pdf	543761 d3104d1507fe3b0431f3d25c46c2ed5319907176	no	15
Warnings:					
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		Total Files Size (in bytes):	4112471		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:	
	Pelletier et al.
Application No.:	16/421,019
Confirmation No.:	9820
Filed:	May 23, 2019
For:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
Group:	2464
Examiner:	Kan Yuen

Our File: SIG-2-1853US06

Date: September 8, 2020

RESPONSE PURSUANT TO 37 C.F.R. §1.111

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

Sir:

This Response is being timely filed in response to the Non-Final Office Action dated June 8, 2020.

Please amend the application without prejudice or disclaimer as follows:

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Electronic Acknowledgement Receipt

EFS ID:	40497348
Application Number:	16421019
International Application Number:	
Confirmation Number:	9820
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Joseph P. Gushue/Margaret Ferello
Filer Authorized By:	Joseph P. Gushue
Attorney Docket Number:	SIG-2-1853US06
Receipt Date:	08-SEP-2020
Filing Date:	23-MAY-2019
Time Stamp:	17:59:22
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		SIG_2_1853US06_Response_Non_Final__efs.pdf	127952 7a8ce245cf0cfc6980f0c0eff449b84091c9bd1c	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	5	9
	Claims	2	4
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	127952	

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS/ARGUMENTS

After the foregoing Amendment, claims 1–10 are currently pending in this application.

Request for an Interview

If any of the claims submitted herewith will be rejected by the Examiner, the Applicant respectfully requests a telephonic interview.

Claim Rejections - 35 U.S.C. §103

Claims 1-3, 5-8 and 10 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Publication No. 2008/0117891 to Damnjanovic et al. (hereinafter "Damnjanovic") in view of U.S. Publication No. 2007/0081492 to Petrovic et al. (hereinafter "Petrovic"). The Applicant respectfully disagrees.

Damnjanovic discloses techniques for efficiently assigning resources for spurts of traffic in a wireless communication system (see paragraph [0008]). In Damnjanovic, a UE may receive data to send on uplink resources (e.g., from a VoIP application), send a request for resources in response to receiving the data to send, and receive the resource assignment in response to the request (see paragraph [0064]). The UE may then send the data based on the resource assignment, set a

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timer to the predetermined time period after sending the data, send more data if available and if the timer has not expired, reset the timer after sending more data, and relinquish the resource assignment when the timer expires (see Damnjanovic, paragraph [0064]).

Damnjanovic fails to teach or suggest the use of an RRC message indicating allocated resources and MAC timer information, wherein the MAC timer being configured based on the MAC timer information as recited in the pending independent claims. The Examiner agrees (see page 3 of the Non-Final Office Action).

As shown above, Damnjanovic teaches the use of a timer where the timer is set by the UE after sending data on an uplink resource. Damnjanovic is silent regarding any teaching or suggestion regarding receiving a RRC message indicating timer information as recited in the pending independent claims. Accordingly, Damnjanovic fails to teach or suggest "receiving, by a wireless transmit/receive unit (WTRU), a radio resource control (RRC) message indicating uplink resources for WTRU and medium access control (MAC) timer information" as recited in the pending independent claims (emphasis added).

Petrovic fails to cure the deficiencies of Damnjanovic. Petrovic discloses a technique for controlling a radio cell change of a UE from a first radio cell to a second

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radio cell, wherein the first and the second radio cell is controlled by at least one base station of a mobile communication system (see paragraph [0001]).

Petrovic teaches that an activation time has to be determined in order to optimize the time delay between the decision of a base station to assign a UE to another radio cell (see paragraph [0120]). Petrovic defines the activation time as the time instant at which the base station controlling the target cell starts transmitting data to the communication terminal (see paragraph [0121]). Petrovic further teaches at least one of the activation time and information relating to the set up of a radio link may be transmitted to a communication terminal in a radio bearer setup message of a radio resource control protocol (see paragraphs [0077]-[0078]).

As shown above, Petrovic teaches the transmission of an "activation time" to a communication terminal performing a cell change. The "activation time" of Petrovic is defined as the time instant at which the base station controlling the target cell starts transmitting data (see paragraph [0121]). The Examiner is equating Petrovic's "activation time" with the "MAC timer information" found in the pending independent claims. This is not correct because Petrovic's "activation time" is related to the receipt of downlink data from a base station while the claimed "MAC timer information" is related to the deactivation of uplink resources at a WTRU. Petrovic fails to teach or suggest the transmission of any information to a communication

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terminal that the communication terminal uses for to set a timer used for deactivating uplink resources as recited in the pending independent claims.

Accordingly, Damnjanovic and Petrovic, used alone or in combination, are silent regarding any teaching or suggestion regarding "receiving ... MAC timer information ... and ... deactivating ... the indicated uplink resources in response to a MAC timer expiring, wherein the MAC timer is configured based on the MAC timer information" as recited in the pending independent claims.

Claims 2-3, 6, 7-8, and 10 are dependent upon claims 1 and 6, and the Applicant believes these claims are allowable over the cited references of record for the same reasons provided above.

Claims 4 and 9 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Damnjanovic in view of Petrovic, as applied to claim 1 above, and further in view of U.S. Publication No. 2007/0135130 to Lee (hereinafter "Lee").

Claims 4 and 9 are dependent upon claims 1 and 6, and the Applicant believes these claims are allowable over the cited references of record for the same reasons provided above.

Based on the arguments presented above, withdrawal of the 35 U.S.C. 103(a) rejection of claims 1-10 is respectfully requested.

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Conclusion

If the Examiner believes that any additional minor formal matters need to be addressed in order to place this application in condition for allowance, or that a telephonic interview will help to materially advance the prosecution of this application, the Examiner is invited to contact the undersigned by telephone at the Examiner's convenience.

In view of the foregoing, Applicant respectfully submits that the present application is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

Signal Trust for Wireless Innovation

By /Joseph P. Gushue/
Joseph P. Gushue
Registration No. 59,819

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JPG/pf

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Amendments to the Claims:

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

1. (Original) A wireless transmit/receive unit (WTRU) comprising:

a receiver;

a transmitter; and

a processor; and

wherein:

the receiver and the processor are configured to receive a radio resource control (RRC) message indicating uplink resources for WTRU and medium access control (MAC) timer information;

the transmitter and the processor are configured to transmit uplink data based on the indicated uplink resources; and

the processor is configured to deactivate the indicated uplink resources in response to a MAC timer expiring, the MAC timer being configured based on the MAC timer information.

2. (Original) The WTRU of claim 1 wherein the receiver and the processor are configured to receive an uplink grant associated with the indicated

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uplink resources and the transmitter and the processor are configured to transmit using the indicated uplink resources based on the grant.

3. (Original) The WTRU of claim 2 wherein based on the receipt of the uplink grant, the WTRU does not deactivate the indicated uplink resources.

4. (Original) The WTRU of claim 1 wherein the receiver and the processor are configured to receive a deactivation message and the processor is configured to deactivate the uplink resources based on the received deactivation message.

5. (Original) The WTRU of claim 1 wherein the MAC timer is based on a number of frames.

6. (Original) A method comprising:

receiving, by a wireless transmit/receive unit (WTRU), a radio resource control (RRC) message indicating uplink resources for WTRU and medium access control (MAC) timer information;

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transmitting, by the WTRU, uplink data based on the indicated uplink resources; and

deactivating, by the WTRU, the indicated uplink resources in response to a MAC timer expiring, wherein the MAC timer is configured based on the MAC timer information.

7. (Original) The method of claim 6 further comprising receiving, by the WTRU, an uplink grant associated with the indicated uplink resources and transmitting, by the WTRU, using the indicated uplink resources based on the grant.

8. (Original) The method of claim 7 wherein based on the receipt of the uplink grant, the WTRU does not deactivate the indicated uplink resources.

9. (Original) The method of claim 7 further comprising receiving, by the WTRU, a deactivation message and deactivating, by the WTRU, the uplink resources based on the received deactivation message.

10. (Original) The method of claim 7 wherein the MAC timer is based on a number of frames.

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

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16421019
Filing Date	2019-05-23
First Named Inventor	Benoit Pelletier
Art Unit	2464
Examiner Name	YUEN, KAN
Attorney Docket Number	SIG-2-1853US06

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	1	20020009774	A1	2002-07-25	Choi et al.	
	2	20090011795	A1	2009-01-08	Fukui et al.	
	3	20100309877	A1	2010-12-09	Damnjanovic et al.	
	4	20070230398	A1	2007-10-04	Jiang	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

ONEPLUS - EX. 1002

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16421019
	Filing Date	2019-05-23
	First Named Inventor	Benoit Pelletier
	Art Unit	2464
	Examiner Name	YUEN, KAN
	Attorney Docket Number	SIG-2-1853US06

	1							

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ONEPLUS - EX. 1002

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16421019
	Filing Date	2019-05-23
	First Named Inventor	Benoit Pelletier
	Art Unit	2464
	Examiner Name	YUEN, KAN
	Attorney Docket Number	SIG-2-1853US06

CERTIFICATION STATEMENT

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

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Joseph P. Gushue/	Date (YYYY-MM-DD)	2020-08-11
Name/Print	Joseph P. Gushue	Registration Number	59,819

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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 record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Electronic Patent Application Fee Transmittal

Application Number:	16421019
Filing Date:	23-May-2019
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
First Named Inventor/Applicant Name:	Benoit Pelletier
Filer:	Joseph P. Gushue/Margaret Ferello
Attorney Docket Number:	SIG-2-1853US06

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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	40246955
Application Number:	16421019
International Application Number:	
Confirmation Number:	9820
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Joseph P. Gushue/Margaret Ferello
Filer Authorized By:	Joseph P. Gushue
Attorney Docket Number:	SIG-2-1853US06
Receipt Date:	11-AUG-2020
Filing Date:	23-MAY-2019
Time Stamp:	14:42:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$240
RAM confirmation Number	E20208AE43084470
Deposit Account	220493
Authorized User	Margaret Ferello

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

37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	SIG_2_1853US06_SIDS_Transmittal_20200811.pdf	89145 adc67badd60bcf46985593ad4fc5ba9ce9a39011	no	4
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	SIG_2_1853US06_IDS_Form_SB08_20200811.pdf	1143483 3df6289867b61a64cfb1f8e5dd248b916f950bfd	no	4
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30487 9ece0924c8d780a65f6c02703a812d228fa7537e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1263115		

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.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:	
	Pelletier et al.
Application No.:	16/421,019
Filed:	May 23, 2019
For:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
Group:	2464
Examiner:	Kan Yuen

Our File:	SIG-2-1853US06
Date:	August 11, 2020

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Further to Applicant's Duty of Disclosure pursuant to 37 C.F.R. § 1.56, Applicant wishes to bring to the Examiner's attention the material cited on the enclosed PTO Form SB-08.

Pursuant to 37 C.F.R.§ 1.98(a)(2)(ii), copies of the newly cited U.S. publications and/or patent documents have not been included.

This application is a continuation of U.S. Patent Application No. 14/876,337 filed October 6, 2015, which issued on May 28, 2019 as U.S. Patent No. 10,306,677, which is

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a continuation of U.S. Patent Application No. 14/319,608 filed June 30, 2014, which issued on April 12, 2016 as U.S. Patent No. 9,313,809, which is a continuation of U.S. Patent Application No. 12/238,910 filed September 26, 2008, which issued on July 8, 2014 as U.S. Patent No. 8,774,104, which claims the benefit of U.S. Provisional Patent Application Nos. 61/083,409 filed July 24, 2008, 61/074,288 filed June 20, 2008, 61/038,576, filed March 21, 2008, 61/025,441 filed February 1, 2008, 61/018,999 filed January 4, 2008, 60/982,528 filed October 25, 2007 and 60/975,985 filed September 28, 2007.

This application is also related to co-pending U.S. Application No. 16/516,893, filed July 19, 2019, which is a continuation of U.S. Application No. 15/836,302, filed December 8, 2017, which issued on July 23, 2019 as U.S. Patent No. 10,362,622, which is a continuation of U.S. Patent Application No. 15/182,218, filed June 14, 2016, which issued on December 12, 2017 as U.S. Patent No. 9,844,093, which is a continuation of U.S. Patent Application No. 15/049,922, filed February 22, 2016, which issued on June 21, 2016 as U.S. Patent No. 9,374,816, which is a continuation of U.S. Patent Application No. 12/256,964, filed October 23, 2008, which issued on February 23, 2016, as U.S. Patent No. 9,217,280, which claims the benefit of U.S. Provisional Patent Application No. 60/982,528, filed October 25, 2007 and U.S. Provisional Patent Application No. 61/018,567, filed January 2, 2008.

Applicant also wishes to bring to the Examiner's attention co-pending U.S. Application No. 16/440,886, filed June 13, 2019, which is a continuation of U.S. Patent

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Application No. 15/782,532, filed October 12, 2017, which issued on June 18, 2019 as U.S. Patent No. 10,327,188, which is a continuation of U.S. Patent Application No. 15/135,616, filed April 22, 2016, which is a continuation of U.S. Patent Application No. 14/875,059 filed October 5, 2015, which is a continuation of U.S. Patent Application No. 13/665,734, filed October 31, 2012, which issued October 13, 2015, as U.S. Patent No. 9,161,285, which is a continuation of U.S. Patent Application No. 12/346,631, filed December 30, 2008, which issued December 4, 2012 as U.S. Patent No. 8,325,684, which claims priority from Provisional Application No. 61/018,567, which was filed January 2, 2008.

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It is respectfully requested that the Examiner consider these documents and return an initialed copy of the PTO Form SB-08 indicating consideration of the cited materials.

Respectfully submitted,

Signal Trust for Wireless Innovation

By /Joseph P. Gushue/
Joseph P. Gushue
Registration No. 59,819
(215) 568-6400

Volpe and Koenig, P.C.
30 South 17th Street; Suite 1800
Philadelphia, PA 19103-4009
Telephone: (215) 568-6400
Facsimile: (215) 568-6499

JPG/JMB/pf
Enclosure

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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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,019	05/23/2019	Benoit Pelletier	SIG-2-1853US06	9820

3624 7590 06/08/2020

VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18TH FLOOR
PHILADELPHIA, PA 19103

EXAMINER
YUEN, KAN

ART UNIT	PAPER NUMBER
2464	

NOTIFICATION DATE	DELIVERY MODE
06/08/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

eoffice@volpe-koenig.com

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Office Action Summary	**Application No.** 16/421,019	**Applicant(s)** Pelletier et al.	
	Examiner KAN YUEN	**Art Unit** 2464	**AIA (FITF) Status** No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 5/23/2019.

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

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-10 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-10 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 5/23/2019 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

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

4) ☐ Other: _____.

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DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Claim Rejections - 35 USC § 103

1. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 5-8, 10 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Damnjanovic et al. (Pub No.: 2008/0117891) in view of Petrovic et al. (Pub No.: 2007/0081492).

Regarding claim 1, Damnjanovic et al. discloses **a wireless transmit/receive unit (WTRU)** (see fig. 2; UE 116) **comprising:**

a receiver (see RCVR 254 in fig. 2)**; a transmitter** (see TMTR 254 in fig. 2)**; and a processor** (see processor 270 in fig. 2)**; and wherein: the receiver and the processor are configured to receive uplink resources for WTRU** (Damnjanovic et al. see para. 0064; the UE may receive the resource assignment in response to the request);

the transmitter and the processor are configured to transmit uplink data based on the indicated uplink resources (Damnjanovic et al. see para. 0064; the UE may then send the data based on the resource assignment, set a timer to the predetermined time period after sending the data); **and**

the processor is configured to deactivate the indicated uplink resources in response to a timer expiring (Damnjanovic et al. see para. 0064; relinquish the resource assignment when the timer expires).

However, Damnjanovic et al. does not explicitly disclose the feature to receive a radio resource control (RRC) message indicating allocated resources and MAC timer information, wherein MAC timer being configured based on the MAC timer information.

Petrovic et al. from the same or similar fields of endeavor discloses the feature to **receive a radio resource control (RRC) message indicating allocated resources** (read as information relating to link setup) **and MAC timer information** (read as the activation time), **wherein MAC timer being configured based on the MAC timer information** (Petrovic et al. see para. 0078, 0079, 0123; the activation time and the information relating to the setup of a radio link may be transmitted to the communication terminal in a radio bearer setup message of a radio resource control (RRC) protocol, wherein in determination of the appropriate activation time for a cell change, the determination process should consider that all transmission data packets (e.g. in form of MAC-hs PDUs) pending for the transmission). In other words, the activation time and information relating to link setup are transmitted

via a RRC message, wherein the information relating to the link setup is the radio link resource being allocated for setting up a radio link. The activation time is determined based on MAC packets.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Damnjanovic et al. and to implement with the feature/teaching of Petrovic et al. to allow allocated resources and timing information to be sent via the RRC protocol, wherein the timing information is based on MAC-hs PDUs.

The motivation would be to improve transmission reliability.

Claim 6 is rejected similarly to claim 1.

Regarding claims 2, 7, Damnjanovic et al. discloses the feature wherein the receiver and the processor are configured to receive an uplink grant associated with the indicated uplink resources and the transmitter and the processor are configured to transmit using the indicated uplink resources based on the grant (Damnjanovic et al. see para. 0007).

Regarding claims 3, 8, Damnjanovic et al. discloses the feature wherein based on the receipt of the uplink grant, the WTRU does not deactivate the indicated uplink resources (Damnjanovic et al. see para. 0007).

Regarding claims 5, 10, Petrovic et al. discloses the feature wherein the MAC timer is based on a number of frames (Petrovic et al. see para. 0078, 0079, 0123; wherein in determination of the appropriate activation time for a cell change, the determination process should consider that all transmission data packets (e.g. in form of MAC-hs PDUs) pending for the transmission). The activation time is determined based on all numbers of MAC packets pending for transmission.

2. Claims 4, 9 rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Damnjanovic et al. (Pub No.: 2008/0117891) in view of Petrovic et al. (Pub No.: 2007/0081492) as applied to claim 1 above, and further in view of Lee (Pub No.: 2007/0135130).

Regarding claims 4, 9, Damnjanovic et al. in view of Petrovic et al. does not explicitly disclose the feature wherein the receiver and the processor are configured to receive a deactivation message and the processor is configured to deactivate the uplink resources based on the received deactivation message.

Lee from the same or similar fields of endeavor discloses the feature wherein the receiver and the processor are configured to receive a deactivation message and the processor is configured to deactivate the uplink resources based on the received deactivation message (Lee see fig. 6, T6; para. 0070, 0078-0082).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Damnjanovic et al. and to implement with the feature/teaching of Petrovic et al. to receive deactivation scheduling grant message from the base station and the mobile stops the packet transmission based on the deactivation scheduling grant message.

The motivation would be to decrease network interference.

Examiner's Note

3. The Applicant is welcome to request a telephonic interview if the Applicant has any questions or requires any additional information that would further or expedite the prosecution of the application.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KAN YUEN whose telephone number is (571)270-1413. The examiner can normally be reached on Monday - Friday 11pm-7pm.

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, Ricky Ngo can be reached on 571-272-3139. 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.

/KAN YUEN/
Primary Examiner, Art Unit 2464

Notice of References Cited	Application/Control No. 16/421,019	Applicant(s)/Patent Under Reexamination Pelletier et al.	
	Examiner KAN YUEN	Art Unit 2464	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-20080117891-A1	05-2008	Damnjanovic; Aleksandar	H04W72/04	370/345
*	B	US-20070081492-A1	04-2007	Petrovic; Dragan	H04L1/1812	370/331
*	C	US-20070135130-A1	06-2007	Lee; Jinsock	H04W72/1289	455/450
	D					
	E					
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	J					
	K					
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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
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	S					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,019	Pelletier et al.
	Examiner	**Art Unit**
	KAN YUEN	2464

✓	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	05/27/2020								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								

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CPC - Searched*		
Symbol	**Date**	**Examiner**
H04L5/001 ; H04L5/0053 ; H04L5/0091 ; H04W52/0216 ; H04W72/0413 ; H04W72/1273 ; H04W76/27 ; H04W76/28 ; H04W76/20 ; Y02D70/00 ; Y02D70/1262 OR Y02D70/142 ; Y02D70/24 ; Y02D70/25	05/27/2020	KY
H04L1/1812 ; H04L5/0053 ; H04L5/0055 ; H04W28/04 ; H04W72/04 ; H04W72/0406 ; H04W72/12 ; H04W74/0833 ; H04W76/27 ; H04W76/38 ; H04W88/08	05/27/2020	KY

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**
EAST SEARCH; MANUAL SEARCH H04L5/0053	05/27/2020	KY
INVENTORSHIP SEARCH	05/27/2020	KY
NPL SEARCH (STIC, 3GPP, IEEE XPLORE, GOOGLE SCHOLAR)	05/27/2020	KY

/KAN YUEN/ Primary Examiner, Art Unit 2464	

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

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	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

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4 Corresponds to JP 2007-506378 and WO 05/029785
5 Corresponds to TW 200640268
6 Corresponds to JP 2009-147920
7 Corresponds to JP 2005-539468
8 Corresponds to RU 2310276

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15 Corresponds to KR 2007-0073578
16 Corresponds to US 7,180,855

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EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
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		NOKIA CORPORATION ET AL., "Introduction of Enhanced Uplink in CELL_FACH in 25.319," 3GPP TSG RAN WG2 meeting #62, R2-082368, Kansas City, USA (May 5-9, 2008). (See pp. 5-7 and 30-35).
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		THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 6)," 3GPP TS 25.211 V6.8.0 (September 2007).
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EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

5740949-1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.Y/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
		THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; UTRAN Iur Interface User Plane Protocols for Common Transport Channel Data Streams (Release 7)," 3GPP TS 25.425 V7.4.0 (June 2007).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 7)," 3GPP TS 25.427 V7.4.0 (March 2007).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 8)," 3GPP TS 25.427 V8.0.0 (March 2008).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 7)," 3GPP TS 25.427 V7.5.0 (September 2007).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 5)," 3GPP TS 25.427 V5.5.0 (June 2005).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 6)," 3GPP TS 25.427 V6.8.0 (December 2006).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 4)," 3GPP TS 25.427 V4.5.0 (December 2003).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 1999)," 3GPP TS 25.427 V3.11.0 (December 2003).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 1999)," 3GPP TS 25.425 V3.8.0 (December 2003).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 4)," 3GPP TS 25.425 V4.4.0 (December 2003).
		THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 5)," 3GPP TS 25.425 V5.8.0 (June 2005).
		THIRD GENERATION PARTNERSHIP PRORGAM SUPPORT TEAM, "Current Minutes of the 59bis TSG-RAN WG2 Meeting (Shanghai, China, 08-12 October 2007)", TSG-RAN WG2 Meeting #60, R2-7xxxx, (Korea, November 05-09, 2007).

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/KAN YUEN/	06/03/2020

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	Application Number	
	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
		TSG-RAN-WG2, "Reply LS on Enhanced Uplink for CELL_FACH state in FDD," 3GPP TSG-RAN-WG2 Meeting #60, R2-075472 (November 5-9, 2007).
		THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 7)", 3GGP TS 25.321 V7.3.0 (December 2006)
		THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group radio Access Network; UTRAN lub/lar interface user plane protocol for DCH data streams," 3GPP TS 25.427 V7.3.0 (December 2006)
		NOKIA SIEMENS NETWORKS, ON E-DCH RESOURCE RELEASE [ONLINE], 3GPP TSG-RAN WG2#62 | R2-082579, KANSAS CITY, USA, MAY 5-9, 2008
		HUAWEI, RLF BACK OFF FOR ENHANCED UPLINK IN CELL_FACH STATE [ONLINE], 3GPP TSG-RAN WG2#63, R2-084415, AUGUST 18-22, 2008, JEJU ISLAND, KR
		ETSI TS 125 321 (V7.2.0 (2006-09) Technical Specification Universal Mobile Telecommunications System (UMTS); Medium Access Control (MAC) protocol specification, (3GPP TS 25.321 version 7.2.0 Release 7)
		3GPP, Tech Spec. Group Radio Access Network; Physical Channels and Mapping of Transport Channels Onto Physical Channels (FDD) Release 7), TS 25.211, V.7.2.0., May 2007
		NOKIA CORPORATION ET AL., "Enhanced Uplink for CELL_FACH in 25.321," 3GPP TSG-RAN WG2 Meeting #61, R2-081774, Shenzhen, China (March 31 - April 4, 2008).
		THIRD GENERATION PARTNERSHIP PROJECT, "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Interface Protocol Architecture (Release 7)," 3GPP TS 25.301 V7.2.0 (June 2007).
		THIRD GENERATION PARTNERSHIP PROJECT, "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Interface Protocol Architecture (Release 7)," 3GPP TS 25.301 V7.3.0 (September 2007).
		THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Radio Interface Protocol Architecture (Release 8)," 3GPP TS 25.301 V8.3.0 (September 2008).
		UNIVERAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS); UTRAN lub interface Node B Application Part (NBAP) signalling (3GPP TS 25.433 version 7.5.0 Release 7), ETSI TS 125 433 V7.5.0 (June 2007).

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/KAN YUEN/	06/03/2020

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	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
		UNIVERAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS); UTRAN Iub interface Node B Application Part (NBAP)signalling, (3GPP TS 25.433 version 7.6.0 Release 7), ETSI TS 125 433 V7.6.0 (October 2007).
		UNIVERAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS); UTRAN Iub interface Node B Application Part (NBAP) signalling (3GPP TS 25.433 version 8.1.0 Release 8), ETSI TS 125 433 V8.1.0 (October 2008).
		3GPP TS 25.321 V7.2.0, SEPTEMBER 9, 2006, PAGES 81-82, PAGES 91-93

X** English Abstract Provided

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BIB DATA SHEET

CONFIRMATION NO. 9820

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
16/421,019	05/23/2019	370	2464	SIG-2-1853US06

APPLICANTS

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INVENTORS

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Vincent Roy, Longueuil, CANADA;
Paul Marinier, Brossard, CANADA;
Eldad M. Zeira, Huntington, NY;

**** CONTINUING DATA ***************************

This application is a CON of 14/876,337 10/06/2015 PAT 10306677
which is a CON of 14/319,608 06/30/2014 PAT 9313809
which is a CON of 12/238,910 09/26/2008 PAT 8774104
which claims benefit of 60/975,985 09/28/2007
and claims benefit of 60/982,528 10/25/2007
and claims benefit of 61/018,999 01/04/2008
and claims benefit of 61/025,441 02/01/2008
and claims benefit of 61/038,576 03/21/2008
and claims benefit of 61/074,288 06/20/2008
and claims benefit of 61/083,409 07/24/2008

**** FOREIGN APPLICATIONS **************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

05/30/2019

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /KAN YUEN/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CANADA	9	10	2

ADDRESS

VOLPE AND KOENIG, P.C.
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PHILADELPHIA, PA 19103
UNITED STATES

TITLE

METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES

FILING FEE RECEIVED	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time)

BIB (Rev. 05/07).

1720	No._____ for following:	❑ 1.18 Fees (Issue) ❑ Other _____ ❑ Credit

ONEPLUS - EX. 1002

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	1909	((Pelletier near3 Benoit) or (Pani near3 Diana) or (DiGirolamo near3 Rocco) or (Cave near3 Christopher) or (Roy near3 Vincent) or (Marinier near3 Paul) or (Zeira near3 Eldad)).in.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:51
L6	553	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:51
L7	13	L5 L6	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:51
L8	2344	(mac near6 tim$4).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:51
L9	1	7 8	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:51
L10	6	("10306677").PN.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	OR	OFF	2020/05/27 21:53
L11	4	("9313809").PN.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	OR	OFF	2020/05/27 21:54

L12	3	("8774104").PN.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	OR	OFF	2020/05/27 21:55
L13	1909	((Pelletier near3 Benoit) or (Pani near3 Diana) or (DiGirolamo near3 Rocco) or (Cave near3 Christopher) or (Roy near3 Vincent) or (Marinier near3 Paul) or (Zeira near3 Eldad)).in.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L14	553	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L15	13	L5 L6	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L16	2344	(mac near6 tim$4).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L21	9936	(timer same (RRC or (radio adj3 resource adj3 control)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L22	10316	(((uplink or ul or upstream$4) near6 (grant$4 or resource or prb)) with (RRC or (radio adj3 resource adj3 control)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L23	2574	L21 L22	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55

L24	1267	(expir$4 or expiration) same (deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L25	203	L23 L24	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L26	203	L23 L24	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L27	116237	((H04L5/001 OR H04L5/0053 OR H04L5/0091 OR H04W52/0216 OR H04W72/0413 OR H04W72/1273 OR H04W76/27 OR H04W76/28 OR H04W76/20 OR Y02D70/00 OR Y02D70/1262 OR Y02D70/142 OR Y02D70/24 OR Y02D70/25).CPC.)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L28	122075	((H04L1/1812 OR H04L5/0053 OR H04L5/0055 OR H04W28/04 OR H04W72/04 OR H04W72/0406 OR H04W72/12 OR H04W74/0833 OR H04W76/27 OR H04W76/38 OR H04W88/08).CPC.)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L29	182217	L27 or L28	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L30	159	L26 L29	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L31	159	L26 L29	US-PGPUB; USPAT; USOCR;	AND	ON	2020/05/27 21:55

			EPO; DERWENT			
L32	1582	(expir$4 or expiration) same (terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L33	1267	L24 L32	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L34	673	L29 L33	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L35	53	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L34	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L36	280	(US-20060054117-$ | US-20070073578-$ | US-0008152-$ | US-0010278-$ | US-00189071-$ | US-0023629-$ | US-0026490-$ | US-0026623-$ | US-0039326-$ | US-0047445-$ | US-0049669-$ | US-0052229-$ | US-0053035-$ | US-0054117-$ | US-0054298-$ | US-0061881-$ | US-0068505-$ | US-0073578-$ | US-0086671-$ | US-0091652-$ | US-0098165-$ | US-0101299-$ | US-0103852-$ | US-0115871-$ | US-0116118-$ | US-0117860-$ | US-0125043-$ | US-0135113-$ | US-0135769-$ | US-0140154-$ | US-0142032-$ | US-0143074-$ | US-0164540-$ | US-0168704-$ | US-0168724-$ | US-0172739-$ | US-0180371-$ | US-0182065-$ | US-0189237-$ | US-0192766-$ | US-	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55

		0194259-$ | US-0196239-$ | US-0206531-$ | US-0213059-$ | US-0214225-$ | US-0215005-$ | US-0216471-$ | US-0219868-$ | US-0223452-$ | US-0223609-$ | US-0225709-$ | US-0225739-$ | US-0249163-$ | US-0250504-$ | US-0251027-$ | US-0257407-$ | US-0268852-$ | US-0278143-$ | US-0280145-$ | US-0285791-$ | US-0309877-$ | US-0318170-$ | US-0327833-$ | US-20030223452-$ | US-20040052229-$ | US-20040068505-$ | US-20040117860-$ | US-20040089937-$ | US-20050026623-$ | US-20050053035-$ | US-20050054298-$ | US-20050101299-$ | US-20050180371-$ | US-20050249163-$ | US-20050250504-$ | US-20060023629-$ | US-20060026490-$ | US-20060039326-$ | US-20060116118-$ | US-20060140154-$ | US-20060142032-$ | US-20060172739-$ | US-20060182065-$ | US-20060251027-$ | US-20060280145-$ | US-20070047445-$ | US-20070115871-$ | US-20070135113-$ | US-20070189237-$ | US-20070206531-$ | US-20070213059-$ | US-20070223609-$ | US-20080008152-$ | US-20080049669-$ | US-20080125043-$ | US-20080192766-$ | US-20080194259-$ | US-20080214225-$ | US-20080268852-$ | US-20090010278-$ | US-20090061881-$ | US-20090086671-$ | US-20090135769-$ | US-20090143074-$ | US-20090168704-$ | US-20090168724-$ | US-20090196239-$ | US-20090219868-$ | US-20090225709-$ | US-20090225739-$ | US-20090257407-$ | US-20090318170-$ | US-20100091652-$ | US-20100098165-$ | US-20100103852-$ | US-20100215005-$ | US-20100216471-$ | US-20100278143-$ | US-20100285791-$ | US-20100309877-$ | US-20110164540-$ | US-20120327833-$ | US-2305372-$ | US-5740949-$ | US-6167248-$ | US-6246692-$ | US-6721566-$ | US-6845238-$ | US-7079489-$ | US-7145889-$ | US-7406314-$ | US-7477609-$ | US-7480269-$ | US-7508792-$ | US-7643515-$ | US-7890094-$ | US-7894390-$ | US-8259752-$ | US-				

		8989082-$ | US-9844093-$ | US-7180855-$).DID.				
L37	1	L34 L36	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L38	1	L34 L36	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L39	11	L21 L36	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L40	1490	((resource or grant) near7 (uplink or "UL" or upstream) same timer same ((high$4 near4 layer near4 signal$4) or RRC or (radio adj3 resource adj3 control)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L41	192	L32 L40	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L42	1	L36 L41	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L43	2	L35 L41	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L44	7768	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with (timer)	US-PGPUB; USPAT; USOCR;	AND	ON	2020/05/27 21:55

			EPO; DERWENT			
L45	611	L32 L44	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L46	77	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L45	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L47	77	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L45	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L48	13338	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with (timer or expir$4 or expiration or (tim$4 near4 limit$4))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L49	4687	L29 L48	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L50	663	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L49	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L51	7606	(timer with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L52	55	L50 L51	US-PGPUB; USPAT; USOCR;	AND	ON	2020/05/27 21:55

			EPO; DERWENT			
L53	55	L50 L51	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L54	25326	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same (timer or expir$4 or expiration or (tim$4 near4 limit$4))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L55	22665	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L56	3744	L54 L55	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L57	240	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L56	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L58	25326	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same (timer or expir$4 or expiration or (tim$4 near4 limit$4))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L59	22665	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L60	3744	L58 L59	US-PGPUB; USPAT; USOCR;	AND	ON	2020/05/27 21:55

			EPO; DERWENT			
L61	240	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L60	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L62	22665	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L63	3797	(expir$4 or expiration) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L64	1834	L62 L63	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L65	54	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L64	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L66	54	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L64	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L67	1	16/421019 (mac with tim$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L68	7606	(timer with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR;	AND	ON	2020/05/27 21:55

			EPO; DERWENT			
L69	11582	((timer or (tim$4 near2 (information or expir$4 or expiration))) with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L70	22665	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L71	2428	L69 L70	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L72	1582	(expir$4 or expiration) same (terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L73	201	L71 L72	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L74	1	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L73	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L75	97	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L71	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55

L76	97	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L71	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L77	3296	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control)) same (timer or (tim$4 near4 (information or expir$4 or expiration)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L78	1337	((timer or (tim$4 near2 (information or expir$4 or expiration))) with (mac or (medium adj3 access adj3 control$4))) L77	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L79	43	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L78	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L80	43	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L78	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L81	33513	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L82	15405	(timer or (tim$4 near4 (information or expir$4 or expiration))) same ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L83	7851	L81 L82	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55

L84	11582	((timer or (tim$4 near2 (information or expir$4 or expiration))) with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L85	2314	L83 L84	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L86	83	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L85	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L87	83	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L85	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L88	280	(US-20060054117-$ | US-20070073578-$ | US-0008152-$ | US-0010278-$ | US-00189071-$ | US-0023629-$ | US-0026490-$ | US-0026623-$ | US-0039326-$ | US-0047445-$ | US-0049669-$ | US-0052229-$ | US-0053035-$ | US-0054117-$ | US-0054298-$ | US-0061881-$ | US-0068505-$ | US-0073578-$ | US-0086671-$ | US-0091652-$ | US-0098165-$ | US-0101299-$ | US-0103852-$ | US-0115871-$ | US-0116118-$ | US-0117860-$ | US-0125043-$ | US-0135113-$ | US-0135769-$ | US-0140154-$ | US-0142032-$ | US-0143074-$ | US-0164540-$ | US-0168704-$ | US-0168724-$ | US-0172739-$ | US-0180371-$ | US-0182065-$ | US-0189237-$ | US-0192766-$ | US-0194259-$ | US-0196239-$ | US-0206531-$ | US-0213059-$ | US-0214225-$ | US-0215005-$ | US-0216471-$ | US-0219868-$ | US-0223452-$ | US-	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55

		0225709-$ | US-0225739-$ | US-0249163-$ | US-0250504-$ | US-0251027-$ | US-0257407-$ | US-0268852-$ | US-0278143-$ | US-0280145-$ | US-0285791-$ | US-0309877-$ | US-0318170-$ | US-0327833-$ | US-20030223452-$ | US-20040052229-$ | US-20040068505-$ | US-20040117860-$ | US-20040089937-$ | US-20050026623-$ | US-20050053035-$ | US-20050054298-$ | US-20050101299-$ | US-20050180371-$ | US-20050249163-$ | US-20050250504-$ | US-20060023629-$ | US-20060026490-$ | US-20060039326-$ | US-20060116118-$ | US-20060140154-$ | US-20060142032-$ | US-20060172739-$ | US-20060182065-$ | US-20060251027-$ | US-20060280145-$ | US-20070047445-$ | US-20070115871-$ | US-20070135113-$ | US-20070189237-$ | US-20070206531-$ | US-20070213059-$ | US-20070223609-$ | US-20080008152-$ | US-20080049669-$ | US-20080125043-$ | US-20080192766-$ | US-20080194259-$ | US-20080214225-$ | US-20080268852-$ | US-20090010278-$ | US-20090061881-$ | US-20090086671-$ | US-20090135769-$ | US-20090143074-$ | US-20090168704-$ | US-20090168724-$ | US-20090196239-$ | US-20090219868-$ | US-20090225709-$ | US-20090225739-$ | US-20090257407-$ | US-20090318170-$ | US-20100091652-$ | US-20100098165-$ | US-20100103852-$ | US-20100215005-$ | US-20100216471-$ | US-20100278143-$ | US-20100285791-$ | US-20100309877-$ | US-20110164540-$ | US-20120327833-$ | US-2305372-$ | US-5740949-$ | US-6167248-$ | US-6246692-$ | US-6721566-$ | US-6845238-$ | US-7079489-$ | US-7145889-$ | US-7406314-$ | US-7477609-$ | US-7480269-$ | US-7508792-$ | US-7643515-$ | US-7890094-$ | US-7894390-$ | US-8259752-$ | US-8989082-$ | US-9844093-$ | US-7180855-$).DID.				

L89	4	L87 L88	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L90	4	L87 L88	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L91	4	10/572277 (activation near5 tim$4 with mac)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L92	4	10/572277 (information with set near4 up)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L93	6651	(terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) near6 (message or packet or signal) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L94	2090	(terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) near6 (message or packet or signal) with (allocat$4 or assign$4 or schedul$4) with (bs or (base adj2 station) or ap or (access adj2 point) or repeater or (node adj b) or bts or node$1b or node-b or enb or node$1b or enodeb or femto or femtocell or femto-cell)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L95	1381	L93 L94	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55

L96	641	h04w72/$.cpc. L95	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L97	118	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L96	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L98	118	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") L96	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L99	1909	((Pelletier near3 Benoit) or (Pani near3 Diana) or (DiGirolamo near3 Rocco) or (Cave near3 Christopher) or (Roy near3 Vincent) or (Marinier near3 Paul) or (Zeira near3 Eldad)).in.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L100	553	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L101	13	L99 L100	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L102	2344	(mac near6 tim$4).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55
L103	1	L101 L102	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2020/05/27 21:55

L104	2	("20040068505").PN.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	OR	OFF	2020/05/27 21:55
L105	2	("20100309877").PN.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	OR	OFF	2020/05/27 21:55
S2	1830	((Pelletier near3 Benoit) or (Pani near3 Diana) or (DiGirolamo near3 Rocco) or (Cave near3 Christopher) or (Roy near3 Vincent) or (Marinier near3 Paul) or (Zeira near3 Eldad)).in.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 16:06
S3	443	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 16:10
S4	13	S2 S3	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 16:10
S5	2212	(mac near6 tim$4).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 16:11
S14	8563	(timer same (RRC or (radio adj3 resource adj3 control)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 19:17
S15	8446	(((uplink or ul or upstream$4) near6 (grant$4 or resource or prb)) with (RRC or (radio adj3 resource adj3 control)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 19:19

S16	2077	S14 S15	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 19:21
S18	1164	(expir$4 or expiration) same (deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:04
S19	163	S16 S18	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:06
S20	163	S16 S18	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:06
S23	101356	((H04L5/001 OR H04L5/0053 OR H04L5/0091 OR H04W52/0216 OR H04W72/0413 OR H04W72/1273 OR H04W76/27 OR H04W76/28 OR H04W76/20 OR Y02D70/00 OR Y02D70/1262 OR Y02D70/142 OR Y02D70/24 OR Y02D70/25).CPC.)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:09
S25	106674	((H04L1/1812 OR H04L5/0053 OR H04L5/0055 OR H04W28/04 OR H04W72/04 OR H04W72/0406 OR H04W72/12 OR H04W74/0833 OR H04W76/27 OR H04W76/38 OR H04W88/08).CPC.)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:09
S26	161356	S23 or S25	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:10
S27	128	S20 S26	US-PGPUB; USPAT; USOCR;	AND	ON	2019/09/19 20:10

			EPO; DERWENT			
S28	128	S20 S26	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:10
S29	1468	(expir$4 or expiration) same (terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:17
S30	1164	S18 S29	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:33
S31	601	S26 S30	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:34
S32	53	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S31	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:34
S34	280	(US-20060054117-$ | US-20070073578-$ | US-0008152-$ | US-0010278-$ | US-00189071-$ | US-0023629-$ | US-0026490-$ | US-0026623-$ | US-0039326-$ | US-0047445-$ | US-0049669-$ | US-0052229-$ | US-0053035-$ | US-0054117-$ | US-0054298-$ | US-0061881-$ | US-0068505-$ | US-0073578-$ | US-0086671-$ | US-0091652-$ | US-0098165-$ | US-0101299-$ | US-0103852-$ | US-0115871-$ | US-0116118-$ | US-0117860-$ | US-0125043-$ | US-	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:35

		0135769-$ | US-0140154-$ | US-0142032-$ | US-0143074-$ | US-0164540-$ | US-0168704-$ | US-0168724-$ | US-0172739-$ | US-0180371-$ | US-0182065-$ | US-0189237-$ | US-0192766-$ | US-0194259-$ | US-0196239-$ | US-0206531-$ | US-0213059-$ | US-0214225-$ | US-0215005-$ | US-0216471-$ | US-0219868-$ | US-0223452-$ | US-0223609-$ | US-0225709-$ | US-0225739-$ | US-0249163-$ | US-0250504-$ | US-0251027-$ | US-0257407-$ | US-0268852-$ | US-0278143-$ | US-0280145-$ | US-0285791-$ | US-0309877-$ | US-0318170-$ | US-0327833-$ | US-20030223452-$ | US-20040052229-$ | US-20040068505-$ | US-20040117860-$ | US-20040089937-$ | US-20050026623-$ | US-20050053035-$ | US-20050054298-$ | US-20050101299-$ | US-20050180371-$ | US-20050249163-$ | US-20050250504-$ | US-20060023629-$ | US-20060026490-$ | US-20060039326-$ | US-20060116118-$ | US-20060140154-$ | US-20060142032-$ | US-20060172739-$ | US-20060182065-$ | US-20060251027-$ | US-20060280145-$ | US-20070047445-$ | US-20070115871-$ | US-20070135113-$ | US-20070189237-$ | US-20070206531-$ | US-20070213059-$ | US-20070223609-$ | US-20080008152-$ | US-20080049669-$ | US-20080125043-$ | US-20080192766-$ | US-20080194259-$ | US-20080214225-$ | US-20080268852-$ | US-20090010278-$ | US-20090061881-$ | US-20090086671-$ | US-20090135769-$ | US-20090143074-$ | US-20090168704-$ | US-20090168724-$ | US-20090196239-$ | US-20090219868-$ | US-20090225709-$ | US-20090225739-$ | US-20090257407-$ | US-20090318170-$ | US-20100091652-$ | US-20100098165-$ | US-20100103852-$ | US-20100215005-$ | US-20100216471-$ | US-20100278143-$ | US-20100285791-$ | US-20100309877-$ | US-20110164540-$ | US-20120327833-$ | US-2305372-$ | US-5740949-$ | US-6167248-$ | US-6246692-$ | US-				

		6721566-$ | US-6845238-$ | US-7079489-$ | US-7145889-$ | US-7406314-$ | US-7477609-$ | US-7480269-$ | US-7508792-$ | US-7643515-$ | US-7890094-$ | US-7894390-$ | US-8259752-$ | US-8989082-$ | US-9844093-$ | US-7180855-$).DID.				
S35	1	S31 S34	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:36
S36	1	S31 S34	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:36
S37	11	S14 S34	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:46
S38	1246	((resource or grant) near7 (uplink or "UL" or upstream) same timer same ((high$4 near4 layer near4 signal$4) or RRC or (radio adj3 resource adj3 control)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:50
S39	173	S29 S38	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:53
S40	1	S34 S39	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 20:54
S41	2	S32 S39	US-PGPUB; USPAT; USOCR;	AND	ON	2019/09/19 20:54

			EPO; DERWENT			
S42	7018	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with (timer)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 21:08
S43	549	S29 S42	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 21:10
S44	76	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S43	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 21:10
S45	76	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S43	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 21:10
S46	12119	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with (timer or expir$4 or expiration or (tim$4 near4 limit$4))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 21:56
S47	4084	S26 S46	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 21:57
S48	659	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S47	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 22:01
S49	6843	(timer with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR;	AND	ON	2019/09/19 22:02

			EPO; DERWENT			
S50	55	S48 S49	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 22:02
S51	55	S48 S49	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 22:03
S52	23276	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same (timer or expir$4 or expiration or (tim$4 near4 limit$4))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 22:10
S53	19355	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 22:11
S54	3147	S52 S53	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 22:12
S55	240	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S54	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/19 22:12
S56	23276	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same (timer or expir$4 or expiration or (tim$4 near4 limit$4))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 10:09
S57	19355	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with	US-PGPUB; USPAT; USOCR;	AND	ON	2019/09/20 10:09

		((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	EPO; DERWENT			
S58	3147	S56 S57	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 10:09
S59	240	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S58	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 10:09
S60	19355	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:15
S61	3274	(expir$4 or expiration) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:15
S62	1542	S60 S61	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:16
S63	52	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S62	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:16
S64	52	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S62	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:16
S65	1	16/421019 (mac with tim$4)	US-PGPUB; USPAT; USOCR;	AND	ON	2019/09/20 14:20

			EPO; DERWENT			
S66	6843	(timer with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:20
S67	10543	((timer or (tim$4 near2 (information or expir$4 or expiration))) with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:25
S68	19355	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) with ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:29
S69	1978	S67 S68	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:30
S70	1468	(expir$4 or expiration) same (terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:30
S71	160	S69 S70	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:31
S72	1	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S71	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:31

S73	96	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S69	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:31
S74	96	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S69	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 14:32
S75	2730	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control)) same (timer or (tim$4 near4 (information or expir$4 or expiration)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 17:52
S76	1105	((timer or (tim$4 near2 (information or expir$4 or expiration))) with (mac or (medium adj3 access adj3 control$4))) S75	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 17:53
S77	42	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S76	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 17:54
S78	42	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S76	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 17:54
S79	28510	(allocat$4 or assign$4 or schedul$4) with (resource or grant or channel) same ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 18:41
S80	13191	(timer or (tim$4 near4 (information or expir$4 or expiration))) same ((higher near3 signal$4 near3 layer) or RRC or (radio adj3 resource adj3 control))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 18:42

S81	6525	S79 S80	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 18:42
S82	10543	((timer or (tim$4 near2 (information or expir$4 or expiration))) with (mac or (medium adj3 access adj3 control$4)))	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 18:43
S83	1907	S81 S82	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 18:44
S84	82	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S83	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 18:44
S85	82	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S83	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 18:44
S86	280	(US-20060054117-$ | US-20070073578-$ | US-0008152-$ | US-0010278-$ | US-00189071-$ | US-0023629-$ | US-0026490-$ | US-0026623-$ | US-0039326-$ | US-0047445-$ | US-0049669-$ | US-0052229-$ | US-0053035-$ | US-0054117-$ | US-0054298-$ | US-0061881-$ | US-0068505-$ | US-0073578-$ | US-0086671-$ | US-0091652-$ | US-0098165-$ | US-0101299-$ | US-0103852-$ | US-0115871-$ | US-0116118-$ | US-0117860-$ | US-0125043-$ | US-0135113-$ | US-0135769-$ | US-0140154-$ | US-0142032-$ | US-0143074-$ | US-0164540-$ | US-0168704-$ | US-0168724-$ | US-0172739-$ | US-0180371-$ | US-	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 19:20

		0189237-$ | US-0192766-$ | US- 0194259-$ | US-0196239-$ | US- 0206531-$ | US-0213059-$ | US- 0214225-$ | US-0215005-$ | US- 0216471-$ | US-0219868-$ | US- 0223452-$ | US-0223609-$ | US- 0225709-$ | US-0225739-$ | US- 0249163-$ | US-0250504-$ | US- 0251027-$ | US-0257407-$ | US- 0268852-$ | US-0278143-$ | US- 0280145-$ | US-0285791-$ | US- 0309877-$ | US-0318170-$ | US- 0327833-$ | US-20030223452-$ | US- 20040052229-$ | US-20040068505-$ | US-20040117860-$ | US-20040089937-$ | US-20050026623-$ | US-20050053035-$ | US-20050054298-$ | US-20050101299-$ | US-20050180371-$ | US-20050249163-$ | US-20050250504-$ | US-20060023629-$ | US-20060026490-$ | US-20060039326-$ | US-20060116118-$ | US-20060140154-$ | US-20060142032-$ | US-20060172739-$ | US-20060182065-$ | US-20060251027-$ | US-20060280145-$ | US-20070047445-$ | US-20070115871-$ | US-20070135113-$ | US-20070189237-$ | US-20070206531-$ | US-20070213059-$ | US-20070223609-$ | US-20080008152-$ | US-20080049669-$ | US-20080125043-$ | US-20080192766-$ | US-20080194259-$ | US-20080214225-$ | US-20080268852-$ | US-20090010278-$ | US-20090061881-$ | US-20090086671-$ | US-20090135769-$ | US-20090143074-$ | US-20090168704-$ | US-20090168724-$ | US-20090196239-$ | US-20090219868-$ | US-20090225709-$ | US-20090225739-$ | US-20090257407-$ | US-20090318170-$ | US-20100091652-$ | US-20100098165-$ | US-20100103852-$ | US-20100215005-$ | US-20100216471-$ | US-20100278143-$ | US-20100285791-$ | US-20100309877-$ | US-20110164540-$ | US-20120327833-$ | US-2305372-$ | US-5740949-$ | US- 6167248-$ | US-6246692-$ | US- 6721566-$ | US-6845238-$ | US- 7079489-$ | US-7145889-$ | US- 7406314-$ | US-7477609-$ | US- 7480269-$ | US-7508792-$ | US- 7643515-$ | US-7890094-$ | US-				

		7894390-$ | US-8259752-$ | US-8989082-$ | US-9844093-$ | US-7180855-$).DID.				
S87	4	S85 S86	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 19:21
S88	4	S85 S86	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 19:21
S91	4	10/572277 (activation near5 tim$4 with mac)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 19:46
S92	4	10/572277 (information with set near4 up)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/20 19:50
S93	6308	(terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) near6 (message or packet or signal) with (allocat$4 or assign$4 or schedul$4) near9 (prb or resource or transmit$4 or transmission or communicat$6 or send$4)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 11:27
S94	1978	(terminat$4 or deactivat$4 or disabl$4 or stop$4 or cancel$4 or cancellation or suspend$4 or halt$4) near6 (message or packet or signal) with (allocat$4 or assign$4 or schedul$4) with (bs or (base adj2 station) or ap or (access adj2 point) or repeater or (node adj b) or bts or node$1b or node-b or enb or node$1b or enodeb or femto or femtocell or femto-cell)	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 11:30

S95	1295	S93 S94	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 11:31
S96	588	h04w72/$.cpc. S95	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 11:32
S97	117	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S96	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 11:32
S98	117	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928") S96	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 11:32
S99	1830	((Pelletier near3 Benoit) or (Pani near3 Diana) or (DiGirolamo near3 Rocco) or (Cave near3 Christopher) or (Roy near3 Vincent) or (Marinier near3 Paul) or (Zeira near3 Eldad)).in.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 13:19
S100	443	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 13:19
S101	13	S99 S100	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 13:19
S102	2212	(mac near6 tim$4).clm.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 13:19

S103	1	S101 S102	US-PGPUB; USPAT; USOCR; EPO; DERWENT	AND	ON	2019/09/23 13:19
S104	2	("20040068505").PN.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	OR	OFF	2019/09/23 14:21
S105	2	("20100309877").PN.	US-PGPUB; USPAT; USOCR; EPO; DERWENT	OR	OFF	2019/09/23 14:22

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2344	(mac near6 tim$4).clm.	US-PGPUB; USPAT	AND	ON	2020/05/27 21:50
L2	553	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT	AND	ON	2020/05/27 21:50
L3	231	(deactivat$6 near5 uplink).clm.	US-PGPUB; USPAT	AND	ON	2020/05/27 21:50
L4	1	L1 L2 L3	US-PGPUB; USPAT	AND	ON	2020/05/27 21:50
L17	2344	(mac near6 tim$4).clm.	US-PGPUB; USPAT	AND	ON	2020/05/27 21:55
L18	553	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT	AND	ON	2020/05/27 21:55
L19	231	(deactivat$6 near5 uplink).clm.	US-PGPUB; USPAT	AND	ON	2020/05/27 21:55
L20	1	L1 L2 L3	US-PGPUB; USPAT	AND	ON	2020/05/27 21:55

S9	2212	(mac near6 tim$4).clm.	US-PGPUB; USPAT	AND	ON	2019/09/19 16:11
S10	443	(rrc near9 uplink near6 resource).clm.	US-PGPUB; USPAT	AND	ON	2019/09/19 16:11
S11	214	(deactivat$6 near5 uplink).clm.	US-PGPUB; USPAT	AND	ON	2019/09/19 16:12
S12	1	S9 S10 S11	US-PGPUB; USPAT	AND	ON	2019/09/19 16:12

5/27/2020 10:21:38 PM
C:\Users\kyuen\Documents\EAST\Workspaces\16421019.wsp

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

PTO/SB/08a (02-18)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16421019
Filing Date	2019-05-23
First Named Inventor	Benoit Pelletier
Art Unit	2464
Examiner Name	YUEN, KAN
Attorney Docket Number	SIG-2-1853US06

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7643419	B2	2010-01-05	Terry et al.	Corresponds to: CN1951043 A
	2	9979514	B2	2018-05-22	Tseng	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20080081651	A1	2008-04-03	Kuroda et al.	Corresponds to: CN101040557 A
	2	20050265301	A1	2005-12-01	Heo et al.	Corresponds to: CN1918822 A
	3	20050281219	A1	2005-12-22	Kim et al.	Corresponds to: CN1969482 A
	4	20180070403	A1	2018-03-08	Uemura et al.	Corresponds to: JP2018-085545 A

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16421019
	Filing Date	2019-05-23
	First Named Inventor	Benoit Pelletier
	Art Unit	2464
	Examiner Name	YUEN, KAN
	Attorney Docket Number	SIG-2-1853US06

	5	20150334619	A1	2015-11-19	Hakola et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2010/124228	WO	A2	2010-10-28	INTERDIGITAL PATENT HOLDINGS INC	Corresponds to: JP2012-525083 A	
	2	2013/040026	WO	A1	2013-03-21	QUALCOMM INC	Corresponds to: JP2014-526834 A	

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	ERICSSON ET AL., "Correction in release of common E-DCH resources," 3GPP TSG-RAN WG2 Meeting #72, R2-106081, (November 2010).	
	2	ERICSSON ET AL., "Hybrid ARQ text proposal for Section 7 of TR25.896," TSG-RAN WG1 #31, R1-030208 (February 2002).	
	3	NOKIA, "Solution on Iur Problem with pre-Rel7 SRNC," 3GPP TSG-RAN WG3 Meeting #55, R3-070278 (February 2007).	
	4	Third Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Resource Control (RRC); Protocol Specification (Release 7), 3GPP TS 25.331 V7.5.0 (June 2007).	

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	Attorney Docket Number	SIG-2-1853US06

	5	Third Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Resource Control (RRC); Protocol Specification (Release 8), 3GPP TS 25.331 V8.4.0 (September 2008).	

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EXAMINER SIGNATURE

Examiner Signature	/KAN YUEN/	Date Considered	05/27/2020

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Art Unit	2464
	Examiner Name	YUEN, KAN
	Attorney Docket Number	SIG-2-1853US06

CERTIFICATION STATEMENT

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

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Joseph P. Gushue/	Date (YYYY-MM-DD)	2020-03-25
Name/Print	Joseph P. Gushue	Registration Number	59,819

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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

PTO/SB/08a (02-18)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
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	Filing Date	2019-05-23
	First Named Inventor	Benoit Pelletier
	Art Unit	2464
	Examiner Name	YUEN, KAN
	Attorney Docket Number	SIG-2-1853US06

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	2	9979514	B2	2018-05-22	Tseng	

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	3	20050281219	A1	2005-12-22	Kim et al.	Corresponds to: CN1969482 A
	4	20180070403	A1	2018-03-08	Uemura et al.	Corresponds to: JP2018-085545 A

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16421019
	Filing Date	2019-05-23
	First Named Inventor	Benoit Pelletier
	Art Unit	2464
	Examiner Name	YUEN, KAN
	Attorney Docket Number	SIG-2-1853US06

	5	20150334619	A1	2015-11-19	Hakola et al.	

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	1	2010/124228	WO	A2	2010-10-28	INTERDIGITAL PATENT HOLDINGS INC	Corresponds to: JP2012-525083 A	
	2	2013/040026	WO	A1	2013-03-21	QUALCOMM INC	Corresponds to: JP2014-526834 A	

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	1	ERICSSON ET AL., "Correction in release of common E-DCH resources," 3GPP TSG-RAN WG2 Meeting #72, R2-106081, (November 2010).	
	2	ERICSSON ET AL., "Hybrid ARQ text proposal for Section 7 of TR25.896," TSG-RAN WG1 #31, R1-030208 (February 2002).	
	3	NOKIA, "Solution on Iur Problem with pre-Rel7 SRNC," 3GPP TSG-RAN WG3 Meeting #55, R3-070278 (February 2007).	
	4	Third Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Resource Control (RRC); Protocol Specification (Release 7), 3GPP TS 25.331 V7.5.0 (June 2007).	

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	5	Third Generation Partnership Project; Technical Specification Group Radio Access Network; Radio Resource Control (RRC); Protocol Specification (Release 8), 3GPP TS 25.331 V8.4.0 (September 2008).	

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Name/Print	Joseph P. Gushue	Registration Number	59,819

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 October 2010 (28.10.2010)

PCT

(10) International Publication Number
WO 2010/124228 A2

(51) International Patent Classification:
H04W 74/08 (2009.01)

(21) International Application Number:
PCT/US2010/032267

(22) International Filing Date:
23 April 2010 (23.04.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

61/171,917	23 April 2009 (23.04.2009)	US
61/172,076	23 April 2009 (23.04.2009)	US
61/181,811	28 May 2009 (28.05.2009)	US
61/293,366	8 January 2010 (08.01.2010)	US
61/303,937	12 February 2010 (12.02.2010)	US
61/320,405	2 April 2010 (02.04.2010)	US

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[Continued on next page]

(54) **Title**: METHOD AND APPARATUS FOR RANDOM ACCESS IN MULTICARRIER WIRELESS COMMUNICATIONS

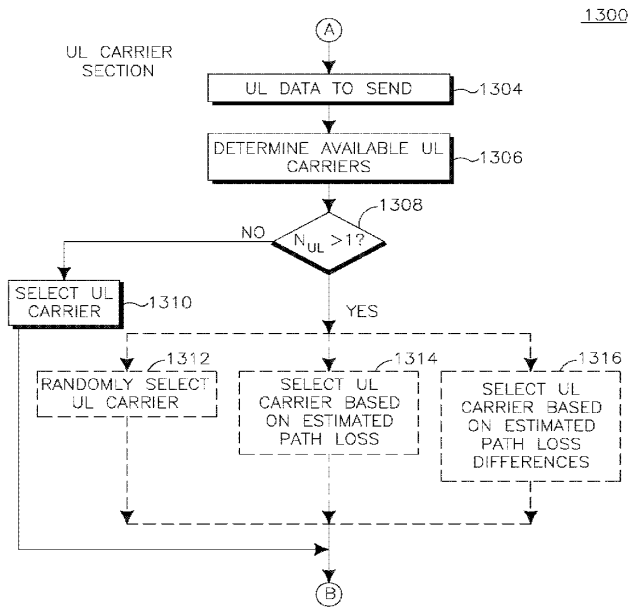


FIG. 13

(57) **Abstract**: Method and apparatus for random access in multicarrier wireless communications are disclosed. Methods and apparatus are provided for physical random access channel (PRACH) resource signaling, PRACH resource handling, preamble and PRACH resource selection, random access response (RAR) reception, preamble retransmission, and transmission and reception of subsequent messages. A method for maintaining an allowed multicarrier uplink (UL) random access channel (RACH) configuration set by adding an UL carrier to the allowed RACH configuration set provided that a triggering event occurs and performing a random access (RA) procedure using the allowed RACH configuration set. A method for sending data in multicarrier wireless communications by determining a set of available UL carriers and selecting an UL carrier from the set of available UL carriers.

WO 2010/124228 A2

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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[0001] METHOD AND APPARATUS FOR RANDOM ACCESS IN MULTICARRIER WIRELESS COMMUNICATIONS

[0002]

[0003] CROSS REFERENCE TO RELATED APPLICATIONS

[0004] This application claims the benefit of U.S. provisional application No. 61/171,917 filed April 23, 2009; U.S. provisional application No. 61/172,076 filed April 23, 2009; U.S. provisional application No. 61/181,811 filed May 28, 2009; U.S. provisional application No. 61/293,366 filed January 8, 2010; U.S. provisional application No. 61/303.937 filed February 12, 2010; and U.S. provisional application No. 61/320,405 filed April 2, 2010, which are incorporated by reference as if fully set forth herein.

[0005] FIELD OF INVENTION

[0006] This application is related to wireless communications.

[0007] BACKGROUND

[0008] In wireless communications a random access procedure may be used to assign dedicated radio resources to a wireless transmit/receive unit (WTRU). A dedicated radio resource may be, for example, a specific preamble or physical random access channel (PRACH) resource. The random access procedure may be either contention-free or contention-based, and may include the following features: preamble transmission; random access response (RAR) reception, in which the RAR contains a grant for an uplink (UL) transmission; transmission of message3 (msg3) for contention-based random access; and contention resolution for contention-based random access (for example, the WTRU may determine whether the random access (RA) procedure was successfully completed).

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[0009] Figure 1 shows an example of a random access procedure including a WTRU and an evolved Node-B (eNB). The WTRU transmits a random access preamble. Then, the eNB responds with a RAR. Next, the WTRU may transmit a scheduled transmission, for example, a msg3 transmission. Then, the eNB may perform contention resolution for contention-based random access and the WTRU may determine whether the random access procedure was successful.

[0010] A WTRU initiates a random access procedure when one of the following events occurs: initial access to the network when the WTRU has no established connection, that is from the radio resource control (RRC)_IDLE state; a RRC connection re-establishment procedure, random access-physical downlink control channel (RA-PDCCH) order; handover; downlink (DL) data arrival during RRC_CONNECTED state requiring a random access procedure; or UL data arrival during RRC_CONNECTED state requiring a random access procedure, known as a random access scheduling request, (RA-SR).

[0011] In some wireless communications systems, such as, for example, Long Term Evolution (LTE), a WTRU may initiate a random access procedure due to one of the aforementioned events and a set of random access channel (RACH) resources is assumed to be available. The set of RACH resources is defined by a single index, *prach-ConfigIndex*, which may take a value between 0 and 63 and identify a preamble format to be used, as well as the set of subframes in which a preamble may be sent. The set of subframes may be further restricted by a provided physical random access channel (PRACH) mask index. In some systems, including orthogonal frequency division multiple access (OFDMA) wireless communication systems, the WTRU operates in a single UL carrier. Thus, there is no ambiguity as to which UL carrier may be used.

[0012] Figure 2 shows a communication system 200 using a single UL carrier. The WTRU 201 communicates with the network 203 using a single

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DL carrier 205. A PRACH configuration is broadcasted on the DL carrier 205. The WTRU sends a preamble using available PRACH resources provided by the single UL carrier 207.

[0013] The WTRU selects a RACH resource within the available set. This involves the selection of a random access preamble followed by the determination of the next subframe containing an available RACH resource. The preamble is then transmitted in the next subframe (in the case of frequency division duplex (FDD)). In the case of time division duplex (TDD), the preamble is transmitted in a randomly selected RACH resource within the next subframe or the two subsequent subframes.

[0014] If a WTRU is configured to operate with multiple UL and DL carriers in a connect mode, multiple RACH resources are available for use to initiate a random access procedure, if required. It may be beneficial to define rules under which a WTRU may determine a RACH resource to utilize and may determine which sets of RACH resources may be considered available among the configured carriers.

[0015] SUMMARY

[0016] Methods and apparatus for random access in multicarrier wireless communications are disclosed. Methods and apparatus are provided for PRACH resource signaling, PRACH resource handling, preamble and PRACH resource selection, RAR reception, preamble retransmission, and transmission and reception of subsequent messages. A method for maintaining an allowed multicarrier UL RACH configuration set by adding an UL carrier to the allowed RACH configuration set provided that a triggering event occurs and performing a RA procedure using the allowed RACH configuration set. A method for sending data in multicarrier wireless communications by determining a set of available UL carriers and selecting an UL carrier from the set of available UL carriers. A method for initial RA

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transmission using a multicarrier UL RACH scheme by selecting an UL carrier from a plurality of UL carriers, selecting a RA preamble group based on the selected UL carrier, and selecting a RA preamble within the selected RA preamble group. A method for transmitting a RAR using a multicarrier UL RACH scheme by determining a DL carrier for RAR transmission, computing a random access radio network temporary identifier (RA-RNTI) associated with the RAR, and transmitting the RAR including the RA-RNTI. A method for determining which DL carrier(s) the RAR should be received on by monitoring at least one PDCCH in a common search space on at least one DL carrier for a RA-RNTI that corresponds to the apparatus and receiving a RAR identified by the RA-RNTI. An apparatus configured to maintain an allowed multicarrier UL RACH configuration set by adding an UL carrier to the allowed RACH configuration set provided that a triggering event occurs and performing a RA procedure using the allowed RACH configuration set. An apparatus configured to perform multicarrier UL communications by determining a set of available UL carriers and selecting an UL carrier from the set of available UL carriers.

[0017] BRIEF DESCRIPTION OF THE DRAWINGS

[0018] A more detailed understanding may be had from the following description, given by way of example in conjunction with the accompanying drawings wherein:

[0019] Figure 1 shows an example of a random access procedure;

[0020] Figure 2 is a block diagram of a single carrier communication system;

[0021] Figure 3 shows an example LTE wireless communication system/ access network;

[0022] Figure 4 is a block diagram of an example LTE wireless communications system;

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[0023] Figure 5 shows an example of RACH period reduction via staggering;

[0024] Figure 6 shows a WTRU and network configured for use with multiple UL carriers and DL carriers that may maintain an allowed RACH configuration set;

[0025] Figure 7 is a flowchart of a procedure for adding a new PRACH/RACH configuration to the allowed RACH configuration set;

[0026] Figure 8 is a flowchart of a procedure for removing or invalidating for a period of time a PRACH/RACH configuration from the allowed RACH configuration set;

[0027] Figure 9 is a flowchart of an example procedure for invalidating a PRACH/RACH configuration from the allowed RACH configuration set for a certain period of time;

[0028] Figure 10 is a flowchart of a procedure for determining that a predetermined maximum number of preamble transmissions have occurred and selecting a new random access resource or reporting a random access problem;

[0029] Figure 11 is a flowchart of a procedure for selecting PRACH resources from a set of available PRACH resources;

[0030] Figure 12 shows an example of transmission of simultaneous RACH requests;

[0031] Figure 13 shows an example procedure for determining available UL carriers;

[0032] Figure 14 shows an example of a procedure demonstrating RA preambles group B selection criteria;

[0033] Figure 15 shows an example procedure of initial RA transmission;

[0034] Figure 16 shows an example procedure of initial RA transmission;

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[0035] Figure 17 shows an example of a procedure for transmitting a Random Access Response (RAR) corresponding to a WTRU's preamble transmission;

[0036] Figure 18 shows an overview of joint processing of a RACH request;

[0037] Figure 19 shows an example of a procedure for determining which DL carrier the RAR may be received on; and

[0038] Figure 20 shows an example of a procedure for preamble retransmission.

[0039] DETAILED DESCRIPTION

[0040] When referred to hereafter, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

[0041] Figure 3 shows a wireless communication system/access network 300 that includes an Evolved-Universal Terrestrial Radio Access Network (E-UTRAN) 305, for example, 3GPP's Long Term Evolution (LTE). The E-UTRAN 305 may include several evolved Node-Bs, (eNBs) 320. The WTRU 310 may be in communication with an eNB 320. The eNBs 320 may interface with each other using an X2 interface. Each of the eNBs 320 may interface with a Mobility Management Entity (MME)/Serving GateWay (S-GW) 330 through an S1 interface. Although a single WTRU 210 and three eNBs 320 are shown in Figure 3, it should be apparent that any combination of wireless

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and wired devices may be included in the wireless communication system access network 300.

[0042] Figure 4 is an example block diagram of an LTE wireless communication system 400 including the WTRU 310, the eNB 320, and the MME/S-GW 330. As shown in Figure 4, the WTRU 310, the eNB 320 and the MME/S-GW 330 are configured to perform random access resource selection with multiple carriers.

[0043] In addition to the components that may be found in a typical WTRU, the WTRU 310 includes a processor 416 with an optional linked memory 422, at least one transceiver 414, an optional battery 420, and at least one antenna 418. The processor 416 is configured to perform random access resource selection with multiple carriers. The at least one transceiver 414 is in communication with the processor 416 and the at least one antenna 418 to facilitate the transmission and reception of wireless communications. In case a battery 420 is used in the WTRU 310, it powers the at least one transceiver 414 and the processor 416.

[0044] In addition to the components that may be found in a typical eNB, the eNB 320 includes a processor 417 with an optional linked memory 415, transceivers 419, and antennas 421. The processor 417 is configured to perform random access resource selection with multiple carriers. The transceivers 419 are in communication with the processor 417 and antennas 421 to facilitate the transmission and reception of wireless communications. The eNB 320 is connected to the Mobility Management Entity/Serving GateWay (MME/S-GW) 330 which includes a processor 433 with an optional linked memory 434.

[0045] In some wireless communications systems configured to perform uplink multiple-input multiple-output (MIMO) communications, such as, for example, a system based on LTE Release 10 (R10) (also referred to as "LTE-Advanced" or "LTE-A"), a WTRU may be configured to use random access

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resources on multiple configured UL carriers, that is, resources from more than one UL carrier. Additionally, a dedicated preamble may be associated with a specific carrier. RACH resources may be selected randomly or in sequence where the RA procedure is initiated by the medium access control (MAC) layer. When random access resources are initiated based on a PDCCH order, the PDCCH order and Random Access Response (RAR) may be transmitted on the DL carrier. The DL carrier may be associated, for example, by the UL/DL pairing, or based on configuration of the uplink carrier supporting the RACH. The WTRU may determine that the UL communications have completely failed if the RA procedure was initiated by MAC and the RA procedure was unsuccessful for each of the RACH resources available to the WTRU in succession.

[0046] Some wireless communication systems, such as those based on LTE-A, may include the use of bandwidth extensions such as carrier aggregation (CA). With CA, a WTRU may transmit and receive simultaneously over multiple component carriers (CCs). Up to five CCs in the UL direction and in the DL direction may be available, thereby supporting flexible bandwidth assignments up to 100 MHz. The WTRU may operate with multiple UL and DL carriers in the connected mode.

[0047] When referred to hereafter, the term "primary component carrier (PCC)", or anchor carrier, may include a carrier of a WTRU configured to operate with multiple component carriers for which some functionality (for example, derivation of security parameters and non-access stratum (NAS) information) may be applicable to that particular CC. The WTRU may be configured with at least one PCC for the DL direction (DL PCC). Consequently, a carrier that is not a PCC of the WTRU may hereafter be referred to as a "secondary component carrier" (SCC).

[0048] The DL PCC may, for example, correspond to the CC used by the WTRU to derive initial security parameters when initially accessing the

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system. The definition of the DL PCC may not be limited to this definition and may be considered the CC that contains important parameters or information for system operation. A primary cell (PCell) may be the cell corresponding to the combination of one DL PCC and one UL PCC. The PCell may correspond to the DL CC used as anchor for NAS mobility and for derivation of security parameters (for example, during initial access).

[0049] PDCCH monitoring may be performed when a WTRU has an established connection to the network. This PDDCH monitoring may occur when the WTRU is in RRC_CONNECTED state. A WTRU may perform PDCCH monitoring to get access to physical radio resources for DL assignment or UL grant transmissions.

[0050] A WTRU configured with multiple CCs may have to receive control signaling for scheduling of all CCs either on a single PDCCH (for example, in the PCC) or on multiple PDCCHs, each on a different CC. This may result in an increase in the reception and processing of PDCCH signaling. Decoding of the PDCCH channel may require the WTRU to perform a number of blind decoding attempts, each validated by a cyclic redundancy check (CRC), to determine whether signaling may be intended for a specific WTRU. In addition, the network may use cross-carrier scheduling, where grants and/or assignments signaled on the PDCCH of one CC may indicate transmissions on the physical uplink shared channel (PUSCH) or physical downlink shared channel (PDSCH) corresponding to a different CC. Blind decoding complexity may be reduced by requiring a WTRU to monitor control signaling only on a subset of the configured CCs. A specified PDCCH monitoring set may represent a set of CCs on which the WTRU may be required to monitor, the size of which may be less than or equal to the size of the UL/DL CC set and may comprise only CCs that are in the WTRU DL CC set.

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[0051] As used herein, the terms "PRACH configuration" and "RACH configuration" refer to a set of parameters corresponding to the information elements (IEs). Examples of PRACH/RACH configuration parameters include the IEs' *PRACH-Config* and *RACH-ConfigCommon* as used in, for example, Release 8 of LTE. A PRACH/RACH configuration may apply to a specific pair of DL and UL carriers. The DL carrier of a PRACH or a RACH configuration is a carrier on which these configurations may be broadcasted. The UL carrier of a PRACH or a RACH configuration is the carrier on which the preamble may be transmitted. The UL carrier may be obtained from the default duplex distance or may be signaled explicitly from the DL carrier, for example, in system information block 2 (SIB2).

[0052] The number of aggregated carriers in the UL and DL directions may be designated, respectively, by N_{UL} and N_{DL}. In asymmetric carrier aggregation, N_{UL} may not equal N_{DL}. The RACH period of each UL CC may be denoted as T_{RACH}.

[0053] The RACH period may be reduced from a WTRU's perspective via staggering. For example, the RACH period of each UL CC may remain at 10 ms while the random access opportunity timing may be staggered across aggregated UL CCs. For example, one UL CC may have no timing offset while another UL CC may have a timing offset of 5 ms. From the WTRU's perspective, the RACH period may appear to be 5 ms, resulting in a 5 ms "effective RACH period." Thus, different UL CCs may have a different RACH timing offset (subframe) within the same RACH period. An effective RACH period of less than 10 ms (the LTE RACH period) may be achieved.

[0054] Figure 5 shows an example of RACH period reduction via staggering 500, including a first UL carrier (UL carrier 1) 502 and a second UL carrier (UL carrier 2) 504. UL carrier 1 502 has a 10 ms RACH period. UL carrier 2 504 has a 10 ms RACH period with a timing offset of 5 ms from

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UL carrier 1 502. Thus, Figure 5 demonstrates a 5 ms effective RACH period. Generally, an effective RACH period of T_{RACH} / N_{UL} may be achieved.

[0055] Figure 6 shows a WTRU 602 and network 604 configured for use with multiple UL carriers 606 and DL carriers 608 that may maintain a set of RACH configurations that may potentially be used by the WTRU 602 for random access. This set may be referred to as the "allowed RACH configuration set." An element of the allowed RACH configuration set may include a PRACH configuration or may include a PRACH configuration and a RACH configuration. A WTRU configured for UL MIMO may require the following information in order to perform a RA procedure: RACH parameters for each UL carrier on which the WTRU may transmit RACH messages (for example, as carried in SIB2 in LTE); RACH start timing offset of each UL carrier on which the WTRU may transmit RACH messages; and location (for example, center frequency) and the bandwidth of each UL carrier on which the WTRU may transmit RACH messages. A WTRU may only need to acquire this information when the WTRU transitions from idle to connected state. A WTRU transitioning from dormant to active sub-state may already know such information.

[0056] In one embodiment, a WTRU may determine the allowed RACH configuration set via information received on a DL PCC using one or a combination of fields. The fields may include: the spare (or reserved) bit in P-BCH; the nonCriticalExtension field of SIB1; or a new SIB type that may complement SIB2. This embodiment may also include transmitting SIB2 for each DL carrier that is mapped to or paired with each UL carrier on which the WTRU may perform a RA procedure. Optionally, the common information between different SIBs may be transmitted or signaled once.

[0057] In another embodiment, a WTRU may determine the allowed RACH configuration set via SIB2, which may be transmitted on each DL PCC. SIB2 may contain RACH configuration parameters and an UL carrier's

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location and bandwidth. Each DL carrier may use a predetermined number of bits to signal a RACH start timing offset of the UL CC that the DL carrier is mapped to or paired with. One or a combination of several fields may be used to accomplish this, including the spare (or reserved) bit in the physical broadcast channel (PBCH); the nonCriticalExtension field of SIB1; or a new SIB type. This embodiment may be applied to a scenario in which a WTRU transitions from dormant to active sub-state. Optionally, the RACH start timing offset is transmitted on the DL PCC.

[0058] In another embodiment, a WTRU may determine the allowed RACH configuration set implicitly through the WTRU carrier configuration provided, for example, by RRC messaging or signaling. The allowed RACH configuration set may be chosen as one or a plurality of the following sets. One possible set may include all PRACH/RACH configurations broadcasted by the DL carriers that the WTRU is configured to use. Another possible set may include one PRACH/RACH configuration per UL carrier that the WTRU is configured to use. The PRACH/RACH configuration for each UL carrier may be provided by its corresponding DL carrier or may be provided by dedicated signaling. Another possible set may include at most one PRACH/RACH configuration per UL carrier that the WTRU is configured to use, provided that a single PRACH/RACH configuration exists for each set of UL carriers sharing a particular timing alignment (TA). Timing alignment may also include "timing advance," which may be a value that represents how early a WTRU may start its transmission in a given subframe as compared to its DL reception. Timing advance may be a function of the WTRU's distance to the eNB or may be a function of the frequency band. Another possible set may include one or more PRACH/RACH configurations per UL carrier associated with one or more DL carriers included in the PDCCH monitoring set.

[0059] Each of the N_{DL} DL carriers may be used by distinct cells broadcasting their own cell identities. The WTRU may acquire system

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information pertaining to one or a plurality of DL carriers. The system information may be transmitted on a carrier (for example, a DL PCC), on a subset of specific carriers, or on all DL carriers.

[0060] A WTRU may modify the allowed RACH configuration set according to events or upon receiving explicit signaling indicating that the allowed RACH configuration set should be modified. A WTRU may add a new PRACH/RACH configuration set to the allowed RACH configuration.

[0061] Figure 7 is a flowchart of a procedure 700 for adding a new PRACH/RACH configuration to the allowed RACH configuration set. A WTRU may add a new PRACH/RACH configuration to the allowed RACH configuration set provided that at least one of a plurality of addition triggering events occurs. For example, a WTRU may maintain an allowed RACH configuration set 702. If an addition triggering event occurs 704, the WTRU may determine whether to add a new PRACH/RACH configuration to the allowed RACH configuration set 706. The WTRU then adds a PRACH/RACH configuration to the allowed RACH configuration set 708. The WTRU may perform a RA procedure 710. An addition triggering event may also be used as any type of triggering event, such as a removal or invalidation triggering event.

[0062] An addition triggering event may include receiving explicit signaling from the network. The explicit signaling may include an indicator sent along with the carrier configuration via RRC signaling. The RRC signaling may indicate that the PRACH/RACH configuration broadcasted on the DL carrier being added to the configuration should be added to the allowed RACH configuration set.

[0063] Alternatively or additionally, an addition triggering event may include receiving a PDCCH order on the DL carrier broadcasting the PRACH/RACH configuration. Alternatively or additionally, an addition triggering event may include receiving a PDCCH order with a carrier

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indication field (CIF) indicating the DL carrier broadcasting the PRACH/RACH configuration. Alternatively or additionally, an addition triggering event may include receiving a PDCCH order with a CIF indicating the DL carrier that is broadcasting the PRACH/RACH configuration. A PDCCH order may be control signaling received from the network instructing the WTRU to initiate a RA procedure using the RACH parameters provided in the control signaling, assuming they are present. The PDCCH order may indicate the CC for which the control signaling is applicable or the identity of the DL CC on which the WTRU may read the broadcasted configuration.

[0064] Figure 8 is a flowchart of a procedure 800 for removing or invalidating for a period of time a PRACH/RACH configuration from the allowed RACH configuration set. A WTRU may remove or invalidate a PRACH/RACH configuration from the allowed RACH configuration set on a condition that at least one of a plurality of removal/invalidation triggering events occurs. In the procedure 800 of Figure 8, a WTRU may maintain an allowed RACH configuration set 802. If a removal/invalidation triggering event occurs 804, the WTRU may determine whether to remove or invalidate a PRACH/RACH configuration from the allowed RACH configuration set 806. The WTRU may remove or invalidate a PRACH/RACH configuration from the allowed RACH configuration set 808. The WTRU may perform a RA procedure 810. A removal/invalidation triggering event may also be used as any type of triggering event, such as an addition or invalidation triggering event.

[0065] A removal/invalidation triggering event may include receiving explicit signaling from the network. Examples of explicit signals include RRC, MAC, or PDCCH signals that may be similar to a backoff indicator. A backoff indicator may be an indication that the WTRU may refrain from performing a given procedure, at least for a certain period of time. Alternatively or additionally, a removal/invalidation triggering event may include determining

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that the DL carrier broadcasting the PRACH/RACH configuration has been removed from the carrier configuration. An example may be receiving a RRC reconfiguration message. Alternatively or additionally, a removal/invalidation triggering event may include determining that the UL carrier corresponding to the PRACH/RACH configuration has been removed from the carrier configuration. An example may be receiving a RRC reconfiguration message. Alternatively or additionally, a removal/invalidation triggering event may include reaching the maximum number of preamble transmissions (for example, *preambleTransMAX*) after transmitting a preamble for a PRACH/RACH configuration. Another example may include an unsuccessful RAR reception, where *preambleTransMAX* is equal to the maximum value. For example, upon reaching the maximum value, the WTRU may remove or invalidate the corresponding configuration, in addition to other responses the WTRU may already perform upon reaching the maximum value.

[0066] Figure 9 is a flowchart of an example procedure 900 for invalidating a PRACH/RACH configuration from the allowed RACH configuration set for a certain period of time. A WTRU that receives explicit signaling from the network 904 may invalidate a PRACH/RACH configuration from the set for a period of time 906. For example, the signaling may be similar to a backoff indicator or may be a backoff or prohibit time during which the WTRU may not use a specific PRACH/RACH configuration. Optionally, the WTRU may use a different resource on a different CC 908. An invalidation triggering event may also be used as any type of triggering event, such as an addition or removal/invalidation triggering event.

[0067] The criterion for indicating a "random access problem" may be modified based on the allowed RACH configuration set so that a WTRU may attempt random access on multiple UL carriers.

[0068] Figure 10 is a flowchart of a procedure 1000 for determining that a predetermined maximum number of preamble transmissions have occurred

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and for selecting a new random access resource or for reporting a random access problem. If the preamble transmission counter exceeds the maximum number of preamble transmissions 1004 (for example, PREAMABLE_TRANSMISSION_COUNTER = *preambleTransMax* + 1), a WTRU may remove or invalidate the PRACH/RACH configuration from the allowed RACH configuration set 1006. Optionally, the WTRU may remove or invalidate PRACH/RACH configurations in the following cases: (1) the configuration was provided by dedicated signaling, for example, via RRC configuration; (2) the configuration was provided for a SCC of the WTRU's configuration or for all SCCs of the same frequency band; or (3) the configuration was configured such that, upon failure of the RA procedure on the corresponding resource, the WTRU does not trigger radio link failure (RLF).

[0069] Alternatively or additionally, the WTRU may remove or invalidate the DL and/or UL carrier corresponding to the PRACH/RACH configuration used for transmission of the preamble from the carrier configuration 1008. This may also result in the WTRU removing the PRACH/RACH configuration from the allowed RACH configuration set 1006. The WTRU may then determine whether there is at least one PRACH/RACH configuration in the allowed RACH configuration set 1010.

[0070] If the WTRU determines that there is at least one valid PRACH/RACH configuration in the allowed RACH configuration set, the WTRU may reset the preamble transmission counter to 1 (for example PREAMABLE_TRANSMISSION_COUNTER = 1) 1012. The WTRU may then proceed to selection of a random access resource within the allowed RACH configuration set 1016 and may optionally set the backoff parameter value to 0 ms and flush the msg3 buffer 1014.

[0071] If the WTRU determines that there is not at least one PRACH/RACH configuration in the allowed RACH configuration set (meaning

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the allowed RACH configuration set is empty or there is no valid item in the set), the WTRU may indicate a random access problem to upper layers 1018. Examples of the indication in element 1018 may include "RA problems" or "UL RLF." Optionally, this may be time-limited. For example, given that the indication pertains to the management of the resources available to the WTRU, the indication may be provided or may be valid only for a certain amount of time. The amount of time may be based on a timer or may be based on the subsequent addition of an item to the allowed RACH configuration set. The maximum number of preamble retransmissions for a given PRACH resource, whether dedicated or not, may or may not be the same for all resources of the WTRU's allowed RACH configuration set. For example, the parameter corresponding to the maximum number of preamble retransmissions may be common to all items in the allowed RACH configuration set or may be specified for each item or for particular groups in the allowed RACH configuration set.

[0072] As an example, in one possible embodiment, a WTRU may attempt a RA procedure using a first PRACH/RACH configuration for which a failure of the RA attempt does not trigger a RLF (for example, a RA attempt in a SCC for gaining TA and/or a RA attempt triggered by a PDCCH order received from the network). Additionally, the WTRU may determine that a RLF may not be triggered by a failure based on at least one of the following: (1) the PRACH/RACH configuration was received via dedicated signaling; (2) the PRACH/RACH configuration corresponds to a SCC of the WTRU's configuration; or (3) the PRACH/RACH configuration indicates that RA failure does not trigger a RLF.

[0073] If a failure of the RA procedure is detected for the first PRACH/RACH configuration, the WTRU may perform a RA procedure using a second PRACH/RACH configuration for which a failure of the RA attempt does trigger a RLF and for which the WTRU determines that a RLF shall not

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be triggered upon failure based on at least one of the following: (1) the PRACH/RACH configuration was received by signaling from the broadcasted system information; (2) the PRACH/RACH configuration corresponds to a PCC of the WTRU's configuration; or (3) the PRACH/RACH configuration indicates that RA failure triggers a RLF. If the failure of the RA procedure is detected for the second PRACH/RACH configuration, the WTRU may indicate a "random access problem" to upper layers via, for example, RRC messaging.

[0074] The WTRU may receive a network request to perform a random access procedure. This request may be signaled on the PDDCH (hereinafter "PDCCH RA order"), for example, using downlink control information (DCI) format 1a. For a WTRU configured to operate with multiple CCs and possibly also with cross-carrier scheduling (for example, where the PDCCH in one carrier may be used to schedule assignments on the PDSCH or grant resources on the PUSCH of a different carrier), it may be necessary to determine which RACH resource the WTRU may use upon reception of a PDCCH RA order.

[0075] RACH resource selection may include selection of a PRACH among a set of available PRACHs and selection of a preamble. The selection of a PRACH may include choosing PRACHs that may be on different UL carriers. The selection of a preamble may include choosing a preamble from a preamble group on a condition that more than one preamble group exists.

[0076] To determine which resource the WTRU may select for the RA procedure, the WTRU may make a selection at least in part as a function of the CC for which the received control information is applicable, on a condition that the WTRU receives a request from the network to perform random access. For example, the selected resource may correspond to a PCC or a SCC of the WTRU's allowed RACH configuration set.

[0077] A WTRU may detect control information on the PDCCH. For example, the WTRU may receive a DCI format scrambled with a radio

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network temporary identifier (RNTI) applicable to the WTRU (WTRU's Cell-RNTI (C-RNTI)). Upon successful detection of control information on the PDCCH indicating that the WTRU may perform the random access procedure, a WTRU may detect whether the DCI format is applicable to a SCC of the WTRU's configuration or to a PCC of the WTRU's configuration. A DCI format may be considered to be applicable to a CC provided that: (1) it is received on the PDCCH of the DL CC corresponding to the CC; or (2) the CIF indicates the CC or corresponds to the CC. If the DCI format is applicable to a SCC, the WTRU may perform at least one or a combination of the following: (1) The WTRU may refrain from performing a random access attempt. For example, the WTRU may ignore the received PDCCH RA order. This may be on a condition that a WTRU only considers a PDCCH order received in a PCC as valid; otherwise, it may be a false detection or a network error. For example, a false detection may be that a WTRU successfully decodes a DCI message scrambled on the PDCCH using one of the WTRU's RNTI, but the message was not intended for that particular WTRU. Decoding may use some form of checksum verification using a 16-bit RNTI, so false detection may occur. (2) The WTRU may perform a RA procedure in a PCC of its configuration, which may be the case if a WTRU may only perform RA in a PCC (for example, where there is DL data arrival for an unsynchronized WTRU). (3) The WTRU may perform a RA procedure using a RACH resource of the applicable SCC, which may be the case if a WTRU performs RA in a SCC (for example, for gaining TA for the CC or a group of CCs with the same TA requirement and/or in the case of downlink data arrival for an unsynchronized WTRU). (4) The WTRU may perform a RA procedure using a RACH resource of any CC which may be part of a group for which the corresponding UL CC has the same TA requirement, which may be the case if different UL CCs may have different TA requirements. (5) The WTRU may perform a RA procedure using a resource indicated in the DCI message, for

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example, using an index to a resource which is part of the WTRU configuration. This may be useful for load balancing in the case of downlink data arrival for an unsynchronized WTRU.

[0078] If the DCI format is applicable to a PCC, the WTRU may perform a RA procedure on a resource of the PCC. A DCI format may be considered to be applicable to a CC on a condition that (1) it is received on the PDCCH of the DL CC corresponding to the CC; or (2) the CIF indicates the CC or corresponds to the CC.

[0079] A WTRU may determine which set or sets of PRACH configurations within the allowed RACH configuration set are available for selection of a PRACH resource. The selection of the PRACH resource may optionally also be considered to be at least partly a function of the reason and/or cause for which the WTRU performs a random access procedure. For example, the reason or cause may be a PDCCH RA order (with or without CIF), RA-SR, or RA for a connection re-establishment. The set of PRACH resources that the WTRU may consider as available may depend on what triggered the random access procedure and how the random access procedure was triggered. The following embodiments are examples of ways in which a WTRU may select a PRACH resource from a set of available PRACHs.

[0080] In one embodiment, a CIF may be used in a PDCCH containing a PDCCH order for a RA procedure. The CIF may indicate at least one DL CC and/or at least one UL CC. The WTRU may receive a PDCCH order along with a CIF and select a PRACH from a set of available PRACH resources given by the PRACH configuration (for example, *prach-ConfigIndex*) broadcasted on the DL carrier indicated by the CIF. This indication may be an explicit indication of the PRACH configuration or may be implicit, for example, based on association with a paired UL carrier.

[0081] Alternatively or additionally, the WTRU may select a PRACH resource from a set of PRACHs available on the UL carrier indicated by the

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CIF. This indication may be an explicit indication of the PRACH configuration or may be implicit, for example, based on association with a paired DL carrier. The set of PRACHs may include the union of multiple sets of PRACHs, with the sets provided via the broadcasts of PRACH configurations on multiple DL carriers, on a condition that more than one DL carrier broadcasts PRACH configurations for the same UL carrier.

[0082] Alternatively or additionally, the WTRU may select a PRACH resource from a set of available PRACH resources represented as an indexed set and using the CIF as an index. The CIF may be interpreted as an index to an ordered sequence of a set of PRACH resources. The order of the set of PRACH resources in the index may be the order in the WTRU's configuration of the DL carriers on which the set of PRACH resources was broadcasted.

[0083] In another embodiment, the WTRU may receive a PDCCH order, with or without a CIF, or may initiate a RA procedure due to a SR being triggered without a valid PUCCH resource. A SR may be triggered if a WTRU needs to send a Buffer Status Report (BSR). A BSR may be triggered periodically, if configured, or if the WTRU has new data available for UL transmission with a higher priority than any existing data. The WTRU may select a PRACH resource from a set of available PRACH resources provided by the PRACH configuration broadcasted by the DL carrier corresponding to the PCell, on a condition that the PRACH configuration is present in the allowed RACH configuration set. Otherwise, the WTRU may determine that the set of available PRACH resources is provided by the union of all sets of PRACH resources provided by all PRACH configurations in the allowed RACH configuration set.

[0084] Alternatively or additionally, the WTRU may select a PRACH resource from a set of available PRACH resources provided by the sets of PRACHs available on the UL carriers for which the applicable TA timer last expired or for which the last TA command was received.

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[0085] Alternatively or additionally, the WTRU may use an identity of the WTRU in the selection of the PRACH resource from the set of available PRACH resources. For example, this may include using a hashing function or using the identity as an index to a list, for example, to distribute the load across available resources. PRACH resources may be available to multiple WTRUs and access to the PRACH resources may be contention-based. Thus, it may be useful to distribute the load as the number of WTRUs in a cell increases. A hash function may randomize the selection of one resource from a set of resources, which may allow each resource an equal chance of being selected. This may help distribute the load across available resources.

[0086] Alternatively or additionally, the WTRU may consider the set of available resources as a priority list. For example, a resource may have a higher priority based on at least one of: (1) a configuration of the network; (2) the DL path loss, based on measurements for a DL CC used for the path loss determination for the UL CC corresponding to the resource; (3) a ranking of the resource based on some criteria, for example, the maximum number of attempts before the WTRU may declare RA failure; (4) round-robin attempts; (5) previous outcome of a RACH procedure on the resource; (6) whether the CC is a PCC or a SCC of the WTRU's configuration; (7) whether or not the resource was provided to the WTRU in a dedicated manner (for example, by dedicated RRC signaling that configured the WTRU for multicarrier operation), possibly having a specific number of preamble transmissions for the resource that differs from that of the maximum number of preamble transmissions broadcasted on the DL CC corresponding to that resource; or (8) whether or not the resource was provided to the WTRU via broadcasted system information (for example, by RRC signaling received by the WTRU on the BCCH, which may include the maximum number of preamble transmissions).

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[0087] As an example, the WTRU may give a higher priority to a resource provided in a dedicated manner (such as, a resource corresponding to a SCC of the WTRU's configuration). If the random access procedure fails on such a resource (meaning that the procedure is not successful after reaching the maximum number of preamble transmissions), the WTRU may select a resource provided by system information (for example, a resource corresponding to a PCC of the WTRU's configuration). The WTRU may then attempt a random access using this resource (for example, if the WTRU does not declare UL RLF due to a RACH failure using the dedicated resource). On a condition that the random access attempt fails for the resource provided by system information, the WTRU may declare UL RLF and may perform recovery actions accordingly.

[0088] In another embodiment, the WTRU may receive a PDCCH order, with or without a CIF. The WTRU may select a PRACH resource from a set of available PRACHs determined as the union of the sets of PRACHs provided by all PRACH configurations in the allowed RACH configuration set, on a condition that the PDCCH order indicates that the preamble may be chosen randomly (for example, preamble index = "000000"). Otherwise, the set of available PRACHs may be selected according to any of the other embodiments described herein.

[0089] Alternatively or additionally, the WTRU may select a PRACH resource from a set of available PRACHs determined as the union of the sets of PRACHs provided by PRACH configurations in the allowed RACH configuration set for which the corresponding UL carrier is not synchronized (or not time-aligned).

[0090] In another embodiment, the WTRU may initiate a random access procedure upon receiving an UL grant for a PUSCH on an UL carrier for which the applicable TA timer has expired. The WTRU may select a PRACH resource from the set of available PRACHs provided by the sets of PRACHs

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available on the UL carrier for which the applicable TA timer has expired. Alternatively or additionally, the WTRU may select a PRACH resource from the set of available PRACHs provided by the sets of PRACHs available on the UL carrier for which the applicable TA timer has expired as well as any UL carrier sharing the same TA (for example, in the same TA subgroup).

[0091] Figure 11 is a flowchart of a procedure 1100 for selecting PRACH resources from a set of available PRACH resources defined by multiple *prach-ConfigIndex* messages. Optionally, a WTRU may determine whether the transmission is the initial preamble transmission 1104, for example, if the parameter PREAMBLE_TRANSMISSION_COUNTER is equal to 1 and/or if the msg3 buffer is empty. If the transmission is not the initial preamble transmission (for example, PREAMBLE_TRANSMISSION_COUNTER is greater than 1), the WTRU may optionally be constrained to select a PRACH resource within the set indicated by the same *prach-ConfigIndex* utilized for the initial preamble transmission 1106.

[0092] The WTRU may select a PRACH resource from a set of available PRACH resources 1108. Optionally, the WTRU may select a PRACH resource on a condition that the transmission is the initial preamble transmission 1104. One or a combination of the following four embodiments may be used to select a PRACH resource from a set of available PRACH resources.

[0093] In one embodiment, a WTRU may select resources corresponding to a specific *prach-ConfigIndex* within the available set. Optionally, this selection may be determined randomly. The WTRU may then determine the next available subframe containing a PRACH resource for this specific *prach-ConfigIndex*. Optionally, other restrictions may be applied. For example, using TDD mode in LTE, the WTRU may randomly select one occasion within three consecutive occasions. The occasions may start from the first available occasion or may start no earlier than at n+6 subframes provided that a PDCCH order is received at subframe n.

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[0094] In another embodiment, a WTRU may determine the next available subframe containing an available PRACH resource within the set of all available PRACH resources given by the set of *prach-ConfigIndex* parameters that may indicate resources on more than one UL frequency. The WTRU may then select one available PRACH resource within the subframe (or within the next n subframes), on a condition that there is more than one PRACH resource available. The selection may be random. Another way to describe this embodiment is that a WTRU may select the PRACH configuration(s) or *prach-ConfigIndex* for which it can utilize a PRACH resource the earliest among the available PRACH resources.

[0095] In another embodiment, the WTRU may select a resource from a set of available PRACH resources with a further restriction that the selected PRACH resource corresponds to a UL CC for which the associated DL CC is configured and activated. For example, the WTRU may receive a PDSCH transmission and may also monitor the PDCCH. This may also correspond only to a DL CC that has been explicitly activated by signaling received from the network. This may be useful to determine the initial transmit power of the preamble, which may be a function of the path loss measured from a DL CC used for the path loss determination for the UL CC.

[0096] In another embodiment, the WTRU may select a resource from a set of available PRACH resources with a further restriction that the selected resource corresponds to a UL CC that is configured, for example, meaning that the UL CC is available to the WTRU for UL transmissions. Optionally, the UL CC may also need to be activated, assuming that an activated/deactivated state is applicable to UL CCs. This may only correspond to an UL CC that has been explicitly activated by signaling received from the network.

[0097] Alternatively or additionally, for any of the above-described embodiments, the WTRU may select any PRACH resource within multiple

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prach-ConfigIndex messages if the PRACH resources are on the same UL carrier as the UL carrier used for the initial preamble transmission.

[0098] Referring again to Figure 11, upon selecting a PRACH resource 1108, the WTRU may select RACH parameters (for example, *preambleInfo*, *powerRampingparameters* and *ra-SupervisionInfo*) according to the RACH configuration broadcasted from the same DL carrier that had broadcasted the PRACH configuration from which the PRACH resource used for the initial preamble transmission was chosen 1110. Alternatively or additionally, the WTRU may be provided with a fixed (non carrier-dependent) set of RACH parameters 1112. This set of RACH parameters may be implicitly determined from the DL carrier corresponding to the PCell 1114 or may be obtained via dedicated signaling 1116.

[0099] Upon selecting a PRACH resource from the set of available PRACHs as described above, a WTRU may select a preamble. The WTRU may select a preamble according to the manner in which the WTRU selected a PRACH resource.

[00100] If the WTRU selected PRACH resources corresponding to a specific *prach-ConfigIndex* within the allowed set, the WTRU may select a preamble using RACH parameters in *preambleInfo* from the RACH configuration broadcasted on the same DL carrier that broadcasted the selected PRACH configuration, for example, as in LTE Release 8.

[00101] If a dedicated preamble is provided by the network, the WTRU may select a preamble using RACH parameters in *preambleInfo* from the RACH configuration broadcasted on the same DL carrier that broadcasted the selected PRACH configuration, for example, as in LTE Release 8.

[00102] If the WTRU selected the PRACH configuration(s) or *prach-ConfigIndex* for which it can utilize a PRACH resource earliest among the available PRACH resources, the WTRU may select a preamble after the PRACH resources are determined. Optionally, the WTRU may then use the

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RACH parameters in *preambleInfo* from the RACH configuration broadcasted on the same DL carrier that broadcasted the PRACH configuration from which the PRACH resource was selected.

[00103] Alternatively or additionally, the WTRU may select a preamble in advance based on a *preambleInfo* set of parameters that may be provided by the network in a dedicated manner. Alternatively or additionally, the WTRU may select the *preambleInfo* set of parameters, among the set of DL carriers broadcasting the available PRACH resources, for which *numberOfRA-Preambles* is the smallest.

[00104] Employing carrier aggregation in wireless communications may allow the RACH delay to be reduced via simultaneous transmission of multiple random access preambles within a given RACH period. A WTRU may send simultaneous random access preambles on multiple or all of the N_{UL} CCs. The transmitted preambles may be the same or may be different. This may reduce delay if there is contention on the UL channel or heavy DL traffic because other CCs may be in a better position to provide PUSCH resources for a msg3 transmission.

[00105] Figure 12 shows an example of transmission of simultaneous RACH requests 1200, including a first UL carrier (UL carrier 1) 1202 and a second UL carrier (UL carrier 2) 1204. A random access preamble is sent on UL Carrier 1 1202 and UL Carrier 2 1202 simultaneously. At least one of the sent preambles may be detected. An eNB may send back one random access response (RAR).

[00106] Figure 13 shows an example procedure 1300 for determining available UL carriers. A WTRU may have UL data to send 1304 and may need to determine available UL carriers 1306. If the number of UL carriers, N_{UL}, is not greater than 1 1308, the WTRU may select, if possible, the one UL carrier that is available 1310. If N_{UL} is greater than 1 1308, the WTRU may randomly select an UL carrier 1312 within the configured set of UL CCs (for

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example, PRACH resources). As an example, the WTRU may perform the selection using a uniform probability mass function or an arbitrary probability mass function. An arbitrary probability mass function may be signaled from the system information acquired on the DL carrier(s) or may be derived from UL load information broadcasted on the DL carrier(s).

[00107] Alternatively, if the number of UL carriers, N_{UL}, is greater than 1 1308, the WTRU may select an UL carrier based on estimated path loss 1314 to the eNB. For example, if there are two UL carriers, the WTRU may select a first UL carrier on a condition that the path loss is below a predetermined threshold and a second UL carrier on a condition that the path loss is above the predetermined threshold. Generally, a set of N_{UL}-1 thresholds (T_i) may be used for N_{UL} UL carriers, where UL carrier #i may be selected if $T_{(i-1)}$ < path loss < T_i. The frequencies of the UL carriers may not need to increase with i. The thresholds T_i used for comparison may depend on the preamble group (which is also dependent on the path loss), thus possibly providing a finer granularity of path loss information. Alternatively, the thresholds used for the preamble group determination may be dependent on the choice of the UL carrier. The thresholds may be signaled as part of system information.

[00108] If the different DL and UL carriers are in different frequency bands, there may be a significant difference of path loss between the carriers that are in different bands. To address this difference, the path loss may be measured on a specific DL carrier (or any DL carrier on a specific frequency band) that is signaled by system information. Second, the path loss may be measured on any DL carrier. The WTRU may apply a compensation offset or factor to the path loss estimate, which may depend on the frequency band. The offset may be pre-defined or may be signaled from system information.

[00109] Alternatively, if the number of UL carriers, N_{UL}, is greater than 1 1308, the WTRU may select a UL carrier based on the difference between the estimated path loss to the serving cell (for example, an eNB) and the

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estimated path loss to a neighboring cell 1316. The neighboring eNB or cell may be the next strongest eNB or cell, or may be signaled from system information. For example, on a condition that there are two UL carriers, the WTRU may select one UL carrier on a condition that the path loss difference is below a predetermined threshold and the other UL carrier on a condition that the path loss difference is above the threshold. Generally, a set of N_{UL}-1 thresholds T_i may be used in the case of N_{UL} UL carriers, where UL carrier #i is selected if $T_{(i-1)}$ < path loss difference < T_i. The frequencies of the UL carriers may not need to increase with i. This may allow the WTRU to quickly indicate to the network whether some resource blocks used in some neighboring cells may be used or may not be used for the accessing the WTRU while considering interference.

[00110] A WTRU may select RA preambles group A or RA preambles group B for preamble transmission based on certain criteria. RA preambles group A may be a group that is already configured. RA preambles group B, if available, may be used to indicate to the network that the WTRU has a message larger than a given value or may indicate that the WTRU is power-limited. This may enable the eNB to provide a grant based on the WTRU's location or distance within a cell. Figure 14 shows an example of a procedure 1400 demonstrating RA preambles group B selection criteria. RA preambles group B may be selected provided that: (1) RA preambles group B exists; (2) potential message size is greater than MESSAGE_SIZE_GROUP_A; and (3) path loss (L) meets the inequality:

L < Pmax – PREAMBLE_INITIAL_RECEIVED_TARGET_POWER – DELTA_PREAMBLE_MSG3 – messagePowerOffsetGroupB

(Equation 1)

The potential message size may be data available for transmission plus an AMC header and, where required, MAC control elements. If the above criteria are not met, RA preambles group A may be selected.

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[00111] Referring to Figure 14, if RA preambles group B does not exist 1402, RA preambles group A is selected 1404. If RA preambles group B does exist 1402, but potential message size is not greater than MESSAGE_SIZE_GROUP_A 1406, RA preambles group A is selected 1404. If RA preambles group B does exist 1402 and the potential message size is greater than MESSAGE_SIZE_GROUP_A 1406, but path loss is not less than the quantity defined by Equation 1 1408, RA preambles group A is selected 1404. If RA preambles group B does exist 1402, the potential message size is greater than MESSAGE_SIZE_GROUP_A 1406, and path loss is less the quantity defined by Equation 1 1408, RA preambles group B is selected step 1410.

[00112] Using the defined RA preambles group B criteria, a WTRU may use one or a combination of the following embodiments to select a RA preamble among multiple UL CCs available for RA. Figure 15 shows an example procedure 1500 of initial RA transmission. The WTRU may divide UL CCs available for random access into two carrier sets 1502. Carrier Set A may include carriers in which RA preambles group B criteria are not met 1504. Carrier Set B may include carriers in which RA preambles group B criteria are met 1506. On a condition that Set B is empty 1508, one UL carrier within Carrier Set A may be selected 1510. On a condition that Set B is non-empty 1508, one UL carrier within Carrier Set B may be selected 1512. The WTRU may then select an UL CC within the chosen set in one or a plurality of ways. The WTRU may randomly select one UL carrier within the carrier set 1514. Alternatively, the WTRU may select the UL carrier with the smallest path loss within the carrier set 1516. Alternatively, if Pmax is assigned per UL carrier, the WTRU may select the UL carrier with the smallest Pmax 1518. Having selected the UL carrier, the WTRU may select the preamble group chosen in the preceding steps 1520. The WTRU may then randomly select a RA preamble within the selected preamble group 1522.

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[00113] A random access retransmission may include retransmitting an UL message containing the C-RNTI MAC control element or the UL message including the common control channel (CCCH) service data unit (SDU). The same random access preamble group (A or B) as was chosen for the earlier preamble transmission attempt may be selected. For the retransmission, the preamble may be sent on a different UL carrier. The UL carrier may be chosen as in element 1514, element 1516, or element 1518. A random access preamble may be randomly selected within the selected preamble group.

[00114] Figure 16 shows an example procedure 1600 of initial RA transmission. The WTRU may select one UL carrier among UL CCs available for RA 1604. The UL carrier may be selected in one of a plurality of ways. The WTRU may randomly select one UL carrier within the carrier set 1606. Alternatively, the WTRU may select the UL carrier with the smallest path loss within the carrier set 1608. Alternatively, if Pmax is assigned per UL carrier, the WTRU may select the UL carrier with the smallest Pmax. Alternatively, if there are different RACH parameters for each UL carrier, the WTRU may select the UL carrier that provides the highest probability of accessing the carrier 1612. In another alternative, the WTRU may select the UL carrier that provides a suitable probability of accessing the carrier. For example, the probability may be a function of at least one of: (1) whether or not previous attempts were successful for a given UL CC / PRACH resource; (2) the number of preamble retransmissions for a given UL CC / PRACH resource; (3) the presence of RA preambles group B for a given UL CC / PRACH resource; or (4) the available transmit power based on Pmax and the path loss of the associated DL CC.

[00115] The selection criteria for element 1612 may include (1) the access class probability factor that allows the highest probability of random access success or that provides a suitable probability of accessing the carrier; (2) the UL carrier that allows a greater number of hybrid automatic repeat request

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(HARQ) msg3 transmissions; (3) the UL carrier that allows a greater offset between preamble and msg3; (4) the UL carrier that allows a highest Pmax, such that the WTRU may have a greater chance of succeeding and selecting RA preambles from group B; or (5) other parameters such as, for example, a delta preamble that may allow the WTRU to select RA preambles from a particular group.

[00116] Upon selecting the UL carrier, the WTRU may determine whether RA preambles group B criteria are met 1614. If RA preambles group B criteria are not met, the WTRU may select RA preambles group A 1616. On a condition that RA preambles group B criteria are met, the WTRU may select RA preambles group B 1618. The WTRU may then randomly select a RA preamble within the selected group 1620.

[00117] A random access retransmission may include retransmitting an UL message containing the C-RNTI MAC control element or the UL message including the CCCH SDU. The WTRU may select the same UL carrier that was used for the first preamble transmission. Within the same UL carrier, the same random access preamble group (A or B) as was chosen for the earlier preamble transmission attempt may be selected. A random access preamble may be randomly selected within the selected preamble group.

[00118] Alternatively or additionally, a WTRU may perform a retransmission by randomly selecting one UL carrier within the same carrier set used for the preamble transmission attempt corresponding to the first transmission. Within the selected UL carrier, the same random access preamble group (A or B) as was chosen for the earlier preamble transmission attempt may be selected. A random access preamble may be randomly selected within the selected preamble group.

[00119] Alternatively or additionally, a WTRU may perform a retransmission by randomly selecting an UL carrier. Within the selected UL carrier, a random access preamble group may be selected according to element

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1614, element 1616, or element 1618. A random access preamble may be randomly selected within the selected preamble group.

[00120] Alternatively or additionally, a WTRU may perform a retransmission by selecting a UL carrier in the same manner as in the initial selection. Depending on the conditions, a different UL carrier than the UL carrier selected for initial transmission may be selected.

[00121] Figure 17 shows an example of a procedure 1700 for transmitting a RAR corresponding to a WTRU's preamble transmission. A RAR corresponding to a WTRU's preamble transmission on a given UL carrier 1704 may be transmitted on a known DL PCC 1706 or transmitted on the DL carrier paired with the given UL carrier 1714. If the RAR is transmitted on a known DL PCC carrier 1706 and RAR windows across different UL carriers may not overlap 1708, RAR windows (for example, *ResponseWindowSize*) may be configured small enough so that RAR windows associated with different UL carriers do not overlap 1710. This may be demonstrated as *ra-ResponseWindowSize* $\leq$ *reduced_RACH_period* (for example, T_{RACH}/N_{UL}). Thus, the RA-RNTI computation in LTE-A may be kept the same as in LTE , such that:

RA-RNTI = 1+t_id+10*f_id

(Equation 2)

where t_id may be the index of the first subframe of the specified PRACH ($0 \leq$ t_id $<$ 10) and f_id may be the index of the specified PRACH within that subframe, in ascending order of frequency domain ($0 \leq$ f_id $<$ 6).

[00122] Alternatively, if the RAR is transmitted on a known DL PCC 1706 and RAR windows on different UL carriers may overlap 1708, the RA-RNTI associated with the PRACH in which the RA preamble is transmitted may be computed as a function of t_id, f_id, and carrier_id 1712, such that:

RA-RNTI = f(t_id, f_id, carrier_id)

(Equation 3)

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where carrier_id is the index of the UL carrier on which a RA preamble is transmitted and whose RAR is mapped on the DL PCC ($1 < carrier\_id \leq N$). An example of function f( ) may be given as:

RA-RNTI = f(t_id, f_id, carrier_id) = 1+carrier_id*(t_id+10*f_id) (Equation 4)

In this formula, the carrier_id of the UL carrier that is paired with the DL PCC, as signaled in SIB2, should be equal to 1. Thus, backward compatibility with other WTRUs may be maintained because RA-RNTI is 1+t_id+10*f_id. Another example of function f( ) may be given as:

RA-RNTI = f(t_id, f_id, carrier_id) = (carrier_id-1)*(t_id+10*f_id) (Equation 5)

[00123] In another embodiment, the RAR corresponding to the WTRU's preamble transmission may be transmitted on the DL carrier paired with the given UL carrier 1714. In this embodiment, the RA-RNTI computation may be performed in the same manner as in LTE Release 8 1716.

[00124] Table 1 shows an example of RNTI values. Allocation of RNTI values may increase the range for RA-RNTI. For example, $Value1_{FDD}$ may equal $(N_{max}*10)-1$ and $Value1_{TDD}$ may equal $(N_{max}*60)-1$, where N_{max} may be the maximum number of UL CCs whose RARs are mapped on the same DL carrier.

[00125]

Value (hexa-decimal)		RNTI
FDD	TDD	
0000-$Value1_{FDD}$	0000-$Value1_{TDD}$	RA-RNTI
$Value1_{FDD}$ +1 - Value2	$Value1_{TDD}$ +1 - Value2	C-RNTI, Semi-Persistent Scheduling C-RNTI, Temporary C-RNTI, Transmit Power Control (TPC)-PUCCH-RNTI and TPC-PUSCH-RNTI
Value2+1 – FFFD		Reserved for future use
FFFE		Paging (P)-RNTI
FFFF		System Information (SI)-RNTI

Table 1

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[00126] RACH delay may be reduced via joint processing of the RACH request while employing carrier aggregation in wireless communications. The eNB may detect a RA preamble on one UL carrier. The eNB may schedule RACH msg3 transmission on any one of the N_{UL} UL carriers. A WTRU may follow the grant received in the RAR, which may provide PUSCH resources on a different UL than the preamble was sent on.

[00127] Figure 18 shows an overview of joint processing of a RACH request at an eNB, including a scheduler 1802 and multiple component carriers 1804_a-1804_n. Each component carrier 1804_a-1804_n may include a RLC layer 1806_a-1806_n, a MAC layer 1808_a-1808_n, and a PHY layer 1808_a-1808_n. When a WTRU request is received at the scheduler 1802, the eNB may respond to the request by considering the capacity of all component carriers 1804_a-1804_n rather than considering only the resource availability of the CC that initiated the RA procedure. Upon detection of a first RACH preamble received on any UL CC 1804_a-1804_n, the eNB may check the resource usage status and load of all available UL CCs 1804_a-1804_n. The eNB may then respond to the WTRU's RA preamble (for example, a request for PUSCH allocation for a RACH msg3) by scheduling PUSCH on any available UL CC 1804_a-1804_n.

[00128] In this manner, the assigned UL CC 1804_a-1804_n may or may not be the same as the CC 1804_a-1804_n that the WTRU transmitted its RACH transmission on.

[00129] Figure 19 shows an example of a procedure 1900 for determining which DL carrier the RAR may be received on. A WTRU may need to determine which DL carrier(s) the RAR may be received on 1904 and may do so, for example, according to one or a combination of the following embodiments. In one embodiment, a WTRU may monitor for PDCCH candidates in the common search space on a single DL carrier 1906, assuming that PDCCH is defined on a per-carrier basis. The DL carrier may be a

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function of the UL carrier used for preamble transmission. Alternatively, the DL carrier may be a function of the preamble that was transmitted. For example, the DL carrier may depend on which preamble group the transmitted preamble belongs to. Alternatively, the DL carrier may be a function of a combination of the two previous alternatives, based on both the UL carrier used for preamble transmission and the transmitted preamble. The PDCCH may be received from a PCC indicated from system information, or it may be received on the same DL carrier on which the data part is to be received. Alternatively, the WTRU may monitor for PDCCH candidates in the common search space of the WTRU-specific PCC while in connected mode. The WTRU-specific PCC may be assigned by the network in a RRC message upon the WTRU entering Connected mode.

[00130] In another embodiment, a WTRU may monitor a plurality of PDCCH candidates in the common search space, each corresponding to a single DL carrier 1908, assuming that PDCCH is defined on a per-carrier basis. The DL carriers may be a function of the UL carrier used for preamble transmission. Alternatively, the DL carriers may be a function of the transmitted preamble. For example, the DL carriers may depend on which preamble group the transmitted preamble belongs to. Alternatively, the DL carriers may be a function of a combination of the two previous alternatives, based on both the UL carrier used for preamble transmission and the transmitted preamble. The PDCCHs may be received on a PCC indicated from system information, or they may be received on the respective DL carriers on which the data part is to be received.

[00131] In another embodiment, the WTRU may monitor a single PDCCH for data on any of the DL carriers 1910. The PDCCH may be received on a PCC indicated from system information, or it may be received on a DL carrier that is a function of either the UL carrier used for preamble transmission, the transmitted preamble, or a combination of both. The DL

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carrier on which the data part (PDSCH) is received may also be a function of either the UL carrier used for preamble transmission, the transmitted preamble, or a combination of both. Alternatively, the DL carrier on which the data part is to be received may be indicated by the contents of the PDCCH or by the RA-RNTI used to mask the PDCCH.

[00132] The monitoring described in the above embodiments (element 1906 through element 1910), may also include a WTRU detecting a RAR identified by one RA-RNTI value or by one of a set of RA-RNTI values 1912. The one RA-RNTI value or the set of RA-RNTI values may be determined from a combination of the t_id and f_id parameters plus one or a combination of the UL carriers used for preamble transmission, the DL carrier used for PDCCH transmission of the RAR, and/or the DL carrier used for PDSCH transmission of the RAR.

[00133] Figure 20 shows an example of a procedure 2000 for preamble retransmission. A WTRU may determine that a RAR failure has occurred and may select one or a plurality of UL carriers to be used for retransmission of the RA preamble. If a WTRU determines that a RAR failure has occurred and the number of UL carriers is greater than 1 2004, the WTRU may then determine whether a PDCCH matching the RA-RNTI was received 2006.

[00134] If no PDCCH matching the RA-RNTI was received 2006 during the RA window interval, the WTRU may then select one or a plurality of UL carriers for retransmission of the RA preamble according to one or a combination of the following embodiments. In one embodiment, the WTRU may send the RA preamble on another UL carrier after a backoff period 2008. Optionally, the WTRU may select the UL carrier randomly 2010. During random selection of the UL carrier, the WTRU may exclude the unsuccessful carrier from the potential carriers 2012 or include the unsuccessful carrier in the potential carriers 2014. Optionally, the power ramp scheme used for the

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RA preamble may be implemented as well. Alternatively, the WTRU may use any of the alternatives described above regarding PRACH resource selection.

[00135] In another embodiment, UL carriers may be ranked based on a path loss measurement 2016 as described above. The WTRU may send the first retransmission on the second highest ranking UL carrier 2018. This process may be repeated and the WTRU may send the second retransmission on the third highest ranking UL carrier, and so on. Optionally, after a predetermined number of RA preamble retransmissions, the WTRU may re-select the highest ranking UL carrier 2020.

[00136] In another embodiment, the WTRU may retransmit on the same UL carrier for a predetermined number of transmissions before selecting a new UL carrier 2022.

[00137] In another embodiment, the WTRU may randomly decide whether to select a new UL carrier 2024. Optionally, the WTRU may assign a probability (less than 1) that a new UL carrier is selected 2026.

[00138] If a PDCCH matching the RA-RNTI was received 2006, the WTRU may determine whether the PDCCH contains a backoff indicator or whether the RAR is missing a preamble identifier 2030. If the PDCCH contains a backoff indicator or the RAR is missing a preamble identifier, the WTRU may select a UL carrier according to the embodiments described above (element 2008 through element 2026) or the WTRU may follow a modified UL carrier algorithm 2032. An example of a modified UL carrier algorithm may be using the last digit of the WTRU's IMSI, the SFN, and the subframe ID to decide whether the WTRU should reselect a new UL carrier for the RA preambles 2034.

[00139] Once a WTRU has detected a RAR on one of the DL carriers, the WTRU may then select an UL carrier on which the next message (for example, msg3) may be transmitted. In one embodiment, the WTRU may transmit the next message on the same UL carrier that is used for preamble transmission.

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In another embodiment, the UL carrier (and optionally a transmit power adjustment) may be determined based on the contents of the RAR that was received. In another embodiment, the UL carrier may be determined based on the DL carrier of the PDCCH used for the RAR scheduling. In another embodiment, the UL carrier may be determined based on the DL carrier from which the data part (for example, PDSCH) of the RAR was received.

[00140] The WTRU may then determine the DL carrier over which the next message (for example, msg4) may be received. In one embodiment, the DL carrier may be determined as the same DL carrier(s) of the PDCCH used for RAR scheduling. In another embodiment, the DL carrier may be determined as the same DL carrier(s) of the PDSCH used for RAR reception. In another embodiment, each of the previous two embodiments may be used, determining the DL carrier based on the DL carrier(s) of the PDCCH used for RAR scheduling as well as the DL carrier(s) of the PDSCH used for RAR reception. In another embodiment, the DL carrier may be determined based on the contents of the RAR.

[00141] Embodiments:

1. A method for selecting a random access channel (RACH) uplink (UL) carrier in a wireless transmit/receive unit (WTRU), the method comprising:

on condition that a plurality of UL carriers are available, selecting one UL carrier from the plurality of UL carriers.

2. The method of embodiment 1 further comprising, prior to selecting one UL carrier from the plurality of UL carriers, determining whether a plurality of UL carriers are available.

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3. The method as in any one of embodiments 1-2 further comprising determining whether a plurality of UL carriers are available based on an extension to an already defined system information block.

4. The method as in any one of embodiments 1-3 further comprising determining whether a plurality of UL carriers are available based on a newly defined system information block.

5. The method as in any one of embodiments 1-4 further comprising randomly selecting the one UL carrier from the plurality of UL carriers.

6. The method as in any one of embodiments 1-5 further comprising selecting the one UL carrier from the plurality of UL carriers based on a uniform probability mass function.

7. The method as in any one of embodiments 1-6 further comprising selecting the one UL carrier from the plurality of UL carriers based on an arbitrary probability mass function.

8. The method as in any one of embodiments 1-7 further comprising receiving a probability mass function signaled from system information acquired from a downlink carrier.

9. The method as in any one of embodiments 1-8 further comprising deriving a probability mass function from uplink load information broadcast from a downlink carrier.

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10. The method as in any one of embodiments 1-9 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss to an enhanced nodeB (eNB).

11. The method as in any one of embodiments 1-10 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss being above a threshold.

12. The method as in any one of embodiments 1-11 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss being above a threshold, wherein the threshold is based on a preamble group.

13. The method as in any one of embodiments 1-12 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss being above a threshold, wherein each UL carrier plurality of UL carriers has an associated threshold.

14. The method as in any one of embodiments 1-13 further comprising receiving threshold information as part of system information.

15. The method as in any one of embodiments 1-14 further comprising measuring path loss on a specific downlink DL carrier signaled by system information.

16. The method as in any one of embodiments 1-15 further comprising measuring path loss on a specific frequency band signaled by system information.

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17. The method as in any one of embodiments 1-16 further comprising measuring path loss on a randomly selected downlink (DL) carrier.

18. The method as in any one of embodiments 1-17 further comprising measuring a path loss on a downlink (DL) carrier and applying a compensation offset to the path loss estimate based on the DL carrier frequency.

19. The method as in any one of embodiments 1-18 further comprising measuring a path loss on a downlink (DL) carrier and applying a compensation offset to the path loss estimate based on the DL carrier frequency, wherein the offset is pre-defined.

20. The method as in any one of embodiments 1-19 further comprising measuring a path loss on a downlink (DL) carrier and applying a compensation offset to the path loss estimate based on the DL carrier frequency, wherein the offset is signaled from system information.

21. The method as in any one of embodiments 1-20 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss associated with one of an initial UL grant and an initial downlink (DL)grant.

22. The method as in any one of embodiments 1-21 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss difference between a first estimated path loss and a second estimated path loss.

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23. The method as in any one of embodiments 1-22 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss difference between a first estimated path loss and a second estimated path loss, wherein the first estimated path loss is measured along a first path to a first enhance node-B (eNB) or first cell and the second estimated path loss is measured along a second path to a second eNB or second cell.

24. The method as in any one of embodiments 1-23 further comprising selecting the one UL carrier from the plurality of UL carriers based on a threshold and an estimated path loss difference between a first estimated path loss and a second estimated path loss.

25. A method for selecting a random access channel (RACH) downlink (DL) carrier in a wireless transmit/receive unit (WTRU), the method comprising:

monitoring a plurality of physical downlink control channel (PDCCH) candidates in a common search space in a single DL carrier for a random access response.

26. The method of embodiment 25 wherein the DL carrier has an associated DL carrier frequency that is a based on an uplink (UL) carrier frequency used for a preamble transmission.

27. The method as in any one of embodiments 25-26 wherein the DL carrier has an associated DL carrier frequency that is based on a preamble transmitted on an uplink (UL) carrier.

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28. The method as in any one of embodiments 25-27 wherein the DL carrier has an associated DL carrier frequency that is derived from a combination of a preamble transmitted on an uplink (UL) carrier and uplink (UL) carrier frequency used for transmission of the preamble.

29. The method as in any one of embodiments 25-28 further comprising receiving a PDCCH from a primary component carrier indicated from system information.

30. The method as in any one of embodiments 25-29 further comprising monitoring for PDCCH candidates in the common search space of a WTRU-specific primary carrier while in connected mode.

31. The method as in any one of embodiments 25-29 further comprising monitoring for PDCCH candidates in the common search space of a WTRU-specific primary carrier while in connected mode, wherein the WTRU-specific primary carrier is received in a network in a RRC message.

32. A method for selecting a random access channel (RACH) downlink (DL) carrier in a wireless transmit/receive unit (WTRU), the method comprising:

monitoring a plurality of physical downlink control channel (PDCCH) candidates in a common search space, wherein each PDCCH candidate corresponds to a single DL carrier.

33. The method of embodiment 32 wherein the DL carrier has an associated DL carrier frequency that is a based on an uplink (UL) carrier frequency used for a preamble transmission.

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34. The method as in any one of embodiments 32-33 wherein the DL carrier has an associated DL carrier frequency that is based on a preamble transmitted on an uplink (UL) carrier.

35. The method as in any one of embodiments 32-34 wherein the DL carrier has an associated DL carrier frequency that is derived from a combination of a preamble transmitted on an uplink (UL) carrier and UL carrier frequency used for transmission of the preamble.

36. The method as in any one of embodiments 32-35 further comprising receiving a PDCCH from a primary carrier indicated from system information.

37. A method for selecting a random access channel (RACH) downlink (DL) carrier in a wireless transmit/receive unit (WTRU), the method comprising:

monitoring a single PDCCH that indicates data reception on any of a plurality of DL carriers.

38. The method of embodiment 37 wherein the DL carrier has an associated DL carrier frequency that is a based on an uplink (UL) carrier frequency used for a preamble transmission.

39. The method as in any one of embodiments 37-38 wherein the DL carrier has an associated DL carrier frequency that is based on a preamble transmitted on an uplink (UL) carrier.

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40. The method as in any one of embodiments 37-39 wherein the DL carrier has an associated DL carrier frequency that is derived from a combination of a preamble transmitted on an uplink (UL) carrier and UL carrier frequency used for transmission of the preamble.

41. The method as in any one of embodiments 37-40 further comprising receiving a PDCCH from a primary carrier indicated from system information.

42. The method as in any one of embodiments 37-41 wherein the DL carrier is indicated by the contents of the PDCCH.

43. The method as in any one of embodiments 37-42 wherein the DL carrier is indicated by a Random Access Radio Network Temporary Identifier (RA-RNTI) used to mask the PDCCH.

44. The method as in any one of embodiments 25-43 further comprising detecting a random access response identified by a Random Access Radio Network Temporary Identifier (RA-RNTI) value.

45. The method as in any one of embodiments 25-44 further comprising detecting a random access response identified by a set of Random Access Radio Network Temporary Identifier (RA-RNTI) values.

46. The method as in any one of embodiments 25-45 further comprising determining a Random Access Radio Network Temporary Identifier (RA-RNTI) value based on a combination of an index of a first subframe (t_id parameter) and an index of the specified PRACH within the first subframe (f_id parameter).

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47. The method as in any one of embodiments 25-46 further comprising determining a Random Access Radio Network Temporary Identifier (RA-RNTI) value based on a combination of an index of a first subframe (t_id parameter) and an index of the specified PRACH within the first subframe (f_id parameter) plus one.

48. The method as in any one of embodiments 25-47 further comprising determining a Random Access Radio Network Temporary Identifier (RA-RNTI) value based on a combination of the uplink (UL) carrier used for preamble transmission and the DL carrier used for PDCCH transmission of the random access response.

49. The method as in any one of embodiments 25-48 further comprising determining a Random Access Radio Network Temporary Identifier (RA-RNTI) value based on a combination of the uplink (UL) carrier used for preamble transmission and a DL carrier used for PDSCH transmission of the random access response.

50. The method as in any one of embodiments 25-49 further comprising: determining a Random Access Radio Network Temporary Identifier (RA-RNTI) value based on a combination of the uplink (UL) carrier used for preamble transmission, the DL carrier used for PDCCH transmission of the random access response and a DL carrier used for PDSCH transmission of the random access response.

51. A method for processing a random access channel (RACH) response failure in a wireless transmit/receive unit (WTRU), the method comprising:

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on condition that the WTRU did not receive a PDCCH matching a Random Access Radio Network Temporary Identifier (RA-RNTI) during a random access window interval after sending an initial random access preamble on a first uplink (UL) carrier selected from a plurality of UL carriers;

transmitting a second random access preamble on a second UL carrier selected from the plurality of UL carriers.

52. The method of embodiment 51 further comprising transmitting a second random access preamble on a second UL carrier after a backoff period.

53. The method as in any one of embodiments 51-52 further comprising randomly selecting the second UL carrier from the plurality of UL carriers.

54. The method as in any one of embodiments 51-53 further comprising randomly selecting the second UL carrier from the plurality of UL carriers, excluding the first UL carrier.

55. The method as in any one of embodiments 51-54 further comprising randomly selecting the second UL carrier from the plurality of UL carriers, including the first UL carrier.

56. The method as in any one of embodiments 51-55 further comprising selecting the second UL carrier from the plurality of UL carriers based on a uniform probability mass function.

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57. The method as in any one of embodiments 51-56 further comprising selecting the second UL carrier from the plurality of UL carriers based on an arbitrary probability mass function.

58. The method as in any one of embodiments 51-57 further comprising receiving a probability mass function signaled from system information acquired from a downlink carrier.

59. The method as in any one of embodiments 51-58 further comprising deriving a probability mass function from uplink load information broadcast from a downlink carrier.

60. The method as in any one of embodiments 51-59 further comprising selecting the second UL carrier from the plurality of UL carriers based on an estimated path loss to an enhanced nodeB (eNB).

61. The method as in any one of embodiments 51-60 further comprising selecting the second UL carrier from the plurality of UL carriers based on an estimated path loss being above a threshold.

62. The method as in any one of embodiments 51-61 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss being above a threshold, wherein the threshold is based on a preamble group.

63. The method as in any one of embodiments 51-62 further comprising selecting the second UL carrier from the plurality of UL carriers based on an estimated path loss being above a threshold, wherein each UL carrier plurality of UL carriers has an associated threshold.

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64. The method as in any one of embodiments 51-63 further comprising receiving threshold information as part of system information.

65. The method as in any one of embodiments 51-64 further comprising measuring path loss on a specific downlink DL carrier signaled by system information.

66. The method as in any one of embodiments 51-65 further comprising measuring path loss on a specific frequency band signaled by system information.

67. The method as in any one of embodiments 51-66 further comprising measuring path loss on a randomly selected downlink (DL) carrier.

68. The method as in any one of embodiments 51-67 further comprising measuring a path loss on a downlink (DL) carrier and applying a compensation offset to the path loss estimate based on the DL carrier frequency.

69. The method as in any one of embodiments 51-68 further comprising measuring a path loss on a downlink (DL) carrier and applying a compensation offset to the path loss estimate based on the DL carrier frequency, wherein the offset is pre-defined.

70. The method as in any one of embodiments 51-69 further comprising measuring a path loss on a downlink (DL) carrier and applying a compensation offset to the path loss estimate based on the DL carrier frequency, wherein the offset is signaled from system information.

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71. The method as in any one of embodiments 51-70 further comprising selecting the one UL carrier from the plurality of UL carriers based on an estimated path loss associated with one of an initial UL grant and an initial downlink (DL)grant.

72. The method as in any one of embodiments 51-71 further comprising selecting the second UL carrier from the plurality of UL carriers based on an estimated path loss difference between a first estimated path loss and a second estimated path loss.

73. The method as in any one of embodiments 51-72 further comprising selecting the second UL carrier from the plurality of UL carriers based on an estimated path loss difference between a first estimated path loss and a second estimated path loss, wherein the first estimated path loss is measured along a first path to a first enhance node-B (eNB) or first cell and the second estimated path loss is measured along a second path to a second eNB or second cell.

74. The method as in any one of embodiments 51-73 further comprising selecting the second UL carrier from the plurality of UL carriers based on a threshold and an estimated path loss difference between a first estimated path loss and a second estimated path loss.

75. The method as in any one of embodiments 51-74 further comprising selecting the second UL carrier from the plurality of UL carriers after k preamble transmissions.

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76. A method for processing a random access channel (RACH) response failure in a wireless transmit/receive unit (WTRU), the method comprising:

on condition that the WTRU received a PDCCH matching a Random Access Radio Network Temporary Identifier (RA-RNTI) during a random access window interval after sending an initial random access preamble on a first uplink (UL) carrier selected from a plurality of UL carriers, but the associated random access response did not contain the RA preamble identifier or contained a backoff indicator;

determining whether or not to select a new UL carrier based on a last digit of the IMSI of the WTRU and a System Frame Number (SFN) and subframe number.

77. The method as in any one of embodiments 51-76 further comprising :

on condition that the WTRU detects a random access response;

transmitting a next message using a UL carrier used for a preamble transmission.

78. The method as in any one of embodiments 51-77 further comprising:

on condition that the WTRU detects a random access response;

selecting a UL carrier from a plurality of UL carriers based on the random access response.

79. The method as in any one of embodiments 51-78 further comprising:

on condition that the WTRU detects a random access response;

selecting a UL carrier from a plurality of UL carriers based on a DL

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carrier used for the random access response.

80. The method as in any one of embodiments 51-79 further comprising:

on condition that the WTRU detects a random access response;

selecting a UL carrier from a plurality of UL carriers based on a DL carrier from which a data part of the random access response was received.

81. A method for random access channel (RACH) period reduction of an uplink (UL) carrier, implemented in a wireless transmit/receive unit (WTRU), the method comprising:

transmitting RACH signal information parameters for each uplink carrier to the WTRU via a downlink primary carrier;

transmitting the random access response (RAR) corresponding to the WTRU preamble via a downlink carrier paired with an uplink carrier; and

configuring the size of each RAR window such that RAR windows associated with uplink carriers do not overlap.

82. The method as in embodiment 81, wherein the RACH signal is transmitted on different uplink (UL) carriers having different RACH timing offsets.

83. The method as in embodiment 81, further comprising transmitting RACH parameters of each uplink carrier where the WTRU transmits the RACH parameters.

84. The method as in embodiment 81, further comprising staggering the RACH timing of each aggregated uplink carrier where the WTRU transmits the RACH parameters.

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85. The method as in embodiment 81, further comprising transmitting the location and the bandwidth for each uplink carrier where the WTRU transmits the RACH parameters.

86. The method as in any of the previous embodiments, wherein the WTRU transits from idle to connected state.

87. The method as in embodiment 81, wherein the RAR corresponding to a WTRU preamble transmission on uplink carrier k is transmitted on a known downlink primary carrier or on a downlink carrier that is paired with the uplink carrier k.

88. The method as in embodiment 81, wherein the RAR is transmitted on a downlink primary carrier to the WTRU and wherein the network configures the size of the random access response window.

89. The method as in embodiment 88, wherein the RAR window is computed according to the formula: *ra-ResponseWindowSize* $\leq$ *reduced_RACH_period* .

90. The method as in embodiment 81, wherein the RAR windows associated with the uplink carriers do not overlap.

91. The method as in embodiment 81, wherein the RACH signal is transmitted on different uplink (UL) carriers and wherein the RAR windows associated with the uplink carriers overlap.

92. The method as in embodiment 81, wherein the random access

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network temporary identifier (RA-RNTI) is transmitted as a function of t_id, f_id and carrier_id, such that RA-RNTI = f(t_id, f_id, carrier_id),where T_id is the index of the first subframe, f_id is the index of the physical random access channel (PRACH) and carrier_id is the index of the uplink carrier on which a random access preamble is transmitted and wherein RAR is mapped on the downlink primary carrier.

93. The method as in embodiment 81, further comprising the eNB responding to the WTRU's request considering the resource availability all the available component carriers that initiated the RACH process.

94. The method as in embodiment 93, further comprising the eNB checking the resource usage status and loading the available UL component carriers upon successful detection of the first RACH preamble received on any uplink carrier component.

95. The method as in embodiment 94, further comprising the eNB responding to the WTRU's access preamble by scheduling a physical uplink control channel (PUSCH) on any available uplink component carrier.

96. The method as in embodiment 95, wherein the assigned uplink component carrier may or may not be the same as the one on which the WTRU transmits its random access channel (RACH).

97. The method as in any preceding embodiment, wherein granting PUSCH for the WTRU is improved by N_{UL} times.

98. The method as in embodiment 81, further comprising performing a eNB detection of random access preamble on one UL carrier.

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99. The method as in embodiment 81, further comprising RACH delay reduction by transmission of simultaneous simultaneous transmission of multiple random access preambles within a given RACH period.

100. The method as in embodiment 99, further comprising WTRU sending simultaneous random access preambles on multiple carriers.

101. The method as in embodiment 99, further comprising a wireless transmit/receive unit (WTRU) sending simultaneous random access preambles on all of the N_{UL} component carriers.

102. The method as in any of embodiments 100 or 101 wherein the transmitted preambles are the same.

103. The method as in any of embodiments 100 or 101 wherein the transmitted preambles are different.

104. The method as in any of the preceding embodiments, wherein a WTRU sends multiple simultaneous random access preambles.

105. The method as in embodiment 104, further comprising detection of at least one of the preambles at the eNB.

106. The method as in embodiment 105, further comprising the eNB sending back one random access response (RAR) to the WTRU.

107. A method of selecting a random access preamble among multiple uplink component carriers available for random access, the method comprising:

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dividing uplink component carriers available for random access into two carrier sets;

selecting one uplink carrier within a first one of the carrier sets on the condition that the first one of the carrier sets is not empty;

selecting one uplink carrier within a second one of the carrier sets on the condition that the first one of the carrier sets is empty;

selecting a preamble group within the selected uplink carrier; and

randomly selecting a random access preamble within the selected preamble group.

108. The method of embodiment 107, wherein the preamble group is random access preamble group A.

109. The method of embodiment 107, wherein the preamble group is random access preamble group B.

110. A method of selecting a random access preamble among multiple uplink component carriers available for random access, the method comprising:

selecting one uplink carrier among uplink component carriers available for random access in a carrier set;

randomly selecting one uplink carrier within the carrier set within the selected uplink carrier, checking whether a random access preamble group criteria is met;

selecting the random access preamble group; and

randomly selecting a random access preamble within the selected group.

111. A method for selecting random access channel (RACH) resources

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in wireless communications implemented in a wireless transmit/receive unit (WTRU), comprising:

determining an allowed random access channel (RACH) configuration set.

112. The method of embodiment 111, further comprising:

transmitting a preamble on at least one physical random access channel (PRACH)/RACH resource.

113. The method of any of embodiments 111-112, wherein the allowed RACH configuration set comprises PRACH/RACH resources associated with a plurality of uplink carriers.

114. The method of any one of embodiments 111-113, further comprising:

adding an additional PRACH/RACH resource to the allowed RACH configuration set.

115. The method of any one of embodiments 111-114, further comprising:

removing at least one element of the allowed RACH configuration set.

116. The method of any one of embodiments 111-115, wherein determining the allowed RACH configuration set comprises:

receiving a radio resource control (RRC) message relating to carrier configurations available to the WTRU.

117. The method of any one of embodiments 111-116, wherein determining the allowed RACH configuration set comprises:

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including all PRACH/RACH configurations broadcast by at least one downlink carrier that the WTRU is configured to utilize.

118. The method of any one of embodiments 111-117, wherein determining the allowed RACH configuration set comprises:

including exactly one PRACH/RACH configuration for each of a plurality of uplink carriers the WTRU is configured to utilize, wherein the PRACH/RACH configuration for each uplink carrier is provided in a paired downlink carrier.

119. The method of any one of embodiments 111-118, wherein determining the allowed RACH configuration set comprises:

including exactly one PRACH/RACH configuration for each of a plurality of uplink carriers the WTRU is configured to utilize, wherein the PRACH/RACH configuration for each uplink carrier is provided by dedicated signaling.

120. The method of any one of embodiments 111-119, wherein determining the allowed RACH configuration set comprises:

including at most one PRACH/RACH resource for each uplink carrier the WTRU is configured to utilize, wherein one PRACH/RACH resource may be associated with more than one uplink carrier sharing the same time advance.

121. The method of any one of embodiments 114-120, wherein adding an additional PRACH/RACH resource further comprises:

receiving explicit signaling from a network.

122. The method of embodiment 121, wherein the explicit signaling is

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a new indicator sent along with the carrier configuration in RRC signaling.

123. The method of embodiment 122, wherein the new indicator indicates a PRACH/RACH configuration broadcast in a downlink carrier carrying the new indicator, should be added to the allowed RACH configuration set.

124. The method of any one of embodiments 114-120, wherein adding an additional PRACH/RACH resource further comprises:

receiving a physical downlink control channel (PDCCH) order from a downlink carrier broadcasting the PRACH/RACH configuration.

125. The method of any one of embodiments 114-120, wherein adding an additional PRACH/RACH resource further comprises:

receiving a physical downlink control channel (PDCCH) order, wherein the PDCCH order includes a carrier indicator field (CIF).

126. The method of embodiment 125, wherein the CIF indicates the downlink carrier broadcasting the PRACH/RACH configuration.

127. The method of embodiment 125, wherein the CIF indicates the uplink carrier corresponding to a PRACH/RACH configuration broadcast in a downlink carrier.

128. The method of any one of embodiments 115-127, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

receiving explicit signaling from a network.

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129. The method of embodiment 128, wherein the explicit signaling is received via radio resource control (RRC) signaling.

130. The method of any one of embodiments 115-127, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

removing or invalidating an associated uplink carrier on a condition that the downlink carrier broadcasting a PRACH/RACH configuration is removed or invalidated from the PRACH/RACH configuration.

131. The method of any one of embodiments 115-127, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

removing or invalidating an uplink carrier on a condition that the uplink carrier is removed or invalidated from the PRACH/RACH configuration broadcast to the WTRU.

132. The method of any one of embodiments 115-131, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

transmitting a preamble based on a PRACH/RACH configuration; and

comparing a number of preamble transmissions attempted with a maximum number of preamble transmissions established for random access.

133. The method of any one of embodiments 115-131, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

transmitting a preamble based on a PRACH/RACH configuration;

receiving a random access response indicating random access was not

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successful.

134. The method of any one of embodiments 132-133, wherein removing or invalidating at least one element from the allowed RACH configuration set further comprises:

removing or invalidating the downlink carrier associated with the PRACH/RACH configuration from the carrier configuration.

135. The method of any one of embodiments 132-134, wherein removing or invalidating at least one element from the allowed RACH configuration set further comprises:

removing or invalidating the uplink carrier associated with the PRACH/RACH configuration from the carrier configuration.

136. The method of any one of embodiments 115-135, wherein removing or invalidating at least one element from the allowed RACH configuration set further comprises:

resetting a PREAMBLE_TRANSMISSION_COUNTER to one.

137. The method of any one of embodiments 115-136, wherein removing or invalidating at least one element from the allowed RACH configuration set further comprises:

setting a backoff parameter value to 0 ms and flushing a MSG3 buffer.

138. The method of any one of embodiments 115-137, wherein removing or invalidating at least one element from the allowed RACH configuration set further comprises:

selecting a RACH resource from the allowed RACH configuration set.

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139. The method of any one of embodiments 111-138, further comprising:

indicating a random access problem to upper layers on a condition that the allowed RACH configuration set is empty.

140. The method of any one of embodiments 111-139, wherein the WTRU determines a set of available PRACH resources before selecting a PRACH resource to utilize.

141. The method of embodiment 140, further comprising:

receiving a CIF in the PDCCH containing the PDCCH order for RACH.

142. The method of any one of embodiments 140-141, further comprising:

determining the set of available PRACH resources based on *prach-ConfigIndex* broadcast in a downlink carrier indicated in the CIF.

143. The method of any one of embodiments 140-142 further comprising:

determining the set of available PRACH resources based on a set of PRACH resources available on the uplink carrier indicated by the CIF.

144. The method of any one of embodiments 140-143 further comprising:

determining the set of available PRACH resources based on the set of PRACH resources available on an uplink carrier indicated by the CIF.

145. The method of any one of embodiments 140-144, wherein the set of available PRACH resources is based on a union of any sets of PRACH

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resources provided in any number of multiple downlink carriers in a PRACH configuration broadcast.

146. The method of any one of embodiments 140-145, further comprising:

interpreting the CIF as an index, wherein the index references an ordered sequence of sets of PRACH resources.

147. The method of embodiment 146, wherein the ordered sequence corresponds to the order of downlink carriers in the carrier configuration.

148. The method of any one of embodiments 111-147, wherein the WTRU initiates RACH and no valid physical uplink control channel (PUCCH) resource is available to the WTRU.

149. The method of embodiment 148, further comprising:

determining a set of available PRACH resources based solely on the PRACH configuration broadcast on the downlink carrier corresponding to a special cell.

150. The method of embodiment 149, wherein the PRACH resources provided in the PRACH configuration are present in the allowed RACH configuration set.

151. The method of embodiment 150, wherein on condition that a PRACH configuration corresponding to the special cell is not present, the WTRU determines a set of available PRACH resources based on a union of sets of PRACH resources provided by all PRACH configurations in the allowed RACH configuration set.

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152. The method of embodiment 148, further comprising:

determining a set of available PRACH resources based on sets of PRACH resources available on a plurality of uplink carriers, wherein an applicable timing advance timer expired for each of the plurality of uplink carriers.

153. The method of embodiment 148, further comprising:

determining a set of available PRACH resources based on sets of PRACH resources available on a plurality of uplink carriers, wherein a timing advance signal was received for each of the plurality of uplink carriers.

154. The method of any one of embodiments 111-153, further comprising:

receiving a PDCCH order indicating that the WTRU randomly select a PRACH resource from the allowed RACH configuration set.

155. The method of embodiment 154, further comprising:

determining a set of available PRACH resources based on a union of any number of sets of PRACH resources provided by all PRACH configurations in the allowed RACH configuration set.

156. The method of any one of embodiments 154-155, further comprising:

determining a set of available PRACH resources based on a union of any number of sets of PRACH resources provided by PRACH configurations for which a corresponding uplink carrier is not synchronized.

157. The method of any one of embodiments 111-156 further

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comprising:

receiving an uplink grant for a Physical Uplink Shared Channel (PUSCH) on an uplink carrier for which an applicable timing advance timer has expired.

158. The method of any one of embodiments 111-156 further comprising:

receiving an uplink grant for a Physical Uplink Shared Channel (PUSCH) on any uplink carrier having a common timing advance.

159. The method of any one of embodiments 111-158, further comprising:

determining a next sub-frame containing an available PRACH from the allowed RACH configuration set.

160. The method of embodiment 159, further comprising:

selecting the next sub-frame containing an available PRACH resource; and

transmitting a preamble in the selected sub-frame.

161. The method of any one of embodiments 111-160, wherein the PRACH resource is selected only for a first preamble transmission.

162. The method of any one of embodiments 111-161, further comprising:

selecting a parameter from *preambleInfo, powerRampingparameters,* and *ra-SupervisionInfo* according to the RACH configuration broadcast from a downlink carrier broadcasting a PRACH configuration used to select the PRACH resource utilized for a first preamble transmission.

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163. The method of any one of embodiments 111-162, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

removing or invalidating any configuration that corresponds to a configuration provided by dedicated signaling.

164. The method of any one of embodiments 111-163, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

removing or invalidating any configuration that corresponds to a configuration provided for a secondary component carrier (SCC) of a WTRU's configuration.

165. The method of any one of embodiments 111-164, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

removing or invalidating any configuration that corresponds to a configuration provided for all SCCs of the same frequency band.

166. The method of any one of embodiments 111-165, wherein removing or invalidating at least one element of the allowed RACH configuration set comprises:

removing or invalidating any configuration that corresponds to a configuration configured such that on a condition of a failure of random access procedure, a WTRU does not trigger radio link failure.

167. The method of any one of embodiments 111-166 wherein:

a WTRU attempts a random access procedure using a first

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PRACH/RACH configuration for which a failure does not trigger radio link failure (RLF); and

the WTRU determines that RLF is not triggered, on a condition that:

the PRACH/RACH configuration was received by dedicated signaling;

the PRACH/RACH configuration corresponds to a SCC of the WTRU's configuration; or

the PRACH/RACH configuration indicates that RA failure does not trigger RLF.

168. The method of embodiment 167, wherein:

on a condition that a random access procedure failure is detected for the first PRACH/RACH configuration, the WTRU performs a random access procedure using a second PRACH/RACH configuration for which a failure of the random access attempt triggers RLF; and

the WTRU determines that RLF is not triggered upon a failure on a condition that:

the PRACH/RACH configuration was received by signaling from the broadcasted system information;

the PRACH/RACH configuration corresponds to a primary component carrier (PCC) of the WTRU's configuration; or

the PRACH/RACH configuration indicates that RA failure triggers RLF.

169. The method of embodiment 168, wherein a WTRU indicates a random access problem to upper layers on a condition that a failure is detected for the second PRACH/RACH configuration.

170. The method of any one of embodiments 111-169, further

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comprising determining which resource a WTRU should select for a RACH procedure by making a selection at least in part as a function based on for which CC the received control information is applicable, on a condition that the WTRU receives a request from the network to perform random access (RA).

171. The method of embodiment 170, further comprising:

the WTRU detecting whether DCI format is applicable to a SCC of the WTRU's configuration or to a PCC of the WTRU's configuration; and

on a condition that the DCI format is applicable to a SCC, the WTRU performing at least one of:

refraining from performing a RA attempt;

performing RACH in a PCC of the WTRU's configuration;

performing RACH using a RACH resource of an applicable SCC;

performing RACH using a RACH resource of any CC which is a part of the group for which the corresponding UL CC has the same timing advance (TA) requirement; or

performing RACH using a resource indicated in a DCI message.

172. The method of any one of embodiments 111-171 wherein a WTRU selects a PRACH resource from a set of available resources using an identity of the WTRU .

173. The method of any one of embodiments 111-172 wherein a WTRU selects a PRACH resource by considering a set of available resources as a priority list.

174. The method of embodiment 173, wherein the priority list determines priority based on:

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a configuration of the network.

175. The method of any one of embodiments 173 or 174 wherein the priority list determines priority based on:

downlink pathloss, based on measurements for a downlink CC used for pathloss determination for an uplink CC corresponding to the resource.

176. The method of any one of embodiments 173-175 wherein the priority list determines priority based on:

a ranking of the resource based on predetermined criteria.

177. The method of any one of embodiments 173-176 wherein the priority list determines priority based on:

round-robin attempts.

178. The method of any one of embodiments 173-177 wherein the priority list determines priority based on:

a previous outcome of a RACH on the same resource.

179. The method of any one of embodiments 173-178 wherein the priority list determines priority based on:

whether the CC is a PCC or a SCC of the WTRU's configuration.

180. The method of any one of embodiments 173-179 wherein the priority list determines priority based on:

whether or not the resource was provided to the WTRU in a dedicated manner.

181. The method of any one of embodiments 173-180 wherein the priority list determines priority based on:

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whether or not the resource was provided to the WTRU using broadcasted system information.

182. The method of any one of embodiments 111-181, wherein a WTRU selects a specific PRACH within an available set, the method further comprising:

the WTRU selecting a resource from a set of available PRACH resources with a further restriction that the selected resource corresponds to an uplink CC for which the associated downlink CC is configured and activated.

183. The method of embodiment 182, wherein the downlink CC must be explicitly activated by received signaling.

184. The method of any one of embodiments 111-183, wherein a WTRU selects a specific PRACH within an available set, the method further comprising:

the WTRU selecting a resource from a set of available PRACH resources with a further restriction that the selected resourced corresponds to an uplink CC that is configured.

185. The method of embodiment 184, wherein the uplink CC must be activated.

186. A method as in any preceding embodiment wherein the WTRU transmits and receives simultaneously over multiple component carriers (CCs) through the use of bandwidth extensions such as carrier aggregation (CA).

187. A method as in any preceding embodiment wherein a special cell

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corresponds to the carrier used as anchor for non-access stratum (NAS) mobility and for security purposes.

188. A method as in any preceding embodiment wherein a WTRU configured with multiple CCs receives control signaling for scheduling of all CCs from at least one of a single PDCCH or multiple PDCCHs.

189. A method as in any preceding embodiment wherein the WTRU performs a number of blind decoding attempts of the PDCCH channel which requires validation by a cyclic redundancy check (CRC), to determine whether signaling for a specific WTRU.

190. A method as in any preceding embodiment wherein blind decoding complexity is reduced by requiring a WTRU to monitor control signaling only on a subset of the configured CCs.

191. A method as in any preceding embodiment wherein a PDCCH monitoring set represents a set of CCs on which the WTRU is required to monitor, which size is less or equal to the size of the UL/DL CC set and is comprise only CCs that are in the WTRU DL CC set.

192. A method as in any preceding embodiment wherein the network uses cross-carrier scheduling, where grants or assignments signaled on the PDCCH of one CC indicates transmissions on the physical uplink shared channel (PUSCH) or physical downlink shared channel (PDSCH) corresponding to a different CC.

193. A method as in any preceding embodiment wherein determining the allowed RACH configuration set comprises:

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one or more PRACH/RACH configurations per uplink carrier associated to one or more downlink carrier included in the PDCCH monitoring set.

194. A method as in any preceding embodiment wherein a WTRU invalidates a certain period of time a PRACH/RACH configuration from the configuration set during explicit signaling from the network.

195. A wireless transmit/receive unit (WTRU) comprising a processor configured to perform a method as in any preceding embodiment.

196. A WTRU configured to perform a method as in any preceding embodiment.

197. The WTRU of embodiment 196, further comprising a receiver.

198. The WTRU as in any of embodiments 196-197, further comprising a transmitter.

199. The WTRU as in any of embodiments 196-198, further comprising a processor in communication with the transmitter and/or receiver.

200. A Node B configured to perform a method as in any of embodiments 1-194.

201. An integrated circuit configured to perform a method as in any of embodiments 1-194.

202. An evolved Node-B configured a method as in any of embodiments 1-194.

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[00142] Although features and elements are described above in particular combinations, each feature or element can be used alone without the other features and elements or in various combinations with or without other features and elements. The methods or flow charts provided herein may be implemented in a computer program, software, or firmware incorporated in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[00143] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

[00144] A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game

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player module, an Internet browser, and/or any wireless local area network (WLAN) or Ultra Wide Band (UWB) module.

* * *

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CLAIMS

What is claimed is:

1. A method for maintaining an allowed multicarrier uplink (UL) random access channel (RACH) configuration set, comprising:

adding an UL carrier to an allowed RACH configuration set, on a condition that a triggering event occurs ; and

performing a random access (RA) procedure using the allowed RACH configuration set.

2. The method according to claim 1, wherein the adding includes adding a physical random access channel (PRACH) / RACH configuration to the allowed RACH configuration set.

3. The method according to claim 1, wherein the performing includes:

selecting a physical random access channel (PRACH) resource from a set of available PRACH resources; and

determining the next available subframe containing an allowed PRACH resource within a set of all available PRACH resources given by a set of parameters that indicate PRACH resources on at least one UL frequency.

4. A method for sending data, comprising:

determining a set of available uplink (UL) carriers; and

on a condition that more than one UL carrier exists, selecting an UL carrier from the set of available UL carriers based on estimated path loss.

5. The method according to claim 4, wherein the selecting includes

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selecting an UL carrier based on estimated path loss differences between a cell and a neighboring cell.

6. A method for initial random access (RA) transmission using a multicarrier uplink (UL) random access channel (RACH) scheme, the method comprising:

selecting an UL carrier from a plurality of UL carriers;

selecting a random access preamble group based on the selected UL carrier; and

selecting a random access preamble within the selected random access preamble group.

7. The method according to claim 6, wherein the selecting an UL carrier from a plurality of UL carriers includes:

dividing available UL component carriers (CCs) into a first carrier set and a second carrier set;

on a condition that the first carrier set is empty, selecting one UL carrier within the second carrier set; and

on a condition that the first carrier set is not empty, selecting one UL carrier within the first carrier set.

8. The method according to claim 6, wherein:

the selecting an UL carrier from a plurality of UL carriers includes selecting one UL carrier among UL component carriers (CCs) based on path loss; and

the selecting a random access preamble within the selected random access preamble group includes randomly selecting a random access preamble within the selected random access preamble group.

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9. The method according to claim 6, wherein:

the selecting an UL carrier from a plurality of UL carriers includes selecting one UL carrier among UL component carriers (CCs) based on Pmax; and

the selecting a random access preamble within the selected random access preamble group includes randomly selecting a random access preamble within the selected random access preamble group.

10. A method for transmitting a random access response (RAR) using a multicarrier uplink (UL) random access channel (RACH) scheme, the method comprising:

determining a downlink (DL) carrier for RAR transmission;

computing a random access radio network temporary identifier (RA-RNTI) associated with the RAR; and

transmitting the RAR including the RA-RNTI.

11. The method according to claim 10, wherein the computing includes:

on a condition that the RAR is to be transmitted on a known DL primary component carrier (PCC):

configuring a RAR window such that RAR windows associated with different UL carriers do not overlap, on a condition that RAR windows may not overlap; and

computing RA-RNTI as a function of the UL carrier on which a random access (RA) preamble was transmitted and the UL carrier for which a RAR is mapped on a DL PCC.

12. A method performed at a wireless transmit/receive unit (WTRU) for determining at least one downlink (DL) carrier on which a random access

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response (RAR) should be received, the method comprising:

monitoring at least one physical downlink control channel (PDCCH) in a common search space on at least one DL carrier for a random access radio network temporary identifier (RA-RNTI) value that corresponds to the WTRU ; and

receiving a RAR identified by the RA-RNTI.

13. A WTRU configured to maintain an allowed multicarrier uplink (UL) random access channel (RACH) configuration set, the WTRU comprising:

a processor and transmitter configured to:

determine whether to add an UL carrier to an allowed RACH configuration set on a condition that a triggering event occurs;

add the UL carrier to the allowed RACH configuration set; and

perform a random access (RA) procedure using the allowed RACH configuration set.

14. The WTRU according to claim 13, wherein the processor is further configured to add an UL carrier to the allowed RACH configuration set by adding a physical random access channel (PRACH) / RACH configuration to the allowed RACH configuration set.

15. A wireless transmit/receive unit (WTRU) configured to perform multicarrier uplink (UL) communications, the WTRU comprising:

a processor and transmitter configured to:

determine available UL carriers; and

on a condition that more than one UL carrier exists, select a UL carrier based on estimated path loss.

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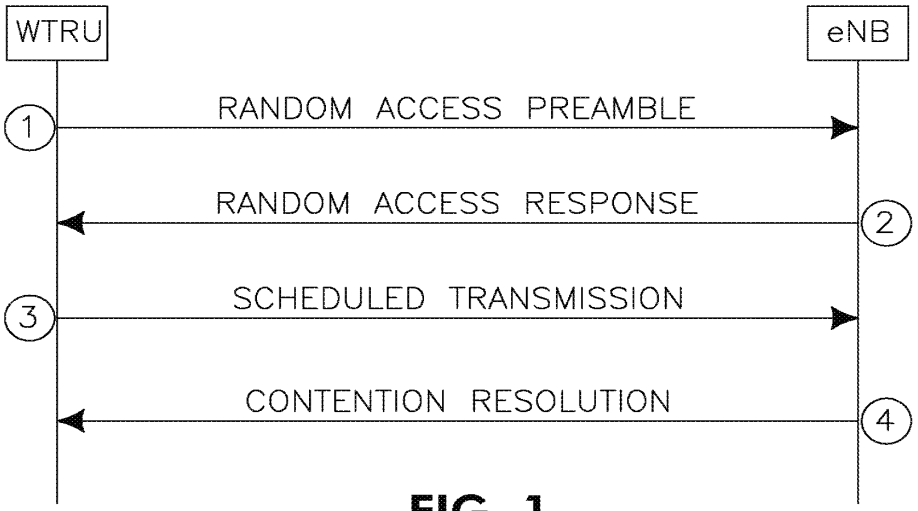


FIG. 1
PRIOR ART

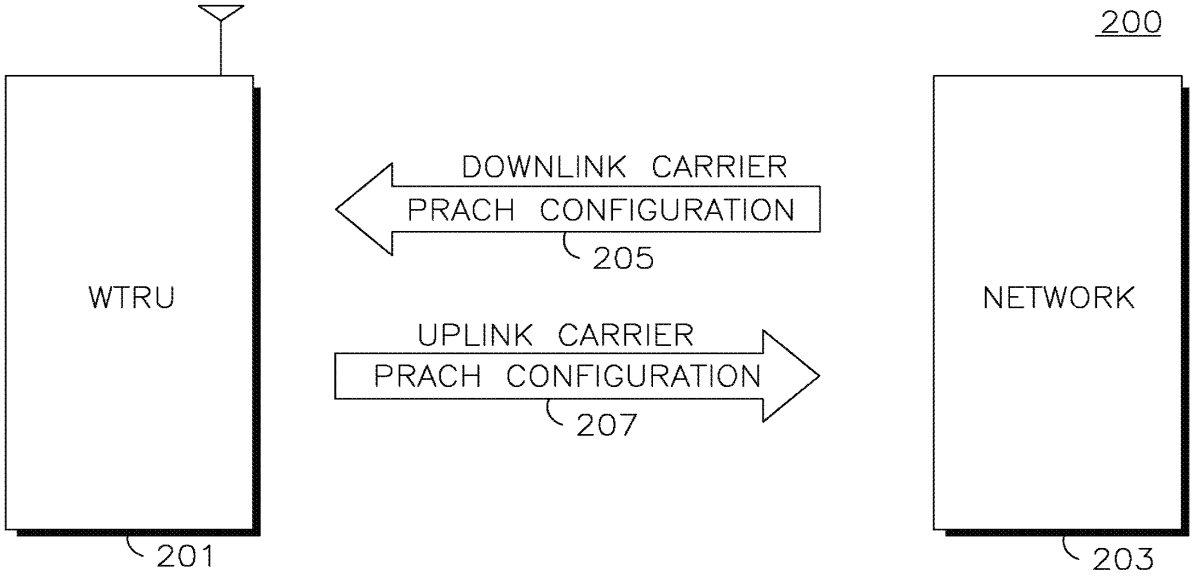


FIG. 2
PRIOR ART

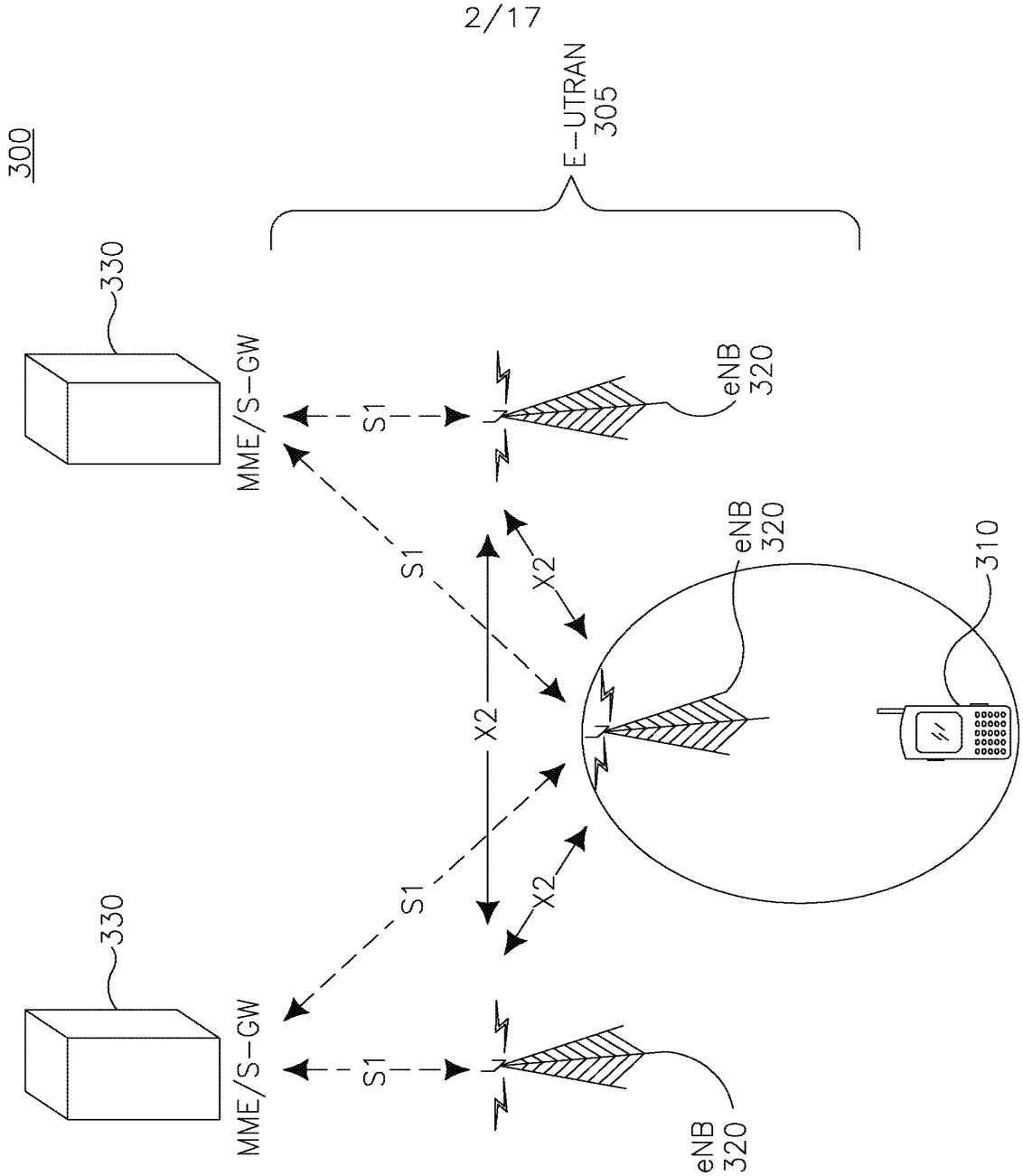

300
E-UTRAN
305
330
MME/S-GW
S1
eNB
320
X2
310
330
MME/S-GW
S1
eNB
320

FIG. 3

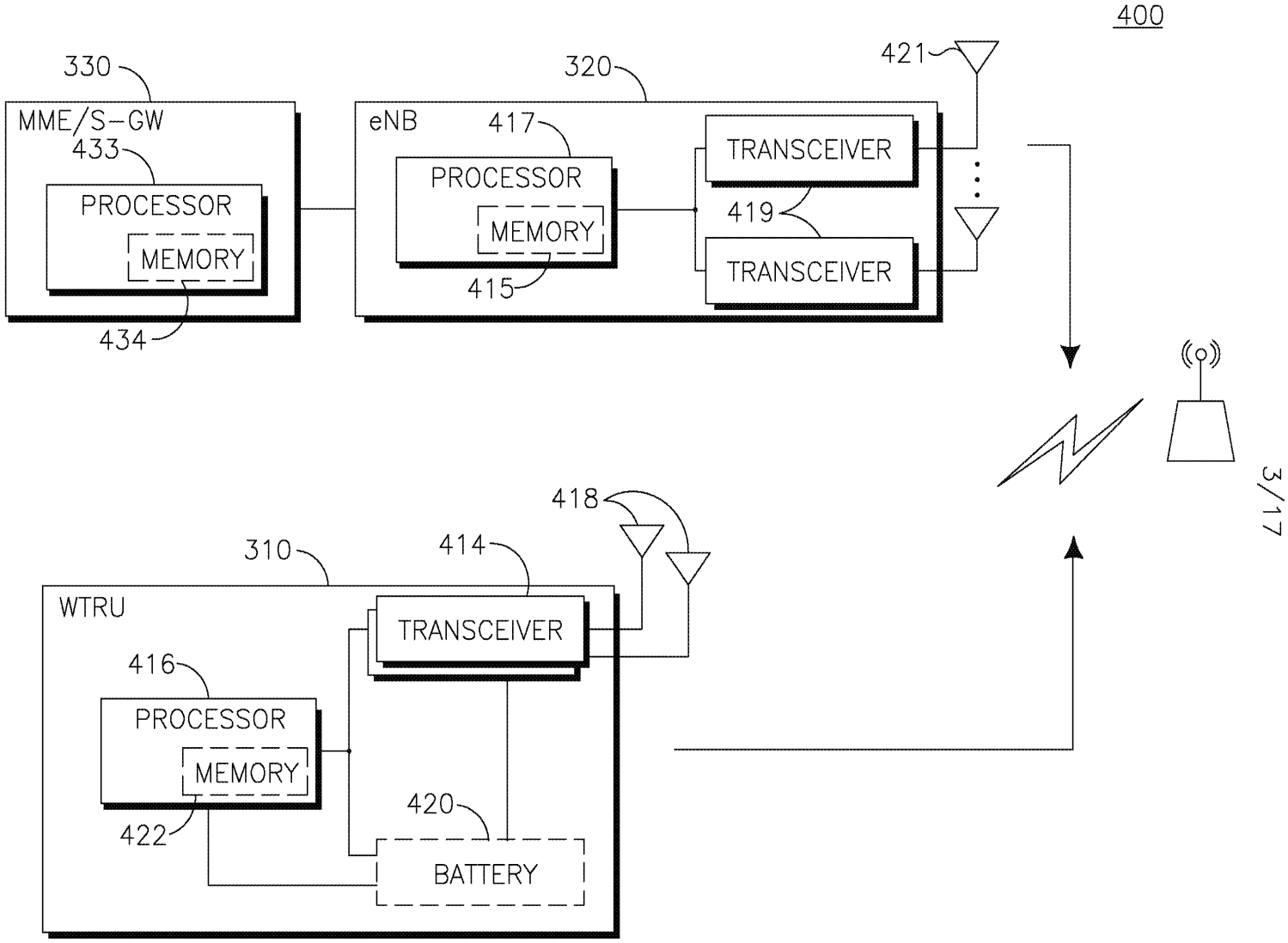


FIG. 4

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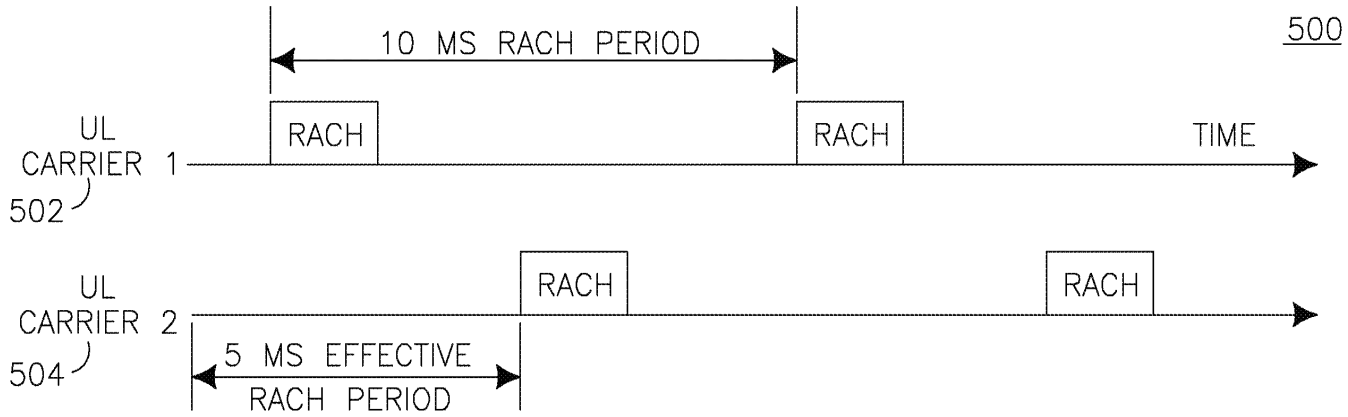

10 MS RACH PERIOD
500
UL CARRIER 1
502
RACH
RACH
TIME
UL CARRIER 2
504
RACH
RACH
5 MS EFFECTIVE RACH PERIOD

FIG. 5

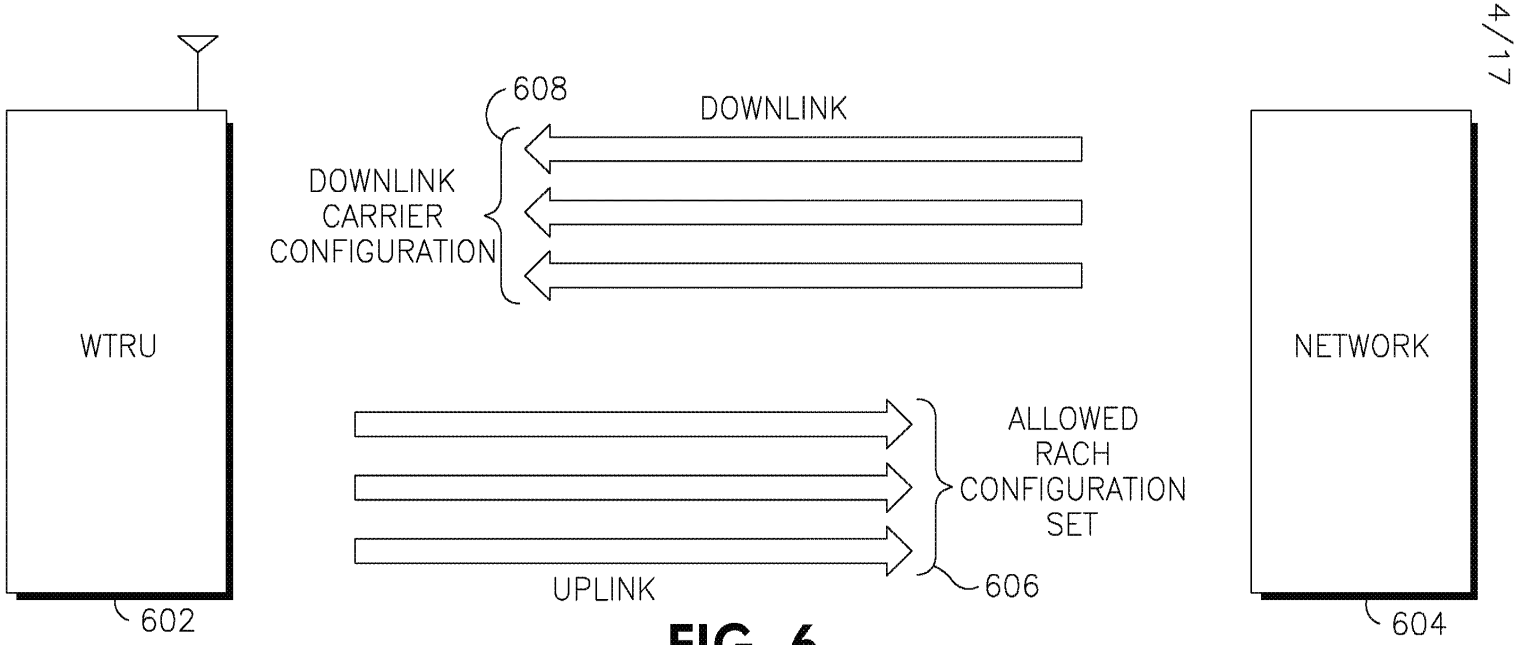

608
DOWNLINK
DOWNLINK CARRIER CONFIGURATION
WTRU
NETWORK
ALLOWED RACH CONFIGURATION SET
UPLINK
606
602
604

FIG. 6

700

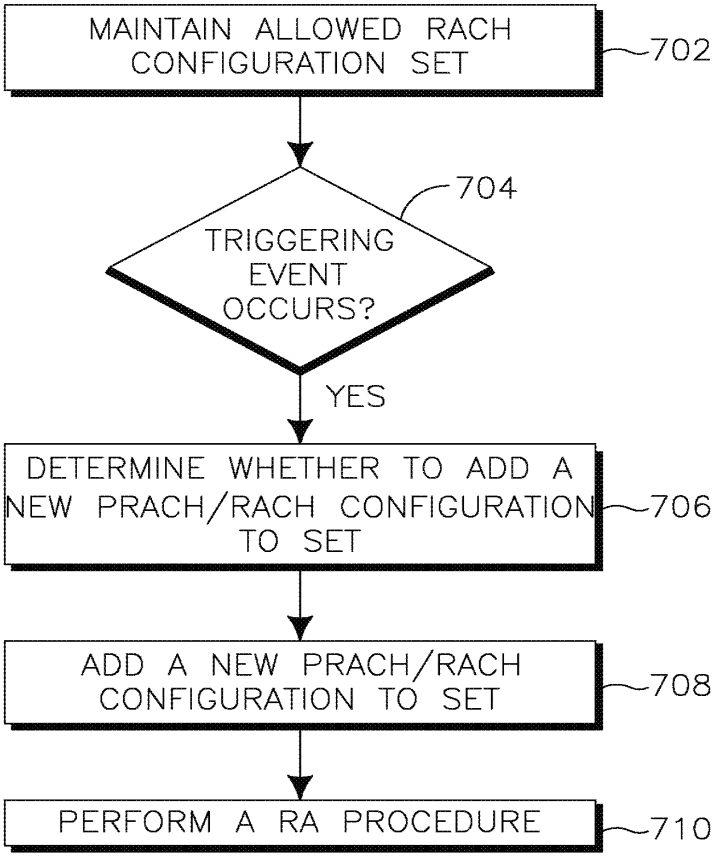

MAINTAIN ALLOWED RACH CONFIGURATION SET
702
704
TRIGGERING EVENT OCCURS?
YES
DETERMINE WHETHER TO ADD A NEW PRACH/RACH CONFIGURATION TO SET
706
ADD A NEW PRACH/RACH CONFIGURATION TO SET
708
PERFORM A RA PROCEDURE
710

FIG. 7

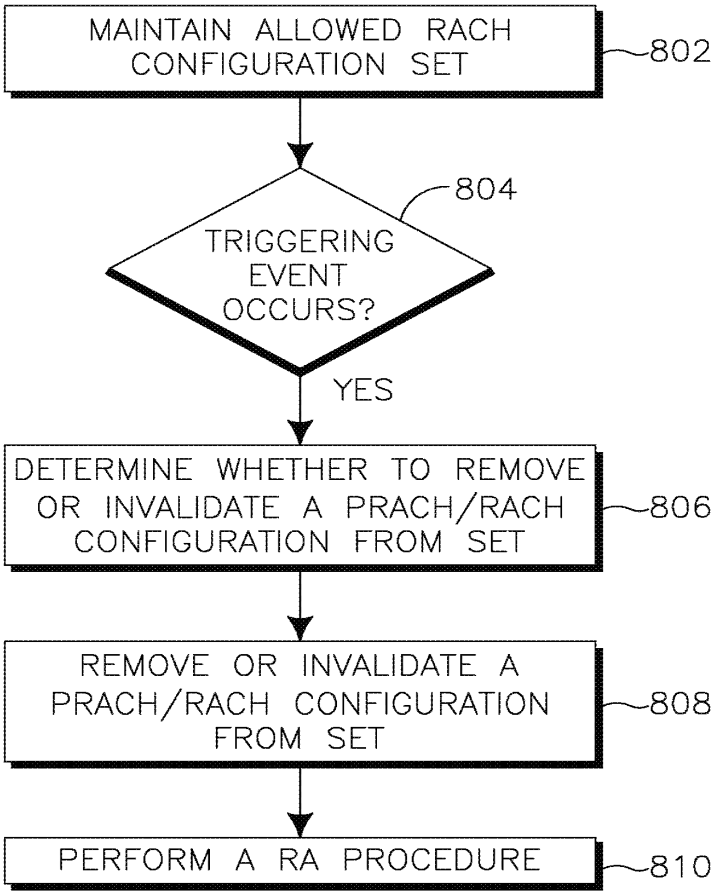

800
MAINTAIN ALLOWED RACH CONFIGURATION SET
802
804
TRIGGERING EVENT OCCURS?
YES
DETERMINE WHETHER TO REMOVE OR INVALIDATE A PRACH/RACH CONFIGURATION FROM SET
806
REMOVE OR INVALIDATE A PRACH/RACH CONFIGURATION FROM SET
808
PERFORM A RA PROCEDURE
810

FIG. 8

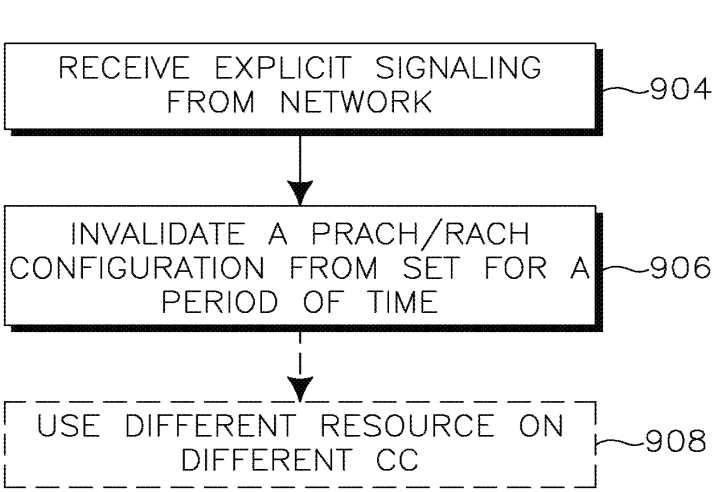

900
RECEIVE EXPLICIT SIGNALING FROM NETWORK
904
INVALIDATE A PRACH/RACH CONFIGURATION FROM SET FOR A PERIOD OF TIME
906
USE DIFFERENT RESOURCE ON DIFFERENT CC
908

FIG. 9

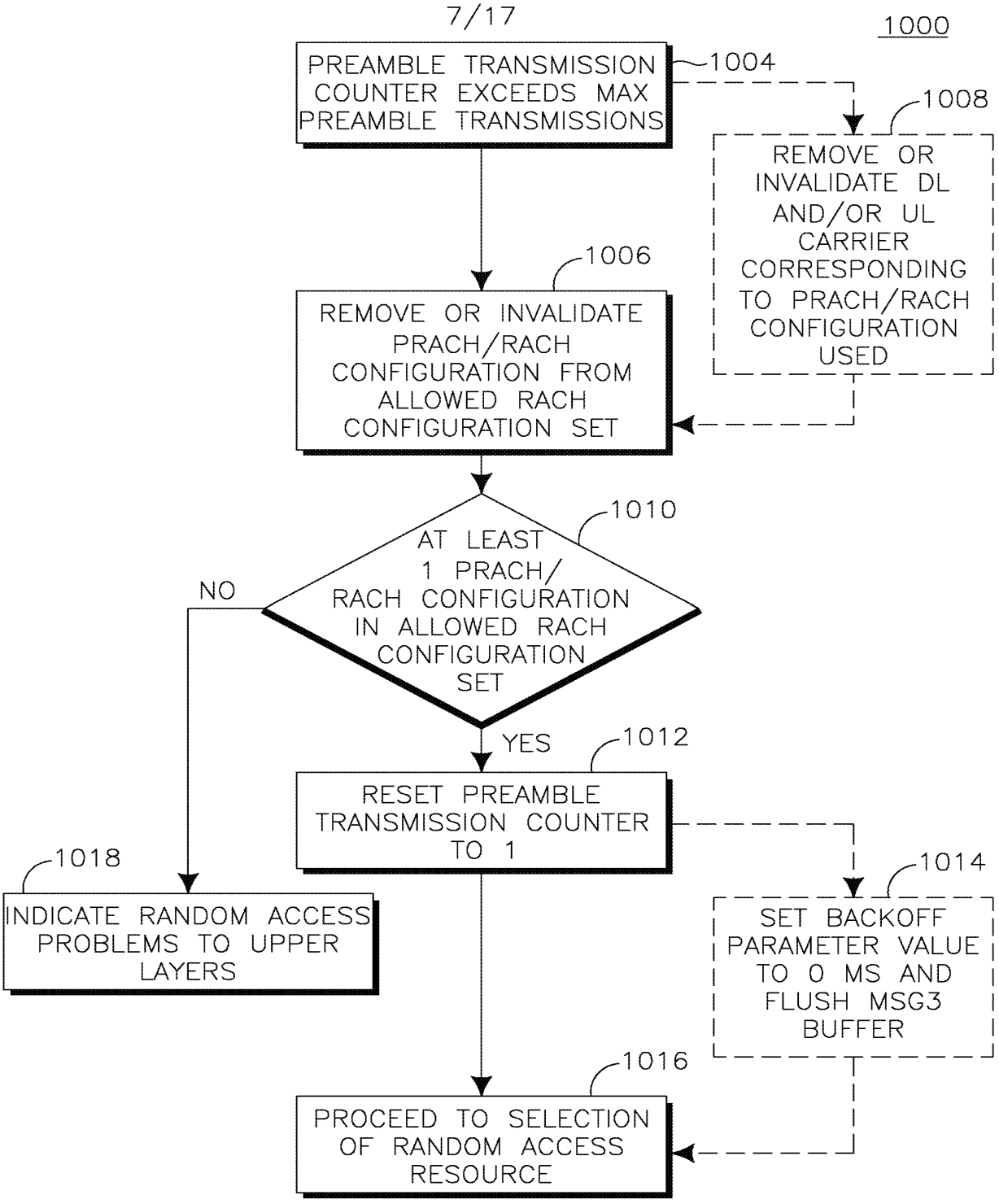

1000
PREAMBLE TRANSMISSION COUNTER EXCEEDS MAX PREAMBLE TRANSMISSIONS
1004
1008
REMOVE OR INVALIDATE DL AND/OR UL CARRIER CORRESPONDING TO PRACH/RACH CONFIGURATION USED
1006
REMOVE OR INVALIDATE PRACH/RACH CONFIGURATION FROM ALLOWED RACH CONFIGURATION SET
1010
AT LEAST 1 PRACH/ RACH CONFIGURATION IN ALLOWED RACH CONFIGURATION SET
NO
YES
1012
RESET PREAMBLE TRANSMISSION COUNTER TO 1
1018
INDICATE RANDOM ACCESS PROBLEMS TO UPPER LAYERS
1014
SET BACKOFF PARAMETER VALUE TO 0 MS AND FLUSH MSG3 BUFFER
1016
PROCEED TO SELECTION OF RANDOM ACCESS RESOURCE

FIG. 10

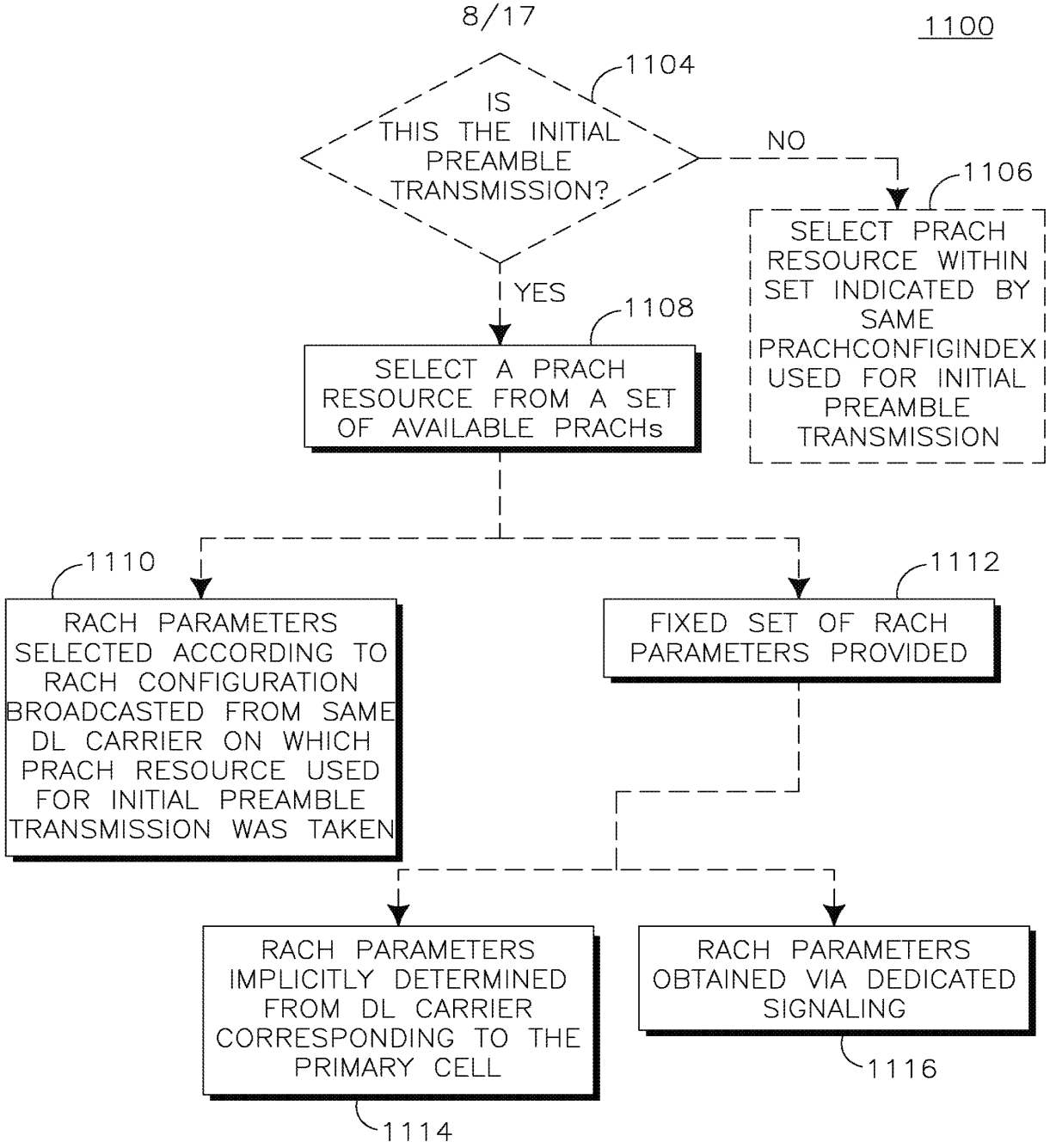

1100
1104
IS THIS THE INITIAL PREAMBLE TRANSMISSION?
NO
1106
SELECT PRACH RESOURCE WITHIN SET INDICATED BY SAME PRACHCONFIGINDEX USED FOR INITIAL PREAMBLE TRANSMISSION
YES
1108
SELECT A PRACH RESOURCE FROM A SET OF AVAILABLE PRACHs
1110
RACH PARAMETERS SELECTED ACCORDING TO RACH CONFIGURATION BROADCASTED FROM SAME DL CARRIER ON WHICH PRACH RESOURCE USED FOR INITIAL PREAMBLE TRANSMISSION WAS TAKEN
1112
FIXED SET OF RACH PARAMETERS PROVIDED
RACH PARAMETERS IMPLICITLY DETERMINED FROM DL CARRIER CORRESPONDING TO THE PRIMARY CELL
1114
RACH PARAMETERS OBTAINED VIA DEDICATED SIGNALING
1116

FIG. 11

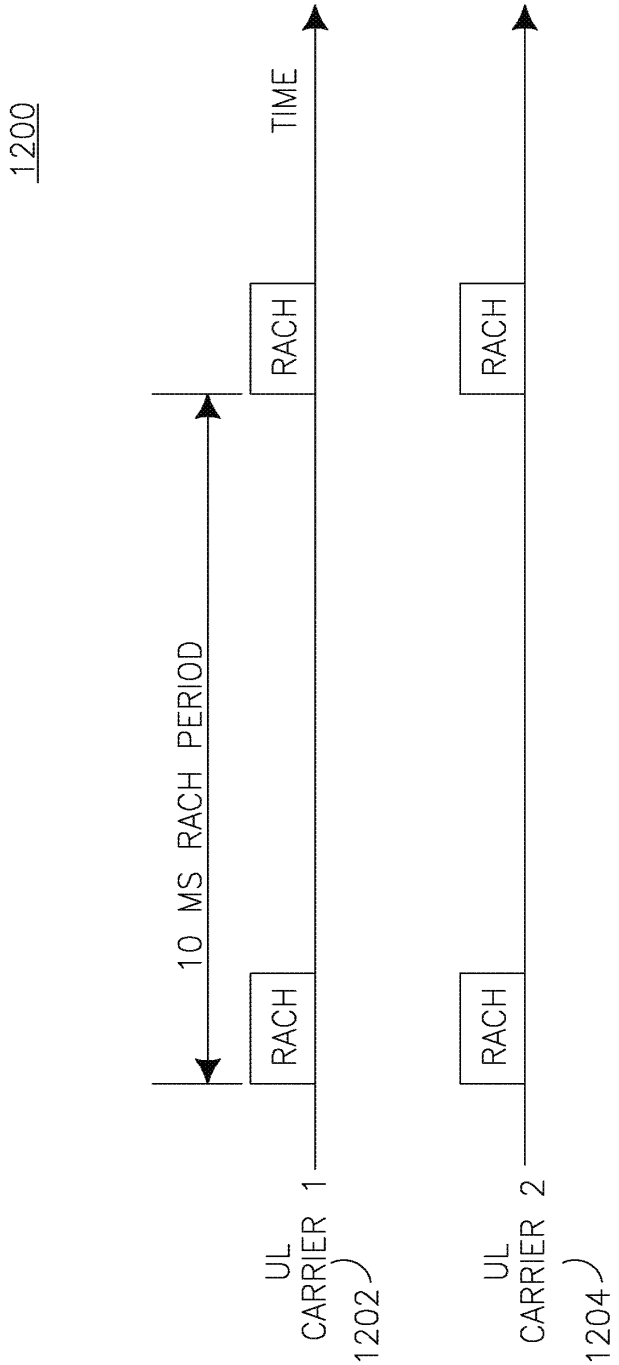

1200
TIME
RACH
RACH
10 MS RACH PERIOD
RACH
RACH
UL CARRIER 1
1202
UL CARRIER 2
1204

FIG. 12

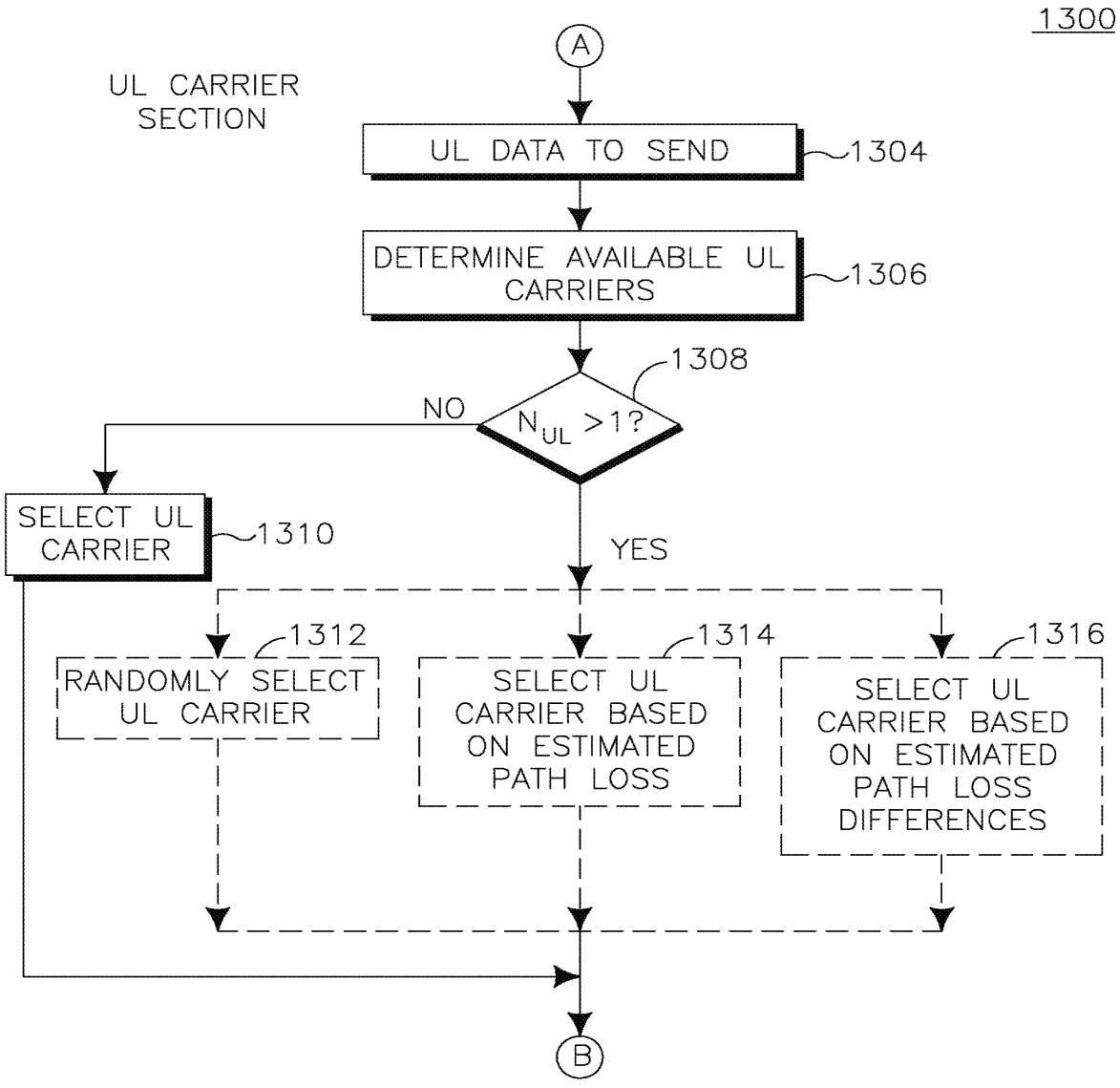

1300
A
UL CARRIER SECTION
UL DATA TO SEND
1304
DETERMINE AVAILABLE UL CARRIERS
1306
1308
NO
N_{UL} >1?
SELECT UL CARRIER
1310
YES
1312
RANDOMLY SELECT UL CARRIER
1314
SELECT UL CARRIER BASED ON ESTIMATED PATH LOSS
1316
SELECT UL CARRIER BASED ON ESTIMATED PATH LOSS DIFFERENCES
B

FIG. 13

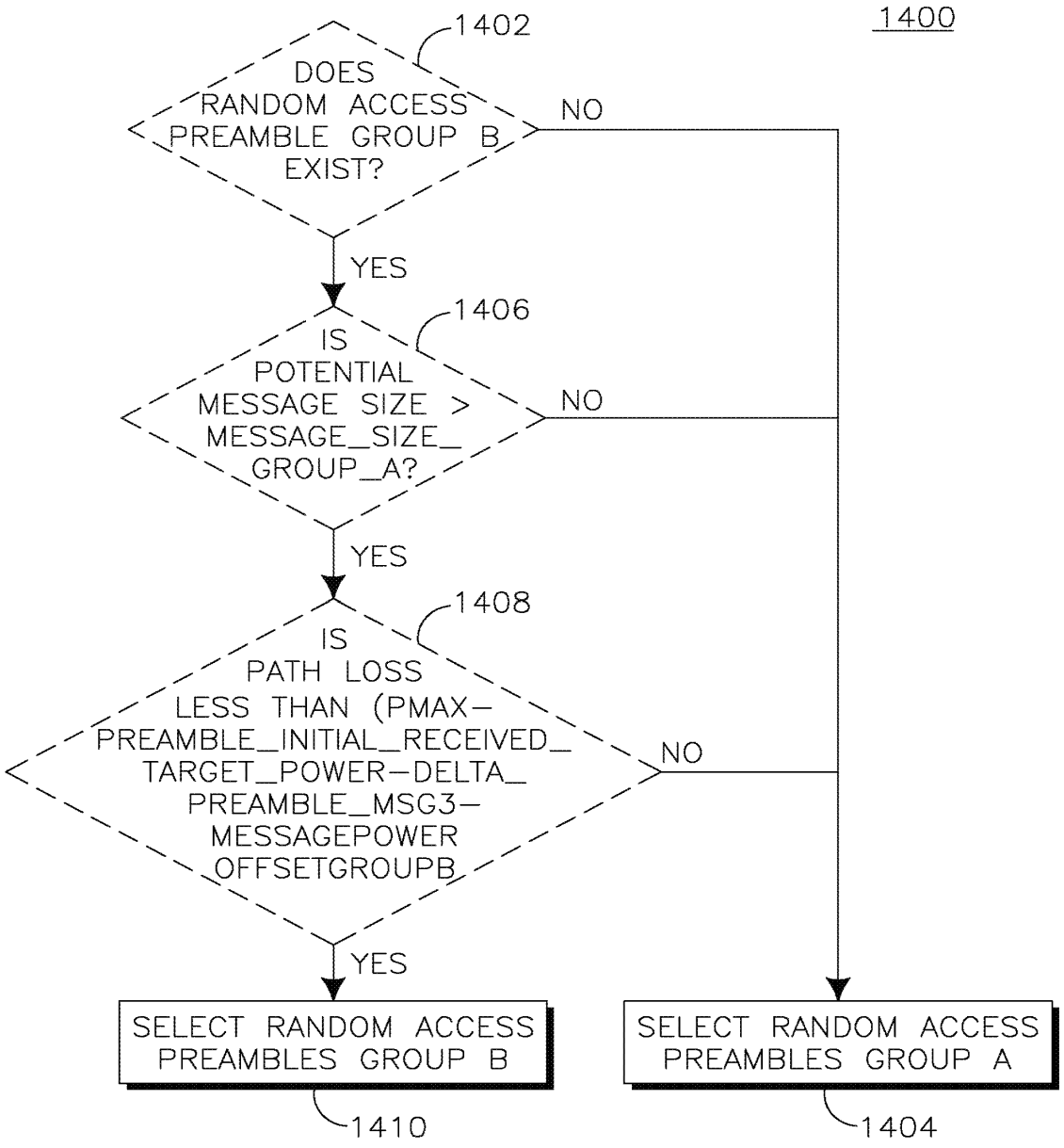

1400
1402
DOES RANDOM ACCESS PREAMBLE GROUP B EXIST?
NO
YES
1406
IS POTENTIAL MESSAGE SIZE > MESSAGE_SIZE_ GROUP_A?
NO
YES
1408
IS PATH LOSS LESS THAN (PMAX– PREAMBLE_INITIAL_RECEIVED_ TARGET_POWER–DELTA_ PREAMBLE_MSG3– MESSAGEPOWER OFFSETGROUPB
NO
YES
SELECT RANDOM ACCESS PREAMBLES GROUP B
1410
SELECT RANDOM ACCESS PREAMBLES GROUP A
1404

FIG. 14

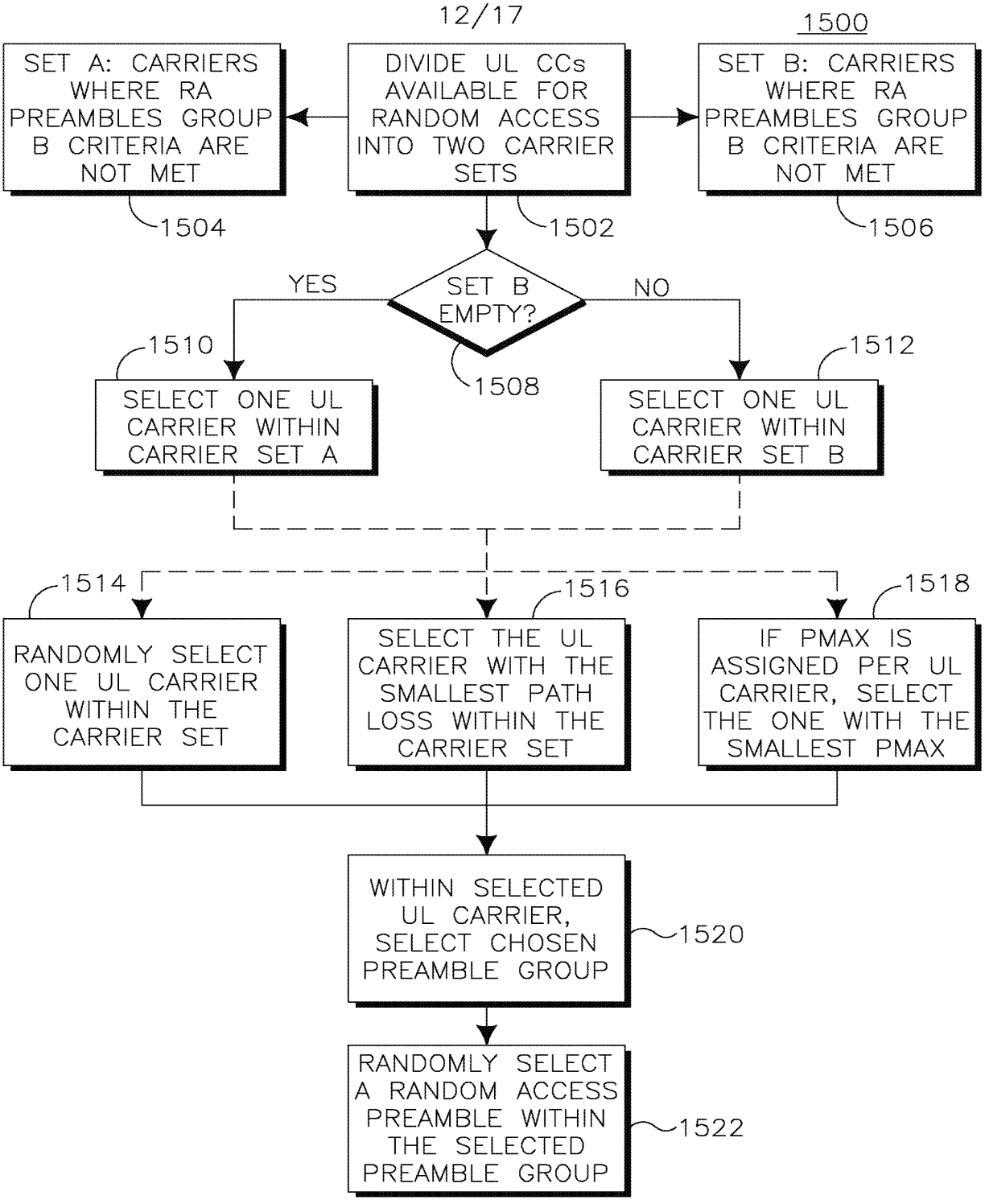

1500
DIVIDE UL CCs AVAILABLE FOR RANDOM ACCESS INTO TWO CARRIER SETS
1502
SET A: CARRIERS WHERE RA PREAMBLES GROUP B CRITERIA ARE NOT MET
1504
SET B: CARRIERS WHERE RA PREAMBLES GROUP B CRITERIA ARE NOT MET
1506
SET B EMPTY?
1508
YES
NO
1510
SELECT ONE UL CARRIER WITHIN CARRIER SET A
1512
SELECT ONE UL CARRIER WITHIN CARRIER SET B
1514
RANDOMLY SELECT ONE UL CARRIER WITHIN THE CARRIER SET
1516
SELECT THE UL CARRIER WITH THE SMALLEST PATH LOSS WITHIN THE CARRIER SET
1518
IF PMAX IS ASSIGNED PER UL CARRIER, SELECT THE ONE WITH THE SMALLEST PMAX
WITHIN SELECTED UL CARRIER, SELECT CHOSEN PREAMBLE GROUP
1520
RANDOMLY SELECT A RANDOM ACCESS PREAMBLE WITHIN THE SELECTED PREAMBLE GROUP
1522

FIG. 15

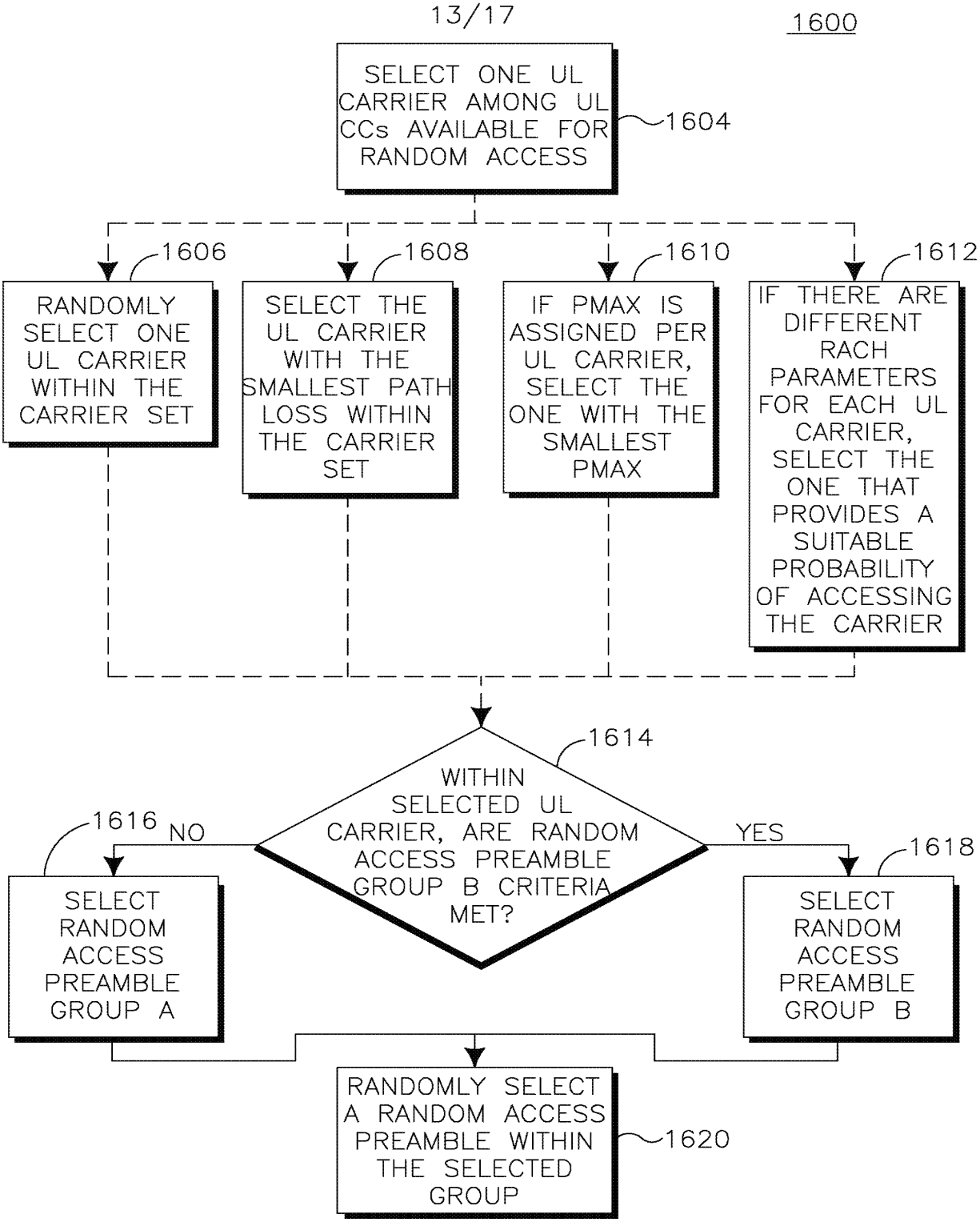

1600
SELECT ONE UL CARRIER AMONG UL CCs AVAILABLE FOR RANDOM ACCESS
1604
1606
RANDOMLY SELECT ONE UL CARRIER WITHIN THE CARRIER SET
1608
SELECT THE UL CARRIER WITH THE SMALLEST PATH LOSS WITHIN THE CARRIER SET
1610
IF PMAX IS ASSIGNED PER UL CARRIER, SELECT THE ONE WITH THE SMALLEST PMAX
1612
IF THERE ARE DIFFERENT RACH PARAMETERS FOR EACH UL CARRIER, SELECT THE ONE THAT PROVIDES A SUITABLE PROBABILITY OF ACCESSING THE CARRIER
1614
WITHIN SELECTED UL CARRIER, ARE RANDOM ACCESS PREAMBLE GROUP B CRITERIA MET?
NO
YES
1616
SELECT RANDOM ACCESS PREAMBLE GROUP A
1618
SELECT RANDOM ACCESS PREAMBLE GROUP B
RANDOMLY SELECT A RANDOM ACCESS PREAMBLE WITHIN THE SELECTED GROUP
1620

FIG. 16

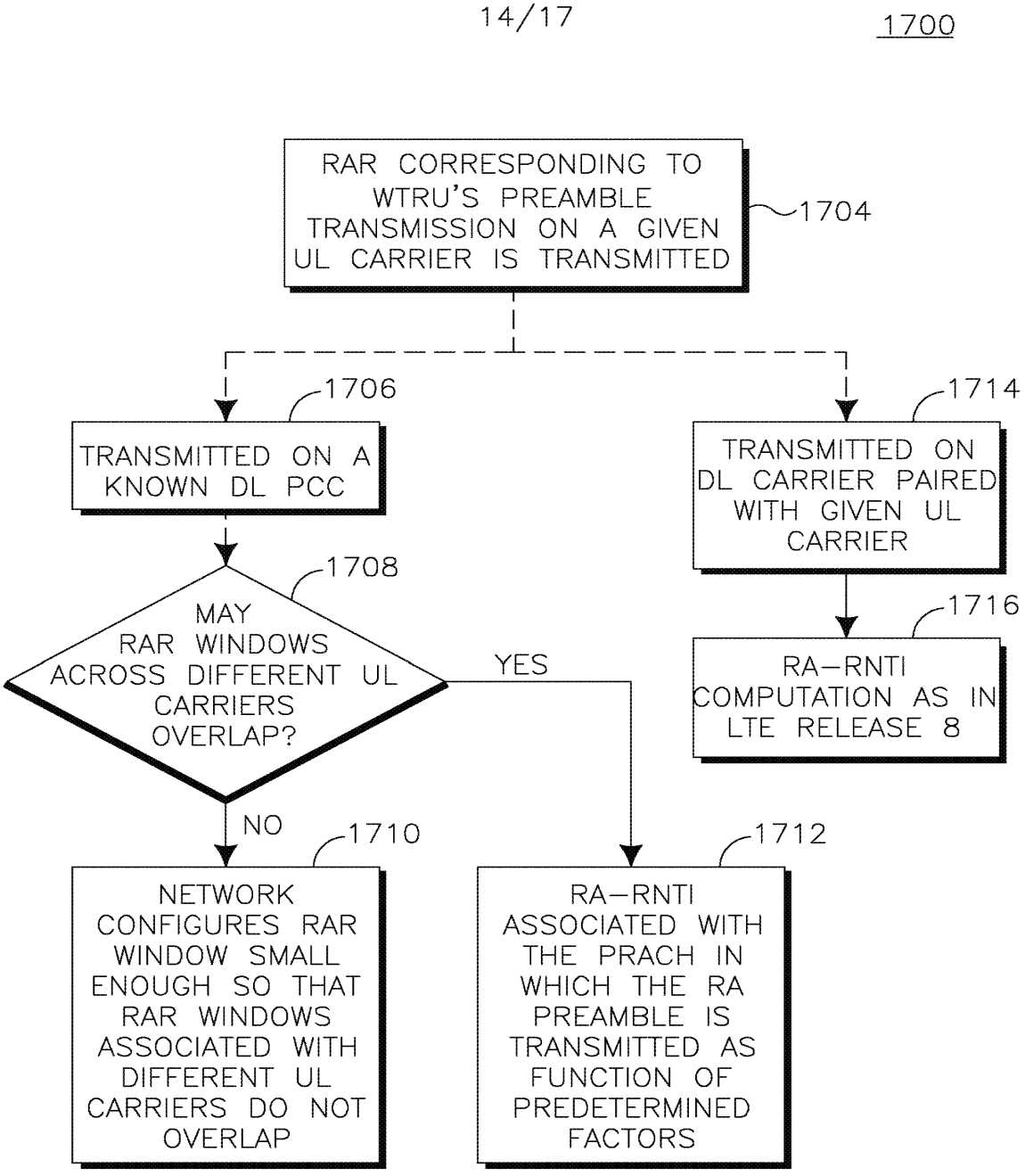

1700
RAR CORRESPONDING TO WTRU'S PREAMBLE TRANSMISSION ON A GIVEN UL CARRIER IS TRANSMITTED
1704
1706
TRANSMITTED ON A KNOWN DL PCC
1708
MAY RAR WINDOWS ACROSS DIFFERENT UL CARRIERS OVERLAP?
YES
NO
1710
NETWORK CONFIGURES RAR WINDOW SMALL ENOUGH SO THAT RAR WINDOWS ASSOCIATED WITH DIFFERENT UL CARRIERS DO NOT OVERLAP
1712
RA-RNTI ASSOCIATED WITH THE PRACH IN WHICH THE RA PREAMBLE IS TRANSMITTED AS FUNCTION OF PREDETERMINED FACTORS
1714
TRANSMITTED ON DL CARRIER PAIRED WITH GIVEN UL CARRIER
1716
RA-RNTI COMPUTATION AS IN LTE RELEASE 8

FIG. 17

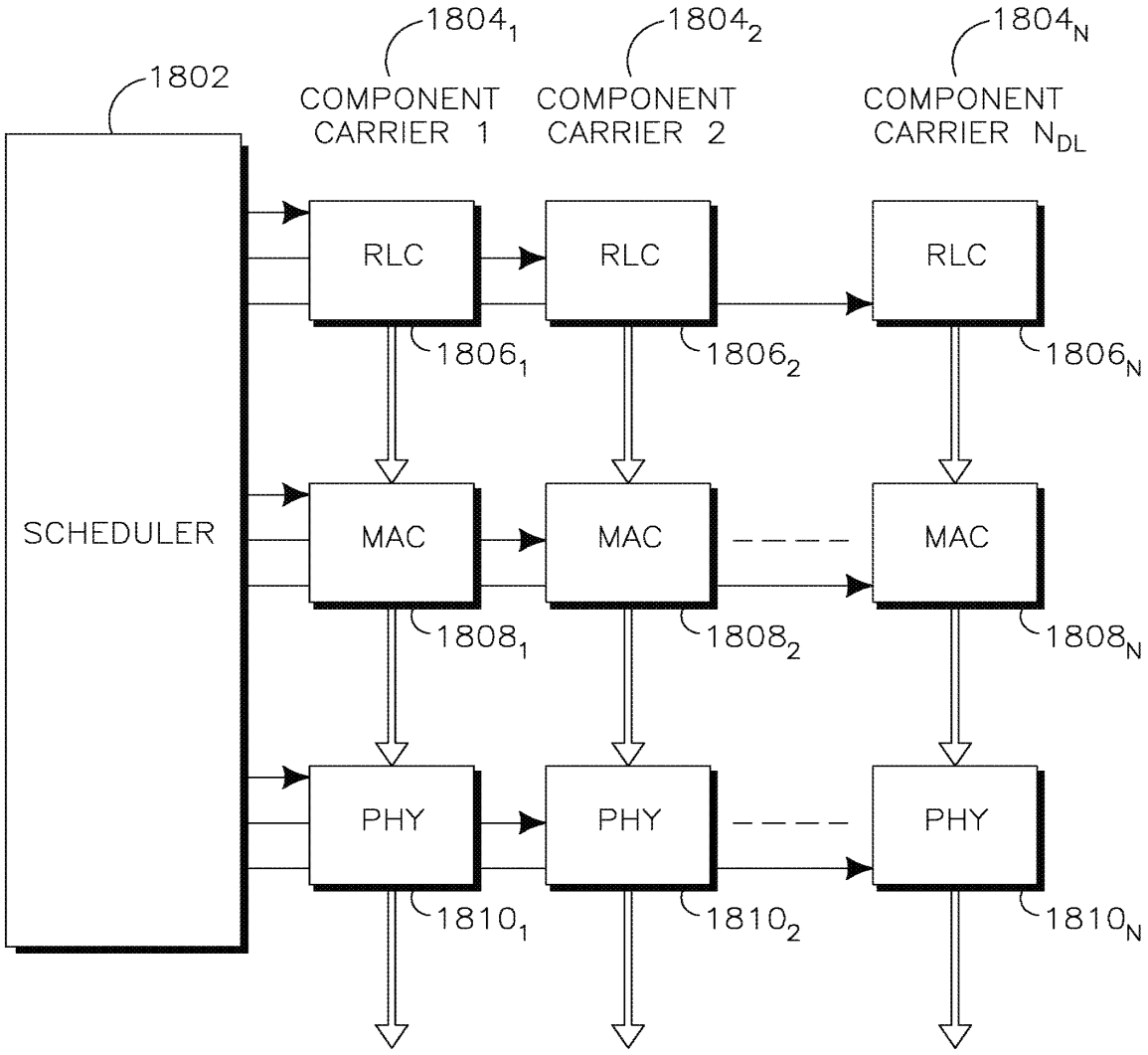

1802
SCHEDULER
1804$_1$
COMPONENT CARRIER 1
1804$_2$
COMPONENT CARRIER 2
1804$_N$
COMPONENT CARRIER N_{DL}
RLC
RLC
RLC
1806$_1$
1806$_2$
1806$_N$
MAC
MAC
MAC
1808$_1$
1808$_2$
1808$_N$
PHY
PHY
PHY
1810$_1$
1810$_2$
1810$_N$

FIG. 18

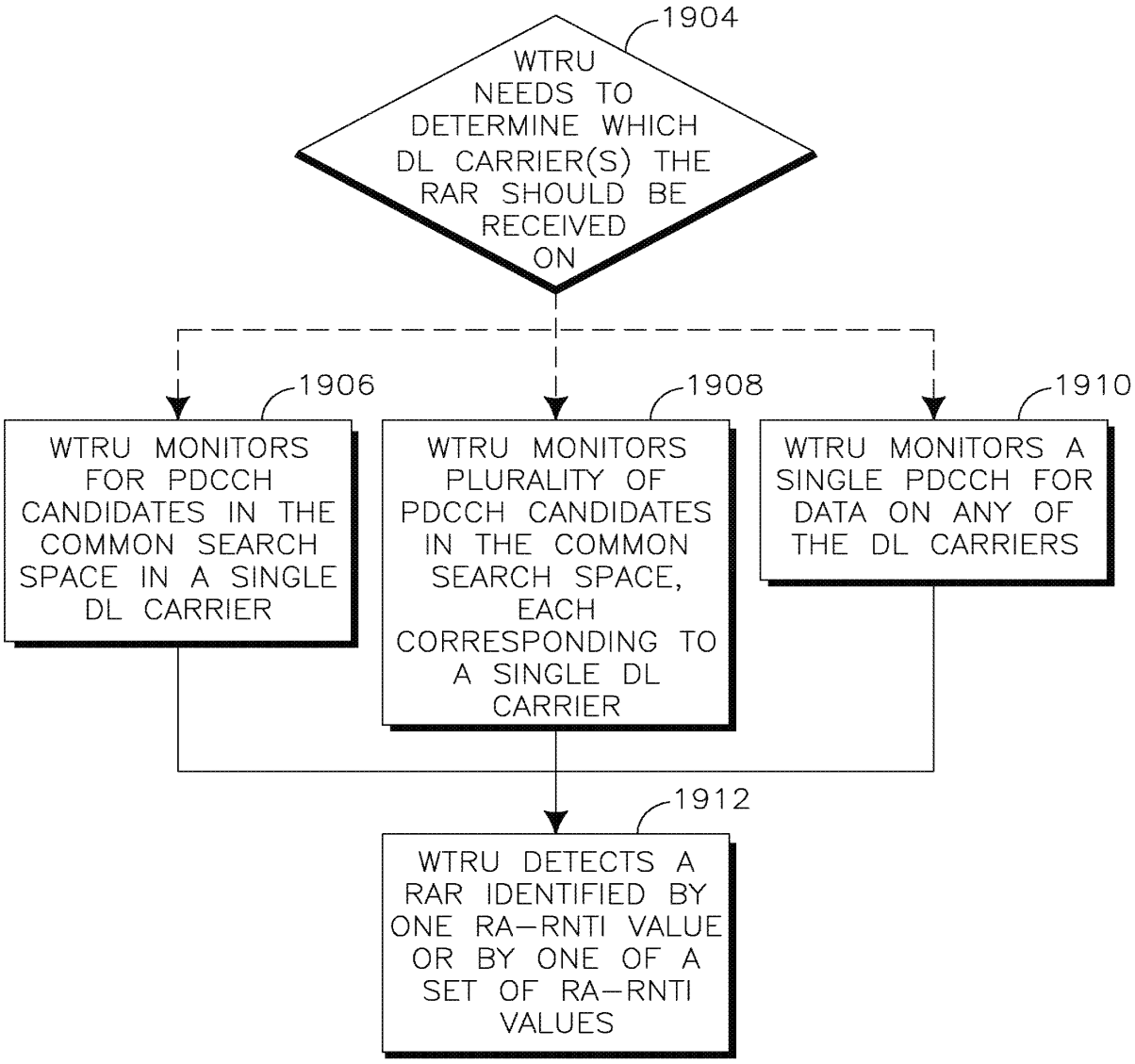

1900
1904
WTRU NEEDS TO DETERMINE WHICH DL CARRIER(S) THE RAR SHOULD BE RECEIVED ON
1906
WTRU MONITORS FOR PDCCH CANDIDATES IN THE COMMON SEARCH SPACE IN A SINGLE DL CARRIER
1908
WTRU MONITORS PLURALITY OF PDCCH CANDIDATES IN THE COMMON SEARCH SPACE, EACH CORRESPONDING TO A SINGLE DL CARRIER
1910
WTRU MONITORS A SINGLE PDCCH FOR DATA ON ANY OF THE DL CARRIERS
1912
WTRU DETECTS A RAR IDENTIFIED BY ONE RA-RNTI VALUE OR BY ONE OF A SET OF RA-RNTI VALUES

FIG. 19

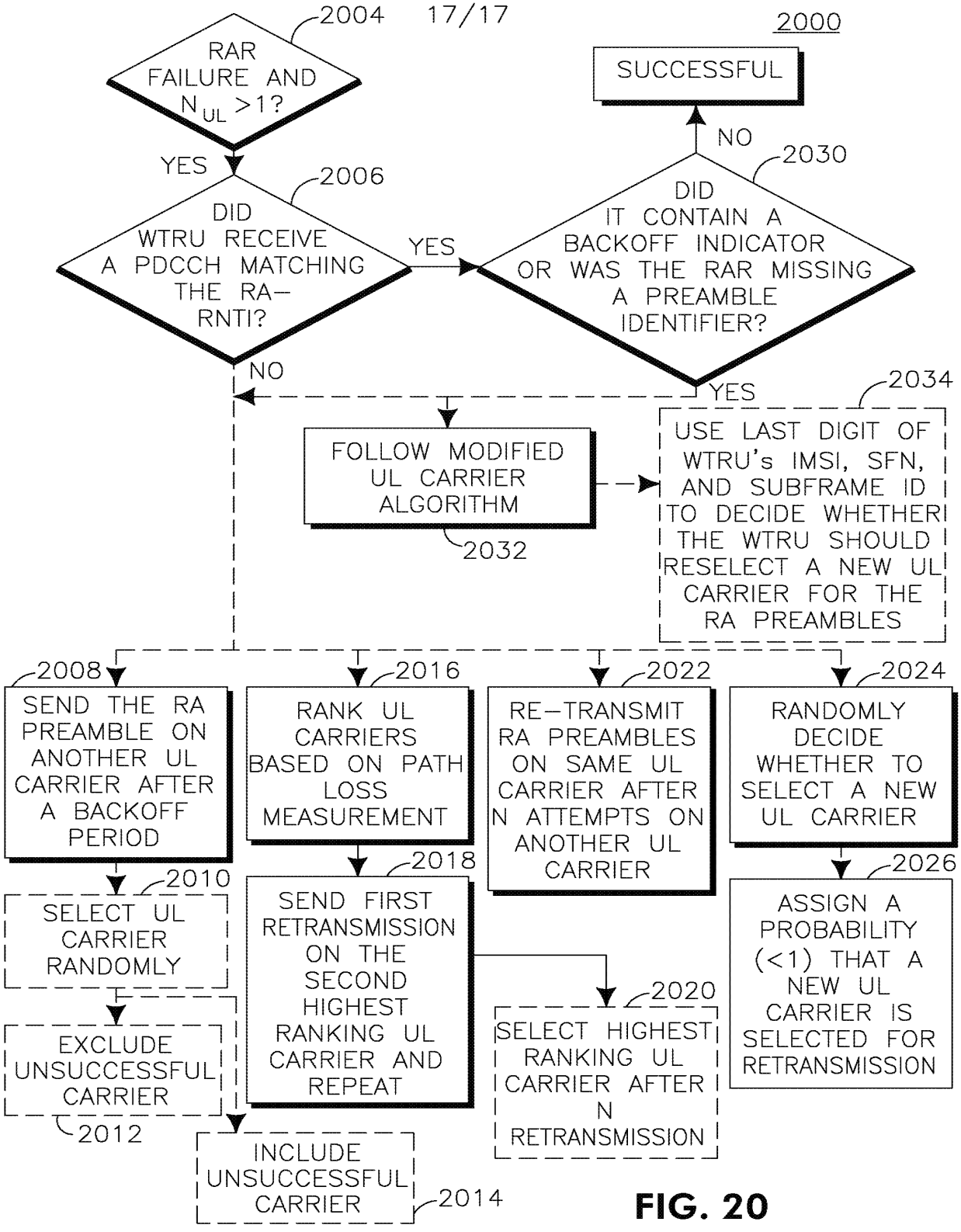

2000
2004
RAR FAILURE AND N_{UL} >1?
YES
2006
DID WTRU RECEIVE A PDCCH MATCHING THE RA-RNTI?
YES
SUCCESSFUL
NO
2030
DID IT CONTAIN A BACKOFF INDICATOR OR WAS THE RAR MISSING A PREAMBLE IDENTIFIER?
NO
YES
2034
USE LAST DIGIT OF WTRU's IMSI, SFN, AND SUBFRAME ID TO DECIDE WHETHER THE WTRU SHOULD RESELECT A NEW UL CARRIER FOR THE RA PREAMBLES
FOLLOW MODIFIED UL CARRIER ALGORITHM
2032
2008
SEND THE RA PREAMBLE ON ANOTHER UL CARRIER AFTER A BACKOFF PERIOD
2010
SELECT UL CARRIER RANDOMLY
EXCLUDE UNSUCCESSFUL CARRIER
2012
INCLUDE UNSUCCESSFUL CARRIER
2014
2016
RANK UL CARRIERS BASED ON PATH LOSS MEASUREMENT
2018
SEND FIRST RETRANSMISSION ON THE SECOND HIGHEST RANKING UL CARRIER AND REPEAT
2022
RE-TRANSMIT RA PREAMBLES ON SAME UL CARRIER AFTER N ATTEMPTS ON ANOTHER UL CARRIER
2020
SELECT HIGHEST RANKING UL CARRIER AFTER N RETRANSMISSION
2024
RANDOMLY DECIDE WHETHER TO SELECT A NEW UL CARRIER
2026
ASSIGN A PROBABILITY (<1) THAT A NEW UL CARRIER IS SELECTED FOR RETRANSMISSION

FIG. 20

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 March 2013 (21.03.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/040026 A1

(51) International Patent Classification:
H04W 56/00 (2009.01)

(21) International Application Number:
PCT/US2012/054848

(22) International Filing Date:
12 September 2012 (12.09.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/533,614 12 September 2011 (12.09.2011) US
61/610,151 13 March 2012 (13.03.2012) US
13/610,139 11 September 2012 (11.09.2012) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM,

[Continued on next page]

(54) Title: SUPPORT OF MULTIPLE TIMING ADVANCE GROUPS FOR USER EQUIPMENT IN CARRIER AGGREGATION IN LTE

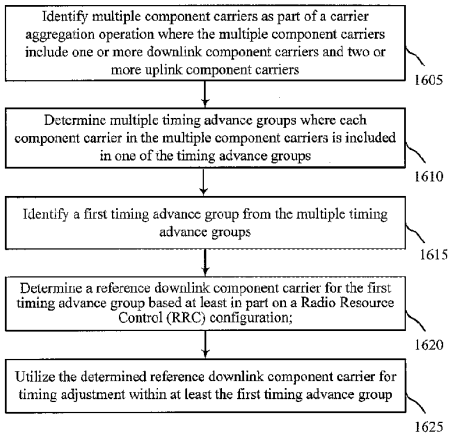


FIG. 16

(57) Abstract: Methods, systems, and devices are described to support multiple timing advance groups for multi-carrier user equipment. Some embodiments provide for utilizing timing advance group synchronization information across multiple timing advance groups. Some embodiments provide support for performing random access procedures in relation to timing advance groups that may not include a primary component carrier. Some embodiments utilize timing advance group indexes to enable cross-carrier random access procedure management. Other embodiments support parallel random access procedures across multiple timing advance groups. Some embodiments provide for a reference downlink component carrier for timing within a timing advance group.

WO 2013/040026 A1

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AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

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SUPPORT OF MULTIPLE TIMING ADVANCE GROUPS FOR USER EQUIPMENT IN CARRIER AGGREGATION IN LTE

CROSS-RELATED APPLICATIONS

[0001] The present Application for Patent claims priority to Provisional Application No. 61/533,614 entitled "SUPPORT OF MULTIPLE TIMING ADVANCE GROUPS FOR USER EQUIPMENT IN CARRIER AGGREGATION IN LTE" filed September 12, 2011, and assigned to the assignee hereof and hereby expressly incorporated by reference herein for all purposes. The present Application for Patent also claims priority to Provisional Application No. 61/610,151 entitled "SUPPORT OF MULTIPLE TIMING ADVANCE GROUPS FOR USER EQUIPMENT IN CARRIER AGGREGATION IN LTE" filed March 13, 2012. The present Application for Patent also claims priority to Utility Application No. 13/610,139 entitled "SUPPORT OF MULTIPLE TIMING ADVANCE GROUPS FOR USER EQUIPMENT IN CARRIER AGGREGATION IN LTE" filed September 11, 2012, and assigned to the assignee hereof and hereby expressly incorporated by reference herein for all purposes.

BACKGROUND

[0002] Wireless communications systems are widely deployed to provide various types of communication content such as voice, video, packet data, messaging, broadcast, and so on. These systems may be multiple-access systems capable of supporting communication with multiple users by sharing the available system resources (e.g., time, frequency, and power). Examples of such multiple-access systems include code-division multiple access (CDMA) systems, time-division multiple access (TDMA) systems, frequency-division multiple access (FDMA) systems, 3GPP Long Term Evolution (LTE) systems, and orthogonal frequency-division multiple access (OFDMA) systems.

[0003] Generally, a wireless multiple-access communications system may include a number of base stations, each simultaneously supporting communication for multiple mobile terminals. Base stations may communicate with user equipment on downstream and upstream links. Each base station has a coverage range, which may be referred to as the coverage area of the cell. Some wireless multiple-access communications systems may

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utilize carrier aggregation, where multiple component carriers are aggregated and used together for transmission between base stations and user equipment. To achieve proper timing for transmission and reception on these different carriers, timing advance information may be distributed from base station to a user equipment to allow the device to account for propagation delay and/or delay due to other factors (*e.g.*, repeaters) on different carriers. Timing advance information can help ensure synchronized reception timing of the uplink stream links transmitted from multiple mobile terminals. The multiple component carriers may be aggregated into different timing advance groups. In some cases, the multiple component carriers may be aggregated into different timing advance groups based on having similar delay characteristics. Synchronization issues, however, may arise for timing advance groups depending on the nature of the component carriers within a given timing advance group.

SUMMARY

[0004] Methods, systems, and devices are provided for utilizing timing advance group synchronization information across multiple timing advance groups. A reference downlink component carrier may be determined among multiple component carriers as part of a carrier aggregation operation. The reference downlink component carrier may be determined based on a Radio Resource Control (RRC) configuration of a user equipment. For example, RRC configuration message(s) may be transmitted to the user equipment identifying one carrier as a primary component carrier (PCC) and additional carriers as secondary component carriers (SCCs). The carrier that is identified as PCC may serve as the reference downlink carrier for multiple timing advance groups, including timing advance groups that may not include the PCC and may only include SCCs.

[0005] Some designs may provide advantages, for example, when the activation status of the SCCs changes from time to time. A timing advance group that contains SCCs, but no PCC, may face synchronization issues because of deactivation of the corresponding secondary cells. In contrast, a timing advance group with a primary cell that corresponds to a PCC may not face the same issues because the primary cell cannot be deactivated. Some aspects also provide advantages over some other techniques that may provide timing information for a timing advance group that include SCCs but no PCC, such as through SIB2 linkage. For example, when a secondary cell downlink component carrier is activated or

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deactivated, the SIB2 linked uplink component carrier is also generally activated or deactivated. As another example, the characteristics of a component carrier can be taken into account (activation status, whether it is equipped with a repeater, whether it is always on or periodically turned off, legacy or new carrier type, etc) in determining the reference downlink component carrier.

[0006] Some aspects include a method for utilizing timing advance group synchronization information across multiple timing advance groups. The method may include identifying multiple component carriers as part of a carrier aggregation operation. The multiple component carriers may include one or more downlink component carriers and two or more uplink component carriers. Multiple timing advance groups may be determined. Each component carrier in the multiple component carriers may be included in one of the timing advance groups. A first timing advance group from the multiple timing advance groups may be identified. A reference downlink component carrier may be determined for the first timing advance group based at least in part on a Radio Resource Control (RRC) configuration. The determined reference downlink component carrier may be utilized for timing adjustment within at least the first timing advance group.

[0007] The method may further include receiving an indication of a primary downlink component carrier through the RRC configuration. The primary downlink component carrier may be the determined reference downlink component carrier. Some embodiments include utilizing the primary downlink component carrier for timing adjustment within a second timing advance group from the multiple timing advance groups. The primary downlink component carrier may be included in the second timing advance group.

[0008] One or more downlink component carriers of the one or more identified downlink carriers may be included in the first timing advance group. Determining the reference downlink component carrier may be based on an RRC configuration for the one or more downlink component carriers in the first timing advance group. The reference downlink component carrier for the first timing advance group may be determined to be a downlink component carrier with a smallest cell index of multiple cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

[0009] The reference downlink component carrier may be determined from a set of activated downlink component carriers. The one or more downlink component carriers and

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the two or more uplink component carriers may be associated with two or more bands. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers of the same band or similar band. As an example, the reference downlink component carrier may be determined to be a downlink component carrier of the same or similar band as an uplink component carrier associated with a random access attempt for the first timing advance group.

[0010] Some designs include performing multiple random access procedures in parallel with respect to two or more of the multiple timing advance groups. Performing the multiple random access procedures may include performing a first random access procedure linked with the first timing advance group; and/or performing a second random access procedure linked with a second timing advance group of the multiple timing advance groups, where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0011] Some aspects include initiating a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast. A cross-carrier indication field may be included in the downlink control channel to enable cross-carrier scheduling.

[0012] The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a similar delay due to downlink repeaters. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a same carrier type where the carrier type includes at least a legacy carrier type or a new carrier type. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a similar activity factor.

[0013] Methods, systems, and devices are provided to support multiple timing advance groups for user equipment in carrier aggregation in LTE. Some embodiments provide support for random access for timing advance groups without a primary component carrier. Some embodiments utilize timing advance group indexes to enable cross-carrier random access procedure management. Other embodiments support parallel random access

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procedures across multiple timing advance groups. Some embodiments provide for a reference downlink component carrier for timing within a timing advance group.

[0014] Methods, systems, and/or devices for cross-carrier management for multiple timing advance groups are provided. In some embodiments, a method for cross-carrier management for multiple timing advance groups is provided. The method may include generating a timing advance group index. The timing advance group index may identify a timing advance group from multiple timing advance groups. Each group may include different sets of component carriers. The timing advance group index may be transmitted as part of a random access procedure.

[0015] In some embodiments, a first timing advance group from the multiple timing advance groups includes a primary component carrier and a second timing advance group includes at least one secondary component carrier. The first timing advance group may also include one or more secondary component carriers, while the second timing advance group does not include a primary component carrier. Some embodiments may also include additional timing advance groups besides the first and second timing advance group. The number of timing advance groups may depend upon a variety of factors including, but not limited, propagation delay characteristics, channel characteristics, user equipment device characteristics, and/or bandwidth characteristics of the component carriers.

[0016] In some embodiments, the timing advance group index is transmitted as a single bit of information. A first bit configuration of the single bit of information may indicate that the timing advance group includes a primary component carrier; a second bit configuration of the single bit may indicate that the timing advance group one or more secondary component carriers without the primary component carrier. Some embodiments may include timing advance indexes that may utilize additional bits to convey their information. The number of bits may depend upon the number of timing advance groups.

[0017] The timing advance group index may be transmitted as part of a MAC payload in some embodiments. The timing advance group index may be transmitted as part of a PDCCH payload. Some embodiments may also include transmitting a component carrier identifier as part of a Radio Resource Control (RRC) configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index. The identified component carrier may be utilized for a random access attempt.

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[0018] Some embodiments may enable cross-carrier random access response procedure management through the utilization of the timing advance group index. Some embodiments may enable cross-carrier PDCCH order through the utilization of the timing advance group index.

[0019] Methods, systems, and/or devices for providing cross-carrier management for multiple timing advance groups are provided. In some embodiments, a method for providing cross-carrier management for multiple timing advance groups is provided. The method may include receiving a timing advance group index as part of a random access procedure. The timing advance group index may be utilized to determine a timing advance group for transmitting data. Some embodiments may further include utilizing the timing advance group index to enable cross-carrier random access procedure management. Some embodiments may further include utilizing the timing advance group index to enable cross-carrier PDCCH order management. Some embodiments may further include receiving a component carrier identifier as part of a Radio Resource Control (RRC) configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index, wherein the identified component carrier is utilized for a random access procedure.

[0020] Methods, system, and/or devices for performing multiple parallel random access procedures are provided. In some embodiments, a method for performing multiple parallel random access procedures is provided. The method may include performing a first random access procedure associated with a first timing advance group of component carriers. A second random access procedure associated with a second timing advance group of component carriers may be performed where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0021] Some embodiments may include performing a power prioritization with respect to the first random access procedure and the second random access procedure. Performing the power prioritization may include performing an equal power scaling with respect to the first random access procedure and the second random access procedure. In some embodiments, performing the power prioritization may include transmitting a first random access attempt with respect to the first timing advance group of component carriers prior to transmitting a second random access attempt with respect to the second timing advance group of component

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carriers, where the first timing advance group of component carriers includes a primary component carrier.

[0022] In some embodiments, the first random access procedure may include a non-contention-based random access procedure and the second random access procedure may include a contention based random access procedure. Performing the power prioritization in this case may include transmitting a first random access attempt with respect to the first timing advance group of component carriers prior to transmitting a second random access attempt with respect to the second timing advance group of component carriers.

[0023] Some embodiments may include configuring a first subframe that includes a first random access response as part of the first random access procedure. A second subframe including a second random access response may be configured as part of the second random access procedure. The first subframe and the second subframe may be transmitted. As a result, the first and second random access responses may not be transmitted in the same subframe. Some embodiments may include triggering an aperiodic channel quality indicator (A-CQI).

[0024] Methods, systems, and/or devices for utilizing timing advance group synchronization information are provided. In some embodiments, a method for utilizing timing advance group synchronization information is provided. The method may include determining a reference downlink component carrier. The reference downlink component carrier may be utilized for timing adjustment within a first timing advance group from multiple timing advance groups. Each timing advance group may include at least one downlink component carrier.

[0025] In some embodiments, a second timing advance group includes a primary component carrier. In some embodiments, determining the reference downlink component carrier includes utilizing a downlink component carrier linked with an uplink component carrier associated with a random access attempt to determine the reference downlink component carrier. The downlink component carrier may be linked with the uplink component carrier through a SIB2 linkage. In some embodiments, determining the reference downlink component carrier may include determining the reference downlink component carrier from a Radio Resource Control (RRC) configuration. The reference downlink carrier may be indicated as a primary component carrier (PCC) in the RRC configuration. The PCC

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may be utilized as a timing reference within a second timing advance group from the multiple timing advance groups.

[0026] Methods, systems, and/or devices for performing random access by a multi-carrier user equipment (UE) are provided. In some embodiments, the UE receives a downlink control message configured to initiate a random access procedure. The UE transmits a response to the downlink control message on a physical random access channel (PRACH). The UE may receive an access grant on a primary component carrier and determine a set of secondary component carriers (SCCs) based on the random access grant. The UE may complete the random access procedure using a carrier in the set of SCCs to obtain timing advance information applicable to the set of SCCs. Receiving the downlink control message may include detecting a physical downlink control channel (PDCCH) message in a UE-specific search space. Receiving the random access grant may include detecting a PDCCH message in a common search space of the PCC.

[0027] In some embodiments, the method may further include obtaining a medium access control (MAC) protocol data unit (PDU) with the random access grant. A timing advance (TA) group index may be determined corresponding to the set of SCCs based on the MAC PDU. Some embodiments may further include receiving a configuration of TA groups corresponding to the component carriers configured for the UE. The configuration of TA groups may include at least a first TA group including the PCC, and a second TA group including the set of secondary CCs (and not the PCC). Some embodiments may further include determining a reference downlink CC for completing the random access procedure based on the TA group index. In some embodiments, the method may further include determining a TA group index corresponding to the set of SCCs as part of a PDCCH payload.

[0028] In some embodiments, the downlink control message configured to initiate the random access procedure comprises an identifier corresponding to the set of SCCs, and transmitting the response to the downlink control message further include determining an SCC to transmit the PRACH based on the identifier.

[0029] The random access procedure may include a first random access procedure of the UE. The method may further include initiating a second random access procedure concurrently with the first random access procedure. Some embodiments may include determining a priority for allocating power between the first random access procedure and the

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second random access procedure. Some embodiments may further include allocating power to the first random access procedure at a higher priority than the second random access procedure when the first random access procedure comprises a contention-free random access procedure and the second random access procedure comprises a contention-based random access procedure. Some embodiments may further include allocating power to the second random access procedure at a higher priority than the first random access procedure when the second random access procedure when the second random access procedure is performed in relation to a group of carriers comprising a primary component carrier of the UE. Determining the priority may include performing an equal power scaling for each CC.

[0030] Methods, systems, and/or device for performing random access by a base station are provided. In some embodiments, the base station may transmit a downlink control message configured to initiate a random access procedure at a user equipment. The base station may receive a response to the downlink control message on a PRACH. Thereafter, the base station may transmit an access grant on a PCC of a user equipment, wherein the access grant includes information regarding a set of SCCs. TA information applicable to the set of SCCs may also be transmitted using a carrier in the set of SCCs.

[0031] Transmitting the downlink control message may include transmitting a PDCCH message in a UE-specific search space. Transmitting the random access grant may include transmitting a PDCCH message in a common search space of the PCC.

[0032] In some embodiments, the method for performing random access by a base station may further include transmitting a MAC PDU with the random access grant. A TA group index corresponding to the set of SCCs with the random access grant may be transmitted. The base station may configure the component carriers configured for the UE into multipl TA groups and may transmit the TA group configuration to the UE. The base station may include a TA group index as part of the MAC PDU during the random access procedure. The configuration of TA groups may include at least a first TA group including the PCC, and a second TA group including the set of secondary CCs. A reference downlink CC may be transmitted for completing the random access procedure based on the TA group index.

[0033] In some embodiments, a method for performing random access by a base station may further include transmitting a TA group index corresponding to the set of SCCs as part of a PDCCH payload. In some embodiments, the downlink control message configured to

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initiate the random access procedure may include an identifier corresponding to the set of SCCs. Receiving the response to the downlink control message may further include receiving the PRACH on an SCC based on the identifier.

[0034] The above methods may be implemented utilizing a variety of wireless communications systems that may include means for performing one or more of the methods, wireless communications devices that may include a processor configured to perform oneor more of the methods, and/or computer program products including a computer readable storage medium may that includes code to perform one or more of the methods.

[0035] The foregoing has outlined rather broadly examples according to disclosure in order that the detailed description that follows may be better understood. Additional features will be described hereinafter. The specific examples disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present disclosure. Such equivalent constructions do not depart from the spirit and scope of the appended claims. Features which are believed to be characteristic of the concepts disclosed herein, both as to their organization and method of operation, together with associated advantages, will be better understood from the following description when considered in connection with the accompanying figures. Each of the figures is provided for the purpose of illustration and description only and not as a definition of the limits of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] A further understanding of the nature and advantages of the present invention may be realized by reference to the following drawings. In the appended figures, similar components or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If only the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

[0037] FIG. 1 is a block diagram illustrating a wireless communications system in accordance with various embodiments;

[0038] FIG. 2 is a block diagram illustrating a wireless communications system in accordance with various embodiments;

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[0039] FIG. 3A illustrates a configuration of timing advance groups in accordance with various embodiments;

[0040] FIG. 3B illustrates a further configuration of timing advance groups in accordance with various embodiments;

[0041] FIG. 4A illustrates an example of a random access procedure in accordance with various embodiments;

[0042] FIG. 4B illustrates an example of a random access procedure in accordance with various embodiments;

[0043] FIG. 4C illustrates an example of a random access procedure in accordance with various embodiments;

[0044] FIG. 5 is an example of a timing advance group index table in accordance with various embodiments;

[0045] FIG. 6 is an example of parallel random access procedures in accordance with various embodiments.

[0046] FIG. 7A is a block diagram illustrating a device that may provide support of multiple timing advance groups for user equipment in carrier aggregation in accordance with various embodiments;

[0047] FIG. 7B is a block diagram illustrating a user equipment that may provide support of multiple timing advance groups for user equipment in carrier aggregation in accordance with various embodiments;

[0048] FIG. 8A is a block diagram illustrating a device that may provide support of multiple timing advance groups for user equipment in carrier aggregation in accordance with various embodiments;

[0049] FIG. 8B is a block diagram illustrating a user equipment that may provide support of multiple timing advance groups for user equipment in carrier aggregation in accordance with various embodiments;

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[0050] FIG. 9A is a block diagram illustrating a device that may provide support of multiple timing advance groups for user equipment in carrier aggregation in accordance with various embodiments;

[0051] FIG. 9B is a block diagram illustrating a communications system that may be configured to support multiple timing advance groups for user equipment in carrier aggregation in accordance with various embodiments;

[0052] FIG. 10A is a flow diagram illustrating a method for providing cross-carrier management for multiple timing advance groups in accordance with various embodiments;

[0053] FIG. 10B is a flow diagram illustrating a method for providing cross-carrier management for multiple timing advance groups in accordance with various embodiments;

[0054] FIG. 11A is a flow diagram illustrating a method for providing cross-carrier management for multiple timing advance groups in accordance with various embodiments;

[0055] FIG. 11B is a flow diagram illustrating a method for providing cross-carrier management for multiple timing advance groups in accordance with various embodiments;

[0056] FIG. 12A is a flow diagram illustrating a method for performing multiple parallel random access procedures in accordance with various embodiments;

[0057] FIG. 12B is a flow diagram illustrating a method for performing multiple parallel random access procedures in accordance with various embodiments;

[0058] FIG. 13 shows a flow diagram of a method for utilizing timing advance group synchronization information;

[0059] FIG. 14 shows a flow diagram of a method for performing random access by a multi-carrier user equipment;

[0060] FIG. 15 shows a flow diagram of a method for performing random access by a base station; and

[0061] FIG. 16 shows a flow diagram of a method for utilizing timing advance group synchronization information in accordance with various embodiments.

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DETAILED DESCRIPTION

[0062] Methods, systems, and devices are described to support multiple timing advance groups for multi-carrier user equipment. Timing advance group synchronization information across multiple timing advance groups may be provided. Support for performing random access procedures in relation to timing advance groups that may not include a primary component carrier may be provided in some designs. Timing advance group indexes may be utilized to enable cross-carrier random access procedure management. Other aspects may support parallel random access procedures across multiple timing advance groups. A reference downlink component carrier for timing within a timing advance group may be provided in some cases.

[0063] The following description provides examples, and is not limiting of the scope, applicability, or configuration set forth in the claims. Changes may be made in the function and arrangement of elements discussed without departing from the spirit and scope of the disclosure. Various embodiments may omit, substitute, or add various procedures or components as appropriate. For instance, the methods described may be performed in an order different from that described, and various steps may be added, omitted, or combined. Also, features described with respect to certain embodiments may be combined in other embodiments.

[0064] Various techniques described herein may be used for different wireless communications systems such as CDMA, TDMA, FDMA, OFDMA, SC-FDMA, and other systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as CDMA2000, Universal Terrestrial Radio Access (UTRA), etc. CDMA2000 covers IS-2000, IS-95, and IS-856 standards. IS-2000 Releases 0 and A are commonly referred to as CDMA2000 1X, 1X, etc. IS-856 (TIA-856) is commonly referred to as CDMA2000 1xEV-DO, High Rate Packet Data (HRPD), etc. UTRA includes Wideband CDMA (WCDMA) and other variants of CDMA. A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Ultra Mobile Broadband (UMB), Evolved UTRA (E-UTRA), IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM, etc. UTRA and E-UTRA are part of Universal Mobile Telecommunication System (UMTS). 3GPP Long Term Evolution (LTE)

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and LTE-Advanced (LTE-A) are new releases of UMTS that use E-UTRA. UTRA, E-UTRA, UMTS, LTE, LTE-A, and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). CDMA2000 and UMB are described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). The techniques described herein may be used for the systems and radio technologies mentioned above, as well as other systems and radio technologies. The description above, however, describes an LTE and/or LTE-Advanced system for purposes of examples, and LTE terminology is used in much of the description above, although the techniques are applicable beyond LTE applications.

[0065] Referring first to **FIG. 1**, a block diagram illustrates an example of a wireless communications system 100. The system 100 includes base transceiver stations 105, disposed in cells 110, mobile user equipment 115 (UEs), controller 120, and core network 125. It is worth noting that terms like user equipment (UE), mobile device, mobile device, access terminal, and others are used interchangeably herein and are not intended to imply a particular network topology or implementation.

[0066] The system 100 may support operation on multiple carriers (waveform signals of different frequencies) and/or carrier aggregation. With carrier aggregation, a user equipment 115 may be configured by a serving base station 105 to communicate using multiple component carriers (CCs). The CCs configured for the UE 115 may include uplink CCs and downlink CCs, which may be further described as primary component carriers (PCCs) or secondary component carriers (SCCs). In one example of system 100, for each UE 115, one CC is designated as the PCC for uplink and downlink transmissions and additional CCs are designated as SCCs. As discussed in more detail below, these different CCs may be aggregated into different timing advance groups based on different factors, such as their delay characteristics. Different embodiments may address different synchronization issues that may arise for timing advance groups depending on the nature of the component carriers within a given timing advance group.

[0067] The base stations 105 can wirelessly communicate with the user equipment 115 via a base station antenna. The base stations 105 may be configured to communicate with the user equipment 115 under the control of the controller 120 via multiple carriers. Each of the base stations 105 can provide communication coverage for a respective geographic area, here

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the cells 110-a, 110-b, or 110-c. The system 100 may include base stations 105 of different types, e.g., macro, pico, and/or femto base stations. The base stations 105 may include Node B, Home Node B, eNode B, and/or Home eNode B base stations.

[0068] The user equipment 115 can be dispersed throughout the cells 110. The user equipment 115 may be referred to as mobile stations, mobile devices, user equipment (UE), or subscriber units. The user equipment 115 here include cellular phones and a wireless communication device, but can also include personal digital assistants (PDAs), other handheld devices, netbooks, notebook computers, etc.

[0069] For the discussion below, the user equipment 115 may operate on (are "camped" on) a macro or similar network facilitated by multiple macro base stations 105. Each macro base station 105 may cover a relatively large geographic area (e.g., several kilometers in radius) and may allow unrestricted access by terminals with a service subscription.

[0070] System 100 may be an LTE system that supports multiple timing advance groups for user equipment 115 in carrier aggregation. With carrier aggregation, multiple component carriers may be aggregated and used together for transmission between base stations 105 and UEs 115. To achieve proper timing for transmission and reception on these different carriers, timing advance information may be distributed from base stations 105 to UEs 115 to allow the UEs 115 to account for propagation delay and/or delay due to other factors (*e.g.*, repeaters) on different carriers. Timing advance information can help ensure synchronized reception timing of the uplink stream links transmitted from multiple UEs 115. The multiple component carriers (CCs) may be aggregated into different timing advance groups. In some cases, the multiple component carriers may be aggregated into different timing advance groups based on having similar delay characteristics. Synchronization issues, however, may arise for timing advance groups depending on the nature of the component carriers within a given timing advance group. System 100 may provide different solutions to these problems in accordance with various embodiments.

[0071] For example, different CCs may have different delay characteristics for UEs 115. Multiple CCs may be aggregated into different timing advance groups based on having similar delay characteristics. Uplink transmissions from multiple UEs115 generally need to be properly aligned. This generally involves utilizing one or more references for timing

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adjustments. One natural approach may involve utilizing SIB2 linkage between uplink CCs and downlink CCs.

[0072] With timing advance groups, CCs with similar characteristics can be grouped together. Different timing advance groups may thus involve different considerations with respect to timing references, such as a reference CC. For example, a secondary CC can be activated and deactivated, while a primary CC is generally always activated. In some cases, a system may benefit through not providing UEs 115 autonomy in selecting a reference CC. Instead, a PCC may be utilized as a reference CC in general. While a PCC may be utilized as a reference CC across different timing advance groups, different implementations may utilize different offsets with respect to the PCC for CCs in different timing advance groups. As discussed in more detail below, determining a reference downlink CC, such as a PCC, may be based in part on a Radio Resource Control (RRC) configuration by user equipment 115.

[0073] For example, in some embodiments, user equipment 115 may be configured for utilizing timing advance group synchronization information across multiple timing advance groups. User equipment 115 may be configured to identify multiple component carriers as part of a carrier aggregation operation. The multiple component carriers may include one or more downlink component carriers and two or more uplink component carriers. Multiple timing advance groups may be determined by user equipment 115. Each component carrier in the multiple component carriers may be included in one of the timing advance groups. A first timing advance group from the multiple timing advance groups may be identified by user equipment 115. A reference downlink component carrier may be determined for the first timing advance group based at least in part on a RRC configuration by user equipment 115. The determined reference downlink component carrier may be utilized by user equipment 115 for timing adjustment within at least the first timing advance group.

[0074] In some embodiments, user equipment 115 may receive from base station 105 an indication of a primary downlink component carrier through the RRC configuration. The primary downlink component carrier may be the determined reference downlink component carrier.

[0075] User equipment 115 may utilize the primary downlink component carrier for timing adjustment within a second timing advance group from the multiple timing advance groups.

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The primary downlink component carrier may be included in the second timing advance group.

[0076] In some embodiments, one or more downlink component carriers of the one or more identified downlink carriers is included in the first timing advance group. Determining the reference downlink component carrier by user equipment 115 may be based on an RRC configuration for the one or more downlink component carriers in the first timing advance group. The reference downlink component carrier for the first timing advance group may be determined by user equipment 115 to be a downlink component carrier with a smallest cell index of multiple cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

[0077] User equipment 115 may determine the reference downlink component carrier from a set of activated downlink component carriers. The one or more downlink component carriers and the two or more uplink component carriers may be associated with two or more bands. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers of the same band or similar band. As an example, the reference downlink component carrier may be determined to be a downlink component carrier of the same or similar band as an uplink component carrier associated with a random access attempt for the first timing advance group. group.

[0078] User equipment 115 may perform multiple random access procedures in parallel with respect to two or more of the multiple timing advance groups. Performing the multiple random access procedures may include performing a first random access procedure linked with the first timing advance group; and/or performing a second random access procedure linked with a second timing advance group of the multiple timing advance groups, where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0079] User equipment 115 may initiate a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast. A cross-carrier indication field may be included in the downlink control channel to enable cross-carrier scheduling.

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[0080] The reference downlink component carrier for the first timing advance group may be determined by user equipment 115 from a set of downlink component carriers with a similar delay due to downlink repeaters. The reference downlink component carrier for the first timing advance group may be determined by user equipment 115 from a set of downlink component carriers with a same carrier type where the carrier type includes at least a legacy carrier type or a new carrier type. The reference downlink component carrier for the first timing advance group may be determined by user equipment 115 from a set of downlink component carriers with a similar activity factor.

[0081] System 100, such as through user equipment 115 and/or base station 105, may take into account different characteristics of a component carrier (e.g., whether it is equipped with a repeater, whether it is always on or periodically turned off, whether it is a new or legacy carrier type, etc.) in determining the reference downlink component carrier. A component carrier may be equipped with a repeater while another component carrier is not. In determining the reference downlink component carrier for a given timing advance group, the component carriers of the same or similar delay characteristics due to repeaters (either downlink repeaters, or uplink repeaters, or a combination thereof) may be determined to be possible candidates for the reference downlink component carrier for the given timing advance group. Different component carriers may have different activity factors. A component carrier may periodically be turned on and carries much less frequent downlink information compared with a regular carrier. It may then be preferable to avoid using this component carrier as the reference downlink component carrier. A component carrier may be of a legacy carrier type and another can be of a new carrier type. Carriers of the same type may be determined to be possible candidates for the reference downlink component carrier for a given timing advance group.

[0082] In some embodiments, base stations 105 and/or user equipment 115 may be configured to support multiple timing advance (TA) groups in connection with random access procedures. For example, different timing advance information may be transmitted to user equipment 115 for different groups of uplink carriers as part of the random access process. First timing advance information may be applicable to a first subset of uplink carriers, while second timing advance information may be applicable to a second, different subset of uplink carriers (e.g., due to a repeater) configured for a particular user equipment 115. A user

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equipment 115 may support two or more timing advance groups and, in some aspects, the user equipment 115 may conduct parallel random access procedures to obtain timing adjustment information applicable to the carriers in each group. Some timing advance groups may not include the primary component carrier, and different specifications may be applicable to such groups.

[0083] As described herein, system 100 can support random access procedures for timing advance groups without a primary component carrier. In some aspects, random access procedures between base stations 105 and user equipment 115 may utilize messages in different search spaces and/or different component carriers. Some messages may be transmitted in a user equipment-specific search space ("UESS"). Other messages may be transmitted in a common search space ("CSS") on the primary component carrier. Additional embodiments may utilize a common search space on a secondary component carrier. Some embodiments may utilize non-contention based random access procedures, while other embodiments may utilize contention based random access procedures. More details are discussed herein with respect to providing support for random access for timing advance groups without a primary carrier component.

[0084] Some embodiments utilize timing advance group indexes to enable cross-carrier random access procedure management. For example, as part of a random access procedure, a base station 105 may transmit a random access response to a user equipment 115 that includes a timing advance group index. Using the TA group index, the user equipment 115 may determine a carrier with which to complete the random access procedure. Different aspects of cross-carrier management, including random access response management, may be facilitated using timing advance group index information. More details are discussed herein with respect to utilizing timing advance group indexes to enable cross-carrier random access procedure management.

[0085] Some embodiments support parallel random access procedures across multiple timing advance groups. For example, multiple parallel random access procedures may occur between base station 105 and user equipment 115. Some embodiments may utilize power prioritization to facilitate these overlapping access procedures. Some embodiments may provide for an Aperiodic Channel Quality Indicator (A-CQI) being triggered within these

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parallel random access procedures. More details are discussed herein with respect to supporting parallel random access procedures across multiple timing advance groups.

[0086] Some embodiments provide for a reference downlink component carrier for timing within a timing advance group. For example, user equipment 115 may utilize a reference downlink component carrier from base station 105 for timing within a timing advance group. More details are discussed herein with respect to providing for a reference downlink component carrier for timing within a timing advance group.

[0087] **FIG. 2** is a block diagram of a wireless communication system 200 including a base station 105-a and a user equipment 115-a. This system 200 may be an example of the system 100 of FIG. 1. The base station 105-a may be equipped with antennas 234-a through 234-x, and the user equipment 115-a may be equipped with antennas 252-a through 252-n. At the base station 105-a, a transmit processor 220 may receive data from a data source.

[0088] The transmit processor 220 and/or processor 240 may process and/or transmit data. The transmit processor 220 may also generate reference symbols and a cell-specific reference signal. A transmit (TX) MIMO processor 230 may perform spatial processing (*e.g.*, precoding) on data symbols, control symbols, and/or reference symbols, if applicable, and may provide output symbol streams to the transmit modulators 232-a through 232-x. Each modulator 232 may process a respective output symbol stream (*e.g.*, for OFDM, etc.) to obtain an output sample stream. Each modulator 232 may further process (*e.g.*, convert to analog, amplify, filter, and upconvert) the output sample stream to obtain a downlink (DL) signal. In one example, DL signals from modulators 232-a through 232-x may be transmitted via the antennas 234-a through 234-x, respectively.

[0089] Processor 240, TX MIMO processor 230, and/or transmit processor 220 may be configured in some embodiments to support random access procedures for timing advance groups without a primary component carrier (e.g., a TA group that includes only secondary component carriers). In particular, these processors may be configured to conduct a random access procedure by which user equipment 115-a achieves uplink synchronization with base station 105-a. Random access procedures may involve the exchange of a series of messages on different carriers and/or different channels. The base station 115-a may send messages in a common search space (or control region) that is monitored by all UEs 115 in a cell, or it may send messages in a search space that is defined for a particular UE. For example, a UE-

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specific search space may be defined by with a starting offset for blind decodes in the PDCCH.

[0090] As described herein, random access procedures may be classified as contention-free or contention-based. With a contention-free procedure, for example, base station 105-a may transmits a physical downlink control channel (PDCCH) order indicating a random access preamble and physical random access channel (PRACH) resource for the UE 115-a to send signaling and data on a physical uplink shared channel (PUSCH). Alternatively, with a contention-based random access procedure, the UE may select the random access preamble and PRACH resource.

[0091] Processor 240, TX MIMO processor 230, and/or transmit processor 220 may be configured enable cross-carrier random access procedure management. For example, processor 240, TX MIMO processor 230, and/or transmit processor 220 may transmit random access responses to user equipment 115-a that include a timing advance group index as part of a random access procedure. In one example of a contention-free random access procedure, base station 105-a transmits a PDCCH message in a UE-specific search space of a secondary component carrier which is included in a particular TA group. In response to a PRACH transmission from UE 115-a, base station 105-a transmits a random access response (RAR) PDCCH in a common search space of the PCC. An RAR message associated with the PDCCH may convey an index corresponding to a timing advance group. The timing advance group may include only SCCs (including the SCC utilized to initiate the random access procedure). The timing advance group index may enable cross-carrier RAR to a secondary SCC as part of the random access procedure. Different aspects of cross-carrier management, including random access response management, may be facilitated using timing advance group index information.

[0092] Processor 240, TX MIMO processor 230, and/or transmit processor 220 may also be configured in some embodiments to transmit reference downlink component carrier information for timing within a timing advance group to user equipment 115-a.

[0093] At the user equipment 115-a, the user equipment antennas 252-a through 252-n may receive the DL signals from the base station 105-a and may provide the received signals to the demodulators 254-a through 254-n, respectively. Each demodulator 254 may condition (*e.g.*, filter, amplify, downconvert, and digitize) a respective received signal to obtain input

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samples. Each demodulator 254 may further process the input samples (*e.g.*, for OFDM, etc.) to obtain received symbols. A MIMO detector 256 may obtain received symbols from all the demodulators 254-a through 254-n, perform MIMO detection on the received symbols if applicable, and provide detected symbols. A receive processor 258 may process (*e.g.*, demodulate, deinterleave, and decode) the detected symbols, providing decoded data for the user equipment 115-a to a data output, and provide decoded control information to a processor 280, or memory 282.

[0094] The received signals at the user 115-a from base station 105-a may be utilized for a variety of purposes with respect to different embodiments. For example, the receive processor 258 and/or the processor 280 may process information according to different embodiments. Some embodiments may configure receive processor 258 and/or the processor 280 to support random access for timing advance groups without a primary component carrier. These embodiments may utilize different search spaces that the receive processor 258 and/or the processor 280 may examine to determine information that may be utilized during a random access procedure. In general, the receive processor 258 and/or the processor 280 may be configured to receive and determine information from different random access response (RAR) grants that utilize different search spaces. These search spaces may include, but are not limited to, UE-specific search spaces on the PCC and SCCs, a common search space on PCC, and/or common search spaces on secondary component carriers.

[0095] Some embodiments may involve configuring the receive processor 258 and/or the processor 280 to utilize timing advance group indexes to enable cross-carrier random access procedure management. For example, the receive processor 258 and/or the processor 280 may receive random access responses from base station 105-a that includes a timing advance group index as part of a random access procedure. The receive processor 258 and/or the processor 280 may then utilize this index information for cross-carrier management, including random access response management.

[0096] The receive processor 258 and/or the processor 280 may also be configured to receive reference downlink component carrier information from base station 105-a. The receive processor 258 and/or the processor 280 may utilize this reference downlink component carrier information for timing within a timing advance group.

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[0097] On the uplink (UL), at the user equipment 115-a, a transmit processor 264 may receive and process data from a data source. The transmit processor 264 may also generate reference symbols for a reference signal. The symbols from the transmit processor 264 may be precoded by a transmit MIMO processor 266 if applicable, further processed by the demodulators 254-a through 254-n (e.g., for SC-FDMA, etc.), and be transmitted to the base station 105-a in accordance with the transmission parameters received from the base station 105-a. At the base station 105-a, the UL signals from the user equipment 115-a may be received by the antennas 234, processed by the demodulators 232, detected by a MIMO detector 236 if applicable, and further processed by a receive processor. The receive processor 238 may provide decoded data to a data output and to the processor 240.

[0098] In some embodiments, processor 280 and/or other components of user equipment 115-a may be configured for utilizing timing advance group synchronization information across multiple timing advance groups. Processor 280 and/or other components of user equipment 115-a may be configured to identify multiple component carriers as part of a carrier aggregation operation. The multiple component carriers may include one or more downlink component carriers and two or more uplink component carriers. Multiple timing advance groups may be determined by processor 280 and/or other components of user equipment 115-a. Each component carrier in the multiple component carriers may be included in one of the timing advance groups. A first timing advance group from the multiple timing advance groups may be identified by processor 280 and/or other components of user equipment 115-a. A reference downlink component carrier may be determined for the first timing advance group based at least in part on a RRC configuration by user equipment processor 280 and/or other components of user equipment 115-a. The determined reference downlink component carrier may be utilized by user equipment 115 for timing adjustment within at least the first timing advance group.

[0099] In some embodiments, processor 280 and/or other components of user equipment 115-a may receive from base station 105-a an indication of a primary downlink component carrier through the RRC configuration. The primary downlink component carrier may be the determined reference downlink component carrier.

[0100] Processor 280 and/or other components of user equipment 115-a may utilize the primary downlink component carrier for timing adjustment within a second timing advance

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group from the multiple timing advance groups. The primary downlink component carrier may be included in the second timing advance group.

[0101] In some embodiments, one or more downlink component carriers of the one or more identified downlink carriers is included in the first timing advance group. Determining the reference downlink component carrier by processor 280 and/or other components of user equipment 115-a may be based on an RRC configuration for the one or more downlink component carriers in the first timing advance group. The reference downlink component carrier for the first timing advance group may be determined by processor 280 and/or other components of user equipment 115-a to be a downlink component carrier with a smallest cell index of multiple cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

[0102] Processor 280 and/or other components of user equipment 115-a may determine the reference downlink component carrier from a set of activated downlink component carriers. The one or more downlink component carriers and the two or more uplink component carriers may be associated with two or more bands. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers of the same band or similar band. As an example, the reference downlink component carrier may be determined to be a downlink component carrier of the same or similar band as an uplink component carrier associated with a random access attempt for the first timing advance group. .

[0103] Processor 280 and/or other components of user equipment 115-a may perform multiple random access procedures in parallel with respect to two or more of the multiple timing advance groups. Performing the multiple random access procedures may include performing a first random access procedure linked with the first timing advance group; and/or performing a second random access procedure linked with a second timing advance group of the multiple timing advance groups, where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0104] Processor 280 and/or other components of user equipment 115-a may initiate a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system

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information block broadcast. A cross-carrier indication field may be included in the downlink control channel to enable cross-carrier scheduling.

[0105] The reference downlink component carrier for the first timing advance group may be determined by processor 280 and/or other components of user equipment 115-a from a set of downlink component carriers with a similar delay due to downlink repeaters. The reference downlink component carrier for the first timing advance group may be determined by processor 280 and/or other components of user equipment 115-a from a set of downlink component carriers with a same carrier type where the carrier type includes at least a legacy carrier type or a new carrier type. The reference downlink component carrier for the first timing advance group may be determined by processor 280 and/or other components of user equipment 115-a from a set of downlink component carriers with a similar activity factor.

[0106] Transmit processor 264 and/or processor 280 may be configured in some embodiments to support parallel random access procedures across multiple timing advance groups. For example, multiple parallel random access procedures may occur between base station 105-a and user equipment 115-a. Transmit processor 264 and/or processor 280 may be configured to utilize power prioritization to facilitate these overlapping access procedures. Transmit processor 264 and/or processor 280 may be configured to provide for an Aperiodic Channel Quality Indicator (A-CQI) being triggered within these parallel random access procedures.

[0107] **FIG. 3A** shows an example of a configuration 300-a of timing advance groups in accordance with various embodiments. Two or more timing advance groups may be configured in various embodiments. Configuration 300 shows two timing advance groups 310-a and 310-b. In some embodiments, a base station, such as a serving eNodeB, may configure the timing advance groups utilizing dedicated signaling. Typically, one of the timing advance groups includes a primary cell 320. In this example, timing advance group 310-a includes primary cell 320. Primary cell 320 includes uplink and downlink primary component carriers, UL-1 and DL-1 respectively. Timing group 310-a also includes a secondary cell 330-a, which includes an uplink component carrier UL-2 and a downlink component carrier DL-2. In this example, the second timing advance group 310-b includes another secondary cell, labeled 330-b, with a downlink component carrier DL-3 and an

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uplink component carrier UL-3. While this example shows two timing advance groups, other embodiments may include more timing advance groups. In addition, different timing advance groups may include more or fewer secondary cells 330. As will be discussed in more detail below, a timing advance group that does not include a primary cell, such as timing advance group 310-b, may have a random access process triggered for the timing advance group by an order, such as a PDCCH order, addressed to an active secondary cell in the timing advance group.

[0108] **FIG. 3B** shows an example of a configuration 300-b of timing advance groups in accordance with various embodiments and based on configuration 300-a of FIG. 3A. Configuration 300-b shows an example where an RRC-configured primary downlink component carrier (DL-1) may serve as the reference carrier for component carriers in each of the two timing advance groups 310-a, 310-b. This RRC-based approach may be advantageous when the activation status of the secondary downlink component carriers (DL-2, DL-3) changes from time to time. In some cases, a reference downlink component carrier may be determined based on an RRC configuration of user equipment 115. For example, as previously described for carrier aggregation, a base station, such as a base station 105 of the other figures, may send RRC configuration message(s) to user equipment 115 identifying one carrier as the primary component carrier (PCC) and additional carriers as secondary component carriers (SCCs). The carrier that is identified as PCC may serve as the reference downlink carrier for one or more timing advance groups 310.

[0109] For example, configuration 300-b may be an example of utilizing timing advance group synchronization information across multiple timing advance groups by a user equipment, such as the user equipment 115 of FIGs. 1, 2, 4, 7B, 8B, and/or 9B. With configuration 300-b, multiple component carriers, such as UL-1, UL-2, UL-3, DL-1, DL-2, and/or DL-3, may be identified as part of a carrier aggregation operation. The multiple component carriers may include one or more downlink component carriers (e.g., DL-1, DL-2, and/or DL-3) and two or more uplink component carriers (e.g., UL-1, UL-2, and/or UL-3). Multiple timing advance groups, such as timing advance groups 310-a and 310-b, may be determined. Each component carrier in the multiple component carriers may be included in one of the timing advance groups. A first timing advance group, such as timing advance group 310-b, from the multiple timing advance groups may be identified. A reference

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downlink component carrier, such as DL-1, may be determined for the first timing advance group based at least in part on an RRC. The determined reference downlink component carrier may be utilized for timing adjustment within at least the first timing advance group. The determined reference downlink component carrier may also be utilized for other timing advance groups, such as timing advance group 310-a. In some cases, timing offset information may be utilized along with timing information from the determined downlink component carrier to determine timing information for the different timing advance groups.

[0110] In some embodiments, an indication of a primary downlink component carrier (e.g., DL-1) may be received through the RRC configuration. The primary downlink component carrier may be the determined reference downlink component carrier. The primary downlink component carrier may be utilized for timing adjustment within a second timing advance group (e.g., timing advance group 310-a) from the multiple timing advance groups. The primary downlink component carrier may be included in the second timing advance group.

[0111] In some embodiments, one or more downlink component carriers of the one or more identified downlink carriers is included in the first timing advance group, such as DL-3 of timing advance group 310-b. Determining the reference downlink component carrier may be based on an RRC configuration for the one or more downlink component carriers in the first timing advance group. The reference downlink component carrier for the first timing advance group may be determined to be a downlink component carrier with a smallest cell index in the first timing advance group, which is the primary component carrier. As another example, although not illustrated, the second timing advance group may have two or more secondary component carriers, and the reference downlink component for the second timing advance group may be determined to be a downlink component carrier with a smallest cell index within the second timing advance group.

[0112] The reference downlink component carrier may be determined from a set of activated downlink component carriers. The one or more downlink component carriers and the two or more uplink component carriers may be associated with two or more bands. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers of the same band or similar band. As an example, the reference downlink component carrier may be determined to be a downlink component carrier of the same or similar band as an uplink component carrier associated with a random

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access attempt for the first timing advance group. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a similar delay due to downlink repeaters. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a same carrier type where the carrier type includes at least a legacy carrier type or a new carrier type. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a similar activity factor.

[0113] Other characteristics of a component carrier can be taken into account (e.g., whether it is equipped with a repeater, whether it is always on or periodically turned off, whether it is a new or legacy carrier type, etc.) in determining the reference downlink component carrier. A component carrier may be equipped with a repeater while another component carrier is not. In determining the reference downlink component carrier for a given timing advance group, the component carriers of the same or similar delay characteristics due to repeaters (either downlink repeaters, or uplink repeaters, or a combination thereof) may be determined to be possible candidates for the reference downlink component carrier for the given timing advance group. Different component carriers may have different activity factors. A component carrier may periodically be turned on and carries much less frequent downlink information compared with a regular carrier. It may then be preferable to avoid using this component carrier as the reference downlink component carrier. A component carrier may be of a legacy carrier type and another can be of a new carrier type. Carriers of the same type may be determined to be possible candidates for the reference downlink component carrier for a given timing advance group.

[0114] In some embodiments, multiple random access procedures may be performed in parallel with respect to two or more of the multiple timing advance groups, such as timing advance group 310-a and 310-b. Performing the multiple random access procedures may include performing a first random access procedure linked with the first timing advance group, such as timing advance group 310-b; and/or performing a second random access procedure linked with a second timing advance group, such as timing advance group 310-a, of the multiple timing advance groups, where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

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[0115] Some embodiments include utilizing a non-contention based random access procedure on an uplink component carrier, such as UL-3, within the first timing advance group, such as timing advance group 310-a, through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast (e.g., the primary component carrier (DL-1)). A cross-carrier indication field may be included in the downlink control channel to enable cross-carrier scheduling.

[0116] Some embodiments may provide advantages, for example, when the activation status of the SCCs changes from time to time. A timing advance group that contains SCCs, but no PCC, may face synchronization issues because of deactivation of the corresponding secondary cells. In contrast, a timing advance group with a primary cell that corresponds to a PCC may not face the same issues because the primary cell cannot be deactivated. Embodiments may also provide advantages over some other techniques that may be provide timing information for a timing advance group that include SCCs but no PCC, such as through SIB2 linkage. For example, when a secondary cell downlink component carrier is activated or deactivated, the SIB2 linked uplink component carrier is also generally activated or deactivated. As another example, the characteristics of a component carrier can be taken into account (activation status, whether it is equipped with a repeater, whether it is always on or periodically turned off, legacy or new carrier type, etc) in determining the reference downlink component carrier.

[0117] FIG. 4A, FIG. 4B, and/or FIG. 4C show examples of random access procedures 400-a, 400-b, and 400-c in accordance with various embodiments. These embodiments provide examples of search space designs that may be utilized with timing advance groups. In particular, these embodiments provide different ways to support random access for timing advance groups without primary component carriers.

[0118] Random access procedures 400-a, 400-b, and/or 400-c may include non-contention based random access. Some of these random access procedures may also be configured for contention-based random access, such as random access procedure 400-b and/or 400-c.

[0119] In general, a non-contention based random access procedure may be initiated for any of the procedures 400-a, 400-b, and/or 400-c utilizing Downlink Control Information (DCI). In one example of an LTE system, the various fields of DCI format 1A may be

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configured to initiate the random access procedure. As illustrated in the figures, eNB 105-i may transmit a DCI format 1A message to UE 115-j on a Physical Downlink Control Channel (PDCCH). The format 1A Cyclic Redundancy Check (CRC) may be scrambled with a Cell Radio-Network Temporary Identifier (C-RNTI). The remaining fields of the format 1A may be configured in the following manner: Localized/Distributed VRB assignment flag (1 bit is set to '0'); resource block assignment (all bits set to '1'); preamble index (6 bits); Physical Random Access Channel (PRACH) Mask Index (4 bits). The remaining bits in format 1A for compact scheduling assignment of the one Physical Downlink Shared Channel (PDSCH) codeword may be set to zero. Other embodiments may utilize other field settings. In addition, some embodiments may utilize other DCI formats.

[0120] In some embodiments, the PDCCH may be transmitted in UE-specific search space (UESS). For example, some embodiments may not allow PDCCH for downlink data arrival using format 1A to be transmitted from a common search space (CSS). The UESS can be on one SCC in a target timing advance group or any other component carrier when a carrier indicator field (CIF) is enabled.

[0121] Embodiments as shown in random access procedures 400 may provide different ways to handle a random access response (RAR) grant. In general, the RAR grant may include an uplink grant on PUSCH and timing information such as a timing advance command for controlling the amount of timing adjustment to be applied by the user equipment. Procedures 400 provide several different examples of search spaces for the accessing procedures. In particular, procedures 400 provide examples of how to send PDCCH for RAR grant (shown as message 2 in procedures 400).

[0122] Turning to **FIG. 4A**, random access procedure 400-a shows an example where a UE-specific search space may be utilized to send PDCCH for the RAR grant. Procedure 400-a shows PDCCH transmitted from eNB 105-i in UESS 410-a as DCI format 1A (message 0) to user equipment 115-i. User equipment 115-i may make a random access attempt by sending a random access preamble as PRACH (message 1) to eNB 105-i. In this example, PDCCH for RAR grant (message 2) may be sent from eNB 105-i in UESS 420-a. In some embodiments, this could be on the same SCC as message 0 or a different CC, depending on whether CIF is enabled for user equipment 115-i. Procedure 400-a also shows Physical Uplink Shared Channel (PUSCH) (message 3) and Physical Downlink Shared Channel

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(PDSCH) (message 4); these messages may involve transmitting signaling and/or user data between eNB105-i and user equipment 115-i. The PDCCH scheduling the PDSCH may utilize UESS 430-a in some cases.

[0123] Some embodiments may utilize a Random Access Radio-Network Temporary Identifier (RA-RNTI) in the UESS for the user equipment 115-i. The number of PDCCH blind decodes may be increased in some cases, depending on whether the CSS DCI format or UESS DCI format is used as they have different sizes, and/or whether DCI format 1C is used. In some embodiments, only DCI format 1A may be utilized. In some cases, the DCI format 1A may confirm to the UESS format. This may result in the number of PDCCH blind decodes not increasing. Embodiments such as procedure 400-a may apply to non-contention based timing advance groups.

[0124] Turning to **FIG. 4B**, random access procedure 400-b shows an example where a CSS on a PCC may be utilized to send PDCCH for the RAR grant. Embodiments may be configured such that procedure 400-b may involve physical layer based handling and/or MAC layer based handling. Procedure 400-b shows PDCCH transmitted from eNB 105-j in UESS 410-b as DCI format 1A (message 0) to user equipment 115-j. User equipment 115-j may make a random access attempt by sending a random access preamble as PRACH (message 1) to eNB 105-j. In this example, PDCCH for RAR grant (message 2) may be sent from eNB 105-j from the common search space on the primary carrier component 420-b. Procedure 400-b also shows Physical Uplink Shared Channel (PUSCH) (message 3) subsequent to the RAR grant and a Physical Downlink Shared Channel (PDSCH) (message 4); these messages may involve transmitting signaling and/or user data between eNodeB 105-j and user equipment 115-j. The PDCCH scheduling the PDSCH may utilize UESS 430-b in some cases.

[0125] Some embodiments of procedure 400-b may utilize a physical layer based approach. For example, a carrier indicator field (CIF) may be enabled for some DCI in CSS. CIF may be added in DCI format 1A, for example, and may enable cross-carrier scheduling in the RAR grant. Additionally, or separately, CIF may be added in DCI format 1C. A combination these approaches, or splitting PDCCH decoding candidates may increase the number of decoding candidates in CSS. If it may be desirable to avoid increasing the number of PDCCH blind decodes, some embodiments may enable on the CIF for DCI format 1C

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and/or use it for message 2. In this case, there may be no cross-carrier RAR grant for DCI format 1A, but may be allowed only with DCI format 1C.

[0126] Some embodiments of procedure 400-b may utilize a MAC layer based approach. With a MAC layer based approach, a component carrier index and/or a timing advance group index may be utilized to enable a cross-carrier random access procedure. As an example, the component carrier index and/or timing advance group index may be introduced in message 0 particularly when CIF is configured for the UE. The signaling of the CC index and/or TA group index in this case can be done by re-interpreting some of the reserved bit(s) in DCI format 1A message 0. The CC index and/or the TA group index may also be included with the RAR in the MAC payload. The CC index and/or TA group index may be introduced to enable cross-carrier RAR management from the PCC to SCC. A CC index may be utilized to identify specific component carriers that may be utilized in the cross-carrier RAR. A TA group index may be utilized to identify different groups of component carriers or cells. TA group indexes are discussed in more detail below. In some cases, a timing advance group index may need the RRC to identify which component carrier to transmit PRACH and/or other messages in the RACH procedure within the timing advance group.

[0127] In one example of utilizing a TA group index with procedure 400-b, a contention-free random access procedure is initiated when eNB 105-j transmits a properly configured PDCCH message (message 0) to UE 115-j. The contention-free random access procedure may be used to establish a timing adjustment applicable to a group of secondary component carriers in a targeted TA group. For example, eNB 105-j may transmit the PDCCH message on an SCC in the targeted group. Alternatively or additionally, the PDCCH may include a TA group index corresponding to the group of SCCs.

[0128] When the PDCCH is received, the UE 115-j transmits message 1 on a physical random access channel (PRACH). The CC on which PRACH is transmitted may be identified by the TA group index included with PDCCH order initiating the random access procedure and/or it may be determined according to the SCC on which the PDCCH was received. The PRACH transmission may occur in a specified subframe and may include a predetermined preamble sequence. When eNB 105-j detects the PRACH transmission, it may generate a random access response message which, at the physical layer, may be referred

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to as an RAR grant (message 2). As shown, the PDCCH for the RAR may be transmitted in a common search defined for UE 115-j on its primary component carrier.

[0129] In this example, the RAR grant enables cross-carrier operation from PCC (on which the corresponding PDCCH is received) to an SCC in the target TA group. As noted previously, the PDSCH transmission corresponding to the PDCCH may carry an RAR message that includes a timing adjustment (TA) value and uplink grant. A MAC payload of the RAR message may also include a TA group index. Based on its TA group configuration, UE 115-j may identify the set of SCCs targeted for timing adjustment and a specific CC to use for completing the random access procedure. Thereafter, the UE 115-j may transmit PUSCH (message 3) on the CC in accordance with the grant included in the RAR message. As described herein, multiple TA groups may be configured for UE 115-j, including TA groups without PCC.

[0130] Turning to **FIG. 4C**, random access procedure 400-c shows an example where a common search space on a SCC may be utilized to send the PDCCH for RAR grant. Procedure 400-c shows PDCCH transmitted from eNodeB 105-k in UESS or CSS on SCC 410-c as DCI 1A message 0 to user equipment 115-k. User equipment 115-k may make a random access attempt by sending a random access preamble as PRACH message 1 to eNodeB 105-k. In this example, PDCCH for RAR grant message 2 may be sent from eNodeB 105-k from the common search space on the secondary carrier component 420-c. Procedure 400-c also shows Physical Uplink Shared Channel (PUSCH) message 3 and Physical Downlink Shared Channel (PDSCH) message 4; these messages may involve transmitting signaling and/or user data in general between eNodeB 105-k and user equipment 115-k. The PDCCH scheduling the PDSCH may utilize CSS on SCC and/or UESS 430-c in some cases.

[0131] Utilizing CSS on SCC for the user equipment 115-k may provide for other useful features so as group power control. Procedure 400-c may also be utilized for contention based SCC timing advance groups.

[0132] **FIG. 5** shows one example of a table 500 that includes timing advance group indexing information in accordance with various embodiments. Different CCs or cells may be grouped into different timing advance groups. In this example, a primary cell, Pcell, and two secondary cells, Scell-1 and Scell-2, may be grouped together and identified by a TA

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group index, "0" in this case. A second group including two secondary cells, Scell-3 and Scell-4, may be grouped together and identified utilizing another TA group index, "1" in this case. In this example, a single bit of information may be utilized to identify each timing advance group, although different amounts of information may be used in different embodiments. This information may be configured for a user equipment 115 by a base station 105 and signaled to the UE 115 in one or RRC messages .

[0133] In some cases, the TA group index may generally indicate the timing advance group that includes a primary cell or PCC through a "0" index. Some embodiments may include timing advance indexes that may utilize additional bits to convey their information. The number of bits utilized may depend upon the number of timing advance groups. Thus, the use of two timing advance groups is provided merely as an example; other examples may include more than two timing advance groups and each group may include zero or more secondary cells or secondary component carriers. The number of timing advance groups with associated timing advance group indexes may depend upon a variety of factors including, but not limited, propagation delay characteristics, channel characteristics, user equipment device characteristics, and/or bandwidth characteristics of the component carriers.

[0134] The timing advance group index, such as seen in table 500, may be included in a MAC payload in some embodiments. The TA group index, such as seen in table 500, may be transmitted as part of a PDCCH payload in some embodiments. Some embodiments may utilize additional information such as a component carrier identifier as part of an RRC configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index. The identified component carrier may be utilized for a random access attempt and/or other messages in the RACH procedure.

[0135] **FIG. 6** shows an exemplary configuration 600 of multiple timing advance groups that may utilize parallel random access procedures in accordance with various embodiments. The exemplary configuration 600 shows two timing advance groups, 610-a and 610-b. Timing advance group 610-a includes primary component carrier 620 and secondary component carrier 630-a. Timing advance group 610-b includes secondary component carrier 630-b and secondary component carrier 630-c. Other embodiments may include timing advance groups that include more or less component carriers. In this example, random access procedures 640-a for timing advance group 610-a may occur in parallel or overlap

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with random access procedures 640-b of timing advance group 610-b. As discussed in more detail below, different embodiments may handle these parallel random access procedures in a variety of ways.

[0136] Turning next to **FIG. 7A**, a block diagram illustrates a device 700-a that supports multiple timing advance groups for user equipment in carrier aggregation. In some embodiments, the device 700-a may be the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, and/or FIG. 9. The device 700-a may also be a processor. The device 700-a may include a receiver module 705, a random access module 715, a timing advance group index module 720, a reference downlink component carrier module 725, and/or a transmitter module 730. Each of these components may be in communication with each other.

[0137] These components of the device 700-a may, individually or collectively, be implemented with one or more Application Specific Integrated Circuits (ASICs) adapted to perform some or all of the applicable functions in hardware. Alternatively, the functions may be performed by one or more other processing units (or cores), on one or more integrated circuits. In other embodiments, other types of integrated circuits may be used (e.g., Structured/Platform ASICs, Field Programmable Gate Arrays (FPGAs), and other Semi-Custom ICs), which may be programmed in any manner known in the art. The functions of each unit may also be implemented, in whole or in part, with instructions embodied in a memory, formatted to be executed by one or more general or application-specific processors.

[0138] The receiver module 705 may receive information from difference sources over different channels and deliver to other modules of device 700-a. The transmitter module 730 may transmit information it may receive form the other modules of device 700-a.

[0139] The timing advance group index receive module 720 may provide a variety of cross-carrier management functions for multiple timing advance groups is provided. For example, the timing advance group index receive module 720 may receive a timing advance group index. The timing advance group index may identify a timing advance group from multiple timing advance groups. Each group may include different sets of component carriers. Some embodiments may include enabling cross-carrier random access procedure through the utilization of the timing advance group index.

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[0140] In some embodiments, the TA group receive module 720 may receive a TA group index for a first timing advance group from the multiple timing advance groups that includes a PCC and a second timing advance group includes at least one SCC. The first timing advance group may also include one or more secondary component carriers, while the second timing advance group does not include the PCC. The timing advance group index receive module 720 may also work with timing advance groups that also include additional timing advance groups besides the first and second timing advance group.

[0141] In some embodiments, the TA group index module 720 may receive TA group indexes that include a single bit of information. A first configuration of the single bit of information may indicate that the timing advance group includes a primary component carrier; a second configuration of the single bit may indicate that the timing advance group one or more secondary component carriers without the primary component carrier. Some embodiments may include timing advance indexes that may utilize additional bits to convey their information. The number of bits that the timing advance group module 720 may utilize may depend upon the number of timing advance groups.

[0142] The TA group index may be received by receiver module 705 as part of a MAC payload in some embodiments. Some embodiments may also include receiving through the receiver module 705 a component carrier identifier as part of a Radio Resource Control (RRC) configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index. The identified component carrier may be utilized from a random access procedure.

[0143] The random access module 715 may be utilized to perform multiple parallel random access procedures. For example, the random access module 715 may be utilized to perform a first random access procedure associated with a first timing advance group of component carriers. The random access module 715 may be utilized to perform a second random access procedure associated with a second timing advance group of component carriers where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0144] The random access module 715 may be utilized to perform power prioritization with respect to the first random access procedure and the second random access procedure. Performing the power prioritization may include performing an equal power scaling with

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respect to the first random access procedure and the second random access procedure. In some embodiments, performing the power prioritization may include transmitting a first random access attempt with respect to the first timing advance group of component carriers prior to transmitting a second random access attempt with respect to the second timing advance group of component carriers, where the first timing advance group of component carriers includes a primary component carrier.

[0145] The random access module 715 may be utilized to perform the first random access procedure that may include a non-contention based random access procedure and the second random access procedure may include a contention based random access procedure. Performing the power prioritization in this case may include transmitting a first random access attempt with respect to the first timing advance group of component carriers prior to transmitting a second random access attempt with respect to the second timing advance group of component carriers. These transmissions may utilize the transmitter module 730 also.

[0146] In some embodiments, performing the power prioritization may take into account some combination of the type of the group (primary or secondary), the type of the RACH procedure (contention-based or non-contention based), and/or simple equal power scaling. As an example, a primary group may be given the highest priority, followed by equal power scaling for all the remaining secondary groups if there are two or more secondary timing advance groups. As another example, a primary group may be given the highest priority, followed by equal power scaling for the secondary groups containing non-contention based RACH procedure, and finally, followed by equal power scaling for the secondary groups containing contention-based RACH procedure.

[0147] Some embodiments may include triggering an aperiodic channel quality indicator (A-CQI) using the random access module 715. In general, device 700-a and random access module 715 in particular may not expect to receive more than one aperiodic Channel-State Information (CSI) report request for a given subframe. If two or more parallel non-contention based RAR grant trigger PUSCH are received by the device 700-a at most one may have an A-CQI bit set. In some embodiments, parallel message 3 PUSCH may be utilized. For example, a component carrier 1 RAR grant in subframe n, with delay bit set to 1, may utilize a message 3 PUSCH in subframe n+7. A component carrier 2 RAR grant in subframe n+1, delay bit set to 0, may utilize a message 3 PUSCH in subframe n+7. As a

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result, parallel message 3 PUSCH in subframe n+7 may be utilized, but only one of the RAR grants may set A-CQI to 1. The PUSCH corresponding to the RAR grant with A-CQI set to 1 carries the A-CQI feedback.

[0148] The reference downlink component carrier receiver module 725 may be utilized to receive timing advance group synchronization information. For example, the reference downlink component carrier receiver module 725 may receive a reference downlink component carrier information. The reference downlink component carrier information may be utilized by device 700-a for timing adjustment within a first timing advance group from multiple timing advance groups. Each timing advance group may include at least one downlink component carrier.

[0149] Device 700-a may be configured for performing random access by a multi-carrier UE in some embodiments. A downlink control message configured to initiate a random access procedure may be received at receiver module 705 and passed to random access module 715. A response to the downlink control message may be generated at the random access module 715 and may be transmitted on a physical random access channel (PRACH) from transmitter module 730. An access grant may be received on a PCC of the user equipment at the receiver module 705. A set SCCs may be determined based on the random access grant. The timing advance group index receive module 720 and/or the random access module 715 may determine the set of secondary components. The random access procedure facilitated by the random access module 715 may be completed using a carrier in the set of SCCs to obtain TA information applicable to the set of SCCs.

[0150] The receiver module 705 and/or the random access module 715 may be configured to receive the downlink control message through detecting a physical downlink control channel (PDCCH) message in a UE-specific search space. The receiver module 705 and/or the random access module 715 may be configured to receive the random access grant through detecting a PDCCH message in a common search space of the PCC.

[0151] In some embodiments, device 700-a may be configured to obtain a medium access control (MAC) protocol data unit (PDU) with the random access grant. Using the timing advance group index receive module 702, a TA group index may be determined corresponding to the set of SCCs based on the MAC PDU. Some embodiments may further include configuring the timing advance group index receive module 720 to receive a

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configuration of TA groups corresponding to component carriers configured for the UE. The TA group index may be obtained from the MAC PDU. The configuration of TA groups may include at least a first TA group including the PCC, and a second TA group including the set of secondary CCs. In some embodiments, the timing advance group index receive module may be configured to determine TA group index corresponding to the set of SCCs as part of a PDCCH payload.

[0152] Some embodiments may further include utilizing the reference downlink component carrier receive module 725 to determine a reference downlink CC for completing the random access procedure based on the TA group index.

[0153] In some embodiments, the downlink control message may be configured to initiate the random access procedure comprises an identifier corresponding to the set of SCCs. The transmitter module 730 may transmit the response to the downlink control message to further include determining an SCC to transmit the PRACH based on the identifier.

[0154] In some embodiments, a second random access procedure may be initiated concurrently with the first random access procedure using the random access module 715. Some embodiments may further include configuring the random access module 715 to determine a priority for allocating power between the first random access procedure and the second random access procedure. The random access module 715 may allocate power to the first random access procedure at a higher priority than the second random access procedure when the first random access procedure comprises a contention-free random access procedure and the second random access procedure comprises a contention-based random access procedure. The random access module 715 may allocate power to the second random access procedure at a higher priority than the first random access procedure when the second random access procedure when the second random access procedure is performed in relation to a group of carriers comprising a primary component carrier of the UE. The random access module 715 may determine the priority including performing an equal power scaling for each CC.

[0155] **FIG. 7B** is a block diagram 700-b of a user equipment 115-b in accordance with various embodiments. The user equipment 115-b may have any of various configurations, such as personal computers (e.g., laptop computers, netbook computers, tablet computers, etc.), cellular telephones, PDAs, digital video recorders (DVRs), internet appliances, gaming

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consoles, e-readers, etc. The user equipment 115-b may have an internal power supply (not shown), such as a small battery, to facilitate mobile operation. . In some embodiments, the user equipment 115-b may be the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 9, and/or device 700-a of FIG. 7A

[0156] The user equipment 115-b may include antennas 740, a transceiver module 750, memory 780, and a processor module 770, which each may be in communication, directly or indirectly, with each other (e.g., via one or more buses). The transceiver module 750 is configured to communicate bi-directionally, via the antennas 740 and/or one or more wired or wireless links, with one or more networks, as described above. For example, the transceiver module 750 may be configured to communicate bi-directionally with base stations 105 of FIG. 1 or 2. The transceiver module 750 may include a modem configured to modulate the packets and provide the modulated packets to the antennas 740 for transmission, and to demodulate packets received from the antennas 740. While the user equipment 115-b may include a single antenna, the user equipment 115-b will typically include multiple antennas 740 for multiple links.

[0157] The memory 780 may include random access memory (RAM) and read-only memory (ROM). The memory 780 may store computer-readable, computer-executable software code 785 containing instructions that are configured to, when executed, cause the processor module 770 to perform various functions described herein (e.g., call processing, database management, message routing, etc.). Alternatively, the software 785 may not be directly executable by the processor module 770 but be configured to cause the computer (e.g., when compiled and executed) to perform functions described herein.

[0158] The processor module 770 may include an intelligent hardware device, e.g., a central processing unit (CPU) such as those made by Intel® Corporation or AMD®, a microcontroller, an application specific integrated circuit (ASIC), etc. The processor module 770 may include a speech encoder (not shown) configured to receive audio via a microphone, convert the audio into packets (e.g., 30 ms in length) representative of the received audio, provide the audio packets to the transceiver module 750, and provide indications of whether a user is speaking. Alternatively, an encoder may only provide packets to the transceiver module 750, with the provision or withholding/suppression of the packet itself providing the indication of whether a user is speaking.

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[0159] According to the architecture of FIG. 7B, the user equipment 115-b may further include a communications management module 760. The communications management module 760 may manage communications with other user equipment 115. By way of example, the communications management module 760 may be a component of the user equipment 115-b in communication with some or all of the other components of the user equipment 115-b via a bus. Alternatively, functionality of the communications management module 760 may be implemented as a component of the transceiver module 750, as a computer program product, and/or as one or more controller elements of the processor module 770.

[0160] The components for user equipment 115-b may be configured to implement aspects discussed above with respect to device 700-a in FIG. 7A and may not be repeated here for the sake of brevity. For example, the timing advance group index receive module 720-a may be an example of the timing advance group index receive module 720 of FIG. 7A. The reference downlink component carrier receive module 725-a may be an example of the reference downlink component carrier receive module 725 of FIG. 7A. Parallel random access control module 717, power prioritization module 718, and/or A-CQI triggering module 719 may provide specific functionality individually or in combination for a random access module 715-a that may be an example of the random access module 715 of FIG. 7A.

[0161] Turning next to **FIG. 8A**, a block diagram illustrates a device 800-a that supports multiple timing advance groups for user equipment in carrier aggregation. In some embodiments, the device 800-a may be the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, and/or FIG. 9; and/or device 700-a of FIG. 7. The device 800-a may also be a processor. The device 800-a may include a receiver module 805, a component carrier identification module 815, a timing advance group module 820, a reference downlink component carrier module 825, and/or a transmitter module 830. Each of these components may be in communication with each other. Device 800-a may be configured as one or more processors.

[0162] These components of the device 800-a may, individually or collectively, be implemented with one or more Application Specific Integrated Circuits (ASICs) adapted to perform some or all of the applicable functions in hardware. Alternatively, the functions may be performed by one or more other processing units (or cores), on one or more integrated

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circuits. In other embodiments, other types of integrated circuits may be used (e.g., Structured/Platform ASICs, Field Programmable Gate Arrays (FPGAs), and other Semi-Custom ICs), which may be programmed in any manner known in the art. The functions of each unit may also be implemented, in whole or in part, with instructions embodied in a memory, formatted to be executed by one or more general or application-specific processors.

[0163] The receiver module 805 may receive information from difference sources over different channels and deliver to other modules of device 800-a. The transmitter module 830 may transmit information it may receive form the other modules of device 800-a.

[0164] The component carrier identification module 815 may identify multiple component carriers as part of a carrier aggregation operation. The multiple component carriers may include one or more downlink component carriers and two or more uplink component carriers. The timing advance group module 820 may determine multiple timing advance groups. Each component carrier in the multiple component carriers may be included in one of the timing advance groups. The timing advance group module 820 may identify a first timing advance group from the multiple timing advance group. The reference downlink component carrier module 825 may determine a reference downlink component carrier for the first timing advance group based at least in part on a Radio Resource Control (RRC) configuration. The timing advance group module 820, the reference downlink component carrier module 825, and/or other components of device 800-a may utilize the determined reference downlink component for timing adjustment within at least the first timing advance group.

[0165] In some embodiments, device 800-a may receive indication of a primary downlink component carrier through the RRC configuration, such as through receiver 805. The primary downlink component carrier may be the determined reference downlink component carrier.

[0166] Some embodiments of device 800-a, through the timing advance group module 820, the reference downlink component carrier module 825, and/or other components of device 800-a, include utilizing the primary downlink component carrier for timing adjustment within a second timing advance group from the multiple timing advance groups. The primary downlink component carrier may be included in the second timing advance group.

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[0167] In some embodiments, the timing advance group module 820 may include one or more downlink component carriers of the one or more identified downlink carriers in the first timing advance group. The reference downlink component carrier module 825 may determine the reference downlink component carrier based on an RRC configuration for the one or more downlink component carriers in the first timing advance group. The reference downlink component carrier module 825 may determine the reference downlink component carrier for the first timing advance group to be a downlink component carrier with a smallest cell index from multiple cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

[0168] The reference downlink component carrier may be determined by the reference downlink component carrier module 825 from a set of activated downlink component carriers. In some cases, the component carrier identification module 815 may determine that the one or more downlink component carriers and the two or more uplink component carriers are associated with two or more bands. The reference downlink component carrier for the first timing advance group may be determined by the reference downlink component carrier module 825 or the timing advance group module 820 from a set of downlink component carriers of the same or similar band. As an example, the reference downlink component carrier may be determined to be a downlink component carrier of the same or similar band as an uplink component carrier associated with a random access attempt for the first timing advance group. The reference downlink component carrier for the first timing advance group may be determined by the reference downlink component carrier module 825 from a set of downlink component carriers with a similar delay due to downlink repeaters. The reference downlink component carrier for the first timing advance group may be determined by the reference downlink component carrier module 825 from a set of downlink component carriers with a same carrier type where the carrier type includes at least a legacy carrier type or a new carrier type. The reference downlink component carrier for the first timing advance group may be determined by the reference downlink component carrier module 825 from a set of downlink component carriers with a similar activity factor.

[0169] Device 800-a, through component carrier identification module 815, timing advance group module 820, or reference downlink component carrier module 825, may take into account different characteristics of a component carrier (e.g., whether it is equipped with a

repeater, whether it is always on or periodically turned off, whether it is a new or legacy carrier type, etc.) in determining the reference downlink component carrier. A component carrier may be equipped with a repeater while another component carrier is not. In determining the reference downlink component carrier for a given timing advance group, the component carriers of the same or similar delay characteristics due to repeaters (either downlink repeaters, or uplink repeaters, or a combination thereof) may be determined to be possible candidates for the reference downlink component carrier for the given timing advance group. Different component carriers may have different activity factors. A component carrier may periodically be turned on and carries mueh less frequent downlink information compared with a regular carrier. It may then be preferable to avoid using this component carrier as the reference downlink component carrier. A component carrier may be of a legacy carrier type and another can be of a new carrier type. Carriers of the same type may be determined to be possible candidates for the reference downlink component carrier for a given timing advance group.

[0170] Some embodiments of device 800-a may be configured for performing multiple random access proeedures in parallel with respect to two or more of the multiple timing advance groups. Performing the multiple random access procedures may include performing a first random access procedure linked with the first timing advance group; and/or performing a second random access procedure linked with a second timing advance group of the multiple timing advance groups, where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0171] Some embodiments of device 800-a may be configured for initiating a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast (e.g., the primary component carrier). A cross-carrier indication field may be included in the downlink control channel to enable cross-carrier scheduling.

[0172] **FIG. 8B** is a block diagram 800-b of a user equipment 115-c in accordance with various embodiments. The user equipment 115-c may have any of various configurations, such as personal computers (e.g., laptop computers, netbook computers, tablet computers, etc.), cellular telephones, PDAs, digital video recorders (DVRs), internet appliances, gaming

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consoles, e-readers, etc. The user equipment 115-c may have an internal power supply (not shown), such as a small battery, to facilitate mobile operation. . In some embodiments, the user equipment 115-c may be the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 9, and/or device 700-a of FIG. 7A and/or device 800-a of FIG. 8A

[0173] The user equipment 115-c may include antennas 840, a transceiver module 850, memory 880, and a processor module 870, which each may be in communication, directly or indirectly, with each other (e.g., via one or more buses). The transceiver module 850 is configured to communicate bi-directionally, via the antennas 840 and/or one or more wired or wireless links, with one or more networks, as described above. For example, the transceiver module 850 may be configured to communicate bi-directionally with base stations 105 of FIG. 1 or 2. The transceiver module 850 may include a modem configured to modulate the packets and provide the modulated packets to the antennas 840 for transmission, and to demodulate packets received from the antennas 840. While the user equipment 115-c may include a single antenna, the user equipment 115-c will typically include multiple antennas 840 for multiple links.

[0174] The memory 880 may include random access memory (RAM) and read-only memory (ROM). The memory 880 may store computer-readable, computer-executable software code 885 containing instructions that are configured to, when executed, cause the processor module 870 to perform various functions described herein (e.g., call processing, database management, message routing, etc.). Alternatively, the software 885 may not be directly executable by the processor module 870 but be configured to cause the computer (e.g., when compiled and executed) to perform functions described herein.

[0175] The processor module 870 may include an intelligent hardware device, e.g., a central processing unit (CPU) such as those made by Intel® Corporation or AMD®, a microcontroller, an application specific integrated circuit (ASIC), etc. The processor module 870 may include a speech encoder (not shown) configured to receive audio via a microphone, convert the audio into packets (e.g., 30 ms in length) representative of the received audio, provide the audio packets to the transceiver module 850, and provide indications of whether a user is speaking. Alternatively, an encoder may only provide packets to the transceiver

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module 850, with the provision or withholding/suppression of the packet itself providing the indication of whether a user is speaking.

[0176] According to the architecture of FIG. 8B, the user equipment 115-c may further include a communications management module 860. The communications management module 860 may manage communications with other user equipment 115. By way of example, the communications management module 860 may be a component of the user equipment 115-c in communication with some or all of the other components of the user equipment 115-c via a bus. Alternatively, functionality of the communications management module 860 may be implemented as a component of the transceiver module 850, as a computer program product, and/or as one or more controller elements of the processor module 870.

[0177] The components for user equipment 115-c may be configured to implement aspects discussed above with respect to device 800-a in FIG. 8A and may not be repeated here for the sake of brevity. For example, the timing advance group module 820-a may be an example of the timing advance group index module 820 of FIG. 8A. The reference downlink component carrier module 825-a may be an example of the reference downlink component carrier module 825 of FIG. 8A. The component carrier identification module 815-a may be an example of the component carrier identification module 815 of FIG. 8A. User equipment 115-c may also include a timing adjustment module 835, whose function has been described above with respect to device 800-a. User equipment 115-c may also include a random access module 845, whose functions have been described above with respect to device 800-a.

[0178] Turning next to **FIG. 9A**, a block diagram illustrates a device 900-a that supports multiple timing advance groups for user equipment in carrier aggregation. In some embodiments, the device 900-a may be the base station 105 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, and/or FIG. 9B. The device 900-a may also be a processor. The device 900-a may include a receiver module 905, a search space module 910, a parallel random access module 915, a timing advance group index generation module 920, a reference downlink component carrier module 925, and/or a transmitter module 930. Each of these components may be in communication with each other.

[0179] These components of the device 900-a may, individually or collectively, be implemented with one or more Application Specific Integrated Circuits (ASICs) adapted to

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perform some or all of the applicable functions in hardware. Alternatively, the functions may be performed by one or more other processing units (or cores), on one or more integrated circuits. In other embodiments, other types of integrated circuits may be used (e.g., Structured/Platform ASICs, Field Programmable Gate Arrays (FPGAs), and other Semi-Custom ICs), which may be programmed in any manner known in the art. The functions of each unit may also be implemented, in whole or in part, with instructions embodied in a memory, formatted to be executed by one or more general or application-specific processors.

[0180] The receiver module 905 may receive information from difference sources over different channels and deliver to other modules of device 900-a. The transmitter module 930 may transmit information it may receive form the other modules of device 900-a.

[0181] Search space module 910 may be utilized to support random access procedures for timing advance groups without a primary component carrier. Search space module 910 may be utilized to generate different search spaces. Some embodiments may utilize a UE-specific search space. Other embodiments may utilize a common search space on the primary component carrier. Additional embodiments may utilize a common search space on a secondary component carrier. Some embodiments may utilize non-contention based random access procedures, while other embodiments may utilize contention based random access procedures.

[0182] The timing advance group index generation module 920 may provide a variety of cross-carrier management functions for multiple timing advance groups is provided. For example, the timing advance group index generation module 920 may generate a timing advance group index. The timing advance group index may identify a timing advance group from multiple timing advance groups. Each group may include different sets of component carriers. The timing advance group index generation module 920 may send the generated timing advance group index to the transmitter module 930, from where the timing advance group index may be transmitted as part of a random access response. Some embodiments may include enabling cross-carrier random access procedure management through the utilization of the timing advance group index.

[0183] In some embodiments, the timing advance index generation group module 920 may generate a timing advance group index for a first timing advance group from the multiple timing advance groups that includes a primary component carrier and a second timing

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advance group includes at least one secondary component carrier. The first timing advance group may also include one or more secondary component carriers, while the second timing advance group does not include a primary component carrier. The timing advance group index generation module 920 may also work with timing advance groups that also include additional timing advance groups besides the first and second timing advance group. The number of timing advance groups associated with timing advance group indexes generated by the timing advance group index generation module 920 may depend upon a variety of factors including, but not limited to, propagation delay characteristics, channel characteristics, user equipment device characteristics, and/or bandwidth characteristics of the component carriers.

[0184] In some embodiments, the timing advance group index generation module 920 may generate timing advance group indexes that utilizes a single bit of information. The transmitter module 930 may transmit these timing advance group indexes as a single bit of information. A first bit configuration of the single bit of information may indicate that the timing advance group includes a primary component carrier; a second bit configuration of the single bit may indicate that the timing advance group one or more secondary component carriers without the primary component carrier. Some embodiments may include timing advance indexes that may utilize additional bits to convey their information. The number of bits that the timing advance group module 920 may utilize may depend upon the number of timing advance groups.

[0185] The timing advance group index may be transmitted by the transmitter module 930 as part of a MAC payload in some embodiments. Some embodiments may also include transmitting through the transmitter module 930 a component carrier identifier as part of a Radio Resource Control (RRC) configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index. The identified component carrier may be utilized for a random access response.

[0186] The parallel random access module 915 may be utilized to perform multiple parallel random access procedures. For example, the parallel random access module 915 may be utilized to perform a first random access procedure associated with a first timing advance group of component carriers. The parallel random access module 915 may be utilized to perform a second random access procedure associated with a second timing advance group of

component carriers where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0187] In some embodiments, the parallel random access module 915 may configure a first subframe that includes a first random access response as part of the first random access procedure. A second subframe including a second random access response may be configured by the parallel random access module 915 as part of the second random access procedure. The first subframe and the second subframe may be transmitted from the parallel random access module 915 through the transmitter module 930. As a result, the first and second random access responses may not be transmitted in the same subframe.

[0188] The reference downlink component carrier module 925 may be utilized to provide timing advance group synchronization information. For example, the reference downlink component carrier module 925 may determine a reference downlink component carrier. Reference downlink component carrier information may be transmitted from transmitter 930 to a user equipment 115 where it may be utilized for timing adjustment within a first timing advance group from multiple timing advance groups. Each timing advance group may include at least one downlink component carrier.

[0189] In some embodiments, the reference downlink component carrier module 925 may determine the reference downlink component carrier such that a second timing advance group includes a primary component carrier. In some embodiments, the reference downlink component carrier module 925 may determine the reference downlink component carrier utilizing a downlink component carrier linked with an uplink component carrier associated with a random access attempt to determine the reference downlink component carrier. The downlink component carrier may be linked with the uplink component carrier through a SIB2 linkage.

[0190] In some embodiments, the reference downlink component carrier module 925 may determine the reference downlink component carrier based on a Radio Resource Control (RRC) configuration of the user equipment. For example, as previously described for carrier aggregation, device 900-a may send RRC configuration message(s) to a user equipment 115 identifying one carrier as the PCC and additional carriers as SCCs. The carrier that is identified as PCC may serve as the reference downlink carrier for one or more timing advance groups. This arrangement is illustrated in FIG. 3B in which the RRC-configured

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PCC (DL-1) for a user equipment 115 serves as the reference carrier for component carriers in each of the two timing advance groups 310-a, 310-b. This RRC-based approach may be advantageous when the activation status of the SCCs (DL-2, DL-3) changes from time to time.

[0191] Device 900-a may be configured for performing random access by a base station in some embodiments. Transmitter module 930 and/or search space module 910 may generate and/or transmit a downlink control message configured to initiate a random access procedure may be transmitted. Receiver module 905 may receive a response to the downlink control message on a physical random access channel (PRACH). Transmitter module 930 and/or search space module 910 may generate and/or transmit an access grant on a primary component carrier (PCC) of a user equipment, wherein the access grant includes information regarding a set of secondary component carriers (SCCs). Transmitter module 930, timing advance group index generation module 920, and/or reference downlink component carrier module 925 may generate and/or transmit timing advance (TA) information applicable to the set of SCCs to complete the random access procedure using a carrier in the set of SCCs.

[0192] Transmitting the downlink control message may include transmitting a physical downlink control channel (PDCCH) message in a UE-specific search space. Transmitting the random access grant may include transmitting a PDCCH message in a common search space of the PCC.

[0193] In some embodiments, transmitter module 930 and/or search space module 910 may further generate and/or transmit a medium access control (MAC) protocol data unit (PDU) with the random access grant. Transmitter module 930 and/or timing advance group index generation module 920 may generate and/or transmit a timing advance (TA) group index corresponding to the set of SCCs with the random access grant.. A configuration of TA groups corresponding to component carriers configured for the UE may be transmitted in some embodiments. The TA group index may be transmitted as part of the MAC PDU. The configuration of TA groups may include at least a first TA group including the PCC, and a second TA group including the set of secondary CCs. Transmitter module 930 and/or reference downlink component carrier module 925 may generate and/or transmit a reference downlink CC for completing the random access procedure based on the TA group index.

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[0194] In some embodiments, the transmitter module 930 and/or the timing advance group index generation module 920 may generate and/or transmit a timing advance (TA) group index corresponding to the set of SCCs as part of a PDCCH payload. In some embodiments, the downlink control message configured to initiate the random access procedure may include an identifier corresponding to the set of SCCs that may be generated and/or transmitted by the transmitter module 930 and/or search space module 910. Receiving the response to the downlink control message at the receiver module 905 may further include receiving the PRACH on an SCC based on the identifier.

[0195] **FIG. 9B** shows a block diagram of a communications system 900-b that may be configured to support multiple timing advancing groups for user equipment. This system 900-b may be an example of aspects of the system 100 depicted in FIG. 1 and/or system 200 of FIG. 2 and/or device 900-a of FIG. 9A, for example. The base station 105-b may include antennas 945, a transceiver module 950, memory 970, and a processor module 965, which each may be in communication, directly or indirectly, with each other (e.g., over one or more buses). The transceiver module 950 may be configured to communicate bi-directionally, via the antennas 945, with the user equipment 115-d. The transceiver module 950 (and/or other components of the base station 105-b) may also be configured to communicate bi-directionally with one or more networks. In some cases, the base station 105-b may communicate with the network 125-a and/or controller 120-a through network communications module 975. Base station 105-b may be an example of a eNodeB base station, a Home eNodeB base station, a NodeB base station, and/or a Home NodeB base station.

[0196] The memory 970 may include random access memory (RAM) and read-only memory (ROM). The memory 970 may also store computer-readable, computer-executable software code 971 containing instructions that are configured to, when executed, cause the processor module 965 to perform various functions described herein (e.g., call processing, database management, message routing, etc.). Alternatively, the software 971 may not be directly executable by the processor module 965 but be configured to cause the computer, e.g., when compiled and executed, to perform functions described herein.

[0197] The processor module 965 may include an intelligent hardware device, e.g., a central processing unit (CPU) such as those made by Intel® Corporation or AMD®, a

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microcontroller, an application specific integrated circuit (ASIC), etc. The processor module 965 may include a speech encoder (not shown) configured to receive audio via a microphone, convert the audio into packets (e.g., 30 ms in length) representative of the received audio, provide the audio packets to the transceiver module 950, and provide indications of whether a user is speaking. Alternatively, an encoder may only provide packets to the transceiver module 950, with the provision or withholding/suppression of the packet itself providing the indication of whether a user is speaking.

[0198] The transceiver module 950 may include a modem configured to modulate the packets and provide the modulated packets to the antennas 945 for transmission, and to demodulate packets received from the antennas 945. While some examples of the base station 105-b may include a single antenna 945, the base station 105-b preferably includes multiple antennas 945 for multiple links which may support carrier aggregation. For example, one or more links may be used to support macro communications with user equipment 115-d.

[0199] According to the architecture of FIG. 9B, the base station 105-b may further include a communications management module 930. The communications management module 930 may manage communications with other base station 105. By way of example, the communications management module 930 may be a component of the base station 105-b in communication with some or all of the other components of the base station 105-b via a bus. Alternatively, functionality of the communications management module 930 may be implemented as a component of the transceiver module 950, as a computer program product, and/or as one or more controller elements of the processor module 965.

[0200] The components for user equipment base station 105-b may be configured to implement aspects discussed above with respect to device 900-a in FIG. 9A and may not be repeated here for the sake of brevity. For example, the timing advance group index generation module 920-a may be an example of the timing advance group index module 920 of FIG. 9. The reference downlink component carrier module 925-a may be an example of the reference downlink component carrier module 925 of FIG. 9. Parallel random access module 915-a may be an example of the parallel random access module 915 of FIG. 9. UESS search space module 911, CSS on PCC search space module 912, and/or CSS on SCC search

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space module 913 may provide specific functionality individually or in combination for a search space module 910-a that may be an example of search space module 910 of FIG. 9.

[0201] Turning to **FIG. 10A**, a flow diagram of a method 1000-a for providing cross-carrier management for multiple timing advance groups is provided. Method 1000-a may be implemented various devices including, but not limited to, the base stations 105 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 9B, and/or device 900-a of FIG. 9A.

[0202] At block 1005, a timing advance group index may be generated. The timing advance group index may identify a timing advance group from multiple timing advance groups. Each group may include different sets of component carriers. At block 1010, the timing advance group index may be transmitted as part of a random access procedure.

[0203] In some embodiments, a first timing advance group from the multiple timing advance groups includes a primary component carrier and a second timing advance group includes at least one secondary component carrier. The first timing advance group may also include one or more secondary component carriers, while the second timing advance group does not include a primary component carrier. Some embodiments may also include additional timing advance groups besides the first and second timing advance group. The number of timing advance groups may depend upon a variety of factors including, but not limited, propagation delay characteristics, channel characteristics, user equipment device characteristics, and/or bandwidth characteristics of the component carriers.

[0204] In some embodiments, the timing advance group index is transmitted as a single bit of information. A first bit configuration of the single bit of information may indicate that the timing advance group includes a primary component carrier; a second bit configuration of the single bit may indicate that the timing advance group one or more secondary component carriers without the primary component carrier. Some embodiments may include timing advance indexes that may utilize additional bits to convey their information. The number of bits may depend upon the number of timing advance groups.

[0205] The timing advance group index may be transmitted as part of a MAC payload in some embodiments. The timing advance group index may be transmitted as part of a PDCCH payload. Some embodiments may also include transmitting a component carrier

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identifier as part of an RRC configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index. The identified component carrier may be utilized for a random access attempt.

[0206] Some embodiments may enable cross-carrier random access response procedure management through the utilization of the timing advance group index. Some embodiments may enable cross-carrier PDCCH order through the utilization of the timing advance group index.

[0207] Turning to **FIG. 10B**, a flow diagram of a method 1000-b for providing cross-carrier management for multiple timing advance groups is provided. Method 1000-b may be implemented on various devices including, but not limited to, the base stations 105 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 9B, and/or device 900-a of FIG. 9A. Method 1000-b may be an example or utilize aspects of method 1000-a of FIG. 10A.

[0208] At block 1005-a, a timing advance group index may be generated that includes a single bit. The timing advance group index may identify a timing advance group from multiple timing advance groups. Each group may include different sets of component carriers. At block 1010-a, the timing advance group index may be transmitted as part of a random access response. At block 1015, a component carrier identifier may be transmitted as part of an RRC. At block 1020, cross-carrier random access procedure management may be enabled through the utilization of the timing advance group index and the component carrier identifier.

[0209] Turning to **FIG. 11A**, a flow diagram of a method 1100-a for providing cross-carrier management for multiple timing advance groups is provided. Method 1100-a may be implemented on various devices including, but not limited to, the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 8B, FIG. 9B, and/or device 700-a of FIG. 7A and/or device 800-a of FIG. 8A.

[0210] At block 1105, a timing advance group index may be received as part of a random access procedure. At block 1110, the timing advance group index may be utilized to determine a timing advance group for transmitting data. Some embodiments may further include utilizing the timing advance group index to enable cross-carrier random access procedure management. Some embodiments may further include utilizing the timing advance

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group index to enable cross-carrier PDCCH order management. Some embodiments may further include receiving a component carrier identifier as part of an RRC configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index. In some embodiments, the RRC configuration may be used to identify a DL component carrier which will serve as a timing reference for component carriers in multiple timing advance groups. For instance, a user equipment may utilize its RRC-configured primary component carrier as the timing reference for the component carriers in multiple timing advance groups as discussed in connection with FIG. 3B, or it may use another component carrier which is determined based on the RRC configuration for this purpose. Determining a DL reference carrier for multiple TA groups based on RRC configuration can improve the base station's flexibility to activate/deactivate secondary component carriers. Alternatively, the timing reference may be determine based on a SIB2 linkage as previously discussed.

[0211] Turning to **FIG. 11B**, a flow diagram of a method 1100-b for providing cross-carrier management for multiple timing advance groups is provided. Method 1100-b may be implemented on various devices including, but not limited to, the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 7B, FIG. 9B, and/or device 700-a of FIG. 7A and/or device 800-a of FIG. 8B. Method 1100-b may be an example of or utilize aspects of method 1100-a of FIG. 11A.

[0212] At block 1105-a, a timing advance group index may be received as part of a random access response. At block 1110-b, the timing advance group index may be utilized to determine a timing advance group for transmitting data. At block 1115, a component carrier identifier may be received as part of an RRC configuration to identify a component carrier within a timing advance group associated with a specific timing advance group index, wherein the identified component carrier is utilized for a random access response. At block 1120, the timing advance group index and the component carrier identifier may be utilized to enable cross-carrier random access procedure management.

[0213] Turning to **FIG. 12A**, a flow diagram of a method 1200-a for performing multiple parallel random access procedures is provided. Method 1200-a may be implemented on systems and/or devices including, but not limited to, the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 8B, FIG. 9B, and/or device

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700-a of FIG. 7A and/or device 800-a of FIG. 8A. In some embodiments, method 1200-a may be implemented on systems and/or devices including, but not limited to, base stations 105 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 9B, and/or device 900-a of FIG. 9B.

[0214] At block 1205, a first random access procedure associated with a first timing advance group of component carriers may be performed. At block 1210, a second random access procedure associated with a second timing advance group of component carriers may be performed where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0215] Some embodiments of method 1200-a may include performing a power prioritization with respect to the first random access procedure and the second random access procedure. Performing the power prioritization may include performing an equal power scaling with respect to the first random access procedure and the second random access procedure. In some embodiments, performing the power prioritization may include transmitting a first random access attempt with respect to the first timing advance group of component carriers prior to transmitting a second random access attempt with respect to the second timing advance group of component carriers, where the first timing advance group of component carriers includes a primary component carrier.

[0216] In some embodiments, the first random access procedure may include a non-contention-based random access procedure and the second random access procedure may include a contention based random access procedure. Performing the power prioritization in this case may include transmitting a first random access attempt with respect to the first timing advance group of component carriers prior to transmitting a second random access attempt with respect to the second timing advance group of component carriers.

[0217] Method 1200-a may further include configuring a first subframe that includes a first random access response as part of the first random access procedure. A second subframe including a second random access response may be configured as part of the second random access procedure. The first subframe and the second subframe may be transmitted. As a result, the first and second random access responses may not be transmitted in the same subframe. Some embodiments may include triggering an aperiodic channel quality indicator (A-CQI).

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[0218] Turning to **FIG. 12B**, a flow diagram of a method 1200-b of performing multiple parallel random access procedures is provided. Method 1200-b may be implemented on systems and/or devices including, but not limited to, the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 8B, FIG. 9B, and/or device 700-a of FIG. 7A and/or device 800-a of FIG. 8A. In some embodiments, method 1200-b may be implemented on systems and/or devices including, but not limited to, base stations 105 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 9B, and/or device 900-a of FIG. 9B. Method 1200-b may be an example of or utilize aspects of method 1200-a of FIG. 12A.

[0219] At block 1205-a, a first random access procedure associated with a first timing advance group of component carriers may be performed. At block 1210-a, a second random access procedure associated with a second timing advance group of component carriers may be performed where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure. At block 1215, an equal power scaling may be performed with respect to the first random access procedure and the second random access procedure.

[0220] **FIG. 13** shows a flowchart of a method 1300 for utilizing timing advance group synchronization information. Method 1300 may be implemented on systems and/or devices including, but not limited to, the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 8B, FIG. 9B, and/or device 700-a of FIG. 7A and/or device 800-a of FIG. 8A. In some embodiments, method 1300 may be implemented on systems and/or devices including, but not limited to, base stations 105 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 9B, and/or device 900-a of FIG. 9A.

[0221] At block 1305, a reference downlink component carrier may be determined. At block 1310, the reference downlink component carrier may be utilized for timing adjustment within a first timing advance group from multiple timing advance groups. Each timing advance group may include at least one downlink component carrier.

[0222] In some embodiments, a second timing advance group includes a primary component carrier. In some embodiments, determining the reference downlink component carrier includes utilizing a downlink component carrier linked with an uplink component carrier associated with a random access attempt to determine the reference downlink

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component carrier. The downlink component carrier may be linked with the uplink component carrier through a SIB2 linkage.

[0161] In some embodiments, determining the reference downlink component carrier may include determining the reference downlink component carrier from an RRC configuration. In some aspects, multiple timing advance groups may share a common reference downlink component carrier. The common reference may be the UE-specific primary component carrier. When more than one downlink carrier is designated as a PCC for a particular UE, there may be a many-to-one relationship between timing advance groups and each RRC-configured PCC. For instance, different PCCs may serve as reference carriers for different timing advance groups as determined by base station 105 based on channel and interference conditions experienced by the UE, system loading considerations of the component carriers, scheduling requirements, etc.

[0223] Turning to **FIG. 14**, a flow diagram of a method 1400 for performing random access by a multi-carrier UE is provided. Method 1400 may be implemented on various devices including, but not limited to, the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 8B, FIG. 9B, and/or device 700-a of FIG. 7A and/or device 800-a of FIG. 8A.

[0224] At block 1405, a downlink control message configured to initiate a random access procedure is received by the UE. For example, the downlink control message may include a message 0 transmission as previously discussed. At block 1410, the UE transmits a response to the downlink control message on a PRACH. The CC for transmitting the PRACH may be determined based on an indicator carried with the message 0 transmission and/or based on an association with the CC on which the message 0 was received. At block 1415, the UE receives an access grant on PCC. At block 1420, the UE determines a set of SCCs based on the random access grant. The random access grant may enable cross-carrier RAR and the UE may determine the set of SCC based on information in the RAR message or corresponding PDCCH payload. At block 1425, the UE may complete the random access procedure using a carrier in the set of SCCs to obtain TA information applicable to the set of SCCs.

[0225] Receiving the downlink control message may include detecting a PDCCH message in a UE-specific search space. Receiving the random access grant may include detecting a PDCCH message in a common search space of the PCC.

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[0226] In some embodiments, the method 1400 may further include obtaining a MAC protocol data unit with the random access grant. A TA group index may be determined corresponding to the set of SCCs based on the MAC PDU. Some embodiments may further include receiving a configuration of TA groups corresponding to component carriers configured for the UE. The configuration of TA groups may include at least a first TA group including the PCC, and a second TA group including only SCCs in a set of secondary CCs. Some embodiments may further include determining a reference downlink CC for completing the random access procedure based on the TA group index. In some embodiments, the method 1400 may further include determining a TA group index corresponding to the set of SCCs as part of a PDCCH payload.

[0227] In some embodiments, the downlink control message may be configured to initiate the random access procedure comprises an identifier corresponding to the set of SCCs. Transmitting the response to the downlink control message further include determining an SCC to transmit the PRACH based on the identifier.

[0228] In some embodiments, method 1400 may further include initiating a second random access procedure concurrently with the first random access procedure. Some embodiments may further include determining a priority for allocating power between the first random access procedure and the second random access procedure. Some embodiments may further include allocating power to the first random access procedure at a higher priority than the second random access procedure when the first random access procedure comprises a contention-free random access procedure and the second random access procedure comprises a contention-based random access procedure. Some embodiments may further include allocating power to the second random access procedure at a higher priority than the first random access procedure when the second random access procedure when the second random access procedure is performed in relation to a group of carriers comprising a primary component carrier of the UE. Determining the priority may include performing an equal power scaling for each CC.

[0229] Turning to **FIG. 15**, a flow diagram of a method 1500 for performing random access by a base station is provided. Method 1500 may be implemented on various devices including, but not limited to, the base stations 105 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 9B, and/or device 900-a of FIG. 9A.

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[0230] At block 1505, a downlink control message configured to initiate a random access procedure may be transmitted. At block 1510, a response to the downlink control message may be received on a PRACH. At block 1515, an access grant may be transmitted on a PCC of a user equipment, wherein the access grant includes information regarding a set of SCCs. At block 1520, TA information applicable to the set of SCCs may be transmitted to complete the random access procedure using a carrier in the set of SCCs.

[0231] Transmitting the downlink control message may include transmitting a PDCCH message in a UE-specific search space. Transmitting the random access grant may include transmitting a PDCCH message in a common search space of the PCC.

[0232] In some embodiments, method 1500 may further include transmitting a medium access control (MAC) protocol data unit (PDU) with the random access grant. A TA group index corresponding to the set of SCCs with the random access grant may be transmitted. A configuration of TA groups corresponding to component carriers configured for the UE may be transmitted. The TA group index may be transmitted as part of the MAC PDU. The configuration of TA groups may include at least a first TA group including the PCC, and a second TA group including the set of secondary CCs. A reference downlink CC may be transmitted for completing the random access procedure based on the TA group index.

[0233] In some embodiments, method 1500 may further include transmitting a TA group index corresponding to the set of SCCs as part of a PDCCH payload. In some embodiments, the downlink control message configured to initiate the random access procedure may include an identifier corresponding to the set of SCCs. Receiving the response to the downlink control message may further include receiving the PRACH on an SCC based on the identifier.

[0234] Turning to **FIG. 16**, a flow diagram of a method 1600 for utilizing timing advance group synchronization information in accordance with various embodiments. Method 1600 may be implemented on various devices including, but not limited to, the user equipment 115 described with reference to FIG. 1, FIG. 2, FIG. 4A, FIG. 4B, 4C, FIG. 7B, FIG. 8B, FIG. 9B, and/or device 700-a of FIG. 7A and/or device 800-a of FIG. 8A.

[0235] At block 1605, multiple component carriers as part of a carrier aggregation operation may be identified. The multiple component carriers may include one or more

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downlink component carriers and two or more uplink component carriers. At block 1610, multiple timing advance groups may be determined. Each component carrier in the multiple component carriers may be included in one of the timing advance groups. At block 1615, a first timing advance group from the multiple timing advance groups may be identified. At block 1620, a reference downlink component carrier may be determined for the first timing advance group based at least in part on an RRC configuration. At block 1625, the determined reference downlink component carrier may be utilized for timing adjustment within at least the first timing advance group.

[0236] In some embodiments, the method further includes receiving an indication of a primary downlink component carrier through the RRC configuration. The primary downlink component carrier may be the determined reference downlink component carrier.

[0237] Some embodiments include utilizing the primary downlink component carrier for timing adjustment within a second timing advance group from the multiple timing advance groups. The primary downlink component carrier may be included in the second timing advance group.

[0238] One or more downlink component carriers of the one or more identified downlink carriers may be included in the first timing advance group. Determining the reference downlink component carrier may be based on an RRC configuration for the one or more downlink component carriers in the first timing advance group. The reference downlink component carrier for the first timing advance group may be determined to be a downlink component carrier with a smallest cell index of multiple cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

[0239] The reference downlink component carrier may be determined from a set of activated downlink component carriers. The one or more downlink component carriers and the two or more uplink component carriers may be associated with two or more bands. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers of the same band or similar band. As an example, the reference downlink component carrier may be determined to be a downlink component carrier of the same or similar band as an uplink component carrier associated with a random access attempt for the first timing advance group. .

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[0240] Some embodiments include performing multiple random access procedures in parallel with respect to two or more of the multiple timing advance groups. Performing the multiple random access procedures may include performing a first random access procedure linked with the first timing advance group; and/or performing a second random access procedure linked with a second timing advance group of the multiple timing advance groups, where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

[0241] Some embodiments include initiating a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast. A cross-carrier indication field may be included in the downlink control channel to enable cross-carrier scheduling.

[0242] The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a similar delay due to downlink repeaters. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a same carrier type where the carrier type includes at least a legacy carrier type or a new carrier type. The reference downlink component carrier for the first timing advance group may be determined from a set of downlink component carriers with a similar activity factor.

[0243] Method 1600 may take into account different characteristics of a component carrier (e.g., whether it is equipped with a repeater, whether it is always on or periodically turned off, whether it is a new or legacy carrier type, etc.) in determining the reference downlink component carrier. A component carrier may be equipped with a repeater while another component carrier is not. In determining the reference downlink component carrier for a given timing advance group, the component carriers of the same or similar delay characteristics due to repeaters (either downlink repeaters, or uplink repeaters, or a combination thereof) may be determined to be possible candidates for the reference downlink component carrier for the given timing advance group. Different component carriers may have different activity factors. A component carrier may periodically be turned on and carries much less frequent downlink information compared with a regular carrier. It may

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then be preferable to avoid using this component carrier as the reference downlink component carrier. A component carrier may be of a legacy carrier type and another can be of a new carrier type. Carriers of the same type may be determined to be possible candidates for the reference downlink component carrier for a given timing advance group.

[0244] The detailed description set forth above in connection with the appended drawings describes exemplary embodiments and does not represent the only embodiments that may be implemented or that are within the scope of the claims. The term "exemplary" used throughout this description means "serving as an example, instance, or illustration," and not "preferred" or "advantageous over other embodiments." The detailed description includes specific details for the purpose of providing an understanding of the described techniques. These techniques, however, may be practiced without these specific details. In some instances, well-known structures and devices are shown in block diagram form in order to avoid obscuring the concepts of the described embodiments.

[0245] Information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0246] The various illustrative blocks and modules described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0247] The functions described herein may be implemented in hardware, software executed by a processor, firmware, or any combination thereof. If implemented in software executed

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by a processor, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Other examples and implementations are within the scope and spirit of the disclosure and appended claims. For example, due to the nature of software, functions described above can be implemented using software executed by a processor, hardware, firmware, hardwiring, or combinations of any of these. Features implementing functions may also be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations. Also, as used herein, including in the claims, "or" as used in a list of items prefaced by "at least one of" indicates a disjunctive list such that, for example, a list of "at least one of A, B, or C" means A or B or C or AB or AC or BC or ABC (i.e., A and B and C).

[0248] Computer-readable media includes computer storage media. A storage medium may be any available medium that can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code means in the form of instructions or data structures and that can be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor. Disk and disc, as used herein, include compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above are also included within the scope of computer-readable storage media.

[0249] The previous description of the disclosure is provided to enable a person skilled in the art to make or use the disclosure. Various modifications to the disclosure will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other variations without departing from the spirit or scope of the disclosure. Throughout this disclosure the term "example" or "exemplary" indicates an example or instance and does not imply or require any preference for the noted example. Thus, the disclosure is not to be limited to the examples and designs described herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

[0250] WHAT IS CLAIMED IS:

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CLAIMS

1. A method for utilizing timing advance group synchronization information, the method comprising:

identifying a plurality of component carriers as part of a carrier aggregation operation, the plurality of component carriers comprising one or more downlink component carriers and two or more uplink component carriers;

determining a plurality of timing advance groups, wherein each component carrier in the plurality of component carriers is included in one of the timing advance groups;

identifying a first timing advance group from the plurality of timing advance groups;

determining a reference downlink component carrier for the first timing advance group based at least in part on a Radio Resource Control (RRC) configuration; and

utilizing the determined reference downlink component carrier for timing adjustment within at least the first timing advance group.

2. The method of claim 1, further comprising:

receiving an indication of a primary downlink component carrier through the RRC configuration.

3. The method of claim 2, wherein the primary downlink component carrier is the determined reference downlink component carrier.

4. The method of claim 2, further comprising:

utilizing the primary downlink component carrier for timing adjustment within a second timing advance group from the plurality of timing advance groups, wherein the primary downlink component carrier is included in the second timing advance group.

5. The method of claim 1, wherein:

one or more downlink component carriers of the one or more identified downlink carriers are included in the first timing advance group; and

determining the reference downlink component carrier is based on an RRC configuration for the one or more downlink component carriers in the first timing advance group.

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6. The method of claim 5, wherein the reference downlink component carrier for the first timing advance group is determined to be a downlink component carrier with a smallest cell index of a plurality of cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

7. The method of claim 1, wherein the reference downlink component carrier is determined from a set of activated downlink component carriers.

8. The method of claim 1, wherein the one or more downlink component carriers and the two or more uplink component carriers are associated with two or more bands.

9. The method of claim 8, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers of at least a same band or a similar band as an uplink component carrier associated with a random access attempt for the first timing advance group.

10. The method of claim 1, further comprising:

performing a plurality of random access procedures in parallel with respect to two or more of the plurality of timing advance groups.

11. The method of claim 10, wherein performing the plurality of random access procedures comprises:

performing a first random access procedure linked with the first timing advance group; and

performing a second random access procedure linked with a second timing advance group of the plurality of timing advance groups, wherein one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

12. The method of claim 1, further comprising:

initiating a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast.

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13. The method of claim 12, wherein a cross-carrier indication field is included in the downlink control channel to enable cross-carrier scheduling.

14. The method of claim 1, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar delay due to downlink repeaters.

15. The method of claim 1, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a same carrier type, wherein the carrier type includes at least a legacy carrier type or a new carrier type.

16. The method of claim 1, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar activity factor.

17. A wireless communications system configured for utilizing timing advance group synchronization information, the system comprising:

means for identifying a plurality of component carriers as part of a carrier aggregation operation, the plurality of component carriers comprising one or more downlink component carriers and two or more uplink component carriers;

means for determining a plurality of timing advance groups, wherein each component carrier in the plurality of component carriers is included in one of the timing advance groups;

means for identifying a first timing advance group from the plurality of timing advance groups;

means for determining a reference downlink component carrier for the first timing advance group based at least in part on a Radio Resource Control (RRC) configuration; and

means for utilizing the determined reference downlink component carrier for timing adjustment within at least the first timing advance group.

18. The wireless communications system of claim 17, further comprising:

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means for receiving an indication of a primary downlink component carrier through the RRC configuration.

19. The wireless communications system of claim 18, wherein the primary downlink component carrier is the determined reference downlink component carrier.

20. The wireless communications system of claim 18, further comprising:

means for utilizing the primary downlink component carrier for timing adjustment within a second timing advance group from the plurality of timing advance groups, wherein the primary downlink component carrier is included in the second timing advance group.

21. The wireless communications system of claim 17, wherein:

one or more downlink component carriers of the one or more identified downlink carriers are included in the first timing advance group; and

determining the reference downlink component carrier is based on an RRC configuration for the one or more downlink component carriers in the first timing advance group.

22. The wireless communications system of claim 21, wherein the reference downlink component carrier for the first timing advance group is determined to be a downlink component carrier with a smallest cell index of a plurality of cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

23. The wireless communications system of claim 17, wherein the reference downlink component carrier is determined from a set of activated downlink component carriers.

24. The wireless communications system of claim 17, wherein the one or more downlink component carriers and the two or more uplink component carriers are associated with two or more bands.

25. The wireless communications system of claim 24, wherein the reference downlink component carrier for the first timing advance group is determined from a

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set of downlink component carriers of at least a same band or a similar band as an uplink component carrier associated with a random access attempt for the first timing advance group.

26. The wireless communications system of claim 17, further comprising:

means for performing a plurality of random access procedures in parallel with respect to two or more of the plurality of timing advance groups.

27. The wireless communications system of claim 26, wherein the means for performing the plurality of random access procedures comprises:

means for performing a first random access procedure linked with the first timing advance group; and

means for performing a second random access procedure linked with a second timing advance group of the plurality of timing advance groups, wherein one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

28. The wireless communications system of claim 17, further comprising:

means for initiating a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast.

29. The wireless communications system of claim 28, wherein a cross-carrier indication field is included in the downlink control channel to enable cross-carrier scheduling.

30. The wireless communications system of claim 17, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar delay due to downlink repeaters.

31. The wireless communications system of claim 17, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a same carrier type, wherein the carrier type includes at least a legacy carrier type or a new carrier type.

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32. The wireless communications system of claim 17, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar activity factor.

33. A computer program product for utilizing timing advance group synchronization information comprising:

a computer-readable storage medium comprising:

code for identifying a plurality of component carriers as part of a carrier aggregation operation, the plurality of component carriers comprising one or more downlink component carriers and two or more uplink component carriers;

code for determining a plurality of timing advance groups, wherein each component carrier in the plurality of component carriers is included in one of the timing advance groups;

code for identifying a first timing advance group from the plurality of timing advance groups;

code for determining a reference downlink component carrier for the first timing advance group based at least in part on a Radio Resource Control (RRC) configuration; and

code for utilizing the determined reference downlink component carrier for timing adjustment within at least the first timing advance group.

34. The computer program product of claim 33, wherein the computer-readable storage medium further comprising:

code for receiving an indication of a primary downlink component carrier through the RRC configuration.

35. The computer program product of claim 34, wherein the primary downlink component carrier is the determined reference downlink component carrier.

36. The computer program product of claim 34, wherein the computer-readable storage medium further comprising:

code for utilizing the primary downlink component carrier for timing adjustment within a second timing advance group from the plurality of timing advance

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groups, wherein the primary downlink component carrier is included in the second timing advance group.

37. The computer program product of claim 33, wherein:

one or more downlink component carriers of the one or more identified downlink carriers are included in the first timing advance group; and

determining the reference downlink component carrier is based on an RRC configuration for the one or more downlink component carriers in the first timing advance group.

38. The computer program product of claim 37, wherein the reference downlink component carrier for the first timing advance group is determined to be a downlink component carrier with a smallest cell index of a plurality of cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

39. The computer program product of claim 33, wherein the reference downlink component carrier is determined from a set of activated downlink component carriers.

40. The computer program product of claim 33, wherein the one or more downlink component carriers and the two or more uplink component carriers are associated with two or more bands.

41. The computer program product of claim 40, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers of at least a same band or a similar band as an uplink component carrier associated with a random access attempt for the first timing advance group.

42. The computer program product of claim 33, wherein the computer-readable storage medium further comprising:

code for performing a plurality of random access procedures in parallel with respect to two or more of the plurality of timing advance groups.

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43. The computer program product of claim 42, wherein the code for performing the plurality of random access procedures comprises:

code for performing a first random access procedure linked with the first timing advance group; and

code for performing a second random access procedure linked with a second timing advance group of the plurality of timing advance groups, wherein one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

44. The computer program product of claim 33, wherein the computer-readable storage medium further comprising:

code for initiating a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast.

45. The computer program product of claim 43, wherein a cross-carrier indication field is included in the downlink control channel to enable cross-carrier scheduling.

46. The computer program product of claim 33, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar delay due to downlink repeaters.

47. The computer program product of claim 33, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a same carrier type, wherein the carrier type includes at least a legacy carrier type or a new carrier type.

48. The computer program product of claim 33, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar activity factor.

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49. A wireless communications device configured utilizing timing advance group synchronization information, the device comprising:

at least one processor configured to:

identify a plurality of component carriers as part of a carrier aggregation operation, the plurality of component carriers comprising one or more downlink component carriers and two or more uplink component carriers;

determine a plurality of timing advance groups, wherein each component carrier in the plurality of component carriers is included in one of the timing advance groups;

identify a first timing advance group from the plurality of timing advance groups;

determine a reference downlink component carrier for the first timing advance group based at least in part on a Radio Resource Control (RRC) configuration; and

utilize the determined reference downlink component carrier for timing adjustment within at least the first timing advance group; and

at least one memory coupled with the at least one processor.

50. The wireless communications device of claim 49, wherein the at least one processor is further configured to:

receive an indication of a primary downlink component carrier through the RRC configuration.

51. The wireless communications device of claim 50, wherein the primary downlink component carrier is the determined reference downlink component carrier.

52. The wireless communications device of claim 50, wherein the at least one processor is further configured to:

utilize the primary downlink component carrier for timing adjustment within a second timing advance group from the plurality of timing advance groups, wherein the primary downlink component carrier is included in the second timing advance group.

53. The wireless communications device of claim 49, wherein:

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one or more downlink component carriers of the one or more identified downlink carriers are included in the first timing advance group; and

determining the reference downlink component carrier is based on an RRC configuration for the one or more downlink component carriers in the first timing advance group.

54. The wireless communications device of claim 53, wherein the reference downlink component carrier for the first timing advance group is determined to be a downlink component carrier with a smallest cell index of a plurality of cell indices configured for each one of the one or more downlink component carriers in the first timing advance group.

55. The wireless communications device of claim 49, wherein the reference downlink component carrier is determined from a set of activated downlink component carriers.

56. The wireless communications device of claim 49, wherein the one or more downlink component carriers and the two or more uplink component carriers are associated with two or more bands.

57. The wireless communications device of claim 56, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers of at least a same band or a similar band as an uplink component carrier associated with a random access attempt for the first timing advance group.

58. The wireless communications system of claim 49, wherein the at least one processor is further configured to:

perform a plurality of random access procedures in parallel with respect to two or more of the plurality of timing advance groups.

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59. The wireless communications device of claim 58, wherein the at least one processor configured to perform the plurality of random access procedures is configured to:

perform a first random access procedure linked with the first timing advance group; and

perform a second random access procedure linked with a second timing advance group of the plurality of timing advance groups, wherein one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure.

60. The wireless communications device of claim 49, wherein the at least one processor is further configured to:

initiate a non-contention based random access procedure on an uplink component carrier within the first timing advance group through utilizing a downlink control channel transmitted on a downlink component carrier that is not linked with the uplink component carrier via a system information block broadcast.

61. The wireless communications device of claim 60, wherein a cross-carrier indication field is included in the downlink control channel to enable cross-carrier scheduling.

62. The wireless communications device of claim 49, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar delay due to downlink repeaters.

63. The wireless communications device of claim 49, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a same carrier type, wherein the carrier type includes at least a legacy carrier type or a new carrier type.

64. The wireless communications device of claim 49, wherein the reference downlink component carrier for the first timing advance group is determined from a set of downlink component carriers with a similar activity factor.

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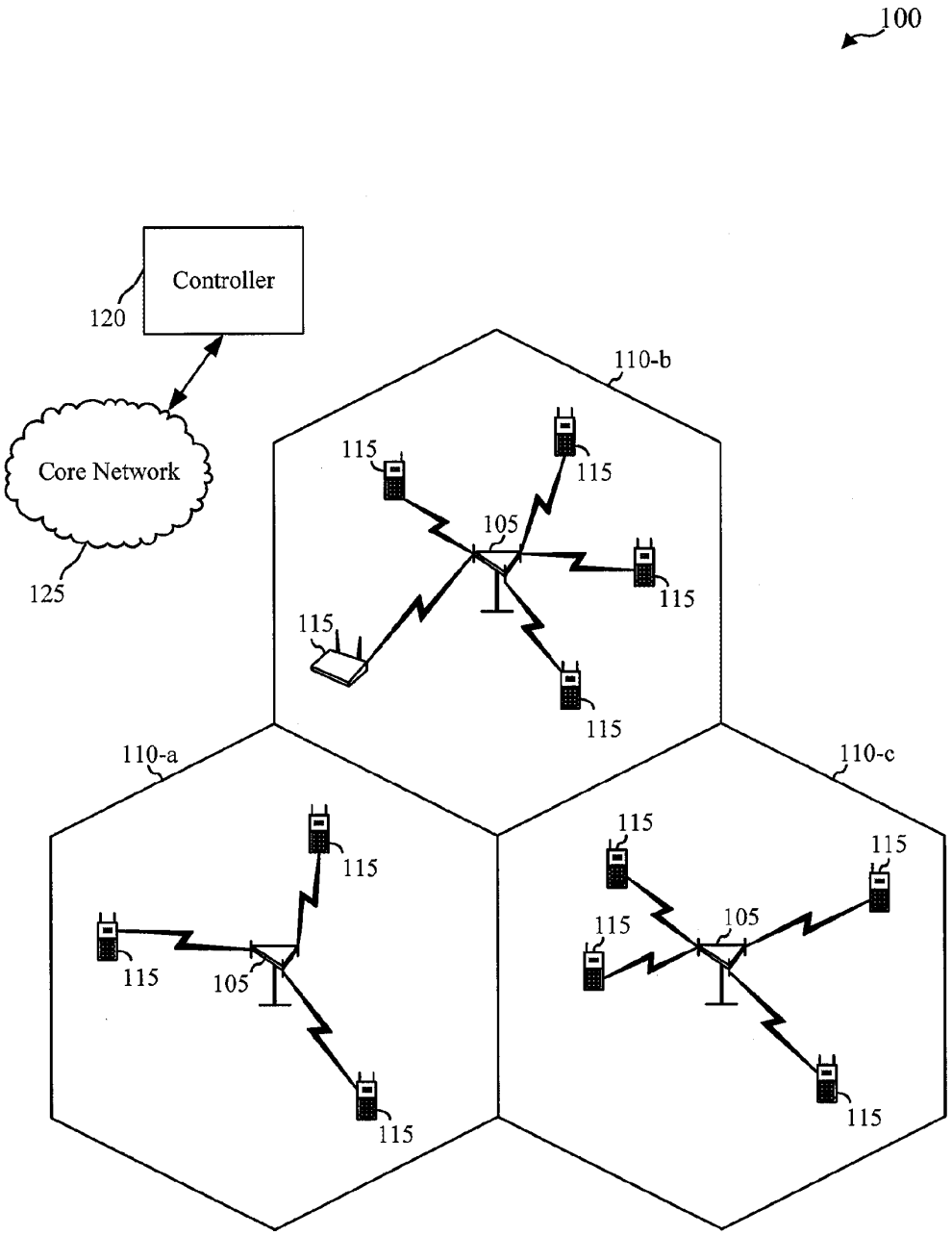


FIG. 1

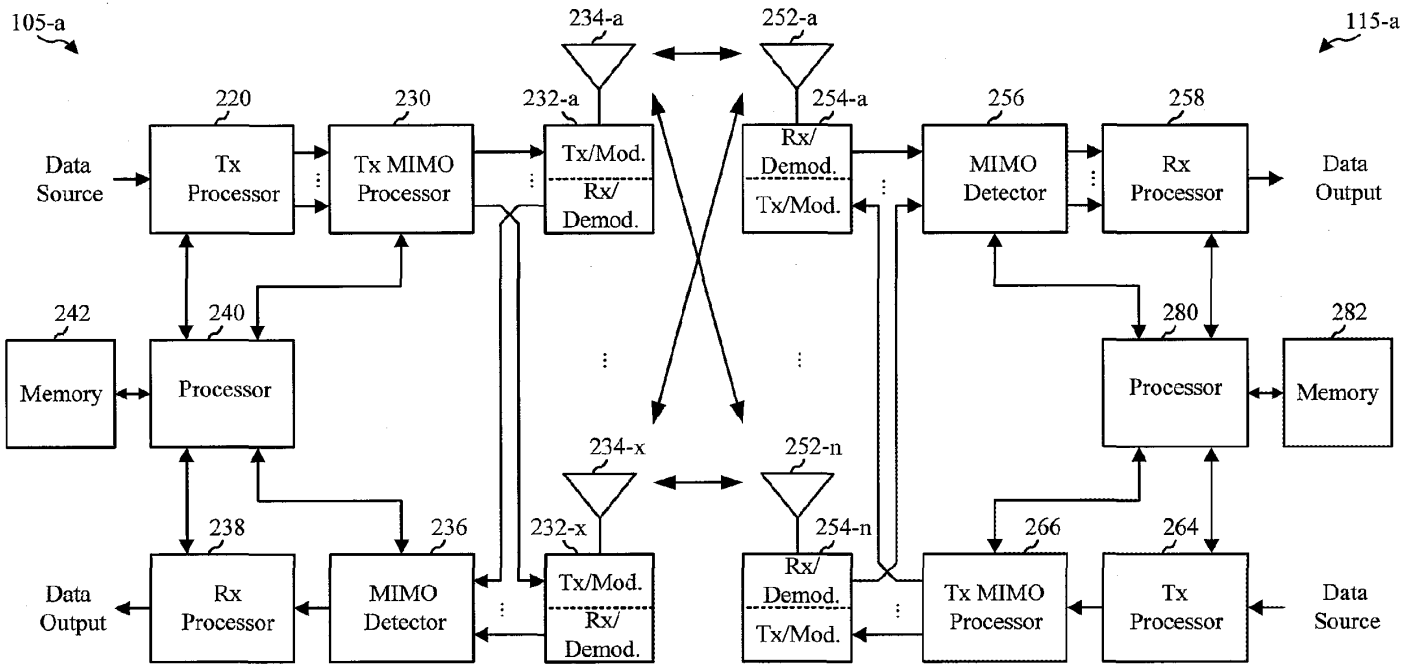


FIG. 2

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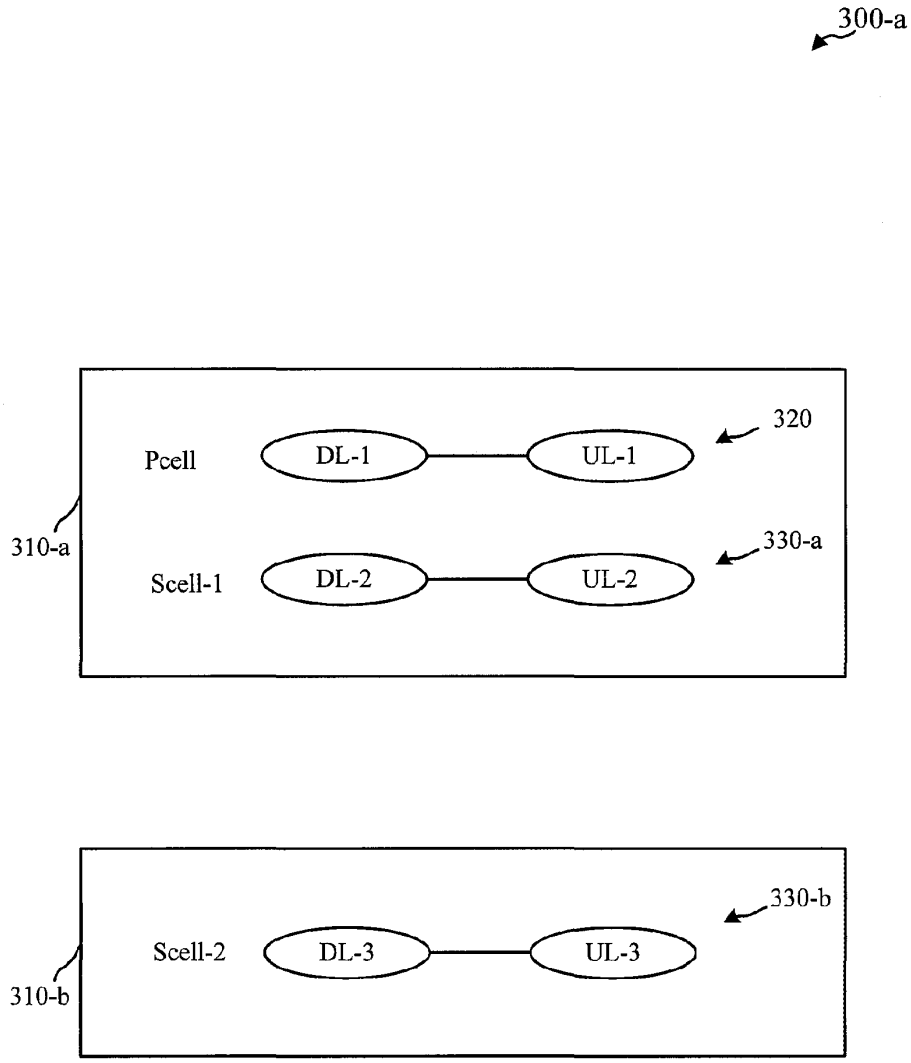

300-a
320
Pcell
DL-1
UL-1
310-a
330-a
Scell-1
DL-2
UL-2
330-b
Scell-2
DL-3
UL-3
310-b

FIG. 3A

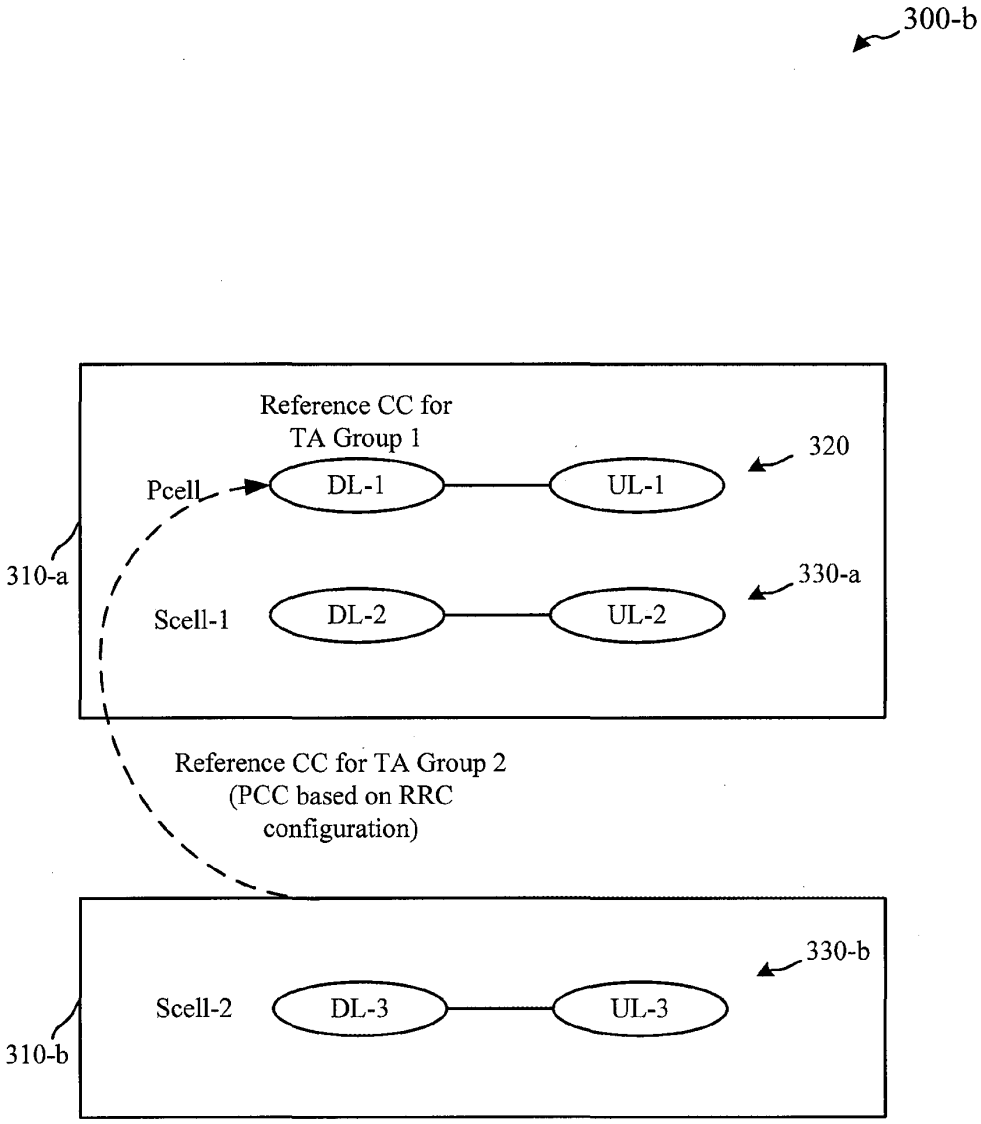


FIG. 3B

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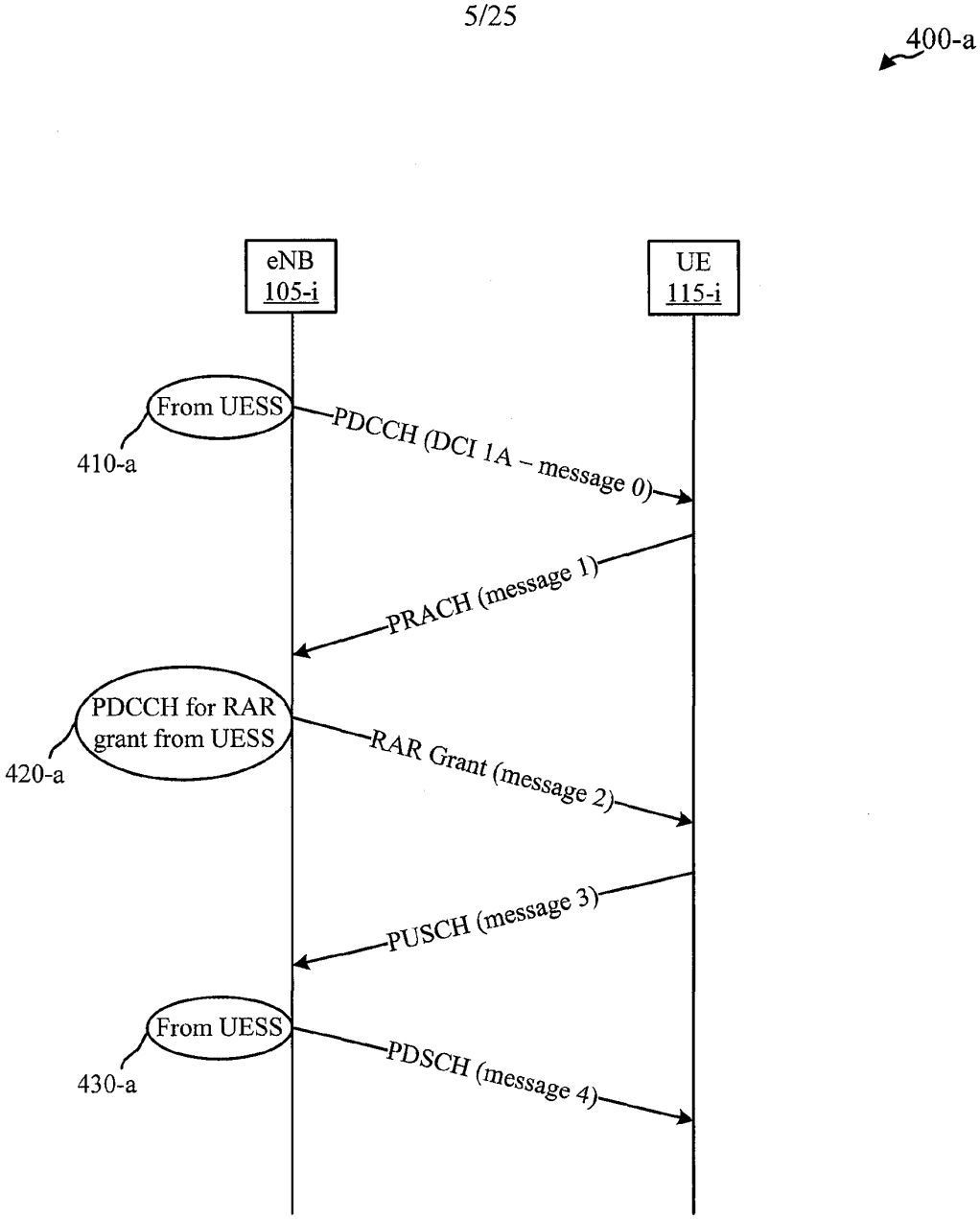

400-a
eNB
105-i
UE
115-i
From UESS
410-a
PDCCH (DCI 1A – message 0)
PRACH (message 1)
PDCCH for RAR grant from UESS
420-a
RAR Grant (message 2)
PUSCH (message 3)
From UESS
430-a
PDSCH (message 4)

FIG. 4A

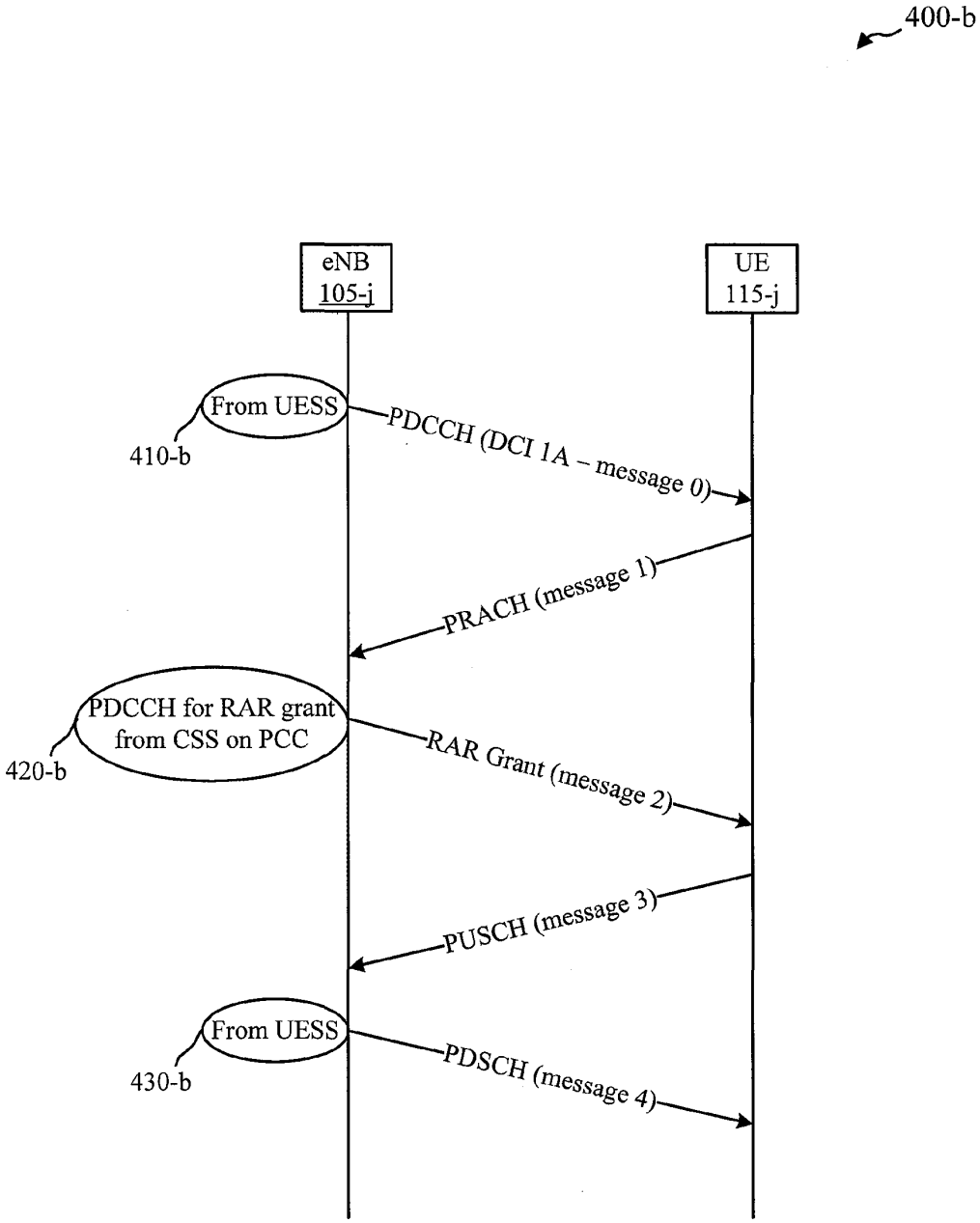

400-b
eNB
105-j
UE
115-j
From UESS
410-b
PDCCH (DCI 1A – message 0)
PRACH (message 1)
PDCCH for RAR grant
from CSS on PCC
420-b
RAR Grant (message 2)
PUSCH (message 3)
From UESS
430-b
PDSCH (message 4)

FIG. 4B

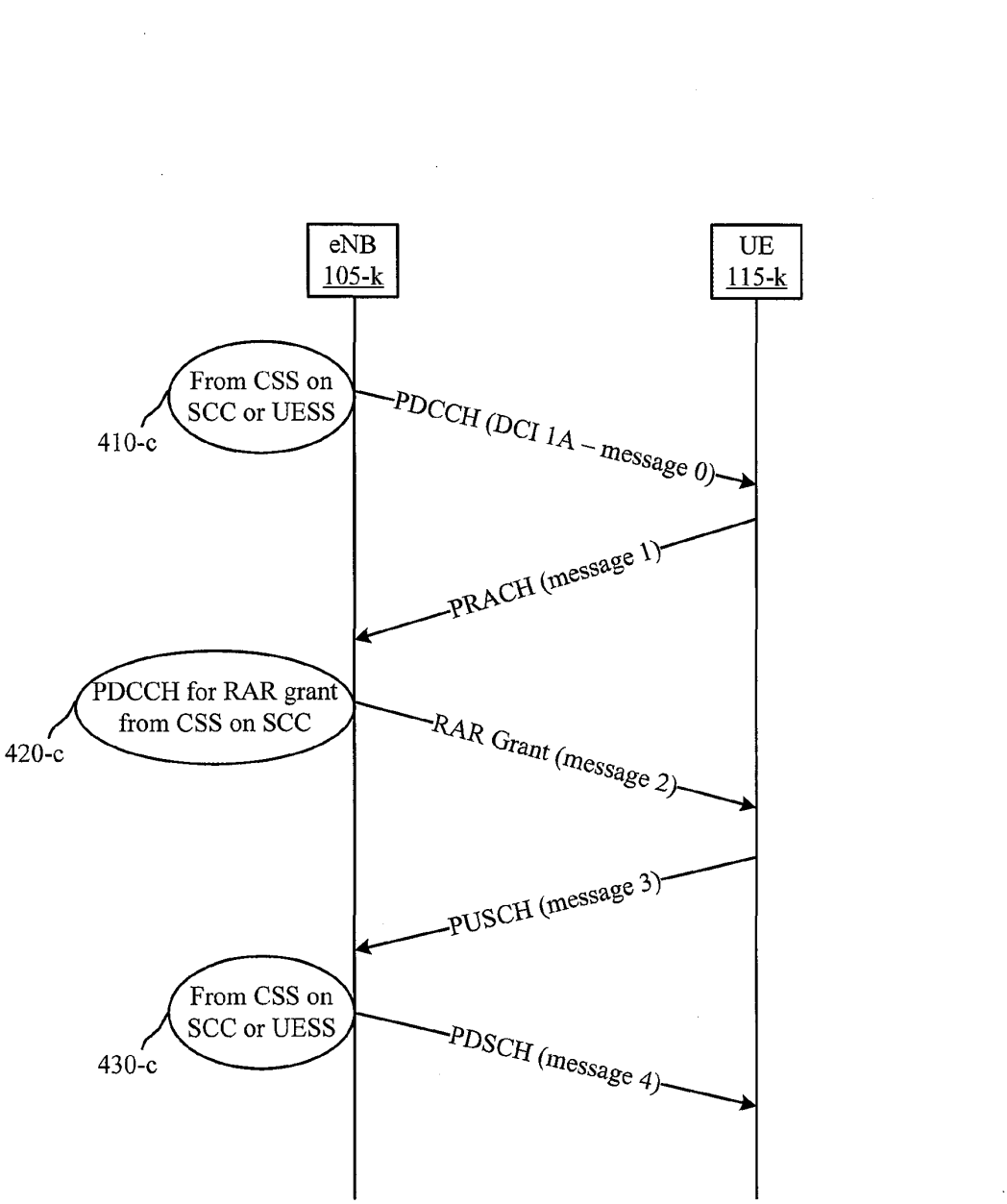

400-c
eNB
105-k
UE
115-k
From CSS on
SCC or UESS
410-c
PDCCH (DCI 1A – message 0)
PRACH (message 1)
PDCCH for RAR grant
from CSS on SCC
420-c
RAR Grant (message 2)
PUSCH (message 3)
From CSS on
SCC or UESS
430-c
PDSCH (message 4)

FIG. 4C

500

Component Carriers	Timing Advance Group Index
Pcell Scell-1 Scell-2	0
Scell-3 Scell-4	1

FIG. 5

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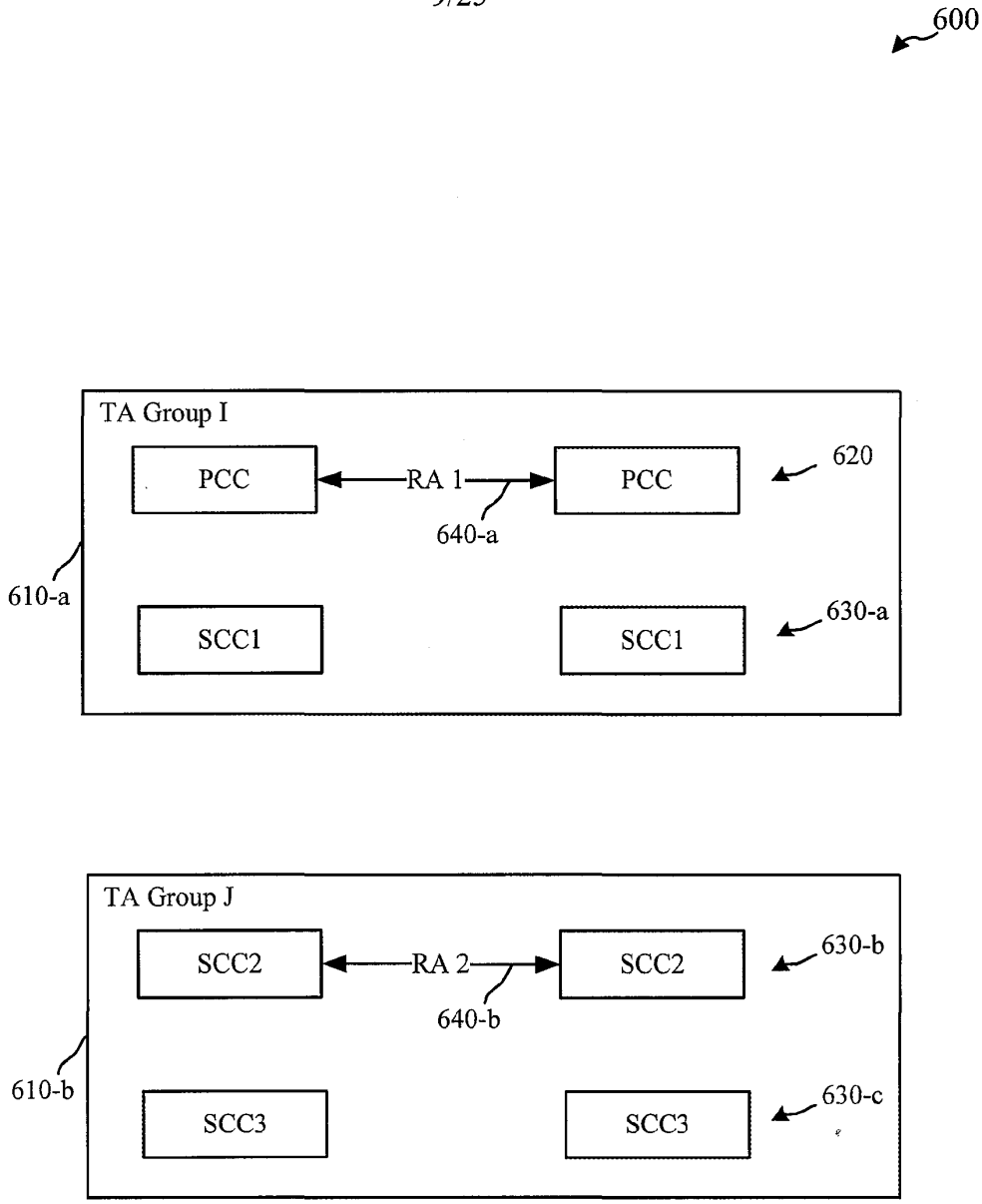

600
TA Group I
PCC
RA 1
PCC
620
640-a
610-a
SCC1
SCC1
630-a
TA Group J
SCC2
RA 2
SCC2
630-b
640-b
610-b
SCC3
SCC3
630-c

FIG. 6

700-a

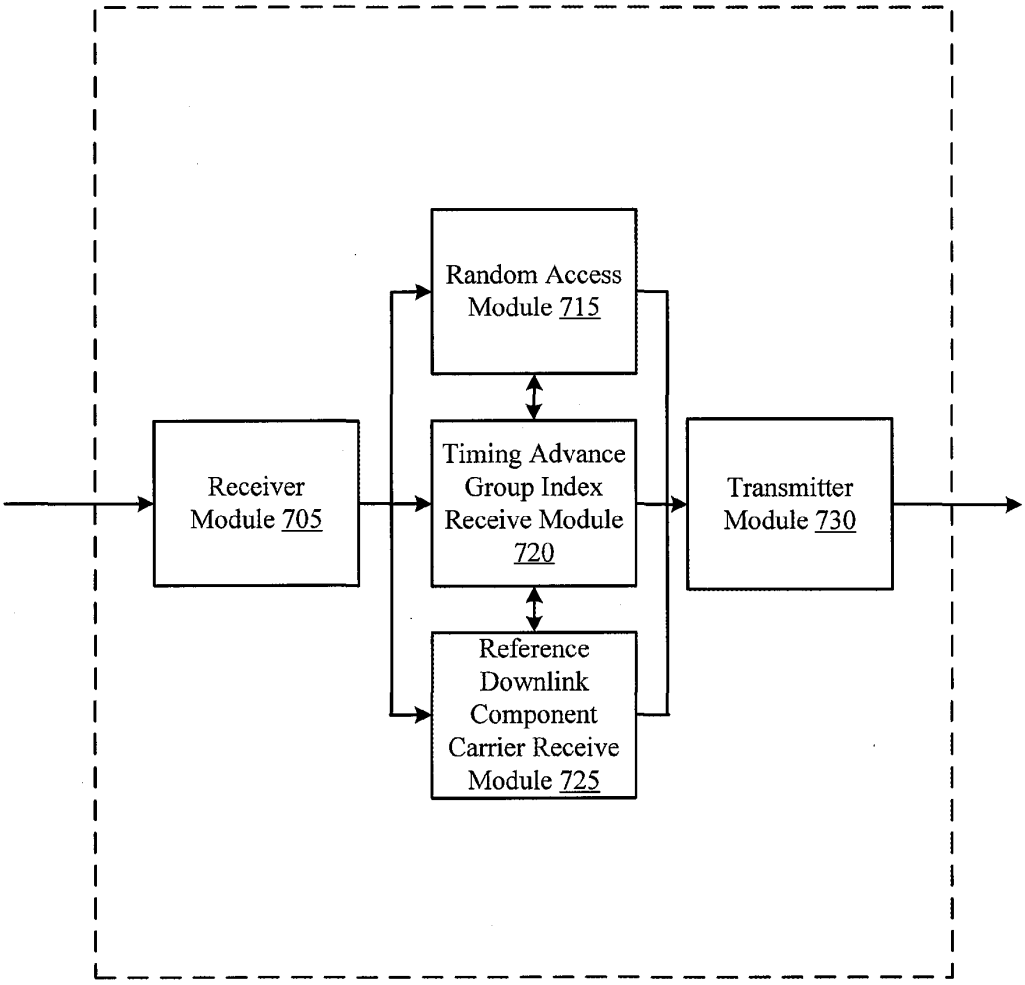

Random Access Module 715
Receiver Module 705
Timing Advance Group Index Receive Module 720
Transmitter Module 730
Reference Downlink Component Carrier Receive Module 725

FIG. 7A

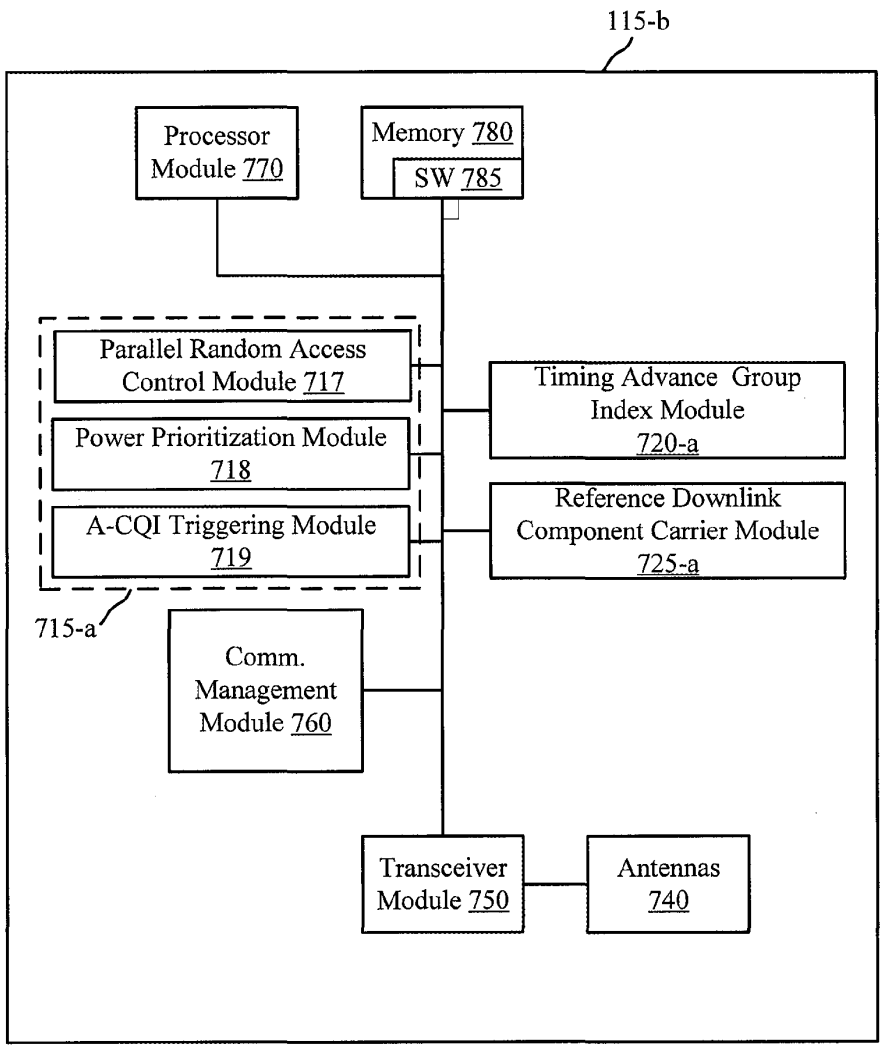

700-b
115-b
Processor Module 770
Memory 780
SW 785
Parallel Random Access Control Module 717
Power Prioritization Module 718
A-CQI Triggering Module 719
715-a
Timing Advance Group Index Module 720-a
Reference Downlink Component Carrier Module 725-a
Comm. Management Module 760
Transceiver Module 750
Antennas 740

FIG. 7B

800-a

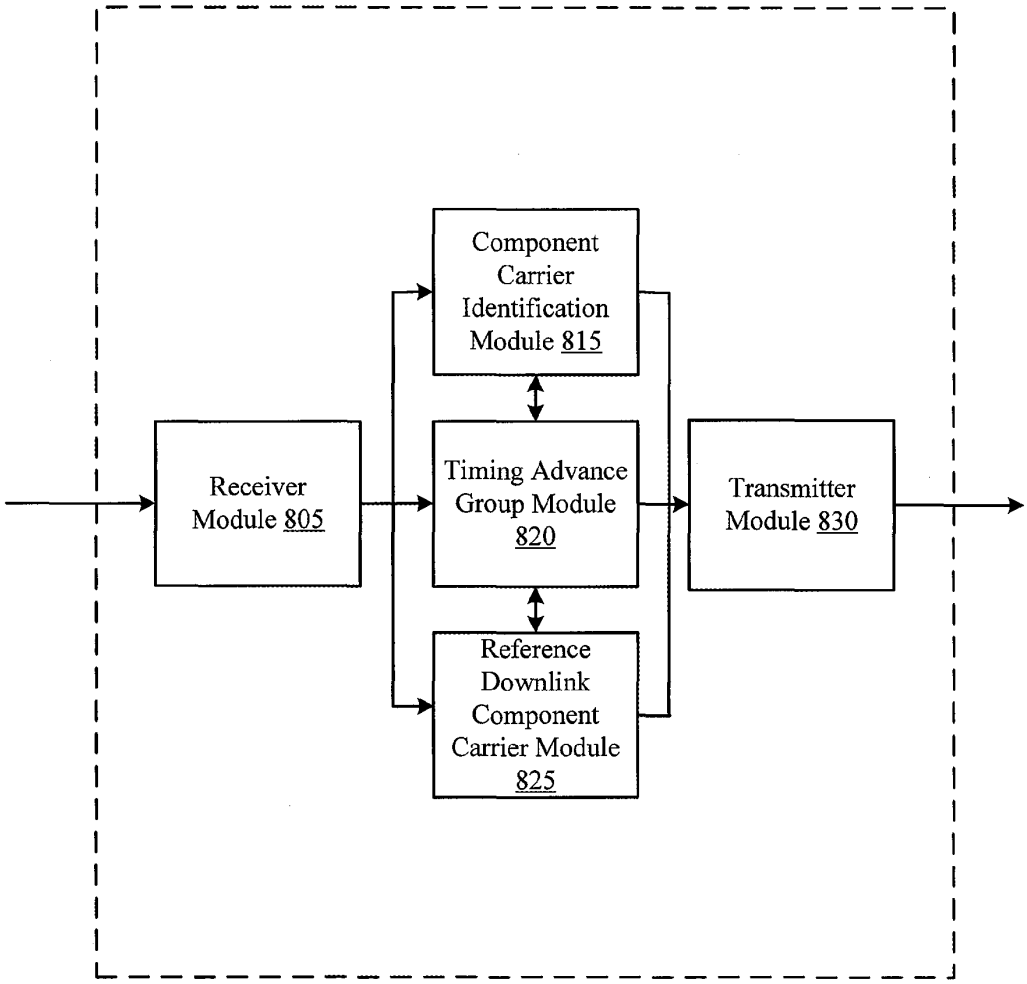


FIG. 8A

ONEPLUS - EX. 1002

800-b

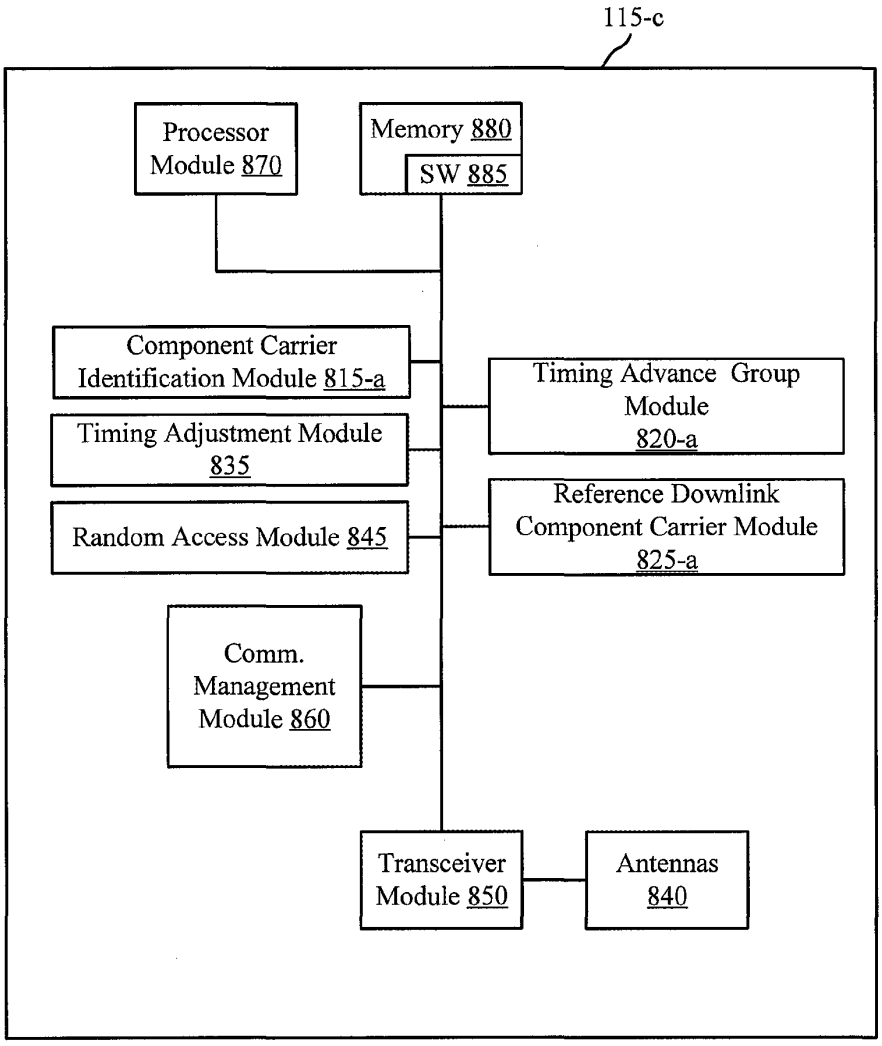


FIG. 8B

ONEPLUS - EX. 1002

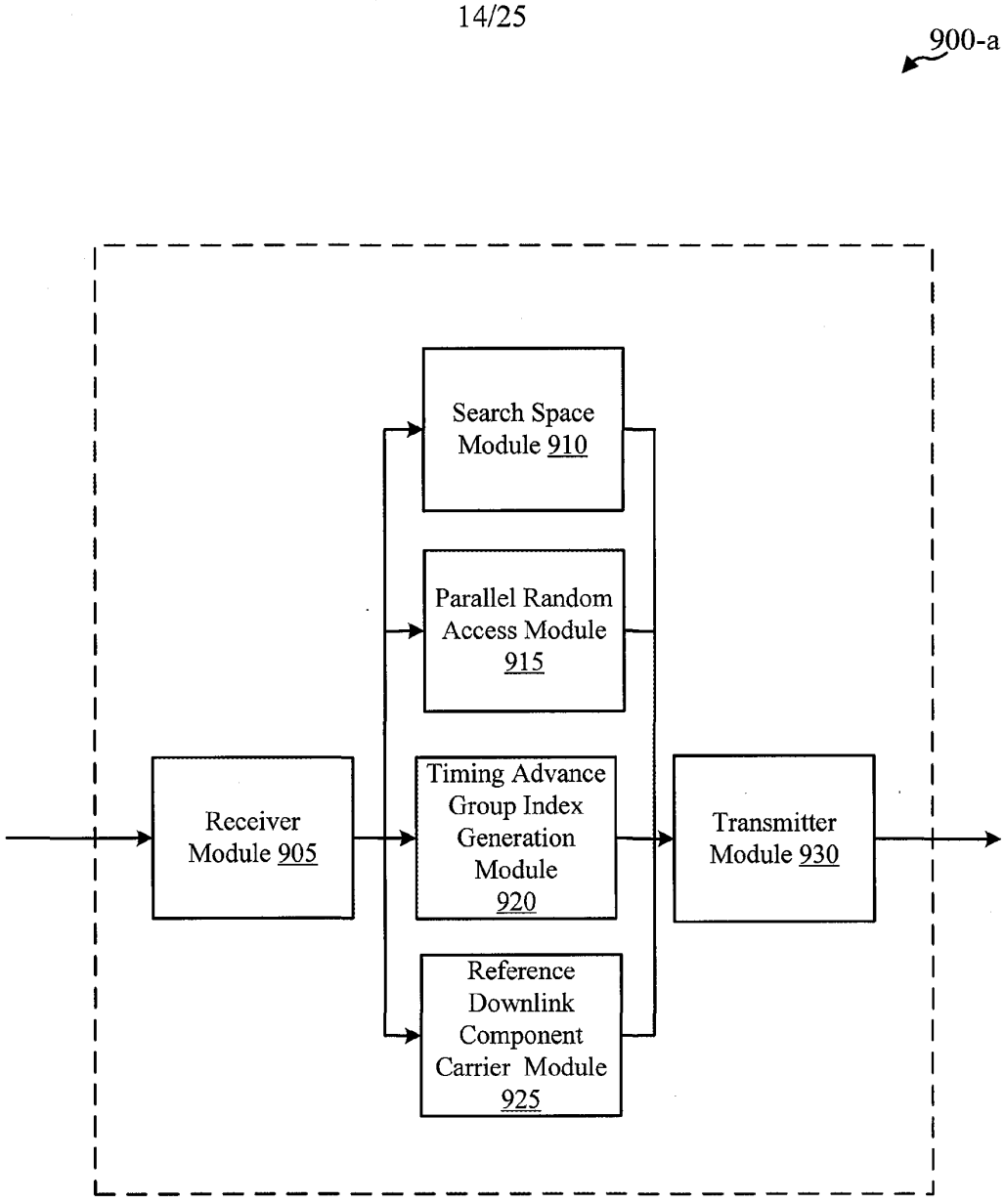

900-a
Search Space Module 910
Parallel Random Access Module 915
Receiver Module 905
Timing Advance Group Index Generation Module 920
Transmitter Module 930
Reference Downlink Component Carrier Module 925

FIG. 9A

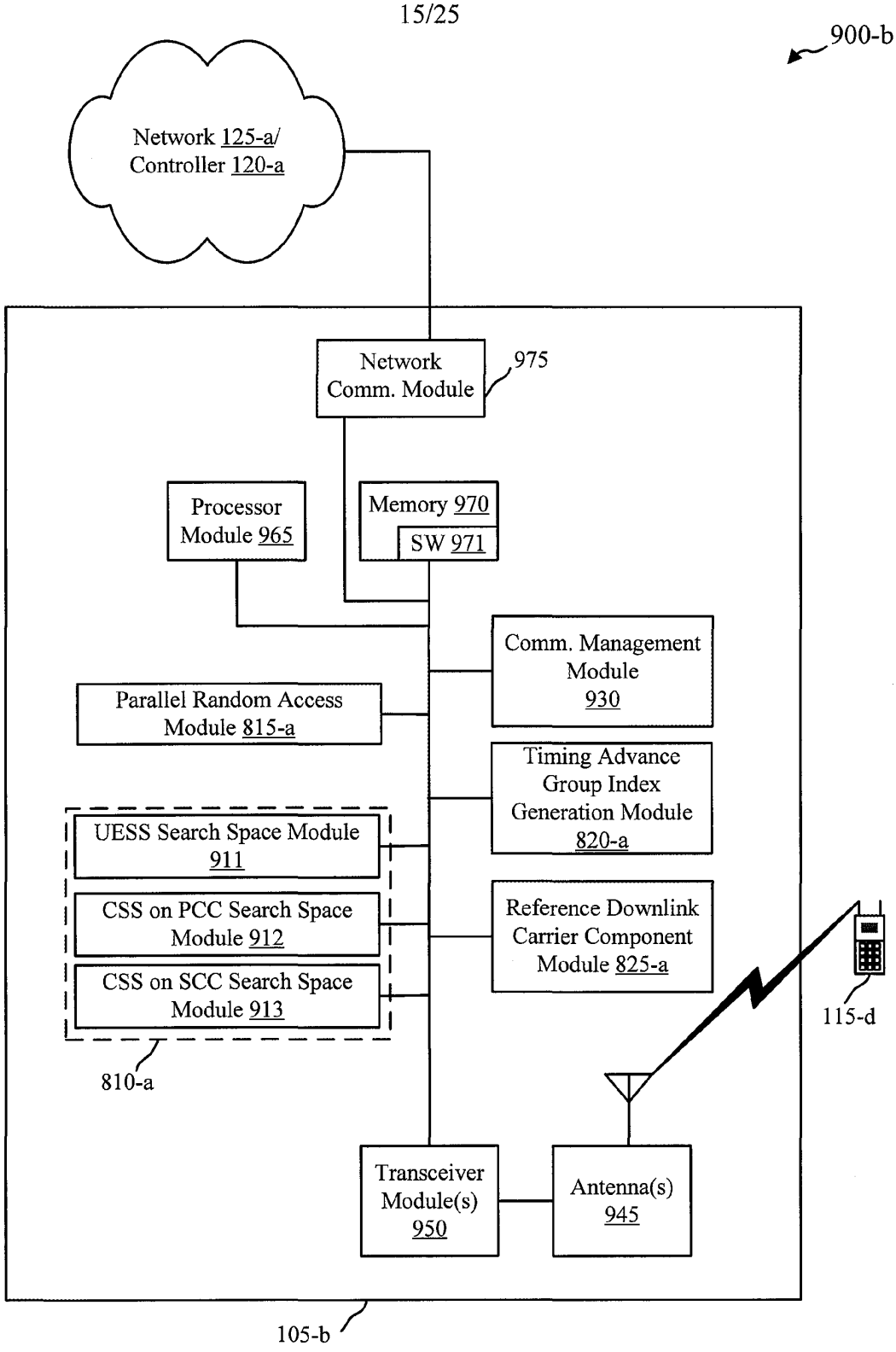


FIG. 9B

ONEPLUS - EX. 1002

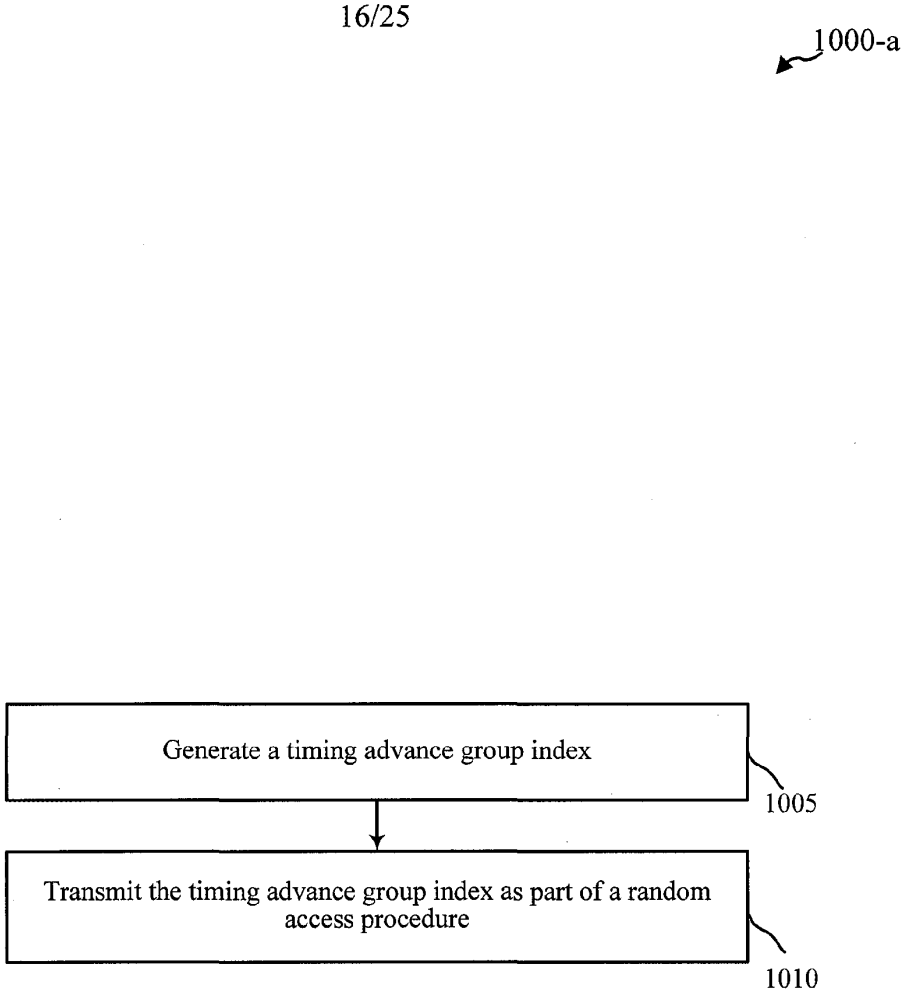


FIG. 10A

ONEPLUS - EX. 1002

1000-b

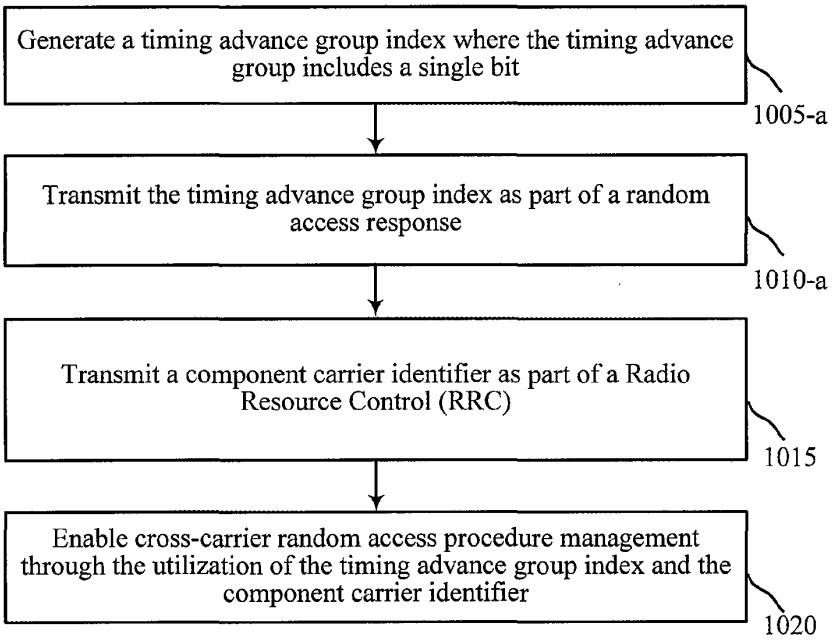


FIG. 10B

ONEPLUS - EX. 1002

1100-a

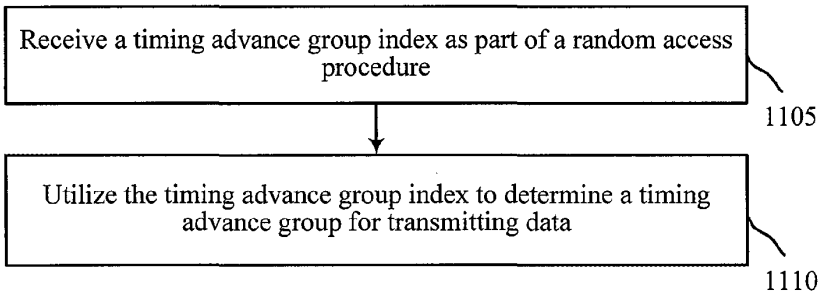


FIG. 11A

ONEPLUS - EX. 1002

1100-b

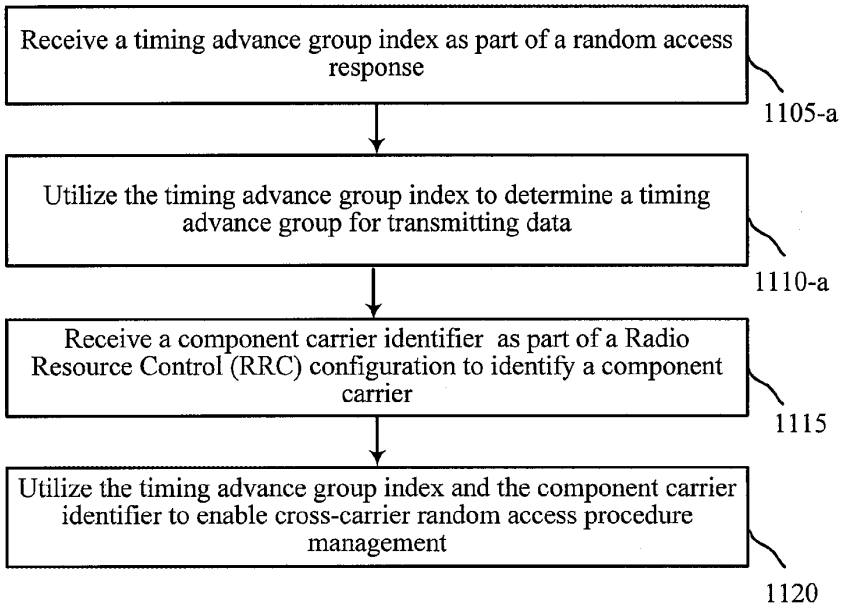


FIG. 11B

ONEPLUS - EX. 1002

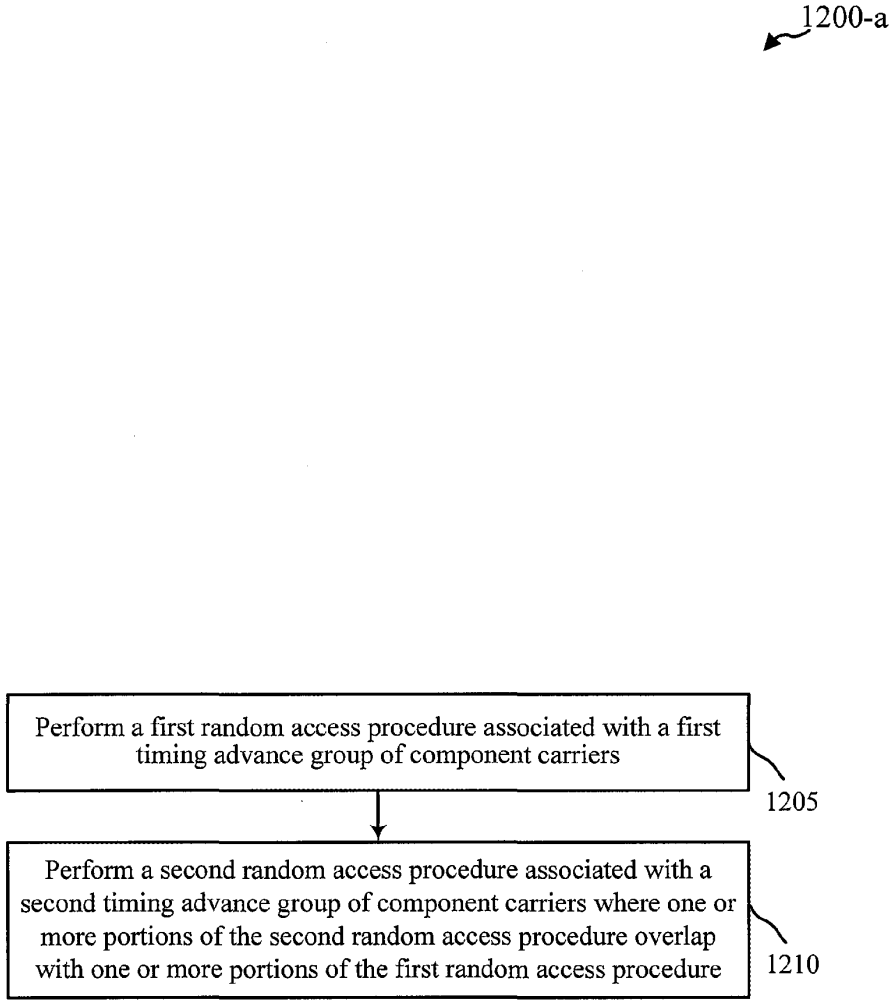


FIG. 12A

ONEPLUS - EX. 1002

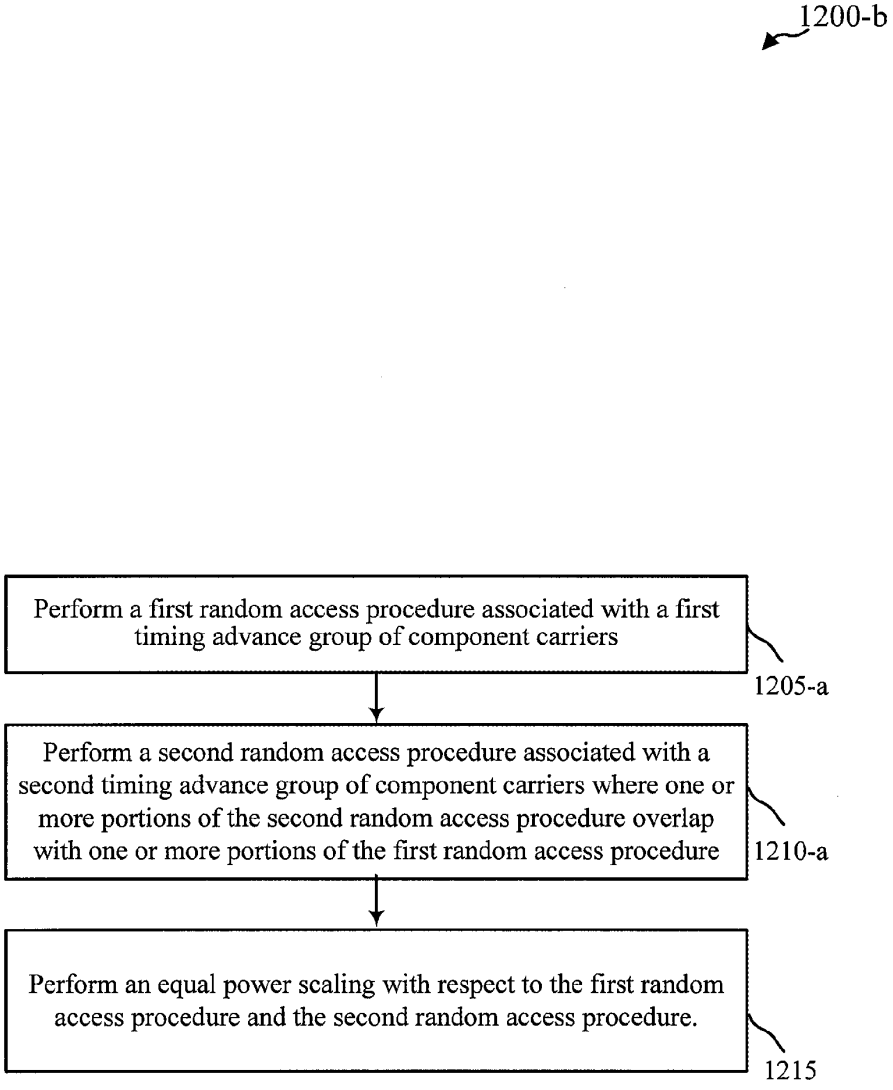

1200-b
Perform a first random access procedure associated with a first timing advance group of component carriers
1205-a
Perform a second random access procedure associated with a second timing advance group of component carriers where one or more portions of the second random access procedure overlap with one or more portions of the first random access procedure
1210-a
Perform an equal power scaling with respect to the first random access procedure and the second random access procedure.
1215

FIG. 12B

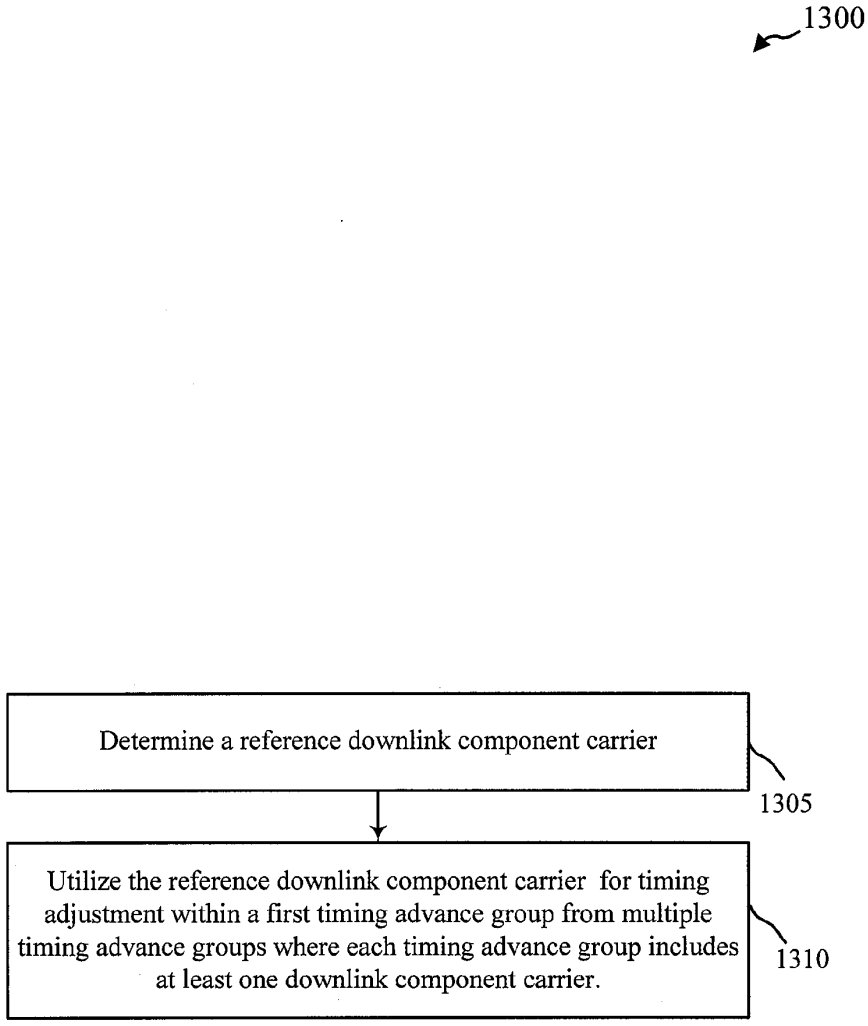


FIG. 13

ONEPLUS - EX. 1002

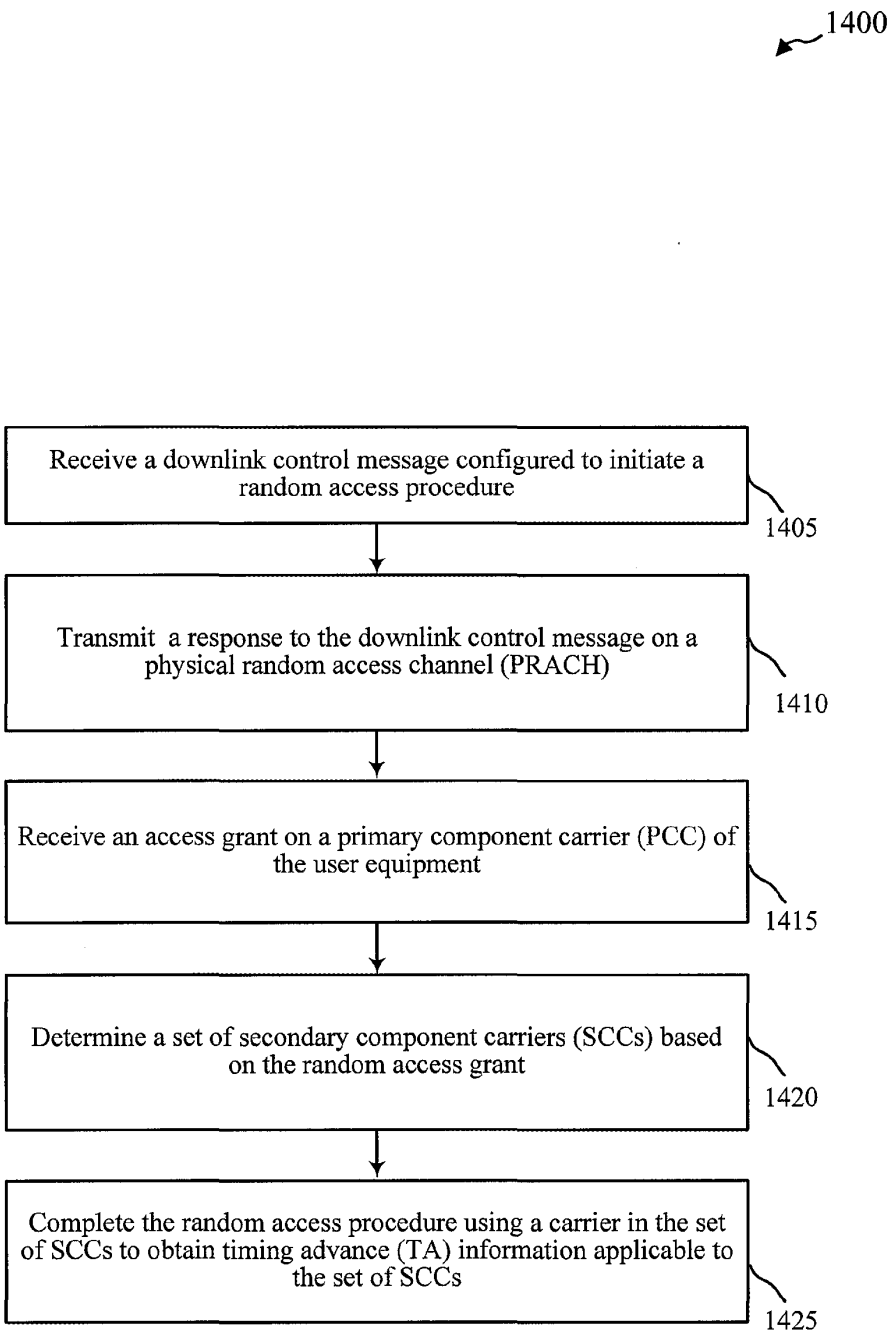


FIG. 14

ONEPLUS - EX. 1002

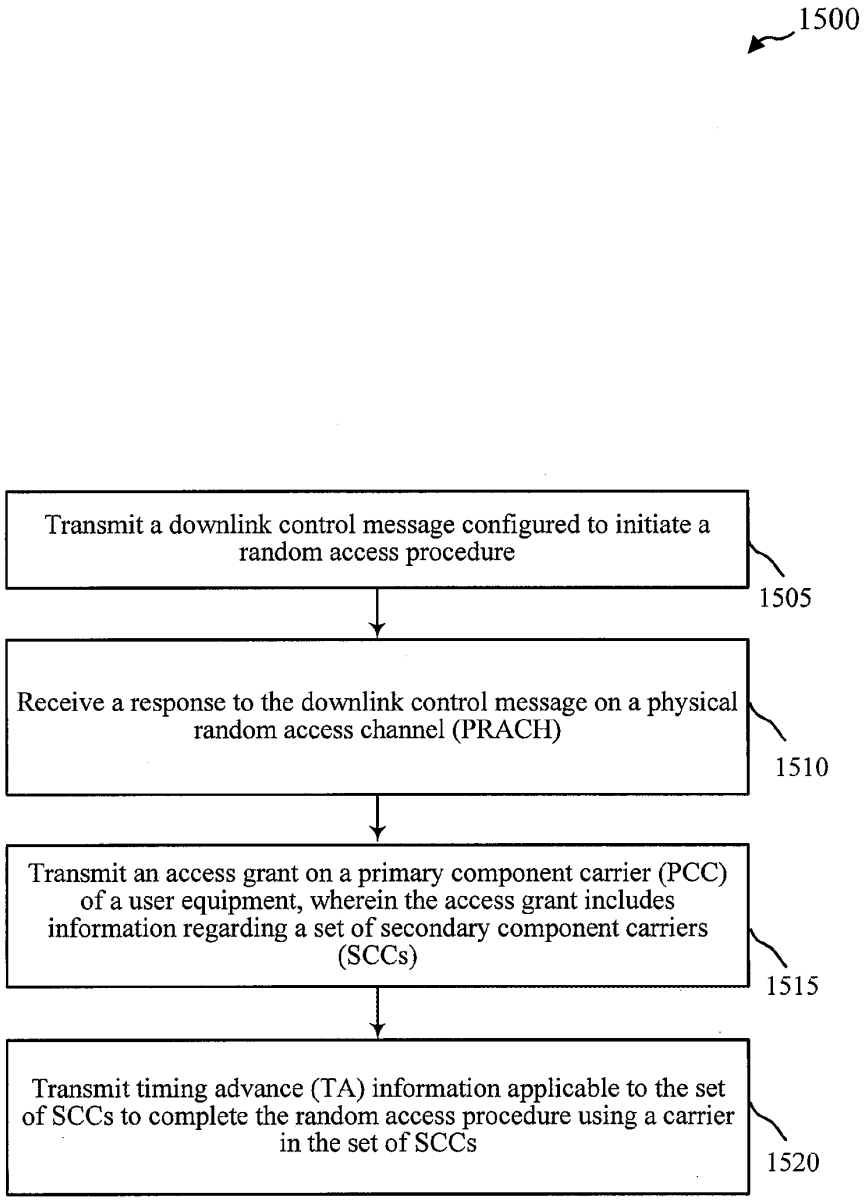


FIG. 15

ONEPLUS - EX. 1002

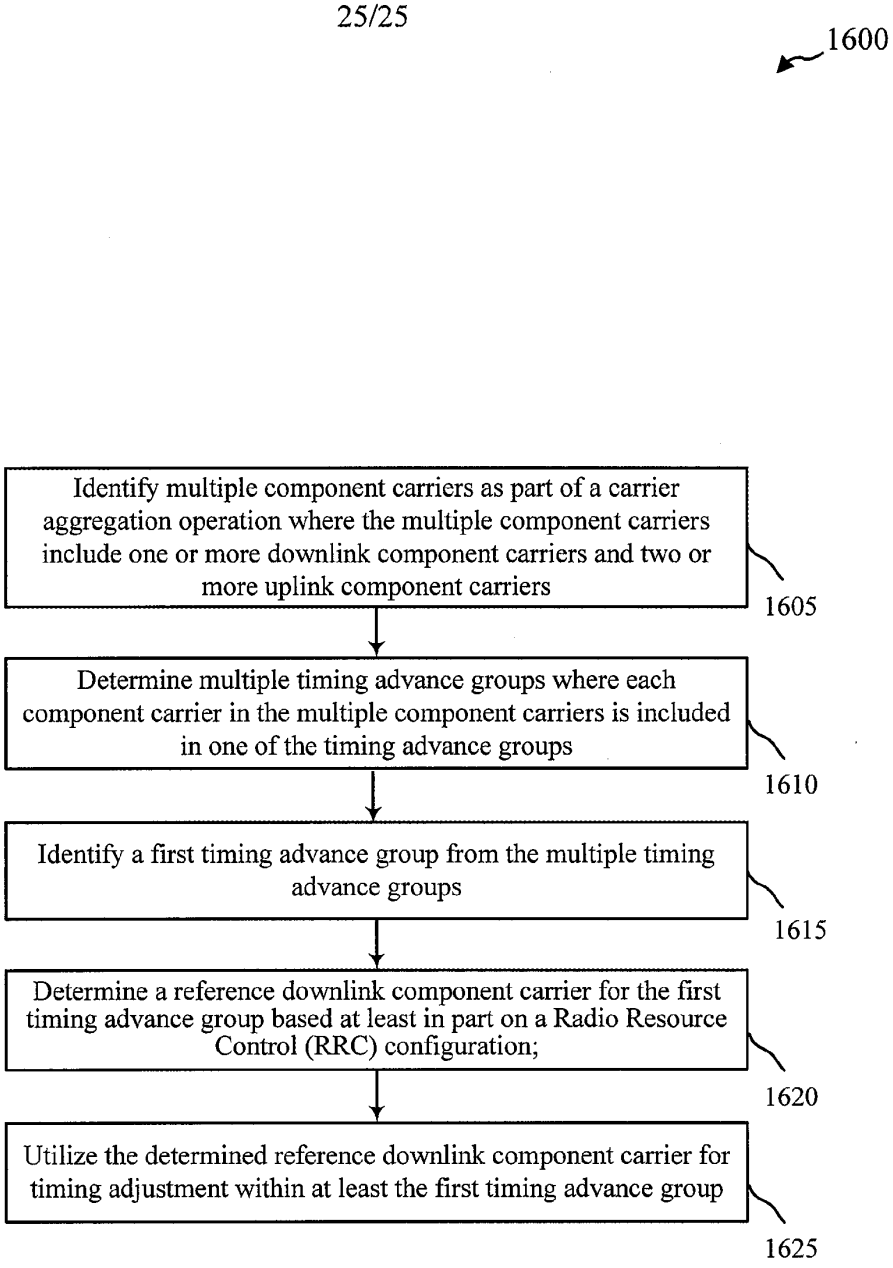


FIG. 16

ONEPLUS - EX. 1002

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/054848

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W56/00
ADD.

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

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ALCATEL-LUCENT ET AL: "Timing reference and pathloss reference for SCell group", 3GPP DRAFT; R2-114321 PATHLOSSTIMINGREF_V5, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Athens, Greece; 20110822, 16 August 2011 (2011-08-16), XP050540051, [retrieved on 2011-08-16]	1,17,33, 49
Y	paragraphs [0001], [02.1]	2-16, 18-32, 34-48, 50-64

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 December 2012	13/12/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Bohnhoff, Peter

Form PCT/ISA/210 (second sheet) (April 2005)

ONEPLUS - EX. 1002

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/054848

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HUAWEI ET AL: "Discussion on TA group management", 3GPP DRAFT; R2-113285 DISCUSSION ON TA GROUP MANAGEMENT, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Barcelona, Spain; 20110509, 3 May 2011 (2011-05-03), XP050495423, [retrieved on 2011-05-03]	1,17,33, 49
Y	paragraph [02.1] - paragraph [02.4]	2-16, 18-32, 34-48, 50-64

X	WO 2011/085200 A1 (INTERDIGITAL PATENT HOLDINGS [US]; MARINIER PAUL [CA]; ANEPU BHASKAR M) 14 July 2011 (2011-07-14) figures 2-4	1,17,33, 49

ONEPLUS - EX. 1002

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2012/054848

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011085200 A1	14-07-2011	EP 2522185 A1	14-11-2012
		US 2012008600 A1	12-01-2012
		WO 2011085200 A1	14-07-2011

Form PCT/ISA/210 (patent family annex) (April 2005)

ONEPLUS - EX. 1002

Electronic Acknowledgement Receipt

EFS ID:	38953851
Application Number:	16421019
International Application Number:	
Confirmation Number:	9820
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Joseph P. Gushue/Margaret Ferello
Filer Authorized By:	Joseph P. Gushue
Attorney Docket Number:	SIG-2-1853US06
Receipt Date:	25-MAR-2020
Filing Date:	23-MAY-2019
Time Stamp:	16:23:00
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	SIG_2_1853US06_IDS_Transmittal_Letter_20200325.PDF	57757 e3ac00d5e70b606c4df2e7cef0ef67f05296ec9d	no	4

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	SIG_2_1853US06_IDS_Form_SB08_20200325.PDF	1035565 523d5a07181b604b3857ec0023238bf1f62e50de	no	5
Warnings:					
Information:					
3	Foreign Reference	a_SIG_2_1853US06_wo10124228_EFS.PDF	3598208 e04c864f7fb9fcb6859e18e908c9b9cefe28fb2d	no	98
Warnings:					
Information:					
4	Foreign Reference	b_SIG_2_1853US06_wo13040026_EFS.PDF	8885115 27b4db55a166cfca29d4b2f286a3e601479ebcef	no	105
Warnings:					
Information:					
5	Non Patent Literature	c_SIG_2_1853US06_R2-106081_EFS.PDF	150458 2d20567cdabba4b8b798115c3acc843790700c58	no	3
Warnings:					
Information:					
6	Non Patent Literature	d_SIG_2_1853US06_R1_030208_EFS.PDF	3057694 8702f3a0686975486833a53766dd4bdfb8faf3ba	no	4
Warnings:					
Information:					
7	Non Patent Literature	e_SIG_2_1853US06_R3_070278_EFS.PDF	1333628 1c511708afec87fa685bd6d4508fc5b3ec9a6209	no	5
Warnings:					
Information:					
8	Non Patent Literature	f_SIG_2_1853US06_25_331_V7_5_0_EFS.PDF	7364529 3c632aca69a88f968e7b289c4996072763fa1753	no	1429
Warnings:					
Information:					

9	Non Patent Literature	g_SIG_2_1853US06_25_331_V8_4_0_EFS.pdf	6408816 cf47ce8d9a721b032b60847b4d16338f47000e42	no	1543
Warnings:					
Information:					
			Total Files Size (in bytes):	31891770	

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.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:	
	Pelletier et al.
Application No.:	16/421,019
Filed:	May 23, 2019
For:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
Group:	2464
Examiner:	Kan Yuen

Our File: SIG-2-1853US06

Date: March 25, 2020

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Further to Applicant's Duty of Disclosure pursuant to 37 C.F.R. § 1.56, Applicant wishes to bring to the Examiner's attention the material cited on the enclosed PTO Form SB-08.

Copies of the newly cited documents are enclosed. Pursuant to 37 C.F.R.§ 1.98(a)(2)(ii), copies of the newly cited U.S. publications and/or patent documents have not been included.

ONEPLUS - EX. 1002

This application is a continuation of U.S. Patent Application No. 14/876,337 filed October 6, 2015, which issued on May 28, 2019 as U.S. Patent No. 10,306,677, which is a continuation of U.S. Patent Application No. 14/319,608 filed June 30, 2014, which issued on April 12, 2016 as U.S. Patent No. 9,313,809, which is a continuation of U.S. Patent Application No. 12/238,910 filed September 26, 2008, which issued on July 8, 2014 as U.S. Patent No. 8,774,104, which claims the benefit of U.S. Provisional Patent Application Nos. 61/083,409 filed July 24, 2008, 61/074,288 filed June 20, 2008, 61/038,576, filed March 21, 2008, 61/025,441 filed February 1, 2008, 61/018,999 filed January 4, 2008, 60/982,528 filed October 25, 2007 and 60/975,985 filed September 28, 2007.

This application is also related to co-pending U.S. Application No. 16/516,893, filed July 19, 2019, which is a continuation of U.S. Application No. 15/836,302, filed December 8, 2017, which issued on July 23, 2019 as U.S. Patent No. 10,362,622, which is a continuation of U.S. Patent Application No. 15/182,218, filed June 14, 2016, which issued on December 12, 2017 as U.S. Patent No. 9,844,093, which is a continuation of U.S. Patent Application No. 15/049,922, filed February 22, 2016, which issued on June 21, 2016 as U.S. Patent No. 9,374,816, which is a continuation of U.S. Patent Application No. 12/256,964, filed October 23, 2008, which issued on February 23, 2016, as U.S. Patent No. 9,217,280, which claims the benefit of U.S. Provisional Patent Application No. 60/982,528, filed October 25, 2007 and U.S. Provisional Patent Application No. 61/018,567, filed January 2, 2008.

ONEPLUS - EX. 1002

Applicant also wishes to bring to the Examiner's attention co-pending U.S. Application No. 16/440,886, filed June 13, 2019, which is a continuation of U.S. Patent Application No. 15/782,532, filed October 12, 2017, which issued on June 18, 2019 as U.S. Patent No. 10,327,188, which is a continuation of U.S. Patent Application No. 15/135,616, filed April 22, 2016, which is a continuation of U.S. Patent Application No. 14/875,059 filed October 5, 2015, which is a continuation of U.S. Patent Application No. 13/665,734, filed October 31, 2012, which issued October 13, 2015, as U.S. Patent No. 9,161,285, which is a continuation of U.S. Patent Application No. 12/346,631, filed December 30, 2008, which issued December 4, 2012 as U.S. Patent No. 8,325,684, which claims priority from Provisional Application No. 61/018,567, which was filed January 2, 2008.

ONEPLUS - EX. 1002

It is respectfully requested that the Examiner consider these documents and return an initialed copy of the PTO Form SB-08 indicating consideration of the cited materials.

Respectfully submitted,

Signal Trust for Wireless Innovation

By /Joseph P. Gushue/
Joseph P. Gushue
Registration No. 59,819
(215) 568-6400

Volpe and Koenig, P.C.
30 South 17th Street; Suite 1800
Philadelphia, PA 19103-4009
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Facsimile: (215) 568-6499

JPG/JMB/pf
Enclosures (8)

ONEPLUS - EX. 1002

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/421,019	05/23/2019	Benoit Pelletier	SIG-2-1853US06

CONFIRMATION NO. 9820

3624
VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

PUBLICATION NOTICE

OC000000111079375

Title:METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES

Publication No.US-2019-0281638-A1
Publication Date:09/12/2019

NOTICE OF PUBLICATION OF APPLICATION

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

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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

ONEPLUS - EX. 1002

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/421,019

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	10 minus 20 =	*			OR	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
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720

APPLICATION AS AMENDED - PART II

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

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

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

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/421,019	05/23/2019		1720	SIG-2-1853US06	10	2

CONFIRMATION NO. 9820

3624
VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

FILING RECEIPT

OC000000108592361

Date Mailed: 06/03/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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)

Benoit Pelletier, Roxboro, CANADA;
Diana Pani, Montreal, CANADA;
Rocco DiGirolamo, Laval, CANADA;
Christopher R. Cave, Dollard-des-Ormeaux, CANADA;
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Paul Marinier, Brossard, CANADA;
Eldad M. Zeira, Huntington, NY;

Applicant(s)

Signal Trust for Wireless Innovation, Wilmington, DE;

Assignment For Published Patent Application

Signal Trust for Wireless Innovation, Wilmington, DE

Power of Attorney: The patent practitioners associated with Customer Number 03624

Domestic Priority data as claimed by applicant

This application is a CON of 14/876,337 10/06/2015 PAT 10306677
which is a CON of 14/319,608 06/30/2014 PAT 9313809
which is a CON of 12/238,910 09/26/2008 PAT 8774104
which claims benefit of 60/975,985 09/28/2007
and claims benefit of 60/982,528 10/25/2007
and claims benefit of 61/018,999 01/04/2008
and claims benefit of 61/025,441 02/01/2008
and claims benefit of 61/038,576 03/21/2008

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and claims benefit of 61/074,288 06/20/2008
and claims benefit of 61/083,409 07/24/2008

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 05/30/2019
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/421,019**
Projected Publication Date: 09/12/2019
Non-Publication Request: No
Early Publication Request: No
Title

METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES

Preliminary Class

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.

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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 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

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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.

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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).

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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.

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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

■ Practitioners associated with Customer Number: 03624

OR

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

Name	Registration Number	Name	Registration Number

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

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

■ The address associated with Customer Number: 03624

OR

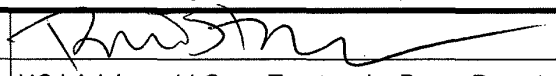
☐	Firm or Individual Name	Volpe and Koenig, P.C.		
	Address			
	City		State	Zip
	Country			
	Telephone		Email	

Assignee Name and Address: Signal Trust For Wireless Innovation
1011 Centre Road, Suite 327
Wilmington, Delaware 19805

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

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

Signature		Date	November 25, 2013
Name	HCJ Advisors LLC, as Trustee, by Bruce Bernstein	Telephone	302-573-3819
Title	President		

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

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

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 Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
First Named Inventor/Applicant Name:	Benoit Pelletier
Filer:	Joseph P. Gushue/Margaret Ferello
Attorney Docket Number:	SIG-2-1853US06

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1720**

Electronic Acknowledgement Receipt

EFS ID:	36095037
Application Number:	16421019
International Application Number:	
Confirmation Number:	9820
Title of Invention:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Joseph P. Gushue/Margaret Ferello
Filer Authorized By:	Joseph P. Gushue
Attorney Docket Number:	SIG-2-1853US06
Receipt Date:	23-MAY-2019
Filing Date:	
Time Stamp:	16:37:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	052419INTEFSW16383700
Deposit Account	220493
Authorized User	Margaret Ferello

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)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	SIG_2_1853US06_Declarations.PDF	1040702 28a556903c130e6e720ed4f4df32b0ad44da365b	no	9
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	SIG_2_1853US06_IDS_efs.PDF	121284 43cebfa47a4ef8c8d1faa12f861296a30d163f65	no	12
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Transmittal Letter	SIG_2_1853US06_IDS_Transmittal_Letter.PDF	57390 a3d290956bc97757a0f0a7866727113bf9d1c305	no	3
Warnings:					
Information:					
4	Application Data Sheet	SIG_2_1853US06_ADS.PDF	1257448 06cf64024ab238ec621411ee2d3af3dab206f1d4	no	11
Warnings:					
Information:					
5	Drawings-only black and white line drawings	SIG_2_1853US06_Drawings_efs.PDF	334317 b19927c89225ac9a1b56140baa3633112359def5	no	9
Warnings:					
Information:					
6		SIG_2_1853US06_Application_efs.PDF	103936 1cd815f76ac803b7f03097cc3ec36beb04ebf8bc	yes	21

	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Specification		1	18	
	Claims		19	20	
	Abstract		21	21	
Warnings:					
Information:					
7	Assignee showing of ownership per 37 CFR 3.73	SIG_2_1853_US06_Statement_under_37_CFR_3_73c.PDF	123874 b18ea871a2448e45a8e9e92ce4f9fffaae1b4e7c	no	3
Warnings:					
Information:					
8	Power of Attorney	SIG_2_1853US06_Power_to_Prosecute.PDF	160838 5cb5799130e7cd1fd3b07260c2dca3ab169bbab1	no	2
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	34984 9955735179890b068af3d10299613aa2964915e1	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3234773		

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.

PTO/AIA/01 (08-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 14/319,608 filed on June 30, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Benoit Pelletier Date (Optional): 2015/04/08

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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☒ United States application or PCT international application number 14/319,608 filed on June 30, 2014.

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LEGAL NAME OF INVENTOR

Inventor: Diana Pani Date (Optional): 07/22/2015

Signature: Pani

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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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.

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PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 14/319,608

filed on June 30, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Rocco DiGirolamo Date (Optional) :

Signature: Rocco D Abel

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

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The above-identified application was made or authorized to be made by me.

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LEGAL NAME OF INVENTOR

Inventor: Christopher R. Cave Date (Optional): JUNE 26 2015

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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LEGAL NAME OF INVENTOR

Inventor: Vincent Roy Date (Optional): April 11, 2015

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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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).
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LEGAL NAME OF INVENTOR

Inventor: Paul Marinier Date (Optional): April 8, 2015

Signature: Paul Marinier

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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LEGAL NAME OF INVENTOR

Inventor: Eldad M. Zeira Date (Optional): 4/7/15

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

U.S. PATENT DOCUMENTS							
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		6,167,248	12/2000	Hamalainen et al.			
		6,246,692	06/2001	Dai et al.			
		6,721,566	04/2004	Longoni et al.			
		6,845,238	01/2005	Muller[1]			
		7,079,489	07/2006	Massie et al.			
		7,145,889	12/2006	Zhang et al.			
		7,406,314	07/2008	Sharma[2]			
		7,477,609	01/2009	Agin			
		7,480,269	01/2009	Heo et al.[3]			
		7,508,792	03/2009	Petrovic et al.[4]			
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		9,844,093	12/2017	Pani et al.			
		2003/0223452	12/2003	Toskala et al.			
		2004/0052229	03/2004	Terry et al.[7]			
		2004/0068505	04/2004	Lee et al.			
		2004/0117860	06/2004	Yi et al.[8]			

1 Corresponds to JP 2003-509982
2 Corresponds to JP 2007-531350
3 Corresponds to RU 2305372
4 Corresponds to JP 2007-506378 and WO 05/029785
5 Corresponds to TW 200640268
6 Corresponds to JP 2009-147920
7 Corresponds to JP 2005-539468
8 Corresponds to RU 2310276

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

5740949-1

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		2005/0026623	02/2005	Fisher			
		2005/0053035	03/2005	Kwak et al.			
		2005/0054298	03/2005	Chen			
		2005/0101299	05/2005	Farnsworth			
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		2005/0249163	11/2005	Kim et al.			
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		2006/0116118	06/2006	Charriere et al.			
		2006/0140154	06/2006	Kwak et al.[10]			
		2006/0142032	06/2006	Derakhshan et al.			
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		2007/0047445	03/2007	Usuda et al.			
		2007/0115871	05/2007	Zhang et al.			
		2007/0135113	06/2007	Moinet et al.[11]			
		2007/0189237	08/2007	Jaatinen et al.			
		2007/0206531	09/2007	Pajukoski et al.			
		2007/0213059	09/2007	Shaheen			
		2007/0223609	09/2007	Obuchi et al.			

9 Corresponds to RU 2005122724
10 Corresponds to KR 2006-0054117
11 Corresponds to EP 1 796 416

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	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		2008/0008152	01/2008	Lohr et al.			
		2008/0049669	02/2008	Lundby et al.			
		2008/0125043	05/2008	Karmanenko et al.			
		2008/0192766	08/2008	Ranta-Aho et al.			
		2008/0194259	08/2008	Vujcic et al.			
		2008/0214225	09/2008	Choukroun, David			
		2008/0268852	10/2008	Petrovic et al.[12]			
		2009/0010278	01/2009	Torsner et al.			
		2009/0061881	03/2009	Gonsa et al.			
		2009/0086671	04/2009	Pelletier et al.			
		2009/0135769	05/2009	Sambhwani et al.			
		2009/0143074	06/2009	Pelletier et al.			
		2009/0168704	07/2009	Lee et al.[13]			
		2009/0168724	07/2009	Umesh et al.[14]			
		2009/0196239	08/2009	Lee et al.			
		2009/0219868	09/2009	Lee et al.[15]			
		2009/0225709	09/2009	Wager et al.			
		2009/0225739	09/2009	Yeo et al.			
		2009/0257407	10/2009	Park et al.			
		2009/0318170	12/2009	Lee et al.			
		2010/00189071	07/2010	Kitazoe			
		2010/0091652	04/2010	Lin[16]			

12 Corresponds to EP 1 583 292
13 Corresponds to WO 07/024099
14 Corresponds to WO 07/148634
15 Corresponds to KR 2007-0073578
16 Corresponds to US 7,180,855

EXAMINER	DATE CONSIDERED

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EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		2010/0098165	04/2010	Farfade et al. [17]			
		2010/0103852	04/2010	Jactat, Caroline			
		2010/0215005	08/2010	Pradas et al.			
		2010/0216471	08/2010	Meyer et al.			
		2010/0278143	11/2010	Chun et al.			
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FOREIGN PATENT DOCUMENTS							

17 Corresponds to JP2010-527194

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
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		2 615 915	03/2004	CA				
		20040089937	10/2004	KR			X**	
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18 US 2010/0098165 A1

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	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

OTHER DOCUMENTS

EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
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	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
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EXAMINER	DATE CONSIDERED

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	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
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	Application Number	
	Filing Date	May 23, 2019
	First Named Inventor	Pelletier et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

EXAMINER INITIAL		DESCRIPTION (Including Author, Title, Date, Pertinent Pages, Etc.)
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	Attorney Docket Number	SIG-2-1853US06

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		THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Radio Interface Protocol Architecture (Release 8)," 3GPP TS 25.301 V8.3.0 (September 2008).
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	Art Unit	
	Examiner Name	
	Attorney Docket Number	SIG-2-1853US06

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		UNIVERAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS); UTRAN Iub interface Node B Application Part (NBAP)signalling, (3GPP TS 25.433 version 7.6.0 Release 7), ETSI TS 125 433 V7.6.0 (October 2007).
		UNIVERAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS); UTRAN Iub interface Node B Application Part (NBAP) signalling (3GPP TS 25.433 version 8.1.0 Release 8), ETSI TS 125 433 V8.1.0 (October 2008).
		3GPP TS 25.321 V7.2.0, SEPTEMBER 9, 2006, PAGES 81-82, PAGES 91-93

X** English Abstract Provided

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5740949-1

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:	
	Pelletier et al.
Application No.:	Not Yet Known
Filed:	May 23, 2019
For:	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES
Group:	Not Yet Assigned
Examiner:	Not Yet Assigned

Our File: SIG-2-1853US06

Date: May 23, 2019

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Further to Applicant's Duty of Disclosure pursuant to 37 C.F.R. § 1.56, Applicant wishes to bring to the Examiner's attention the material cited on the enclosed Information Disclosure Statement Form.

Pursuant to 37 C.F.R. § 1.98(d) copies of documents cited in the parent application are not enclosed, but copies will be provided upon request.

This application is a continuation of U.S. Patent Application No. 14/876,337 filed October 6, 2015, which is a continuation of U.S. Patent Application No. 14/319,608 filed

ONEPLUS - EX. 1002

June 30, 2014, which issued on April 12, 2016 as U.S. Patent No. 9,313,809, which is a continuation of U.S. Patent Application No. 12/238,910 filed September 26, 2008, which issued on July 8, 2014 as U.S. Patent No. 8,774,104, which claims the benefit of U.S. Provisional Patent Application Nos. 61/083,409 filed July 24, 2008, 61/074,288 filed June 20, 2008, 61/038,576, filed March 21, 2008, 61/025,441 filed February 1, 2008, 61/018,999 filed January 4, 2008, 60/982,528 filed October 25, 2007 and 60/975,985 filed September 28, 2007.

This application is also related to co-pending U.S. Application No. 15/836,302, filed December 8, 2017, which is a continuation of U.S. Patent Application No. 15/182,218, filed June 14, 2016, which issued on December 12, 2017 as U.S. Patent No. 9,844,093, which is a continuation of U.S. Patent Application No. 15/049,922, filed February 22, 2016, which issued on June 21, 2016 as U.S. Patent No. 9,374,816, which is a continuation of U.S. Patent Application No. 12/256,964, filed October 23, 2008, which issued on February 23, 2016, as U.S. Patent No. 9,217,280, which claims the benefit of U.S. Provisional Patent Application No. 60/982,528, filed October 25, 2007 and U.S. Provisional Patent Application No. 61/018,567, filed January 2, 2008.

Applicant also wishes to bring to the Examiner's attention co-pending U.S. Application No. 15/782,532, filed October 12, 2017, which is a continuation of U.S. Patent Application No. 15/135,616, filed April 22, 2016, and to co-pending U.S. Application No. 15/782,549, filed October 12, 2017, which is a continuation of U.S. Application No. 15/135,620, filed April 22, 2016, both of which are continuations of U.S.

ONEPLUS - EX. 1002

Patent Application No. 14/875,059 filed October 5, 2015, which is a continuation of U.S. Patent Application No. 13/665,734, filed October 31, 2012, which issued October 13, 2015, as U.S. Patent No. 9,161,285, which is a continuation of U.S. Patent Application No. 12/346,631, filed December 30, 2008, which issued December 4, 2012 as U.S. Patent No. 8,325,684, which claims priority from Provisional Application No. 61/018,567, which was filed January 2, 2008.

It is respectfully requested that the Examiner consider these documents and return an initialed copy of the Information Disclosure Statement Form indicating consideration of the cited materials.

Respectfully submitted,

Signal Trust for Wireless Innovation

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Enclosure

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

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

Secrecy Order 37 CFR 5.2:

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

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Benoit		Pelletier	

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Country [i]	CA

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Diana		Pani	

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

City	Country of Residence [i]
Montreal	CA

Mailing Address of Inventor:

Address 1	730 Lusignan
Address 2	Apartment 4
City	Montreal
State/Province	QC
Postal Code	H3C 1Y9
Country [i]	CA

Inventor 3 Remove

Legal Name

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Rocco		DiGirolamo	

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

City	Laval	Country of Residence [i]	CA

Mailing Address of Inventor:

Address 1	632 de Fribourg Street		
Address 2			
City	Laval	State/Province	QC
Postal Code	H7K 3Y3	Country [i]	CA

Inventor 4 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Christopher	R.	Cave	

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

City	Dollard-des-Ormeaux	Country of Residence [i]	CA

Mailing Address of Inventor:

Address 1	258 Baffin		
Address 2			
City	Dollard-des-Ormeaux	State/Province	QC
Postal Code	H9A 3J2	Country [i]	CA

Inventor 5 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Vincent		Roy	

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

City	Longueuil	Country of Residence [i]	CA

Mailing Address of Inventor:

Address 1	1980 du Caribou		
Address 2			
City	Longueuil	State/Province	QC
Postal Code	J4N 1N3	Country [i]	CA

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

Inventor 6 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Paul		Marinier	

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

City	Brossard	Country of Residence	CA

Mailing Address of Inventor:

Address 1	1805 Stravinski		
Address 2			
City	Brossard	**State/Province**	QC
Postal Code	J4X 2J7	**Country**	CA

Inventor 7 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Eldad	M.	Zeira	

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

City	Huntington	State/Province	NY	Country of Residence	US

Mailing Address of Inventor:

Address 1	106 East Neck Road		
Address 2			
City	Huntington	**State/Province**	NY
Postal Code	11743	**Country**	US

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

Correspondence Information:

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

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

Customer Number	03624		
Email Address	eoffice@vklaw.com	Add Email	Remove Email

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

Application Information:

Title of the Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES		
Attorney Docket Number	SIG-2-1853US06	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	9	**Suggested Figure for Publication (if any)**	2

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	03624		

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

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)
	Continuation of	14876337	2015-10-06
Prior Application Status	Patented		Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14876337	Continuation of	14319608	2014-06-30	9313809	2016-04-12

Prior Application Status	Patented		Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14319608	Continuation of	12238910	2008-09-26	8774104	2014-07-08

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12238910	Claims benefit of provisional	60975985	2007-09-28
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12238910	Claims benefit of provisional	60982528	2007-10-25
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12238910	Claims benefit of provisional	61018999	2008-01-04
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12238910	Claims benefit of provisional	61025441	2008-02-01
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12238910	Claims benefit of provisional	61038576	2008-03-21

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12238910	Claims benefit of provisional	61074288	2008-06-20
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
12238910	Claims benefit of provisional	61083409	2008-07-24
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

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

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 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	Signal Trust for Wireless Innovation

Mailing Address Information For Applicant:

Address 1	1011 Centre Road		
Address 2	Suite 327		
City	Wilmington	**State/Province**	DE
Country	US	Postal Code	19805
Phone Number		Fax Number	
Email Address			

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

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.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

Organization Name	Signal Trust for Wireless Innovation

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	1011 Centre Road		
Address 2	Suite 327		
City	Wilmington	**State/Province**	DE
Country i	US	Postal Code	19805
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

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	/Joseph P. Gushue/			Date (YYYY-MM-DD)	2019-05-23
First Name	Joseph P.	Last Name	Gushue	Registration Number	59819

Additional Signature may be generated within this form by selecting the Add button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SIG-2-1853US06
	Application Number	
Title of Invention	METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES	

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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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 CooperationTreaty.

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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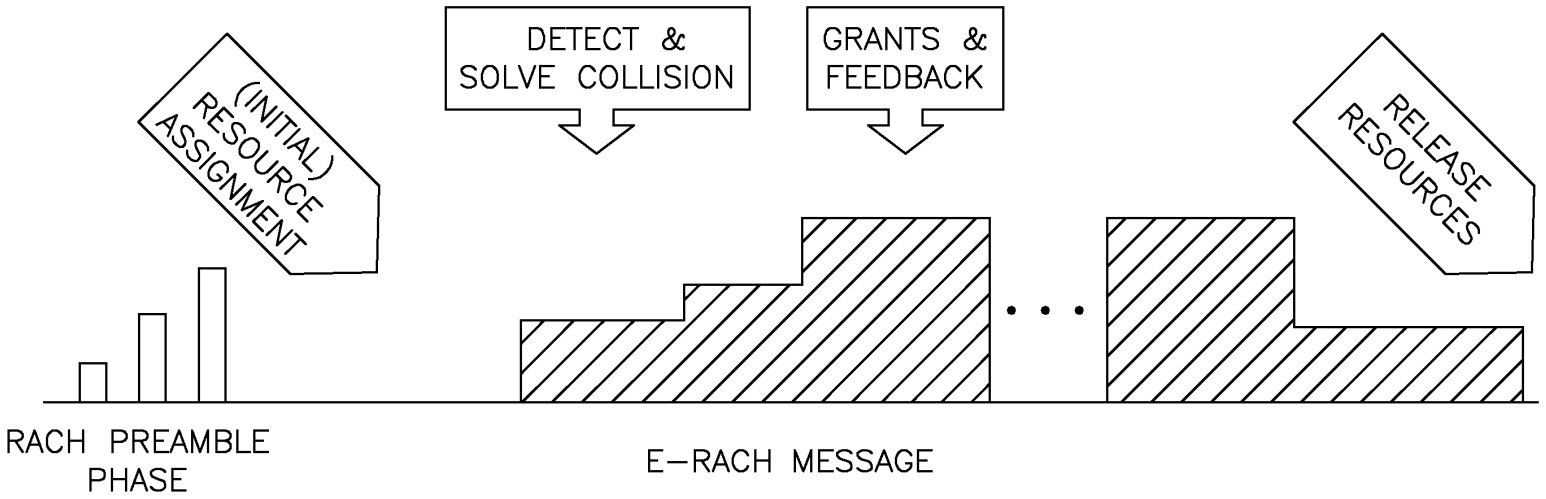


FIG. 1 (PRIOR ART)

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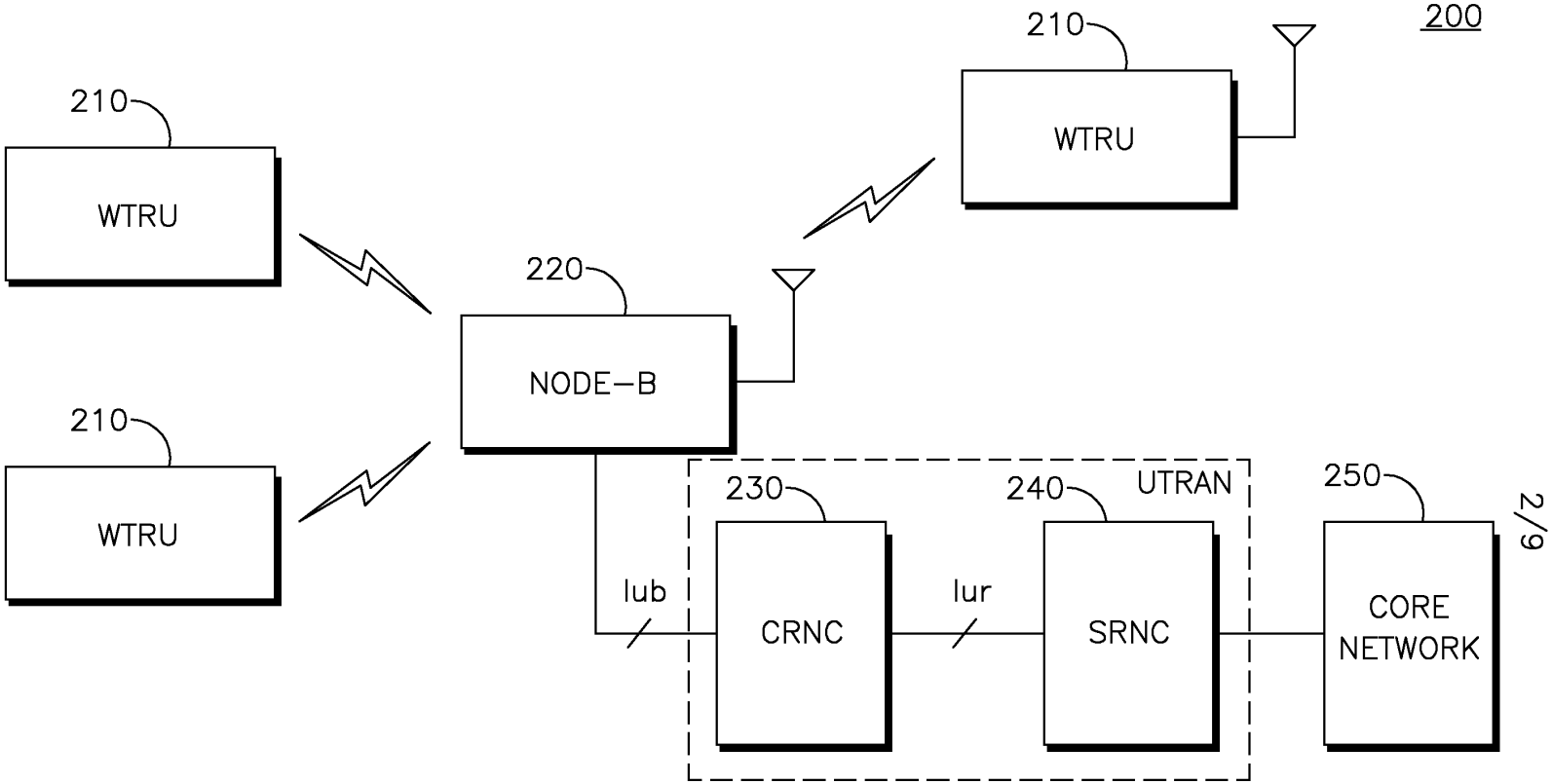


FIG. 2

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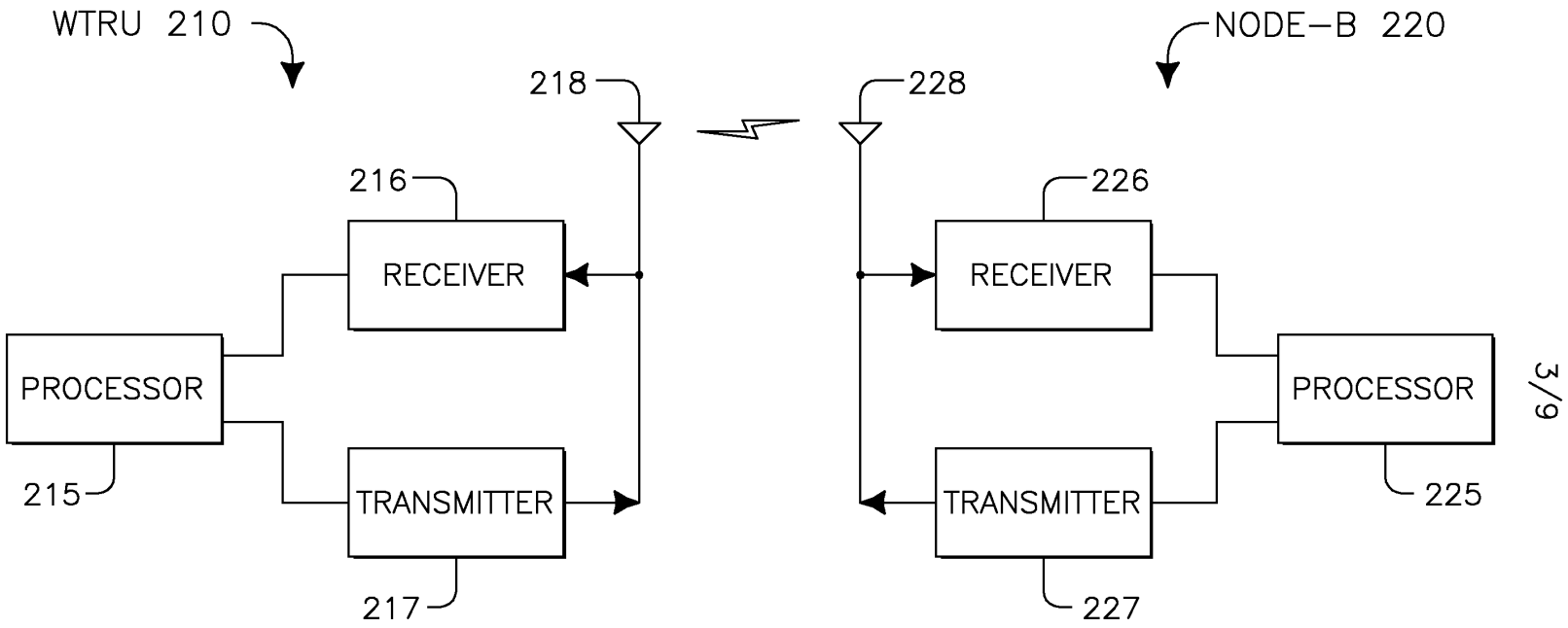


FIG. 3

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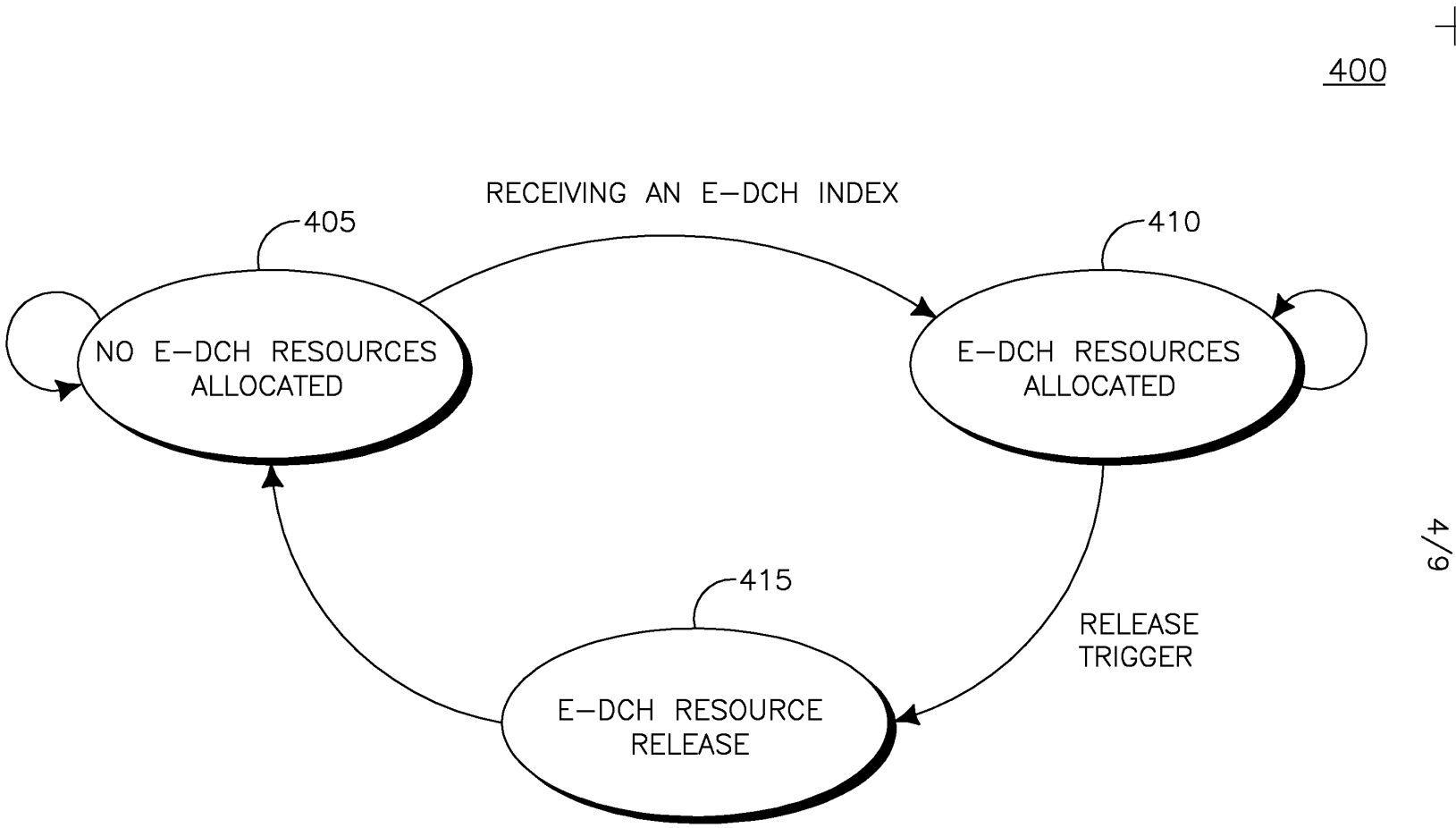


FIG. 4

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500

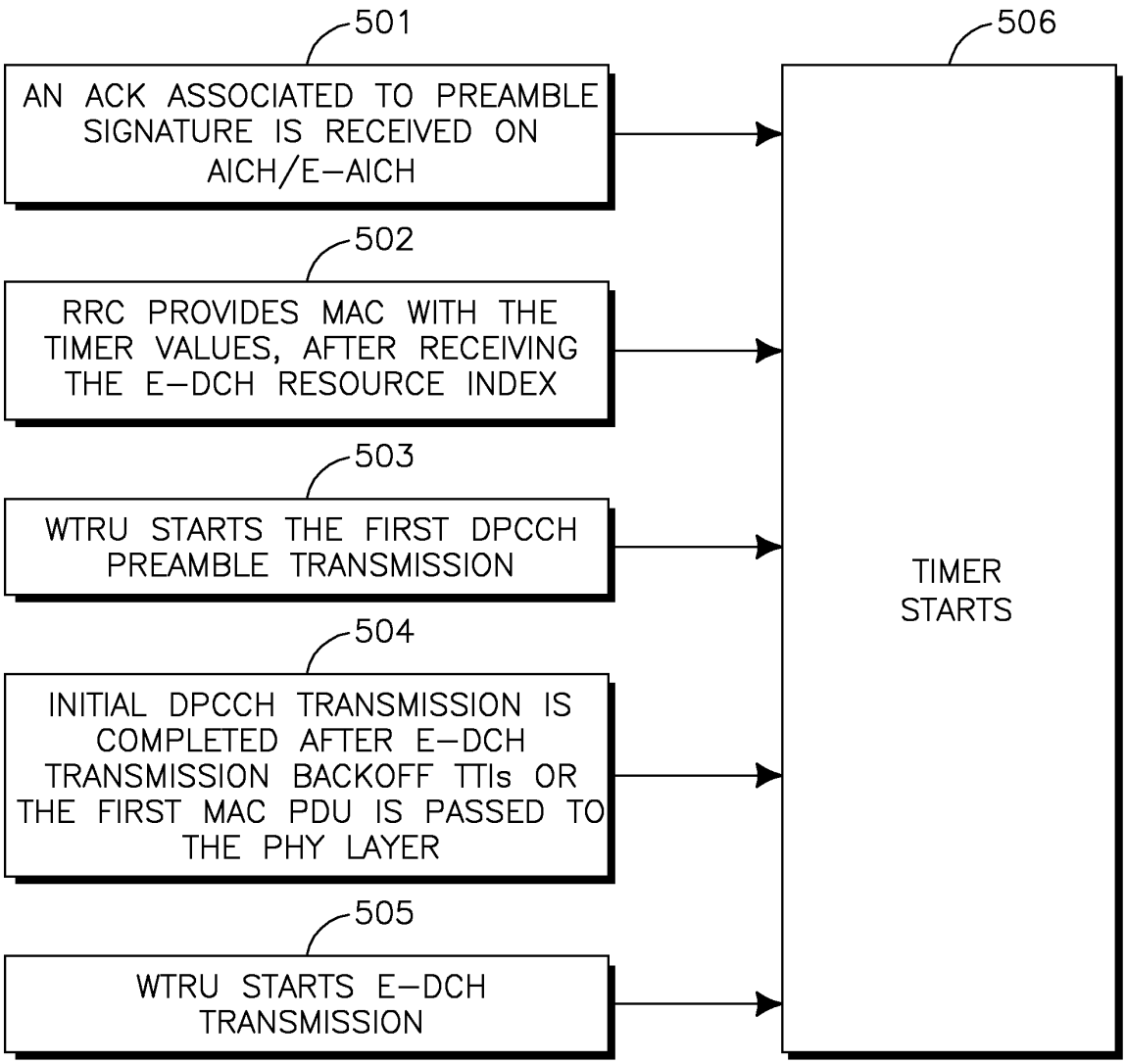

501
AN ACK ASSOCIATED TO PREAMBLE SIGNATURE IS RECEIVED ON AICH/E-AICH
502
RRC PROVIDES MAC WITH THE TIMER VALUES, AFTER RECEIVING THE E-DCH RESOURCE INDEX
503
WTRU STARTS THE FIRST DPCCH PREAMBLE TRANSMISSION
504
INITIAL DPCCH TRANSMISSION IS COMPLETED AFTER E-DCH TRANSMISSION BACKOFF TTIs OR THE FIRST MAC PDU IS PASSED TO THE PHY LAYER
505
WTRU STARTS E-DCH TRANSMISSION
506
TIMER STARTS

FIG. 5

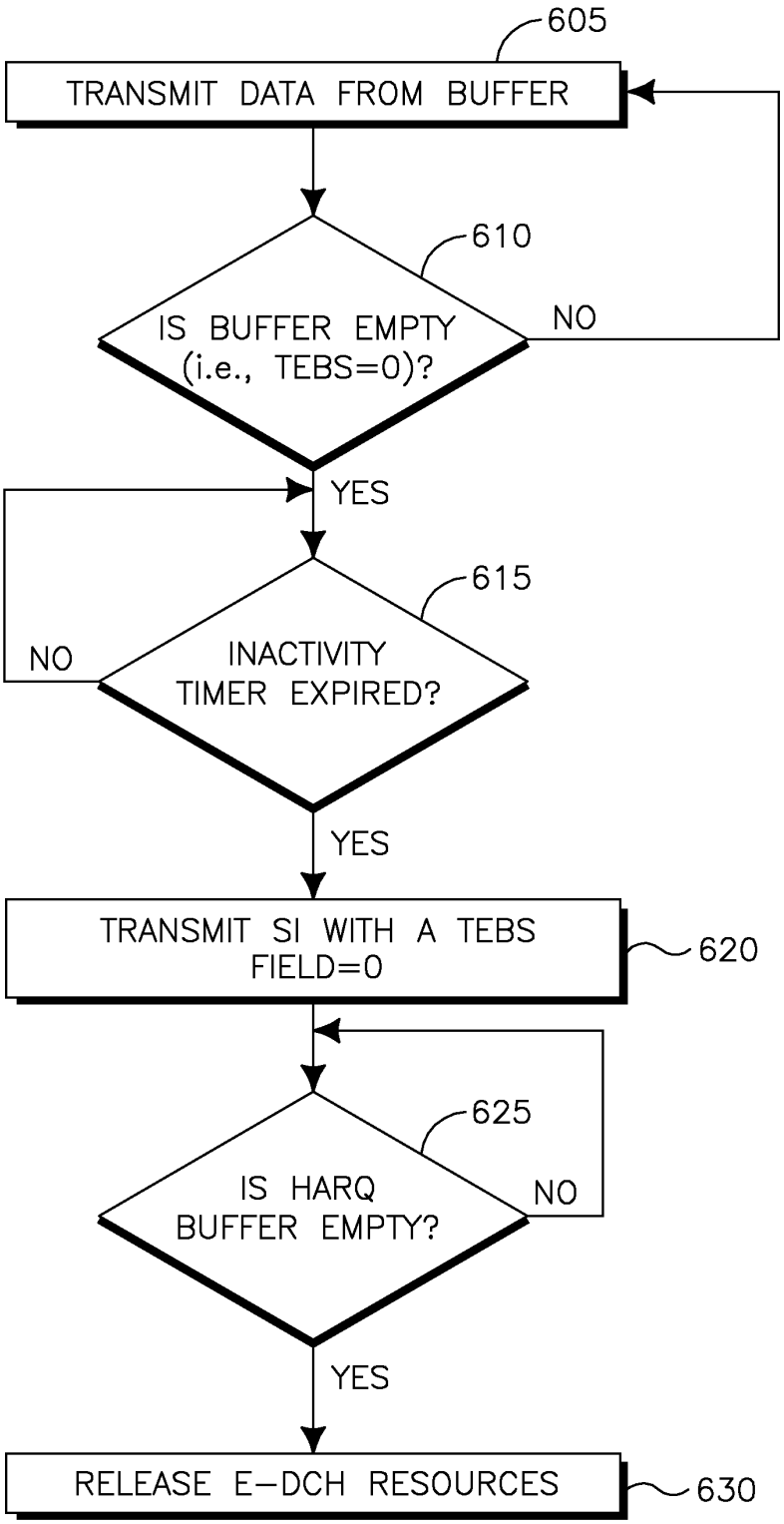

600
605
TRANSMIT DATA FROM BUFFER
610
IS BUFFER EMPTY (i.e., TEBS=0)?
NO
YES
615
INACTIVITY TIMER EXPIRED?
NO
YES
TRANSMIT SI WITH A TEBS FIELD=0
620
625
IS HARQ BUFFER EMPTY?
NO
YES
RELEASE E-DCH RESOURCES
630

FIG. 6

700

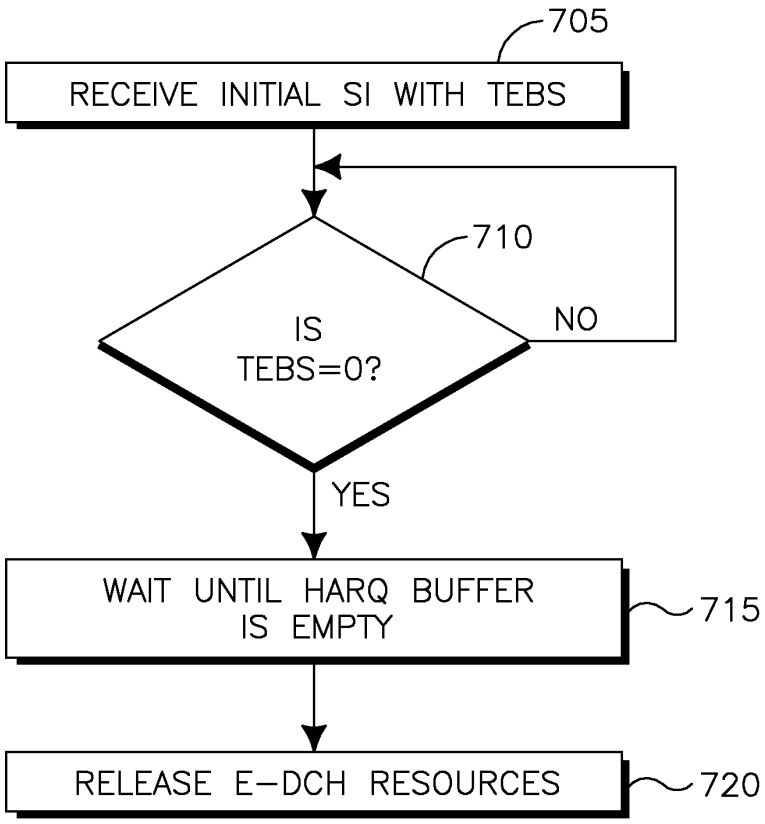

705
RECEIVE INITIAL SI WITH TEBS
710
IS
TEBS=0?
NO
YES
WAIT UNTIL HARQ BUFFER
IS EMPTY
715
RELEASE E-DCH RESOURCES
720

FIG. 7

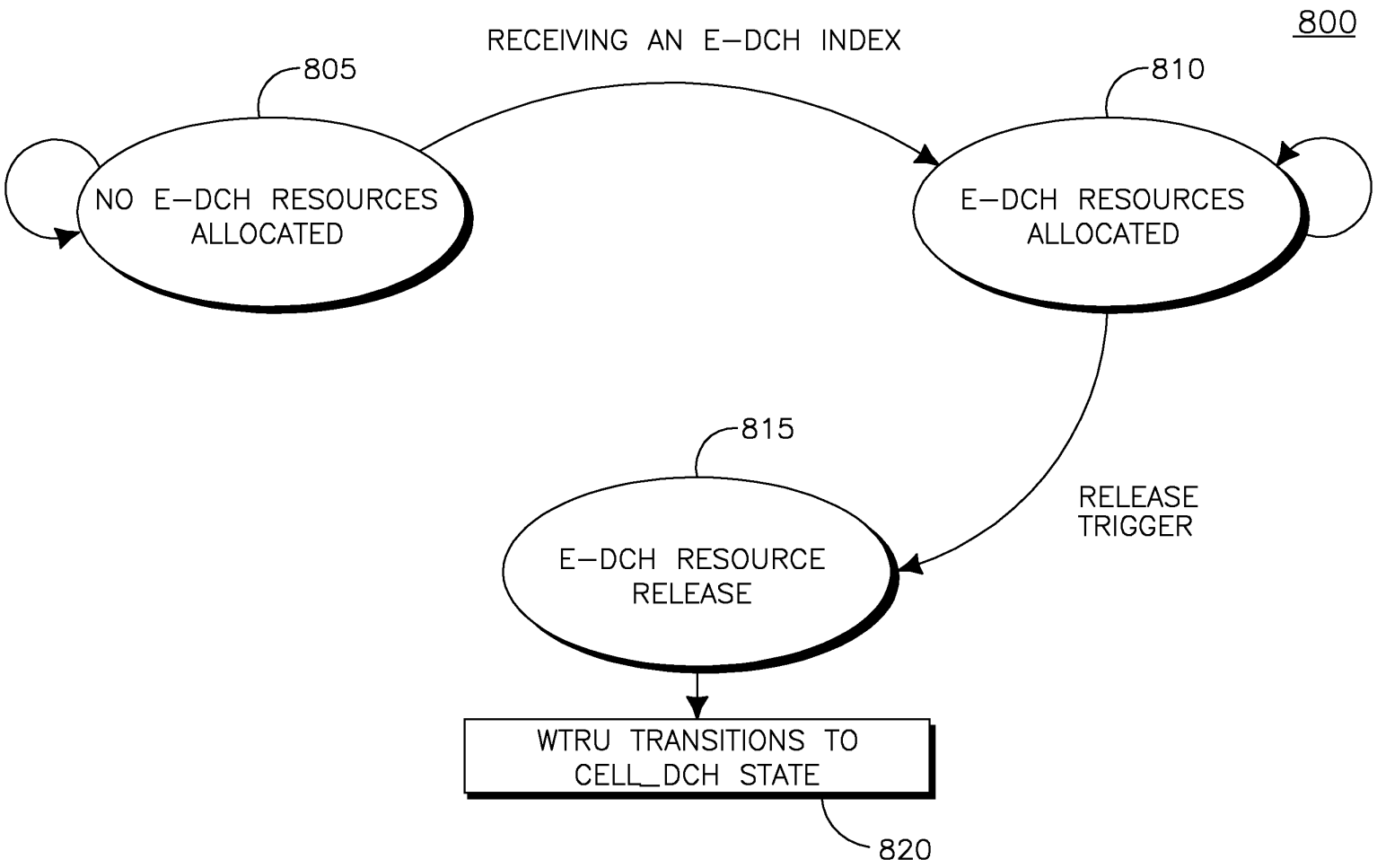


FIG. 8

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900

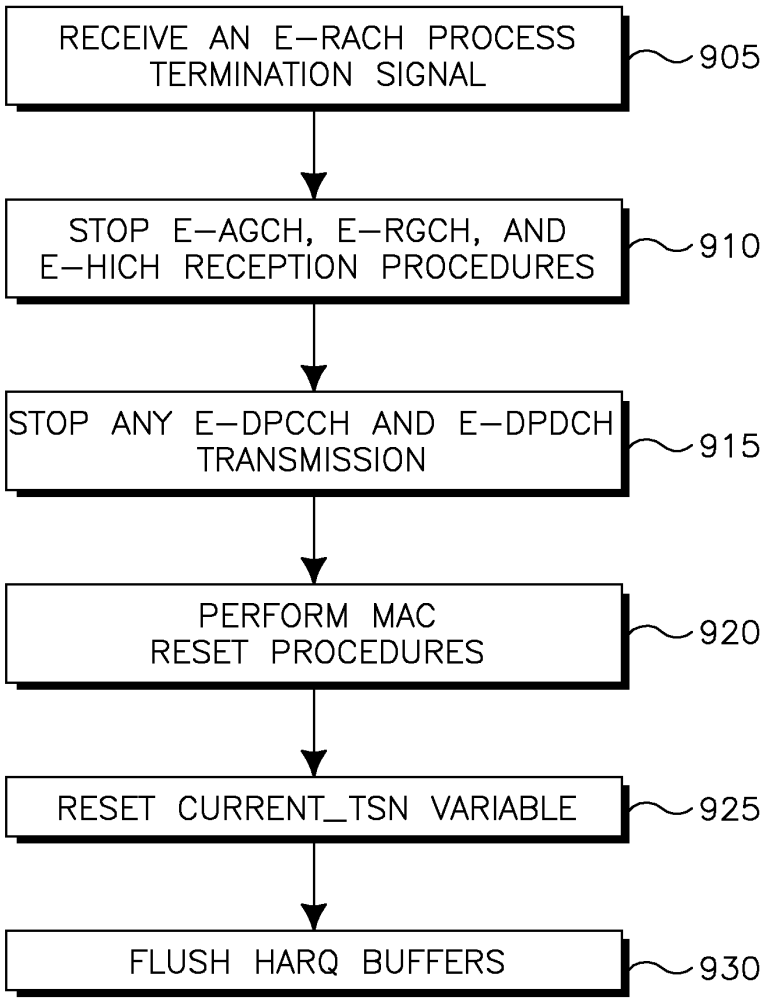

RECEIVE AN E-RACH PROCESS TERMINATION SIGNAL
905
STOP E-AGCH, E-RGCH, AND E-HICH RECEPTION PROCEDURES
910
STOP ANY E-DPCCH AND E-DPDCH TRANSMISSION
915
PERFORM MAC RESET PROCEDURES
920
RESET CURRENT_TSN VARIABLE
925
FLUSH HARQ BUFFERS
930

FIG. 9

METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 14/876,337, filed on October 6, 2015, which is a continuation of U.S. Patent Application No. 14/319,608, filed June 30, 2014, now known as U.S. Patent No. 9,313,809, which issued on April 12, 2016, which is a continuation of U.S. Patent Application No. 12/238,910 filed September 26, 2008, now known as U.S. Patent No. 8,774,104, which issued on July 8, 2014, and claims the benefit of U.S. Provisional Application No. 60/975,985 filed on September 28, 2007; U.S. Provisional Application No. 60/982,528 filed on October 25, 2007; U.S. Provisional Application No. 61/018,999, filed on January 4, 2008; U.S. Provisional Application No. 61/025,441 filed on February 1, 2008; U.S. Provisional Application No. 61/038,576 filed on March 21, 2008; U.S. Provisional Application No. 61/074,288 filed on June 20, 2008; and U.S. Provisional Application No. 61/083,409 filed on July 24, 2008, which are incorporated by reference as if fully set forth. U.S. Patent Application No. 14/319,608 is also related to U.S. Patent Application No. 14/319,975 filed on June 30, 2014, and is incorporated by reference as if fully set forth.

FIELD OF INVENTION

[0002] The present application is related to wireless communication.

BACKGROUND

[0003] In wireless communications systems, access to radio resources is controlled by a radio network. When a wireless transmit receive unit (WTRU) has data to transmit to the network, the WTRU requires access to the radio resources before transmitting its data payload. In a Third Generation Partnership Project (3GPP) network, the WTRU may transmit on the uplink using a contentious

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channel known as a random access channel (RACH). Because access to the RACH is contentious, a collision might occur when multiple WTRUs are accessing the resources simultaneously.

[0004] The current RACH access procedure in the 3GPP comprises a preamble phase with power ramp-up, followed by channel acquisition information and message transmission for random access. Because the RACH is a shared channel, in order to avoid WTRUs holding the shared radio resource for a long time, only relatively short message payloads are transmitted on the RACH; this leads to a relatively small data rate. The RACH is thus used for the transmission of short control messages. Typically, the WTRUs demanding larger data rates may be configured by the network to use dedicated resources.

[0005] The data rate provided by the RACH is sufficient for the transmission of short control messages supporting mostly speech communications, however it may be inefficient for transmission of data messages associated to the new non real-time data services such as internet browsing, e-mail, etc. For such data services, the traffic is ruptured by nature and long periods of inactivity may exist between successive transmissions. For example, applications requiring frequent transmission of keep-alive messages, may result in an inefficient utilization of dedicated resources. In such cases, it may be advantageous for the network to use shared resources for data transmission instead. The difficulty however, resides in the low data rate offered by the RACH.

[0006] To overcome these difficulties, it was proposed to use the enhanced dedicated channel (E-DCH) in the CELL_FACH state to increase the data rate of the shared channel.

[0007] Figure 1 is a diagram of an enhanced RACH (E-RACH) access. The E-RACH procedure may include, a RACH preamble phase and an E-RACH message phase. During the initial RACH preamble phase, a WTRU transmits a RACH preamble, it continues transmitting the preamble while ramping up the power of

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the transmission until it receives an initial resource assignment. The WTRU may also perform collision detection and resolution, if other WTRUs are attempting to access the RACH during this time. Once the WTRU has received permission to access the RACH, the WTRU may transmit data until the resources are released or the WTRU transitions to another state.

[0008] As mentioned above, it was proposed to use the E-DCH in a CELL_FACH state to increase the data rate of the shared channel. However, in the current standard, there are no methods to terminate the E-RACH message phase. Accordingly, it would be beneficial to provide a method and apparatus to terminate an E-RACH message phase in an E-RACH.

SUMMARY

[0009] A method and an apparatus is provided for terminating an E-RACH message in an E-RACH transmission. Triggers for terminating the E-RACH message are also provided. The actions upon termination of the E-RACH messages or transition to CELL_DCH state are provided in order to release the shared E-DCH resources while in the CELL_FACH state.

[0010] A method for terminating an enhanced random access channel (E-RACH) message in an E-RACH transmission determining that a buffer is empty; triggering a transmission of a scheduling information (SI) with the value of total enhanced dedicated channel (E-DCH) buffer status (TEBS) equal to zero; determining last hybrid automatic repeat request (HARQ) data transmission; and releasing the E-DCH resources allocation is provided.

[0011] A method for terminating an enhanced random access channel (E-RACH) message in an E-RACH transmission where the network waits until a HARQ buffer is empty and when the SI with a value of zero is received, the resources are released.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0012] A more detailed understanding may be had from the following description, given by way of example and to be understood in conjunction with the accompanying drawings wherein:

[0013] Figure 1 is a diagram of an E-RACH access with an E-DCH;

[0014] Figure 2 shows a wireless communication system;

[0015] Figure 3 is a functional block diagram of a WTRU and the base station of the wireless communication system shown in Figure 2;

[0016] Figure 4 is a flow diagram of a E-DCH resource allocation and de-allocation;

[0017] Figure 5 is a diagram of triggers for starting the timer that the WTRU may initiate for the timers;

[0018] Figure 6 is a flow diagram of a method to release E-DCH resources based on the status of a WTRU's queue or buffer;

[0019] Figure 7 is a flow diagram of a network configured to determine termination of an E-RACH message transmission;

[0020] Figure 8 is a flow diagram of E-DCH resources release when the WTRU transitions from the CELL_FACH state to the CELL_DCH state; and

[0021] Figure 9 is a flow diagram for releasing the E-DCH resources while in the CELL_FACH state.

DETAILED DESCRIPTION

[0022] When referred to hereafter, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of user device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access

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point (AP), or any other type of interfacing device capable of operating in a wireless environment.

[0023] When referred to herein, the term RACH and E-RACH may be used to describe a resource that is selected by a WTRU for uplink contention based access. The term E-RACH resource may also indicate any combination of a scrambling code, a channelization code, a timeslot, an access opportunity, or a signature sequence that are associated to an E-RACH channel in a future system architecture. The term E-RACH may also indicate the use of the E-DCH in CELL_FACH, CELL_PCH, URA_PCH states or Idle mode.

[0024] When referred to hereafter, the term enhanced medium access control (MAC)-e/es entities may refer to the MAC entities used to perform E-DCH transmission in the CELL_FACH state, which in release 8 is referred to as MAC-i/is. MAC-e/es and MAC-i/is are the MAC entities that handle the transport channel such as the enhanced dedicated transport channel (E-DCH).

[0025] Figure 2 shows a wireless communication system 200 including a plurality of WTRUs 210, a base station 220, a CRNC 230, an SRNC 240, and a core network 250. As shown in Figure 2, the WTRUs 210 are in communication with the base station 220, which is in communication with the CRNC 230 and the SRNC 240. Although three WTRUs 210, one base station 220, one CRNC 230, and one SRNC 240 are shown in Figure 3, it should be noted that any combination of wireless and wired devices may be included in the wireless communication system 200.

[0026] Figure 3 is a functional block diagram 300 of a WTRU 210 and the base station 220 of the wireless communication system 200 of Figure 2. As shown in Figure 3, the WTRU 210 is in communication with the base station 220 and both are configured to perform a method to terminate transmission of a message in an E-RACH.

[0027] In addition to the components that may be found in a typical WTRU, the WTRU 210 includes a processor 215, a receiver 216, a transmitter 217, and an

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antenna 218. The processor 215 is configured to perform a method to terminate transmission of a message in an E-RACH. The receiver 216 and the transmitter 217 are in communication with the processor 215. The antenna 218 is in communication with both the receiver 216 and the transmitter 217 to facilitate the transmission and reception of wireless data.

[0028] In addition to the components that may be found in a typical base station, the base station 220 includes a processor 225, a receiver 226, a transmitter 227, and an antenna 228. The processor 225 is configured to perform a method to terminate transmission of a message in an E-RACH. The receiver 226 and the transmitter 227 are in communication with the processor 225. The antenna 228 is in communication with both the receiver 226 and the transmitter 227 to facilitate the transmission and reception of wireless data.

[0029] Figure 4 is a flow diagram of E-DCH resource allocation and de-allocation 400 using triggering for a WTRU. The first state corresponds to a WTRU 210 that operates with no E-DCH resources allocated to it 405. Once uplink (UL) data has to be transmitted, the WTRU 210 requests E-DCH resources from the network, by transmitting a preamble and waiting for the response on the acquisition indication channel (AICH). In other words, the WTRU 210 may remain in this state until it receives a positive acknowledgement (ACK) on the AICH, or a negative acknowledgement (NACK) on the AICH followed by a resource assignment index over the E-AICH, which may also be referred to as the WTRU 210 receiving an E-DCH index. After receiving the E-DCH resource assignment, the WTRU may transition to the next state wherein E-DCH resources are allocated for enhanced uplink transmissions 410. The WTRU 210 may use these E-DCH resources for UL transmission until it receives a trigger, at which point the WTRU 210 will release the resources 415. After the WTRU 210 releases the resources, it returns to the initial state. As will be described in further detail hereafter, the trigger may be

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timer based, it may be based on the WTRU buffer status, or may be based on signaling from the RNC or the Node-B 220.

[0030] In one embodiment, the WTRU 210 may be configured to include a timer module. The timer module may include multiple timers, wherein a timer may be associated to each logical channel or each MAC-d flow. The timer module may be configured to indicate the maximum allowable transmission time for a logical channel (i.e., dedicated control channel (DCCH), dedicated traffic channel (DTCH), common control channel (CCCH), etc.). The values for the timer module may be preconfigured or signaled to the WTRU 210. The timers may be activated upon the WTRU's 210 first transmission, once an E-DCH resource index is received. The WTRU may be configured to release an E-DCH resource upon expiry of its associated timer. For example, the WTRU 210 may be configured to release a common E-DCH resource when the maximum common E-DCH resource allocation time for the CCCH has been reached. This embodiment would allow the flexibility to configure a smaller transmission time duration for a logical channel such as the CCCH.

[0031] The timer module may also be configured based on logical channel identity and the absence of an E-DCH radio network temporary identifier (E-RNTI). More specifically, a maximum E-DCH allocation time may be allocated to the CCCH transmission when an E-RNTI is not present. If the timer expires, and the WTRU 210 that is performing a CCCH transmission does not have the E-RNTI present, the E-RACH access is terminated and the resources are released. If a CCCH transmission is occurring and an E-RNTI is present, (which may occur during period cell update procedure) then the WTRU 210 is not configured to have a maximum E-DCH allocation time and the timer will not affect the WTRU 210.

[0032] Alternatively, the network may configure the transmission duration timer based on the presence or absence of an E-RNTI. The WTRU 210 may be configured to have a maximum E-DCH allocation time if it has data (user plane or

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control plane) to transmit and no E-RNTI is present. Otherwise if an E-RNTI is present the WTRU 210 is not configured with a maximum E-DCH allocation time.

[0033] Figure 5 shows a diagram of triggers for starting the timer that the WTRU 210 may initiate for the timers T_1 and T_2 500. The timers such as collision resolution T_1 and CCCH timer T_2 are started according to one of the triggers 501 to 505. This embodiment may include any combination of at least one of the shown trigger 501-505 for starting the timer 506. The timer may start if an ACK associated to the preamble signature transmitted is received on the AICH or E-AICH 501. The timer may start as soon as the radio resource control (RRC) provides the MAC with the timer values, and after receiving the E-DCH resource index 502. The timer may start if the WTRU 210 starts the first dedicated physical control channel (DPCCH) preamble transmission 503. The timer may start when the initial DPCCH transmission is completed after E-DCH transmission backoff transmission time intervals (TTIs) or the first MAC protocol data unit (PDU) is passed to the physical layer 504. Or, the timer may start when the WTRU 210 starts the E-DCH transmission 505. In addition, the WTRU 210 may initiate the timer when the collision resolution E-DCH absolute grant channel (E-AGCH) carrying the WTRU 210 E-RNTI is received. Other triggers may also be used as designed.

[0034] Alternatively, the WTRU 210 timer module may be configured such that the length of time available to the WTRU 210 is based on the number of data bits that need to be transmitted. The length of the time variable to the WTRU 210 may also be based on the number of radio link controller (RLC) or MAC PDUs. Additionally, it may also be based on the number of RLC service data units (SDUs).

[0035] Alternatively, the E-RACH message duration may be fixed at either 10 msec or 20 msec (as is specified in the current 3GPP standards). As a result, the E-RACH message phase may be active for a maximum number of frames or sub-frames. An E-RACH message duration information element (IE) may be broadcast as part of the system information broadcast (SIB), or may be included as part of L1

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signaling. For example, the E-RACH message duration IE may be transmitted with the initial resource assignment or during the collision resolution phase. In addition, the E-RACH message duration may be linked to an access service class.

[0036] Alternatively, the WTRU 210 may count the number of transmissions and retransmissions and use the count as a trigger to stop the transmission of the E-RACH message phase. For example, if the WTRU 210 is configured for repeat automatic repeat request (ARQ) type of operation and transmission on consecutive TTIs, then the WTRU may be configured to terminate the transmission of the E-RACH message phase after K retransmissions. It is noted that the value of K may be preconfigured in the WTRU, broadcasted as part of the SIB, or signaled during the E-RACH allocation phase.

[0037] Figure 6 is a flow diagram of a method to release E-DCH resources based on the status of a WTRU's 210 queue or buffer. When the WTRU 210 has data in the transmit buffer, the WTRU 210 may transmit the data 605. After a transmission, the WTRUs 210 may check if the transmit buffer is empty 610. If the transmit buffer is not empty, then the WTRU 210 will transmit the data that is in the buffer 605. If the transmit buffer is empty 610 (i.e., the Total E-DCH Buffer Status (TEBS) is equal to zero), optionally it is checked if an inactivity timer has expired 615. If the inactivity timer has expired, then the WTRU 210 may be configured to transmit a special or reserved value of the SI where TEBS is set to zero 620. The WTRU 210 may be configured to release E-DCH resource 630 after the inactivity timer has expired 615, wherein the inactivity timer is started once the TEBS is equal to zero. The WTRU 210 is considered to be inactive, if no UL or downlink (DL) traffic has been received. Alternatively, the implicit release timers (i.e., the inactivity timer) may be restarted based on a trigger mechanism when the WTRU 210 decodes its H-RNTI on the high speed shared control channel (HS-SCCH). Once the inactivity timer has expired, the WTRU 210 may be configured to transmit a special or reserved value of the SI 620. For example, the special or

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reserved value of the SI may comprise a TEBS with a value set to zero 620. The SI with the TEBS set to zero may be used to signal to the network for releasing the resources. After successfully transmitting the SI and emptying the HARQ buffers 625, the WTRU 210 releases the E-DCH resources 630.

[0038] Alternatively, the WTRU 210 may transmit a signal to the network indicating to release the resources. The signal may comprise a special combination of the SI and a Happy Bit, a new MAC signaling, where a special combination of MAC header fields may be re-interpreted. Alternatively, a field may be added in the enhanced MAC-e header or MAC-e trailer denoting a request to terminate transmission of the E-RACH message phase. For example, the WTRU 210 may transmit this signal to the network via a reserved data description indicator (DDI) combination. In another alternative, the signal may be a new RRC message; special value of the enhanced transport format combination index (E-TFCI) field in the E-DPCCH or a special combination of the E-DPCCH fields; or, a new L1 message. The final decision to release the resources may be determined by the network; which may indicate the release of resources back to the WTRU 210. Alternatively, the WTRU 210 may simply stop transmission of the E-DCH as a means to indicate the termination of the E-RACH message phase, at which point the network may release the radio resources.

[0039] Alternatively, the timer module may be configured to start when the WTRU 210 has transmitted all PDUs which were present when the E-RACH was initiated, or the buffer has passed a predetermined threshold level. The threshold level may be an absolute value or based on a relative measure using the initial queue size.

[0040] Releasing the resources upon the transmission of all PDUs in the buffer that pass a predetermined threshold level, may free up the E-RACH resources for other WTRUs 210. For example, the threshold levels may be set to allow the network to tradeoff fairness between WTRUs 210 and transmission delay.

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These levels may be configured through system information or they may be preconfigured in the WTRU 210.

[0041] In addition, there may be procedures for physical layer that may trigger a termination of the E-RACH message transmission. This includes cell reselection and measurements controlled by the FACH measurement occasions or detection of radio link (RL) failure.

[0042] Alternatively, the WTRU 210 may suspend all transmission during the measurement occasion. Also, the scheduler at the Node-B 220 may be aware of the measurement occasion and may also suspend any grant, ACK, or NACK downlink transmission. Upon resuming normal operation, the network may optionally transmit an initial grant so that the power control loop may be re-established. Or, the network may wait for an indication from the WTRU 210 using a preamble power ramp or similar procedure. Optionally, the WTRU 210 may indicate the reason for termination in the termination signal or the termination message. Reasons for E-RACH termination may include a RL failure and E-RACH transmission complete.

[0043] Figure 7 shows a flow diagram of a network configured to determine termination of an E-RACH message transmission 700. The termination of the E-RACH message phase may be established by the network based on the reception of the amount of data indicated in an initial SI 705 by the Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Network (UTRAN). Alternatively, it may be established based on the UTRAN receiving the amount of data indicated in subsequent SIs or indicated using a different mechanism. The UTRAN may use the values of SI to determine when to terminate the message transmission. More specifically, an SI with TEBS set to zero 710 signals to the network that the WTRU 210 is releasing the resources once the transmission of data in the HARQ buffers is completed. The UTRAN releases E-DCH resources 720

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after SI with TEBS set to zero is received and there is no more HARQ transmission 715.

[0044] Alternatively, the UTRAN may simply turn off transmission of the associated F-DPCH and explicit additional signaling is not used. This approach may be used in the case where both the WTRU 210 and the network are aware that the transmission is to be terminated.

[0045] Alternatively, SI may be transmitted every time the buffer occupancy changes. Alternatively, an SI may be transmitted every time the buffer occupancy changes by a pre-defined or signaled amount (i.e., additional data is received in the buffer), even if the new data is not from higher priority logical channels. If the TEBS is equal to zero then the SI triggering mechanism may be modified to allow the SI to be transmitted. The SI with TEBS set to zero signals to the network that the WTRU is releasing the resources once the transmission of data in the HARQ buffers is completed and the UTRAN also releases the E-DCH resources. Alternatively, an SI may be transmitted in every HARQ transmission when the WTRU 210 is in CELL_FACH state or occupying E-RACH resources.

[0046] In another termination option, the UTRAN may explicitly signal the end of the E-RACH transmission. Once the UTRAN determines the end of the E-RACH message transmission, it signals to the WTRU 210 by transmitting a special value over the E-AGCH (e.g., a 0 grant). Or, the UTRAN signals to the WTRU 210 by transmitting an RRC message over the FACH or over the High Speed Downlink Shared channel (HS-DSCH) if the WTRU 210 is configured for HS-DSCH in CELL_FACH state. Alternatively, the network signals to the WTRU 210 by using L1 signaling. This may include stopping the fractional dedicated physical channel (F-DPCH) or transmitting a flag or combination of pre-determined fields on the HS-SCCH if the WTRU 210 is configured for HS-DSCH in CELL_FACH state, for example, using an HS-SCCH order.

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[0047] Alternatively, the termination of the E-RACH message may be established based on a lack of activity on the enhanced dedicated physical data channel (E-DPDCH) or enhanced DPCCH (E-DPCCH) transmission.

[0048] The termination of the E-RACH part may also be established based on the status of the WTRU 210 scheduling requests. As an example, the UTRAN may monitor the received SI or Happy Bit status. If this information indicates low usage, the network may decide to terminate the current transmission of the E-RACH message so that the other WTRUs 210 may have an opportunity to access the resources. Alternatively, if this information indicates high usage and continued need with the Happy Bit set to unhappy, then the UTRAN may decide to transition the WTRU 210 to CELL_DCH state. As another alternative, the UTRAN may use the traffic volume measurement report (such as uplink RRC measurement report) to determine that the WTRU 210 does not have any further data or a small amount of data to transmit.

[0049] Alternatively, the UTRAN may implicitly signal the WTRU 210 to release the E-RACH resource by not transmitting predefined physical channels or signals for a predetermined amount of time. In other words, the WTRU 210 releases the E-RACH resources if it does not receive any transmission from the UTRAN on either channel E-AGCH destined to the WTRU 210, E-RGCH associated with E-RACH resource that is used by the WTRU 210, F-DPCH associated with the E-RACH resource that is used by the WTRU 210, and/or, HS-SCCH or high speed physical downlink shared channel (HS-PDSCH) that is destined to the WTRU 210.

[0050] Optionally, the UTRAN may indicate the reason for termination in the termination signal or termination message. Reasons for E-RACH termination may include, but are not limited to an RL failure, completion of the E-RACH transmission, and network congestion.

[0051] Figure 8 is a flow diagram of the E-DCH resources released when the WTRU 210 transitions from the CELL_FACH state to the CELL_DCH state. The

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WTRU 210 operates without any E-DCH resources allocated 805. Upon receiving an E-DCH resource assignment on the AICH or E-AICH or a NACK on the AICH followed by a resource assignment index over the E-AICH, which may also be referred to as the WTRU 210 receiving an E-DCH index, the WTRU 210 may access the E-DCH resources allocated to it in the CELL_FACH state 810. The WTRU 210 retains control of the E-DCH resources until it receives a reconfiguration message, (e.g., via the FACH or the HS-DSCH), indicating that a switch to the CELL_DCH state may be performed. The E-DCH resources are then released 815. And, the WTRU 210 may transition to the CELL_DCH state 820. If the UTRAN reconfigures the WTRU 210 to the CELL_DCH state with dedicated E-DCH resources while the WTRU 210 is transmitting over the E-RACH, then the WTRU 210 may release the E-RACH resources at the activation time that is specified in the reconfiguration message in the case of synchronous reconfiguration. Alternatively, the WTRU 210 may release the E-RACH resources at a fixed delay prior to or after the activation time. Alternatively, the WTRU 210 may release the E-RACH resources immediately upon reception of the RRC reconfiguration message.

[0052] Additionally, the WTRU 210 may be configured to release the E-RACH resources at the same time as it configures itself for a transmission over the dedicated E-DCH resources. Alternatively, the WTRU 210 may release the E-RACH resources at a fixed delay prior to or after configuring itself for transmission using the dedicated E-DCH resources; or, release the E-RACH resources once the WTRU 210 is fully synchronized with the UTRAN with the dedicated E-DCH resources.

[0053] Figure 9 is a flow chart of a procedure for releasing the E-DCH resources while in the CELL_FACH state or idle mode, when the E-RACH termination triggers occur. The WTRU 210 begins the E-RACH termination process 905. The WTRU 210 may be configured to stop any E-AGCH, E-RGCH, and E-HICH reception procedures that are occurring 910. The WTRU 210 may be further

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configured to stop any E-DPCCH and E-DPDCH transmission procedures that are occurring 915. The WTRU 210 may then perform a MAC reset procedure 920 and release HARQ buffers 930. The enhanced MAC-e/es reset procedure may include flushing the HARQ processes, discarding any remaining segments in the segmentation entity of the enhanced MAC-e/es and resetting the CURRENT_transmission sequence number (TSN) value to zero. Alternatively, if the remaining segment is from a DTCH or a DCCH logical channel the WTRU 210 may resume transmission of the segment at a remaining process. An indication may be transmitted to the SRNC 240 via Iub signaling to discard any stored segment and reset the TSN reordering numbers.

[0054] If the E-DCH has terminated and the DTCH or the DCCH transmission is active, the WTRU 210 may flush the HARQ processes 930 and discard any remaining segments in the segmentation entity of the MAC-i/is.

[0055] The other logical channels or queues of the MAC-i/is entity that do not correspond to the CCCH are not reset. The Node-B 220 may be configured to perform a reset of the MAC-is entity of the CCCH. In other words, any segment may be discarded and the expected TSN is set to its initial value. If the MAC-is entity is in the CRNC 230, Node-B 220 uses Iub signaling indicating to the MAC-is entity to perform a reset. In addition, the MAC-i entity associated to the E-DCH resource is reset (i.e., HARQ soft buffers are flushed).

[0056] When the WTRU 210 performs a full MAC-i/is reset, the MAC-is entity in the SRNC 240 may be notified via a new Iub/Iur signaling that E-RACH access has been terminated; thus MAC-is entity in the SRNC 240 may also perform a reset. More specifically, when the Node-B 220 terminates the E-DCH connection with the WTRU 210, it releases the E-DCH resources, flushes the HARQ buffers, and notifies the SRNC 240 or CRNC 230 that the connection has been terminated and thus the CRNC 230 or SRNC 240 also perform a reset of the MAC. The CRNC 230 or SRNC 240 is notified via Iub or Iur signaling. A new control bit may be

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introduced in the Iub or Iur frame format or a new frame format may be defined to signal to the SRNC 240 or CRNC 230 the release of the resources.

[0057] Also, optionally, the reset of the MAC-i/is or only discarding of the segments may be performed after a time interval (Tr) because the termination of the E-RACH resource. The timer is also initiated in the network side. Tr may be a system configured timer signaled to the WTRU 210 via RRC message, via system information block (SIB), or preconfigured in the WTRU 210. The timer is initiated as soon as the E-DCH resources are terminated in the WTRU 210.

[0058] The WTRU 210 may be configured to stop the timer if it is running and if the WTRU 210 attempts to perform E-RACH access. Also, the WTRU 210 may also stop the timer, if the WTRU 210 attempts the E-RACH access and obtains the E-DCH resources assigned, or the WTRU 210 obtains the E-DCH resources assigned and resolves the contention resolution phase.

[0059] Alternatively, the WTRU 210, the Node-B 220 and/or the RNCs may be configured with a TSN_RESET_TIMER, wherein the WTRU 210 is configured to perform a TSN reset when the timer expires. Optionally, the WTRU 210 may perform a full enhanced MAC-e/es reset procedure when the timer expires.

[0060] The E-DCH resources are released when a transition from CELL_FACH to CELL_DCH occurs.

[0061] The WTRU 210 and the RNC may reset the value of the last used TSN number (i.e., CURRENT_TSN) to the initial value upon the release of the E-DCH resource set being used by the WTRU 210. The WTRU 210 and the RNC may each include synchronized timers, wherein the expiry of the timer signals the release of the E-DCH resources. After the timer expires and the resources are released, the WTRU 210 may reset the TSN and optionally perform a full enhanced MAC-e/es reset procedure.

[0062] Alternatively, the UTRAN may order the release of the resources. The UTRAN may signal the WTRU indicating that the resources must be released. In

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this case, upon reception of the message, the WTRU 210 and UTRAN reset the TSN to an initial value.

[0063] Alternatively, the TSN number may be reset upon the expiration of an inactivity timer. In this case, an inactivity timer may be started in both the WTRU 210 and the network after the last MAC-e PDU is transmitted and received, respectively. If the timer expires, the WTRU 210 and the RNC resets the TSN to its initial value. Optionally, a full enhanced MAC-e/es reset procedure may be performed.

[0064] In another alternative, the TSN number may not reset. The last TSN values used are stored in memory and continuously incremented for each new transmission, regardless of the E-DCH resource set being used or the time in which the transmission is taking place.

[0065] Alternatively, the TSN number may be set to its initial value and optionally a full enhanced MAC-e/es reset may take place when a cell reselection occurs. Resetting the TSN or the MAC-e/es may always occur after the WTRU 210 performs cell reselection. Alternatively, it may only occur when a serving radio network subsystem (SRNS) relocation occurs. The RNC may signal the TSN reset via an explicit enhanced MAC-e/es reset indicator or the WTRU 210 may implicitly detect that SRNS relocation has occurred due to the presence or the change of a new UTRAN RNTI (U-RNTI).

[0066] Although features and elements are described above in particular combinations, each feature or element may be used alone without the other features and elements or in various combinations with or without other features and elements. The methods or flow charts provided herein may be implemented in a computer program, software, or firmware tangibly embodied in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor

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memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[0067] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

[0068] A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet browser, and/or any wireless local area network (WLAN) or Ultra Wide Band (UWB) module.

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CLAIMS

What is claimed is:

1. A wireless transmit/receive unit (WTRU) comprising:

a receiver;

a transmitter; and

a processor; and

wherein:

the receiver and the processor are configured to receive a radio resource control (RRC) message indicating uplink resources for WTRU and medium access control (MAC) timer information;

the transmitter and the processor are configured to transmit uplink data based on the indicated uplink resources; and

the processor is configured to deactivate the indicated uplink resources in response to a MAC timer expiring, the MAC timer being configured based on the MAC timer information.

2. The WTRU of claim 1 wherein the receiver and the processor are configured to receive an uplink grant associated with the indicated uplink resources and the transmitter and the processor are configured to transmit using the indicated uplink resources based on the grant.

3. The WTRU of claim 2 wherein based on the receipt of the uplink grant, the WTRU does not deactivate the indicated uplink resources.

4. The WTRU of claim 1 wherein the receiver and the processor are configured to receive a deactivation message and the processor is configured to deactivate the uplink resources based on the received deactivation message.

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5. The WTRU of claim 1 wherein the MAC timer is based on a number of frames.

6. A method comprising:

receiving, by a wireless transmit/receive unit (WTRU), a radio resource control (RRC) message indicating uplink resources for WTRU and medium access control (MAC) timer information;

transmitting, by the WTRU, uplink data based on the indicated uplink resources; and

deactivating, by the WTRU, the indicated uplink resources in response to a MAC timer expiring, wherein the MAC timer is configured based on the MAC timer information.

7. The method of claim 6 further comprising receiving, by the WTRU, an uplink grant associated with the indicated uplink resources and transmitting, by the WTRU, using the indicated uplink resources based on the grant.

8. The method of claim 7 wherein based on the receipt of the uplink grant, the WTRU does not deactivate the indicated uplink resources.

9. The method of claim 7 further comprising receiving, by the WTRU, a deactivation message and deactivating, by the WTRU, the uplink resources based on the received deactivation message.

10. The method of claim 7 wherein the MAC timer is based on a number of frames.

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ABSTRACT

A method and an apparatus is provided for transmitting uplink data on uplink resources. The method and apparatus includes receiving a radio resource control (RRC) message indicating uplink resources for wireless transmit/receive unit (WTRU) and medium access control (MAC) timer information, transmitting uplink data based on the indicated uplink resources, and deactivating the indicated uplink resources in response to a MAC timer expiring, wherein the MAC timer is configured based on the MAC timer information.

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Signal Trust for Wireless Innovation

Application No./Patent No.: Not Yet Known Filed/Issue Date: Herewith

Titled: METHOD AND APPARATUS FOR TRANSMITTING UPLINK DATA ON UPLINK RESOURCES

Signal Trust for Wireless Innovation, 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:

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   The document was recorded in the United States Patent and Trademark Office at Reel 021966, Frame 0202, or for which a copy thereof is attached.

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STATEMENT UNDER 37 CFR 3.73(c)

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

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

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

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

/Joseph P. Gushue/	May 23, 2019
Signature	Date
Joseph P. Gushue	59,819
Printed or Typed Name	Title or Registration Number

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