PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Pantech Inc.

Application No./Patent No.: _____ Filed/Issue Date: 2016-10-31

Titled: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

Pantech Inc., a Corporation

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

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

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

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

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

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

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

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

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

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

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

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

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

1. From: Ki Bum KWON, et al To: Pantech Co., Ltd.

   The document was recorded in the United States Patent and Trademark Office at
   Reel 030072, Frame 0257, or for which a copy thereof is attached.

2. From: Pantech Co., Ltd. To: Pantech Inc.

   The document was recorded in the United States Patent and Trademark Office at
   Reel 040005, Frame 0257, or for which a copy thereof is attached.

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

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

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/Christopher B. Kilner/	2016-10-31
Signature	Date
Christopher B. Kilner	Patent Attorney (Reg. No. 45,381)
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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.

HC Park & Associates, PLC
COUNSELORS at LAW

ASSIGNMENT SERVING AS DECLARATION PER 37 C.F.R. § 1.63(e)

As a below named inventor and Assignor, I declare that:

This assignment and declaration are directed to:

☒ The attached application entitled
APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

having attorney docket number ("Application"), which claims priority from:
Korean Patent Application No. 10-2012-0030216, filed March 23, 2012.

☐ As amended on _____ (if applicable);

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.

Whereas, Assignor has invented certain new and useful processes, machines, articles of manufacture, compositions of matter, and/or improvements thereof ("Invention") disclosed in the Application,

Whereas, Assignor desires to convey all rights, titles, and interests in and to the same to:

PANTECH CO., LTD.
Pantech Bldg., I-2, DMC Sangam-dong
Mapo-gu
121-792 Seoul
South Korea

PANTECH CO., LTD. herein further referred to as ("Assignee").

Now, for valuable consideration by Assignee to Assignor, the receipt of which is hereby acknowledged, and for other good and valuable consideration, Assignee and Assignor hereby agree as follows:

Assignor hereby conveys, assigns, sells and transfers to Assignee all rights, title and interests in and to the Invention disclosed in said application and in and to any Letters Patent of

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Page 4 of 353

the United States (US), any continuation, division, renewal, or substitute thereof, and hereby grant to Assignee the right to apply in its own name for patents or Inventor's certificates and related rights heretofore or hereafter filed for the Invention in any and all countries, including (without limitation) all rights to claim priority based thereon, all patents granted thereon and all reissues, extensions and renewals thereof.

Assignor hereby covenants that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this Assignment.

Assignor further covenants that Assignee will, upon Assignee's request, be provided promptly with all pertinent facts and documents relating to the Invention, Patent, Application and any patents granted thereon, as may be known and accessible to Assignor, and Assignor will testify as to the same in any interference, litigation or proceeding related thereto and will promptly execute and deliver to Assignee or Assignee's legal representative any and all papers, instruments or affidavits required to apply for, protect, obtain, maintain, issue, defend and enforce the Application, Patent, Invention, whether in the US or any and all foreign countries and any patents granted thereon and/or for obtaining any reissue or reissues of any patent which may be granted for the invention and perform such further acts which may be necessary or desirable to carry out the intent of this agreement as the Assignee thereof shall hereafter require and prepare at assignee's expense.

IN WITNESS WHEREOF, Inventor and Assignor has hereunto set hand and seal.

First Inventor's and Assignor's Name: Ki Bum KWON

Address: Pantech Bldg., I-2, DMC
Sangam-dong, Mapo-gu
121-270 Seoul
South Korea

First Inventor's and Assignor's Signature: Ki Bum Kwon

Date: 2013 - 3 - 20

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Page 5 of 353

HC Park & Associates, PLC
COUNSELORS at LAW

Docket No. _____

Second Inventor's and Assignor's Name: Jae Hyun AHN

Address: Pantech Bldg., I-2, DMC
Sangam-dong, Mapo-gu
121-270 Seoul
South Korea

Second Inventor's and Assignor's Signature: _____

Date: 2013. 3. 20

Third Inventor's and Assignor's Name: Kang Suk HUH

Address: Pantech Bldg., I-2, DMC
Sangam-dong, Mapo-gu
121-270 Seoul
South Korea

Third Inventor's and Assignor's Signature: Huh, Kang Suk

Date: March 20, 2013

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Page 6 of 353

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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	
Filing Date	2016-10-31
First Named Inventor	Ki Bum KWON
Art Unit	
Examiner Name	
Attorney Docket Number	P5256USC1C1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8804668		2014-08-12	Dinan	
	2	8964645		2015-02-00	Kwon, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20130114574		2013-05-09	Ng et al.	
	2	20120142361		2012-06-07	Zhao et al.	
	3	20130028185		2013-01-31	Wu	
	4	20130064165		2013-03-14	Chen et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2016-10-31
	First Named Inventor	Ki Bum KWON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P5256USC1C1

	5	20090170510		2009-07-02	Kim		
	6	20130336298		2013-12-19	Dinan		
	7	20130058309		2013-03-00	Kuo		
	8	20130188612		2013-07-00	Dinan, Esmael Hejazi		
	9	20140286240		2014-09-00	Kim, et al.		
	10	20140120920		2014-05-00	Park, et al.		
	11	20130188473		2013-07-00	Dinan, Esmael Hejazi		

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2011-032497	WO		2011-03-24	Datang Mobile Comm. Equip. Co.	Corresponds to US 2012-0142361	☐
	2	2257085	EP		2010-12-01	ZTE Corporation		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2016-10-31
	First Named Inventor	Ki Bum KWON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P5256USC1C1

	3	2424306	EP		2012-02-29	NEC Corporation		☐
	4	2387279	EP		2011-11-16	Panasonic Corporation		☐

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

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	International Search Report dated June 26, 2013, issued for International Application No. PCT/KR2013/002421.	☐
	2	Notice of Allowance issued October 17, 2014 issued for US Patent Application No. 13/849,296.	☐
	3	3rd Generation Partnership Project Technical Specification 36.331, v10.5.0, dated March 14, 2012	☐
	4	3rd Generation Partnership Project Technical Specification 36.300, v10.7.0, dated March 14, 2012	☐
	5	3rd Generation Partnership Project Technical Specification 36.321, v10.5.0, dated March 16, 2012	☐
	6	Non-Final Office Action issued March 27, 2015, in U.S. Patent Application No. 14/626,047.	☐
	7	Non-Final Office Action issued April 21, 2016, in U.S. Patent Application No. 14/626,047.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2016-10-31
	First Named Inventor	Ki Bum KWON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P5256USC1C1

	8	Notice of Allowance issued July 29, 2016 issued for US Patent Application No. 14/626,047.	☐

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

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2016-10-31
	First Named Inventor	Ki Bum KWON
	Art Unit	
	Examiner Name	
	Attorney Docket Number	P5256USC1C1

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	/Christopher B. Kilner/	Date (YYYY-MM-DD)	2016-10-31
Name/Print	Christopher B. Kilner	Registration Number	45,381

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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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.

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

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

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

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

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

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

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

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Filer:	Hae-Chan Park/Sheryll Jenkins
Attorney Docket Number:	P5256USC1C1

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	280	280
UTILITY SEARCH FEE	1111	1	600	600
UTILITY EXAMINATION FEE	1311	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1600**

Electronic Acknowledgement Receipt

EFS ID:	27371323
Application Number:	15338993
International Application Number:	
Confirmation Number:	3430
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Customer Number:	58027
Filer:	Hae-Chan Park/Sheryll Jenkins
Filer Authorized By:	Hae-Chan Park
Attorney Docket Number:	P5256USC1C1
Receipt Date:	31-OCT-2016
Filing Date:	
Time Stamp:	15:29:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1600
RAM confirmation Number	110116INTEFSW15312000
Deposit Account	
Authorized User	

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		P5256USC1C1-Specification.pdf	304614 2d1b82186826cf36574b7ee98053a732f645324c	yes	68

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	64
	Claims	65	67
	Abstract	68	68

Warnings:

Information:

2	Drawings-only black and white line drawings	P5256USC1C1-Drawings.pdf	1532339 74b02f5c804633870a208d869a4a37189c26b5f3	no	16

Warnings:

Information:

3	Application Data Sheet	P5256USC1C1-ADS.pdf	3057316 54ba8113cfdd0f941cfa3cc79882b2071d65d7ed	no	9

Warnings:

Information:

This is not an USPTO supplied ADS fillable form

4	Power of Attorney	P5256USC1C1-POA-373C.pdf	821391 067683c358d4835c103e872398100f0331855772	no	3

Warnings:

Information:

5	Oath or Declaration filed	P5256USC1C1-Oaths.pdf	366498 8c4ff417d2c98b943950eaf76ecf3121a4907c9b	no	3
Warnings:					
Information:					
6	Information Disclosure Statement (IDS) Form (SB08)	P5256USC1C1-IDS.pdf	1669399 02f643c250fcf7ba2e7bef0e0a447e4d1b813730	no	6
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
7	Non Patent Literature	P5256USC1C1-NPL1.pdf	262895 44fbf3f87bce11097ac911d1cf6f8f1c9c826680	no	12
Warnings:					
Information:					
8	Non Patent Literature	P5256USC1C1-NPL2.pdf	84859 a7cba2ca3d56ea83635057448600c493a2c1674b	no	4
Warnings:					
Information:					
9	Non Patent Literature	P5256USC1C1-NPL3.pdf	246922 40fb1a640f0edf6b850812759c0987488ecacb81	no	8
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	35114 ef4a72beb3f85ad8f211b024b0b62c1749abecc1	no	2
Warnings:					
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APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 14/626,047, filed February 19, 2015, which is a continuation of U.S. Patent Application No. 13/849,296, filed on March 22, 2013, now issued as U.S. Pat. No., 8,964,645, and claims priority from and the benefit of Korean Patent Application No. 10-2012-0030216, filed on March 23, 2012, all of which are incorporated by reference for all purposes as if set forth herein.

BACKGROUND

[0002] FIELD

[0003] The present invention relates to wireless communication and, more particularly, to an apparatus and method for uplink synchronization in a multiple component carrier system.

[0004] DISCUSSION OF THE BACKGROUND

[0005] In a common wireless communication system, although an uplink bandwidth and a downlink bandwidth are differently set, only one carrier is chiefly taken into consideration. In 3rd Generation Partnership Project (3GPP) Long Term Evolution (LTE), the number of carriers forming uplink and downlink is one based on a single carrier and the bandwidth of uplink and the bandwidth of downlink are symmetrical to each other. In this single carrier system, random access is performed using one carrier. As multiple component carrier systems are recently introduced, random access has been able to be implemented through several component carriers.

[0006] A multiple component carrier system means a wireless communication system

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capable of a carrier aggregation. The carrier aggregation is technology in which small fragmented bands are efficiently used, and the carrier aggregation creates an effect that uses a logically wide band by aggregating a plurality of physically continuous or discontiguous bands in a frequency domain.

[0007] A terminal performs a random access procedure in order to access a network. The random access procedure can be divided into a contention-based random access procedure and a non-contention-based random access procedure. The greatest difference between the contention-based random access procedure and the non-contention-based random access procedure lies in whether a random access preamble is dedicated to one terminal or not. An object of a terminal to perform a random access procedure on a network can include initial access, a handover, a scheduling request, and timing alignment.

[0008] In a multiple component carrier, in order to effectively perform timing alignment, a concept of a Timing Advance Group (TAG) is used. The TAG is a group of one or more serving cells having the same timing advance value and is configured in response to higher layer signaling. A base station can indicate that a secondary serving cell is included in what TAG for each secondary serving cell. For example, a base station can inform a terminal that a first secondary serving cell is included in a first TAG, a second secondary serving cell is included in a second TAG, and a third secondary serving cell is included in a first TAG, regarding the three secondary serving cells configured in the terminal.

[0009] However, a signaling protocol for informing that a secondary serving cell is included in what TAG has not yet been clearly defined. Furthermore, when a TAG to which a secondary serving cell belongs is changed according to a channel condition, whether a terminal will be informed using what method and how the method will be implemented have not yet been

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disclosed.

SUMMARY

[0010] An object of the present invention is to provide an apparatus and method for uplink synchronization in a multiple component carrier system.

[0011] Another object of the present invention is to provide an apparatus and method for reorganizing a TAG based on an RRC connection reconfiguration procedure.

[0012] Yet another object of the present invention is to provide an apparatus and method for reorganizing a TAG based on a random access procedure.

[0013] Yet further another object of the present invention is to provide an apparatus and method for sending TAG configuration information for reorganizing a TAG and secondary serving cell configuration information.

[0014] In accordance with an aspect of the present invention, there is provided UE for obtaining uplink synchronization in a multiple component carrier system. The UE includes a random access processing unit configured to control the transmission of a random access preamble used to obtain a timing advance value for the uplink timing synchronization of a secondary serving cell, a transmission unit configured to send the random access preamble to an eNB, a reception unit configured to receive secondary serving cell configuration information ordering the secondary serving cell to be additionally configured in the UE, from the eNB, and a Radio Resource Control (RRC) processing unit configured to reorganize a TAG that is a set of serving cells having the same timing advance value so that the secondary serving cell is included in the TAG.

[0015] In accordance with another aspect of the present invention, there is provided a

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method of UE obtaining uplink synchronization in a multiple component carrier system. The method includes sending a random access preamble used to obtain a timing advance value for the uplink timing synchronization of a secondary serving cell to an eNB, receiving secondary serving cell configuration information, ordering the secondary serving cell to be additionally configured in the UE, from the eNB, receiving a Random Access Response (RAR) message including a timing advance value from the eNB as a response to the random access preamble, and reorganizing a TAG that is a set of serving cells having the same timing advance value so that the secondary serving cell is included in the TAG.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments of the invention, and together with the description serve to explain the principles of the invention.

[0017] FIG. 1 shows a wireless communication system to which the present invention is applied;

[0018] FIG. 2 is a flowchart illustrating a procedure of obtaining a multiple timing advance value in accordance with an example of the present invention;

[0019] FIG. 3 shows a process of sending secondary serving cell configuration information and TAG configuration information through one RRC connection reconfiguration procedure;

[0020] FIG. 4 is a flowchart illustrating a method of performing random access in accordance with an example of the present invention;

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[0021] FIG. 5 is a flowchart illustrating a method of reorganizing a TAG in accordance with an example of the present invention;

[0022] FIG. 6 is a flowchart illustrating a method of reorganizing a TAG in accordance with another example of the present invention;

[0023] FIG. 7 is a flowchart illustrating a method of reorganizing a TAG in accordance with yet another example of the present invention;

[0024] FIG. 8 is a flowchart illustrating a method of reorganizing a TAG in accordance with still yet another example of the present invention;

[0025] FIG. 9 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention;

[0026] FIG. 10 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention;

[0027] FIG. 11 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention;

[0028] FIG. 12 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention;

[0029] FIG. 13 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention;

[0030] FIG. 14 is a flowchart illustrating a method of UE reorganizing a TAG in accordance with an example of the present invention;

[0031] FIG. 15 is a flowchart illustrating a method of a BS reorganizing a TAG in accordance with an example of the present invention; and

[0032] FIG. 16 is a block diagram showing UE and a BS for sending signals regarding

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uplink synchronization in accordance with an example of the present invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0033] Hereinafter, in this specification, the contents of the present invention will be described in detail in connection with some exemplary embodiments, with reference to the accompanying drawings. It is to be noted that in assigning reference numerals to elements in the drawings, the same reference numerals denote the same elements throughout the drawings even in cases where the elements are shown in different drawings. Furthermore, in describing the embodiments of the present invention, a detailed description of the known functions and constitutions will be omitted if it is deemed to make the gist of the present invention unnecessarily vague.

[0034] Furthermore, in this specification, a wireless communication network is described as the subject, but tasks performed in the wireless communication network can be performed in a process in which a system (e.g., a base station) managing the wireless communication network controls the wireless communication network and sends data or can be performed by a terminal that accesses the wireless communication network. In accordance with the present invention, the wireless communication system includes a communication system supporting one or more component carriers.

[0035] FIG. 1 shows a wireless communication system to which the present invention is applied.

[0036] Referring to FIG. 1, a plurality of the wireless communication systems 10 are widely deployed in order to provide a variety of communication services, such as voice and packet data. The wireless communication system 10 includes one or more Base Stations (BS)

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11. The BSs 11 provide communication services to specific cells 15a, 15b, and 15c. Each of the cells may be classified into a plurality of areas (called sectors).

[0037] User Equipment (UE) 12 may be fixed or mobile and may also be called another terminology, such as a Mobile Station (MS), a Mobile Terminal (MT), a User Terminal (UT), a Subscriber Station (SS), a wireless device, a Personal Digital Assistant (PDA), a wireless modem, or a handheld device. The BS 11 may also be called another terminology, such as an evolved-NodeB (eNB), a Base Transceiver System (BTS), an access point, a femto BS, a home NodeB, or a relay. The cell should be interpreted as a comprehensive meaning that indicates some area covered by the BS 11. The cell has a meaning that covers a variety of coverage areas, such as a mega cell, a macro cell, a micro cell, a pico cell, and a femto cell.

[0038] Hereinafter, downlink refers to communication from the BS 11 to the UE 12, and uplink refers to communication from the UE 12 to the BS 11. In downlink, a transmitter may be part of the BS 11, and a receiver may be part of the UE 12. In uplink, a transmitter may be part of the UE 12, and a receiver may be part of the BS 11. Multiple access schemes applied to the wireless communication system are not limited. A variety of multiple access schemes, such as Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Orthogonal Frequency Division Multiple Access (OFDMA), Single Carrier-Frequency Division Multiple Access (SC-FDMA), OFDM-FDMA, OFDM-TDMA, and OFDM-CDMA, may be used. Uplink transmission and downlink transmission may be performed in accordance with a Time Division Duplex (TDD) scheme using different times or a Frequency Division Duplex (FDD) scheme using different frequencies.

[0039] A Carrier Aggregation (CA) supports a plurality of component carriers. The CA is also called a spectrum aggregation or a bandwidth aggregation. The CA is technology in

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which small fragmented bands are efficiently used. The CA can create an effect that uses a logically wide band by aggregating a plurality of physically continuous or discontiguous bands in a frequency domain. Each of carriers aggregated by a CA is called a Component Carrier (CC). Each of the CCs is defined by a bandwidth and a center frequency. A CA is introduced in order to support an increased throughput, prevent an increase of costs due to the introduction of wideband Radio Frequency (RF) devices, and guarantee compatibility with the existing systems. For example, if 5 CCs are allocated as the granularity of a carrier unit having a 20 MHz bandwidth, a maximum of a 100 MHz bandwidth can be supported.

[0040] CCs may have different sizes (i.e., bandwidths). For example, assuming that 5 CCs are used to form a 70 MHz band, a resulting configuration may be, for example, 5 MHz CC (carrier #0) + 20 MHz CC (carrier #1) + 20 MHz CC (carrier #2) + 20 MHz CC (carrier #3) + 5 MHz CC (carrier #4).

[0041] Hereinafter, a multiple component carrier system to which the present invention is applied refers to a system configured to include pieces of UE and eNBs and support a CA. In a multiple component carrier system, a contiguous CA and/or a discontiguous CA may be used and a symmetric aggregation or an asymmetric aggregation may be used. UE supporting a wireless communication system according to the present invention can support one or more carriers, that is, a CA, depending on its capabilities.

[0042] Hereinafter, a set of serving cells configured in one MS can be formed of only one primary serving cell or of one primary serving cell and one or more secondary serving cells. A primary serving cell means one serving cell which provides security inputs and NAS mobility information in an RRC establishment or re-establishment state. At least one cell can be configured to form a set of serving cells together with a primary serving cell depending on the

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capabilities of UE. The at least one cell is called a secondary serving cell.

[0043] Meanwhile, the CC can be divided into a Primary CC (PCC) and a Secondary CC (SCC). UE may use only one PCC or may use one or more SCCs together with a PCC. UE can receive a PCC and/or one or more SCCs allocated by an eNB.

[0044] A DL CC corresponding to a primary serving cell is called a downlink PCC (DL PCC), and an UL CC corresponding to a primary serving cell is called an uplink PCC (UL PCC). Furthermore, in downlink, a CC corresponding to a secondary serving cell is called a downlink SCC (DL SCC). In uplink, a CC corresponding to a secondary serving cell is called an uplink SCC (UL SCC). Only a DL CC may correspond to one serving cell, and both a DL CC and an UL CC may correspond to one serving cell.

[0045] Accordingly, communication between UE and an eNB performed through a DL CC or an UL CC in a carrier system has the same concept as communication between UE and an eNB performed through a serving cell.

[0046] A random access procedure can be performed in order to obtain uplink synchronization. During the random access procedure, UE obtains uplink synchronization based on a timing advance value transmitted by an eNB. The timing advance value is indicated by a Timing Advance Command (TAC) transmitted from the eNB to the UE. The timing advance value may also be called a timing alignment value. A random access preamble is used to obtain a timing advance value for the uplink timing synchronization of a secondary serving cell.

[0047] When uplink synchronization is obtained, UE starts a timing alignment timer. When the timing alignment timer operates, the UE determines that uplink synchronization has been achieved between the UE and an eNB. If the timing alignment timer expires or does not operate, the UE determines that uplink synchronization between the UE and the eNB has not

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been achieved and does not perform uplink transmission other than the transmission of a random access preamble.

[0048] Meanwhile, in a multiple component carrier system, one MS performs communication with an eNB through a plurality of CCs or a plurality of serving cells. If signals transmitted from UE to an eNB through a plurality of serving cells have the same time delay, the UE can obtain uplink synchronization for all the serving cells by using one timing advance value. In contrast, if the signals transmitted from the UE to the eNB through the plurality of serving cells have different time delays, different timing advance values are necessary for the respective serving cells. That is, multiple timing alignment values are necessary for the plurality of serving cells. If the UE performs random access procedures on the respective serving cells in order to obtain the multiple timing advance values, overhead is generated in limited uplink and downlink resources and the complexity of a synchronization tracking procedure for maintaining uplink synchronization can be increased because the number of random access procedures necessary to obtain uplink synchronization is increased. In order to reduce this overhead and complexity, a TAG is defined. A TAG may also be called a timing alignment group.

[0049] A TAG is a group including a serving cell(s) using the same timing advance value and the same timing reference or a timing reference cell having the same timing reference, from among serving cells for which uplink has been configured. For example, if a first serving cell and a second serving cell belong to a TAG1 and the second serving cell is a timing reference cell, the same timing advance value TA1 is applied to the first serving cell and the second serving cell, and the TA1 value is applied to the first serving cell on the basis of the downlink synchronization timing of the DL CC of the second serving cell. In contrast, if the first serving cell and the second serving cell belong to respective TAG1 and TAG2, the first serving cell and

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the second serving cell become timing reference cells within the respective TAG1 and TAG2, and different timing advance values TA1 and TA2 are applied to the first serving cell and the second serving cell. A TAG can include a primary serving cell, may include at least one secondary serving cell, and may include a primary serving cell and at least one secondary serving cell.

[0050] Each TAG includes at least one serving cell in which an UL CC has been configured, and information about a serving cell mapped to each TAG is called TAG configuration information. A TAG is transmitted to UE through RRC signaling when the first group configuration and group reorganization are determined by a serving eNB which has configured a corresponding serving cell.

[0051] A primary serving cell does not change a TAG. Furthermore, UE has to be able to support two or more TAGs if multiple timing advance values are necessary. For example, UE has to be able to support TAGs including a primary TAG (pTAG) including a primary serving cell and a secondary TAG (sTAG) not including a primary serving cell. Here, only one pTAG is always present, and one or more sTAGs may be present if multiple timing advance values are necessary. A maximum number of TAGs can be set to 2 or 4. Furthermore, a pTAG may always have a value of TAG ID = 0 or have no value.

[0052] FIG. 2 is a flowchart illustrating a procedure of obtaining a multiple timing advance value in accordance with an example of the present invention.

[0053] Referring to FIG. 2, UE and an eNB perform an RRC connection establishment procedure on the eNB through a selected cell at step S500. The selected cell becomes a primary serving cell. The RRC connection establishment procedure includes a process in which the eNB sends an RRC connection establishment message to the UE and the UE sends an RRC

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connection establishment-complete message to the eNB.

[0054] The eNB performs an RRC connection reconfiguration procedure for additionally configuring at least one secondary serving cell in the UE at step S505. The addition of the secondary serving cell may be performed, for example, at the request of the UE or a network or when the eNB determines to allocate more radio resources to the UE. The addition of the secondary serving cell to the UE or the release of the secondary serving cell configured in the UE can be ordered by an RRC connection reconfiguration message. The RRC connection reconfiguration procedure includes a process in which the eNB sends an RRC connection reconfiguration message to the UE and the UE sends an RRC connection re-establishment-complete message to the eNB.

[0055] The eNB configures a TAG for thee serving cell configured in the UE at step S510. A TAG configuration between the serving cells may be performed in a cell-specific way according to a CA condition. For example, if the serving cell of a specific frequency band is provided through an FSR or a Remote Radio Head (RRH), the serving cell of the specific frequency band and the serving cell of a frequency band directly served by an eNB can be configured so that they always belong to different TAGs in relation to all MSs within the service coverage of the eNB.

[0056] i) If the eNB determines that the same timing advance value as that of a primary serving cell can be applied to the added secondary serving cell, the eNB configures the added secondary serving cell so that it has the same TAG as the primary serving cell. In this case, a process of sending TAG configuration information, such as the step S515, may not be performed. Here, if the UE receives an activation indicator for the added secondary serving cell and uplink scheduling information without receiving TAG configuration information, the UE

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determines that the added secondary serving cell has been configured to have the same TAG as the primary serving cell.

[0057] ii) If the eNB determines that the same timing advance value as that of a primary serving cell cannot be applied to the added secondary serving cell, the eNB configures an sTAG including the added secondary serving cell. A TAG ID to identify each TAG is assigned to the TAG. Here, the eNB may selectively assign the TAG ID to the sTAG. For example, if the eNB confirms that the sTAG including the added secondary serving cell is different from existing configured TAGs, the eNB may assign the TAG ID to the sTAG before obtaining uplink synchronization through the random access procedure. For another example, if the eNB determines that the added secondary serving cell cannot be included in an existing configured TAG or does not know that the added secondary serving cell is included in what TAG, the eNB may not assign the TAG ID to the sTAG until it obtains uplink synchronization through the random access procedure. In this case, after the UE obtains uplink synchronization, the eNB can send TAG configuration information to the UE, and the UE can obtain the TAG ID of a corresponding sTAG.

[0058] The eNB performs an RRC connection reconfiguration procedure for sending TAG configuration information to the UE at step S515. The TAG configuration information can have a format including TAG ID information for each secondary serving cell. More particularly, uplink configuration information about each secondary serving cell can include TAG ID information. In some embodiments, the TAG configuration information can have a format for mapping a serving cell index 'ServCellIndex' assigned to each serving cell or a secondary serving cell index 'ScellIndex' assigned to only secondary serving cells. For example, a pTAG can be configured like {ServCellIndex = '1', '2'}, an sTAG1 can be configured like

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{ServCellIndex = '3', '4'} or a pTAG can be configured like {ScellIndex = '1', '2'}, and an sTAG1 can be configured like {SCellIndex = '3', '4'}. A primary serving cell does not have configuration information because a serving cell index is '0' and a TAG ID = 0. Furthermore, if there is TAG ID information in secondary serving cells, the secondary serving cells may mean serving cells within a pTAG or may mean serving cells within an independent sTAG different from all TAGs.

[0059] TAG configuration information can further include information about a representative serving cell within each TAG. The representative serving cell is a serving cell capable of performing a random access procedure for maintaining and achieving uplink synchronization within each TAG and of being used as a timing reference cell. Unlike in the above embodiment, if TAG configuration information does not include a representative serving cell, UE by itself can select a representative serving cell within each TAG. In one embodiment, UE can select a serving cell on which a random access procedure has been most recently ordered by an eNB or on which a random access procedure has been successfully completed, from among serving cells on which random access procedures have been ordered by the eNB, as a representative serving cell. In another embodiment, UE can select a serving cell in which parameters for a random access procedure have been set when an eNB configures a secondary serving cell as a representative serving cell. If the number of serving cells complying with a condition on a representative serving cell is plural or a representative serving cell has been deactivated, UE can set a secondary serving cell having the lowest secondary serving cell index as a representative serving cell.

[0060] If the eNB determines to schedule a specific secondary serving cell, the eNB sends an activation indicator for activating the specific secondary serving cell to the UE at step

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S520.

[0061] If uplink synchronization is not obtained from a specific sTAG, the UE has to obtain a timing advance value to be adjusted in relation to the specific sTAG. This adjustment can be implemented by a random access procedure ordered by the eNB at step S525.

[0062] The random access procedure on the activated secondary serving cell within the sTAG can be started by a PDCCH order transmitted by the eNB. Only a secondary serving cell including a timing reference designated within an sTAG may become a secondary serving cell which can receive a PDCCH order, or all secondary serving cells in which an RACH has been configured may become the secondary serving cell which can receive a PDCCH order.

[0063] The eNB performs control so that the UE performs two or more random access procedures at the same time. The simultaneous execution of random access procedures includes a first case where two or more random access procedures are synchronized with each other and performed at the same time and a second case where two or more random access procedures are performed at the same time in some of the time when the random access procedures are performed. For example, the second case includes a case where when UE performs a random access procedure on a primary serving cell, a random access procedure is started through a secondary serving cell (i.e., a PDCCH order is received) during the time when the UE waits for a Random Access Response (RAR) message. Here, the time when the UE waits for the RAR message may include or may not include a period in which an RAR message can be determined to be retransmitted by the UE.

[0064] If the eNB determines that it has not secured information enough to map a specific secondary serving cell to a specific TAG although it uses existing information within a network and/or assistant information (e.g., location information, an RSRP, and an RSRQ)

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received from UE, the eNB sets the specific secondary serving cell as a new sTAG and obtains the uplink timing advance value through a random access procedure.

[0065] In response to the RAR message received from the eNB, the UE determines that the random access procedure has been successfully completed and updates the timing advance value of the secondary serving cell at step S530. The RAR message can be included in an RAR MAC Protocol Data Unit (PDU) that is included in and received from a PDSCH indicated by a PDCCH scrambled into a Random Access-Radio Network Temporary Identifier (RA-RNTI) and then transmitted or may be received in the form of a MAC Control Element (CE) within a MAC PDU that is included in and received from a PDSCH indicated by a PDCCH scrambled into a C-RNTI.

[0066] If the RAR message is received in the form of the MAC CE, the RAR message may be called an 'extended TAC MAC CE'. In this case, the RAR message can include a TA value and a TAG ID or a secondary serving cell index.

[0067] The RRC connection reconfiguration procedure S505 for configuring a secondary serving cell and the procedure S515 for sending TAG configuration information for configuring a TAG are illustrated as being separately performed in FIG. 2, but this is only illustrative. Secondary serving cell configuration information and TAG configuration information may be included in one RRC connection reconfiguration message. FIG. 3 shows a process of sending secondary serving cell configuration information and TAG configuration information through one RRC connection reconfiguration procedure. The procedure of FIG. 3 differs from the procedure of FIG. 2 in that both secondary serving cell configuration information and TAG configuration information are transmitted to UE according to one RRC connection reconfiguration procedure at step S610 and the UE performs the reconfiguration of a secondary

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serving cell and the configuration of a TAG at once. That is, TAG configuration information is also transmitted in an RRC connection reconfiguration procedure for sending secondary serving cell configuration information.

[0068] For example, the secondary serving cell configuration information may include the TAG configuration information. For example, the secondary serving cell configuration information may be an index regarding a secondary serving cell added to UE and the identifier (ID) of a TAG to which the secondary serving cell having the index belongs. For another example, the TAG configuration information may include the secondary serving cell configuration information. For example, the TAG configuration information may include the TAG ID of each TAG configured in UE, the index of a serving cell belonging to each TAG, the index of a secondary serving cell added to a specific TAG, and TAT parameters. The TAG configuration information may not be removed although a serving cell belonging to a corresponding TAG is not present. In other words, configuration information about a specific TAG within the TAG configuration information may include only a TAG ID and TAT parameters.

[0069] An RRC connection reconfiguration message transmitted from the eNB to the UE at the step S610 may be a first RRC reconfiguration message received right after the RRC connection reconfiguration procedure has been successfully performed or may be other RRC reconfiguration messages. The remaining steps S600, S605, S615, S620, and S625 are the same as those of FIG. 2, and a detailed description thereof is omitted.

[0070] Referring back to FIG. 2, the random access procedure at the step S525 can be performed by, for example, a procedure of FIG. 4.

[0071] FIG. 4 is a flowchart illustrating a method of performing random access in

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accordance with an example of the present invention.

[0072] Referring to FIG. 4, an eNB sends a PDCCH order, ordering the start of the random access procedure regarding a secondary serving cell configured in UE, to the UE at step S700. Here, the secondary serving cell may be a secondary serving cell on which uplink synchronization is determined to be needed by the eNB.

[0073] For example, in the case of a non-contention-based random access procedure, the eNB selects one of pre-agreed dedicated random access preambles, from among all available random access preambles, and sends RA preamble assignment information including the index of the selected random access preamble and information about available time/frequency resources to the UE through the PDCCH order. This is because the eNB has to assign a dedicated random access preamble without a possible collision to the UE for the non-contention-based random access procedure.

[0074] For example, if the random access procedure is performed during a handover process, the UE can obtain a dedicated random access preamble from a handover command message. For another example, if the random access procedure is performed at the request of the eNB (i.e., in response to the PDCCH order), the UE can obtain a dedicated random access preamble through a PDCCH, that is, physical layer signaling. In this case, the physical layer signaling has a Downlink Control Information (DCI) format 1A and can include fields shown in Table 1.

Table 1

A Carrier Indicator Field (CIF) - 0 or 3 bits.
- a flag for identifying formats 0/1A - 1 bit (indicates format 0 in the case of 0 and format 1A in the case of 1)

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If format 1A CRC is scrambled into a C-RNTI and the remaining fields are set as follows, the format 1A is used for a random access procedure started by a PDCCH order.

- Below-

- A localized/distributed) VRB assignment flag – 1 bit. Set to 0.

- Resource block assignment - $\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2 \rceil$ bits. All bits are set to 1

- A preamble index - 6 bits

- A PRACH mask index (mask Index) - 4 bits

- All the remaining bits of the format 1A for the temporary scheduling assignment of one PDSCH codeword are set to 0.

[0075] Referring to Table 1, the preamble index is an index indicating one preamble selected from pre-agreed dedicated random access preambles for the non-contention-based random access procedure, and the PRACH mask index is information about available time/frequency resources. The information about available time/frequency resources is different depending on a Frequency Division Duplex (FDD) system and a Time Division Duplex (TDD) system as in Table 2.

Table 2

PRACH MASK INDEX	PERMITTED PRACH (FDD)	PERMITTED PRACH (TDD)
0	All	All
1	PRACH RESOURCE INDEX 0	PRACH RESOURCE INDEX 0

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2	PRACH RESOURCE INDEX 1	PRACH RESOURCE INDEX 1
3	PRACH RESOURCE INDEX 2	PRACH RESOURCE INDEX 2
4	PRACH RESOURCE INDEX 3	PRACH RESOURCE INDEX 3
5	PRACH RESOURCE INDEX 4	PRACH RESOURCE INDEX 4
6	PRACH RESOURCE INDEX 5	PRACH RESOURCE INDEX 5
7	PRACH RESOURCE INDEX 6	RESERVED
8	PRACH RESOURCE INDEX 7	RESERVED
9	PRACH RESOURCE INDEX 8	RESERVED
10	PRACH RESOURCE INDEX 9	RESERVED
11	All even-numbered PRACH opportunities within time domain, a first PRACH resource index wihtin a subframe	All even-numbered PRACH opportunities wihtihn time domain, a first PRACH resource index wihtin a subframe
12	All odd-numbered PRACH opportunities within time domain, a first PRACH resource index wihtin a subframe	All odd-numbered PRACH opportunities within time domain, a first PRACH resource index wihtin a subframe
13	RESERVED	a first PRACH resource index wihtin a subframe
14	RESERVED	a second PRACH resource index wihtin a subframe
15	RESERVED	a third PRACH resource index wihtin a subframe

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[0076] For another example, in the case of a contention-based random access procedure, the eNB sets a preamble index within the RA preamble assignment information to '000000' and sends the RA preamble assignment information to the UE. The UE randomly selects one of contention-based random access preambles, sets a value of the PRACH mask index to '0', and performs a contention-based procedure. Furthermore, the RA preamble assignment information can be transmitted to the UE through a higher layer message (e.g., Mobility Control Information (MCI) within a handover command), such as RRC signaling.

[0077] The UE sends a random access preamble on the secondary serving cell designated at the step S700 to the eNB at step S705. The random access preamble may be transmitted on a representative serving cell within a TAG to which the secondary serving cell belongs. A representative serving cell is a serving cell that has been selected to send the random access preamble within the TAG configured in the UE. The representative serving cell can be selected for each TAG. Furthermore, the UE may send the random access preamble on a representative serving cell within any one TAG, from among a plurality of TAGs, or may send the random access preamble on two or more representative serving cells within respective TAGs. For example, it is assumed that TAGs configured in the UE are a TAG1 and a TAG2, the TAG1={a first serving cell, a second serving cell, a third serving cell}, and the TAG2={a fourth serving cell, a fifth serving cell}. If the representative serving cell of the TAG1 is the second serving cell and the representative serving cell of the TAG2 is the fifth serving cell, the UE sends an assigned dedicated random access preamble to the eNB through the second serving cell or the fifth serving cell.

[0078] The representative serving cell may also be called a special serving cell (special SCell), a reference serving cell (reference SCell), or a timing reference serving cell (or timing

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reference cell).

[0079] The eNB sends an RAR message to the UE at step S710. The RAR message includes a timing advance value. When the eNB successfully receives the random access preamble, the eNB can check that what UE has sent the random access preamble through what serving cell on the basis of the received random access preamble and time/frequency resources. In particular, if UE starts a random access procedure for a secondary serving cell in response to the PDCCH order of the eNB, the UE has already secured an identifier unique to the UE, for example, a C-RNTI, from a primary serving cell. Accordingly, the eNB can send an RAR message to the UE by using the C-RNTI of the UE if necessary. Here, to use the C-RNTI includes scrambling a PDCCH, indicating a PDSCH to which the RAR message has been mapped, into the C-RNTI.

[0080] In another embodiment, the eNB may send the RAR message on the primary serving cell by using the Random Access-Radio Network Temporary Identifier (RA-RNTI) of the UE. In response to the RAR message received from the eNB, the UE determines that the random access procedure has been successfully completed.

[0081] If a secondary serving cell is added to or released from the UE, an existing TAG can be updated by the UE or the eNB. For example, it is assumed that TAGs configured in the UE are a TAG1 and a TAG2, the TAG1={a first serving cell, a second serving cell}, and the TAG2={a fourth serving cell}. If a third secondary serving cell has to be added in order to extend the bandwidth of the UE, the eNB sends secondary serving cell configuration information for adding the third secondary serving cell to the UE by using an RRC connection reconfiguration procedure. If the third secondary serving cell has the same timing advance value as the TAG1, the third secondary serving cell is enrolled in the TAG1. Here, the eNB or the UE

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is updated from the TAG1 into a TAG1={the first serving cell, the second serving cell, the third serving cell}, but does not change the TAG2. In contrast, if the third secondary serving cell has a different timing advance value from that of the TAG1 or the TAG2, the third secondary serving cell belongs to a new TAG3. Accordingly, the eNB or the UE configures the new TAG3={the third secondary serving cell}.

[0082] As described above, secondary serving cell configuration information and TAG configuration information have a close relationship because a change in the configuration of secondary serving cells leads to the reorganization of a TAG. The reorganization of a TAG is also related to uplink synchronization because it can result in the update of a timing advance value applied to a secondary serving cell. The reorganization of a TAG may also be called the update, change, or reconfiguration of a TAG. The reorganization of a TAG may have the same meaning as the update or change of TAG configuration information because UE or an eNB updates or changes TAG configuration information.

[0083] The reorganization of a TAG includes all cases where a TAG is newly generated and deleted if a secondary serving cell included in the TAG is changed. The reorganization of a TAG due to a change in the configuration of a secondary serving cell can include a variety of embodiments. For example, in order to reorganize a TAG, an eNB may send signaling related to the reorganization of the TAG to UE and the UE by itself can reorganize the TAG even without signaling. Furthermore, for the reorganization of a TAG, a message for an RRC connection reconfiguration procedure may be used and signaling for a random access procedure may be used. Furthermore, a message for the reorganization of a TAG can have a variety of formats. The reorganization of a TAG according to a variety of embodiments and corresponding uplink synchronization are described below. First, a procedure for reorganizing a TAG when a

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secondary serving cell is released is described below.

[0084] (1) A procedure for reorganizing a TAG when a secondary serving cell is released

[0085] FIG. 5 is a flowchart illustrating a method of reorganizing a TAG in accordance with an example of the present invention.

[0086] Referring to FIG. 5, an eNB determines to release a secondary serving cell configured in UE at step S800. For example, if a frequency band necessary for UE is reduced or connection to secondary serving cells configured by a serving eNB is released in a target eNB after a handover, the eNB can determine to release a secondary serving cell. If UE releases all secondary serving cells owing to the start of an RRC connection reconfiguration procedure due to a Radio Link Failure (RLF), the UE resets or removes all pieces of TAG configuration information. When the TAG configuration information is reset, TAG ID information remains intact, but a TA value within each TAG is set to '0', information about a serving cell included in each TAG is removed, and a TAT parameter is set to 'infinity'.

[0087] The eNB reorganizes a TAG at step S805. Here, the reorganization of the TAG corresponds to the update of the TAG to which the released secondary serving cell belonged. For example, if a TAG to which the secondary serving cell belonged is a TAG1={a first serving cell, a second serving cell} and the secondary serving cell to be released is the second serving cell, the eNB is updated into a TAG1={the first serving cell}.

[0088] Since the eNB has released the secondary serving cell and reorganized the TAG, the eNB has to inform the UE of the release of the secondary serving cell and the reorganization of the TAG. Here, the eNB can send only secondary serving cell configuration information, ordered the release of the secondary serving cell, to the UE. This is because the UE can update the TAG so that the secondary serving cell is released from the TAG even without additional

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TAG configuration information because the UE is already aware that the secondary serving cell to be released belongs to what TAG.

[0089] Accordingly, the eNB performs an RRC connection reconfiguration procedure for releasing the secondary serving cell at step S810. For example, in the RRC connection reconfiguration procedure at the step S810, the secondary serving cell configuration information for releasing the secondary serving cell and information about the configuration of the reorganized TAG (hereinafter abbreviated to 'reorganized TAG configuration information') may be included in different RRC connection reconfiguration messages as in FIG. 2. In this case, the RRC connection reconfiguration procedure is performed twice. Here, the sequence of the step S805 may be performed in the RRC connection reconfiguration procedure for sending the reorganized TAG configuration information at the step S810.

[0090] For another example, in the RRC connection reconfiguration procedure at the step S810, the secondary serving cell configuration information and the reorganized TAG configuration information may be included in the same RRC connection reconfiguration message as in FIG. 3. In this case, the RRC connection reconfiguration procedure is performed once. That is, the reorganized TAG configuration information is also transmitted in the existing RRC connection reconfiguration procedure for sending the secondary serving cell configuration information. Here, the reorganized TAG configuration information may be included in the secondary serving cell configuration information and transmitted or may be transmitted through an additional field different from that of the secondary serving cell configuration information. If the reorganized TAG configuration information is transmitted through an additional field, the reorganized TAG configuration information may be represented by, for example, a pTAG = {1, 3} and an sTAG[TAG ID = 1] = {2, 4}. Here, the pTAG = {1, 3} means a primary serving cell

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and serving cells in which a secondary serving cell1 and a secondary serving cell3 form the pTAG.

[0091] For yet another example, the RRC connection reconfiguration procedure at the step S810 may not include the reorganized TAG configuration information. This means that configuration information does not include TAG configuration information.

[0092] The secondary serving cell configuration information for releasing the secondary serving cell is sCellToReleaseList and can be defined as in the following table.

Table 3

```
RRCConnectionReconfiguration IEs ::= SEQUENCE {
        sCellToReleaseList                          SCellToReleaseList
                        OPTIONAL,   -- Need ON
        sCellToAddModList                           SCellToAddModList
                        OPTIONAL,   -- Need ON
        nonCriticalExtension                        SEQUENCE {}
                                OPTIONAL    -- Need OP
}
SCellToReleaseList ::=          SEQUENCE (SIZE (1..maxSCell)) OF SCellIndex
```

[0093] Referring to Table 3, the RRC connection reconfiguration message 'RRCConnectionReconfiguration IEs' include sCellToReleaseList, that is, the secondary serving cell configuration information for releasing the secondary serving cell. The size of sCellToReleaseList can be set to 1 to a maximum number of secondary serving cells 'maxScell, and sCellToReleaseList indicates the index of a secondary serving cell 'SCellIndex' to be released.

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[0094] If the RRC connection reconfiguration message including the secondary serving cell configuration information for releasing the secondary serving cell is received, the UE releases the secondary serving cell from a TAG to which the secondary serving cell to be released belongs and reorganizes the TAG at step S815. The UE can perform the reorganization of the TAG even without TAG configuration information. In this aspect, the RRC connection reconfiguration message at the step S810 has a function of releasing a secondary serving cell and also ordering a TAG to be reorganized. If a pTAG and an sTAG are configured in the UE and the secondary serving cell of the sTAG is released when one secondary serving cell is included in the sTAG, the TAG ID of the sTAG is also removed due to the reorganization of the TAG. In contrast, if only a pTAG is configured in the UE, the reorganization of a TAG including the removal of the pTAG is not performed because although a secondary serving cell is released from the pTAG because the pTAG necessarily includes a primary serving cell. As described above, the reorganization of the TAG can be performed when both a pTAG and an sTAG are configured in the UE.

[0095] As described above, a procedure can be simplified and a TAG can be reorganized more rapidly because TAG configuration information for the reorganization of the TAG does not need to be separately transmitted.

[0096] A procedure for reorganizing a TAG when a secondary serving cell is added is described below.

[0097] (2) A procedure for reorganizing a TAG when a secondary serving cell is added is described below

[0098] In releasing a secondary serving cell, UE and an eNB do not need to further maintain uplink synchronization with a secondary serving cell to be released. Accordingly, a

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timing advance value is also not necessary. In adding a secondary serving cell, however, an eNB or UE has to reorganize a TAG to which the added secondary serving cell belongs and know the timing advance value of the added secondary serving cell for the reorganization.

[0099] The timing advance value of the added secondary serving cell can be basically obtained on the basis of a random access procedure. If the added secondary serving cell can be mapped to an already defined TAG, a random access procedure for obtaining the timing advance value does not need to be performed. Here, the case where the added secondary serving cell can be mapped to the already defined TAG can include a case where the added secondary serving cell has the same timing advance value as the already defined TAG. Furthermore, the case where the added secondary serving cell can be mapped to the already defined TAG may include a case where an eNB is already aware of the timing advance value of the added secondary serving cell.

[0100] If the eNB is already aware of the timing advance value of the added secondary serving cell, the eNB can be aware that the added secondary serving cell has to be reorganized in what TAG. That is, the eNB can determine a TAG. For example, it is assumed that a TAG1 and a TAG2 are configured in UE, the timing advance value of the TAG1 is TA1, and the timing advance value of the TAG2 is TA2. If an eNB is aware that an added secondary serving cell has the timing advance value=TA2, the eNB reorganizes the added secondary serving cell into the TAG2. If the eNB is aware that the added secondary serving cell has a timing advance value=TA3, the eNB reorganizes the added secondary serving cell into a new TAG3.

[0101] In contrast, if an eNB is not aware of the timing advance value of an added secondary serving cell, the eNB cannot determine a TAG. In this case, the eNB can set the TAG ID of the added secondary serving cell by default. The TAG ID set by default may also be called

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a temporary TAG ID. Subsequently, the eNB can reorganize the added secondary serving cell into a specific TAG. That is, in the contents of reorganized TAG configuration information, the reorganized TAG configuration information can include a definite TAG ID or a temporary TAG ID. The temporary TAG ID is set to a default value. Here, the default value can be, for example, 0, and the temporary TAG ID may not have any value.

[0102] A method in which an eNB informs UE of information about the configuration of a TAG reorganized by the addition of a secondary serving cell can be implemented by using a variety of embodiments. For example, in a method of sending TAG configuration information, an eNB can send secondary serving cell configuration information, ordering the addition of a secondary serving cell, and reorganized TAG configuration information to UE through an RRC connection reconfiguration procedure. Here, the secondary serving cell configuration information and the TAG configuration information may be transmitted through one RRC connection reconfiguration procedure or may be transmitted through different RRC connection reconfiguration procedures.

[0103] A case where an eNB does not need an additional random access procedure in order to map an added secondary serving cell to a TAG is first described below.

[0104] (2-1) When a random access procedure is not necessary in order to reorganize a TAG

[0105] FIG. 6 is a flowchart illustrating a method of reorganizing a TAG in accordance with another example of the present invention.

[0106] Referring to FIG. 6, an eNB determines to add a secondary serving cell at step S900. For example, if a bandwidth supported for UE is increased or the new cell of a target eNB is accessed due to a handover, the eNB can determine to add the secondary serving cell. The

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reorganization of a TAG due to the addition of the secondary serving cell can include two cases. In the first case, an existing TAG configured in the UE remains intact, and the secondary serving cell is added to an existing pTAG or any one of sTAGs. In the second case, a new TAG is configured in addition to a TAG already configured in the UE, and the secondary serving cell is added to the new TAG. In either case, the added secondary serving cell needs to be mapped to the TAG. Furthermore, the eNB does not perform an additional random access procedure because it is aware of the timing advance value of the added secondary serving cell. That is, the eNB can directly reorganize a TAG and send reorganized TAG configuration information without an additional random access procedure.

[0107] The eNB reorganizes a TAG in response to the added secondary serving cell at step S905. The reorganization of the TAG includes adding the secondary serving cell to an existing TAG or configuring a new TAG including the added secondary serving cell.

[0108] The eNB performs an RRC connection reconfiguration procedure for adding the secondary serving cell at step S910. For example, in the RRC connection reconfiguration procedure at the step S910, the secondary serving cell configuration information for adding the secondary serving cell and the reorganized TAG configuration information may be included in different RRC connection reconfiguration messages (refer to the steps S505 and S515) as in FIG. 2. In this case, the RRC connection reconfiguration procedure is performed twice. Here, the sequence of the step S905 may be performed in the RRC connection reconfiguration procedure for sending the reorganized TAG configuration information at the step S910. Meanwhile, the reorganized TAG configuration information may be represented by, for example, a pTAG = {1, 3} and an sTAG[TAG ID = 1] = {2, 4}.

[0109] For another example, in the RRC connection reconfiguration procedure at the step

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S910, the secondary serving cell configuration information for adding the secondary serving cell and the reorganized TAG configuration information may be included in the same RRC connection reconfiguration message as in FIG. 3. In this case, the RRC connection reconfiguration procedure is performed once. That is, in the existing RRC connection reconfiguration procedure for sending the secondary serving cell configuration information, the TAG configuration information is also transmitted. Here, the reorganized TAG configuration information may be included in the secondary serving cell configuration information and transmitted or may be transmitted through an additional field different from that of the secondary serving cell configuration information. If the reorganized TAG configuration information is transmitted through an additional field, the reorganized TAG configuration information may be represented by, for example, a pTAG = {1, 3} and an sTAG[TAG ID = 1] = {2, 4}.

[0110] The reorganized TAG configuration information includes information for assigning the added secondary serving cell to a new TAG ID or assigning the added secondary serving cell to an existing TAG ID. The secondary serving cell configuration information for releasing the secondary serving cell is sCellToAddModList and can be defined as in the following table.

Table 4

```
RRCConnectionReconfiguration IEs ::= SEQUENCE {
    sCellToReleaseList                  SCellToReleaseList
                OPTIONAL,   -- Need ON
    sCellToAddModList                   SCellToAddModList
                OPTIONAL,   -- Need ON
    nonCriticalExtension                SEQUENCE {}
```


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```
                                OPTIONAL    -- Need OP
}

SCellToAddModList ::=              SEQUENCE (SIZE (1..maxSCell)) OF
SCellToAddMod

SCellToAddMod ::=                  SEQUENCE {
        sCellIndex                                      SCellIndex,
        cellIdentification                          SEQUENCE {
                physCellId                                  PhysCellId,
                dl-CarrierFreq                      ARFCN-ValueEUTRA
        }
                                                    OPTIONAL,   -- Cond
SCellAdd
        radioResourceConfigCommonSCell  RadioResourceConfigCommonSCell
                                                    OPTIONAL,   -- Cond
SCellAdd
        radioResourceConfigDedicatedSCell
        RadioResourceConfigDedicatedSCell           OPTIONAL,   -- Cond
SCellAdd2
        ...
}
```

[0111] Referring to Table 4, the RRC connection reconfiguration message

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'RRCConnectionReconfiguration IEs' includes sCellToAddModList and SCellToAddMod, that is, pieces of secondary serving cell configuration information for adding a secondary serving cell. The size of sCellToAddModList can be set to 1 to a maximum number of secondary serving cells 'maxScell', and sCellToAddModList indicates the index of the secondary serving cell to be added 'SCellIndex'. SCellToAddMod includes the index of an added secondary serving cell 'sCellIndex'. SCellToAddMod can further include a TAG ID regarding the added secondary serving cell.

[0112] When the RRC connection reconfiguration message including the secondary serving cell configuration information for adding the secondary serving cell is received, the UE reorganizes the TAG at step S915. The UE reorganizes the TAG based on the TAG configuration information included in the secondary serving cell configuration information.

[0113] A case where an eNB needs an additional random access procedure in order to map an added secondary serving cell to a TAG is described below. This case corresponds to a case where the eNB is not aware of the timing advance value of the added secondary serving cell.

[0114] (2-2) When a random access procedure is necessary to reorganize a TAG

[0115] An eNB can obtain a timing advance value regarding an added secondary serving cell by performing a random access procedure in order to reorganize a TAG. Before obtaining the timing advance value, the eNB has to configure the added secondary serving cell in UE and perform an RRC connection reconfiguration procedure for reorganizing the TAG. Meanwhile, when reorganizing the TAG, the eNB may not be aware that the added secondary serving cell belongs to what TAG or may not assign another TAG ID to the UE because a maximum number of TAG IDs have already been assigned to the UE. In this case, how a TAG regarding the added

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secondary serving cell will be defined becomes ambiguous. Accordingly, there is a need for a criterion for determining the contents of reorganized TAG configuration information. For example, the eNB may define a temporary TAG ID and map the added secondary serving cell to the temporary TAG ID. In this case, reorganized TAG configuration information includes the temporary TAG ID. For example, the eNB can determine a TAG ID having the lowest index, from among the remaining TAG IDs other than the IDs of TAGs now configured in the UE, as the temporary TAG ID. For another example, the eNB may determine a specific one of the remaining TAG IDs other than the IDs of TAGs now configured in the UE as the temporary TAG ID.

[0116] For another example, the eNB may not define an additional TAG ID for the added secondary serving cell. In this case, the reorganized TAG configuration information may include a TAG ID set to 'Null', or the reorganized TAG configuration information is not transmitted.

[0117] A case where the reorganized TAG configuration information includes the temporary TAG ID is described below.

[0118] (2-2-1) A case where reorganized TAG configuration information includes a temporary TAG ID

[0119] The present embodiment includes a first embodiment in which TAG configuration information is defined in an additional field different from that of secondary serving cell configuration information and a second embodiment in which TAG configuration information is included in secondary serving cell configuration information. The first embodiment is first described below.

[0120] FIG. 7 is a flowchart illustrating a method of reorganizing a TAG in accordance with yet another example of the present invention.

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[0121] Referring to FIG. 7, an eNB determines to add a secondary serving cell at step S1000. For example, if a bandwidth supported for UE is increased or the new cell of a target eNB is accessed due to a handover, the eNB can determine to add the secondary serving cell.

[0122] The eNB and the UE first perform an RRC connection reconfiguration procedure for adding the secondary serving cell at step S1005. An RRC connection reconfiguration message at the step S1005 includes secondary serving cell configuration information. Next, the eNB and the UE perform an RRC connection reconfiguration procedure for reorganizing a TAG at step S1010. An RRC connection reconfiguration message at the step S1010 includes TAG configuration information. Furthermore, the TAG configuration information indicates a temporary TAG ID.

[0123] If the eNB tries to schedule the added secondary serving cell, the eNB sends an activation indicator for activating the added secondary serving cell to the UE at step S1015.

[0124] The UE has to obtain a timing advance value to be adjusted in relation to the added secondary serving cell because it has not achieved uplink synchronization regarding the added secondary serving cell. This can be implemented by a random access procedure ordered by the eNB.

[0125] The eNB sends a PDCCH order, ordering the start of the random access procedure regarding the secondary serving cell additionally configured in the UE, to the UE at step S1020.

[0126] The UE sends a random access preamble to the eNB on the added secondary serving cell at step S1025. The random access procedures at the steps S1020 and S1025 can be performed as in FIG. 4.

[0127] The eNB can obtain a timing advance value regarding the added secondary serving cell through the random access procedure and performs TAG reorganization for mapping

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the added secondary serving cell to a specific TAG based on the timing advance value at step S1030.

[0128] The eNB performs an RRC connection reconfiguration procedure for reorganizing the existing TAG at step S1035. The RRC connection reconfiguration procedure for reorganizing the TAG includes a process in which the eNB sends an RRC connection reconfiguration message, including the reorganized TAG configuration information, to the UE and the UE sends an RRC connection re-establishment-complete message to the eNB after the TAG is reorganized.

[0129] In accordance with a common random access procedure, the eNB has to send an RAR message in response to the random access preamble. However, the random access procedures at the steps S1025 and S1030 are additionally used to map the added secondary serving cell to the TAG and reorganize the TAG. Accordingly, a step of sending the RAR message may be omitted, and the RRC connection reconfiguration message for reorganizing the TAG can order the TAG to be reorganized and also mean the success or stop of the random access procedure. The present embodiment, however, may include a step of sending an RAR message. In this case, the step S1035 can be performed after the eNB sends the RAR message to the UE.

[0130] When receiving the RRC connection reconfiguration message for reorganizing the TAG during the random access procedure, the UE determines that the random access procedure has been successful or that the random access procedure has been stopped by an order of the eNB and terminates the random access procedure. Next, the UE reorganizes the TAG based on the reorganized TAG configuration information at step S1040. For example, the UE maps the secondary serving cell to which the temporary TAG ID has been assigned to a TAG having an

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ID assigned based on the reorganized TAG configuration information. Here, the TAG having the assigned ID may be a pTAG or an sTAG already configured in the UE or may be a new sTAG.

[0131] The second embodiment in which the TAG configuration information is included in the secondary serving cell configuration information is described below.

[0132] FIG. 8 is a flowchart illustrating a method of reorganizing a TAG in accordance with still yet another example of the present invention.

[0133] Referring to FIG. 8, an eNB determines to add a secondary serving cell at step S1100. For example, if a bandwidth supported for UE is increased or the new cell of a target eNB is accessed due to a handover, the eNB can determine to add the secondary serving cell.

[0134] The eNB and the UE first perform an RRC connection reconfiguration procedure for adding the secondary serving cell and reorganizing a TAG at step S1105. An RRC connection reconfiguration message at the step S1105 includes secondary serving cell configuration information, and the secondary serving cell configuration information includes TAG configuration information. Furthermore, the TAG configuration information indicates a temporary TAG ID.

[0135] If the eNB tries to schedule the added secondary serving cell, the eNB sends an activation indicator for activating the added secondary serving cell to the UE at step S1110.

[0136] The UE has to obtain a timing advance value to be adjusted in relation to the added secondary serving cell because it has not achieved uplink synchronization regarding the added secondary serving cell. This can be implemented by a random access procedure ordered by the eNB.

[0137] The eNB sends a PDCCH order, ordering the start of the random access procedure

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regarding the secondary serving cell additionally configured in the UE, to the UE at step S1115.

[0138] The UE sends a random access preamble to the eNB on the added secondary serving cell at step S1120. The random access procedures at the steps S1115 and S1120 can be performed as in FIG. 4.

[0139] The eNB can obtain a timing advance value regarding the added secondary serving cell through the random access procedure and performs TAG reorganization for mapping the added secondary serving cell to a specific TAG based on the timing advance value at step S1125.

[0140] The eNB performs an RRC connection reconfiguration procedure for the change of the secondary serving cell and the reorganization of the TAG at step S1130. The RRC connection reconfiguration procedure for the change of the secondary serving cell and the reorganization of the TAG includes a process in which the eNB sends an RRC connection reconfiguration message to the UE and the UE sends an RRC connection re-establishment-complete message to the eNB after reorganizing the TAG. Here, the RRC connection reconfiguration message includes secondary serving cell configuration information on which the eNB orders the secondary serving cell to be changed, and the secondary serving cell configuration information includes reorganized TAG configuration information.

[0141] In accordance with a common random access procedure, the eNB has to send an RAR message in response to the random access preamble. However, the random access procedures at the steps S1120 and S1125 are additionally used to map the added secondary serving cell to the TAG and reorganize the TAG. Accordingly, a step of sending the RAR message may be omitted, and the RRC connection reconfiguration message for reorganizing the TAG can order the TAG to be reorganized and also mean the success or stop of the random

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access procedure. The present embodiment, however, may include a step of sending an RAR message. In this case, the step S1130 can be performed after the eNB sends the RAR message to the UE.

[0142] In response to the RRC connection reconfiguration message received during the random access procedure, the UE determines that the random access procedure is successful or that the random access procedure has been stopped by an order of the eNB and terminates the random access procedure. Next, the UE reorganizes the TAG based on the reorganized TAG configuration information at step S1135. For example, the UE maps the secondary serving cell to which the temporary TAG ID has been assigned to a TAG having an ID assigned based on the reorganized TAG configuration information. Here, the TAG of the assigned ID may be a pTAG or an sTAG already configured in the UE or may be a new sTAG.

[0143] FIGS. 7 and 8 illustrate embodiments in which an eNB directly informs UE of the reorganization of a TAG by using an RRC connection reconfiguration procedure. In accordance with another embodiment, however, the eNB may inform the UE of a timing advance value through an RAR message because a random access procedure is already in progress. In this case, the UE is not directly informed of reorganized TAG configuration information, but the UE by itself can reorganize a TAG based on the timing advance value. In this sense, it can be seen that the eNB implicitly informs the UE of the reorganized TAG configuration information.

[0144] FIG. 9 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention.

[0145] Steps S1200 to S1225 of FIG. 9 are the same as the steps S1100 to S1125 of FIG. 8, and thus a detailed description thereof is omitted.

[0146] An eNB calculates a timing advance value regarding an added secondary serving

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cell when receiving a random access preamble and sends an RAR message indicative of the timing advance value to UE at step S1230. Here, the RAR message is a MAC message, and the timing advance value may be indicated by a field within a MAC Random Access Response (RAR). In this case, the RAR message is mapped to a PDSCH indicated by a PDCCH that is scrambled into a Random Access (RA)-Radio Network Temporary Identifier (RNTI) for identifying the UE in a random access procedure and is then transmitted. The PDCCH scrambled into the RA-RNTI is transmitted on a primary serving cell which provides a common search space.

[0147] In an embodiment, the RAR message may be indicated by a MAC Control Element (CE). The field indicative of the timing advance value is called a Timing Advance Command (TAC) field. In this case, the RAR message is mapped to a PDSCH indicated by a PDCCH scrambled into a Cell (C)-RNTI for identifying the UE in a UE-specific space and then transmitted. The PDCCH scrambled into the C-RNTI can be transmitted on a secondary serving cell which provides a UE-specific search space.

[0148] In response to the RAR message, the UE performs TAG reorganization at step S1235. As an example of the TAG reorganization, if there is a TAG having the same timing advance value as that of an existing TAG (a pTAG or an sTAG), the UE maps the added secondary serving cell to the corresponding TAG.

[0149] As another example of the TAG reorganization, if the timing advance value is different from a timing advance value applied to an existing TAG (a pTAG or an sTAG) and the number of TAGs now configured in the UE is smaller than a maximum number of TAGs that can be configured, the UE designates a temporary TAG ID as the TAG ID of a new sTAG and maps an additional secondary serving cell to the TAG.

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[0150] As yet another example of the TAG reorganization, if the timing advance value is different from a timing advance value applied to an existing TAG (a pTAG or an sTAG) and the number of TAGs now configured in the UE is the same as a maximum number of TAGs that can be configured, the UE can perform one of the following operations. i) The UE may determine that the timing advance value for the added secondary serving cell is not valid and disregard the received timing advance value. ii) The UE may deactivate the added secondary serving cell in order to prevent uplink transmission within a corresponding TAG. This is because may be a problem in uplink transmission within the TAG because a new TAG ID and the configuration of a current TAG are not valid. iii) The UE may release the configuration of the added secondary serving cell instead of the deactivation operation.

[0151] A case where reorganized TAG configuration information is not transmitted is described below.

[0152] (2-2-2) When reorganized TAG configuration information is not transmitted

[0153] The meaning that reorganized TAG configuration information is not transmitted may be i) a TAG ID=0 or ii) a TAG ID='Null' or iii) may be that TAG configuration information is not included in secondary serving cell configuration information. In the case of i), an added secondary serving cell is mapped to the pTAG by default because the ID of a pTAG is basically 0. In the case of ii) and iii), an added secondary serving cell may be mapped to a pTAG by default or may not have been mapped to any TAG. Some embodiments are described below assuming that an added secondary serving cell is mapped to a pTAG by default when TAG configuration information is not transmitted. It is however to be noted that each of the embodiments may be likewise applied to a case where an added secondary serving cell is assumed not to be mapped to any TAG.

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[0154] The present embodiment includes a first embodiment in which TAG configuration information is defined by secondary serving cell configuration information and an additional field and a second embodiment in which TAG configuration information is included in secondary serving cell configuration information. The first embodiment is first described below.

[0155] FIG. 10 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention.

[0156] Referring to FIG. 10, an eNB determines to add a secondary serving cell at step S1300. For example, if a bandwidth supported for UE is increased or the new cell of a target eNB is accessed due to a handover, the eNB can determine to add the secondary serving cell.

[0157] The eNB and the UE first perform an RRC connection reconfiguration procedure for adding the secondary serving cell at step S1305. An RRC connection reconfiguration message at the step S1305 includes secondary serving cell configuration information. The eNB and the UE do not perform an RRC connection reconfiguration procedure for reorganizing a TAG. That is, the reorganized TAG configuration information is not transmitted.

[0158] The UE reorganizes the added secondary serving cell into a pTAG at step S1310. That is, the added secondary serving cell is mapped to the pTAG by default.

[0159] If the eNB tries to schedule the added secondary serving cell, the eNB sends an activation indicator for activating the added secondary serving cell to the UE at step S1315.

[0160] The UE has to obtain a timing advance value to be adjusted in relation to the added secondary serving cell because it has not achieved uplink synchronization regarding the added secondary serving cell. This can be implemented by a random access procedure ordered by the eNB.

[0161] The eNB sends a PDCCH order, ordering the start of the random access procedure

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regarding the secondary serving cell additionally configured in the UE, to the UE at step S1320.

[0162] The UE sends a random access preamble to the eNB on the added secondary serving cell at step S1325. The added secondary serving cell has belonged to the pTAG by default. In the pTAG, only a primary serving cell is a representative serving cell which sends the random access preamble. However, since the added secondary serving cell is a new secondary serving cell and the newest timing advance value can be obtained, the UE is permitted to send the random access preamble on the added secondary serving cell. The random access procedures at the steps S1320 and S1325 can be performed as in FIG. 4.

[0163] The eNB can obtain the timing advance value regarding the added secondary serving cell through the random access procedure and performs TAG reorganization for mapping the added secondary serving cell to a specific TAG based on the timing advance value at step S1330.

[0164] The eNB performs an RRC connection reconfiguration procedure for reorganizing the TAG at step S1335. The RRC connection reconfiguration procedure for the reorganization of the TAG includes a process in which the eNB sends an RRC connection reconfiguration message, including reorganized TAG configuration information, to the UE and the UE sends an RRC connection re-establishment-complete message to the eNB after reorganizing the TAG.

[0165] In accordance with a common random access procedure, the eNB has to send an RAR message in response to the random access preamble. However, the random access procedures at the steps S1325 and S1330 are additionally used to map the added secondary serving cell to the TAG and reorganize the TAG. Accordingly, a step of sending the RAR message may be omitted, and the RRC connection reconfiguration message for reorganizing the TAG can order the TAG to be reorganized and also mean the success or stop of the random

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access procedure. The present embodiment, however, may include a step of sending an RAR message. In this case, the step S1335 can be performed after the eNB sends the RAR message to the UE.

[0166] When receiving the RRC connection reconfiguration message for reorganizing the TAG during the random access procedure, the UE determines that the random access procedure is successful or that the random access procedure has been stopped by an order of the eNB and terminates the random access procedure. Next, the UE reorganizes the TAG based on the reorganized TAG configuration information at step S1340. For example, the UE maps the secondary serving cell to which the temporary TAG ID has been assigned to a TAG having an ID assigned based on the reorganized TAG configuration information. Here, the TAG of the assigned ID may be a pTAG or an sTAG already configured in the UE or may be a new sTAG.

[0167] The second embodiment in which TAG configuration information is included in secondary serving cell configuration information is described below.

[0168] FIG. 11 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention.

[0169] Referring to FIG. 11, an eNB determines to add a secondary serving cell at step S1400. For example, if a bandwidth supported for UE is increased or the new cell of a target eNB is accessed due to a handover, the eNB can determine to add the secondary serving cell.

[0170] The eNB and the UE first perform an RRC connection reconfiguration procedure for adding the secondary serving cell and reorganizing a TAG at step S1405. An RRC connection reconfiguration message at the step S1405 includes secondary serving cell configuration information, and the secondary serving cell configuration information includes TAG configuration information. Furthermore, the TAG configuration information includes a

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TAG ID set to 'Null'.

[0171] The UE reorganizes the added secondary serving cell into a pTAG at step S1410. That is, the added secondary serving cell is mapped to the pTAG by default.

[0172] If the eNB tries to schedule the added secondary serving cell, the eNB sends an activation indicator for activating the added secondary serving cell to the UE at step S1415.

[0173] The UE has to obtain a timing advance value to be adjusted in relation to the added secondary serving cell because it has not achieved uplink synchronization regarding the added secondary serving cell. This can be implemented by a random access procedure ordered by the eNB.

[0174] The eNB sends a PDCCH order, ordering the start of the random access procedure regarding the secondary serving cell additionally configured in the UE, to the UE at step S1420.

[0175] The UE sends a random access preamble to the eNB on the added secondary serving cell at step S1425. The added secondary serving cell has belonged to the pTAG by default. In the pTAG, only a primary serving cell is a representative serving cell which sends the random access preamble. However, since the added secondary serving cell is a new secondary serving cell and the newest timing advance value can be obtained, the UE is permitted to send the random access preamble on the added secondary serving cell. The random access procedures at the steps S1420 and S1425 can be performed as in FIG. 4.

[0176] The eNB can obtain a timing advance value regarding the added secondary serving cell through the random access procedure and performs TAG reorganization for mapping the added secondary serving cell to a specific TAG based on the timing advance value at step S1430.

[0177] The eNB performs an RRC connection reconfiguration procedure for changing

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the secondary serving cell and reorganizing the TAG at step S1435. The RRC connection reconfiguration procedure for the change of the secondary serving cell and the reorganization of the TAG includes a process in which the eNB sends an RRC connection reconfiguration message to the UE and the UE sends an RRC connection re-establishment-complete message to the eNB after reorganizing the TAG. Here, the RRC connection reconfiguration message includes secondary serving cell configuration information on which the eNB orders the secondary serving cell to be changed, and the secondary serving cell configuration information includes reorganized TAG configuration information.

[0178] In accordance with a common random access procedure, the eNB has to send an RAR message in response to the random access preamble. However, the random access procedures at the steps S1420 and S1425 are additionally used to map the added secondary serving cell to the TAG and reorganize the TAG. Accordingly, a step of sending the RAR message may be omitted, and the RRC connection reconfiguration message for reorganizing the TAG can order the TAG to be reorganized and also mean the success or stop of the random access procedure. The present embodiment, however, may include a step of sending an RAR message. In this case, the step S1435 can be performed after the eNB sends the RAR message to the UE.

[0179] In response to the RRC connection reconfiguration message received during the random access procedure, the UE determines that the random access procedure is successful or that the random access procedure has been stopped by an order of the eNB and terminates the random access procedure. Next, the UE reorganizes the TAG based on the reorganized TAG configuration information at step S1440. For example, the UE maps the secondary serving cell to which the temporary TAG ID has been assigned to a TAG having an ID assigned based on the

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reorganized TAG configuration information. Here, the TAG of the assigned ID may be a pTAG or an sTAG already configured in the UE or may be a new sTAG.

[0180] FIGS. 10 and 11 illustrate embodiments in which an eNB directly informs UE of the reorganization of a TAG by using an RRC connection reconfiguration procedure. In accordance with another embodiment, however, the eNB may inform the UE of a timing advance value through an RAR message because a random access procedure is already in progress. In this case, the UE is not directly informed of reorganized TAG configuration information, but the UE by itself can reorganize a TAG based on the timing advance value. In this sense, it can be seen that the eNB implicitly informs the UE of the reorganized TAG configuration information.

[0181] FIG. 12 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention.

[0182] Steps S1500 to S1530 of FIG. 12 are the same as the steps S1400 to S1430 of FIG. 11, and thus a detailed description thereof is omitted.

[0183] An eNB calculates a timing advance value regarding an added secondary serving cell when receiving a random access preamble and sends an RAR message indicative of the timing advance value to UE at step S1535. Here, the RAR message is a MAC message, and the timing advance value may be indicated by a field within a MAC Random Access Response (RAR). In this case, the RAR message is mapped to a PDSCH indicated by a PDCCH that is scrambled into a Random Access (RA)-Radio Network Temporary Identifier (RNTI) for identifying the UE in a random access procedure and is then transmitted. The PDCCH scrambled into the RA-RNTI is transmitted on a primary serving cell which provides a common search space.

[0184] In an embodiment, the RAR message may be indicated by a MAC Control

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Element (CE). The field indicative of the timing advance value is called a Timing Advance Command (TAC) field. In this case, the RAR message is mapped to a PDSCH indicated by a PDCCH scrambled into a Cell (C)-RNTI for identifying the UE in a UE-specific space and then transmitted. The PDCCH scrambled into the C-RNTI can be transmitted on a secondary serving cell which provides a UE-specific search space.

[0185] In response to the RAR message, the UE checks the timing advance value and performs TAG reorganization at step S1540. If a PDCCH scrambled into an RA-RNTI is received, the UE checks a Random Access Preamble ID (RAPID) within the subheader of an RAR MAC PDU and checks a timing advance value from a MAC RAR indicated by the subheader. If a PDCCH scrambled into a C-RNTI is received, the UE checks a TAC MAC CE extended from the subheader of the MAC PDU or a value of an indicator (LCID) corresponding to the TAC MAC CE and checks a timing advance value from the MAC CE indicated by the subheader.

[0186] As an example of the TAG reorganization, if there is a TAG having the same timing advance value as that of an existing TAG (a pTAG or an sTAG), the UE maps the added secondary serving cell to the corresponding TAG.

[0187] As another example of the TAG reorganization, if the timing advance value is different from a timing advance value applied to an existing TAG (a pTAG or an sTAG), the UE reorganizes the added secondary serving cell into a new TAG. Furthermore, a TAG ID having the smallest value, from among TAG IDs not used as a TAG ID in the UE, may be set as the TAG ID of the new TAG, or a specific one of TAG IDs not used as a TAG ID in the UE may be set as the TAG ID of the new TAG. For example, if a pTAG (TAG ID=0) and an sTAG (TAG ID=2) are configured in the UE, the TAG ID of the new TAG becomes 1. If a pTAG (TAG

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ID=0) and an sTAG (TAG ID=1) are configured in the UE, the TAG ID of the new TAG becomes 2.

[0188] FIGS. 10 to 12 illustrate embodiments in which an added secondary serving cell is reorganized into an sTAG not a pTAG. If the reorganization of a TAG is not necessary because it is determined that the added secondary serving cell should be reorganized into the pTAG after an eNB checks a timing advance value, however, there is a need for a method of the eNB informing UE of this process.

[0189] FIG. 13 is a flowchart illustrating a method of reorganizing a TAG in accordance with further yet another example of the present invention.

[0190] Steps S1600 to S1625 of FIG. 13 are the same as the steps S1500 to S1525 of FIG. 12, and thus a detailed description thereof is omitted.

[0191] An eNB can obtain a timing advance value regarding an added secondary serving cell through a random access procedure. If it is correct that the added secondary serving cell is mapped to a pTAG based on the timing advance value, the eNB determines to not perform TAG reorganization at step S1630.

[0192] Next, the eNB sends a PDCCH order to UE at step S1635. Here, the PDCCH order may mean that a current TAG reorganization has been determined. In an embodiment, the PDCCH order may mean the stop of an ongoing random access procedure.

[0193] If the PDCCH order for the secondary serving cell is received during a random access procedure on an added secondary serving cell within a pTAG, UE stops the ongoing random access procedure at step S1640. Here, the ongoing random access procedure is stopped only when parameters within a PDCCH order recognized as the stop of a random access procedure are the same as parameters within a PDCCH order received by the added secondary

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serving cell for the ongoing random access procedure.

[0194] FIG. 14 is a flowchart illustrating a method of UE reorganizing a TAG in accordance with an example of the present invention.

[0195] Referring to FIG. 14, UE receives secondary serving cell configuration information or the secondary serving cell configuration information and reorganized TAG configuration information from an eNB at step S1700. The secondary serving cell configuration information and the TAG configuration information may be received through one RRC connection reconfiguration procedure or different RRC connection reconfiguration procedures. In an embodiment, the TAG configuration information may be included in the secondary serving cell configuration information.

[0196] The UE checks whether the secondary serving cell configuration information is for adding or releasing a secondary serving cell at step S1705. If the secondary serving cell configuration information includes a field 'sCellToReleaseList', the secondary serving cell configuration information is for releasing the secondary serving cell. In contrast, if the secondary serving cell configuration information includes a field 'sCellToAddModList', the secondary serving cell configuration information is for adding the secondary serving cell.

[0197] If the secondary serving cell configuration information is for releasing the secondary serving cell, the UE releases the configuration of the secondary serving cell at step S1710. For example, if the UE receives the secondary serving cell configuration information and the reorganized TAG configuration information through one RRC connection reconfiguration procedure, the UE releases the secondary serving cell. For another example, if the UE receives the secondary serving cell configuration information and the reorganized TAG configuration information through different RRC connection reconfiguration procedures, the UE releases the

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secondary serving cell and reorganizes a TAG.

[0198] If, as a result of the check, the secondary serving cell configuration information is for adding the secondary serving cell, the UE checks whether TAG configuration information has been received or not at step S1715. If the UE has not received the TAG configuration information, it may mean that an eNB has not sent the TAG configuration information or that the TAG configuration information is not included in the secondary serving cell configuration information. As described in Paragraph (2-2-2), it may mean that i) a TAG ID=0, ii) a TAG ID='Null', or iii) TAG configuration information is not included in the secondary serving cell configuration information.

[0199] If, as a result of the check at the step S1715, the UE has not received the TAG configuration information, the UE reorganizes the added secondary serving cell into a pTAG by default, assigns the added secondary serving cell to a new sTAG, or does not assign any TAG ID to the added secondary serving cell at step S1720.

[0200] The UE receives a PDCCH order from the eNB at step S1725. In response thereto, the UE sends a random access preamble to the eNB at step S1730.

[0201] The UE receives a reorganization-complete message from the eNB at step S1735 and reorganizes the TAG in response to the reorganization-complete message at step S1740. The reorganization-complete message may be, for example, at least of an RAR message including a timing advance value, an RRC connection reconfiguration message, and a PDCCH order.

[0202] For example, if the reorganization-complete message is the RAR message, the reorganization-complete message may be a MAC RAR or a MAC CE. If a PDCCH scrambled into an RA-RNTI is received, the UE can check a MAC RAR including a timing advance value from a PDSCH indicated by the PDCCH. If a PDCCH scrambled into a C-RNTI is received, the

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UE can check a MAC CE including a timing advance value from a PDSCH indicated by the PDCCH. Next, the UE performs TAG reorganization. As an example of the TAG reorganization, if the timing advance value has the same timing advance value applied to an existing TAG (a pTAG or an sTAG), the UE maps the added secondary serving cell to a corresponding TAG. As another example of the TAG reorganization, if the timing advance value is different from a timing advance value applied within an existing TAG (a pTAG or an sTAG) and the number of TAGs now configured in the UE is smaller than a maximum number of TAGs that can be configured, the UE designates a temporary TAG ID as the TAG ID of a new sTAG and maps the added secondary serving cell to the TAG. As yet another example of the TAG reorganization, if the timing advance value is different from a timing advance value applied within an existing TAG (a pTAG or an sTAG) and the number of TAGs now configured in the UE is the same as a maximum number of TAGs that can be configured, the UE performs one of the following operation. That is, i) the UE may determine that the timing advance value for the added secondary serving cell is not valid and disregard the received timing advance value. ii) The UE may deactivate the added secondary serving cell in order to prevent uplink transmission within a corresponding TAG. This is because there may be a problem in uplink transmission within the TAG because a new TAG ID and the configuration of a current TAG are not valid. iii) The UE may release the configuration of the added secondary serving cell instead of the deactivation operation.

[0203] For another example, if the reorganization-complete message is the RRC connection reconfiguration message, the reorganization-complete message includes reorganized TAG configuration information. The reorganized TAG configuration information indicates a specific TAG ID in addition to a pTAG. In this case, the UE reorganizes the added secondary

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serving cell into a TAG having the specific TAG ID.

[0204] For yet another example, if the reorganization-complete message is the PDCCH order, the reorganization-complete message is an indicator having a meaning that a random access procedure in the added secondary serving cell is stopped. In this case, the UE maintains the added secondary serving cell in a temporally mapped TAG (e.g., a pTAG) and does not reorganize the TAG.

[0205] If, as a result of the check at the step S1715, the UE has received the TAG configuration information, the UE checks whether a TAG ID indicated by the TAG configuration information is a temporary TAG ID or a normal TAG ID and configures a temporary TAG or a new sTAG in response to the TAG ID indicated by the TAG configuration information at step S1745. Next, the UE performs the step S1725 to the step S1740.

[0206] FIG. 15 is a flowchart illustrating a method of an eNB reorganizing a TAG in accordance with an example of the present invention.

[0207] Referring to FIG. 15, an eNB determines to add or release a secondary serving cell at step S1800. For example, if a frequency band necessary for UE is reduced or access to a secondary serving cell of a serving eNB is released due to a handover, the eNB can determine to release a secondary serving cell configured in UE. For another example, if a bandwidth supported for UE is increased or the new cell of a target eNB is accessed due to a handover, the eNB can determine to additionally configure a secondary serving cell in UE. The addition or release of the secondary serving cell corresponds to the change or update of secondary serving cell configuration information.

[0208] If a change of secondary serving cell configuration information corresponds to the release of the secondary serving cell at step S1805, the eNB sends an RRC connection

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reconfiguration message for releasing the secondary serving cell to the UE at step S1810.

[0209] In contrast, if a change of secondary serving cell configuration information corresponds to the addition of the secondary serving cell at step S1805, the eNB checks whether a timing advance value for the added secondary serving cell can be obtained at step S1815. If the eNB has obtained the timing advance value for the added secondary serving cell or can obtain the timing advance value for the added secondary serving cell, the eNB reorganizes the added secondary serving cell into a specific TAG at step S1820 and sends TAG configuration information, indicating a TAG ID to be mapped to the added secondary serving cell, to the UE at step S1825. Here, the TAG configuration information may be included in secondary serving cell configuration information and transmitted or may be transmitted separately from secondary serving cell configuration information. In contrast, if a serving cell having a specific frequency band is always provided through an FSR or a remote radio head, the eNB cannot secure a timing advance value because the serving cell having the specific frequency band and a serving cell directly served by the eNB have different timing advance values and belong to different TAGs in relation to all pieces of UE within the service coverage of the eNB.

[0210] If, as a result of the check at step S1815, a timing advance value for the added secondary serving cell cannot be obtained, the eNB maps the added secondary serving cell to a temporary TAG ID or sets a TAG ID regarding the added secondary serving cell to 'Null' or does not generate TAG configuration information. Next, the eNB sends the secondary serving cell configuration information for adding the secondary serving cell or the secondary serving cell configuration information and TAG configuration information to the UE at step S1830. The secondary serving cell configuration information and the TAG configuration information may be transmitted through one RRC connection reconfiguration procedure or different RRC connection

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reconfiguration procedures. In an embodiment, the TAG configuration information may be included in the secondary serving cell configuration information. If a TAG regarding the secondary serving cell is set to 'Null' or a TAG ID=0, it may be considered that the added secondary serving cell is temporally mapped to a pTAG or that the added secondary serving cell is not mapped to any TAG.

[0211] The eNB sends a PDCCH order to the UE at step S1835. In response thereto, the eNB receives a random access preamble from the UE on the added secondary serving cell at step S1840.

[0212] The eNB obtains a timing advance value for the added secondary serving cell when receiving the random access preamble and reorganizes the added secondary serving cell into a specific TAG based on the timing advance value at step S1845. For example, if the timing advance value is the same as that of a pTAG in the state in which the added secondary serving cell has been reorganized into the pTAG when adding the secondary serving cell, the eNB does not reorganize the TAG. For another example, if the timing advance value is different from that of a pTAG, but is the same as that of another sTAG in the state in which the added secondary serving cell has been reorganized into the pTAG when adding the secondary serving cell, the eNB reorganizes the added secondary serving cell into the sTAG. For yet another example, if the timing advance value is different from that of a pTAG and also different from that of another sTAG in the state in which the added secondary serving cell has been reorganized into the pTAG when adding the secondary serving cell, the eNB reorganizes the added secondary serving cell into a new sTAG.

[0213] The eNB sends a reorganization-complete message for informing the UE of the reorganized TAG to at step S1850. The reorganization-complete message can be at least one of,

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for example, an RAR message including a timing advance value, an RRC connection reconfiguration message, and a PDCCH order.

[0214] For example, if the reorganization-complete message is the RAR message, the reorganization-complete message may be a MAC RAR or a MAC CE. If a PDCCH scrambled into an RA-RNTI is received, the UE can check a MAC RAR including a timing advance value from a PDSCH indicated by the PDCCH. If a PDCCH scrambled into a C-RNTI is received, the UE can check a MAC CE including a timing advance value from a PDSCH indicated by the PDCCH. In this case, the UE implicitly reorganizes the added secondary serving cell into any one existing TAG based on the timing advance value.

[0215] For another example, if the reorganization-complete message is the RRC connection reconfiguration message, the reorganization-complete message includes reorganized TAG configuration information. The reorganized TAG configuration information indicates a specific TAG ID in addition to a pTAG. In this case, the UE reorganizes the added secondary serving cell into a TAG having the specific TAG ID.

[0216] For yet another example, if the reorganization-complete message is the PDCCH order, the reorganization-complete message is an indicator having a meaning that a random access procedure in the added secondary serving cell is stopped. In this case, the UE maintains the added secondary serving cell in a temporally mapped TAG (e.g., a pTAG) and does not reorganize the TAG.

[0217] FIG. 16 is a block diagram showing UE and an eNB for sending signals regarding uplink synchronization in accordance with an example of the present invention.

[0218] Referring to FIG. 16, the UE 1900 includes a reception unit 1905, a UE processor 1910, and a transmission unit 1920. The UE processor 1910 includes an RRC processing unit

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1911 and a random access processing unit 1912.

[0219] The reception unit 1905 receives secondary serving cell configuration information, TAG configuration information, a PDCCH order, an RAR message, and a reorganization-complete message from an eNB 1950. The reorganization-complete message can be at least one of, for example, an RAR message including a timing advance value, an RRC connection reconfiguration message, and a PDCCH order.

[0220] The RRC processing unit 1911 generates a message used in an RRC procedure or receives the message from the eNB 1950. The RRC procedure can include, for example, an RRC connection establishment procedure and an RRC connection reconfiguration procedure. A message used in the RRC connection reconfiguration procedure can include at least one of secondary serving cell configuration information and TAG configuration information.

[0221] The RRC processing unit 1911 configures a primary serving cell and at least one secondary serving cell, used in a CA, in the UE 1900 in the form of the CA. A procedure for additionally configuring a secondary serving cell in the UE 1900 or releasing a secondary serving cell configured in the UE 1900 can be indicated by secondary serving cell configuration information.

[0222] Meanwhile, the RRC processing unit 1911 reorganizes a TAG based on at least one of secondary serving cell configuration information and a TAG ID indicated by TAG configuration information. The RRC processing unit 1911 reorganizes the TAG so that the secondary serving cell is included in the TAG. For example, if the secondary serving cell configuration information includes an information field for adding or releasing a specific secondary serving cell, the RRC processing unit 1911 adds or releases the specific secondary serving cell based on an order of the information field and updates or reorganizes a TAG to or

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from which the specific secondary serving cell is added or released.

[0223] Furthermore, if the TAG configuration information indicates that a specific secondary serving cell is mapped to a TAG having a specific ID, the RRC processing unit 1911 reorganizes the specific secondary serving cell into the TAG having the specific ID based on the TAG configuration information. If the specific TAG ID=0 or the TAG ID='Null', the RRC processing unit 1911 determines that the specific secondary serving cell belongs to a pTAG by default and reorganizes the specific secondary serving cell into the pTAG. In an embodiment, the RRC processing unit 1911 does not reorganize the specific secondary serving cell into any TAG. If a TAG has a temporary value, that is, a specific TAG ID≠0, the RRC processing unit 1911 reorganizes the specific secondary serving cell into a temporary TAG ID.

[0224] Furthermore, the RRC processing unit 1911 can reorganize the TAG based on the timing advance value regarding the secondary serving cell received from the random access processing unit 1912. As an example of the TAG reorganization, if there is a TAG having the same timing advance value as that of an existing TAG (a pTAG or an sTAG), the RRC processing unit 1911 maps the added secondary serving cell to the corresponding TAG. As another example of the TAG reorganization, if the timing advance value is different from a timing advance value applied within an existing TAG (a pTAG or an sTAG) and the number of TAGs now configured in the UE 1900 is smaller than a maximum number of TAGs that can be configured, the RRC processing unit 1911 designates a temporary TAG ID as the TAG ID of a new sTAG and maps the added secondary serving cell to the TAG. As yet another example of the TAG reorganization, if the timing advance value is different from a timing advance value applied within an existing TAG (a pTAG or an sTAG) and the number of TAGs now configured in the UE 1900 is the same as a maximum number of TAGs that can be configured, the RRC

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processing unit 1911 performs one of the following operations. That is, i) the RRC processing unit 1911 determines that the timing advance value for the added secondary serving cell is not valid and disregards the received timing advance value. ii) The RRC processing unit 1911 deactivates the added secondary serving cell in order to prevent uplink transmission within a corresponding TAG. This is because there may be a problem in uplink transmission within a TAG because a new TAG ID and the configuration of a current TAG are not valid. iii) The RRC processing unit 1911 may release the added secondary serving cell instead of the deactivation operation.

[0225] The random access processing unit 1912 generates a random access preamble in response to a PDCCH order and sends the random access preamble to the transmission unit 1920. Furthermore, the random access processing unit 1912 obtains a timing advance value regarding a secondary serving cell from a Random Access Response (RAR) message received from the reception unit 1905 and controls uplink synchronization regarding the secondary serving cell based on the timing advance value. Furthermore, the random access processing unit 1912 can provide the timing advance value to the RRC processing unit 1911 so that the RRC processing unit 1911 reorganizes a TAG.

[0226] The transmission unit 1920 sends the random access preamble or an RRC message to the eNB 1950.

[0227] The eNB 1950 includes a transmission unit 1955, a reception unit 1960, and an eNB processor 1970. The eNB processor 1970 includes an RRC processing unit 1971 and a random access processing unit 1972.

[0228] The transmission unit 1955 sends secondary serving cell configuration information, TAG configuration information, a PDCCH order, and an RAR to the UE 1900.

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Here, the transmission unit 1955 may send the secondary serving cell configuration information including the TAG configuration information or may send the TAG configuration information separately from the secondary serving cell configuration information.

[0229] The reception unit 1960 receives a random access preamble and an RRC message from the UE 1900.

[0230] The RRC processing unit 1971 determines to add or release a secondary serving cell for the UE 1900. For example, if a frequency band necessary for the UE 1900 is reduced or access to the secondary serving cell of a serving eNB is released due to a handover, the RRC processing unit 1971 can determine to release a secondary serving cell configured in the UE 1900. For another example, if a bandwidth supported for the UE 1900 is increased or the new cell of a target eNB is accessed due to a handover, the RRC processing unit 1971 can determine to additionally configure a secondary serving cell in the UE 1900. The addition or release of the secondary serving cell corresponds to the change or update of secondary serving cell configuration information.

[0231] If a change of the secondary serving cell configuration information corresponds to the release of the secondary serving cell, the RRC processing unit 1971 generates an RRC connection reconfiguration message for releasing the secondary serving cell and sends the RRC connection reconfiguration message to the transmission unit 1955.

[0232] In contrast, if a change of the secondary serving cell configuration information corresponds to the addition of the secondary serving cell, the RRC processing unit 1971 checks whether the timing advance value of the secondary serving cell can be obtained. If, as a result of the check, the RRC processing unit 1971 has secured the timing advance value of the secondary serving cell or can secure the timing advance value of the secondary serving cell, the RRC

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processing unit 1971 reorganizes the secondary serving cell into a specific TAG, generates TAG configuration information indicative of a TAG ID to which the secondary serving cell will be mapped, sends the TAG configuration information to the transmission unit 1955. Here, the TAG configuration information may be included in secondary serving cell configuration information or may be generated separately from secondary serving cell configuration information.

[0233] If, as a result of the check, the RRC processing unit 1971 is unable to secure the timing advance value of the secondary serving cell, the RRC processing unit 1971 maps the secondary serving cell to a temporary TAG ID, sets a TAG ID regarding the added secondary serving cell to 'Null', or does not generate TAG configuration information. Furthermore, the RRC processing unit 1971 generates secondary serving cell configuration information for adding the secondary serving cell or the secondary serving cell configuration information and TAG configuration information and sends the secondary serving cell configuration information for adding the secondary serving cell or the secondary serving cell configuration information and the TAG configuration information to the transmission unit 1955.

[0234] The RRC processing unit 1971 may include the secondary serving cell configuration information and the TAG configuration information in one RRC connection reconfiguration message or in different RRC connection reconfiguration messages. In an embodiment, the RRC processing unit 1971 may include the TAG configuration information in the secondary serving cell configuration information. If a TAG ID regarding the secondary serving cell is 'Null' or the TAG ID=0, it may be considered that the added secondary serving cell is temporally mapped to a pTAG or that the added secondary serving cell is not mapped to any TAG.

[0235] The random access processing unit 1972 generates a PDCCH order in order to

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obtain a timing advance value for the uplink synchronization of the added secondary serving cell and sends the PDCCH order to the transmission unit 1955. As a response thereto, the reception unit 1960 receives a random access preamble from the UE 1900 on the secondary serving cell.

[0236] The random access processing unit 1972 obtains a timing advance value for the added secondary serving cell when receiving the random access preamble, and the RRC processing unit 1971 reorganizes the added secondary serving cell into a specific TAG based on the timing advance value. For example, if the timing advance value is the same as that of a pTAG in the state in which an added secondary serving cell has been reorganize into the pTAG when adding the secondary serving cell, the RRC processing unit 1971 does not reorganize a TAG. For another example, if the timing advance value is different from that of a pTAG and is the same as another sTAG in the state in which an added secondary serving cell has been reorganize into the pTAG when adding the secondary serving cell, the RRC processing unit 1971 reorganizes the added secondary serving cell into the sTAG. For yet another example, if the timing advance value is different from that of a pTAG and is different another sTAG in the state in which an added secondary serving cell has been reorganize into the pTAG when adding the secondary serving cell, the RRC processing unit 1971 reorganizes the added secondary serving cell into a new sTAG.

[0237] The RRC processing unit 1971 or the random access processing unit 1972 generates a reorganization-complete message for informing the UE 1900 of the reorganized TAG and sends the reorganization-complete message to the transmission unit 1955. The reorganization-complete message can be at least one of, for example, an RAR message including a timing advance value, an RRC connection reconfiguration message, and a PDCCH order.

[0238] For example, if the reorganization-complete message is the RAR message, the

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reorganization-complete message can be a MAC RAR or a MAC CE. If a PDCCH scrambled into an RA-RNTI is received, the random access processing unit 1972 can check a MAC RAR including a timing advance value from a PDSCH indicated by a PDCCH. If a PDCCH scrambled into a C-RNTI is received, the random access processing unit 1972 can check a MAC CE including a timing advance value from a PDSCH indicated by a PDCCH. In this case, the RRC processing unit 1971 implicitly reorganizes the added secondary serving cell into any one existing TAG based on the timing advance value.

[0239] For another example, if the reorganization-complete message is the RRC connection reconfiguration message, the reorganization-complete message includes reorganized TAG configuration information. The reorganized TAG configuration information indicates a specific TAG ID other than a pTAG. In this case, the RRC processing unit 1971 reorganizes the added secondary serving cell into a TAG having the specific TAG ID.

[0240] For yet another example, if the reorganization-complete message is the PDCCH order, the reorganization-complete message is an indicator having a meaning that a random access procedure in the added secondary serving cell is stopped. In this case, the RRC processing unit 1971 maintains the added secondary serving cell in a a temporally mapped TAG (e.g., a pTAG) and does not reorganize a corresponding TAG.

[0241] In accordance with the present invention, a procedure can be simplified and TAG reorganization can be performed more rapidly because TAG configuration information for reorganizing a TAG does not need to be separately transmitted. Furthermore, an eNB may explicitly order TAG reorganization for UE or UE can implicitly perform TAG reorganization.

[0242] While some exemplary embodiments of the present invention have been described with reference to the accompanying drawings, those skilled in the art may change and modify the

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present invention in various ways without departing from the essential characteristic of the present invention. Accordingly, the disclosed embodiments should not be construed as limiting the technical spirit of the present invention, but should be construed as illustrating the technical spirit of the present invention. The scope of the technical spirit of the present invention is not restricted by the embodiments, and the scope of the present invention should be interpreted based on the following appended claims. Accordingly, the present invention should be construed as covering all modifications or variations derived from the meaning and scope of the appended claims and their equivalents.

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WHAT IS CLAIMED IS:

1. A user equipment (UE) comprising:

a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex and a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and an identifier of a timing advance group (TAG) associated with the one or more SCell;

a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and to add the one or more SCell as an available SCell for use with the UE and to associate the one or more SCell with another available SCell associated with same TAG identifier, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.

2. The UE of claim 1, wherein the RRC processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG.

3. The UE of claim 1, wherein the receiver receives the first and second field through a RRC connection reconfiguration message.

4. The UE of claim 1, wherein the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE.

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5. A method of user equipment (UE), comprising:

receiving, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex

receiving, from the base station, a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellindex and an identifier of a timing advance group (TAG) associated with the one or more SCell;

releasing the SCell associated with the first SCellIndex for use with the UE;

adding the one or more SCell as available SCell for use with the UE; and

associating the one or more SCell with another available SCell associated with same TAG identifier, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.

6. The method of claim 5, further comprising:

associating an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG.

7. The method of claim 5, wherein the first and second field are received through a Radio Resource Control (RRC) connection reconfiguration message.

8. The method of claim 5, further comprising:

receiving, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE.

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9. A method of a base station (BS), comprising:

generating a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex;

generating a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and an identifier of a timing advance group (TAG) associated with the one or more SCell; and

transmitting, to a user equipment (UE), the first field to release the SCell associated with the first SCell and the second field to reconfigure the TAG by associating the one or more SCell with the TAG, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.

10. The method of claim 9, further comprising:

configuring the identifier with no identifier of a TAG if the TAG of the one or more SCell is associated with a primary serving cell (PCell).

11. The method of claim 9, wherein the first and second field are transmitted through a Radio Resource Control (RRC) connection reconfiguration message.

12. The method of claim 9, further comprising:

generating the first field comprising an indication to remove an SCell from SCells available to the UE.

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ABSTRACT

A user equipment (UE) of re-organizing a timing advance group (TAG) is provided. The UE includes: a receiving unit for receiving, from a serving base station, secondary serving cell (SCell) configuration information which includes a first field and a second field, the first field including an ScellIndex of an SCell to indicate a removal of the SCell, the second field including at least one of the ScellIndex to indicate an addition of the SCell and a TAG ID indicating a TAG of the SCell, and a radio resource control (RRC) processing unit for performing the addition of the SCell after performing the removal of the SCell from one or more SCells configured in the UE, and for reorganizing the TAG by including the SCell in the TAG.

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FIG. 1

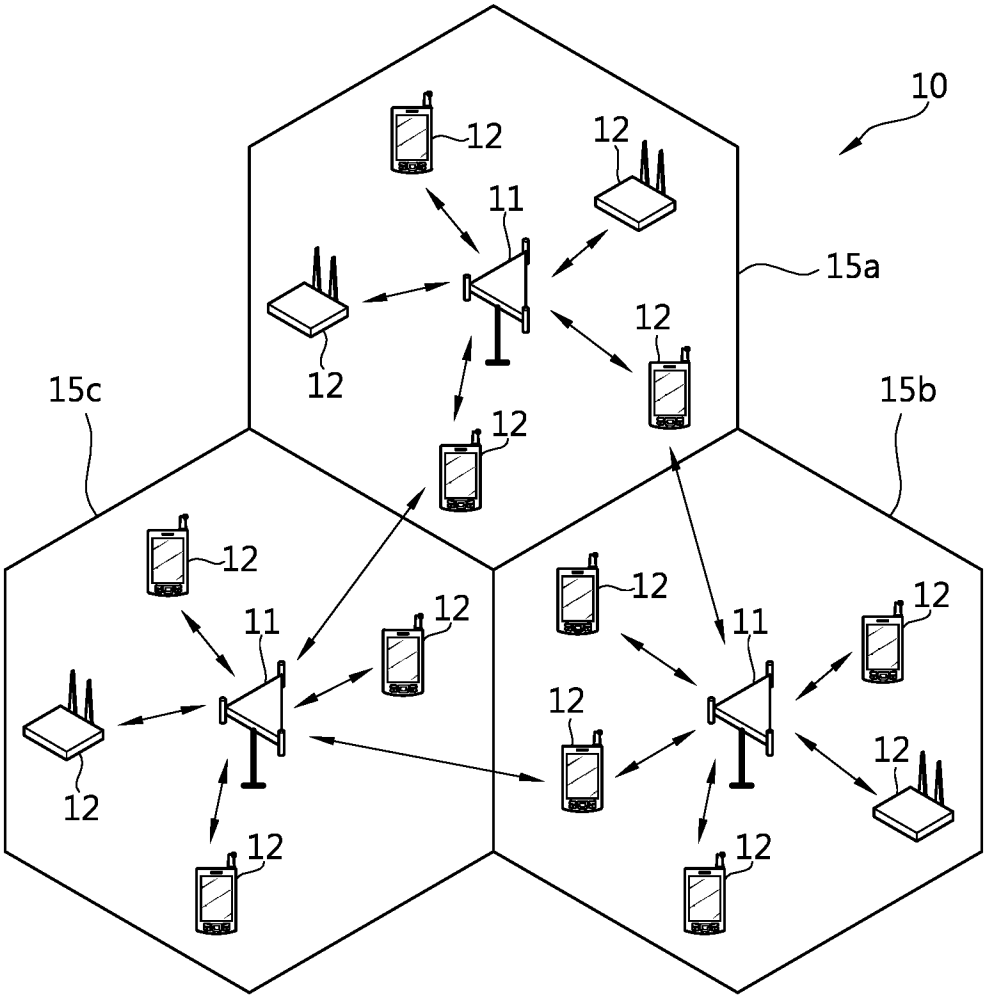


FIG. 2

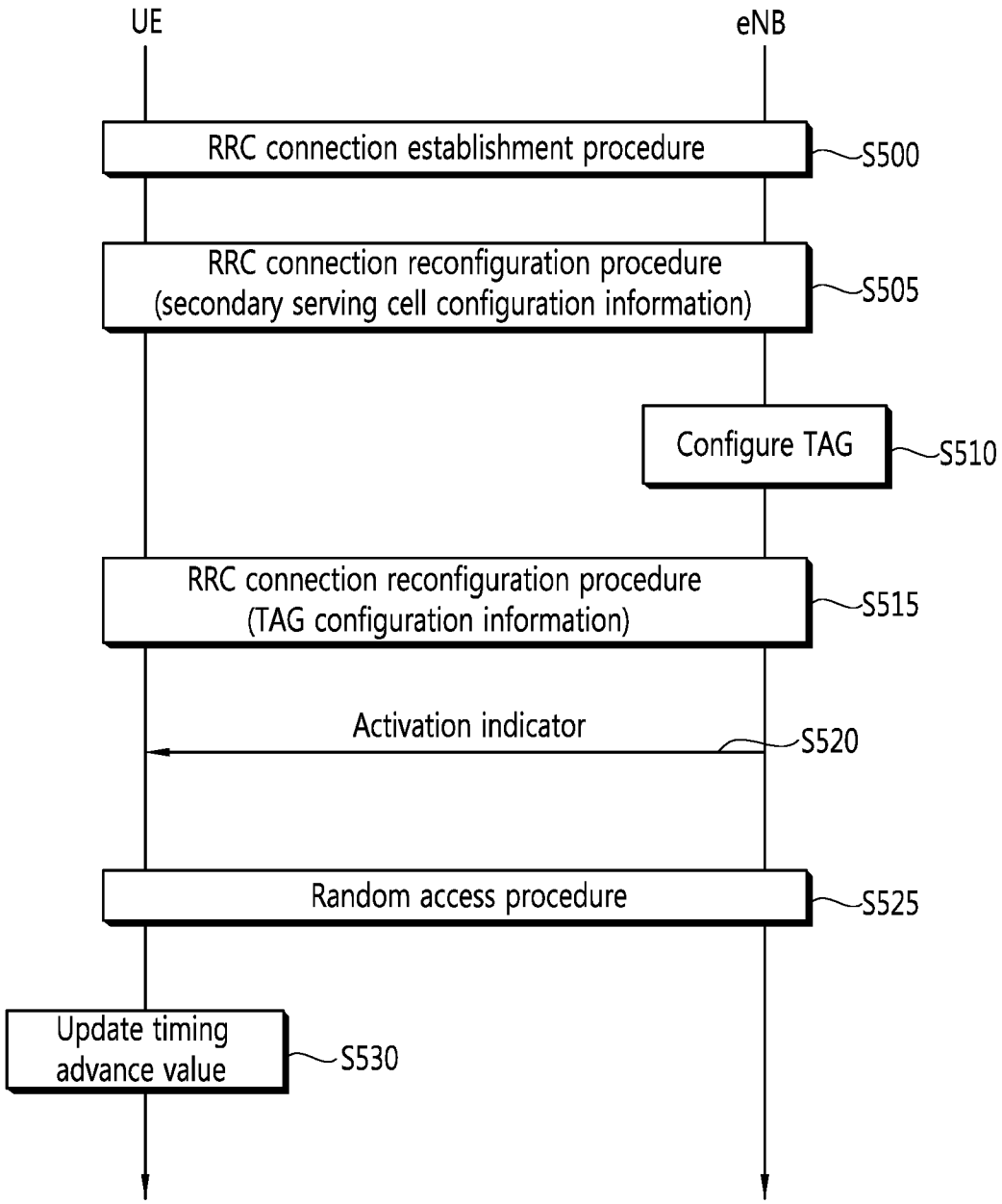

UE
eNB
RRC connection establishment procedure
S500
RRC connection reconfiguration procedure
(secondary serving cell configuration information)
S505
Configure TAG
S510
RRC connection reconfiguration procedure
(TAG configuration information)
S515
Activation indicator
S520
Random access procedure
S525
Update timing
advance value
S530

FIG. 3

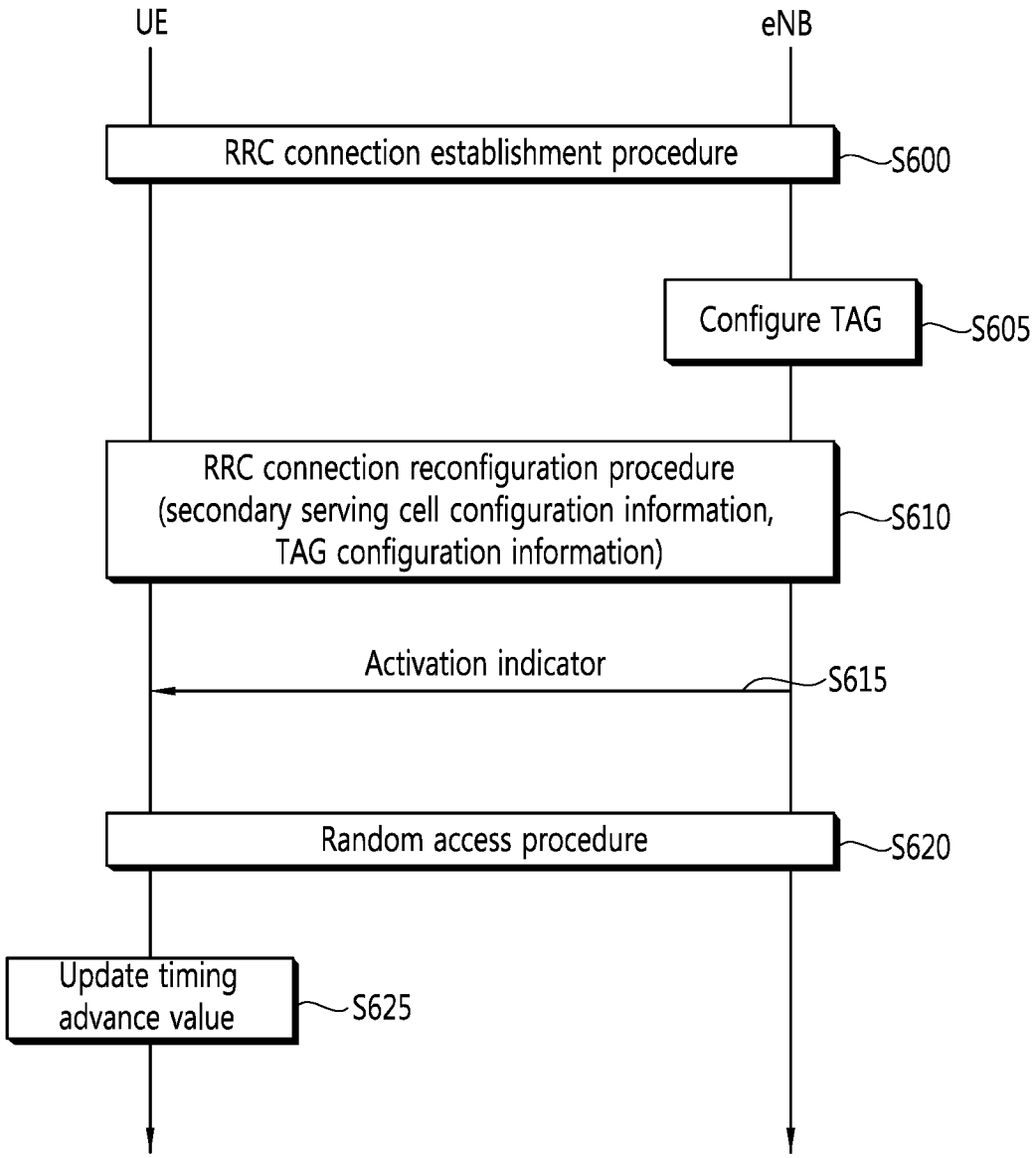

UE
eNB
RRC connection establishment procedure
S600
Configure TAG
S605
RRC connection reconfiguration procedure
(secondary serving cell configuration information,
TAG configuration information)
S610
Activation indicator
S615
Random access procedure
S620
Update timing
advance value
S625

FIG. 4

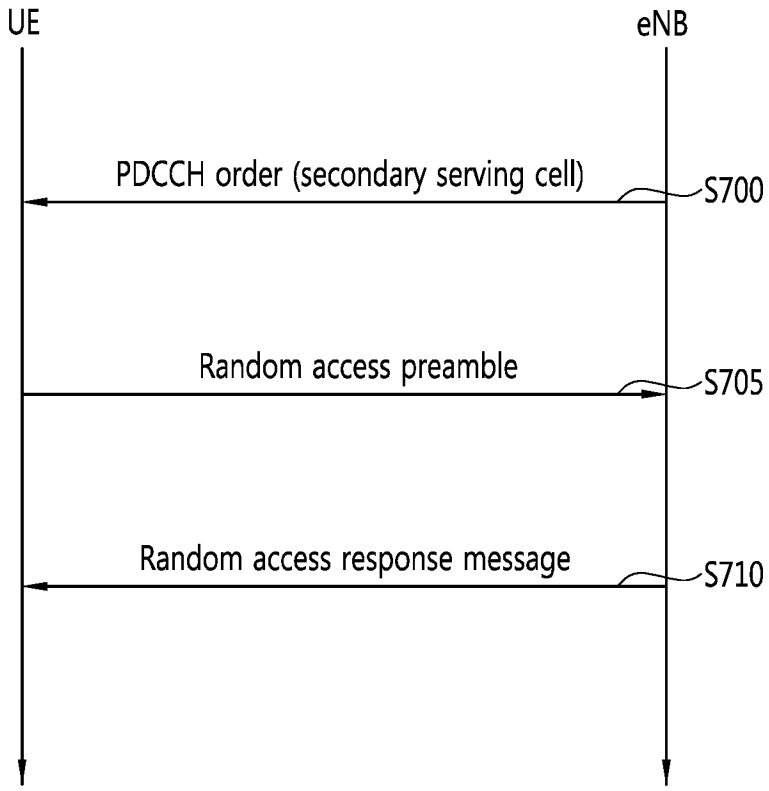

UE
eNB
PDCCH order (secondary serving cell)
S700
Random access preamble
S705
Random access response message
S710

FIG. 5

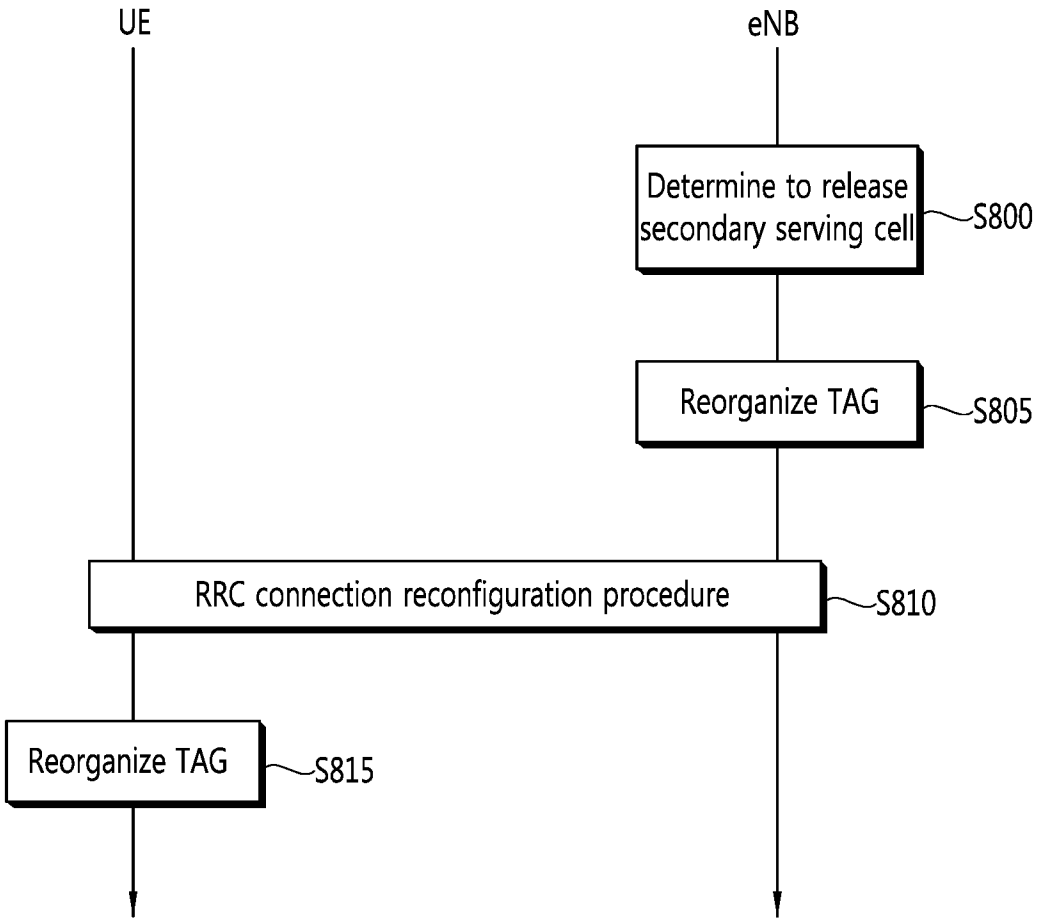

UE
eNB
Determine to release secondary serving cell
S800
Reorganize TAG
S805
RRC connection reconfiguration procedure
S810
Reorganize TAG
S815

FIG. 6

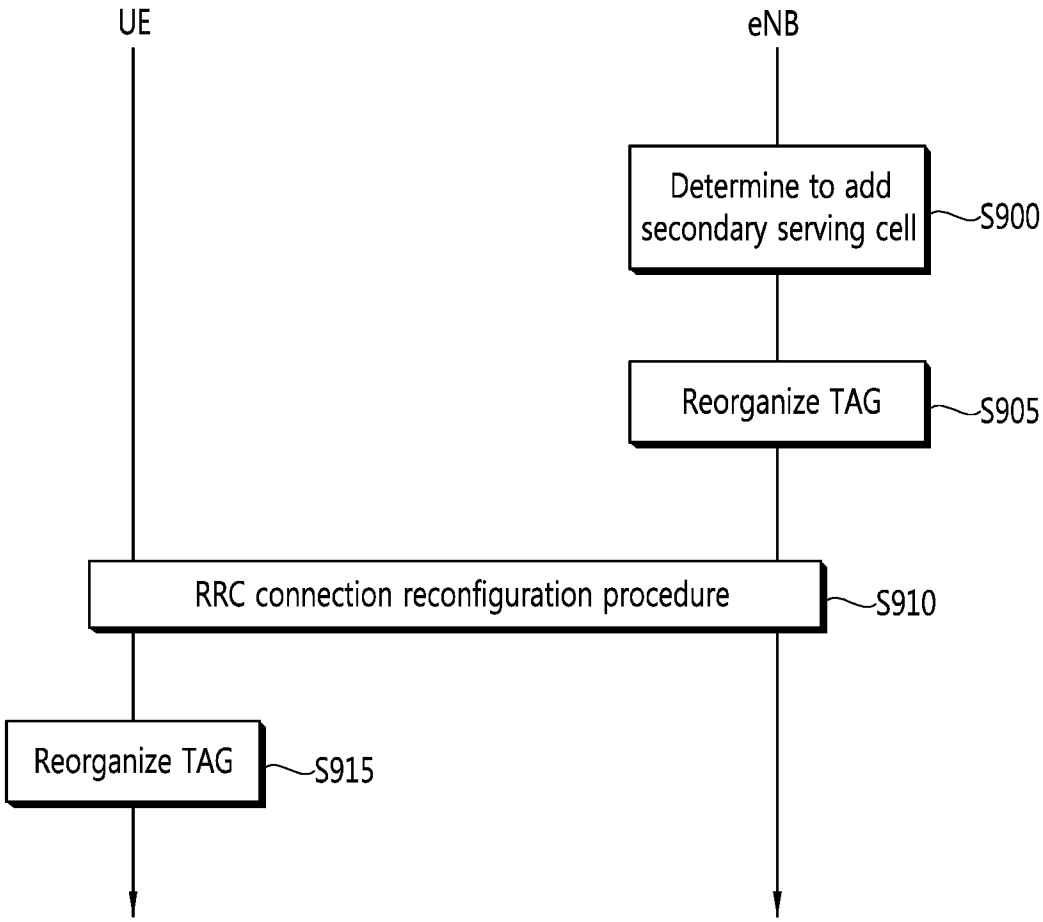

UE
eNB
Determine to add secondary serving cell
S900
Reorganize TAG
S905
RRC connection reconfiguration procedure
S910
Reorganize TAG
S915

FIG. 7

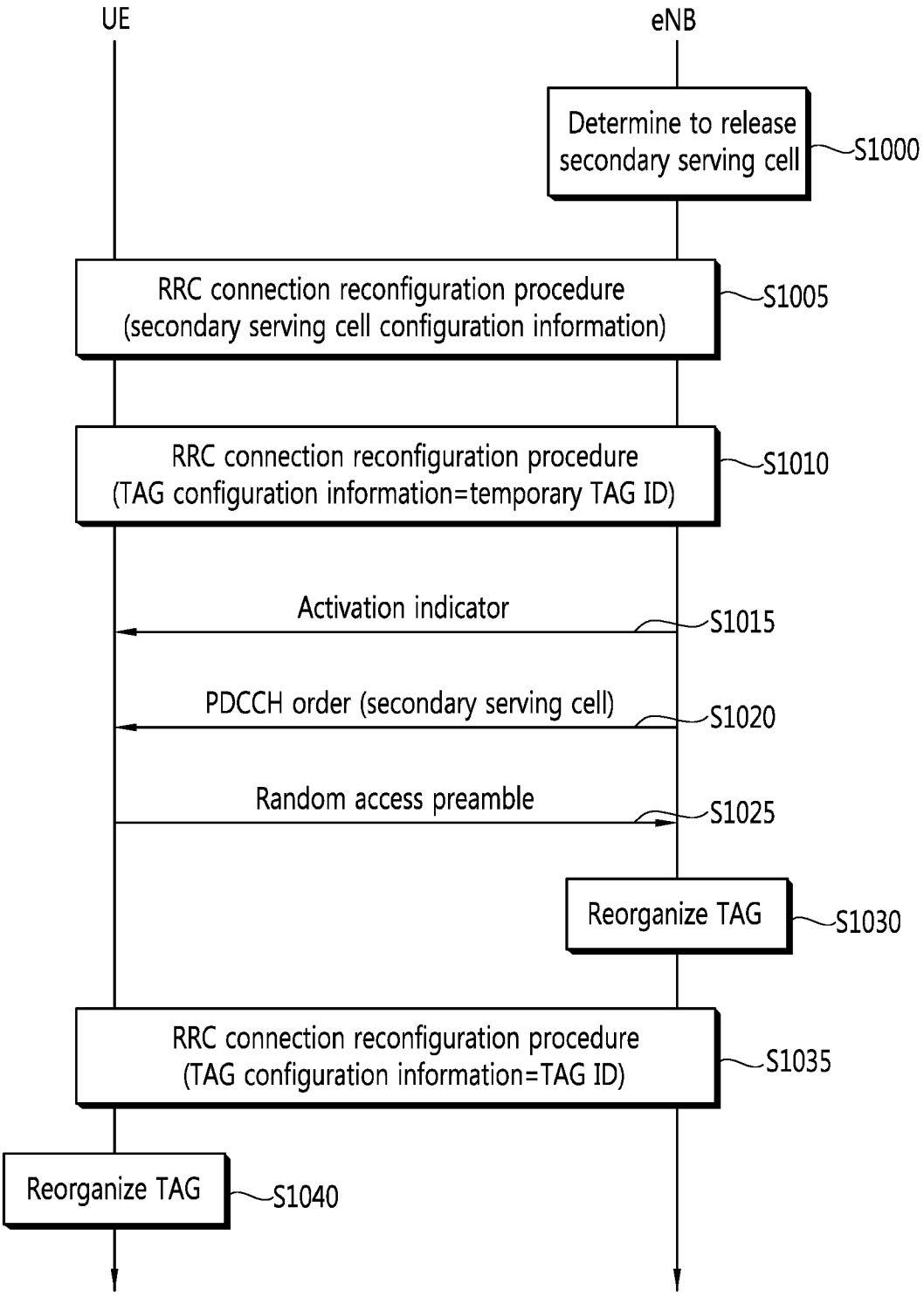

UE
eNB
Determine to release secondary serving cell
S1000
RRC connection reconfiguration procedure (secondary serving cell configuration information)
S1005
RRC connection reconfiguration procedure (TAG configuration information=temporary TAG ID)
S1010
Activation indicator
S1015
PDCCH order (secondary serving cell)
S1020
Random access preamble
S1025
Reorganize TAG
S1030
RRC connection reconfiguration procedure (TAG configuration information=TAG ID)
S1035
Reorganize TAG
S1040

FIG. 8

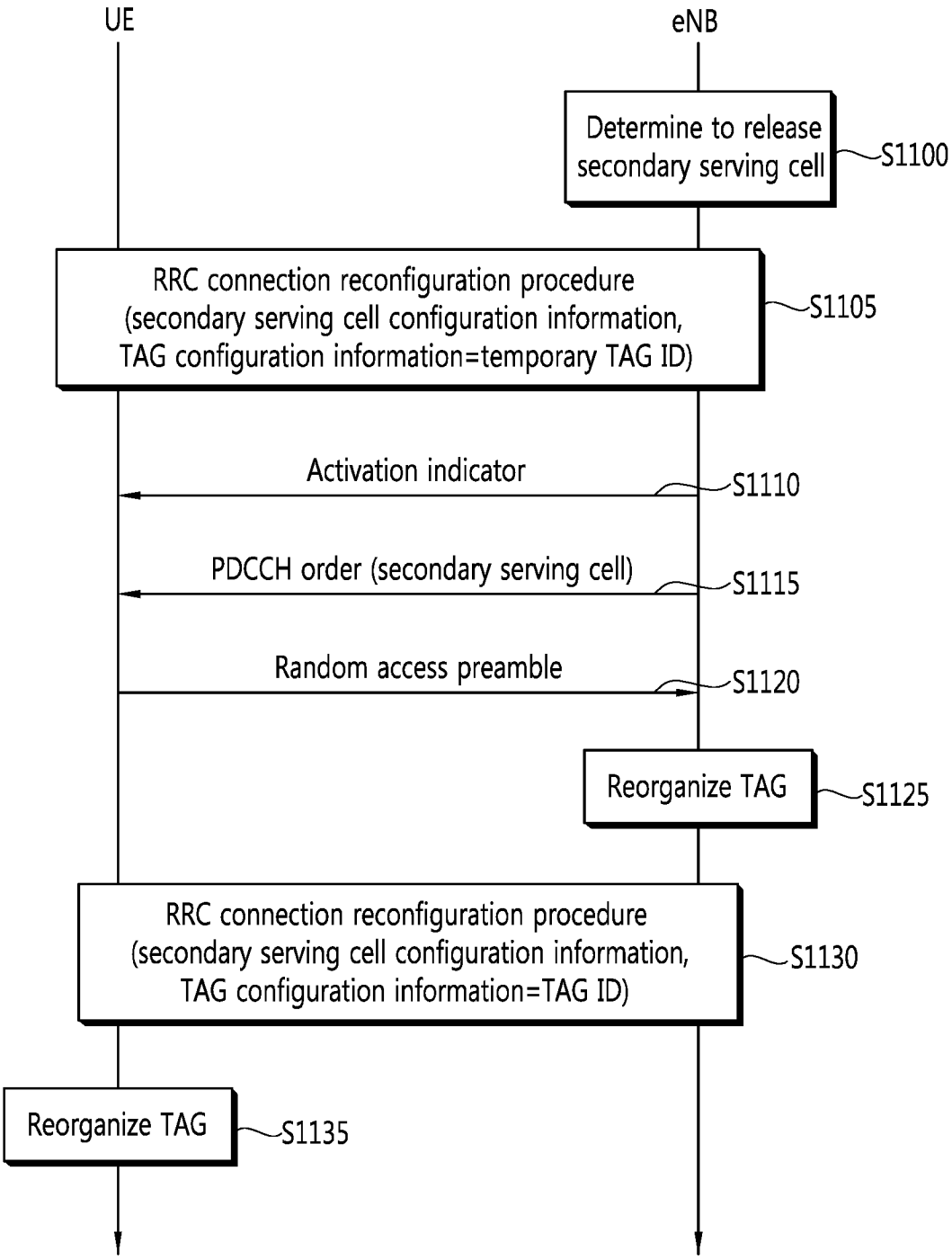

UE
eNB
Determine to release secondary serving cell
S1100
RRC connection reconfiguration procedure (secondary serving cell configuration information, TAG configuration information=temporary TAG ID)
S1105
Activation indicator
S1110
PDCCH order (secondary serving cell)
S1115
Random access preamble
S1120
Reorganize TAG
S1125
RRC connection reconfiguration procedure (secondary serving cell configuration information, TAG configuration information=TAG ID)
S1130
Reorganize TAG
S1135

FIG. 9

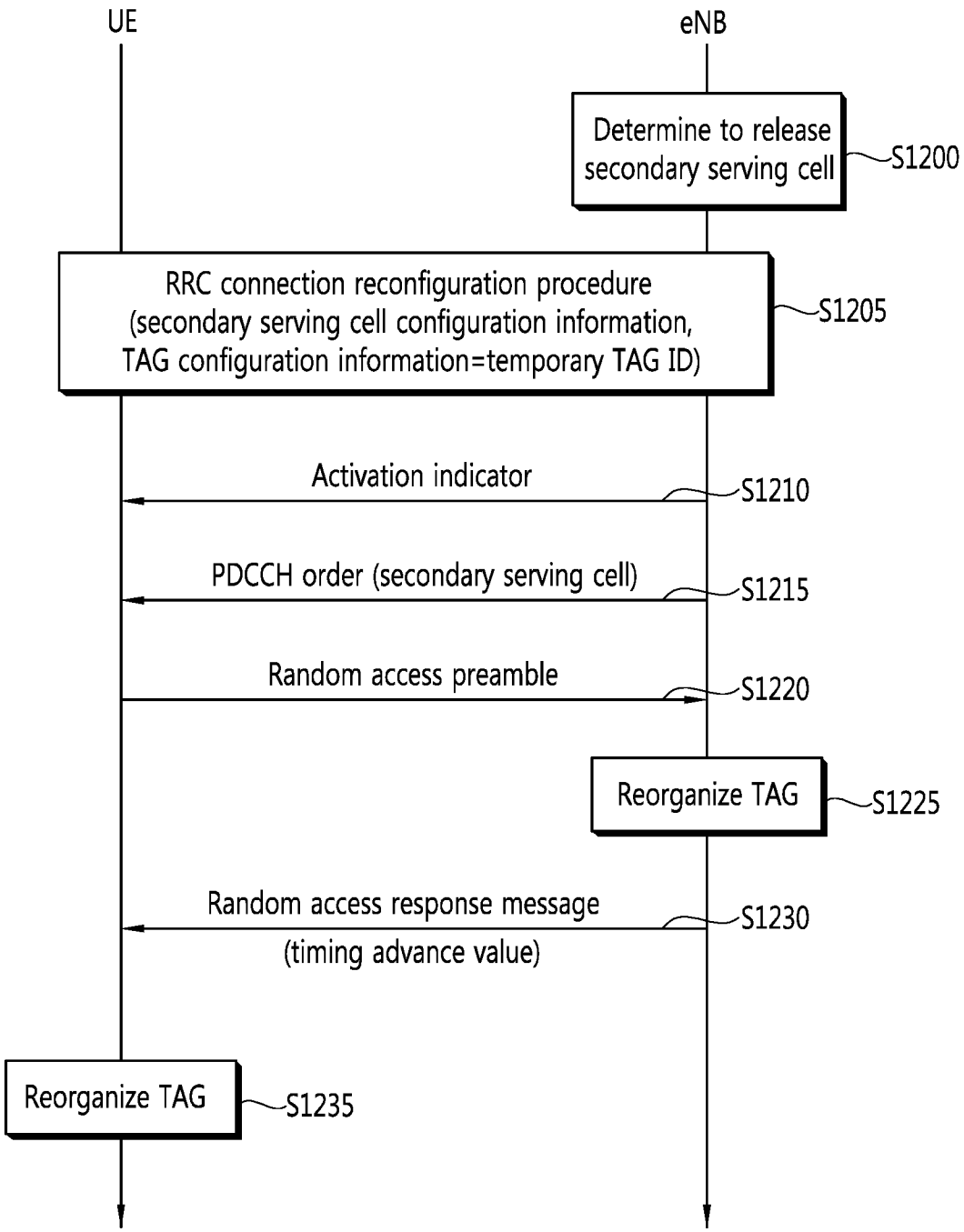

UE
eNB
Determine to release secondary serving cell
S1200
RRC connection reconfiguration procedure (secondary serving cell configuration information, TAG configuration information=temporary TAG ID)
S1205
Activation indicator
S1210
PDCCH order (secondary serving cell)
S1215
Random access preamble
S1220
Reorganize TAG
S1225
Random access response message
(timing advance value)
S1230
Reorganize TAG
S1235

FIG. 10

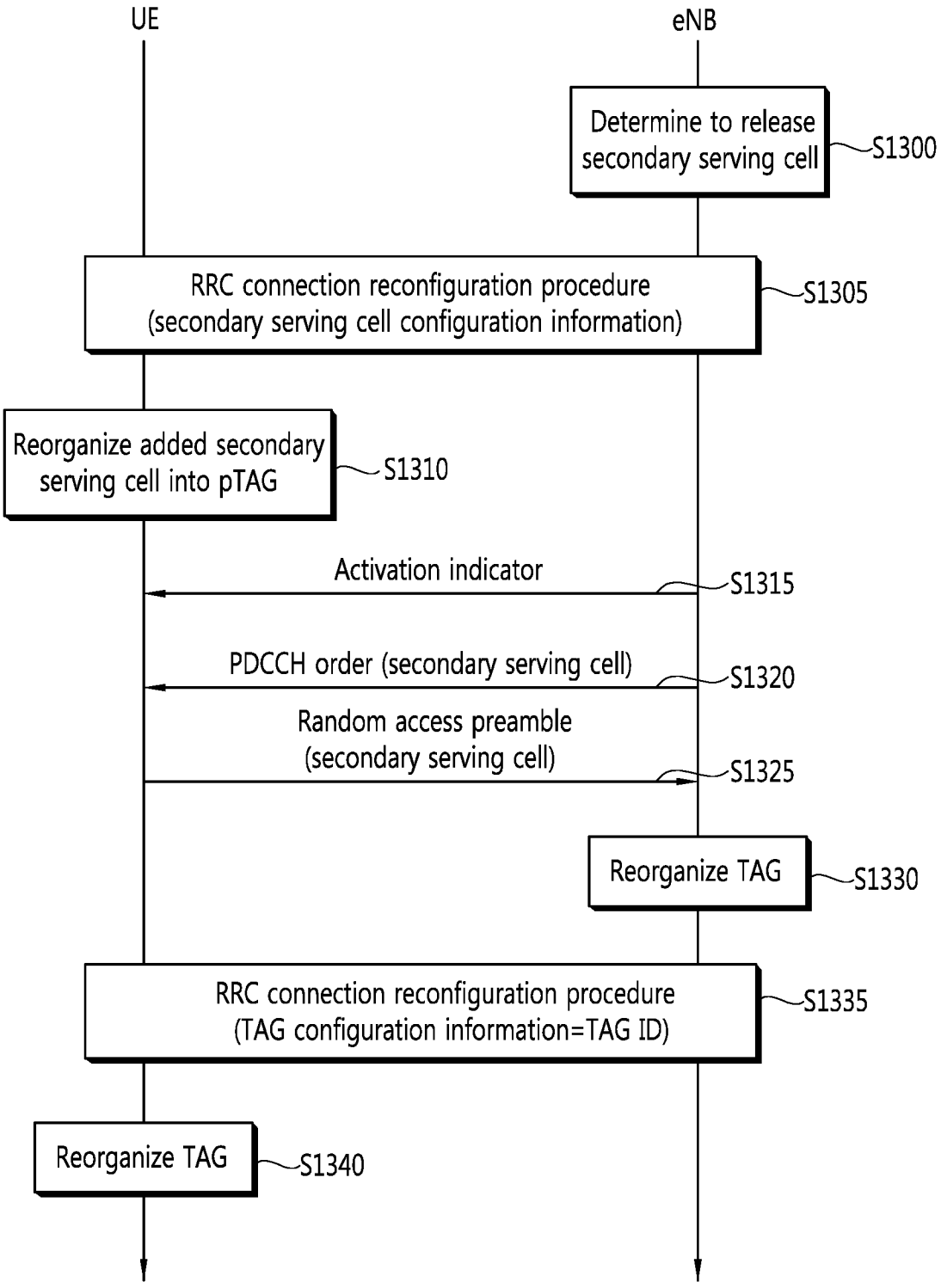

UE
eNB
Determine to release secondary serving cell
S1300
RRC connection reconfiguration procedure (secondary serving cell configuration information)
S1305
Reorganize added secondary serving cell into pTAG
S1310
Activation indicator
S1315
PDCCH order (secondary serving cell)
S1320
Random access preamble (secondary serving cell)
S1325
Reorganize TAG
S1330
RRC connection reconfiguration procedure (TAG configuration information=TAG ID)
S1335
Reorganize TAG
S1340

FIG. 11

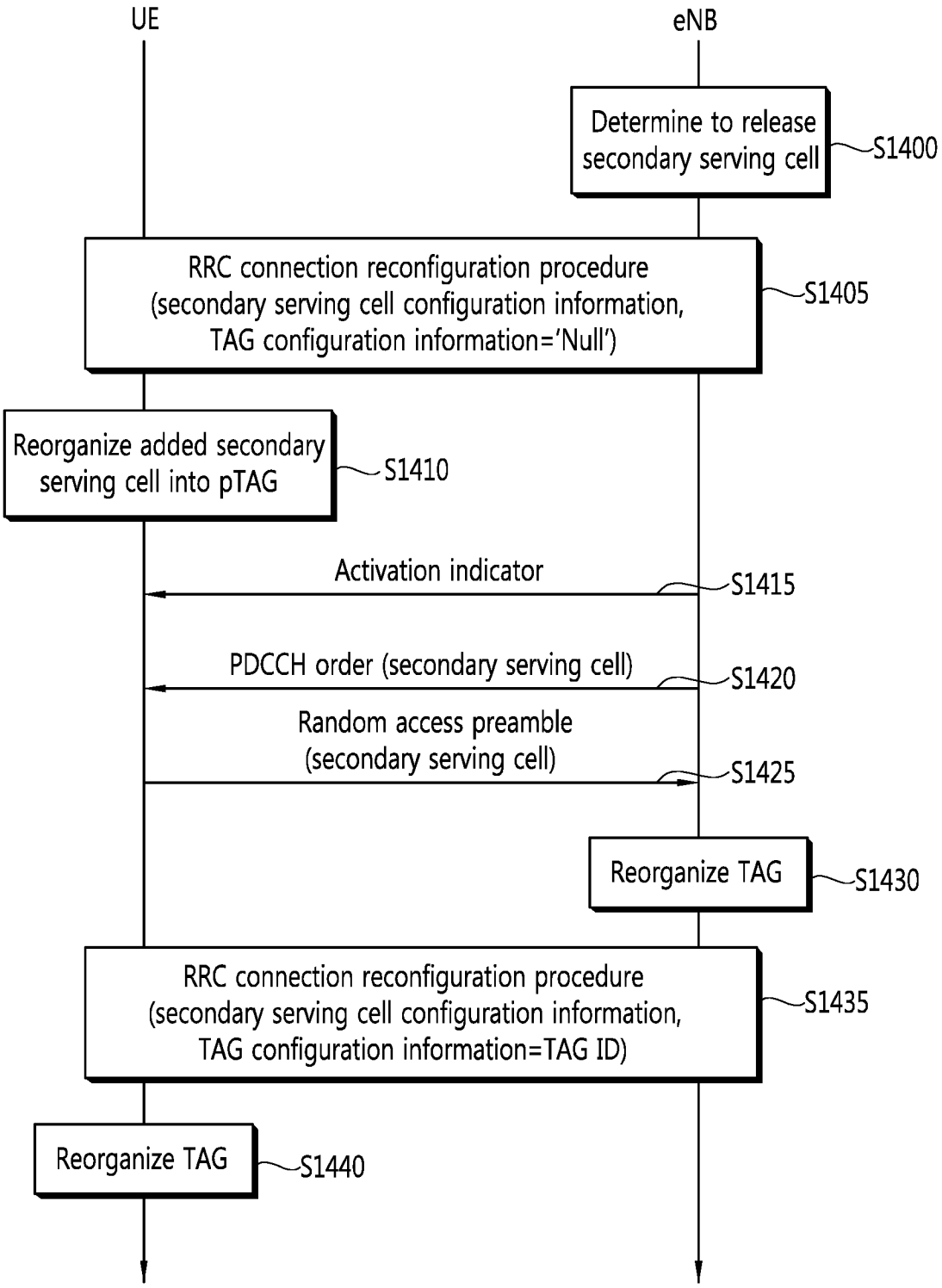

UE
eNB
Determine to release secondary serving cell
S1400
RRC connection reconfiguration procedure (secondary serving cell configuration information, TAG configuration information='Null')
S1405
Reorganize added secondary serving cell into pTAG
S1410
Activation indicator
S1415
PDCCH order (secondary serving cell)
S1420
Random access preamble (secondary serving cell)
S1425
Reorganize TAG
S1430
RRC connection reconfiguration procedure (secondary serving cell configuration information, TAG configuration information=TAG ID)
S1435
Reorganize TAG
S1440

FIG. 12

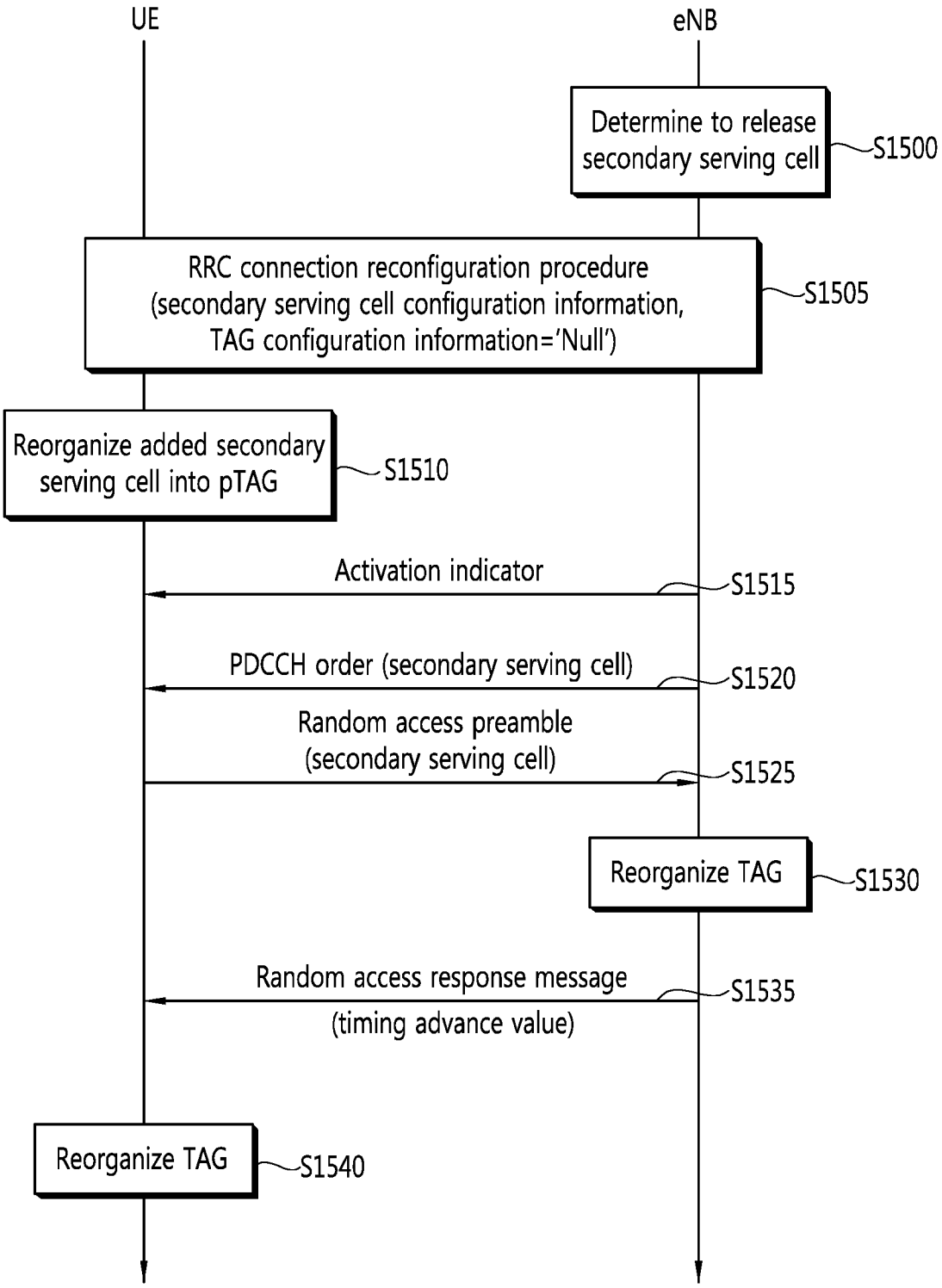

UE
eNB
Determine to release secondary serving cell
S1500
RRC connection reconfiguration procedure (secondary serving cell configuration information, TAG configuration information='Null')
S1505
Reorganize added secondary serving cell into pTAG
S1510
Activation indicator
S1515
PDCCH order (secondary serving cell)
S1520
Random access preamble (secondary serving cell)
S1525
Reorganize TAG
S1530
Random access response message (timing advance value)
S1535
Reorganize TAG
S1540

FIG. 13

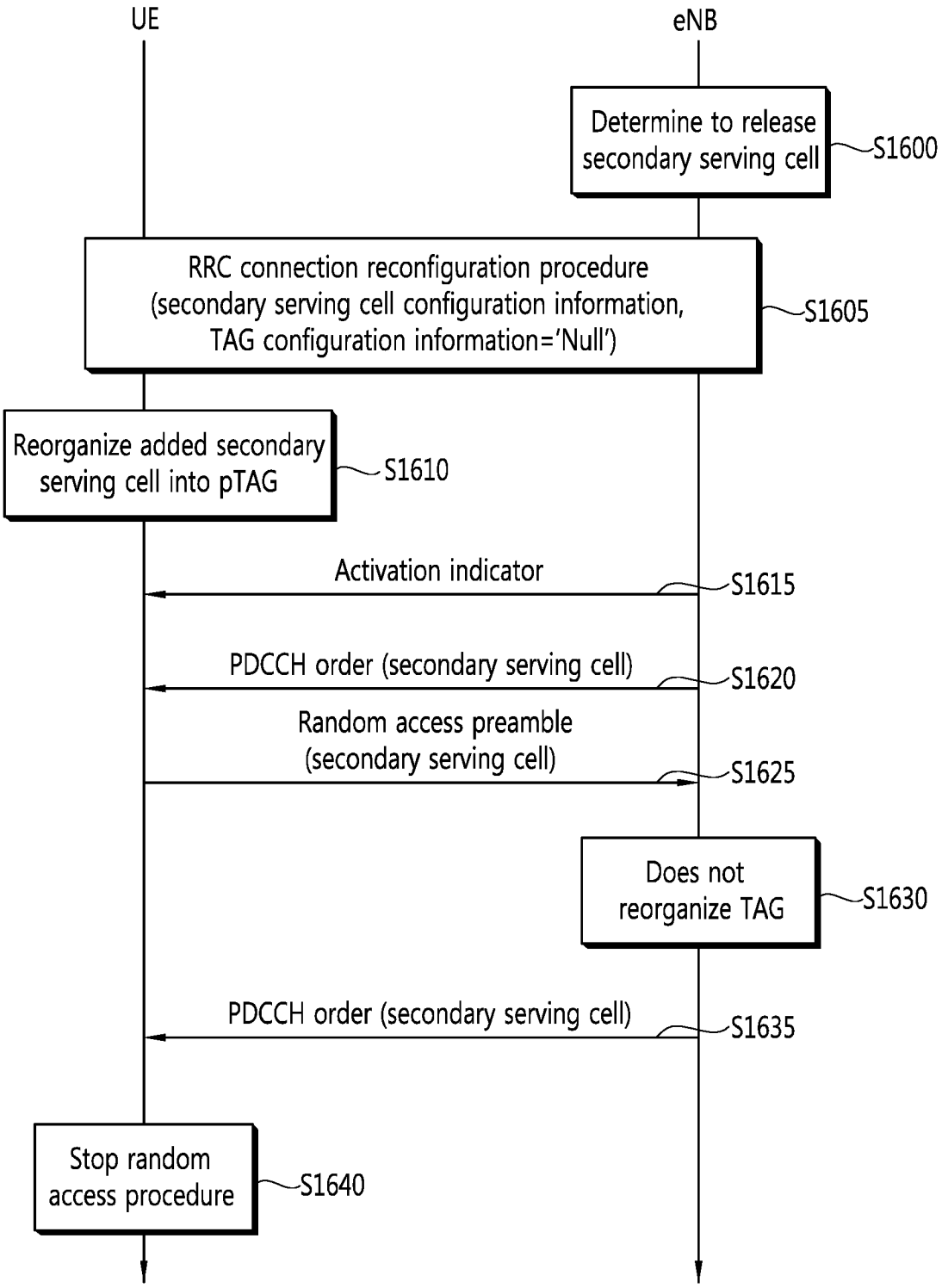

UE
eNB
Determine to release secondary serving cell
S1600
RRC connection reconfiguration procedure (secondary serving cell configuration information, TAG configuration information='Null')
S1605
Reorganize added secondary serving cell into pTAG
S1610
Activation indicator
S1615
PDCCH order (secondary serving cell)
S1620
Random access preamble (secondary serving cell)
S1625
Does not reorganize TAG
S1630
PDCCH order (secondary serving cell)
S1635
Stop random access procedure
S1640

FIG. 14

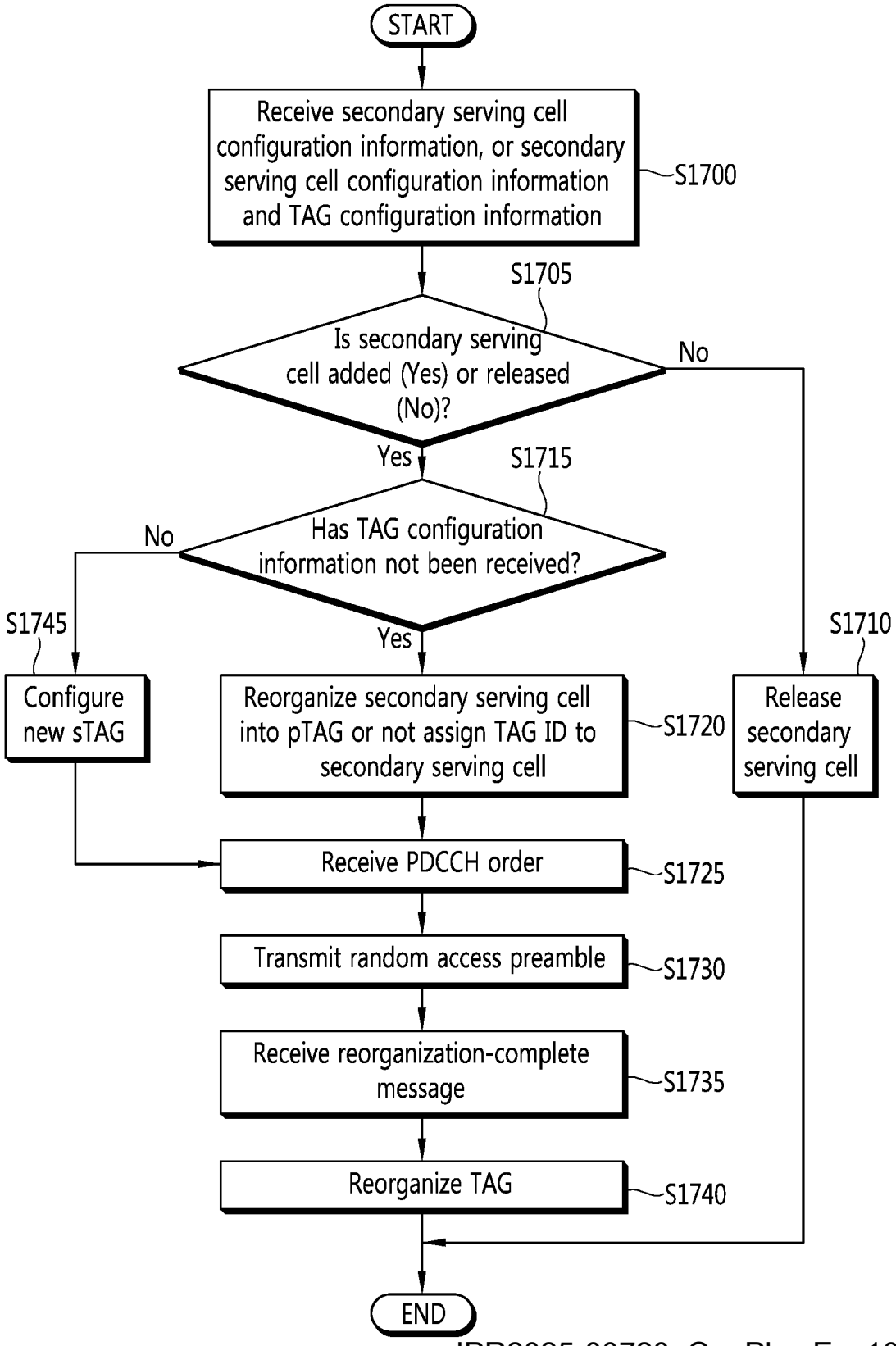

START
Receive secondary serving cell configuration information, or secondary serving cell configuration information and TAG configuration information
S1700
S1705
Is secondary serving cell added (Yes) or released (No)?
No
Yes
S1715
Has TAG configuration information not been received?
No
Yes
S1745
S1710
Configure new sTAG
Reorganize secondary serving cell into pTAG or not assign TAG ID to secondary serving cell
S1720
Release secondary serving cell
Receive PDCCH order
S1725
Transmit random access preamble
S1730
Receive reorganization-complete message
S1735
Reorganize TAG
S1740
END

FIG. 15

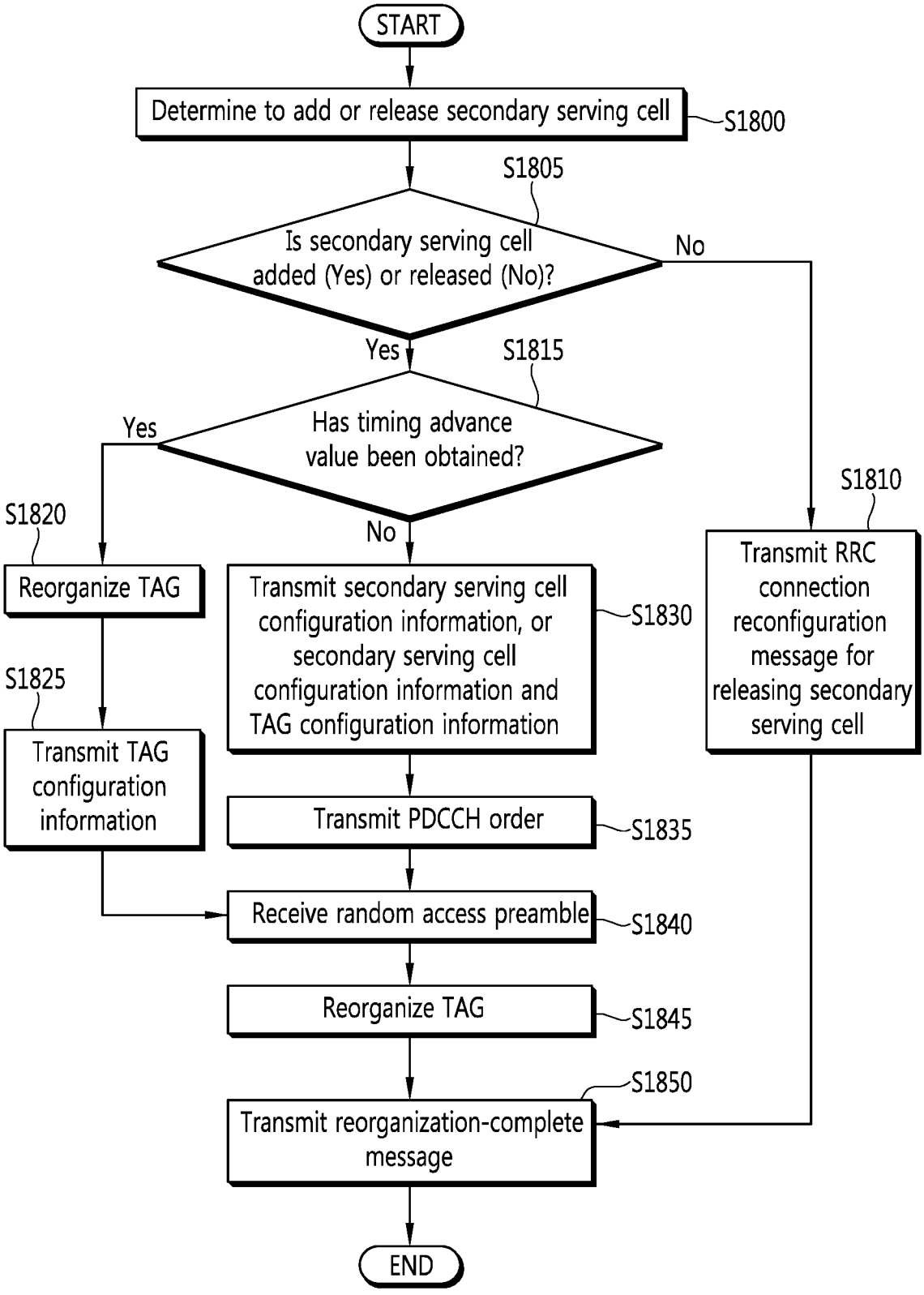
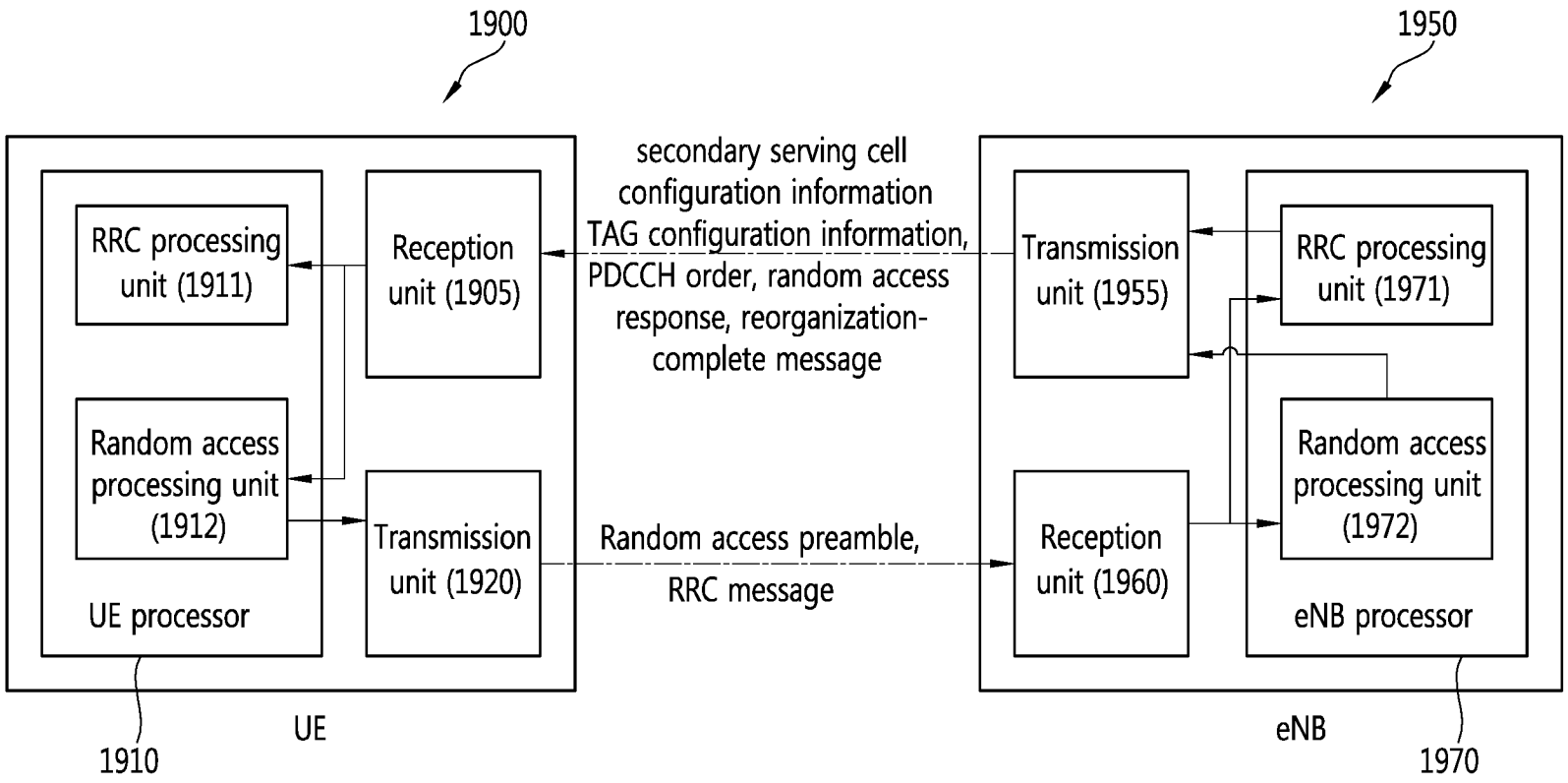

START
Determine to add or release secondary serving cell
S1800
S1805
Is secondary serving cell added (Yes) or released (No)?
No
Yes
S1815
Has timing advance value been obtained?
Yes
No
S1820
Reorganize TAG
S1825
Transmit TAG configuration information
Transmit secondary serving cell configuration information, or secondary serving cell configuration information and TAG configuration information
S1830
S1810
Transmit RRC connection reconfiguration message for releasing secondary serving cell
Transmit PDCCH order
S1835
Receive random access preamble
S1840
Reorganize TAG
S1845
S1850
Transmit reorganization-complete message
END

FIG. 16



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PTO/AIA/14 (11-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
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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.)

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City: Seoul	State/Province:
Postal Code:	Country: KR

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jae Hyun		AHN	

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

City	Seoul	Country of Residence	KR

Mailing Address of Inventor:

Address 1	179 Seongam-ro, Mapo-gu
Address 2	
City: Seoul	State/Province:
Postal Code:	Country: KR

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kang Suk		HUH	

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

PTO/AIA/14 (11-15)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

City	Seoul	Country of Residence i	KR

Mailing Address of Inventor:

Address 1	179 Seongam-ro, Mapo-gu		
Address 2			
City	Seoul	**State/Province**	
Postal Code		**Country** i	KR

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	58027		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM		
Attorney Docket Number	P5256USC1C1	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	16	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country i

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

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	58027		

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	14626047	2015-02-19
Prior Application Status	Patented		Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14626047	Continuation of	13849296	2013-03-22	8964645	2015-02-24

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

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)
10-2012-0030216	KR	2012-03-23	

Remove

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

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

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

PTO/AIA/14 (11-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

Applicant Information:

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

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	Pantech Inc.

Mailing Address Information For Applicant:

Address 1	179 Seongam-ro, Mapo-gu		
Address 2			
City	Seoul	**State/Province**	
Country KR		Postal Code	
Phone Number		Fax Number	
Email Address			

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

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.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Christopher B. Kilner/			Date (YYYY-MM-DD)	2016-10-31
First Name	Christopher	Last Name	Kilner	Registration Number	45381

Additional Signature may be generated within this form by selecting the Add button.

PTO/AIA/14 (11-15)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	P5256USC1C1
	Application Number	
Title of Invention	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM	

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.**

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/338,993	10/31/2016		1600	P5256USC1C1	12	3

CONFIRMATION NO. 3430

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

FILING RECEIPT

OC000000087091077

Date Mailed: 11/10/2016

Receipt is acknowledged of this non-provisional 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 APPLICANT, 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 Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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**

Inventor(s)

Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;
Jae Hyun Ahn, Seoul, KOREA, REPUBLIC OF;
Kang Suk Huh, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

Pantech Inc., Seoul, KOREA, REPUBLIC OF;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 14/626,047 02/19/2015
which is a CON of 13/849,296 03/22/2013 PAT 8964645

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2012-0030216 03/23/2012

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.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 11/08/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/338,993**

Projected Publication Date: 02/16/2017

Non-Publication Request: No

Early Publication Request: No

Title

APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

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.

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

GRANTED

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

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

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

NOT GRANTED

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

SelectUSA

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

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

IPR2025-00720, OnePlus Ex. 1002
Page 115 of 353

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/338,993

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	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	12 minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	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	1600

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($)	ADDITIONAL FEE($)		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.

대한민국특허청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

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출 원 번 호 : 10-2012-0030216
Application Number

출 원 년 월 일 : 2012년 03월 23일
Filing Date MAR. 23, 2012

출 원 인 : 주식회사 팬택
Applicant(s) PANTECH INC.

2016년 11월 30일

특 허 청
COMMISSIONER

제출 일자 : 2012-03-23

【서지사항】

【서류명】 특허출원서

【참조번호】 0155

【출원구분】 특허출원

【출원인】

【명칭】 주식회사 팬택

【특허고객번호】 1-1998-004053-1

【대리인】

【성명】 오재언

【대리인번호】 9-2009-000121-9

【포괄위임등록번호】 2011-090516-2

【발명의 국문명칭】 다중 요소 반송파 시스템에서 상향링크 동기화 장치 및 방법

【발명의 영문명칭】 APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

【발명자】

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【주민등록번호】 800831-1XXXXXX

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제출 일자 : 2012-03-23

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【취지】 위와 같이 특허청장에게 제출합니다.

대리인 오재언 (서명 또는 인)

【수수료】

【출원료】	0	면	38,000 원
【가산출원료】	93	면	0 원
【우선권주장료】	0	건	0 원
【심사청구료】	0	항	0 원

【합계】 38,000 원

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【발명의 설명】

【발명의 명칭】

다중 요소 반송파 시스템에서 상향링크 동기화 장치 및 방법{APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM}

【기술분야】

<1> 본 발명은 무선통신에 관한 것으로서, 보다 상세하게는 다중 요소 반송파 시스템에서 상향링크 동기화 장치 및 방법에 관한 것이다.

【배경기술】

<2> 일반적인 무선통신 시스템에서는 상향링크와 하향링크간의 대역폭은 서로 다르게 설정되더라도 주로 하나의 반송파(carrier)만을 고려하고 있다. 3GPP(3rd Generation Partnership Project) LTE(long term evolution)에서도 단일 반송파를 기반으로 하여, 상향링크와 하향링크를 구성하는 반송파의 수가 1개이고, 상향링크의 대역폭과 하향링크의 대역폭이 서로 대칭적이다. 이러한 단일 반송파 시스템에서 랜덤 액세스는 하나의 반송파를 이용하여 랜덤 액세스를 수행하였다. 그런데, 최근 다중 요소 반송파 시스템(multiple component carrier system)이 도입됨에 따라 랜덤 액세스는 여러 개의 요소 반송파(component carrier)를 통해 구현될 수 있게 되었다.

<3> 다중 요소 반송파 시스템은 반송파 집성(carrier aggregation)을 지원할 수 있는 무선통신 시스템을 의미한다. 반송파 집성이란 조각난 작은 대역을 효율적으

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로 사용하기 위한 기술로 주파수 영역에서 물리적으로 연속적인(continuous) 또는 비연속적인(non-continuous) 다수 개의 밴드를 묶어 논리적으로 큰 대역의 밴드를 사용하는 것과 같은 효과를 내도록 하기 위한 것이다.

<4> 단말이 망(network)에 접속하기 위해서는 랜덤 액세스(random access) 절차를 거친다. 랜덤 액세스 절차는 경합 기반 랜덤 액세스 절차(contention based random access procedure)와 비경합 기반 랜덤 액세스 절차(non-contention based random access procedure)으로 구분될 수 있다. 경합 기반 랜덤 액세스 절차와 비경합 기반 랜덤 액세스 절차의 가장 큰 차이점은 랜덤 액세스 프리앰블(Random access preamble)이 하나의 단말에게 전용(dedicated)으로 지정되는지 여부에 대한 것이다. 비경합 기반 랜덤 액세스 절차에서는 단말이 자신에게만 지정된 전용 랜덤 액세스 프리앰블을 사용하기 때문에 다른 단말과의 경합(또는 충돌)이 발생하지 않는다. 여기서 경합이란 기지국에 액세스하기 위해 설정된 시간/주파수/시퀀스 자원을 기지국이 각 단말에게 할당하지 않고 다수에 단말들에게 사용할 수 있도록 설정하여 2개 이상의 단말이 경쟁적으로 사용하는 것을 말한다. 경합기반 랜덤 액세스 절차에서는 단말이 임의로 선택한 시간/주파수 자원 및 랜덤 액세스 프리앰블을 사용하기 때문에 상기 단말 이외의 또 다른 단말과의 경합 가능성이 존재한다.

<5> 단말이 네트워크로 랜덤 액세스 과정을 수행하는 목적은 초기 접속(initial access), 핸드오버(handover), 무선자원 요청(Scheduling Request), 시간 정렬(timing alignment) 등이 있을 수 있다.

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【발명의 내용】

【해결하려는 과제】

<6> 본 발명의 기술적 과제는 다중 요소 반송파 시스템에서 상향링크 동기화 장치 및 방법을 제공함에 있다.

<7> 본 발명의 다른 기술적 과제는 RRC 연결 재구성 절차에 기반하여 시간정렬그룹을 재편성하는 장치 및 방법을 제공함에 있다.

<8> 본 발명의 또 다른 기술적 과제는 랜덤 액세스 절차에 기반하여 시간정렬그룹을 재편성하는 장치 및 방법을 제공함에 있다.

<9> 본 발명의 또 다른 기술적 과제는 시간정렬그룹을 재편성하는 TAG 구성정보와 부서빙셀 구성정보를 전송하는 장치 및 방법을 제공함에 있다.

【과제의 해결 수단】

<10> 본 발명의 일 양태에 따르면, 다중 요소 반송파 시스템에서 상향링크 동기를 획득하는 단말을 제공한다. 상기 단말은 부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용되는 랜덤 액세스 프리앰블의 전송을 제어하는 랜덤 액세스 처리부, 상기 랜덤 액세스 프리앰블을 기지국으로 전송하는 전송부, 상기 부서빙셀을 상기 단말에 추가적으로 구성함을 지시하는 부서빙셀 구성정보를 상기 기지국으로부터 수신하는 수신부, 및 동일한 시간정렬 값을 가지는 서빙셀들의 집합인 시간정렬그룹(TAG)에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성(re-organizing)하는 RRC(radio resource control) 처리부를 포함한다.

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<11> 본 발명의 다른 양태에 따르면, 다중 요소 반송파 시스템에서 단말에 의한 상향링크 동기를 획득하는 방법을 제공한다. 상기 방법은 부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용되는 랜덤 액세스 프리앰블을 기지국으로 전송하는 단계, 상기 부서빙셀을 상기 단말에 추가적으로 구성함을 지시하는 부서빙셀 구성정보를 상기 기지국으로부터 수신하는 단계, 상기 랜덤 액세스 프리앰블에 대한 응답으로서 상기 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지를 상기 기지국으로부터 수신하는 단계, 및 동일한 시간정렬 값을 가지는 서빙셀들의 집합인 시간정렬그룹(TAG)에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성하는 단계를 포함한다.

【발명의 효과】

<12> TAG 재편성을 위한 TAG 구성정보가 별도로 전송될 필요가 없으므로, 절차가 간소화되고 TAG 재편성이 보다 빠르게 진행될 수 있다. 또한, 기지국이 단말에게 명시적으로 TAG 재편성을 지시할 수도 있고, 단말이 묵시적으로 TAG 재편성을 수행할 수 있다.

【도면의 간단한 설명】

<13> 도 1은 본 발명이 적용되는 무선통신 시스템을 나타낸다.

도 2는 본 발명이 적용되는 다중 요소 반송파를 지원하기 위한 프로토콜 구조의 일 예를 나타낸다.

도 3은 본 발명이 적용되는 다중 요소 반송파 동작을 위한 프레임 구조의 일

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예를 나타낸다.

도 4는 본 발명이 적용되는 다중 요소 반송파 시스템에서 하향링크 요소 반송파와 상향링크 요소 반송파간의 연결설정(linkage)을 나타낸다.

도 5는 본 발명의 일 예에 따른 다중 시간 정렬 값을 획득하는 절차를 설명하는 흐름도이다.

도 6은 부서빙셀 구성정보와 TAG 구성정보가 한 번의 RRC 연결 재구성 절차에 의해 전송되는 과정을 도시한 것이다.

도 7은 본 발명의 일 예에 따른 랜덤 액세스 수행 방법을 설명하는 흐름도이다.

도 8은 본 발명의 일 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 9는 본 발명의 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 10은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 11은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 12는 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 13은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도

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이다.

도 14는 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 15는 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 16은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

도 17은 본 발명의 일 예에 따른 단말이 TAG를 재편성하는 방법을 설명하는 순서도이다.

도 18은 본 발명의 일 예에 따른 기지국이 TAG를 재편성하는 방법을 설명하는 순서도이다.

도 19는 본 발명의 일 예에 따른 상향링크 동기에 관한 신호를 전송하는 단말과 기지국을 도시한 블록도이다.

【발명을 실시하기 위한 구체적인 내용】

<14> 이하, 본 명세서에서는 일부 실시 예들을 예시적인 도면을 통해 상세하게 설명한다. 각 도면의 구성요소들에 참조부호를 부가함에 있어서, 동일한 구성요소들에 대해서는 비록 다른 도면상에 표시되더라도 가능한 한 동일한 부호를 가지도록 하고 있음에 유의해야 한다. 또한, 본 명세서의 실시 예를 설명함에 있어, 관련된 공지 구성 또는 기능에 대한 구체적인 설명이 본 명세서의 요지를 흐릴 수 있다고

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판단되는 경우에는 그 상세한 설명은 생략한다.

<15> 또한 본 명세서는 무선 통신 네트워크를 대상으로 설명하며, 무선 통신 네트워크에서 이루어지는 작업은 해당 무선 통신 네트워크를 관할하는 시스템(예를 들어 기지국)에서 네트워크를 제어하고 데이터를 송신하는 과정에서 이루어지거나, 해당 무선 네트워크에 결합한 단말에서 작업이 이루어질 수 있다.

<16> 도 1은 본 발명이 적용되는 무선통신 시스템을 나타낸다.

<17> 도 1을 참조하면, 무선통신 시스템(10)은 음성, 패킷 데이터 등과 같은 다양한 통신 서비스를 제공하기 위해 널리 배치된다. 무선통신 시스템(10)은 적어도 하나의 기지국(11; Base Station, BS)을 포함한다. 각 기지국(11)은 특정한 셀(cell)(15a, 15b, 15c)에 대해 통신 서비스를 제공한다. 셀은 다시 다수의 영역(섹터라고 함)으로 나누어질 수 있다.

<18> 단말(User Equipment: UE, 12)은 고정되거나 이동성을 가질 수 있으며, MS(Mobile Station), MT(mobile terminal), UT(user terminal), SS(subscriber station), 무선기기(wireless device), PDA(personal digital assistant), 무선 모뎀(wireless modem), 휴대기기(handheld device) 등 다른 용어로 불릴 수 있다. 기지국(11)은 eNB(evolved-NodeB), BTS(Base Transceiver System), 액세스 포인트(Access Point), 펨토(femto) 기지국, 가내 기지국(Home nodeB), 릴레이(relay) 등 다른 용어로 불릴 수 있다. 셀은 기지국(11)이 커버하는 일부 영역을 나타내는 포괄적인 의미로 해석되어야 하며, 메가셀, 매크로셀, 마이크로셀, 피코셀, 펨토셀 등 다양한 커버리지 영역을 모두 포괄하는 의미이다.

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<19> 이하에서 하향링크(downlink)는 기지국(11)에서 단말(12)로의 통신을 의미하며, 상향링크(uplink)는 단말(12)에서 기지국(11)으로의 통신을 의미한다. 하향링크에서 송신기는 기지국(11)의 일부분일 수 있고, 수신기는 단말(12)의 일부분일 수 있다. 상향링크에서 송신기는 단말(12)의 일부분일 수 있고, 수신기는 기지국(11)의 일부분일 수 있다. 무선통신 시스템에 적용되는 다중 접속 기법에는 제한이 없다. CDMA(Code Division Multiple Access), TDMA(Time Division Multiple Access), FDMA(Frequency Division Multiple Access), OFDMA(Orthogonal Frequency Division Multiple Access), SC-FDMA(Single Carrier-FDMA), OFDM-FDMA, OFDM-TDMA, OFDM-CDMA와 같은 다양한 다중 접속 기법을 사용할 수 있다. 상향링크 전송 및 하향링크 전송은 서로 다른 시간을 사용하여 전송되는 TDD(Time Division Duplex) 방식이 사용될 수 있고, 또는 서로 다른 주파수를 사용하여 전송되는 FDD(Frequency Division Duplex) 방식이 사용될 수 있다.

<20> 반송파 집성(carrier aggregation; CA)은 복수의 반송파를 지원하는 것으로서, 스펙트럼 집성 또는 대역폭 집성(bandwidth aggregation)이라고도 한다. 반송파 집성은 조각난 작은 대역을 효율적으로 사용하기 위한 기술로서, 주파수 영역에서 물리적으로 연속적(continuous) 또는 비연속적인(non-continuous) 다수 개의 밴드를 묶어 논리적으로 큰 대역의 밴드를 사용하는 것과 같은 효과를 낼 수 있다. 반송파 집성에 의해 묶이는 개별적인 단위 반송파를 요소 반송파(component carrier; CC)라고 한다. 각 요소 반송파는 대역폭과 중심 주파수로 정의된다. 반송파 집성은 증가되는 수율(throughput)을 지원하고, 광대역 RF(radio frequency) 소

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자의 도입으로 인한 비용 증가를 방지하고, 기존 시스템과의 호환성을 보장하기 위해 도입되는 것이다. 예를 들어, 20MHz 대역폭을 갖는 반송파 단위의 그래뉼래리티(granularity)로서 5개의 요소 반송파가 할당된다면, 최대 100Mhz의 대역폭을 지원할 수 있는 것이다.

<21> 반송파 집성은 주파수 영역에서 연속적인 요소 반송파들 사이에서 이루어지는 인접(contiguous) 반송파 집성과 불연속적인 요소 반송파들 사이에 이루어지는 비인접(non-contiguous) 반송파 집성으로 나눌 수 있다. 하향링크와 상향링크 간에 집성되는 반송파들의 수는 다르게 설정될 수 있다. 하향링크 요소 반송파 수와 상향링크 요소 반송파 수가 동일한 경우를 대칭적(symmetric) 집성이라고 하고, 그 수가 다른 경우를 비대칭적(asymmetric) 집성이라고 한다.

<22> 요소 반송파들의 크기(즉 대역폭)는 서로 다를 수 있다. 예를 들어, 70MHz 대역의 구성을 위해 5개의 요소 반송파들이 사용된다고 할 때, 5MHz 요소 반송파(carrier #0) + 20MHz 요소 반송파(carrier #1) + 20MHz 요소 반송파(carrier #2) + 20MHz 요소 반송파(carrier #3) + 5MHz 요소 반송파(carrier #4)과 같이 구성될 수도 있다.

<23> 이하에서, 다중 요소 반송파(multiple component carrier) 시스템이라 함은 반송파 집성을 지원하는 단말과 기지국을 포함하는 시스템을 말한다. 다중 요소 반송파 시스템에서 인접 반송파 집성 및/또는 비인접 반송파 집성이 사용될 수 있으며, 또한 대칭적 집성 또는 비대칭적 집성 어느 것이나 사용될 수 있다.

<24> 도 2는 본 발명이 적용되는 다중 요소 반송파를 지원하기 위한 프로토콜 구

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조의 일 예를 나타낸다.

<25> 도 2를 참조하면, 공용 매체접근제어(Medium Access Control: MAC) 개체(210)는 복수의 반송파를 이용하는 물리(physical) 계층(220)을 관리한다. 특정 반송파로 전송되는 MAC 관리 메시지는 다른 반송파에게 적용될 수 있다. 즉, 상기 MAC 관리 메시지는 상기 특정 반송파를 포함하여 다른 반송파들을 제어할 수 있는 메시지이다. 물리계층(220)은 TDD(Time Division Duplex) 및/또는 FDD(Frequency Division Duplex)로 동작할 수 있다.

<26> 물리계층(220)에서 사용되는 몇몇 물리채널들이 있다.

<27> 먼저, 하향링크 물리채널로서, PDCCH(physical downlink control channel)는 단말에게 PCH(paging channel)와 DL-SCH(downlink shared channel)의 자원 할당 및 DL-SCH와 관련된 HARQ(hybrid automatic repeat request) 정보를 알려준다. PDCCH는 단말에게 상향링크 전송의 자원 할당을 알려주는 상향링크 그랜트(uplink grant)를 나를 수 있다. PDSCH(physical downlink shared channel)에는 DL-SCH가 맵핑된다. PCFICH(physical control format indicator channel)는 단말에게 PDCCH들에 사용되는 OFDM 심벌의 수를 알려주고, 매 서브프레임마다 전송된다. PHICH(physical Hybrid ARQ Indicator Channel)는 하향링크 채널로서, 상향링크 전송의 응답인 HARQ ACK/NACK 신호를 나른다.

<28> 다음으로 상향링크 물리채널로서, PUCCH(Physical uplink control channel)은 하향링크 전송에 대한 HARQ ACK/NACK 신호, 스케줄링 요청 및 CQI와 같은 상향링크 제어 정보를 나른다. PUSCH(Physical uplink shared channel)은 UL-

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SCH(uplink shared channel)을 나른다. PRACH(physical random access channel)는 랜덤 액세스 프리앰블을 나른다.

<29> 도 3은 본 발명이 적용되는 다중 요소 반송파 동작을 위한 프레임 구조의 일 예를 나타낸다.

<30> 도 3을 참조하면, 하나의 프레임(frame)은 10개 서브프레임(subframe)으로 구성된다. 서브프레임은 시간축으로는 복수의 OFDM 심벌과, 주파수 축으로는 적어도 하나의 요소 반송파로 구성될 수 있다. 각 요소 반송파(carrier)는 자신의 제어 채널(예를 들어 PDCCH)를 가질 수 있다. 다중 요소 반송파들은 서로 인접할 수도 있고, 인접하지 않을 수도 있다. 단말은 자신의 역량에 따라 하나 또는 그 이상의 요소 반송파를 지원할 수 있다.

<31> 요소 반송파는 주요소 반송파(Primary Component Carrier; PCC)와 부요소 반송파(Secondary Component Carrier; SCC)로 나뉠 수 있다. 단말은 하나의 주요소 반송파만을 사용하거나, 주요소 반송파와 더불어 하나 또는 그 이상의 부요소 반송파를 사용할 수 있다. 단말은 주요소 반송파 및/또는 부요소 반송파를 기지국으로부터 할당받을 수 있다. 본 발명의 일 양태에 따르면, 다중 요소 반송파 시스템에서 상향링크 동기를 획득하는 단말을 제공한다. 상기 단말은 부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용되는 랜덤 액세스 프리앰블의 전송을 제어하는 랜덤 액세스 처리부, 상기 랜덤 액세스 프리앰블을 기지국으로 전송하는 전송부, 상기 부서빙셀을 상기 단말에 추가적으로 구성함을 지시하는 부서빙셀 구성정보를 상기 기지국으로부터 수신하는 수신부, 및 동일한 시간정렬 값을 가지

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는 서빙셀들의 집합인 시간정렬그룹(TAG)에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성(re-organizing)하는 RRC(radio resource control) 처리부를 포함한다.

<32> 본 발명의 다른 양태에 따르면, 다중 요소 반송파 시스템에서 단말에 의한 상향링크 동기를 획득하는 방법을 제공한다. 상기 방법은 부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용되는 랜덤 액세스 프리앰블을 기지국으로 전송하는 단계, 상기 부서빙셀을 상기 단말에 추가적으로 구성함을 지시하는 부서빙셀 구성정보를 상기 기지국으로부터 수신하는 단계, 상기 랜덤 액세스 프리앰블에 대한 응답으로서 상기 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지를 상기 기지국으로부터 수신하는 단계, 및 동일한 시간정렬 값을 가지는 서빙셀들의 집합인 시간정렬그룹(TAG)에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성하는 단계를 포함한다.

<33> 도 4는 본 발명이 적용되는 다중 요소 반송파 시스템에서 하향링크 요소 반송파와 상향링크 요소 반송파간의 연결설정(linkage)을 나타낸다.

<34> 도 4를 참조하면, 하향링크에서, 하향링크 요소 반송파 D1, D2, D3이 집성되어(aggregated) 있고, 상향링크에서 상향링크 요소 반송파 U1, U2, U3이 집성되어 있다. 여기서 Di는 하향링크 요소 반송파의 인덱스이고, Ui는 상향링크 요소 반송파의 인덱스이다(i=1, 2, 3). 적어도 하나의 하향링크 요소 반송파는 주요소 반송파이고, 나머지는 부요소 반송파이다. 마찬가지로, 적어도 하나의 상향링크 요소 반송파는 주요소 반송파이고, 나머지는 부요소 반송파이다. 예를 들어, D1, U1이 주요소 반송파이고, D2, U2, D3, U3은 부요소 반송파이다. 여기서 주요소 반송파의

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인덱스는 0으로 설정될 수 있으며 그 이외의 자연수 중 하나가 부요소 반송파의 인덱스일 수 있다. 또한 상기 하향링크/상향링크 요소 반송파의 인덱스는 해당 하향링크/상향링크 요소 반송파가 포함된 요소 반송파 (또는 서빙셀)의 인덱스와 동일하게 설정될 수 있다. 또 다른 예로써 상기 요소 반송파 인덱스 또는 부요소 반송파 인덱스만이 설정되고 해당 요소 반송파에 포함된 상향링크/상향링크 요소 반송파 인덱스는 존재하지 않을 수 있다.

<35> FDD 시스템에서 하향링크 요소 반송파와 상향링크 요소 반송파는 1:1로 연결설정된다. 예를 들어 D1은 U1과, D2는 U2와, D3은 U3과 각각 1:1로 연결설정된다. 단말은 논리채널 BCCH가 전송하는 시스템정보 또는 DCCH가 전송하는 단말전용 RRC 메시지를 통해, 상기 하향링크 요소 반송파들과 상향링크 요소 반송파들간의 연결을 설정한다. 이러한 연결을 SIB1(system information block 1) 연결 또는 SIB2(system information block 2) 연결이라고 한다. 각 연결설정은 셀 특정하게(cell specific) 설정할 수도 있으며, 단말 특정하게(UE specific) 설정할 수도 있다. 일 예로, 주요소 반송파는 셀 특정하게 설정되며 부요소 반송파는 단말 특정하게 설정될 수 있다.

<36> 도 4는 하향링크 요소 반송파와 상향링크 요소 반송파간의 1:1 연결설정만을 예시로 들었으나, 1:n 또는 n:1의 연결설정도 성립할 수 있음은 물론이다. 또한, 요소 반송파의 인덱스는 요소 반송파의 순서 또는 해당 요소 반송파의 주파수 대역의 위치에 일치하는 것은 아니다.

<37> 주서빙셀(primary serving cell)은 RRC 설정(establishment) 또는 재설정

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(re-establishment) 상태에서, 보안입력(security input)과 NAS 이동 정보(mobility information)을 제공하는 하나의 서빙셀을 의미한다. 단말의 성능(capabilities)에 따라, 적어도 하나의 셀이 주서빙셀과 함께 서빙셀의 집합을 형성하도록 구성될 수 있는데, 상기 적어도 하나의 셀을 부서빙셀(secondary serving cell)이라 한다.

<38> 따라서, 하나의 단말에 대해 설정된 서빙셀의 집합은 하나의 주서빙셀만으로 구성되거나, 또는 하나의 주서빙셀과 적어도 하나의 부서빙셀로 구성될 수 있다.

<39> 주서빙셀에 대응하는 하향링크 요소 반송파를 하향링크 주요소 반송파(DL PCC)라 하고, 주서빙셀에 대응하는 상향링크 요소 반송파를 상향링크 주요소 반송파(UL PCC)라 한다. 또한, 하향링크에서, 부서빙셀에 대응하는 요소 반송파를 하향링크 부요소 반송파(DL SCC)라 하고, 상향링크에서, 부서빙셀에 대응하는 요소 반송파를 상향링크 부요소 반송파(UL SCC)라 한다. 하나의 서빙셀에는 하향링크 요소 반송파만이 대응할 수도 있고, DL CC와 UL CC가 함께 대응할 수도 있다.

<40> 따라서, 반송파 시스템에서 단말과 기지국간의 통신이 DL CC 또는 UL CC를 통해 이루어지는 것은 단말과 기지국간의 통신이 서빙셀을 통해 이루어지는 것과 동등한 개념이다. 예를 들어, 본 발명에 따른 랜덤 액세스 수행방법에서, 단말이 UL CC상에서 프리앰블을 전송하는 것은, 주서빙셀 또는 부서빙셀상에서 프리앰블을 전송하는 것과 동등한 개념으로 볼 수 있다. 또한, 단말이 DL CC상에서 하향링크 정보를 수신하는 것은, 주서빙셀 또는 부서빙셀상에서 하향링크 정보를 수신하는 것과 동등한 개념으로 볼 수 있다.

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<41> 한편, 주서빙셀과 부서빙셀은 다음과 같은 특징을 가진다.

<42> 첫째, 주서빙셀은 PUCCH의 전송을 위해 사용된다. 반면, 부서빙셀은 PUCCH를 전송할 수 없으나 PUCCH 내의 정보 중 일부 제어정보를 PUSCH를 통하여 전송할 수 있다.

<43> 둘째, 주서빙셀은 항상 활성화되어(activated) 있는 반면, 부서빙셀은 특정 조건에 따라 활성화/비활성화되는 반송파이다. 상기 특정 조건은 기지국의 활성화/비활성화 지시자를 수신하였거나 단말내의 비활성화 타이머가 만료되는 경우가 될 수 있다. 활성화는 트래픽 데이터의 송신 또는 수신이 행해지거나 준비 상태(ready state)에 있는 것을 말한다. 비활성화(deactivation)는 트래픽 데이터 및 상기 트래픽 데이터에 대한 제어정보의 송신 또는 수신이 불가능하고 하향링크 채널상태정보를 생성하기 위한 측정 및 보고도 불가능하지만, 최소한의 측정이나 최소 정보의 송신/수신이 가능한 것을 말한다. 예를 들어, 경로감쇄 계산 등을 위한 참조신호수신전력(reference signal received power) 등의 측정 및 해당 서빙셀의 하향링크를 통해 제어정보가 전송되는 영역을 지시하는 물리제어포멧지시채널(PCFICH:physical control format indicator channel)등을 수신할 수 있다.

<44> 넷째, 주서빙셀은 보안키(security key) 변경이나 RACH 절차와 동반하는 핸드오버 절차에 의해서 변경될 수 있다. 단, 경합 해결(contention resolution: CR) 메시지의 경우, 경합 해결 메시지를 지시하는 PDCCH만 주서빙셀를 통하여 전송되어야 하고 경합 해결 메시지는 주서빙셀 또는 부서빙셀을 통하여 전송될 수 있다.

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<45> 다섯째, NAS(non-access stratum) 정보는 주서빙셀을 통해서 수신한다.

<46> 여섯째, 언제나 주서빙셀는 DL PCC와 UL PCC가 짝(pair)으로 구성된다.

<47> 일곱째, 각 단말마다 다른 CC를 주서빙셀로 설정할 수 있다.

<48> 여덟째, 부서빙셀의 재설정(reconfiguration), 추가(adding) 및 제거(removal)와 같은 절차는 무선 리소스 제어(RRC) 계층에 의해 수행될 수 있다. 신규 부서빙셀의 추가에 있어서, 전용(dedicated) 부서빙셀의 시스템 정보를 전송하는데 RRC 시그널링이 사용될 수 있다. 일 예로 상기 RRC 시그널링으로 RRC 연결 재구성 절차가 사용될 수 있다.

<49> 아홉째, 주서빙셀은 제어정보를 전송하는 영역 내에서 특정 단말에 한하여 제어정보를 전송하기 위해 설정된 단말-특정 검색 공간(UE-specific search space)에 할당되는 PDCCH(예를 들어, 하향링크 할당정보 또는 상향링크 그랜트 정보) 및 셀 내 모든 단말들 또는 특정조건에 부합하는 다수의 단말들에게 제어정보를 전송하기 위해 설정된 공용 검색 공간(common search space)에 할당되는 PDCCH(예를 들어, 시스템 정보(SI), 랜덤 액세스 응답(RAR), 전송전력제어(transmit power control: TPC))를 모두 제공할 수 있다. 반면, 부서빙셀은 단말-특정 검색 공간만 설정될 수 있다. 즉, 단말은 부서빙셀을 통해서 공용 검색 공간을 확인할 수 없으므로 공용 검색 공간을 통해서만 전송되는 제어정보들 및 상기 제어정보들이 지시하는 데이터 정보들을 수신할 수 없다.

<50> 부서빙셀들 중에서 공용 검색 공간(CSS)이 정의될 수 있는 부서빙셀을 정의

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할 수 있으며 상기 부서빙셀은 특수 부서빙셀(special SCell)이라고 지칭한다. 상기 특수 부서빙셀은 교차 요소 반송파 스케줄링 (cross carrier scheduling) 시 언제나 스케줄링 셀로 설정된다. 또한 PCell에 설정되는 PUCCH가 상기 특수 부서빙셀에 대하여 정의될 수 있다.

<51> 상기 특수 부서빙셀에 대한 PUCCH는 특수 부서빙셀 구성 시 고정적으로 설정될 수도 있고, 또는 기지국이 해당 부서빙셀에 대한 재구성 시 RRC 시그널링(RRC 재구성 메시지)에 의해 할당(구성) 또는 해제될 수도 있다.

<52> 상기 특수 부서빙셀에 대한 PUCCH는, 해당 sTAG내에 존재하는 부서빙셀들의 ACK/NACK 정보 또는 CQI(channel quality information)를 포함하며, 상기 언급한 바와 같이, 기지국에 의해 RRC 시그널링을 통해 구성될 수 있다.

<53> 또한, 기지국은 sTAG내에 다수의 부서빙셀들 중 하나의 특수 부서빙셀을 구성하거나, 또는 특수 부서빙셀을 구성하지 않을 수도 있다. 상기 특수 부서빙셀을 구성하지 않는 이유는 CSS 및 PUCCH가 설정될 필요가 없다고 판단되기 때문이다. 일 예로, 경합 기반 랜덤 액세스 절차가 어떤 부서빙셀에서도 진행될 필요가 없다고 판단하거나, 또는 현재 주서빙셀의 PUCCH의 용량이 충분하다고 판단하여 추가적인 부서빙셀에 대한 PUCCH를 설정할 필요가 없는 경우가 이에 해당한다.

<54> 주서빙셀과 부서빙셀의 특징에 관한 본 발명의 기술적 사상은 반드시 상기의 설명에 한정되는 것은 아니며, 이는 예시일 뿐이고 더 많은 예를 포함할 수 있다.

<55> 무선 통신 환경에서는 송신기에서 전파가 전파되어 수신기에서 전달되는 동

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안에 전파지연(propagation delay)을 겪게 된다. 따라서 송수신기 모두 정확히 송신기에서 전파가 전파되는 시간을 알고 있다 하더라도 수신기에 신호가 도착하는 시간은 송수신기간 거리, 주변 전파 환경 등에 의해 영향을 받게 되고 수신기가 이동하는 경우 시간에 따라 변하게 된다. 만일 수신기가 송신기가 전달하는 신호가 수신되는 시점을 정확히 알 수 없는 경우 신호 수신이 실패하거나 수신하더라도 왜곡된 신호를 수신하게 되어 통신이 불가능하게 된다.

<56> 따라서, 무선 통신 시스템에서는 하향링크/상향링크를 막론하고, 정보 신호를 수신하기 위해 기지국과 단말간 동기(synchronization)가 반드시 선결되어야 한다. 동기의 종류는 프레임 동기(frame synchronization), 정보심벌 동기(information symbol synchronization), 샘플링 주기 동기(sampling period synchronization) 등 다양하다. 샘플링 주기 동기는 물리적 신호를 구분하기 위해 가장 기본적으로 획득하여야 하는 동기이다.

<57> 하향링크 동기 획득은 기지국의 신호를 기반으로 단말에서 수행된다. 기지국은 단말에서 하향링크 동기 획득이 용이하도록 상호 약속된 특정 신호를 송신한다. 단말은 기지국에서 보내온 특정 신호가 송신된 시간을 정확히 분별할 수 있어야 한다. 하향링크의 경우 하나의 기지국이 다수의 단말들에게 동시에 동일한 동기신호를 송신하므로 단말들은 각각 독립적으로 동기를 획득할 수 있다. 여기서 상호 약속된 특정 신호로서 주동기신호 (PSS: primary synchronization signal), 부동기신호 (SSS: secondary synchronization signal), 셀 참조 신호(CRS: cell reference signal) 등이 있다.

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<58> 또한, 단말이 다수의 서빙셀들을 구성하고 있는 경우, 단말은 각각의 서빙셀마다 독립적으로 하향링크 동기를 획득할 수도 있다. 만일 상기 서빙셀들 중에서 상기 하향링크 동기 획득이 용이하도록 상호 약속된 특정 신호를 송신하지 않는 서빙셀(ECell: Extended serving cell)이 존재하는 경우, 상기 서빙셀에 대한 하향링크 동기를 참조하기 위한 참조 서빙셀을 설정할 수 있다. 상기 참조 서빙셀의 설정은 RRC 시그널링으로 가변적으로 설정될 수도 있으며 주서빙셀로 고정적으로 설정될 수도 있으며 추후 기술될 타이밍 참조 셀이 될 수도 있다. 상기 ECell은 추후 기술될 타이밍 참조 셀이 될 수 없다.

<59> 상향링크의 경우 기지국은 다수의 단말들로부터 송신된 신호를 수신한다. 각 단말과 기지국간 거리가 상이한 경우 각 기지국이 수신하는 신호들은 서로 다른 송신지연 시간을 갖게 되고, 각각 획득한 하향링크 동기를 기준으로 상향링크 정보를 송신하는 경우, 각 단말의 정보가 서로 다른 시간에 해당 기지국에서 수신되게 된다. 이러한 경우, 기지국은 어느 하나의 단말을 기준으로 동기를 획득할 수가 없다. 따라서 상향링크 동기 획득은 하향링크와는 다른 절차가 필요하다.

<60> 랜덤 액세스 절차(random access procedure)가 상향링크 동기 획득을 위해 수행된다. 랜덤 액세스 절차 중에 단말은 기지국으로부터 전송되는 시간 정렬값(timing alignment value)에 기반하여 상향링크 동기를 획득한다. 상향링크 시간을 앞당기는 값을 가지는 점에서, 시간 정렬 값은 시간 전진 값(timing advanced value)이라 불릴 수도 있다. 랜덤 액세스 프리앰블은 부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용된다.

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<61> 상향링크 동기가 획득되면, 단말은 시간 정렬 타이머(time alignment timer)를 시작한다. 시간 정렬 타이머가 작동 중이면 단말은 단말과 기지국간에 서로 상향링크 동기가 이루어진 상태에 있다고 판단한다. 시간 정렬 타이머가 만료되거나 작동되지 않으면, 단말은 단말과 기지국간 상향링크 동기가 이루어져 있지 않은 것으로 보고, 단말은 랜덤 액세스 프리앰블의 전송 이외의 상향링크 전송은 수행하지 않는다.

<62> 한편, 다중 요소 반송파 시스템에서는 하나의 단말이 복수의 요소 반송파 또는 복수의 서빙셀들을 통해 기지국과 통신을 수행한다. 단말에서 복수의 서빙셀들을 통해 기지국으로 전송되는 신호들이 모두 동일한 시간지연을 가지면, 단말은 하나의 시간 정렬 값으로 모든 서빙셀들에 대한 상향링크 동기 획득이 가능하다. 반면 복수의 서빙셀들을 통해 기지국으로 전송되는 신호들이 서로 다른 시간지연을 가지면, 각 서빙셀마다 다른 시간 정렬 값이 요구된다. 즉, 다중 시간 정렬 값들(multiple timing alignment values)이 요구된다. 만약 다중 시간 정렬 값들을 획득하기 위해 단말이 각 서빙셀에 대해 일일이 랜덤 액세스 절차를 수행한다면, 상향링크 동기 획득을 위해 요구되는 랜덤 액세스 절차 수가 증가하므로 한정된 상향링크 및 하향링크 자원에 오버헤드가 발생하고, 상향링크 동기 유지를 위한 동기 추적 절차의 복잡도가 증가할 수 있다. 이러한 오버헤드와 복잡도를 줄이기 위해 시간 정렬 그룹(timing alignment group: TAG)이 정의된다. 시간 정렬 그룹은 시간 전진 그룹(timing advance group)이라고 불릴 수도 있다.

<63> TAG는 UL CC가 구성된 서빙셀들 중에서, 동일한 시간 정렬 값과 동일한 타이

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밍 참조(timing reference) 또는 상기 타이밍 참조를 포함하는 타이밍 참조 셀을 사용하는 서빙셀(들)을 포함하는 그룹이다. 예를 들어, 제1 서빙셀과 제2 서빙셀이 TAG1에 속하고 제2 서빙셀이 타이밍 참조 셀인 경우, 제1 서빙셀과 제2 서빙셀에는 동일한 시간 정렬 값 TA1이 적용되며 제1 서빙셀은 상기 TA1 값을 제2 서빙셀의 DL CC의 하향링크 동기시점을 기준으로 적용한다. 반면 제1 서빙셀과 제2 서빙셀이 각각 TAG1, TAG2에 속하면, 제1 서빙셀과 제2 서빙셀은 각각 해당 TAG내 타이밍 참조 셀이 되며 제1 서빙셀과 제2 서빙셀에는 다른 시간 정렬 값 TA1과 TA2가 각각 적용된다. TAG는 주서빙셀을 포함할 수 있고, 적어도 하나의 부서빙셀을 포함할 수도 있으며, 주서빙셀과 적어도 하나의 부서빙셀을 포함할 수도 있다.

<64> 각 TAG는 UL CC가 구성된 서빙셀을 적어도 하나 포함하며, 각 TAG에 맵핑되는 서빙셀에 대한 정보를 TAG 구성정보라 한다. TAG는 해당 서빙셀을 구성한 서빙 기지국에 의해 최초 그룹설정 및 그룹 재편성이 결정되면 RRC 시그널링을 통해 단말에게 전송된다.

<65> 주서빙셀은 TAG를 변경하지 않는다. 또한 단말은 다중 시간 정렬 값이 필요한 경우 적어도 2개의 TAG을 지원할 수 있어야 한다. 일 예로, 주서빙셀이 포함된 pTAG(primary TAG)와 주서빙셀이 포함되지 않은 sTAG(secondary TAG)로 구분된 TAG를 지원할 수 있어야 한다. 여기서 pTAG는 언제나 단 하나만 존재하고 sTAG는 다중 시간 정렬 값이 필요한 경우라면 적어도 하나 이상 존재할 수 있다. 최대 TAG 개수는 2개 또는 4개로 설정될 수 있다. 또한 pTAG는 언제나 TAG ID = 0의 값을 갖거나, 아무런 값을 갖지 않을 수 있다.

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<66> 서빙 기지국과 단말은 각 TAG들에 대한 시간 정렬(TA) 값 획득 및 유지를 위해 다음과 같은 동작을 수행할 수 있다.

<67> 1. 서빙 기지국과 단말은 주서빙셀을 통해 pTAG의 시간정렬 값 획득 및 유지를 수행한다. 또한 pTAG의 TA값 계산 및 적용을 위한 다운링크 동기의 기준이 되는 타이밍 참조는 언제나 주서빙셀내의 DL CC가 된다.

<68> 2. sTAG에 대한 초기 상향링크 시간정렬 값을 얻기 위해서는 기지국에 의해 초기화되는 비경쟁 기반 RA 절차가 사용된다. 따라서 기지국은 물리계층 제어정보 채널인 PDCCH를 통해 랜덤 액세스 절차의 시작을 지시하는 정보를 전송한다. 상기 지시 정보를 PDCCH 지시(order)라 정의한다. 상기 PDCCH 지시는 해당 단말의 sTAG 내 부서빙셀에서 사용할 수 있는 랜덤 액세스 프리앰블 인덱스 정보와 해당 부서빙셀에서 가용한 시간/주파수 자원 중에서 전체 또는 일부에 대하여 랜덤 액세스 프리앰블 전송을 허용하는 PRACH 마스크 인덱스 정보를 포함한다. 여기서 비경쟁 기반 랜덤 액세스 절차를 지시하기 위해 PDCCH 지시내의 포함된 랜덤 액세스 프리앰블 정보는 '000000' 이외의 정보로 지시되어야 한다.

<69> 3. sTAG에 대한 타이밍 참조는 가장 최근에 진행된 랜덤 액세스 절차에서 랜덤 액세스 프리앰블을 전송한 부서빙셀의 UL CC와 SIB2로 연결설정된(linked) DL CC이다. 여기서 SIB2는 브로드캐스팅 채널을 통해 전송된 시스템 정보 블록 중 하나이며 상기 SIB2는 부서빙셀을 구성할 때 RRC 재구성 절차를 통해 기지국에서 단말에게 전송된다. SIB2내에는 상향링크 중심 주파수 정보가 포함되어 있고 SIB1내에는 하향링크 중심 주파수 정보가 포함되어 있다. 따라서 SIB2로 연결설정되었다

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함은 해당 부서빙셀의 SIB1내의 정보를 기반으로 구성된 DL CC와 SIB2내의 정보를 기반으로 구성된 UL CC간의 연결설정을 의미한다.

<70> 4. 각 TAG는 하나의 타이밍 참조와 하나의 TAT를 가진다. 그리고 각 TAT는 서로 다른 타이머 만료 값으로 구성될 수 있다. TAT는 각 TAG가 획득하고 적용한 시간정렬값의 유효성 여부를 알려주기 위해 서빙 기지국으로부터 시간정렬값을 획득한 직후부터 시작 또는 재시작한다.

<71> 5. pTAG의 TAT가 만료된 경우, pTAG를 포함한 모든 TAG의 TAT가 만료된다. 그리고 단말은 모든 서빙셀들의 HARQ 버퍼들을 초기화(flush)한다. 또한 모든 하향크 및 상향링크에 대한 자원할당 구성을 초기화(clear)한다. 일 예로 반지속적 스케줄링(semi-persistent scheduling: SPS) 방식처럼 PDCCH와 같은 하향링크/상향링크에 대한 자원할당을 목적으로 전송되는 제어정보 없이 주기적인 자원할당이 구성되어 있는 경우, 상기 SPS 구성을 초기화한다. 또한 모든 서빙셀들의 PUCCH 및 타입 0 (주기적) SRS의 구성을 해제한다.

<72> 6. 만일 sTAG의 TAT만 만료된 경우는 다음과 같은 절차를 진행한다.

<73> A. sTAG내 부서빙셀들의 UL CC를 통한 SRS 전송을 중지한다.

<74> B. 타입 0 (주기적) SRS 구성을 해제한다. 타입 1 (비주기적) SRS 구성은 유지한다.

<75> C. CSI 보고에 대한 구성정보는 유지한다.

<76> D. sTAG내 부서빙셀들의 업링크에 대한 HARQ 버퍼들을 초기화(flush)한다.

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<77> 7. sTAG내의 모든 부서빙셀들이 비활성화된 경우라도 단말은 해당 sTAG의 TAT를 중지하지 않는다. 7번 동작과 같이 sTAG내의 모든 부서빙셀들이 비활성화된 경우라도 단말은 해당 sTAG의 TAT를 중지하지 않는다. 이는 sTAG내의 모든 부서빙셀들이 비활성화되어 상향링크 동기를 추적하기 위한 어떠한 SRS도 전송하지 못하는 상황이 특정 시간동안 유지되는 상태에서도 TAT를 통해 해당 sTAG의 TA값의 유효성을 보증할 수 있다는 의미이다.

<78> 8. 만일 sTAG내의 마지막 부서빙셀이 제거된 경우, 즉 sTAG내의 어떠한 부서빙셀도 구성되어 있지 않은 경우, 해당 sTAG내의 TAT는 중지된다.

<79> 9. RAR 전송을 위한 PDCCH는 랜덤 액세스 프리앰블을 전송했던 부서빙셀 이외의 다른 서빙셀을 통해 전송될 수 있다.

<80> 10. 부서빙셀의 랜덤 액세스 프리앰블의 재전송 횟수가 최대 허용 재전송 횟수에 도달한 경우: A) MAC 계층은 랜덤 액세스가 실패하였음을 RRC 계층에 알리지 않는다. 따라서 RLF의 트리거링을 유발하지 않는다. B) 단말은 기지국에게 부서빙셀의 랜덤 액세스가 실패했음을 알리지 않는다. C) 단말은 최대 허용 재전송 횟수에서 진행된 랜덤 액세스 절차가 실패한 경우, MAC 계층에서 현재 진행 중인 랜덤 액세스 절차를 중지한다.

<81> 11. pTAG의 경로감쇄 참조는 주서빙셀 또는 pTAG내의 부서빙셀이 될 수 있으며 기지국은 pTAG 내의 각 서빙셀마다 RRC 시그널링을 통해 서로 다르게 설정할 수 있다.

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<82> 12. sTAG내의 각 서빙셀들의 업링크 CC들의 경로감쇄 참조는 각각 SIB2 연결 설정된 다운링크 CC이다.

<83> 도 5는 본 발명의 일 예에 따른 다중 시간 정렬 값을 획득하는 절차를 설명하는 흐름도이다.

<84> 도 5를 참조하면, 단말과 기지국은 선택된 셀을 통해 기지국에 대해 RRC 연결 설정 절차를 수행한다(S500). 상기 선택된 셀은 주서빙셀이 된다. RRC 연결 설정 절차는 기지국이 단말로 RRC 연결 설정 메시지를 전송하고, 단말이 기지국으로 RRC 연결 설정 완료 메시지를 전송하는 과정을 포함한다.

<85> 기지국은 하나 이상의 부서빙셀을 단말에 추가로 구성하기 위한 RRC 연결 재구성 절차를 수행한다(S505). 부서빙셀의 추가는 예를 들어, 단말의 요청 또는 네트워크의 요청 또는 기지국의 자체판단에 의해 더 많은 무선자원을 단말에 할당해야 하는 경우에 수행될 수 있다. 부서빙셀을 단말에 추가하거나, 단말에 구성된 부서빙셀을 제거하는 것은 RRC 연결 재구성 메시지로 지시될 수 있다. RRC 연결 재구성 절차는 기지국이 단말로 RRC 연결 재구성 메시지를 전송하고, 단말이 기지국으로 RRC 연결 재구성 완료 메시지를 전송하는 과정을 포함한다.

<86> 기지국은 단말에 추가된 서빙셀에 대해 TAG를 구성한다(S510). 반송파 집성 상황에 따라 서빙셀간 TAG 설정은 셀 특정(cell-specific)하게 될 수도 있다. 예를 들어, 특정 주파수 대역의 서빙셀은 항상 FSR이나 원격 무선 헤드(remote radio head: RRH)를 통해 제공되는 경우, 기지국의 서비스 지역 내 모든 단말에 대해서

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상기 특정 주파수 대역의 서빙셀과 기지국으로부터 직접 서비스되는 주파수 대역의 서빙셀은 항상 서로 다른 TAG에 속하도록 설정될 수 있다.

<87> 만약 i) 기지국이 상기 추가된 부서빙셀에 주서빙셀과 동일한 시간정렬 값을 적용할 수 있다고 판단하는 경우, 상기 추가된 부서빙셀을 주서빙셀과 동일한 TAG으로 설정한다. 이 경우 단계 S515와 같은 TAG 구성정보의 전송 동작은 수행되지 않을 수 있다. 이때 단말이 TAG 구성정보의 수신없이 상기 추가된 부서빙셀에 대한 활성화 지시자와 상향링크 스케줄링 정보를 수신하는 경우, 단말은 상기 추가된 부서빙셀을 주서빙셀과 동일한 TAG으로 설정된 것으로 여긴다.

<88> 만약 ii) 기지국이 상기 추가된 부서빙셀에 주서빙셀과 동일한 시간정렬 값을 적용할 수 없다고 판단하는 경우, 기지국은 상기 추가된 부서빙셀을 포함하는 sTAG을 구성한다. 각 TAG에는 TAG를 식별하는 TAG ID가 부여된다. 다만, 기지국은 sTAG에 대한 TAG ID를 선택적으로 부여할 수 있다. 일례로서, 기지국이 상기 추가된 부서빙셀을 포함하는 sTAG가 기존에 구성된 TAG들과 다른 TAG임을 확인한 경우, 기지국은 랜덤 액세스 절차를 통해 상향링크 동기를 획득하기 이전에 상기 sTAG에 대한 TAG ID를 부여할 수 있다. 다른 예로서, 기지국이 상기 추가된 부서빙셀이 기존에 구성된 TAG내에 포함될 수도 있다고 판단하거나, 또는 어느 TAG에 포함되는지 확인할 수 없는 경우, 기지국은 랜덤 액세스 절차를 통해 상향링크 동기를 획득하기 이전에 상기 sTAG에 대한 TAG ID를 부여하지 않을 수 있다. 따라서 이 경우 기지국은 단말이 상향링크 동기를 획득 이후 필요 시 TAG 구성정보를 단말로 전송하고, 단말은 해당 sTAG의 TAG ID를 획득할 수 있다.

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<89> 기지국은 TAG 구성정보를 단말로 전송하는 RRC 연결 재구성 절차를 수행한다(S515). TAG 구성정보는 각 부서빙셀마다 TAG ID 정보가 포함되는 포맷일 수 있다. 구체적으로 각 부서빙셀의 상향링크 구성정보가 TAG ID 정보를 포함할 수 있다. 또는 TAG 구성정보는 서빙셀마다 할당된 서빙셀 인덱스(ServCellIndex) 또는 부서빙셀들에게만 할당되는 부서빙셀 인덱스(ScellIndex)를 맵핑하는 포맷일 수 있다. 예를 들어, pTAG = {ServCellIndex = '1', '2'}, sTAG1 = {ServCellIndex = '3', '4'} 또는 pTAG = {ScellIndex = '1', '2'}, sTAG1 = {SCellIndex = '3', '4'}와 같은 형태로 설정될 수 있다. 주서빙셀은 언제나 서빙셀 인덱스가 '0'이고, TAG ID = 0이므로 설정정보가 존재하지 않는다. 또한 부서빙셀들 중에서 TAG ID 정보가 없는 경우, 해당 부서빙셀들은 pTAG내의 서빙셀임을 의미하거나 현재 구성되어 있는 모든 TAG와는 별개의 독립적인 sTAG내의 서빙셀임을 의미할 수 있다.

<90> TAG 구성정보는 각 TAG내의 대표 서빙셀 정보를 더 포함할 수 있다. 대표 서빙셀은 각 TAG내에서 상향링크 동기 유지 및 설정을 위한 랜덤 액세스 절차를 진행할 수 있으며 타이밍 참조 셀로 사용될 수 있는 서빙셀이다. 만약 상기 실시예와는 달리 TAG 구성정보가 대표 서빙셀을 포함하지 않는 경우 단말은 스스로 각 TAG내의 대표 서빙셀을 선정할 수 있다. 예를 들어, 기지국이 랜덤 액세스 절차를 지시한 서빙셀들 중 가장 최근에 랜덤 액세스 절차를 지시하거나 성공적으로 완료된 서빙셀을 대표 서빙셀로 선정할 수 있다. 또는 기지국이 부서빙셀 구성 시 랜덤 액세스 절차를 위한 파라미터들을 구성한 서빙셀을 대표 서빙셀로 선정할 수 있다. 만일 대표 서빙셀이 될 수 있는 조건에 부합하는 서빙셀이 다수인 경우 또는 대표 서빙

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셀이 비활성화 된 경우, 가장 낮은 부서빙셀 인덱스를 갖는 부서빙셀을 대표 서빙셀로 설정할 수 있다.

<91> 기지국은 특정한 부서빙셀에 대하여 스케줄링하고자 하는 경우, 상기 특정한 부서빙셀을 활성화하는 활성화 지시자를 단말로 전송한다(S520).

<92> 단말은 특정 sTAG에서 상향링크 동기를 확보하지 못한 경우, 상기 특정 sTAG에 대해 조정되어야 할 시간정렬 값을 획득하여야 한다. 이는 기지국에 의해 지시되는 랜덤 액세스 절차를 통해 구현될 수 있다(S525).

<93> sTAG 내의 활성화된 부서빙셀에 대한 랜덤 액세스 절차는 기지국에 의해 전송되는 PDCCH 지시에 의해서 시작될 수 있다. PDCCH 지시를 수신할 수 있는 부서빙셀은 상기 sTAG내에서 지정된 타이밍 참조를 포함한 부서빙셀로 한정할 수도 있으며 RACH 구성된 모든 부서빙셀이 될 수도 있다.

<94> 기지국은 단말이 동시에 2개 이상의 랜덤 액세스 절차를 진행하지 않도록 제어한다. 랜덤 액세스 절차의 동시 진행은 2개 이상의 랜덤 액세스 절차가 동기화되어 동시에 진행되는 경우와, 랜덤 액세스 절차가 진행되는 일부 시간에 대하여 동시에 진행중인 경우를 포함한다. 예를 들어, 단말이 주서빙셀을 통해 랜덤 액세스 절차를 진행할 때, 단말이 랜덤 액세스 응답 메시지를 기다리는 동안에 부서빙셀을 통해 랜덤 액세스 절차가 시작하는 경우(PDCCH order를 수신)이다. 여기서 상기 랜덤 액세스 응답 메시지를 기다리는 동안은 단말에 의해 랜덤 액세스 응답 메시지가 재전송될 수 있다고 판단되는 구간을 포함할 수도 있으며 포함하지 않을 수도 있다.

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<95> 기지국은 기존에 확보한 네트워크 내 정보 및/또는 단말로부터 수신한 보조(assistant) 정보(e.g. 위치정보, RSRP, RSRQ 등)를 이용하여도 특정 부서빙셀을 특정 TAG에 맵핑시킬 수 있을 만큼 충분한 정보를 확보하지 못한 경우, 상기 특정 부서빙셀을 새로운 sTAG로 설정하고 랜덤 액세스 절차를 통해 상기 상향링크 시간 정렬 값을 획득한다.

<96> 단말이 랜덤 액세스 응답 메시지를 기지국으로부터 수신하면, 단말은 랜덤 액세스 절차가 성공적으로 완료된 것으로 판단하고, 상기 부서빙셀의 시간정렬 값을 갱신한다(S530). 상기 랜덤 액세스 응답 메시지는 RA-RNTI(random access-radio network temporary identifier)로 스크램블링된 PDCCH에 의해 지시되는 PDSCH내에 포함되어 수신되는 RAR MAC PDU(protocol data unit)내에 포함되어 전송되거나 C-RNTI로 스크램블링된 PDCCH에 의해 지시되는 PDSCH내에 포함되어 수신되는 MAC PDU 내의 MAC 제어요소(control element: CE) 형태로 수신될 수도 있다. 상기 MAC CE 형태로 수신되는 경우 랜덤 액세스 응답 메시지는 '확장된 시간전진 명령'(Extended TAC MAC CE)라는 용어로 불릴 수 있으며 TA 값과 TAG ID 또는 부서빙셀 인덱스 등이 포함될 수 있다.

<97> 도 5에서는 부서빙셀을 구성하기 위한 RRC 연결 재구성 절차(S505)와, TAG를 구성하기 위한 TAG 구성정보의 전송 절차(S515)가 별도로 진행되는 것으로 도시하였으나, 이는 예시일 뿐이고 하나의 RRC 연결 재구성 메시지내에 부서빙셀의 구성정보와 TAG 구성정보가 포함될 수도 있다. 도 6은 부서빙셀 구성정보와 TAG 구성정보가 한 번의 RRC 연결 재구성 절차에 의해 전송되는 과정을 도시한 것이다. 도 6

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을 참조하면, 도 6은 도 5와 비교할 때 단계 S610에서의 한 번의 RRC 연결 재구성 절차에 의해 부서빙셀 구성정보와 TAG 구성정보가 모두 단말로 전송되고, 단말이 부서빙셀의 재구성 및 TAG 구성을 한 번에 수행하는 점에 차이가 있다. 즉, 기왕에 진행되는 부서빙셀 구성정보의 전송을 위한 RRC 연결 재구성 절차에서 TAG 구성정보의 전송도 함께 이루어진다.

<98> 일례로서, 부서빙셀의 구성정보가 TAG 구성정보를 포함할 수도 있다. 예를 들어, 부서빙셀의 구성정보가 단말에 추가되는 부서빙셀에 관한 인덱스 및, 상기 인덱스의 부서빙셀이 속하는 TAG의 식별자(identifier: ID)를 포함할 수 있다. 다른 예로서, TAG 구성정보가 부서빙셀의 구성정보를 포함할 수도 있다. 예를 들어, TAG 구성정보가 단말에 구성된 각 TAG의 TAG ID와 각 TAG에 속하는 서빙셀의 인덱스, 그리고 특정 TAG에 추가되는 부서빙셀의 인덱스, TAT 파라미터를 포함할 수도 있다. 상기 TAG 구성정보는 해당 TAG내 속하는 서빙셀이 존재하지 않더라도 제거되지 않을 수 있다. 다시 말해, TAG 구성정보 내 특정 TAG에 대한 구성정보로써 TAG ID와, TAT 파라미터만을 포함할 수도 있다.

<99> 여기서, 단계 S610에서 기지국에서 단말로 전송되는 RRC 연결 재구성 메시지는 RRC 연결 재구성 절차가 성공된 직후 수신된 최초 RRC 재구성 메시지일 수도 있고, 그 이외의 RRC 재구성 메시지인 경우일 수도 있다. 나머지 단계 S600, S605, S615, S620 및 S625는 도 5에서의 절차와 동일하므로 상세한 설명은 생략한다.

<100> 다시 도 5를 참조하면, 단계 S525의 랜덤 액세스 절차는 예를 들어 도 7의 절차에 의해 수행될 수 있다.

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<101> 도 7은 본 발명의 일 예에 따른 랜덤 액세스 수행 방법을 설명하는 흐름도이다.

<102> 도 7을 참조하면, 기지국은 단말에 구성된 부서빙셀에 관한 랜덤 액세스 절차의 개시를 지시하는 PDCCH 지시(order)를 단말로 전송한다(S700). 이때, 부서빙셀은 기지국이 상향링크 동기가 필요하다고 판단한 것일 수 있다.

<103> 일례로, 비경합 기반의 랜덤 액세스 절차인 경우, 기지국은 가용한 전체 랜덤 액세스 프리앰블들 중에서 미리 예약한 전용 랜덤 액세스 프리앰블들 중 하나를 선택하고, 상기 선택된 랜덤 액세스 프리앰블의 인덱스 및 사용 가능한 시간/주파수 자원 정보를 포함하는 프리앰블 할당 정보(RA Preamble assignment)를 PDCCH 지시를 통해 단말로 전송한다. 이는 비경합 기반의 랜덤 액세스 과정을 위해서는 단말이 충돌 가능성이 없는 전용 랜덤 액세스 프리앰블을 기지국으로부터 할당받아야 하기 때문이다.

<104> 예를 들어, 랜덤 액세스 과정이 핸드오버 과정 중에 수행되는 경우, 단말은 전용 랜덤 액세스 프리앰블을 핸드오버 명령 메시지로부터 얻을 수 있다. 또는 예를 들어, 랜덤 액세스 과정이 기지국의 요청(PDCCH order)에 의해 수행되는 경우 단말은 전용 랜덤 액세스 프리앰블을 PDCCH, 즉 물리계층 시그널링을 통해 얻을 수 있다. 이 경우 물리계층 시그널링은 하향링크 제어정보(downlink control information: DCI) 포맷 1A로서, 표 1과 같은 필드들을 포함할 수 있다.

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<105> 【표 1】

캐리어 지시자 필드(Carrier indicator field: CIF) - 0 or 3 bits.
- 포맷 0/1A 식별을 위한 플래그 - 1 bit (0인 경우 포맷 0을, 1인 경우 포맷 1A를 지시함)
포맷 1A CRC가 C-RNTI에 의해 스크램블되고, 남은 필드들이 아래와 같이 설정되는 경우, 포맷 1A는 PDCCH 명령(order)에 의해 개시되는 랜덤 액세스 절차를 위해 사용된다.
-아래-
- 국지적/분산적(Localized/Distributed) VRB 할당 플래그 - 1 bit. 0으로 설정됨
- 자원블록할당 - $\lceil \log_2(N_{RB}^{DL}(N_{RB}^{DL}+1)/2 \rceil$ bits. 모든 비트들이 1로 설정됨
- 프리앰블 인덱스(Preamble Index) - 6 bits
- PRACH 마스크 인덱스(Mask Index) - 4 bits
- 하나의 PDSCH 부호어의 간이 스케줄링 할당을 위한 포맷 1A의 모든 남은 비트들이 0으로 설정됨

<106> 표 1을 참조하면, 프리앰블 인덱스는 비경합 기반 랜덤 액세스 절차를 위해 미리 예약한 전용 랜덤 액세스 프리앰블들 중 선택된 하나의 프리앰블을 지시하는 인덱스이고, PRACH 마스크 인덱스는 사용 가능한 시간/주파수 자원 정보이다. 사용 가능한 시간/주파수 자원 정보는 다시 표 2와 같이 주파수 분할 듀플렉스(frequency division duplex: FDD) 시스템과 시간 분할 듀플렉스(time division duplex: TDD) 시스템에 따라, 지시하는 자원이 달라진다.

<107> 【표 2】

PRACH 마스크 인덱스	허용되는 PRACH (FDD)	허용되는 PRACH (TDD)
0	모두	모두
1	PRACH 자원 인덱스0	PRACH 자원 인덱스0
2	PRACH 자원 인덱스1	PRACH 자원 인덱스1
3	PRACH 자원 인덱스2	PRACH 자원 인덱스2
4	PRACH 자원 인덱스3	PRACH 자원 인덱스3
5	PRACH 자원 인덱스4	PRACH 자원 인덱스4
6	PRACH 자원 인덱스5	PRACH 자원 인덱스5
7	PRACH 자원 인덱스6	예비됨
8	PRACH 자원 인덱스7	예비됨
9	PRACH 자원 인덱스8	예비됨

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10	PRACH 자원 인덱스9	예비됨
11	시간 영역내의 모든 짝수 PRACH 기회(opportunity), 서브프레임내의 첫번째 PRACH 자원 인덱스	시간 영역내의 모든 짝수 PRACH 기회, 서브프레임내의 첫번째 PRACH 자원 인덱스
12	시간 영역내의 모든 홀수 PRACH 기회, 서브프레임내의 첫번째 PRACH 자원 인덱스	시간 영역내의 모든 홀수 PRACH 기회, 서브프레임내의 첫번째 PRACH 자원 인덱스
13	예비됨	서브프레임내의 첫번째 PRACH 자원 인덱스
14	예비됨	서브프레임내의 두번째 PRACH 자원 인덱스
15	예비됨	서브프레임내의 세번째 PRACH 자원 인덱스

<108> 다른 예로, 경합 기반의 랜덤 액세스 절차인 경우, 기지국은 프리앰블 할당 정보내의 프리앰블 인덱스를 '000000'으로 설정하여 단말로 전송한다. 단말은 경쟁 기반 랜덤 액세스 프리앰블들 중 하나를 랜덤하게 선택하고 PRACH 마스크 인덱스 값도 '0'으로 설정한 후 경쟁기반 절차로 진행한다. 또한, 프리앰블 할당 정보는 RRC와 같은 상위계층의 메시지(예를 들어 핸드오버 명령 내 이동제어정보(MCI: mobility control information))를 통해 단말로 전송될 수 있다.

<109> 단말은 단계 S700에서 지정된 부서빙셀상에서 랜덤 액세스 프리앰블을 기지국으로 전송한다(S705). 물론, 랜덤 액세스 프리앰블은 상기 부서빙셀이 속하는 TAG내의 대표 서빙셀상으로 전송될 수도 있다. 대표 서빙셀은 단말에 구성되는 TAG에서 랜덤 액세스 프리앰블을 전송하도록 선정된 서빙셀이다. 대표 서빙셀은 TAG마다 선정될 수 있다. 또한 단말은 복수의 TAG들 중에서, 어느 하나의 TAG내의 대표 서빙셀상으로 랜덤 액세스 프리앰블을 전송할 수도 있고, 2개 이상의 TAG내의 각각의 대표 서빙셀상으로 랜덤 액세스 프리앰블을 전송할 수도 있다. 예를 들어, 단말에 구성된 TAG가 TAG1, TAG2이고, TAG1={제1 서빙셀, 제2 서빙셀, 제3 서빙셀}, TAG2={제4 서빙셀, 제5 서빙셀}이라 하자. TAG1의 대표 서빙셀이 제2 서빙셀, TAG2

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의 대표 서빙셀이 제5 서빙셀이면, 단말은 할당된 전용 랜덤 액세스 프리앰블을 제2 서빙셀 또는 제5 서빙셀을 통해 기지국으로 전송한다.

<110> 대표 서빙셀은 특별 서빙셀(special SCell) 또는 참조 서빙셀(reference SCell) 또는 타이밍 참조 서빙셀(timing reference Cell)이라 불릴 수도 있다.

<111> 기지국은 랜덤 액세스 응답 메시지를 단말로 전송한다(S710). 랜덤 액세스 응답 메시지는 시간정렬 값을 포함한다. 기지국이 랜덤 액세스 프리앰블을 성공적으로 수신하면, 기지국은 수신된 랜덤 액세스 프리앰블 및 시간/주파수 자원을 기반으로 어느 단말이 어느 서빙셀을 통해 랜덤 액세스 프리앰블을 전송했는지 확인할 수 있다. 특히, 기지국의 PDCCH 지시에 의해 단말이 부서빙셀에 대한 랜덤 액세스 절차를 개시하는 경우, 단말은 이미 주서빙셀에서 단말의 고유한 식별자, 예를 들어 C-RNTI를 확보한 상태이다. 따라서 기지국은 필요에 따라 단말의 C-RNTI를 이용하여 단말로 랜덤 액세스 응답 메시지(ramdon access response message)를 전송할 수 있다. 여기서, C-RNTI를 이용한다는 것은, 랜덤 액세스 응답 메시지가 맵핑된 PDSCH를 지시하는 PDCCH를 C-RNTI로 스크램블링(scrambling)하는 것을 포함한다.

<112> 또는, 기지국은 단말의 RA-RNTI(Random Access-RNTI)를 이용하여 주서빙셀상에서 랜덤 액세스 응답 메시지를 전송할 수도 있다. 단말이 랜덤 액세스 응답 메시지를 기지국으로부터 수신하면, 단말은 랜덤 액세스 절차가 성공적으로 완료된 것으로 판단한다.

<113> 부서빙셀이 단말에 추가(addition)되거나 제거(release)되면, 단말 또는 기

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지국에 의해 TAG가 갱신될 수 있다. 예를 들어, 단말에 구성된 TAG가 TAG1, TAG2이고, TAG1={제1 서빙셀, 제2 서빙셀}, TAG2={제4 서빙셀}이라 하자. 만약 단말의 대역폭 확장을 위해 제3 부서빙셀이 추가되어야 하는 경우, 기지국은 RRC 연결 재구성 절차를 이용하여 단말로 제3 부서빙셀의 추가를 위한 부서빙셀 구성정보를 전송한다. 만약 제3 부서빙셀의 시간정렬 값이 TAG1의 시간정렬 값과 동일하면 제3 부서빙셀은 TAG1에 편입된다. 이때 기지국 또는 단말은 TAG1={제1 서빙셀, 제2 서빙셀, 제3 서빙셀}로 갱신하고, TAG2는 변경하지 않는다. 또는 만약 제3 부서빙셀의 시간정렬 값이 TAG1이나 TAG2의 시간정렬 값과 다르면 제3 부서빙셀은 새로운 TAG3에 속한다. 따라서 기지국 또는 단말은 새로운 TAG3={제3 부서빙셀}로 구성한다.

<114> 이와 같이 부서빙셀의 구성변경은 TAG의 재편성(re-organization)을 발생시키므로, 부서빙셀 구성정보와 TAG 구성정보는 밀접한 관계가 있다. TAG의 재편성은 또한 부서빙셀에 적용되는 시간정렬 값의 갱신을 야기할 수 있으므로, 상향링크 동기화와도 관련된다. TAG의 재편성은 TAG의 갱신(update) 또는 변경(change) 또는 재구성(reconfiguration)이라 불릴 수도 있다. TAG의 재편성은 결국 단말 또는 기지국이 TAG 구성정보를 갱신 또는 변경하는 것이므로, TAG의 재편성은 TAG 구성정보의 갱신 또는 변경과 동일한 의미를 가질 수도 있다.

<115> TAG 재편성은 TAG에 포함된 부서빙셀이 변경되는 경우, TAG가 새롭게 생성되거나 삭제되는 경우를 모두 포함한다. 부서빙셀의 구성변경에 의한 TAG의 재편성은 다양한 실시예를 포함할 수 있다. 예를 들어, TAG의 재편성을 위해 기지국이 단말로 TAG 재편성에 관련된 시그널링을 줄 수도 있고, 상기 시그널링없이도 단말이 자

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발적으로 TAG를 재편성할 수 있다. 또는 TAG의 재편성을 위해 RRC 연결 재구성 절차의 메시지가 사용될 수도 있고, 랜덤 액세스 절차의 시그널링이 사용될 수도 있다. 또한, TAG의 재편성을 위해 사용되는 메시지의 구조도 다양할 수 있다. 이하에서는 다양한 실시예에 따른 TAG의 재편성과, 그에 따른 상향링크 동기화에 관하여 상세히 개시된다. 먼저, 부서빙셀이 제거(release)되는 경우 TAG의 재편성 절차에 관하여 설명된다.

<116> (1) 부서빙셀이 제거(release)되는 경우 TAG의 재편성 절차

<117> 도 8은 본 발명의 일 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<118> 도 8을 참조하면, 기지국은 단말에 구성된 부서빙셀의 제거를 결정한다(S800). 예를 들어, 단말이 필요로 하는 주파수 대역이 감소하거나, 핸드오버(handover)이후 서빙 기지국(serving eNB)에서 구성했던 부서빙셀들을 타겟 기지국(Target eNB)에서 접속을 해제하는 경우에 기지국은 부서빙셀의 제거를 결정할 수 있다. 만일 무선링크실패(radio link failure: RLF)에 이은 RRC 연결 재설정(re-establishment) 절차를 시작함으로 인해 단말이 모든 부서빙셀을 해제하는 경우, 단말은 모든 TAG 구성정보를 초기화 하거나 제거한다. 상기 TAG 구성정보 초기화 시 TAG ID 정보는 유지하되 각 TAG 내의 TA 값은 '0'으로 초기화 되며 각 TAG 내 포함되는 서빙셀 정보는 제거되고 TAT 파라미터는 '무한(infinity)'로 설정된다.

<119> 기지국은 TAG를 재편성한다(S805). 여기서, TAG의 재편성은 제거된 부서빙셀이 속했던 TAG의 갱신이다. 예를 들어 부서빙셀이 속했던 TAG가 TAG1={제1 서빙셀, 제2 서빙셀}이고, 제거 대상인 부서빙셀이 제2 서빙셀이면, 기지국은 TAG1={제1 서

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빙셀}로 갱신된다.

<120> 기지국이 부서빙셀을 제거하고 TAG를 재편성하였으므로, 기지국은 부서빙셀의 제거와 TAG 재편성을 단말로 알려주어야 한다. 이때, 기지국은 부서빙셀의 제거를 지시하는 부서빙셀 구성정보만을 단말로 전송할 수 있다. 단말은 제거될 부서빙셀이 어느 TAG에 속하는지 이미 알고 있고, 별도의 TAG 구성정보가 없더라도 상기 TAG를 상기 부서빙셀이 제거된 것으로 갱신할 수 있기 때문이다.

<121> 따라서, 기지국은 부서빙셀의 제거를 위한 RRC 연결 재구성 절차를 수행한다(S810). 일례로서, 단계 S810의 RRC 연결 재구성 절차는 부서빙셀의 제거를 위한 부서빙셀 구성정보 및 재편성된 TAG 구성정보가 도 5와 같이 서로 다른 RRC 연결 재구성 메시지에 포함되는 것일 수 있다. 이 경우, RRC 연결 재구성 절차가 2회 수행된다. 이때, 단계 S805의 순서는 단계 S810에서 재편성된 TAG 구성정보가 전송되는 RRC 연결 재구성 절차에서 수행될 수도 있다.

<122> 다른 예로서, 단계 S810의 RRC 연결 재구성 절차는 부서빙셀 구성정보와 재편성된 TAG 구성정보가 도 6과 같이 동일한 RRC 연결 재구성 메시지에 포함되는 것일 수 있다. 이 경우 RRC 연결 재구성 절차는 1회 수행된다. 즉, 기왕에 진행되는 부서빙셀 구성정보의 전송을 위한 RRC 연결 재구성 절차에서 TAG 구성정보의 전송도 함께 이루어진다. 이때, 재편성된 TAG 구성정보는 부서빙셀 구성정보에 포함되어 전송될 수도 있고, 부서빙셀 구성정보와는 별개의 필드로 전송될 수도 있다. 재편성된 TAG 구성정보가 별개의 필드로 전송되는 경우, 재편성된 TAG 구성정보는 예를 들어, pTAG = {1, 3}, sTAG[TAG ID = 1] = {2, 4}와 같이 표시될 수 있다. 여기

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서 상기 pTAG = {1, 3}는 주서빙셀 및 부서빙셀1, 부서빙셀3이 pTAG를 구성하는 서빙셀들임을 의미한다.

<123> 또 다른 예로서, 단계 S810의 RRC 연결 재구성 절차는 재편성된 TAG 구성정보를 포함하지 않을 수 있다. 이는 구성정보가 TAG 구성정보를 포함하지 않는 경우를 포함한다.

<124> 부서빙셀의 제거를 위한 부서빙셀 구성정보는 sCellToReleaseList로서, 다음의 표와 같이 정의될 수 있다.

<125> 【표 3】

```
RRCConnectionReconfiguration IEs ::= SEQUENCE {
        sCellToReleaseList                              SCellToReleaseList
                OPTIONAL,       -- Need ON
        sCellToAddModList                               SCellToAddModList
                OPTIONAL,       -- Need ON
        nonCriticalExtension                            SEQUENCE {}
                OPTIONAL        -- Need OP
}
SCellToReleaseList ::=  SEQUENCE (SIZE (1..maxSCell)) OF SCellIndex
```

<126> 표 3을 참조하면, RRC 연결 재구성 메시지(RRCConnectionReconfiguration IEs)는 부서빙셀의 제거를 위한 부서빙셀 구성정보인 sCellToReleaseList를 포함한다. sCellToReleaseList의 크기는 1~부서빙셀의 최대개수(maxScell)로 설정될 수 있으며, 제거될 부서빙셀의 인덱스(SCellIndex)를 지시한다.

<127> 부서빙셀의 제거를 위한 부서빙셀 구성정보를 포함하는 RRC 연결 재구성 메시지를 수신하면, 단말은 부서빙셀이 속하는 TAG에서 상기 부서빙셀을 제거하고 TAG를 재편성한다(S815). 단말은 TAG 구성정보가 없더라도 TAG 재편성을 수행할 수

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있다. 이러한 측면에서, 단계 S810의 RRC 연결 재구성 메시지는 부서빙셀의 제거뿐만 아니라 TAG의 재편성을 지시하는 기능을 가진다. 만약 단말에 pTAG와 sTAG가 구성된 경우, sTAG에 1개의 부서빙셀이 포함된 상태에서 상기 sTAG의 부서빙셀이 제거되면, TAG의 재편성에 의해 상기 sTAG의 TAG ID도 함께 제거된다. 반면 만약 단말에 pTAG만이 구성된 경우, pTAG는 반드시 주서빙셀을 포함하므로 pTAG내의 부서빙셀이 제거되더라도 pTAG가 제거되는 TAG 재편성은 발생하지 않는다. 이와 같이 TAG의 재편성은 단말에 pTAG와 sTAG가 모두 구성되어 있는 경우에 수행될 수 있다.

<128> TAG 재편성을 위한 TAG 구성정보가 별도로 전송될 필요가 없으므로, 절차가 간소화되고 TAG 재편성이 보다 빠르게 진행될 수 있다.

<129> 다음으로, 부서빙셀이 추가(add)되는 경우 TAG의 재편성 절차에 관하여 설명된다.

<130> (2) 부서빙셀이 추가(add)되는 경우 TAG의 재편성 절차

<131> 부서빙셀의 제거에 있어서, 단말과 기지국은 제거되는 부서빙셀의 상향링크 동기를 더 이상 유지할 필요가 없다. 따라서 시간정렬 값도 불필요하다. 그러나, 부서빙셀의 추가에 있어서, 기지국 또는 단말은 추가되는 부서빙셀이 속하는 TAG를 재편성해야 하고, 이를 위해서는 추가되는 부서빙셀의 시간정렬 값을 알아야 한다.

<132> 추가되는 부서빙셀에 관한 시간정렬 값은 기본적으로 랜덤 액세스 절차를 기반으로 획득될 수 있다. 그런데, 추가되는 부서빙셀이 이미 정의된 TAG에 맵핑될 수 있는 경우, 시간정렬 값의 획득을 위한 랜덤 액세스 절차는 수행되지 않아도 된

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다. 여기서, 추가되는 부서빙셀이 미리 정의된 TAG에 맵핑될 수 있는 경우란, 추가되는 부서빙셀의 시간정렬 값이 미리 정의된 TAG의 시간정렬 값과 동일한 경우를 의미할 수 있다. 또한, 추가되는 부서빙셀이 미리 정의된 TAG에 맵핑될 수 있는 경우란, 추가되는 부서빙셀의 시간정렬 값을 기지국이 이미 알고 있는 경우를 의미할 수도 있다.

<133> 만약 기지국이 추가되는 부서빙셀의 시간정렬 값을 이미 알고 있다면, 추가되는 부서빙셀을 어느 TAG로 재편성해야 하는지 알 수 있다. 즉, TAG를 확정할 수 있다. 예를 들어, 단말에 TAG1, TAG2가 구성되고, TAG1의 시간정렬 값은 TA1, TAG2의 시간정렬 값은 TA2라 하자. 추가되는 부서빙셀의 시간정렬 값=TA2이고 기지국이 이것을 알고 있으면, 기지국은 추가되는 부서빙셀을 TAG2로 재편성한다. 또는 추가되는 부서빙셀의 시간정렬 값=TA3이고 기지국이 이것을 알고 있으면, 기지국은 추가되는 부서빙셀을 새로운 TAG3으로 재편성한다.

<134> 반면, 기지국이 추가되는 부서빙셀의 시간정렬 값을 알 수 없는 경우에는 TAG를 확정할 수 없다. 따라서 기지국은 추가되는 부서빙셀의 TAG ID를 디폴트(default)로 설정할 수 있다. 디폴트로 설정되는 TAG ID는 임시(temporary) TAG ID라고도 불릴 수 있다. 추후에 기지국은 추가되는 부서빙셀을 특정한 TAG로 재편성할 수 있다. 즉, 재편성된 TAG의 구성정보의 내용에 있어서, 재편성된 TAG의 구성정보는 확정적(definite) TAG ID를 포함하거나, 임시 TAG ID를 포함할 수 있다. 임시 TAG ID는 디폴트 값으로 설정되며, 여기서 디폴트 값의 일례는 0일 수 있다. 또는 임시 TAG ID는 아무런 값을 가지지 않을 수도 있다.

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<135> 부서빙셀의 추가로 인해 재편성되는 TAG의 구성정보를 기지국이 단말에 알려주는 방법은 다양한 실시예에 의해 구현될 수 있다. 예를 들어, TAG 구성정보의 전송방식에 있어서, 기지국은 부서빙셀의 추가를 지시하는 부서빙셀 구성정보 및 재편성된 TAG의 구성정보를 RRC 연결 재구성 절차에 기반하여 단말로 전송할 수 있다. 이때, 부서빙셀 구성정보와 TAG 구성정보는 하나의 RRC 연결 재구성 절차에 의해 전송될 수도 있고, 각각 다른 RRC 연결 재구성 절차에 의해 전송될 수도 있다.

<136> 먼저, 추가되는 부서빙셀을 TAG에 맵핑하기 위해 기지국이 별도의 랜덤 액세스 절차를 필요로 하지 않는 경우에 관하여 개시한다.

<137> (2-1) TAG 재편성을 위해 랜덤 액세스 절차가 필요하지 않은 경우

<138> 도 9는 본 발명의 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<139> 도 9를 참조하면, 기지국은 부서빙셀의 추가를 결정한다(S900). 예를 들어, 단말에 지원해야 하는 대역폭이 증가하는 경우 또는 핸드오버에 의해 타겟 기지국(target eNB)의 새로운 셀로 접속하는 경우 기지국은 부서빙셀의 추가를 결정할 수 있다. 부서빙셀의 추가로 인한 TAG의 재편성은 2가지 경우가 있을 수 있다. 첫 번째는 기존에 단말에 구성된 TAG는 그대로 유지되면서, 부서빙셀이 기존의 pTAG 또는 sTAG들 중 어느 하나에 추가되는 경우이다. 두 번째는 기존에 단말에 구성된 TAG 이외에 새로운 TAG가 구성되고, 부서빙셀이 상기 새로운 TAG에 추가되는 경우

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이다. 어느 경우이든 추가된 부서빙셀의 TAG로의 맵핑은 필수적이다. 여기에서는 어느 경우이든 기지국은 추가되는 부서빙셀의 시간정렬 값을 알고 있어 별도의 랜덤 액세스 절차를 수행하지 않는다. 즉, 기지국은 랜덤 액세스 절차없이 바로 TAG의 재편성 및 재편성된 TAG의 구성정보의 전송을 수행할 수 있다.

<140> 기지국은 추가된 부서빙셀에 따라 TAG를 재편성한다(S905). TAG의 재편성은, 기존에 구성된 TAG에 부서빙셀을 추가하거나, 추가되는 부서빙셀을 포함하는 새로운 TAG를 구성하는 것이다.

<141> 기지국은 부서빙셀의 추가를 위한 RRC 연결 재구성 절차를 수행한다(S910). 일례로서, 단계 S910의 RRC 연결 재구성 절차는 부서빙셀의 추가를 위한 부서빙셀 구성정보 및 재편성된 TAG 구성정보가 도 5와 같이 서로 다른 RRC 연결 재구성 메시지(단계 S505 및 S515)에 포함되는 것일 수 있다. 이 경우, RRC 연결 재구성 절차가 2회 수행된다. 이때, 단계 S905의 순서는 단계 S910에서 재편성된 TAG 구성정보가 전송되는 RRC 연결 재구성 절차에서 수행될 수도 있다. 한편, 재편성된 TAG 구성정보는 예를 들어, pTAG = {1, 3}, sTAG[TAG ID = 1] = {2, 4}와 같이 표시될 수 있다.

<142> 다른 예로서, 단계 S910의 RRC 연결 재구성 절차는 부서빙셀의 추가를 위한 부서빙셀 구성정보 및 재편성된 TAG 구성정보가 도 6과 같이 동일한 RRC 연결 재구성 메시지에 포함되는 것일 수 있다. 이 경우 RRC 연결 재구성 절차는 1회 수행된다. 즉, 기왕에 진행되는 부서빙셀 구성정보의 전송을 위한 RRC 연결 재구성 절차에서 TAG 구성정보의 전송도 함께 이루어진다. 이때, 재편성된 TAG 구성정보는 부

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서빙셀 구성정보에 포함되어 전송될 수도 있고, 부서빙셀 구성정보와는 별개의 필드로 전송될 수도 있다. 재편성된 TAG 구성정보가 별개의 필드로 전송되는 경우, 재편성된 TAG 구성정보는 예를 들어, pTAG = {1, 3}, sTAG[TAG ID = 1] = {2, 4}와 같이 표시될 수 있다.

<143> 재편성된 TAG 구성정보는 추가되는 부서빙셀을 새로운 TAG ID에 할당하거나, 기존에 구성된 TAG ID에 할당한다. 부서빙셀의 제거를 위한 부서빙셀 구성정보는 sCellToAddModList로서, 다음의 표와 같이 정의될 수 있다.

<144> 【표 4】

```
RRCConnectionReconfiguration IEs ::= SEQUENCE {
        sCellToReleaseList                              SCellToReleaseList
                OPTIONAL,       -- Need ON
        sCellToAddModList                               SCellToAddModList
                OPTIONAL,       -- Need ON
        nonCriticalExtension                            SEQUENCE {}
                OPTIONAL        -- Need OP
}
SCellToAddModList ::=           SEQUENCE (SIZE (1..maxSCell)) OF SCellToAddMod
SCellToAddMod ::=                       SEQUENCE {
        sCellIndex                                              SCellIndex,
        cellIdentification                              SEQUENCE {
                physCellId                                              PhysCellId,
                dl-CarrierFreq                                  ARFCN-ValueEUTRA
        }
                                                        OPTIONAL,       -- Cond SCellAdd
        radioResourceConfigCommonSCell  RadioResourceConfigCommonSCell
                                        OPTIONAL,       -- Cond SCellAdd
        radioResourceConfigDedicatedSCell
        RadioResourceConfigDedicatedSCell               OPTIONAL,       -- Cond SCellAdd2
        ...
}
```

<145> 표 4를 참조하면, RRC 연결 재구성 메시지(RRCConnectionReconfiguration

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IEs)는 부서빙셀의 추가를 위한 부서빙셀 구성정보인 sCellToAddModList와 SCellToAddMod를 포함한다. sCellToAddModList의 크기는 1~부서빙셀의 최대개수(maxScell)로 설정될 수 있으며, 추가될 부서빙셀의 인덱스(SCellIndex)를 지시한다. SCellToAddMod는 추가되는 부서빙셀의 인덱스(sCellIndex)를 포함한다. 또한 SCellToAddMod는 추가되는 부서빙셀에 관한 TAG ID를 더 포함할 수 있다.

<146> 부서빙셀의 추가를 위한 부서빙셀 구성정보를 포함하는 RRC 연결 재구성 메시지를 수신하면, 단말은 TAG를 재편성한다(S915). 단말은 부서빙셀 구성정보에 포함된 TAG 구성정보에 기반하여 TAG를 재편성한다.

<147> 다음으로, 추가되는 부서빙셀을 TAG에 맵핑하기 위해 기지국이 별도의 랜덤 액세스 절차를 필요로 하는 경우에 관하여 개시한다. 이는 기지국이 추가되는 부서빙셀의 시간정렬 값을 알 수 없는 경우이다.

<148> (2-2) TAG 재편성을 위해 랜덤 액세스 절차가 필요한 경우

<149> 기지국은 TAG 재편성을 위해 랜덤 액세스 절차를 수행함으로써, 추가되는 부서빙셀에 관한 시간정렬 값을 획득할 수 있다. 그런데, 시간정렬 값을 획득하기에 앞서, 기지국은 먼저 추가되는 부서빙셀이 단말에 구성하고, TAG의 재편성을 위한 RRC 연결 재구성 절차를 수행해야 한다. 한편, 기지국은 TAG의 재편성을 수행할 때, 추가되는 부서빙셀이 어느 TAG에 속하는지 알 수 없거나, 단말에 최대한의 TAG ID를 할당하여 더 이상 TAG ID를 할당할 수 없을 수 있다. 이 경우 추가되는 부서빙셀에 관한 TAG를 어떻게 정의할지 모호해진다. 따라서 재편성된 TAG 구성정보의 내용을 정하는 기준이 필요하다. 일례로서, 기지국은 임시 TAG ID를 정의하고, 추

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가되는 부서빙셀을 임시 TAG ID에 맵핑할 수 있다. 이 경우 재편성된 TAG 구성정보는 임시 TAG ID를 포함한다. 예를 들어, 기지국은 현재 단말에 구성된 TAG의 ID를 제외하고 남은 TAG ID 중에서 가장 낮은 인덱스의 TAG ID를 임시 TAG ID로 결정할 수 있다. 또는 기지국은 현재 단말에 구성된 TAG의 ID를 제외하고 남은 TAG ID 중에서 임의로 임시 TAG ID를 결정할 수도 있다.

<150> 다른 예로서, 기지국은 추가되는 부서빙셀을 위한 별도의 TAG ID를 정의하지 않을 수 있다. 이 경우 재편성된 TAG 구성정보는 'Null'로 설정된 TAG ID를 포함하거나, 재편성된 TAG 구성정보가 전송되지 않는다.

<151> 먼저, 재편성된 TAG 구성정보가 임시 TAG ID를 포함하는 경우에 관하여 설명한다.

<152> (2-2-1) 재편성된 TAG 구성정보가 임시 TAG ID를 포함하는 경우

<153> 본 실시예는 TAG 구성정보가 부서빙셀 구성정보와 별개의 필드로 정의되는 경우의 제1 실시예와, TAG 구성정보가 부서빙셀 구성정보에 포함되는 경우의 제2 실시예를 포함한다. 먼저, 제1 실시예에 관하여 개시된다.

<154> 도 10은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<155> 도 10을 참조하면, 기지국은 부서빙셀의 추가를 결정한다(S1000). 예를 들어, 단말에 지원해야 하는 대역폭이 증가하는 경우 또는 핸드오버에 의해 타겟 기지국(target eNB)의 새로운 셀로 접속하는 경우 기지국은 부서빙셀의 추가를 결

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정할 수 있다.

<156> 기지국과 단말은 먼저 부서빙셀의 추가를 위한 RRC 연결 재구성 절차를 수행한다(S1005). 단계 S1005의 RRC 연결 재구성 메시지는 부서빙셀 구성정보를 포함한다. 다음으로, 기지국과 단말은 TAG 재편성을 위한 RRC 연결 재구성 절차를 수행한다(S1010). 단계 S1010의 RRC 연결 재구성 메시지는 TAG 구성정보를 포함한다. 그리고 TAG 구성정보는 임시 TAG ID를 지시한다.

<157> 기지국은 추가된 부서빙셀에 대하여 스케줄링하고자 하는 경우, 상기 추가된 부서빙셀을 활성화하는 활성화 지시자를 단말로 전송한다(S1015).

<158> 단말은 추가된 부서빙셀에 관한 상향링크 동기를 확보하지 못하였으므로, 상기 추가된 부서빙셀에 대해 조정되어야 할 시간정렬 값을 획득하여야 한다. 이는 기지국에 의해 지시되는 랜덤 액세스 절차를 통해 구현될 수 있다.

<159> 기지국은 단말에 추가 구성된 부서빙셀에 관한 랜덤 액세스 절차의 개시를 지시하는 PDCCH 지시(order)를 단말로 전송한다(S1020).

<160> 단말은 추가된 부서빙셀상에서 랜덤 액세스 프리앰블을 기지국으로 전송한다(S1025). 단계 S1020과 S1025의 랜덤 액세스 절차는 도 7에 따를 수 있다.

<161> 랜덤 액세스 절차에 의해, 기지국은 추가된 부서빙셀에 관한 시간정렬 값을 획득할 수 있고, 이를 기반으로 추가된 부서빙셀을 특정한 TAG에 맵핑하는 TAG 재편성을 수행한다(S1030).

<162> 기지국은 TAG의 재편성을 위한 RRC 연결 재구성 절차를 수행한다(S1035).

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TAG의 재편성을 위한 RRC 연결 재구성 절차는, 기지국이 상기 재편성된 TAG 구성정보를 포함하는 RRC 연결 재구성 메시지를 단말로 전송하고, 단말이 TAG를 재편성한 후에 RRC 연결 재구성 완료 메시지를 기지국으로 전송하는 과정을 포함한다.

<163> 일반적인 랜덤 액세스 절차에 따르면, 기지국이 랜덤 액세스 프리앰블에 대한 응답으로 랜덤 액세스 응답 메시지를 전송해야 한다. 그러나, 단계 S1025, S1030의 랜덤 액세스 절차는 추가되는 부서빙셀을 TAG에 맵핑하고 TAG를 재편성하는데 사용하는 부수적인 것이다. 따라서 랜덤 액세스 응답 메시지를 전송하는 단계는 생략될 수 있으며, TAG의 재편성을 위한 RRC 연결 재구성 메시지가 TAG의 재편성을 지시할 뿐만 아니라, 랜덤 액세스 절차의 성공 또는 중단을 의미할 수 있다. 물론, 본 실시예는 랜덤 액세스 응답 메시지를 전송하는 단계를 포함할 수도 있으며, 이 경우 단계 S1035는 기지국이 랜덤 액세스 응답 메시지를 단말로 전송한 이후에 수행될 수 있다.

<164> 랜덤 액세스 절차의 진행 중에 TAG의 재편성을 위한 RRC 연결 재구성 메시지를 수신한 단말은 랜덤 액세스 절차가 성공한 것으로 판단하거나, 랜덤 액세스 절차가 기지국의 지시에 의해 중단된 것으로 판단하고, 랜덤 액세스 절차를 종료한다. 그리고 단말은 재편성된 TAG 구성정보에 따라 TAG를 재편성한다(S1040). 예를 들어, 단말은 임시 TAG ID가 부여되었던 부서빙셀을 재편성된 TAG 구성정보에 따라 할당된 ID의 TAG에 맵핑한다. 이 때, 할당된 ID의 TAG는 기존에 단말에 구성된 pTAG 또는 sTAG일 수도 있고, 새로운 sTAG일 수도 있다.

<165> 다음으로, TAG 구성정보가 부서빙셀 구성정보에 포함되는 경우의 제2 실시예

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를 개시한다.

<166> 도 11은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<167> 도 11을 참조하면, 기지국은 부서빙셀의 추가를 결정한다(S1100). 예를 들어, 단말에 지원해야 하는 대역폭이 증가하는 경우 또는 핸드오버에 의해 타겟 기지국(target eNB)의 새로운 셀로 접속하는 경우 기지국은 부서빙셀의 추가를 결정할 수 있다.

<168> 기지국과 단말은 먼저 부서빙셀의 추가 및 TAG 재편성을 위한 RRC 연결 재구성 절차를 수행한다(S1105). 단계 S1105의 RRC 연결 재구성 메시지는 부서빙셀 구성정보를 포함하고, 부서빙셀 구성정보는 TAG 구성정보를 포함한다. 그리고 TAG 구성정보는 임시 TAG ID를 지시한다.

<169> 기지국은 추가된 부서빙셀에 대하여 스케줄링하고자 하는 경우, 상기 추가된 부서빙셀을 활성화하는 활성화 지시자를 단말로 전송한다(S1110).

<170> 단말은 추가된 부서빙셀에 관한 상향링크 동기를 확보하지 못하였으므로, 상기 추가된 부서빙셀에 대해 조정되어야 할 시간정렬 값을 획득하여야 한다. 이는 기지국에 의해 지시되는 랜덤 액세스 절차를 통해 구현될 수 있다.

<171> 기지국은 단말에 추가 구성된 부서빙셀에 관한 랜덤 액세스 절차의 개시를 지시하는 PDCCH 지시(order)를 단말로 전송한다(S1115).

<172> 단말은 추가된 부서빙셀상에서 랜덤 액세스 프리앰블을 기지국으로 전송한다

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(S1120). 단계 S1115와 S1120의 랜덤 액세스 절차는 도 7에 따를 수 있다.

<173> 랜덤 액세스 절차에 의해, 기지국은 추가된 부서빙셀에 관한 시간정렬 값을 획득할 수 있고, 이를 기반으로 추가된 부서빙셀을 특정한 TAG에 맵핑하는 TAG 재편성을 수행한다(S1125).

<174> 기지국은 부서빙셀의 변경과 TAG의 재편성을 위한 RRC 연결 재구성 절차를 수행한다(S1130). 부서빙셀의 변경과 TAG의 재편성을 위한 RRC 연결 재구성 절차는, RRC 연결 재구성 메시지를 단말로 전송하고, 단말이 TAG를 재편성한 후에 RRC 연결 재구성 완료 메시지를 기지국으로 전송하는 과정을 포함한다. 여기서, RRC 연결 재구성 메시지는 기지국이 부서빙셀의 변경을 지시하는 부서빙셀 구성정보를 포함하고, 부서빙셀 구성정보는 상기 재편성된 TAG 구성정보를 포함한다.

<175> 일반적인 랜덤 액세스 절차에 따르면, 기지국이 랜덤 액세스 프리앰블에 대한 응답으로 랜덤 액세스 응답 메시지를 전송해야 한다. 그러나, 단계 S1120, S1125의 랜덤 액세스 절차는 추가되는 부서빙셀을 TAG에 맵핑하고 TAG를 재편성하는데 사용하는 부수적인 것이다. 따라서 랜덤 액세스 응답 메시지를 전송하는 단계는 생략될 수 있으며, TAG의 재편성을 위한 RRC 연결 재구성 메시지가 TAG의 재편성을 지시할 뿐만 아니라, 랜덤 액세스 절차의 성공 또는 중단을 의미할 수 있다. 물론, 본 실시예는 랜덤 액세스 응답 메시지를 전송하는 단계를 포함할 수도 있으며, 이 경우 단계 S1130은 기지국이 랜덤 액세스 응답 메시지를 단말로 전송한 이후에 수행될 수 있다.

<176> 랜덤 액세스 절차의 진행 중에 RRC 연결 재구성 메시지를 수신한 단말은 랜

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덤 액세스 절차가 성공한 것으로 판단하거나, 랜덤 액세스 절차가 기지국의 지시에 의해 중단된 것으로 판단하고, 랜덤 액세스 절차를 종료한다. 그리고 단말은 재편성된 TAG 구성정보에 따라 TAG를 재편성한다(S1135). 예를 들어, 단말은 임시 TAG ID가 부여되었던 부서빙셀을 재편성된 TAG 구성정보에 따라 할당된 ID의 TAG에 맵핑한다. 이 때, 할당된 ID의 TAG는 기존에 단말에 구성된 pTAG 또는 sTAG일 수도 있고, 새로운 sTAG일 수도 있다.

<177> 도 10과 도 11는 기지국이 TAG를 재편성한 것을 RRC 연결 재구성 절차를 이용하여 단말에 직접적으로 알려주는 실시예이다. 그런데, 다른 실시예에 따르면, 기왕에 랜덤 액세스 절차가 진행 중이므로, 기지국이 시간정렬 값을 랜덤 액세스 응답 메시지를 통해 단말로 알려줄 수도 있다. 이는 재편성된 TAG 구성정보를 단말에 직접적으로 알려주는 것은 아니지만, 단말이 시간정렬 값에 기초하여 스스로 TAG를 재편성할 수 있기 때문에, 기지국이 묵시적으로 재편성된 TAG 구성정보를 알려주는 것이라 볼 수 있다.

<178> 도 12는 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<179> 도 12를 참조하면, 단계 S1200 내지 단계 S1225는 도 11의 단계 S1100 내지 단계 S1125와 동일하므로, 설명을 생략한다.

<180> 기지국은 랜덤 액세스 프리앰블의 수신시점을 기준으로, 추가된 부서빙셀에 관한 시간정렬 값을 계산하고, 시간정렬 값을 지시하는 랜덤 액세스 응답 메시지를 단말로 전송한다(S1230). 이 때, 랜덤 액세스 응답 메시지는 MAC 메시지로서, 시간

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정렬 값은 MAC 랜덤 액세스 응답(RAR) 구조내의 필드에 의해 지시될 수도 있다. 이 경우, 랜덤 액세스 응답 메시지는 랜덤 액세스 절차에서 단말을 식별하는 RA(random access)-RNTI(radio network temporary identifier)에 의해 스크램블된(scrambled) PDCCH가 지시하는 PDSCH에 맵핑되어 전송된다. RA-RNTI에 의해 스크램블된 PDCCH는 공용 검색 공간을 제공하는 주서빙셀상으로 전송된다.

<181> 또는, 랜덤 액세스 응답 메시지는 MAC 제어요소(control element)에 의해 지시될 수도 있다. 시간정렬 값을 지시하는 필드를 시간전진명령(timing advance command: TAC) 필드라 한다. 이 경우, 랜덤 액세스 응답 메시지는 단말 특정 공간에서 단말을 식별하는 C(cell)-RNTI에 의해 스크램블된 PDCCH가 지시하는 PDSCH에 맵핑되어 전송된다. C-RNTI에 의해 스크램블된 PDCCH는 단말 특정 검색 공간을 제공하는 부서빙셀상으로 전송될 수 있다.

<182> 랜덤 액세스 응답 메시지를 수신하면, 단말은 TAG 재편성을 수행한다(S1235). TAG 재편성의 일례로서, 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG)에 적용되는 시간정렬 값과 동일한 TAG가 존재하는 경우, 단말은 추가된 부서빙셀을 해당 TAG로 매핑한다.

<183> TAG 재편성의 다른 예로서, 상기 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG) 내 적용되는 시간정렬 값과 다르고, 단말에 현재 구성된 TAG의 개수가 구성 가능한 최대 TAG 개수보다 작은 경우, 단말은 임시 TAG ID를 새로운 sTAG의 TAG ID로 지정하고, 추가 부서빙셀을 상기 TAG에 맵핑한다.

<184> TAG 재편성의 또 다른 예로서, 상기 시간정렬 값이 기존에 구성된 TAG(pTAG

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또는 sTAG) 내 적용되는 시간정렬 값과 다르고, 단말에 현재 구성된 TAG의 개수가 구성 가능한 최대 TAG 개수와 동일한 경우, i) 단말은 추가된 부서빙셀에 대한 시간정렬 값이 유효하지 않다고 판단하고 수신된 시간정렬값을 무시한다. ii) 또는 단말은 해당 TAG내의 상향링크 전송을 막기 위해 추가된 부서빙셀을 비활성화(deactivation)시킨다. 이는 새로운 TAG ID 및 현재 TAG의 구성이 유효하지 않으므로, 상기 TAG내의 상향링크 전송이 문제가 있을 수 있기 때문이다. iii) 또는 단말은 상기 비활성화 동작 대신 추가된 부서빙셀의 구성을 제거(release)할 수도 있다.

<185> 다음으로, 재편성된 TAG 구성정보가 전송되지 않은 경우에 관하여 설명한다.

<186> (2-2-2) 재편성된 TAG 구성정보가 전송되지 않은 경우

<187> 재편성된 TAG 구성정보가 전송되지 않는다는 것은, i) TAG ID=0이거나, ii) TAG ID='Null'이거나, iii)부서빙셀 구성정보내에 TAG 구성정보가 포함되지 않음을 의미할 수 있다. i)의 경우, pTAG의 ID가 기본적으로 0이므로, 추가되는 부서빙셀은 디폴트로서 pTAG에 맵핑된다. ii)와 iii)의 경우, 추가되는 부서빙셀은 디폴트로서 pTAG에 맵핑될 수도 있고, 어떠한 TAG에도 맵핑되지 않은 상태일 수도 있다. 이하에서, TAG 구성정보의 비전송시, 추가되는 부서빙셀이 pTAG에 디폴트로 맵핑되는 것으로 가정하여 각 실시예를 설명한다. 그러나, 각 실시예는 추가되는 부서빙셀이 어떠한 TAG에도 맵핑되지 않는 것으로 가정된 경우에도 동일하게 적용될 수 있다.

<188> 본 실시예는 TAG 구성정보가 부서빙셀 구성정보와 별개의 필드로 정의되는

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경우의 제1 실시예와, TAG 구성정보가 부서빙셀 구성정보에 포함되는 경우의 제2 실시예를 포함한다. 먼저, 제1 실시예에 관하여 개시된다.

<189> 도 13은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<190> 도 13을 참조하면, 기지국은 부서빙셀의 추가를 결정한다(S1300). 예를 들어, 단말에 지원해야 하는 대역폭이 증가하는 경우 또는 핸드오버에 의해 타겟 기지국의 새로운 셀로 접속하는 경우 기지국은 부서빙셀의 추가를 결정할 수 있다.

<191> 기지국과 단말은 먼저 부서빙셀의 추가를 위한 RRC 연결 재구성 절차를 수행한다(S1305). 단계 S1305의 RRC 연결 재구성 메시지는 부서빙셀 구성정보를 포함한다. 기지국과 단말은 TAG 재편성을 위한 RRC 연결 재구성 절차를 수행하지 않는다. 즉, 재편성된 TAG 구성정보가 전송되지 않는다.

<192> 단말은 추가된 부서빙셀을 pTAG로 재편성한다(S1310). 이는 추가되는 부서빙셀을 pTAG에 디폴트로서 맵핑하는 것이다.

<193> 기지국은 추가된 부서빙셀에 대하여 스케줄링하고자 하는 경우, 상기 추가된 부서빙셀을 활성화하는 활성화 지시자를 단말로 전송한다(S1315).

<194> 단말은 추가된 부서빙셀에 관한 상향링크 동기를 확보하지 못하였으므로, 상기 추가된 부서빙셀에 대해 조정되어야 할 시간정렬 값을 획득하여야 한다. 이는 기지국에 의해 지시되는 랜덤 액세스 절차를 통해 구현될 수 있다.

<195> 기지국은 단말에 추가 구성된 부서빙셀에 관한 랜덤 액세스 절차의 개시를

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지시하는 PDCCH 지시(order)를 단말로 전송한다(S1320).

<196> 단말은 추가된 부서빙셀상에서 랜덤 액세스 프리앰블을 기지국으로 전송한다(S1325). 추가된 부서빙셀은 디폴트로서 pTAG에 속한 상태이다. pTAG에서는 주서빙셀만이 랜덤 액세스 프리앰블을 전송하는 대표 서빙셀이다. 그러나, 추가된 부서빙셀은 새로운 부서빙셀이고 가장 최신의 시간정렬 값을 획득할 수 있으므로 단말이 랜덤 액세스 프리앰블을 추가된 부서빙셀상으로 전송하는 것이 허용된다. 단계 S1320과 S1325의 랜덤 액세스 절차는 도 7에 따를 수 있다.

<197> 랜덤 액세스 절차에 의해, 기지국은 추가된 부서빙셀에 관한 시간정렬 값을 획득할 수 있고, 이를 기반으로 추가된 부서빙셀을 특정한 TAG에 맵핑하는 TAG 재편성을 수행한다(S1330).

<198> 기지국은 TAG의 재편성을 위한 RRC 연결 재구성 절차를 수행한다(S1335). TAG의 재편성을 위한 RRC 연결 재구성 절차는, 기지국이 상기 재편성된 TAG 구성정보를 포함하는 RRC 연결 재구성 메시지를 단말로 전송하고, 단말이 TAG를 재편성한 후에 RRC 연결 재구성 완료 메시지를 기지국으로 전송하는 과정을 포함한다.

<199> 일반적인 랜덤 액세스 절차에 따르면, 기지국이 랜덤 액세스 프리앰블에 대한 응답으로 랜덤 액세스 응답 메시지를 전송해야 한다. 그러나, 단계 S1325, S1330의 랜덤 액세스 절차는 추가되는 부서빙셀을 TAG에 맵핑하고 TAG를 재편성하는데 사용하는 부수적인 것이다. 따라서 랜덤 액세스 응답 메시지를 전송하는 단계는 생략될 수 있으며, TAG의 재편성을 위한 RRC 연결 재구성 메시지가 TAG의 재편성을 지시할 뿐만 아니라, 랜덤 액세스 절차의 성공 또는 중단을 의미할 수 있다.

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물론, 본 실시예는 랜덤 액세스 응답 메시지를 전송하는 단계를 포함할 수도 있으며, 이 경우 단계 S1335는 기지국이 랜덤 액세스 응답 메시지를 단말로 전송한 이후에 수행될 수 있다.

<200> 랜덤 액세스 절차의 진행 중에 TAG의 재편성을 위한 RRC 연결 재구성 메시지를 수신한 단말은 랜덤 액세스 절차가 성공한 것으로 판단하거나, 랜덤 액세스 절차가 기지국의 지시에 의해 중단된 것으로 판단하고, 랜덤 액세스 절차를 종료한다. 그리고 단말은 재편성된 TAG 구성정보에 따라 TAG를 재편성한다(S1340). 예를 들어, 단말은 임시 TAG ID가 부여되었던 부서빙셀을 재편성된 TAG 구성정보에 따라 할당된 ID의 TAG에 맵핑한다. 이 때, 할당된 ID의 TAG는 기존에 단말에 구성된 pTAG 또는 sTAG일 수도 있고, 새로운 sTAG일 수도 있다.

<201> 다음으로, TAG 구성정보가 부서빙셀 구성정보에 포함되는 경우의 제2 실시예를 개시한다.

<202> 도 14는 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<203> 도 14를 참조하면, 기지국은 부서빙셀의 추가를 결정한다(S1400). 예를 들어, 단말에 지원해야 하는 대역폭이 증가하는 경우 또는 핸드오버에 의해 타겟 기지국의 새로운 셀로 접속하는 경우 기지국은 부서빙셀의 추가를 결정할 수 있다.

<204> 기지국과 단말은 먼저 부서빙셀의 추가 및 TAG 재편성을 위한 RRC 연결 재구성 절차를 수행한다(S1405). 단계 S1405의 RRC 연결 재구성 메시지는 부서빙셀 구

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성정보를 포함하고, 부서빙셀 구성정보는 TAG 구성정보를 포함한다. 그리고 TAG 구성정보는 'Null'을 지시하는 TAG ID를 포함한다.

<205> 단말은 추가된 부서빙셀을 pTAG로 재편성한다(S1410). 이는 추가되는 부서빙셀을 pTAG에 디폴트로서 맵핑하는 것이다.

<206> 기지국은 추가된 부서빙셀에 대하여 스케줄링하고자 하는 경우, 상기 추가된 부서빙셀을 활성화하는 활성화 지시자를 단말로 전송한다(S1415).

<207> 단말은 추가된 부서빙셀에 관한 상향링크 동기를 확보하지 못하였으므로, 상기 추가된 부서빙셀에 대해 조정되어야 할 시간정렬 값을 획득하여야 한다. 이는 기지국에 의해 지시되는 랜덤 액세스 절차를 통해 구현될 수 있다.

<208> 기지국은 단말에 추가 구성된 부서빙셀에 관한 랜덤 액세스 절차의 개시를 지시하는 PDCCH 지시(order)를 단말로 전송한다(S1420).

<209> 단말은 추가된 부서빙셀상에서 랜덤 액세스 프리앰블을 기지국으로 전송한다(S1425). 추가된 부서빙셀은 디폴트로서 pTAG에 속한 상태이다. pTAG에서는 주서빙셀만이 랜덤 액세스 프리앰블을 전송하는 대표 서빙셀이다. 그러나, 추가된 부서빙셀은 새로운 부서빙셀이고 가장 최신의 시간정렬 값을 획득할 수 있으므로 단말이 랜덤 액세스 프리앰블을 추가된 부서빙셀상으로 전송하는 것이 허용된다. 단계 S1420과 S1425의 랜덤 액세스 절차는 도 7에 따를 수 있다.

<210> 랜덤 액세스 절차에 의해, 기지국은 추가된 부서빙셀에 관한 시간정렬 값을 획득할 수 있고, 이를 기반으로 추가된 부서빙셀을 특정한 TAG에 맵핑하는 TAG 재

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편성을 수행한다(S1430).

<211> 기지국은 부서빙셀의 변경과 TAG의 재편성을 위한 RRC 연결 재구성 절차를 수행한다(S1435). 부서빙셀의 변경과 TAG의 재편성을 위한 RRC 연결 재구성 절차는, RRC 연결 재구성 메시지를 단말로 전송하고, 단말이 TAG를 재편성한 후에 RRC 연결 재구성 완료 메시지를 기지국으로 전송하는 과정을 포함한다. 여기서, RRC 연결 재구성 메시지는 기지국이 부서빙셀의 변경을 지시하는 부서빙셀 구성정보를 포함하고, 부서빙셀 구성정보는 상기 재편성된 TAG 구성정보를 포함한다.

<212> 일반적인 랜덤 액세스 절차에 따르면, 기지국이 랜덤 액세스 프리앰블에 대한 응답으로 랜덤 액세스 응답 메시지를 전송해야 한다. 그러나, 단계 S1420, S1425의 랜덤 액세스 절차는 추가되는 부서빙셀을 TAG에 맵핑하고 TAG를 재편성하는데 사용하는 부수적인 것이다. 따라서 랜덤 액세스 응답 메시지를 전송하는 단계는 생략될 수 있으며, TAG의 재편성을 위한 RRC 연결 재구성 메시지가 TAG의 재편성을 지시할 뿐만 아니라, 랜덤 액세스 절차의 성공 또는 중단을 의미할 수 있다. 물론, 본 실시예는 랜덤 액세스 응답 메시지를 전송하는 단계를 포함할 수도 있으며, 이 경우 단계 S1435은 기지국이 랜덤 액세스 응답 메시지를 단말로 전송한 이후에 수행될 수 있다.

<213> 랜덤 액세스 절차의 진행 중에 RRC 연결 재구성 메시지를 수신한 단말은 랜덤 액세스 절차가 성공한 것으로 판단하거나, 랜덤 액세스 절차가 기지국의 지시에 의해 중단된 것으로 판단하고, 랜덤 액세스 절차를 종료한다. 그리고 단말은 재편성된 TAG 구성정보에 따라 TAG를 재편성한다(S1440). 예를 들어, 단말은 임시 TAG

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ID가 부여되었던 부서빙셀을 재편성된 TAG 구성정보에 따라 할당된 ID의 TAG에 맵핑한다. 이 때, 할당된 ID의 TAG는 기존에 단말에 구성된 pTAG 또는 sTAG일 수도 있고, 새로운 sTAG일 수도 있다.

<214> 도 13과 도 14는 기지국이 TAG를 재편성한 것을 RRC 연결 재구성 절차를 이용하여 단말에 직접적으로 알려주는 실시예이다. 그런데, 다른 실시예에 따르면, 기왕에 랜덤 액세스 절차가 진행 중이므로, 기지국이 시간정렬 값을 랜덤 액세스 응답 메시지를 통해 단말로 알려줄 수도 있다. 이는 재편성된 TAG 구성정보를 단말에 직접적으로 알려주는 것은 아니지만, 단말이 시간정렬 값에 기초하여 스스로 TAG를 재편성할 수 있기 때문에, 기지국이 묵시적으로 재편성된 TAG 구성정보를 알려주는 것이라 볼 수 있다.

<215> 도 15는 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<216> 도 15를 참조하면, 단계 S1500 내지 단계 S1530은 도 14의 단계 S1400 내지 단계 S1430과 동일하므로, 설명을 생략한다.

<217> 기지국은 랜덤 액세스 프리앰블의 수신시점을 기준으로, 추가된 부서빙셀에 관한 시간정렬 값을 계산하고, 시간정렬 값을 지시하는 랜덤 액세스 응답 메시지를 단말로 전송한다(S1535). 이 때, 랜덤 액세스 응답 메시지는 MAC 메시지로서, 시간정렬 값은 MAC 랜덤 액세스 응답(RAR) 구조내의 필드에 의해 지시될 수도 있다. 이 경우, 랜덤 액세스 응답 메시지는 랜덤 액세스 절차에서 단말을 식별하는 RA(random access)-RNTI(radio network temporary identifier)에 의해 스크램블된

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(scrambled) PDCCH가 지시하는 PDSCH에 맵핑되어 전송된다. RA-RNTI에 의해 스크램블된 PDCCH는 공용 검색 공간을 제공하는 주서빙셀상으로 전송된다. 또한 상기 랜덤 액세스 응답 메시지를 포함하는 PDSCH 또한 주서빙셀상으로 전송된다.

<218> 또는, 랜덤 액세스 응답 메시지는 MAC 제어요소(control element)에 의해 지시될 수도 있다. 시간정렬 값을 지시하는 필드를 시간전진명령(timing advance command: TAC) 필드라 한다. 이 경우, 랜덤 액세스 응답 메시지는 단말 특정 공간에서 단말을 식별하는 C(cell)-RNTI에 의해 스크램블된 PDCCH가 지시하는 PDSCH에 맵핑되어 전송된다. C-RNTI에 의해 스크램블된 PDCCH는 단말 특정 검색 공간을 제공하는 부서빙셀상으로 전송될 수 있다.

<219> 랜덤 액세스 응답 메시지를 수신하면, 단말은 시간정렬 값을 확인하고, TAG 재편성을 수행한다(S1540). RA-RNTI로 스크램블된 PDCCH를 수신한 경우, 단말은 RAR MAC PDU내의 서브헤더내의 랜덤 액세스 프리앰블 ID (RAPID)를 확인하고 상기 서브헤더에 의해 지시되는 MAC RAR로부터 시간정렬 값을 확인한다. C-RNTI로 스크램블된 PDCCH를 수신한 경우, 단말은 MAC PDU내의 서브헤더에서 확장된 TAC MAC CE 또는 TAC MAC CE에 해당하는 지시자 (LCID) 값을 확인하고 상기 서브헤더에 의해 지시되는 MAC 제어요소로부터 시간정렬 값을 확인한다.

<220> TAG 재편성의 일례로서, 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG) 내 적용되는 시간정렬 값과 동일한 경우, 단말은 추가된 부서빙셀을 해당 TAG로 재편성한다.

<221> TAG 재편성의 다른 예로서, 시간정렬 값이 기존에 구성된 TAG(pTAG 또는

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sTAG) 내 적용되는 시간정렬 값과 다른 경우, 단말은 추가된 부서빙셀을 새로운 TAG로 재편성한다. 또한 상기 새로운 TAG의 TAG ID는 단말에서 TAG ID로 사용되지 않는 TAG ID들 중 가장 작은 TAG ID값으로 설정된다. 또는 임의의 TAG ID값으로 설정될 수도 있다. 예를 들어, pTAG(TAG ID=0) 및 sTAG(TAG ID=2)가 단말에 구성되어 있는 경우, 새로운 TAG의 TAG ID=1이 된다. 또는, pTAG(TAG ID=0) 및 sTAG(TAG ID=1)가 단말에 구성되어 있는 경우, 새로운 TAG의 TAG ID=2가 된다.

<222> 도 13 내지 도 15는 추가된 부서빙셀이 pTAG가 아닌 다른 sTAG로 재편성되는 경우의 실시예들이다. 그런데, 기지국이 시간정렬 값을 확인한 결과, 추가된 부서빙셀이 pTAG에 편성되는 것이 맞아서 TAG의 재편성이 불필요한 경우, 기지국이 이를 단말에 알려줄 수 있는 방법이 필요하다.

<223> 도 16은 본 발명의 또 다른 예에 따른 TAG의 재편성 방법을 설명하는 흐름도이다.

<224> 도 16을 참조하면, 단계 S1600 내지 단계 S1625는 도 15의 단계 S1500 내지 단계 S1525와 동일하므로, 설명을 생략한다.

<225> 랜덤 액세스 절차에 의해, 기지국은 추가된 부서빙셀에 관한 시간정렬 값을 획득할 수 있고, 이를 기반으로 추가된 부서빙셀이 pTAG에 맵핑되는 것이 맞는 것으로 확인된 경우, 기지국은 TAG 재편성을 하지 않는 것으로 결정한다(S1630).

<226> 그리고 기지국은 PDCCH 지시를 단말로 전송한다(S1635). 이 때의 PDCCH 지시는 현재의 TAG 재편성이 확정됨을 의미할 수 있다. 또는 PDCCH 지시는 현재 진행

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중인 랜덤 액세스 절차의 중단을 의미할 수 있다.

<227> 단말은 pTAG 내 추가된 부서빙셀에 대하여 랜덤 액세스 절차를 진행 중에 부서빙셀에 대한 PDCCH 지시를 수신한 경우, 진행 중이던 랜덤 액세스 절차를 중단한다(S1640). 이 때 PDCCH 지시가 랜덤 액세스 절차 중단으로 인식되는 경우는 추가된 부서빙셀이 현재 진행 중인 랜덤 액세스 절차를 위해 수신했던 PDCCH 지시내 파라미터들과 동일한 경우에 한한다.

<228> 도 17은 본 발명의 일 예에 따른 단말이 TAG를 재편성하는 방법을 설명하는 순서도이다.

<229> 도 17을 참조하면, 단말은 부서빙셀 구성정보 또는, 상기 부서빙셀 구성정보와 재편성된 TAG 구성정보를 기지국으로부터 수신한다(S1700). 상기 부서빙셀 구성정보와 상기 TAG 구성정보는 하나의 RRC 연결 재구성 절차를 통해 수신될 수도 있고, 서로 다른 RRC 연결 재구성 절차를 통해 수신될 수도 있다. 또는, 상기 TAG 구성정보는 상기 부서빙셀 구성정보에 포함될 수도 있다.

<230> 단말은 부서빙셀 구성정보가 부서빙셀의 추가를 위한 것인지, 부서빙셀의 제거를 위한 것인지 확인한다(S1705). 부서빙셀 구성정보가 sCellToReleaseList 필드를 포함하면, 상기 부서빙셀 구성정보는 부서빙셀의 제거를 위한 것이다. 반면, 부서빙셀 구성정보가 sCellToAddModList 필드를 포함하면, 상기 부서빙셀 구성정보는 부서빙셀의 추가를 위한 것이다.

<231> 만약 상기 부서빙셀 구성정보가 부서빙셀의 제거를 위한 것이면, 단말은 해

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당 부서빙셀의 구성을 제거한다(S1710). 일례로서, 단말이 상기 부서빙셀 구성정보와 재편성된 TAG 구성정보를 하나의 RRC 연결 재구성 절차를 통해 수신한 경우, 단말은 해당 부서빙셀을 제거한다. 다른 예로서, 단말이 상기 부서빙셀 구성정보와 재편성된 TAG 구성정보를 서로 다른 RRC 연결 재구성 절차를 통해 수신한 경우, 단말은 해당 부서빙셀을 제거하고, TAG를 재편성한다.

<232> 만약, 상기 부서빙셀 구성정보가 부서빙셀의 추가를 위한 것이면, 단말은 TAG 구성정보를 수신하였는지 확인한다(S1715). 단말이 TAG 구성정보를 수신하지 않았다는 것은, 기지국이 TAG 구성정보를 전송하지 않았다는 것을 의미한다. 또는 TAG 구성정보를 수신하지 않았다는 것은, TAG 구성정보가 부서빙셀 구성정보에 포함되지 않았다는 것을 의미한다. 이는 곧 (2-2-2)절에서 설명된 바와 같이 i) TAG ID=0이거나, ii) TAG ID='Null'이거나, iii) 부서빙셀 구성정보내에 TAG 구성정보가 포함되지 않음을 의미할 수 있다.

<233> 만약, 단말이 TAG 구성정보를 수신하지 않았다면, 단말은 추가된 부서빙셀을 디폴트로서 pTAG에 재편성하거나, 새로운 sTAG로 할당하거나 어떠한 TAG ID도 부여하지 않는다(S1720).

<234> 단말은 기지국으로부터 PDCCH 지시(order)를 수신하고(S1725), 그에 대한 응답으로 랜덤 액세스 프리앰블을 기지국으로 전송한다(S1730).

<235> 단말은 재편성 완료 메시지를 기지국으로부터 수신하고(S1735), 재편성 완료 메시지의 지시에 기반하여 TAG를 재편성한다(S1740). 재편성 완료 메시지는 예를 들어, 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지, RRC 연결 재구성 메시지,

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및 PDCCH 지시 중 적어도 하나일 수 있다.

<236> 일례로서, 재편성 완료 메시지가 랜덤 액세스 응답 메시지인 경우, 재편성 완료 메시지는 MAC RAR 또는 MAC 제어요소일 수 있다. RA-RNTI로 스크램블된 PDCCH를 수신한 경우, 단말은 상기 PDCCH에 의해 지시되는 PDSCH로부터 시간정렬 값을 포함하는 MAC RAR을 확인할 수 있다. C-RNTI로 스크램블된 PDCCH를 수신한 경우, 단말은 상기 PDCCH에 의해 지시되는 PDSCH로부터 시간정렬 값을 포함하는 MAC 제어요소를 확인할 수 있다. 그리고 단말은 TAG 재편성을 수행한다. TAG 재편성의 일례로서, 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG)에 적용되는 시간정렬 값과 동일한 TAG가 존재하는 경우, 단말은 추가된 부서빙셀을 해당 TAG로 매핑한다. TAG 재편성의 다른 예로서, 상기 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG) 내 적용되는 시간정렬 값과 다르고, 단말에 현재 구성된 TAG의 개수가 구성 가능한 최대 TAG 개수보다 작은 경우, 단말은 임시 TAG ID를 새로운 sTAG의 TAG ID로 지정하고, 추가 부서빙셀을 상기 TAG에 맵핑한다. TAG 재편성의 또 다른 예로서, 상기 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG) 내 적용되는 시간정렬 값과 다르고, 단말에 현재 구성된 TAG의 개수가 구성 가능한 최대 TAG 개수와 동일한 경우, i) 단말은 추가된 부서빙셀에 대한 시간정렬 값이 유효하지 않다고 판단하고 수신된 시간정렬값을 무시한다. ii) 또는 단말은 해당 TAG내의 상향링크 전송을 막기 위해 추가된 부서빙셀을 비활성화 (deactivation)시킨다. 이는 새로운 TAG ID 및 현재 TAG의 구성이 유효하지 않으므로, 상기 TAG내의 상향링크 전송이 문제가 있을 수 있기 때문이다. iii) 또는 단말은 상기 비활성화 동작 대신 추가된

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부서빙셀의 구성을 제거(release)할 수도 있다.

<237> 다른 예로서, 재편성 완료 메시지가 RRC 연결 재구성 메시지인 경우, 재편성 완료 메시지는 재편성된 TAG 구성정보를 포함한다. 재편성된 TAG 구성정보는 pTAG 이외의 특정한 TAG ID를 지시한다. 이 경우, 단말은 추가된 부서빙셀을 상기 특정한 TAG ID에 따른 TAG로 재편성한다.

<238> 또 다른 예로서, 재편성 완료 메시지가 PDCCH 지시인 경우, 재편성 완료 메시지는 추가되는 부서빙셀에서의 랜덤 액세스 절차를 중단시키는 의미의 지시자이다. 이 경우, 단말은 추가된 부서빙셀을 임시적으로 맵핑된 TAG(예를 들어 pTAG)로 유지하고, TAG를 재편성하지 않는다.

<239> 다시 단계 S1715에서, 만약 단말이 TAG 구성정보를 수신한 경우, TAG 구성정보가 지시하는 TAG ID가 임시 TAG ID인지, 정규 TAG ID인지 확인하고, TAG 구성정보가 지시하는 TAG ID에 따라 임시 TAG 또는 새로운 sTAG를 구성한다(S1745). 그리고 단말은 단계 S1725부터 단계 S1740을 수행한다.

<240> 도 18은 본 발명의 일 예에 따른 기지국이 TAG를 재편성하는 방법을 설명하는 순서도이다.

<241> 도 18을 참조하면, 기지국은 부서빙셀의 추가 또는 제거를 결정한다(S1800). 일례로서, 단말이 필요로 하는 주파수 대역이 감소하거나, 핸드오버로 서빙 기지국의 부서빙셀과의 접속을 해제하는 경우에 기지국은 단말에 구성된 부서빙셀의 제거를 결정할 수 있다. 다른 예로서, 단말에 지원해야 하는 대역폭이 증가하는 경우

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또는 핸드오버에 의해 타겟 기지국의 새로운 셀로 접속하는 경우 기지국은 단말에 부서빙셀의 추가구성을 결정할 수 있다. 부서빙셀의 추가 또는 제거는 부서빙셀 구성정보의 변경 또는 갱신에 해당한다.

<242> 단계 S1805에서, 부서빙셀 구성정보의 변경이 부서빙셀의 제거인 경우(S1805), 기지국은 부서빙셀의 제거를 위한 RRC 연결 재구성 메시지를 단말로 전송한다(S1810).

<243> 한편, 단계 S1805에서, 부서빙셀 구성정보의 변경이 부서빙셀의 추가인 경우, 기지국은 추가되는 부서빙셀의 시간정렬 값을 획득할 수 있는지 확인한다(S1815). 만약 기지국이 추가되는 부서빙셀의 시간정렬 값을 확보하고 있거나 확보할 수 있는 경우, 기지국은 추가되는 부서빙셀을 특정한 TAG로 재편성하고(S1820), 맵핑되어야 하는 TAG ID를 지시하는 TAG 구성정보를 단말로 전송한다(S1825). 이때, TAG 구성정보는 부서빙셀 구성정보에 포함되어 전송될 수도 있고, 부서빙셀 구성정보와는 별개로 전송될 수도 있다.

<244> 특정 주파수 대역의 서빙셀은 항상 FSR이나 원격 무선 헤드를 통해 제공되는 경우, 기지국의 서비스 지역 내 모든 단말에 대해서 상기 특정 주파수 대역의 서빙셀과 기지국으로부터 직접 서비스되는 서빙셀은 시간정렬 값이 다르고 서로 다른 TAG에 속하므로, 기지국은 시간정렬 값을 확보할 수 없다.

<245> 다시 단계 S1815에서, 만약 기지국이 추가되는 부서빙셀의 시간정렬 값을 확보할 수 없는 경우, 기지국은 추가되는 부서빙셀을 임시 TAG ID에 맵핑하거나 추가되는 부서빙셀에 관한 TAG ID='Null'로 설정하거나, TAG 구성정보를 생성하지 않

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는다. 그리고 기지국은 부서빙셀의 추가를 위한 부서빙셀 구성정보, 또는 상기 부서빙셀 구성정보와 TAG 구성정보를 단말로 전송한다(S1830). 상기 부서빙셀 구성정보와 상기 TAG 구성정보는 하나의 RRC 연결 재구성 절차를 통해 전송될 수도 있고, 서로 다른 RRC 연결 재구성 절차를 통해 전송될 수도 있다. 또는, 상기 TAG 구성정보는 상기 부서빙셀 구성정보에 포함될 수도 있다. 부서빙셀에 관한 TAG ID='Null'이거나, TAG ID=0이면, 추가되는 부서빙셀은 임시적으로 pTAG에 맵핑되는 것으로 간주할 수도 있고, 어떠한 TAG에도 맵핑되지 않는 것으로 간주될 수도 있다.

<246> 기지국은 단말로 PDCCH 지시를 전송하고(S1835), 그에 대한 응답으로 랜덤 액세스 프리앰블을 추가되는 부서빙셀상에서 단말로부터 수신한다(S1840).

<247> 기지국은 랜덤 액세스 프리앰블의 수신 시점에 기반하여, 추가되는 부서빙셀의 시간정렬 값을 획득하고, 시간정렬 값에 기반하여 추가되는 부서빙셀을 특정한 TAG로 재편성한다(S1845). 예를 들어, 부서빙셀의 추가시 pTAG로 재편성된 상태에서 시간정렬 값이 pTAG와 동일하면, 기지국은 TAG를 재편성하지 않는다. 또는 부서빙셀의 추가시 pTAG로 재편성된 상태에서 시간정렬 값이 pTAG와 다르고, 다른 sTAG와 동일하면, 기지국은 추가되는 부서빙셀을 상기 sTAG로 재편성한다. 또는, 부서빙셀의 추가시 pTAG로 재편성된 상태에서 시간정렬 값이 pTAG와 다르고, 다른 sTAG와도 다르면, 기지국은 추가되는 부서빙셀을 새로운 sTAG로 재편성한다.

<248> 기지국은 재편성된 TAG를 단말에 알려주기 위한 재편성 완료 메시지를 단말로 전송한다(S1850). 재편성 완료 메시지는 예를 들어, 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지, RRC 연결 재구성 메시지, 및 PDCCH 지시 중 적어도 하나일

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수 있다.

<249> 일례로서, 재편성 완료 메시지가 랜덤 액세스 응답 메시지인 경우, 재편성 완료 메시지는 MAC RAR 또는 MAC 제어요소일 수 있다. RA-RNTI로 스크램블된 PDCCH를 수신한 경우, 단말은 상기 PDCCH에 의해 지시되는 PDSCH로부터 시간정렬 값을 포함하는 MAC RAR을 확인할 수 있다. C-RNTI로 스크램블된 PDCCH를 수신한 경우, 단말은 상기 PDCCH에 의해 지시되는 PDSCH로부터 시간정렬 값을 포함하는 MAC 제어요소를 확인할 수 있다. 이 경우, 단말은 시간정렬 값으로부터 추가된 부서빙셀을 기존에 구성된 어느 하나의 TAG로 묵시적으로 재편성한다.

<250> 다른 예로서, 재편성 완료 메시지가 RRC 연결 재구성 메시지인 경우, 재편성 완료 메시지는 재편성된 TAG 구성정보를 포함한다. 재편성된 TAG 구성정보는 pTAG 이외의 특정한 TAG ID를 지시한다. 이 경우, 단말은 추가된 부서빙셀을 상기 특정한 TAG ID에 따른 TAG로 재편성한다.

<251> 또 다른 예로서, 재편성 완료 메시지가 PDCCH 지시인 경우, 재편성 완료 메시지는 추가되는 부서빙셀에서의 랜덤 액세스 절차를 중단시키는 의미의 지시자이다. 이 경우, 단말은 추가된 부서빙셀을 임시적으로 맵핑된 TAG(예를 들어 pTAG)로 유지하고, TAG를 재편성하지 않는다.

<252> 도 19는 본 발명의 일 예에 따른 상향링크 동기에 관한 신호를 전송하는 단말과 기지국을 도시한 블록도이다.

<253> 도 19를 참조하면, 단말(1900)은 수신부(1905), 단말 프로세서(1910) 및 전

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송부(1920)를 포함한다. 단말 프로세서(1910)는 RRC 처리부(1911) 및 랜덤 액세스 처리부(1912)를 포함한다.

<254> 수신부(1905)는 기지국(1950)으로부터 부서빙셀 구성정보, TAG 구성정보, PDCCH 지시(order), 랜덤 액세스 응답 메시지 및 재편성 완료 메시지를 수신한다. 재편성 완료 메시지는 예를 들어, 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지, RRC 연결 재구성 메시지, 및 PDCCH 지시 중 적어도 하나일 수 있다.

<255> RRC 처리부(1911)는 RRC 절차에서 사용되는 메시지를 생성하거나, 기지국(1950)으로부터 수신한다. RRC 절차는 예를 들어, RRC 연결 설정 절차와 RRC 연결 재구성 절차를 포함한다. RRC 연결 재구성 절차에서 사용되는 메시지는 부서빙셀 구성정보, TAG 구성정보 중 적어도 하나를 포함할 수 있다.

<256> RRC 처리부(1911)는 주서빙셀과, 반송파 집성에 사용되는 적어도 하나의 부서빙셀을 반송파 집성으로 단말(1900)에 구성한다. 부서빙셀을 단말(1900)에 추가적으로 구성하거나, 이미 구성된 부서빙셀을 제거하는 절차는 부서빙셀 구성정보에 의해 지시될 수 있다.

<257> 한편, RRC 처리부(1911)는 부서빙셀 구성정보 및 TAG 구성정보가 지시하는 TAG ID 중 적어도 하나를 기반으로 TAG를 재편성한다. RRC 처리부(1911)는 TAG에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성한다. 예를 들어, 부서빙셀 구성정보가 특정 부서빙셀의 추가 또는 제거를 위한 정보필드를 포함하는 경우, RRC 처리부(1911)는 상기 정보필드의 지시에 따라 부서빙셀을 추가하거나 제거하고, 부서빙셀이 추가되거나 제거되는 TAG를 갱신 또는 재편성한다.

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<258> 또는 TAG 구성정보가 특정 부서빙셀이 특정 ID의 TAG로 맵핑됨을 지시하면, RRC 처리부(1911)는 TAG 구성정보에 기반하여 특정 부서빙셀을 상기 특정 ID의 TAG로 재편성한다. 특정한 TAG ID=0이거나, TAG ID=' Null' 이면, RRC 처리부(1911)는 상기 특정 부서빙셀이 디폴트로서 pTAG에 속하는 것으로 간주하고, 상기 특정 부서빙셀을 pTAG로 재편성한다. 또는 RRC 처리부(1911)는 상기 특정 부서빙셀을 어떠한 TAG에도 재편성하지 않는다. 만약, 특정한 TAG ID≠0인 임시적인 값을 가지는 경우, RRC 처리부(1911)는 상기 특정 부서빙셀을 임시 TAG ID로 재편성한다.

<259> 또는, RRC 처리부(1911)는 랜덤 액세스 처리부(1912)로부터 전달되는 부서빙셀에 관한 시간정렬 값에 기반하여 TAG를 재편성할 수 있다. TAG 재편성의 일례로서, 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG)에 적용되는 시간정렬 값과 동일한 TAG가 존재하는 경우, RRC 처리부(1911)는 추가된 부서빙셀을 해당 TAG로 매핑한다. TAG 재편성의 다른 예로서, 상기 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG) 내 적용되는 시간정렬 값과 다르고, 단말(1900)에 현재 구성된 TAG의 개수가 구성 가능한 최대 TAG 개수보다 작은 경우, RRC 처리부(1911)는 임시 TAG ID를 새로운 sTAG의 TAG ID로 지정하고, 추가 부서빙셀을 상기 TAG에 맵핑한다. TAG 재편성의 또 다른 예로서, 상기 시간정렬 값이 기존에 구성된 TAG(pTAG 또는 sTAG) 내 적용되는 시간정렬 값과 다르고, 단말(1900)에 현재 구성된 TAG의 개수가 구성 가능한 최대 TAG 개수와 동일한 경우, i) RRC 처리부(1911)는 추가된 부서빙셀에 대한 시간정렬 값이 유효하지 않다고 판단하고 수신된 시간정렬값을 무시한다. ii) 또는 RRC 처리부(1911)는 해당 TAG내의 상향링크 전송을 막기 위해

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추가된 부서빙셀을 비활성화(deactivation)시킨다. 이는 새로운 TAG ID 및 현재 TAG의 구성이 유효하지 않으므로, 상기 TAG내의 상향링크 전송이 문제가 있을 수 있기 때문이다. iii) 또는 RRC 처리부(1911)는 상기 비활성화 동작 대신 추가된 부서빙셀의 구성을 제거(release)할 수도 있다.

<260> 랜덤 액세스 처리부(1912)는 PDCCH 지시에 따라 랜덤 액세스 프리앰블을 생성하고, 이를 전송부(1920)로 보낸다. 또한, 랜덤 액세스 처리부(1912)는 수신부(1905)로부터 전달받은 랜덤 액세스 응답(RAR) 메시지에서 부서빙셀에 관한 시간정렬 값을 획득하고, 시간정렬 값으로서 상기 부서빙셀에 관한 상향링크 동기를 제어한다. 또한, 랜덤 액세스 처리부(1912)는 시간정렬 값을 RRC 처리부(1911)로 제공하여, RRC 처리부(1911)가 TAG 재편성을 할 수 있도록 허용한다.

<261> 전송부(1920)는 랜덤 액세스 프리앰블 또는 RRC 메시지를 기지국(1950)으로 전송한다.

<262> 기지국(1950)은 전송부(1955), 수신부(1960) 및 기지국 프로세서(1970)를 포함한다. 기지국 프로세서(1970)는 RRC 처리부(1971) 및 랜덤 액세스 처리부(1972)를 포함한다.

<263> 전송부(1955)는 부서빙셀 구성정보, TAG 구성정보, PDCCH 지시 및 RAR를 단말(1900)로 전송한다. 이때, 전송부(1955)는 부서빙셀 구성정보에 TAG 구성정보를 포함하여 전송할 수도 있고, 부서빙셀 구성정보와 독립 개별적으로 전송할 수도 있다.

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<264> 수신부(1960)는 랜덤 액세스 프리앰블 및 RRC 메시지를 단말(1900)로부터 수신한다.

<265> RRC 처리부(1971)는 단말(1900)에 대한 부서빙셀의 추가 또는 제거를 결정한다. 일례로서, 단말(1900)이 필요로 하는 주파수 대역이 감소하거나, 핸드오버로 서빙 기지국의 부서빙셀과의 접속을 해제하는 경우에 RRC 처리부(1971)는 단말(1900)에 구성된 부서빙셀의 제거를 결정할 수 있다. 다른 예로서, 단말(1900)에 지원해야 하는 대역폭이 증가하는 경우 또는 핸드오버에 의해 타겟 기지국의 새로운 셀로 접속하는 경우 RRC 처리부(1971)는 단말(1900)에 부서빙셀의 추가구성을 결정할 수 있다. 부서빙셀의 추가 또는 제거는 부서빙셀 구성정보의 변경 또는 갱신에 해당한다.

<266> 부서빙셀 구성정보의 변경이 부서빙셀의 제거인 경우, RRC 처리부(1971)는 부서빙셀의 제거를 위한 RRC 연결 재구성 메시지를 생성하여 전송부(1955)로 보낸다.

<267> 한편, 부서빙셀 구성정보의 변경이 부서빙셀의 추가인 경우, RRC 처리부(1971)는 부서빙셀의 시간정렬 값을 획득할 수 있는지 확인한다. 만약 RRC 처리부(1971)가 부서빙셀의 시간정렬 값을 확보하고 있거나 확보할 수 있는 경우, RRC 처리부(1971)는 부서빙셀을 특정한 TAG로 재편성하고 맵핑되어야 하는 TAG ID를 지시하는 TAG 구성정보를 생성하여 전송부(1955)로 보낸다. 이때, TAG 구성정보는 부서빙셀 구성정보에 포함될 수도 있고, 부서빙셀 구성정보와는 별개로 생성될 수도 있다.

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<268> RRC 처리부(1971)가 부서빙셀의 시간정렬 값을 확보할 수 없는 경우, RRC 처리부(1971)는 부서빙셀을 임시 TAG ID에 맵핑하거나 추가되는 부서빙셀에 관한 TAG ID='Null'로 설정하거나, TAG 구성정보를 생성하지 않는다. 그리고 RRC 처리부(1971)는 부서빙셀의 추가를 위한 부서빙셀 구성정보, 또는 상기 부서빙셀 구성정보와 TAG 구성정보를 생성하여 전송부(1955)로 보낸다.

<269> RRC 처리부(1971)는 상기 부서빙셀 구성정보와 상기 TAG 구성정보를 하나의 RRC 연결 재구성 메시지에 포함시킬 수도 있고, 서로 다른 RRC 연결 재구성 메시지에 포함시킬 수도 있다. 또는, RRC 처리부(1971)는 상기 TAG 구성정보를 상기 부서빙셀 구성정보에 포함시킬 수도 있다. 부서빙셀에 관한 TAG ID='Null'이거나, TAG ID=0이면, 추가되는 부서빙셀은 임시적으로 pTAG에 맵핑되는 것으로 간주할 수도 있고, 어떠한 TAG에도 맵핑되지 않는 것으로 간주될 수도 있다.

<270> 랜덤 액세스 처리부(1972)는 추가되는 부서빙셀의 상향링크 동기를 위한 시간정렬 값의 획득을 위해, PDCCH 지시자를 생성하여 전송부(1955)로 보낸다. 그리고 그에 대한 응답으로 수신부(1960)는 랜덤 액세스 프리앰블을 부서빙셀상에서 단말로부터 수신한다.

<271> 랜덤 액세스 처리부(1972)는 랜덤 액세스 프리앰블의 수신 시점에 기반하여, 추가되는 부서빙셀의 시간정렬 값을 획득하고, RRC 처리부(1971)는 시간정렬 값에 기반하여 추가되는 부서빙셀을 특정한 TAG로 재편성한다. 예를 들어, 부서빙셀의 추가시 pTAG로 재편성된 상태에서 시간정렬 값이 pTAG와 동일하면, RRC 처리부(1971)는 TAG를 재편성하지 않는다. 또는 부서빙셀의 추가시 pTAG로 재편성된 상태

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에서 시간정렬 값이 pTAG와 다르고, 다른 sTAG와 동일하면, RRC 처리부(1971)는 추가되는 부서빙셀을 상기 sTAG로 재편성한다. 또는, 부서빙셀의 추가시 pTAG로 재편성된 상태에서 시간정렬 값이 pTAG와 다르고, 다른 sTAG와도 다르면, RRC 처리부(1971)는 추가되는 부서빙셀을 새로운 sTAG로 재편성한다.

<272> RRC 처리부(1971) 또는 랜덤 액세스 처리부(1972)는 재편성된 TAG를 단말에 알려주기 위한 재편성 완료 메시지를 생성하여 전송부(1955)로 전달한다. 재편성 완료 메시지는 예를 들어, 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지, RRC 연결 재구성 메시지, 및 PDCCH 지시 중 적어도 하나일 수 있다.

<273> 일례로서, 재편성 완료 메시지가 랜덤 액세스 응답 메시지인 경우, 재편성 완료 메시지는 MAC RAR 또는 MAC 제어요소일 수 있다. RA-RNTI로 스크램블된 PDCCH를 수신한 경우, 랜덤 액세스 처리부(1972)는 상기 PDCCH에 의해 지시되는 PDSCH로부터 시간정렬 값을 포함하는 MAC RAR을 확인할 수 있다. C-RNTI로 스크램블된 PDCCH를 수신한 경우, 랜덤 액세스 처리부(1972)는 상기 PDCCH에 의해 지시되는 PDSCH로부터 시간정렬 값을 포함하는 MAC 제어요소를 확인할 수 있다. 이 경우, RRC 처리부(1971)는 시간정렬 값으로부터 추가된 부서빙셀을 기존에 구성된 어느 하나의 TAG로 묵시적으로 재편성한다.

<274> 다른 예로서, 재편성 완료 메시지가 RRC 연결 재구성 메시지인 경우, 재편성 완료 메시지는 재편성된 TAG 구성정보를 포함한다. 재편성된 TAG 구성정보는 pTAG 이외의 특정한 TAG ID를 지시한다. 이 경우, RRC 처리부(1971)는 추가된 부서빙셀을 상기 특정한 TAG ID에 따른 TAG로 재편성한다.

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<275> 또 다른 예로서, 재편성 완료 메시지가 PDCCH 지시인 경우, 재편성 완료 메시지는 추가되는 부서빙셀에서의 랜덤 액세스 절차를 중단시키는 의미의 지시자이다. 이 경우, RRC 처리부(1971)는 추가된 부서빙셀을 임시적으로 맵핑된 TAG(예를 들어 pTAG)로 유지하고, TAG를 재편성하지 않는다.

<276> 이상의 설명은 본 발명의 기술 사상을 예시적으로 설명한 것에 불과한 것으로서, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자라면 본 발명의 본질적인 특성에서 벗어나지 않는 범위에서 다양한 수정 및 변형이 가능할 것이다. 따라서, 본 발명에 개시된 실시 예들은 본 발명의 기술 사상을 한정하기 위한 것이 아니라 설명하기 위한 것이고, 이러한 실시 예에 의하여 본 발명의 기술 사상의 범위가 한정되는 것은 아니다. 본 발명의 보호 범위는 아래의 청구범위에 의하여 해석되어야 하며, 그와 동등한 범위 내에 있는 모든 기술 사상은 본 발명의 권리범위에 포함되는 것으로 해석되어야 할 것이다.

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【특허청구범위】

【청구항 1】

다중 요소 반송파 시스템에서 상향링크 동기를 획득하는 단말에 있어서,

부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용되는 랜덤 액세스 프리앰블의 전송을 제어하는 랜덤 액세스 처리부;

상기 랜덤 액세스 프리앰블을 기지국으로 전송하는 전송부;

상기 부서빙셀을 상기 단말에 추가적으로 구성함을 지시하는 부서빙셀 구성정보를 상기 기지국으로부터 수신하는 수신부; 및

동일한 시간정렬 값을 가지는 서빙셀들의 집합인 시간정렬그룹(TAG)에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성(re-organizing)하는 RRC(radio resource control) 처리부를 포함함을 특징으로 하는, 단말.

【청구항 2】

제 1 항에 있어서,

상기 부서빙셀 구성정보는 상기 TAG의 식별자(ID)를 지시하는 TAG 구성정보를 포함함을 특징으로 하는, 단말.

【청구항 3】

제 2 항에 있어서,

상기 TAG의 ID는 임시적으로 할당된 값인 것을 특징으로 하는, 단말.

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【청구항 4】

제 2 항에 있어서,

상기 RRC 처리부는 상기 TAG 구성정보를 기반으로 상기 TAG를 재편성함을 특징으로 하는, 단말.

【청구항 5】

제 1 항에 있어서,

상기 수신부는 상기 부서빙셀 구성정보와는 별개로 상기 TAG의 ID를 지시하는 TAG 구성정보를 수신함을 더 포함하는 것을 특징으로 하는, 단말.

【청구항 6】

제 1 항에 있어서,

상기 수신부는 상기 랜덤 액세스 프리앰블에 대한 응답으로서 상기 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지를 수신함을 더 포함하는 것을 특징으로 하는, 단말.

【청구항 7】

제 6 항에 있어서,

상기 RRC 처리부는 상기 시간정렬 값을 기반으로 상기 TAG를 재편성함을 특징으로 하는, 단말.

【청구항 8】

다중 요소 반송파 시스템에서 단말에 의한 상향링크 동기를 획득하는 방법에

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있어서,

부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용되는 랜덤 액세스 프리앰블을 기지국으로 전송하는 단계;

상기 부서빙셀을 상기 단말에 추가적으로 구성함을 지시하는 부서빙셀 구성정보를 상기 기지국으로부터 수신하는 단계;

상기 랜덤 액세스 프리앰블에 대한 응답으로서 상기 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지를 상기 기지국으로부터 수신하는 단계; 및

동일한 시간정렬 값을 가지는 서빙셀들의 집합인 시간정렬그룹(TAG)에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성하는 단계를 포함함을 특징으로 하는, 상향링크 동기의 획득방법.

【청구항 9】

제 8 항에 있어서,

상기 부서빙셀 구성정보는 상기 TAG의 식별자(ID)를 지시하는 TAG 구성정보를 포함함을 특징으로 하는, 상향링크 동기의 획득방법.

【청구항 10】

제 9 항에 있어서,

상기 TAG의 ID는 임시적으로 할당된 값인 것을 특징으로 하는, 상향링크 동기의 획득방법.

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【청구항 11】

제 9 항에 있어서,

상기 TAG는 상기 TAG 구성정보를 재편성됨을 특징으로 하는, 상향링크 동기의 획득방법.

【청구항 12】

제 8 항에 있어서,

상기 부서빙셀 구성정보와는 별개로 상기 TAG의 ID를 지시하는 TAG 구성정보를 수신하는 단계를 더 포함함을 특징으로 하는, 상향링크 동기의 획득방법.

【청구항 13】

제 8 항에 있어서,

상기 랜덤 액세스 프리앰블에 대한 응답으로서 상기 시간정렬 값을 포함하는 랜덤 액세스 응답 메시지를 수신하는 단계를 더 포함함을 특징으로 하는, 상향링크 동기의 획득방법.

【청구항 14】

제 13 항에 있어서,

상기 TAG는 상기 시간정렬 값을 기반으로 재편성됨을 특징으로 하는, 상향링크 동기의 획득방법.

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제출 일자 : 2012-03-23

【요약서】

【요약】

본 발명은 다중 요소 반송파 시스템에서 상향링크 동기화 장치 및 방법에 관한 것이다.

이러한 본 명세서는 부서빙셀의 상향링크 시간의 동기를 위한 시간정렬 값의 획득에 사용되는 랜덤 액세스 프리앰블의 전송을 제어하는 랜덤 액세스 처리부, 상기 랜덤 액세스 프리앰블을 기지국으로 전송하는 전송부, 상기 부서빙셀을 상기 단말에 추가적으로 구성함을 지시하는 부서빙셀 구성정보를 상기 기지국으로부터 수신하는 수신부, 및 동일한 시간정렬 값을 가지는 서빙셀들의 집합인 시간정렬그룹(TAG)에 상기 부서빙셀이 포함되도록 상기 TAG를 재편성하는 RRC) 처리부를 포함하는 단말을 개시한다.

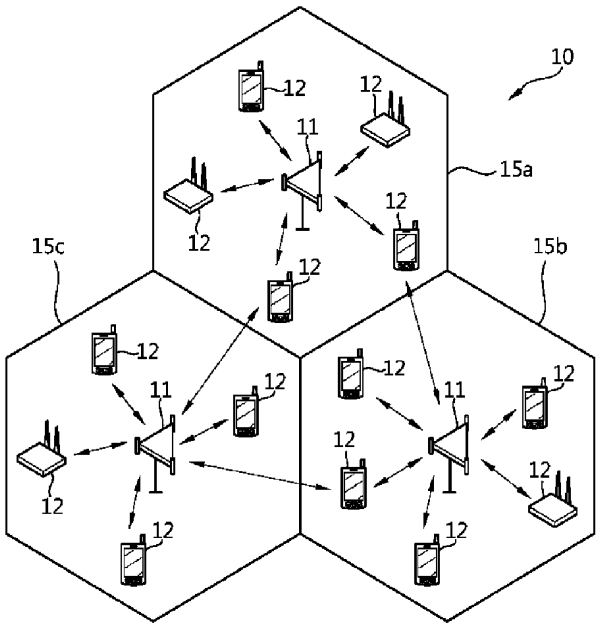
【대표도】

도 17

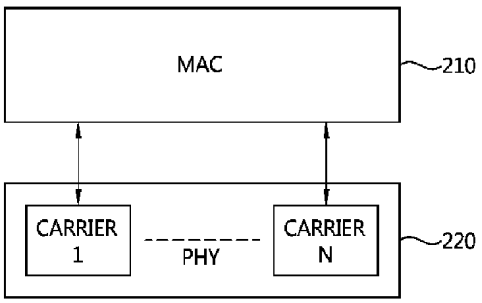
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【도면】

【도 1】

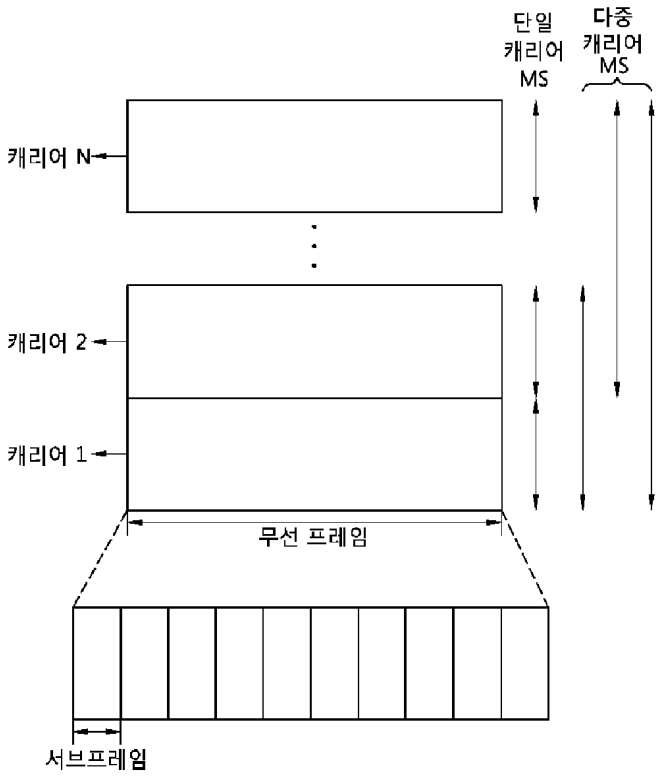


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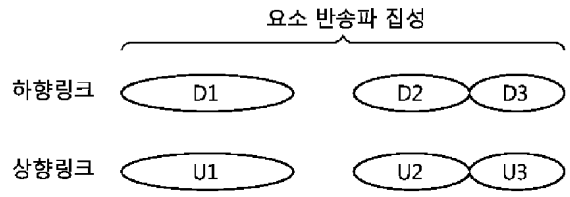


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【도 3】

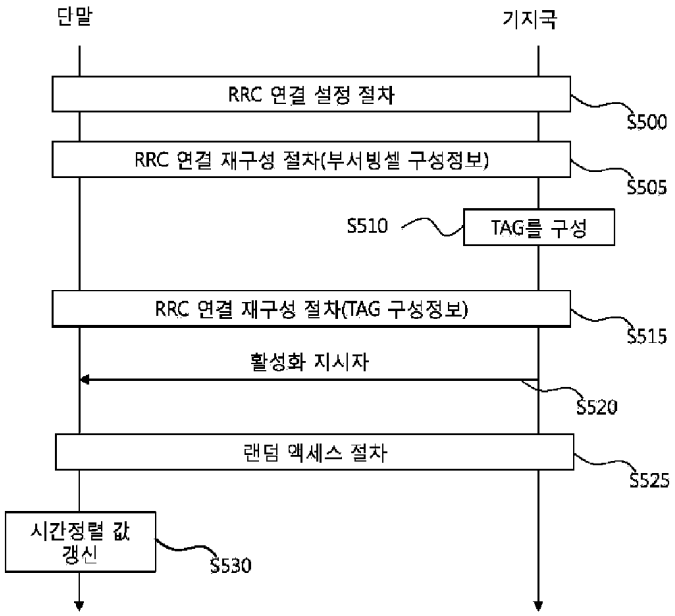


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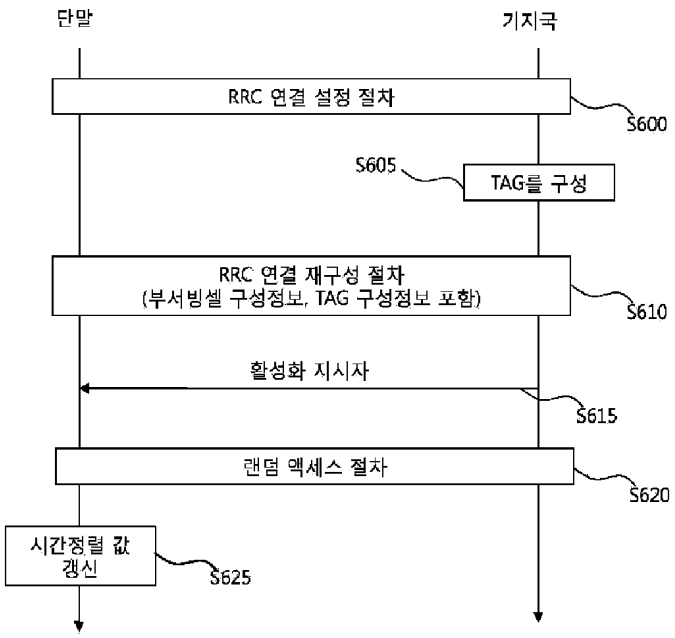


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【도 5】

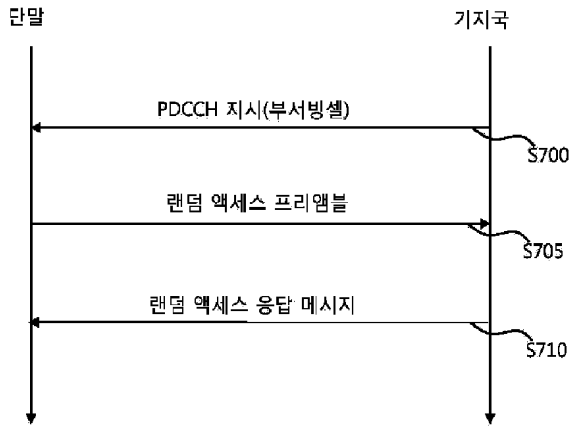


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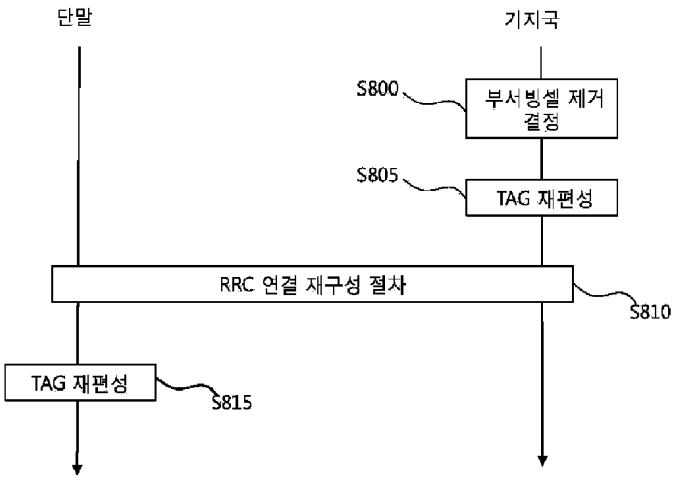


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【도 7】

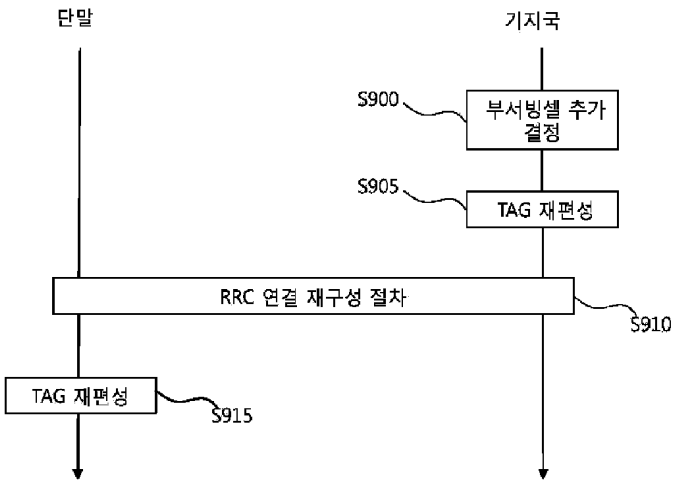


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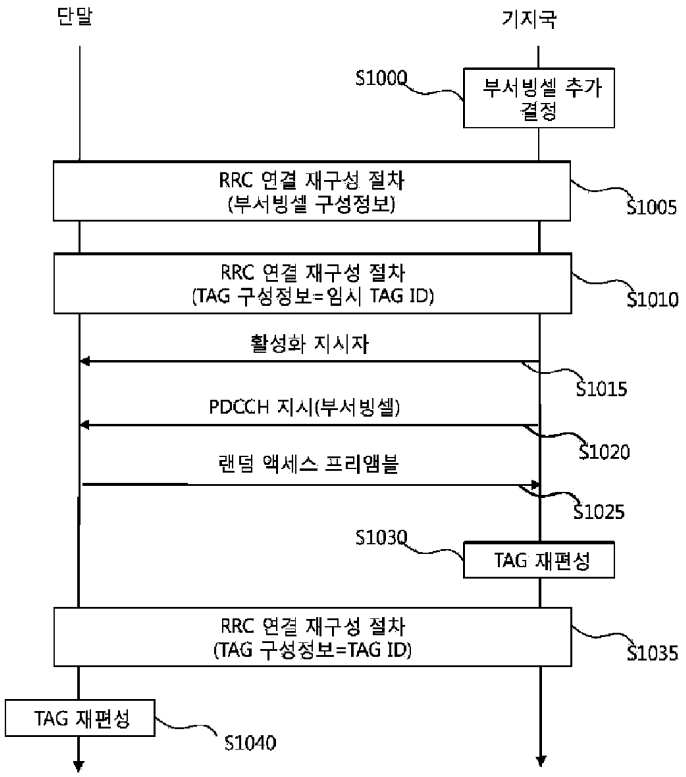


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【도 9】

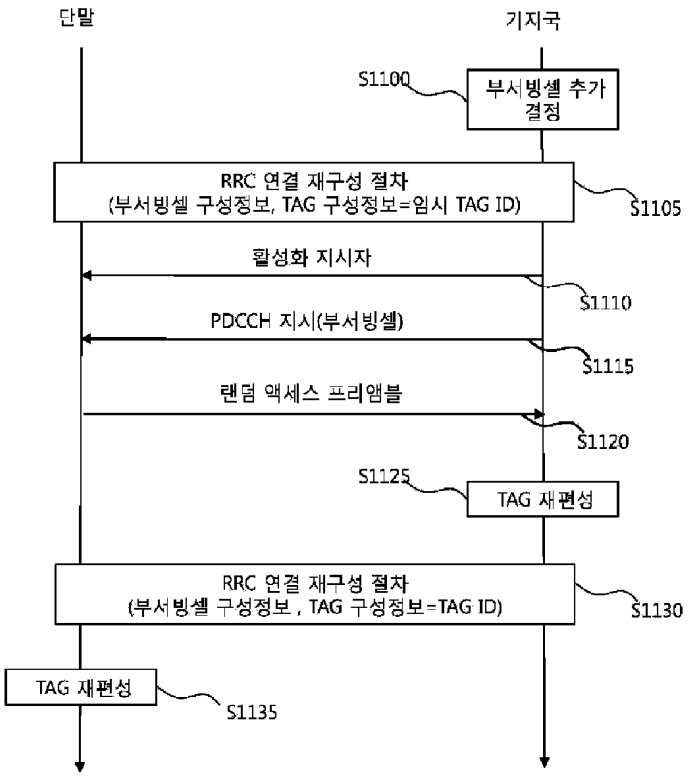


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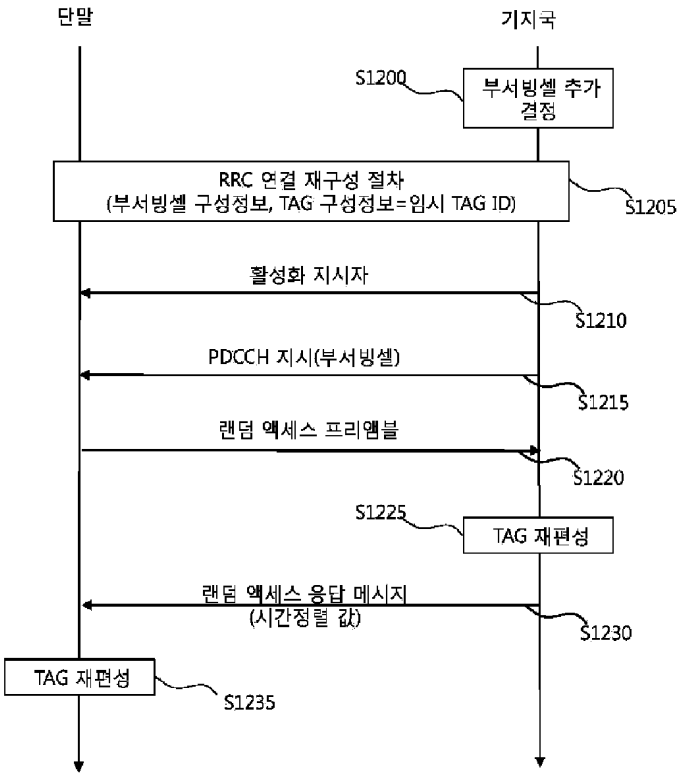
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【도 11】



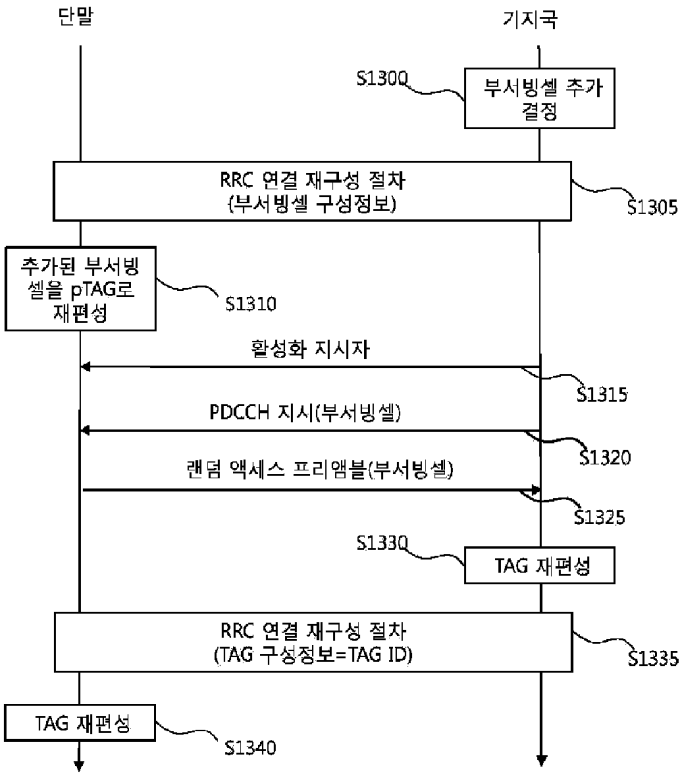
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【도 12】



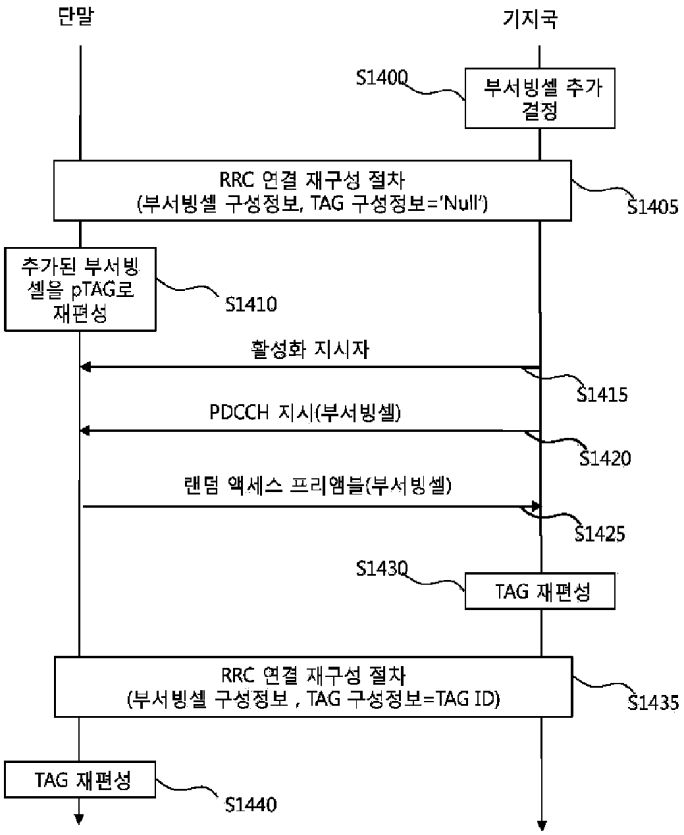
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【도 13】



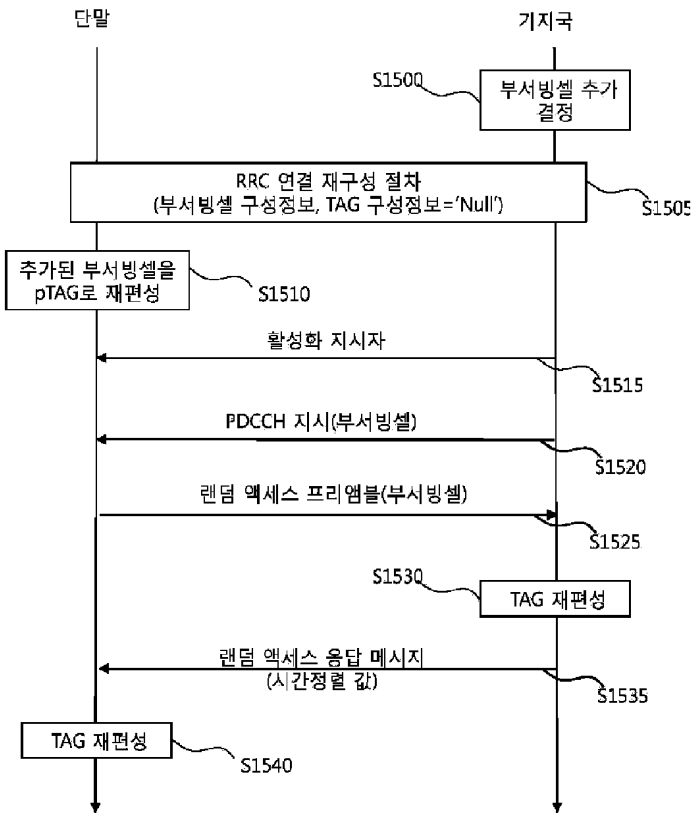
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【도 14】



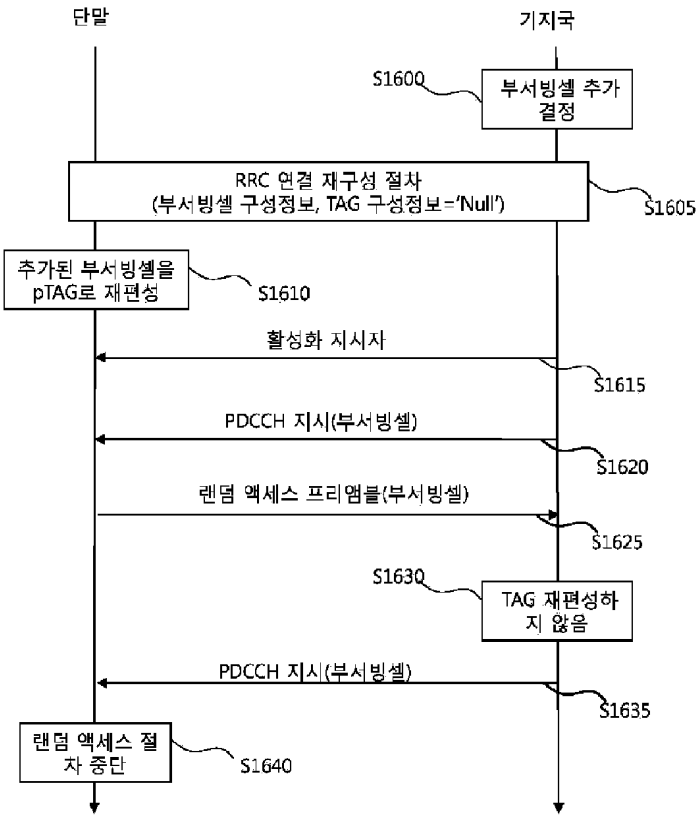
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【도 15】



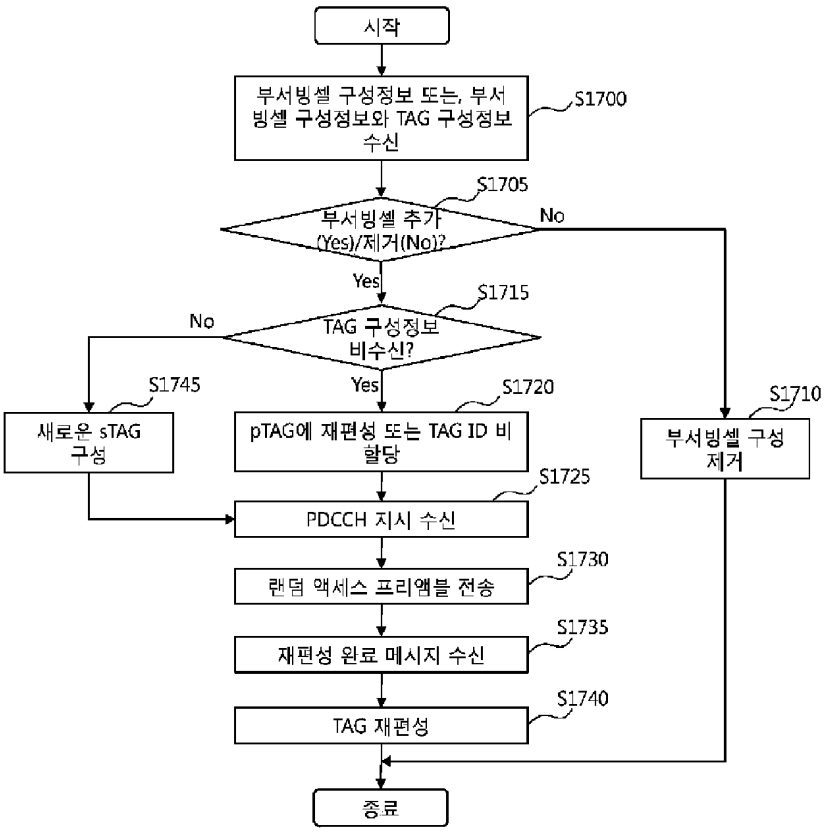
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【도 16】



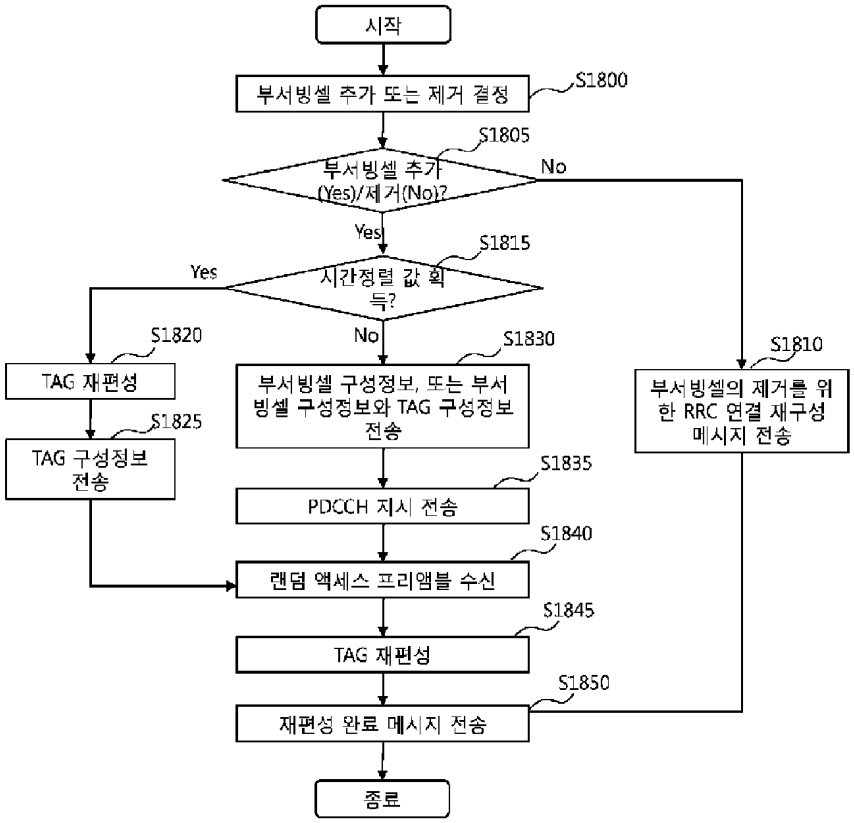
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【도 17】



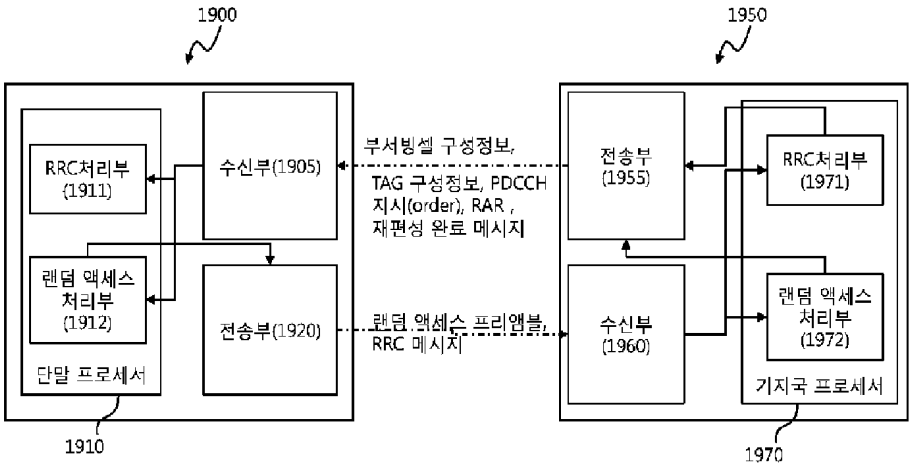
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【도 18】



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【도 19】



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1	3430

58027 7590 12/27/2016

H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

EXAMINER
HO, DUC CHI

ART UNIT	PAPER NUMBER
2465	

NOTIFICATION DATE	DELIVERY MODE
12/27/2016	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):

PATENT@PARK-LAW.COM

Office Action Summary	Application No. 15/338,993	Applicant(s) KWON ET AL.	
	Examiner DUC C. HO	Art Unit 2465	AIA (First Inventor to File) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* 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 *10-31-2016*.

☐ 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) *1-12* 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) *1-3,5-7 and 9-11* is/are rejected.

8)☒ Claim(s) *4,8 and 12* is/are objected to.

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

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

Application Papers

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

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

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☒ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *10-31-2016*.

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

4) ☐ Other: _____.

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

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit http://www.uspto.gov/forms/. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

3. Claims 1-3, 5-7 and 9-11 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-3, 5-7 and 9-11, respectively, of U.S. Patent No. 8,964,645. Although the claims at issue are not identical, they are not patentably distinct from each other because

Regarding claim 1, see entire claim (see claim 1 of the patent 8,964,645 at col.33, lines 14-29).

Regarding claim 2, see entire claim (see claim 2 of the patent 8,964,645 at col.33, lines 30-32).

Regarding claim 3, see entire claim (see claim 3 of the patent 8,964,645 at col.33, lines 33-35).

Regarding claim 5, see entire claim (see claim 5 of the patent 8,964,645 at col.33, lines 39-54).

Regarding claim 6, see entire claim (see claim 6 of the patent 8,964,645 at col.34, lines 1-3).

Regarding claim 7, see entire claim (see claim 7 of the patent 8,964,645 at col.34, lines 4-6).

Regarding claim 9, see entire claim (see claim 9 of the patent 8,964,645 at col.34, lines 10-23).

Regarding claim 10, see entire claim (see claim 10 of the patent 8,964,645 at col.34, lines 24-26).

Regarding claim 11, see entire claim (see claim 11 of the patent 8,964,645 at col.34, lines 27-29).

Regarding claim 1, Applicant merely narrows the scope of patent claim 1 by eliminating the limitations “wherein the TAG is associated with Scells having timing based on a same timing advance (TA) value”.

Regarding claims 2-3, these claims have similar limitations as those of the patent claims 2-3, respectively.

Regarding claim 5, Applicant merely narrows the scope of patent claim 5 by eliminating the limitations “wherein the TAG is associated with Scells having timing based on a same timing advance (TA) value”.

Regarding claims 6-7, these claims have similar limitations as those of the patent claims 6-7, respectively.

Regarding claim 9, Applicant merely narrows the scope of patent claim 9 by eliminating the limitations "wherein the TAG is associated with Scells having timing based on a same timing advance (TA) value".

Regarding claims 10-11, these claims have similar limitations as those of the patent claims 10-11, respectively.

It has been held that adding a functional limitation is an obvious expedient if the remaining elements perform the same function as before. Therefore, omission of a reference element whose function is not needed would be obvious to one skilled in the art.

Allowable subject matter

4. Claim 4 would be allowable if claim 1 rewritten or amended to overcome the DP rejection(s), set forth in this Office action.

5. Claim 8 would be allowable if claim 5 rewritten or amended to overcome the DP rejection(s), set forth in this Office action.

6. Claim 12 would be allowable if claim 9 rewritten or amended to overcome the DP rejection(s), set forth in this Office action.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Pelsa et al. (US 2012/0178456) is cited to show apparatus and

method for uplink synchronizing in multiple component carrier, which is considered pertinent to the claimed invention.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duc Ho whose telephone number is (571) 272-3147. The examiner can normally be reached on Monday through Friday from 9:30 am to 5:30 pm.

If attempt to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha Banks-Harold, can be reached on (571) 272-7905.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (571) 272-2600.

The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

9. 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).

Patent Examiner
/Duc Chi Ho/
12-15-2016

Notice of References Cited	Application/Control No. 15/338,993	Applicant(s)/Patent Under Reexamination KWON ET AL.	
	Examiner DUC C. HO	Art Unit 2465	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-2012/0178456 A1	07-2012	Peisa; Janne	H04W8/245	455/436
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	23	h04w56/0005 and scell and tag and add$4 and scellindex and rrc and (releas$3 or remov$3) near10 scell	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 17:40
L5	2	h04w36/0055 and scell and tag and add$4 and scellindex and rrc and (releas$3 or remov$3) near10 scell	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 17:44
L8	105	scell and "same" near4 tag and add$4 and scellindex and rrc with (releas$3 or remov$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:07
L9	2	rrc with ((releas$3 or remov$3) with scellindex) and scell with ("same" adj3 tag)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:23

12/ 14/ 2016 6:28:51 PM
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PTO/SB/08a (03-15)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	2016-10-31
First Named Inventor	Ki Bum KWON
Art Unit	15338993 - GAU: 2465
Examiner Name	
Attorney Docket Number	P5256USC1C1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/D.C.H/	1	8804668		2014-08-12	Dinan	
/D.C.H/	2	8964645		2015-02-00	Kwon, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/D.C.H/	1	20130114574		2013-05-09	Ng et al.	
/D.C.H/	2	20120142361		2012-06-07	Zhao et al.	
/D.C.H/	3	20130028185		2013-01-31	Wu	
/D.C.H/	4	20130064165		2013-03-14	Chen et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2016-10-31
	First Named Inventor	Ki Bum KWON
	Art Unit	15338993 - GAU: 2465
	Examiner Name	
	Attorney Docket Number	P5256USC1C1

/D.C.H/	5	20090170510		2009-07-02	Kim		
/D.C.H/	6	20130336298		2013-12-19	Dinan		
/D.C.H/	7	20130058309		2013-03-00	Kuo		
/D.C.H/	8	20130188612		2013-07-00	Dinan, Esmael Hejazi		
/D.C.H/	9	20140286240		2014-09-00	Kim, et al.		
/D.C.H/	10	20140120920		2014-05-00	Park, et al.		
/D.C.H/	11	20130188473		2013-07-00	Dinan, Esmael Hejazi		

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
/D.C.H/	1	2011-032497	WO		2011-03-24	Datang Mobile Comm. Equip. Co.	Corresponds to US 2012-0142361	☐
/D.C.H/	2	2257085	EP		2010-12-01	ZTE Corporation		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2016-10-31
	First Named Inventor	Ki Bum KWON
	Art Unit	15338993 – GAU: 2465
	Examiner Name	
	Attorney Docket Number	P5256USC1C1

/D.C.H/	3	2424306	EP		2012-02-29	NEC Corporation		☐
/D.C.H/	4	2387279	EP		2011-11-16	Panasonic Corporation		☐

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

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/D.C.H/	1	International Search Report dated June 26, 2013, issued for International Application No. PCT/KR2013/002421.	☐
/D.C.H/	2	Notice of Allowance issued October 17, 2014 issued for US Patent Application No. 13/849,296.	☐
/D.C.H/	3	3rd Generation Partnership Project Technical Specification 36.331, v10.5.0, dated March 14, 2012	☐
/D.C.H/	4	3rd Generation Partnership Project Technical Specification 36.300, v10.7.0, dated March 14, 2012	☐
/D.C.H/	5	3rd Generation Partnership Project Technical Specification 36.321, v10.5.0, dated March 16, 2012	☐
/D.C.H/	6	Non-Final Office Action issued March 27, 2015, in U.S. Patent Application No. 14/626,047.	☐
/D.C.H/	7	Non-Final Office Action issued April 21, 2016, in U.S. Patent Application No. 14/626,047.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2016-10-31
	First Named Inventor	Ki Bum KWON
	Art Unit	15338993 -- GAU: 2465
	Examiner Name	
	Attorney Docket Number	P5256USC1C1

/D.C.H/	8	Notice of Allowance issued July 29, 2016 issued for US Patent Application No. 14/626,047.	☐

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

EXAMINER SIGNATURE

Examiner Signature	/DUC C HO/	Date Considered	12/15/2016

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	2016-10-31
First Named Inventor	Ki Bum KWON
Art Unit	
Examiner Name	
Attorney Docket Number	P5256USC1C1

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	/Christopher B. Kilner/	Date (YYYY-MM-DD)	2016-10-31
Name/Print	Christopher B. Kilner	Registration Number	45,381

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

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The information provided by you in this form will be subject to the following routine uses:

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

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

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

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

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

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

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

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	50	(tag with ((secondary adj3 serving adj3 cell) or scell)) near5 chang$3 and "same" adj3 timing adj3 advance and scellindex	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/15 10:01
L7	22	rrc adj3 connection adj3 reconfiguration and first adj3 second adj3 field	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/15 10:04
L8	9	rrc adj3 connection adj3 reconfiguration and first adj3 second adj3 field and tag	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/15 10:05
L10	18	field adj10 ((release or removal) near10 scell)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/15 10:09
L11	3	field adj10 reconfigur$5 adj4 tag	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/15 10:09

12/ 15/ 2016 10:13:34 AM
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BIB DATA SHEET

CONFIRMATION NO. 3430

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
15/338,993	10/31/2016	370	2465	P5256USC1C1

APPLICANTS

Pantech Inc., Seoul, KOREA, REPUBLIC OF;

INVENTORS

Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;
Jae Hyun Ahn, Seoul, KOREA, REPUBLIC OF;
Kang Suk Huh, Seoul, KOREA, REPUBLIC OF;

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

This application is a CON of 14/626,047 02/19/2015 PAT 9516614
which is a CON of 13/849,296 03/22/2013 PAT 8964645

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

REPUBLIC OF KOREA 10-2012-0030216 03/23/2012

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

11/08/2016

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ Yes ☐ No	☑ Yes ☐ No	/DUC CHI HO/ Examiner's Signature	☐ Initials	KOREA, REPUBLIC OF	16	12	3

ADDRESS

H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191
UNITED STATES

TITLE

APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

FILING FEE RECEIVED		
1600	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15338993	KWON ET AL.
	Examiner	Art Unit
	DUC C HO	2465

CPC- SEARCHED		
Symbol	Date	Examiner
H04W56/0005; H04W36/0055	12-15-2016	DH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
East search	12-15-2016	DH
Inventor search	12-15-2016	DH

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15338993	KWON ET AL.
	Examiner	**Art Unit**
	DUC C HO	2465

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

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

CLAIM		DATE								
Final	Original	12/15/2016								
	1	✓								
	2	✓								
	3	✓								
	4	O								
	5	✓								
	6	✓								
	7	✓								
	8	O								
	9	✓								
	10	✓								
	11	✓								
	12	O								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L7	19	serving adj3 cell adj3 index and tag and scellindex and rrc with (removal or release)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:36
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L9	5	h04w56/0005.cpc. and "same" adj3 tag adj3 (id or identifier) and scellindex and rrc with (removal or release)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:37
L10	2	h04w36/0055.cpc. and "same" adj3 tag adj3 (id or identifier) and scellindex and rrc with (removal or release)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:38
L16	66	"same" adj3 tag and scellindex and rrc with ((removal or release) adj10 scell) and scell with tag and timing adj3 advance adj3 value and field with add$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:41
L20	4	rrc with (removal or release) and rrc adj3 connection adj3 reconfiguration and (second adj3 field) with scellindex	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:45
L21	5	(second adj3 field) with scellindex	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/12/14 18:45

12/14/2016 6:47:40 PM
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1

CONFIRMATION NO. 3430

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

PUBLICATION NOTICE



Title:APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

Publication No.US-2017-0048813-A1
Publication Date:02/16/2017

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 Office of Public Records. The Office of Public Records 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, Office of Public Records, 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 http://pair.uspto.gov/. 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

IPR2025-00720, OnePlus Ex. 1002
Page 234 of 353

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	Docket No.: P5256USC1C1
Ki Bum KWON *et al.*	
Serial No.: 15/338,993	Group Art Unit: 2465
Confirmation No.: 3430	
Filed: October 31, 2016	Examiner: HO, DUC CHI

For: **APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM**

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

REPLY UNDER 37 C.F.R. § 1.111

Dear Commissioner:

In response to the Non-Final Office Action mailed December 27, 2016 ("Office Action"), Applicants respectfully request reconsideration of the Application in view of the following Remarks.

A **Claim List** begins on page 2.

Remarks begin on page 5.

No extensions of time are required at this time. If extensions of time are necessary to prevent abandonment of this Application, then they are petitioned for under 37 C.F.R. § 1.136(a). No fees for net addition of claims are required at this time. Any fees required for extensions of time or for the net addition of claims may be charged to our Deposit Account No. 50-3698.

CLAIM LIST

This claim list replaces all prior claim lists in the Application.

1. (Original) A user equipment (UE) comprising:

a receiver to receive, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex and a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and an identifier of a timing advance group (TAG) associated with the one or more SCell;

a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and to add the one or more SCell as an available SCell for use with the UE and to associate the one or more SCell with another available SCell associated with same TAG identifier, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.

2. (Original) The UE of claim 1, wherein the RRC processor associates an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG.

3. (Original) The UE of claim 1, wherein the receiver receives the first and second field through a RRC connection reconfiguration message.

4. (Original) The UE of claim 1, wherein the receiver receives, from the base station, the first field comprising an indication to remove an SCell from SCells available to the

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UE.

5. (Original) A method of user equipment (UE), comprising:

receiving, from a base station, a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex

receiving, from the base station, a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellindex and an identifier of a timing advance group (TAG) associated with the one or more SCell;

releasing the SCell associated with the first SCellIndex for use with the UE;

adding the one or more SCell as available SCell for use with the UE; and

associating the one or more SCell with another available SCell associated with same TAG identifier, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.

6. (Original) The method of claim 5, further comprising:

associating an SCell with a TAG associated with a primary serving cell (PCell) when the second field to add an SCell does not comprise identifier of the TAG.

7. (Original) The method of claim 5, wherein the first and second field are received through a Radio Resource Control (RRC) connection reconfiguration message.

8. (Original) The method of claim 5, further comprising:

receiving, from the base station, the first field comprising an indication to remove an SCell from SCells available to the UE.

9. (Original) A method of a base station (BS), comprising:

generating a first field comprising a first serving cell index (SCellIndex) to release a serving cell (SCell) associated with the first SCellIndex;

generating a second field comprising at least one SCellIndex to add one or more SCell associated with the at least one SCellIndex and an identifier of a timing advance group (TAG) associated with the one or more SCell; and

transmitting, to a user equipment (UE), the first field to release the SCell associated with the first SCell and the second field to reconfigure the TAG by associating the one or more SCell with the TAG, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value.

10. (Original) The method of claim 9, further comprising:

configuring the identifier with no identifier of a TAG if the TAG of the one or more SCell is associated with a primary serving cell (PCell).

11. (Original) The method of claim 9, wherein the first and second field are transmitted through a Radio Resource Control (RRC) connection reconfiguration message.

12. (Original) The method of claim 9, further comprising:

generating the first field comprising an indication to remove an SCell from SCells available to the UE.

REMARKS

The claims have not been amended. Accordingly, claims 1-12 are currently pending in the Application, of which claims 1, 5, and 9 are independent. Applicants appreciate the indication that claims 4, 8, and 12 contain allowable subject matter.

In view of the following Remarks, Applicants respectfully request reconsideration and timely withdrawal of the pending rejections for the reasons discussed below.

Rejection of Claims under Double Patenting

Claims 1-3, 5-7, and 9-11 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-3, 5-7, and 9-11 of U. S. Patent No. 8,964,645 issued to Kwon, *et al*. ("Kwon").

Applicants have submitted a terminal disclaimer to overcome this rejection. Accordingly, Applicants respectfully request withdrawal of this double patenting rejection of claims 1-3, 5-7, and 9-11.

Applicants note that "[t]he filing of a terminal disclaimer to obviate a rejection based on nonstatutory double patenting is not an admission of the propriety of the rejection [because] the filing of a terminal disclaimer simply serves the statutory function of removing the rejection of double patenting, and raises neither a presumption nor estoppel on the merits of the rejection" (MPEP § 804.02.II, citations omitted). Hence, the terminal disclaimer included with this reply simply serves the statutory function of removing the double patenting rejection without raising a presumption or estoppel on the merits of the rejection.

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CONCLUSION

A full and complete response has been made to the pending Office Action, and all of the grounds for rejection have been overcome or rendered moot. Accordingly, all pending claims are allowable, and the Application is in condition for allowance.

The Examiner is invited to contact Applicants' undersigned representative at the number below if it would expedite prosecution. Prompt and favorable consideration of this Reply is respectfully requested.

Respectfully submitted,

/Christopher B. Kilner/

Christopher B. Kilner
Reg. No. 45,381

Date: March 17, 2017

CUSTOMER NUMBER: 58027
H.C. Park & Associates, PLC
1894 Preston White Drive
Reston, VA 20191
Tel: 703-288-5105
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PTO/AIA/80 (07-12)
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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: 58027

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: 58027

OR

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

Assignee Name and Address: Pantech Inc.
179 Seongam-ro, Mapo-gu, Seoul, Republic of Korea

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	이 석		Date November 19, 2015
Name	Jong-Seok Lee	Telephone	82-2-2030-0491
Title	IP Legal Team Leader		

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.

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Pantech Inc.

Application No./Patent No.: 15/338,993 Filed/Issue Date: 2016-10-31

Titled: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

Pantech Inc., a Corporation

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

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

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

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

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

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

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

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

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

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

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

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

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

1. From: Ki Bum KWON, et al To: Pantech Co., Ltd.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 030072, Frame 0257, or for which a copy thereof is attached.

2. From: Pantech Co., Ltd. To: Pantech Inc.

   The document was recorded in the United States Patent and Trademark Office at

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

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STATEMENT UNDER 37 CFR 3.73(c)

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4. From: _____ To: _____

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Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

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6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/Christopher B. Kilner/	2017-03-17
Signature	Date
Christopher B. Kilner	Patent Attorney (Reg. No. 45,381)
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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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TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) P5256USC1C1

In re Application of: Kwon et al.

Application No.: 15/338,993

Filed: October 31, 2016

For: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

The applicant, Pantech Inc., owner of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 8,964,645 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

expires for failure to pay a maintenance fee;
is held unenforceable;
is found invalid by a court of competent jurisdiction;
is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
has all claims canceled by a reexamination certificate;
is reissued; or
is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

I hereby acknowledge that any willful false statements made are punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 45,381

/Christopher B. Kilner/ — Signature
March 17, 2017 — Date

Christopher B. Kilner — Typed or printed name

Patent Attorney — Title
703-288-5105 — Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) included.

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

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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.

Electronic Patent Application Fee Transmittal

Application Number:	15338993
Filing Date:	31-Oct-2016
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Filer:	Hae-Chan Park/Lauren Spivey
Attorney Docket Number:	P5256USC1C1

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($)
Miscellaneous:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
		Total in USD ($)		**160**

Electronic Acknowledgement Receipt

EFS ID:	28664990
Application Number:	15338993
International Application Number:	
Confirmation Number:	3430
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Customer Number:	58027
Filer:	Hae-Chan Park/Lauren Spivey
Filer Authorized By:	Hae-Chan Park
Attorney Docket Number:	P5256USC1C1
Receipt Date:	17-MAR-2017
Filing Date:	31-OCT-2016
Time Stamp:	15:36:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$160
RAM confirmation Number	032017INTEFSW15370900
Deposit Account	
Authorized User	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		P5256USC1C1-NFOA.pdf	109931 fdc78edd4e247e46ab2d4fc2aa742399a0a2b482	yes	6

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Claims	2	4
Applicant Arguments/Remarks Made in an Amendment	5	6

Warnings:

Information:

2	Power of Attorney	P5256USC1C1-POA.pdf	716462 1a7290edc849f60b7b37fff6dff2e2ba1cdd0053	no	4

Warnings:

Information:

3	Terminal Disclaimer Filed	P5256USC1C1-TD.pdf	129590 bacf0184e1d8b11d3bd514c6ba56be3d0e86fed2	no	2

Warnings:

Information:

4	Fee Worksheet (SB06)	fee-info.pdf	30832 b3f2e502c8ad865c78c56713902c2f4119264a56	no	2

Warnings:

Information:

Total Files Size (in bytes):	986815

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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.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/338,993	Filing Date 10/31/2016	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

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

APPLICATION AS AMENDED – PART II

AMENDMENT **03/17/2017**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

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

* 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 number found in the appropriate box in column 1.

LIE
LINDA HUMES

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	15/338,993	KWON ET AL.	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 17 March, 2017	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

/CHARRISSA BROWN/

Technology Center: PLRC

Telephone: (571)272-1558

U.S. Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1

CONFIRMATION NO. 3430

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

POA ACCEPTANCE LETTER

OC000000090097609

Date Mailed: 03/24/2017

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/17/2017.

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

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

/yteferra/

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT4338246

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
PANTECH INC	10/31/2016

RECEIVING PARTY DATA

Name:	GOLDPEAK INNOVATIONS INC
Street Address:	SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU
City:	SEOUL
State/Country:	KOREA, REPUBLIC OF

PROPERTY NUMBERS Total: 39

Property Type	Number
Patent Number:	8145252
Patent Number:	8606284
Patent Number:	9503559
Patent Number:	9516614
Patent Number:	9575631
Patent Number:	9596352
Patent Number:	7257410
Patent Number:	7366222
Patent Number:	7639991
Patent Number:	7739190
Patent Number:	7801074
Patent Number:	7890130
Patent Number:	7929924
Patent Number:	8275328
Patent Number:	8332706
Patent Number:	8433350
Patent Number:	8583098
Patent Number:	8594740
Patent Number:	9008637
Patent Number:	9122518
Patent Number:	9191932

Property Type	Number
Patent Number:	9210594
Patent Number:	9363801
Patent Number:	8634818
Patent Number:	9100496
Application Number:	15457560
Application Number:	15338993
Application Number:	15173139
Application Number:	14589971
Application Number:	14754045
Application Number:	15167518
Application Number:	15017133
Application Number:	15436299
Application Number:	13466042
Application Number:	15354691
Application Number:	14921414
Application Number:	14179976
Application Number:	12958749
Application Number:	15212562

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Email: edward.park@fidelis-laws.com
Correspondent Name: FIDELIS LAW GROUP, PLLC
Address Line 1: 444 W BROAD ST UNIT 426
Address Line 4: FALLS CHURCH, VIRGINIA 22046

NAME OF SUBMITTER:	EDWARD PARK
SIGNATURE:	/sjp/
DATE SIGNED:	03/27/2017
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 4
source=Second Patent Assignment_Signed by Pantech_GP_Redacted#page1.tif
source=Second Patent Assignment_Signed by Pantech_GP_Redacted#page2.tif
source=Second Patent Assignment_Signed by Pantech_GP_Redacted#page3.tif
source=Second Patent Assignment_Signed by Pantech_GP_Redacted#page4.tif

PATENT ASSIGNMENT (SECOND)

This Patent Assignment (the "Assignment") is made from **PANTECH INC** ("Assignor"), a corporation organized and existing under the laws of Korea with its principal place at Pantech Building, 179 Seongam-ro Mapo-go, Seoul, Korea, to **GoldPeak Innovations Inc** ("Assignee"), a corporation organized under the laws of the Republic of Korea, having an address at suite # 806, Digital-ro 34-gil, 55, Guro-gu, Seoul, Korea.

WHEREAS, Assignor and Assignee have entered into that certain Patent Assignment Agreement dated as of October 31, 2016 (the "Agreement"), whereby, among other things, Assignor has agreed to assign, and Assignee has agreed to accept, all of those patents and patent applications listed on Annex A hereto, and all existing and any future Patents that may be granted therefore throughout the world, all of their foreign counterparts, reissues, re-examinations, renewals, extensions, provisional, divisional and continuation applications including continuation in part, and any United States and foreign applications and patents that claimed, claim and will claim priorities to those listed above, as well as all patents and applications from which those listed above derive, relate, or claim priority (collectively, the "Patent Rights").

NOW THEREFORE, in exchange for good and valuable consideration under the Agreement, the receipt and sufficiency of which Assignor hereby acknowledges, and as a condition to Assignee entering into the Agreement, Assignor hereby assigns and transfers to Assignee and Assignee accepts, all of the right, title and interest of Assignor throughout the world in and to any and all inventions claimed or disclosed in the Patent Rights.

This Assignment includes all of Assignor's right, title and interest in, to and under each of the Patent Rights (including without limitation, rights to damages and payments for past, present and future infringements or misappropriations, including the right to collect and receive any royalties, or settlements for such infringements, all rights to sue for injunctive or other equitable relief, and any and all causes of action relating to any of the inventions or discoveries thereof), and, as agreed to between the parties, all continuations, continuations-in-part, divisionals, substitutes, reexaminations, post-opposition foreign counterpart patents and applications, reissues and extensions thereof, if any; and, Assignor requests the Commissioner of Patents of the United States (and all foreign officials, whose duty it is to issue patents and applications as aforesaid) to record Assignee as the owner of such Patent Rights, to the same extent as held by Assignor, and to issue the Letters Patent for such Patent Rights in the name of Assignee, as assignee of the Patent Rights.

This instrument shall inure to the benefit of Assignee and its successors and assigns, and shall be binding upon Assignor and its successors and assigns.

Assignor hereby covenants that it has full right to convey the entire interest herein assigned, and that it has not executed, and will not execute, any agreement in conflict with this Assignment. Assignor hereby further covenants and agrees that it will communicate to Assignee any and all facts known to it respecting the Patent Rights, including the existing licenses, encumbrances or other restrictions that are expressly binding on successors to the Patent Rights, and testify in any

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legal proceeding, sign all lawful papers, execute and deliver all papers and take any actions that may be necessary or desirable to perfect the title to any aforementioned patents and inventions, execute all divisional, continuation, reexamination, reissue, substitute applications, and any similar and equivalent procedure under current and future legislations and regulations throughout the world, and make all rightful oaths to aid Assignee to obtain and enforce proper patent protection for said inventions in all countries.

Date of: _Dec 14, 2016_

PANTECH INC.

Signature

KIM, BYEONG JIN
Name

C.F.O
Title

GoldPeak Innovations Inc..:

Signature

Youngjoon Rhee
Name

CEO
Title

Annex A

Patents and/or Patent Applications

NO	Category	Application No	Filing Date	Patent No	Issued Date
1	[redacted]	14/685,143	4/13/2015	9300805	3/29/2016
2		13/849,296	3/22/2013	8964645	2/24/2015
3		13/888,891	5/7/2013	9030973	5/12/2015
4		13/978,524	7/5/2013	8934440	1/13/2015
5		13/580,779	8/23/2012	9071486	6/30/2015
6		14/816,736	8/3/2015	9357363	5/31/2016
7		13/758,444	2/4/2013	9256747	2/9/2016
8		14/840,644	8/31/2015	9250957	2/2/2016
9		12/777,006	5/10/2010	8341079	12/25/2012
10		14/152,152	1/10/2014	9113312	8/18/2015
11		14/058,901	10/21/2013	9172906	10/27/2015
12		12/556,331	9/9/2009	8332706	12/11/2012
13		12/599,463	5/9/2008	8278744	10/2/2012
14		11/285,960	11/23/2005	7881723	2/1/2011
15		KR 2012-0023831	3/8/2012	KR 1314472	9/26/2013
16		KR 2010-0084319	8/30/2010	KR 1318013	10/7/2013
17		13/857,294	4/5/2013	9072108	6/30/2015
18		13/412,933	3/6/2012	9167534	10/20/2015
19		13/594,539	8/24/2012	8489036	7/16/2013
20		11/285,943	11/23/2005	7577115	8/18/2009
21		12/904,777	10/14/2010	8682319	3/25/2013
22		10/330,737	12/27/2002	7167716	1/23/2007
23		13/875,808	5/2/2013	9392582	7/12/2016
24		13/143,688	7/7/2011	8559480	10/15/2013
25		12/629,570	12/2/2009	8345867	1/1/2013
26		14/464,041	8/20/2014	9380581	6/28/2016
27		13/383,821	1/12/2012	9009207	4/14/2015
28		12/546,363	8/24/2009	8144815	3/27/2012
29		12/582,164	10/20/2009	8675510	10/31/2013
30		11/532,284	9/13/2006	7853289	12/14/2010
31		13/653,969	10/17/2012	9398499	7/19/2016
32		13/177,761	7/7/2011	8929223	12/17/2014

33	[redacted]	12/832,685	7/8/2010	8301151	6/29/2012
34		12/539,384	10/12/2009	RE43930	8/30/2012
35		12/759,674	4/14/2010	RE43059	1/3/2012
36		11/263,858	11/2/2005	7904025	3/8/2011
37		12/861,637	8/23/2010	8098624	1/17/2012
38		10/744,321	12/22/2003	7333828	2/19/2008
39		10/749,456	12/31/2003	7123912	10/17/2006

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PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
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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: 146410

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: 146410

OR

☐

Firm or Individual Name	Fidelis Law Group, PLLC		
Address	444 W Broad St unit 426		
City	Falls Church	State VA	Zip 22046
Country	USA		
Telephone	571.730.4572	Email	edward.park@fidelis-laws.com

Assignee Name and Address: GOLDPEAK INNOVATIONS INC
SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU
SEOUL, REPUBLIC OF KOREA

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	27 / Mar / 2017
Name	Youngjoon Rhee	Telephone	+82.10.8929.1905
Title	CEO		

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.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: GOLDPEAK INNOVATIONS INC

Application No./Patent No.: 15/338,993 Filed/Issue Date: 10-31-2016

Titled: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

GOLDPEAK INNOVATIONS INC, a Corporation

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

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

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

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

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

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

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

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

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

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

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

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

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

1. From: PANTECH CO., LTD. To: PANTECH INC.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 039428, Frame 0268, or for which a copy thereof is attached.

2. From: PANTECH INC. To: GOLDPEAK INNOVATIONS INC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 041752, Frame 0983, or for which a copy thereof is attached.

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

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

PTO/AIA/96 (08-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/sjp/	4/4/2017
Signature	Date
Seong Jun PARK	73,534
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	28833350
Application Number:	15338993
International Application Number:	
Confirmation Number:	3430
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Customer Number:	58027
Filer:	Seong Jun Park
Filer Authorized By:	
Attorney Docket Number:	P5256USC1C1
Receipt Date:	04-APR-2017
Filing Date:	31-OCT-2016
Time Stamp:	19:36:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	POA.pdf	1045958 a87949d5c25ca9a30afe1aff1de0bb07b1b67cde	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	15338993.pdf	121971 65bcbfb28bd2ad7d178b2b42f1112b177ddffc16	no	3
Warnings:					
Information:					
			Total Files Size (in bytes):	1167929	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1

CONFIRMATION NO. 3430

OC000000090414166

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

Cc: FIDELIS LAW GROUP , PLLC
444 W BROAD ST UNIT 426
FALLS CHURCH, VA 22046

Date Mailed: 04/05/2017

DENIAL OF REQUEST FOR POWER OF ATTORNEY

The request for Power of Attorney filed 04/04/2017 is acknowledged. However, the request cannot be granted at this time for the reason stated below.

- ☐ The Power of Attorney you provided did not comply with the new Power of Attorney rules that became effective on June 25, 2004. See 37 CFR 1.32.
- ☐ The revocation is not signed by the applicant, the assignee of the entire interest, or one particular principal attorney having the authority to revoke.
- ☐ The Power of Attorney is from an assignee and the Certificate required by 37 CFR 3.73(c) has not been received.
- ☐ The person signing for the assignee has omitted their empowerment to sign on behalf of the assignee.
- ☐ The inventor(s) is without authority to appoint attorneys since the assignee has intervened as provided by 37 CFR 3.71.
- ☐ The signature(s) of _____ , a co-inventor in this application, has been omitted. The Power of Attorney will be entered upon receipt of confirmation signed by said co-inventor(s).
- ☐ The person(s) appointed in the Power of Attorney is not registered to practice before the U.S. Patent and Trademark Office.
- ☐ Only one Customer Number can be designated for the Power of Attorney in an application. The Customer Number that was captured is the first Customer Number provided on the Power of Attorney document.
- ☐ A request under 37 CFR 1.48 to add an inventor was granted in this application, however, no power of attorney consistent with the power of attorney granted by the originally named inventive entity has been

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received. Thus, the addition of the inventor has resulted in the loss of power of attorney in the application. See 37 CFR 1.32(e).

☐ The power of attorney has not been accepted because the party who is giving power of attorney has not been identified. Power of attorney may only be signed by the applicant for patent (37 CFR 1.42) or the patent owner. A patent owner who was not the applicant must appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. See 37 CFR 1.32(b)(4).

☐ The power of attorney from the inventors has not been accepted because it is a copy from a prior national application for which benefit is claimed and the continuing application names an inventor who was not named as an inventor in the prior application.

☐ The power of attorney from the inventors has not been accepted because the power of attorney must be signed by the applicant for patent. See 37 CFR 1.32(b)(4).

☐ Any request to correct or update the name of the applicant must include an application data sheet (ADS) in compliance with 37 CFR 1.76 specifying the correct or updated name of the applicant in the applicant information section. Any request to change the applicant after an original applicant has been specified under 37 CFR 1.46(b) must include a new ADS in compliance with 37 CFR 1.76 specifying the applicant in the applicant information section and comply with 37 CFR 3.71 and 3.73. See 37 CFR 1.46(c).

Any inquiries regarding this notice should be directed to the Application Assistance Unit at 571-272-4200.

Application Assistance Unit
571-272-4200

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1

CONFIRMATION NO. 3430

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

MISCELLANEOUS NOTICE

OC000000090414166

Date Mailed: 04/06/2017

A communication which cannot be delivered in electronic form has been mailed to the applicant.

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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: 146410

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: 146410

OR

☐

Firm or Individual Name	Fidelis Law Group, PLLC		
Address	444 W Broad St unit 426		
City	Falls Church	State VA	Zip 22046
Country	USA		
Telephone	571.730.4572	Email	edward.park@fidelis-laws.com

Assignee Name and Address: GOLDPEAK INNOVATIONS INC
SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU
SEOUL, REPUBLIC OF KOREA

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	27 / Mar / 2017
Name	Youngjoon Rhee	Telephone	+82.10.8929.1905
Title	CEO		

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)).
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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.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: GOLDPEAK INNOVATIONS INC

Application No./Patent No.: 15/338,993 Filed/Issue Date: 10-31-2016

Titled: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

GOLDPEAK INNOVATIONS INC, a Corporation

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

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

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

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

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

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

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

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

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

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

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

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

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

1. From: PANTECH CO., LTD. To: PANTECH INC.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 039428, Frame 0268, or for which a copy thereof is attached.

2. From: PANTECH INC. To: GOLDPEAK INNOVATIONS INC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 041752, Frame 0983, or for which a copy thereof is attached.

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

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

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/sjp/	4/19/2017
Signature	Date
Seong Jun PARK	73,534
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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.
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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)).
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APPLICATION DATA SHEET 37 CFR 1.76

****If no data is shown, no data has been corrected/updated****

APPLICANT INFORMATION

Applicant Authority Type:: Assignee

Organization:: Yes

Applicant name:: ~~Pantech Inc.~~ GOLDPEAK INNOVATIONS INC

Street of mailing address:: ~~179 Seongam-ro, Mapo-gu,~~ SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU

City of mailing address:: Seoul

Country of mailing address:: KR

Postal or Zip Code of mailing address:: 08378

SIGNATURE OF REGISTERED U.S. PATENT PRACTITIONER

Signature	/sjp/	Date	4/19/2017
Name	Seong Jun PARK	Reg No.	73,534

Electronic Acknowledgement Receipt

EFS ID:	28970504
Application Number:	15338993
International Application Number:	
Confirmation Number:	3430
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Customer Number:	58027
Filer:	Seong Jun Park
Filer Authorized By:	
Attorney Docket Number:	P5256USC1C1
Receipt Date:	19-APR-2017
Filing Date:	31-OCT-2016
Time Stamp:	16:00:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	POA.pdf	1045958 a87949d5c25ca9a30afe1aff1de0bb07b1b67cde	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	15338993.pdf	121973 76670f071a687542593e8d828badcfd73a9f9d91	no	3
Warnings:					
Information:					
3	Application Data Sheet	15338993CorrectedADS.pdf	26645 6502b33d962c389adcb70983a059b40c9e8611be	no	1
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
			Total Files Size (in bytes):	1194576	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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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
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1

CONFIRMATION NO. 3430

POWER OF ATTORNEY NOTICE

58027
H.C. PARK & ASSOCIATES, PLC
1894 PRESTON WHITE DRIVE
RESTON, VA 20191

OC000000090814810

Date Mailed: 04/21/2017

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/19/2017.

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

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

/sphouminh/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1

CONFIRMATION NO. 3430

146410
Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

POA ACCEPTANCE LETTER

OC000000090814829

Date Mailed: 04/21/2017

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/19/2017.

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

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

/sphouminh/

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Alexandria, Virginia 22313-1450
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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
15/338,993	10/31/2016	2465	1600	P5256USC1C1	12	3

CONFIRMATION NO. 3430

CORRECTED FILING RECEIPT

146410
Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

OC000000090814831

Date Mailed: 04/21/2017

Receipt is acknowledged of this non-provisional 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 APPLICANT, 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 Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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**

Inventor(s)

Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;
Jae Hyun Ahn, Seoul, KOREA, REPUBLIC OF;
Kang Suk Huh, Seoul, KOREA, REPUBLIC OF;

Applicant(s)

GOLDPEAK INNOVATIONS INC, Seoul, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 146410

Domestic Priority data as claimed by applicant

This application is a CON of 14/626,047 02/19/2015 PAT 9516614
which is a CON of 13/849,296 03/22/2013 PAT 8964645

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2012-0030216 03/23/2012

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.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 11/08/2016
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/338,993**
Projected Publication Date: Not Applicable
Non-Publication Request: No
Early Publication Request: No
Title

APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

Preliminary Class

370

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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

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

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

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

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

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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

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

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

NOT GRANTED

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

SelectUSA

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

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

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Page 284 of 353

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

146410 7590 04/27/2017

Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

EXAMINER
HO, DUC CHI

ART UNIT	PAPER NUMBER
2465	

DATE MAILED: 04/27/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1	3430

TITLE OF INVENTION: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	07/27/2017

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

IPR2025-00720, OnePlus Ex. 1002
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PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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

146410 7590 04/27/2017
Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1	3430

TITLE OF INVENTION: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	07/27/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
HO, DUC CHI	2465	370-331000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

IPR2025-00720, OnePlus Ex. 1002

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1	3430

146410 7590 04/27/2017

Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

EXAMINER	
HO, DUC CHI	
ART UNIT	PAPER NUMBER
2465	

DATE MAILED: 04/27/2017

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/338,993	Applicant(s) KWON ET AL.	
	Examiner DUC C. HO	Art Unit 2465	AIA (First Inventor to File) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the TD filed 03-17-2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-12*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☒ All b) ☐ Some *c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

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

Reason for Allowance

2. Regarding claims 1-8, the prior art fails to teach or suggest a user equipment (UE) comprising a radio resource control (RRC) processor to release the SCell associated with the first SCellIndex and to add the one or more SCell as an available SCell for use with the UE and to associate the one or more SCell with another available SCell associated with same TAG identifier, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value, in combination with other limitations, as specified in the independent claims 1 and 5.

Regarding claims 9-12, the prior art fails to teach or suggest a method of a base station (BS), comprising a step of transmitting, to a user equipment (UE), the first field to release the SCell associated with the first SCell and the second field to reconfigure the TAG by associating the one or more SCell with the TAG, wherein the TAG is associated with SCells having timing based on a same timing advance (TA) value, in combination with other limitations, as specified in the independent claim 9.

3. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duc Ho whose telephone number is (571) 272-3147.

The examiner can normally be reached on Monday through Friday from 9:30 am to 5:30 pm.

If attempt to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha Banks-Harold, can be reached on (571) 272-7905.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (571) 272-2600.

The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

5. 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.

Patent Examiner
/Duc Chi Ho/
04-06-2017

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	h04w56/0005.cpc. and (releas$3 adj3 scell and add$3 adj3 scell and (tag near10 scell) with (ta or (timing adj3 advance))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/06 15:49
L2	1	h04w36/0055.cpc. and (releas$3 adj3 scell and add$3 adj3 scell and (tag near10 scell) with (ta or (timing adj3 advance))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/06 15:50
L3	1	h04w56/00.cpc. and (releas$3 adj3 scell and add$3 adj3 scell and (tag near10 scell) with (ta or (timing adj3 advance))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/06 15:51
L4	1	(releas$3 adj3 scell and add$3 adj3 scell and (tag near10 scell) with (ta or (timing adj3 advance))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/06 15:51

4/6/2017 3:51:38 PM
C:\Users\dho\Documents\EAST\\default.wsp

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	1	(releas$3 adj3 scell and add$3 adj3 scell and (tag near10 scell) with (ta or (timing adj3 advance))).clm.	US-PGPUB; USPAT	ADJ	ON	2017/04/06 15:52

4/6/2017 3:52:26 PM
C:\Users\dho\Documents\EAST\\default.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15338993	KWON ET AL.
	Examiner	**Art Unit**
	DUC C HO	2465

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

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

CLAIM		DATE								
Final	Original	12/15/2016	04/06/2017							
	1	✓	=							
	2	✓	=							
	3	✓	=							
	4	O	=							
	5	✓	=							
	6	✓	=							
	7	✓	=							
	8	O	=							
	9	✓	=							
	10	✓	=							
	11	✓	=							
	12	O	=							

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15338993	KWON ET AL.
	Examiner	**Art Unit**
	DUC C HO	2465

CPC						
Symbol					**Type**	**Version**
H04W		56	/	0005	F	2013-01-01
H04W		56	/	00	I	2013-01-01
H04W		36	/	0055	I	2013-01-01
			/			
			/			
			/			
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			/			

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

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/DUC C HO/ Primary Examiner.Art Unit 2465	04-06-2017	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	16

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15338993	KWON ET AL.
	Examiner	**Art Unit**
	DUC C HO	2465

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
		H	0	4	W	56 / 0005						
CROSS REFERENCE(S)												
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)											

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/DUC C HO/ Primary Examiner.Art Unit 2465	04-06-2017	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	16

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15338993	KWON ET AL.
	Examiner	**Art Unit**
	DUC C HO	2465

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1														
	2														
	3														
	4														
	5														
	6														
	7														
	8														
	9														
	10														
	11														
	12														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 12	
/DUC C HO/ Primary Examiner.Art Unit 2465 (Primary Examiner)	04-06-2017 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 16

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15338993	KWON ET AL.
	Examiner	Art Unit
	DUC C HO	2465

CPC- SEARCHED		
Symbol	Date	Examiner
H04W56/0005; H04W36/0055	12-15-2016	DH
Updated as above	04-06-17	DH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
East search	12-15-2016	DH
Inventor search	12-15-2016	DH

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
H04W	56/0005; 36/0055; 56/00	04-06-17	DH
USPAT; US-PGPUB	Interference search	04-06-17	DH

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Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

Courtesy Reminder for
Application Serial No: 15/338,993

Attorney Docket No: P5256USC1C1
Customer Number: 146410
Date of Electronic Notification: 04/27/2017

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

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:
fidelis@fidelis-laws.com

To view your correspondence online or update your email addresses, please visit us anytime at **https://sportal.uspto.gov/secure/myportal/privatepair.** If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

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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.
15/338,993	10/31/2016	Ki Bum KWON	P5256USC1C1	3430

7590 08/16/2017

Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

EXAMINER	
HO, DUC CHI	
ART UNIT	PAPER NUMBER
2465	
NOTIFICATION DATE	DELIVERY MODE
08/16/2017	ELECTRONIC

Notice of Abandonment

This application is abandoned in view of:

1. ☐ The applicant's failure to timely file a proper reply to the Office letter mailed on _____.
   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the period for reply (including a total extension of ____ month(s)) which expired on _____.
   (b) ☐ No reply has been received.
2. ☑ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
   (a) ☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
   (b) ☐ The submitted fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____.
   The publication fee, if required by 37 CFR 1.18(d), is $_____.
   (c) ☑ The issue fee and publication fee, if applicable, has not been received.
3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
   (a) ☐ Proposed corrected drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.
   (b) ☐ No corrected drawing have been received.
4. ☐ Applicant's failure to timely file the inventor's oath or declaration no later than the date on which the issue fee was paid as required by the Notice Requiring Inventor's Oath or Declaration (PTO-2306).
   (a) ☐ An inventor's oath or declaration was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the date on which the issue fee was paid.
   (b) ☐ While an oath or declaration (or substitute statement) for one or more inventors was received, an oath or declaration (or substitute statement) for at least one other inventor has not been received.
   (c) ☐ No inventor's oath or declaration has been received.
5. ☐ Drawings received on _____ were disapproved by examiner. See examiner's response dated _____.
6. ☐ Corrected drawings were received on _____ , which is after the expiration of the one-month period for reply set in examiner's response dated _____.
7. ☐ No corrected drawings have been received in reply to one-month period set in examiner's response dated _____.
8. ☐ The reason(s) below:

Petitions to revive under 37 CFR 1.137(a) or request to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

/Brandi Tyler for/

(571)-272-4200 or 1(888)-786-0101
Patent Publication Branch
Office of Data Management

FORM PTO-ABN0 (Rev. 03/17)

OPAP
AUG 1 6 2017

PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), to: Mail

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22314-1450

or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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

Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church VA 22046

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's Name)
(S-signature)
(Date)

08/17/2017 INTEFSW 00004157 15338993

01 FC:1501 960.00 OP

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
15/338,993	2016-10-31	Ki Bum KWON	P5256USC1C1	3430

TITLE OF INVENTION:

APPLN: TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	Undiscounted	$960	$0	$0	$960	7/27/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS

1. Change of correspondence address or indication of "Fee Address" (37CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered attorney or agent. If no name is listed, no name will be printed

1.
2.
3.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

1a. NAME OF ASSIGNEE

GOLDPEAK INNOVATIONS INC

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU

SEOUL, KOREA, REPUBLIC OF

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

4a. The following fee(s) are submitted:
☑ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

4b. Payment of Fees(s): **(Please first reapply and previously paid fee shown above)**
☐ A check is enclosed
☑ Payment be credit card. Form PTO-2038 is attached
☑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 60-1655 (enclose an extra copy of this form)

5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29 NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

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

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

08/17/2017 INTEFSW 00004157 15338993
01 FC:1501 960.00 OP

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Seong Jun PARK/ Date 2017-08-16

Typed or printed name Seong Jun PARK Registration No. 73,534

PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22314-1450
or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church VA 22046

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(Depositor's Name)
(S-signature)
(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
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APPLN: TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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EXAMINER	ART UNIT	CLASS-SUBCLASS

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(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
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(B) RESIDENCE: (CITY and STATE OR COUNTRY): SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU
SEOUL, KOREA, REPUBLIC OF

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

4a. The following fee(s) are submitted:
☑ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

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

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

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Seong Jun PARK/ Date 2017-08-16

Typed or printed name Seong Jun PARK Registration No. 73,534

IPR2025-00720, OnePlus Ex. 1002

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether 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:	15338993
Filing Date:	31-Oct-2016
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Filer:	Seong Jun Park
Attorney Docket Number:	P5256USC1C1

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
PET. REVIVE ABANDON APP, DELAY PYMT-RESP	1453	1	1700	1700
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1700**

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Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
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Decision Date : August 16, 2017

In re Application of :

Ki Bum KWON

Application No : 15338993

Filed : 31-Oct-2016

Attorney Docket No : P5256USC1C1

DECISION ON PETITION

UNDER CFR 1.137(a)

This is an electronic decision on the petition under 37 CFR 1.137(a), filed August 16, 2017 , to revive the above-identified application.

The petition is **GRANTED.**

The above-identified application became abandoned for failure to reply in a timely manner to the Notice of Allowance and Issue Fee(s) Due. The date of abandonment is the day after the expiration date of the period set for reply in the Notice.

The electronic petition satisfies the conditions for revival pursuant to the provisions of 37 CFR 1.137(a) in that (1) the reply in the form of payment of the Issue Fee and the Publication Fee (if necessary); (2) the petition fee as set forth in 37 CFR 1.17 (m); (3) the drawing correction and/or other deficiencies (if necessary); and (4) the required statement of unintentional delay have been received. Accordingly, the Issue Fee payment is accepted as having been unintentionally delayed.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being directed to the Office of Data Management.

Office of Petitions

Electronic Acknowledgement Receipt

EFS ID:	30100044
Application Number:	15338993
International Application Number:	
Confirmation Number:	3430
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Customer Number:	146410
Filer:	Seong Jun Park
Filer Authorized By:	
Attorney Docket Number:	P5256USC1C1
Receipt Date:	16-AUG-2017
Filing Date:	31-OCT-2016
Time Stamp:	17:24:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1700
RAM confirmation Number	081717INTEFSW17240601
Deposit Account	601655
Authorized User	Seong Jun Park

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition automatically granted by EFS	petition-request.pdf	32028 d3ff4924647b54a9b57a816acd51be47bfd46bd1	no	2
Warnings:					
Information:					
2	Issue Fee Payment (PTO-85B)	IssueFee.pdf	154865 fa2545b98fd02889788b0bead772b64123a6db7e	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30774 84df48b0dd94ba707061963378e96efd11af0f7e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	217667		

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.

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/64 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(a)
Application Number	15338993
Filing Date	31-Oct-2016
First Named Inventor	Ki Bum KWON
Art Unit	2465
Examiner Name	DUC HO
Attorney Docket Number	P5256USC1C1
Title	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the office notice or action plus any extensions of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:
(1) Petition fee;
(2) Reply and/or issue fee;
(3) Terminal disclaimer with disclaimer fee – required for all utility and plant applications filed before June 8, 1995; and for all design applications;
(4) Statement that the entire delay was unintentional.

Petition Fee

◯ Small Entity	
◯ Micro Entity	
◉ Regular Undiscounted	

Issue Fee and Publication Fee :

Issue Fee and Publication Fee are not due.

☒ Issue Fee Transmittal is attached

Drawing corrections and/ or other deficiencies.

◉ Drawing corrections and/ or other deficiencies are not required

○ I certify, in accordance with 37 CFR 1.4.(d)(4), that drawing corrections and/ or other deficiencies have previously been filed on

○ Drawing corrections and/ or other deficiencies are attached.

☒ STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(a) was unintentional.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application.

○ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity.

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this e-petition.

Signature	/Seong Jun PARK/
Name	Seong Jun PARK
Registration Number	73534

PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22314-1450
or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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

Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church VA 22046

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's Name)
(S-signature)
(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
15/338,993	2016-10-31	Ki Bum KWON	P5256USC1C1	3430

TITLE OF INVENTION:

APPLN: TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	Undiscounted	$960	$0	$0	$960	7/27/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS

1. Change of correspondence address or indication of "Fee Address" (37CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered attorney or agent. If no name is listed, no name will be printed

1.
2.
3.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

1a. NAME OF ASSIGNEE: GOLDPEAK INNOVATIONS INC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU
SEOUL, KOREA, REPUBLIC OF

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

4a. The following fee(s) are submitted:
☑ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

4b. Payment of Fees(s): **(Please first reapply and previously paid fee shown above)**
☐ A check is enclosed
☑ Payment be credit card. Form PTO-2038 is attached
☑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 60-1655 (enclose an extra copy of this form)

5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

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

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

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Seong Jun PARK/ Date 2017-08-16

Typed or printed name Seong Jun PARK Registration No. 73,534

IPR2025-00720, OnePlus Ex. 1002

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	15338993
Filing Date:	31-Oct-2016
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Filer:	Seong Jun Park
Attorney Docket Number:	P5256USC1C1

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:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt

EFS ID:	30100141
Application Number:	15338993
International Application Number:	
Confirmation Number:	3430
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Customer Number:	146410
Filer:	Seong Jun Park
Filer Authorized By:	
Attorney Docket Number:	P5256USC1C1
Receipt Date:	16-AUG-2017
Filing Date:	31-OCT-2016
Time Stamp:	17:26:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$960
RAM confirmation Number	081717INTEFSW17273600
Deposit Account	601655
Authorized User	Seong Jun Park

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IssueFee.pdf	154865 fa2545b98fd02889788b0bead772b64123a6db7e	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30740 062d479ee6644d202aa1ebceae296fd5f99f7838	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	185605		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/338,993	09/19/2017	9769776	GP.032	3430

146410 7590 08/30/2017

Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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

Ki Bum KWON, Seoul, KOREA, REPUBLIC OF;
GOLDPEAK INNOVATIONS INC, Seoul, KOREA, REPUBLIC OF;
Jae Hyun Ahn, Seoul, KOREA, REPUBLIC OF;
Kang Suk Huh, Seoul, KOREA, REPUBLIC OF;

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

PTO/AIA/80 (07-17)
Approved for use through 01/31/2018. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no person is required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

[x] Practitioners associated with Customer Number: 66390

OR

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

Name	Registration Number	Name	Registration Number

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

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

[x] The address associated with Customer Number: 66390

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: GOLDPEAK INNOVATIONS INC.
Suite # 808, Digital-ro 34-gil, 55,Guro-gu, Seoul, 08378, South Korea(Republic of Korea)

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 17 / 10 / 2017
Name Youngjoon Rhee	Telephone +82-10-8929-1905
Title CEO at GOLDPEAK INNOVATIONS INC	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: GOLDPEAK INNOVATIONS INC

Application No./Patent No.: 9769776 Filed/Issue Date: 2017-09-19

Titled: APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM

GOLDPEAK INNOVATIONS INC, a corporation

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

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

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

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

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

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

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

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

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

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

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

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 041752, Frame 0983, or for which a copy thereof is attached.

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

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/jwkim/	2018-01-24
Signature	Date
Jongwon Kim	66993
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	31590805
Application Number:	15338993
International Application Number:	
Confirmation Number:	3430
Title of Invention:	APPARATUS AND METHOD FOR UPLINK SYNCHRONIZING IN MULTIPLE COMPONENT CARRIER SYSTEM
First Named Inventor/Applicant Name:	Ki Bum KWON
Customer Number:	146410
Filer:	Jongwon Kim
Filer Authorized By:	
Attorney Docket Number:	GP.032
Receipt Date:	24-JAN-2018
Filing Date:	31-OCT-2016
Time Stamp:	13:07:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	80_sb_GPOA_GoldPeak.pdf	684881 66f5127db48c2b8b41fad91bdf748c3f97e394eb	no	2

Warnings:

Information:					
2	Power of Attorney	15338993-3430.pdf	1888590 c5625b65094bd6c22419770c4f24ac19825c77f0	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	2573471		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/338,993	10/31/2016	Ki Bum KWON	GP.032

CONFIRMATION NO. 3430

66390
LEX IP MEISTER, PLLC
5180 PARKSTONE DRIVE, SUITE 175
CHANTILLY, VA 20151

POA ACCEPTANCE LETTER

OC000000097059446

Date Mailed: 01/30/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/24/2018.

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

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

/qtran/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/338,993	10/31/2016	Ki Bum KWON	GP.032

CONFIRMATION NO. 3430

POWER OF ATTORNEY NOTICE

146410
Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

OC000000097059426

Date Mailed: 01/30/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/24/2018.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

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

/qtran/

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6105570

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
GOLDPEAK INNOVATIONS INC	05/07/2020

RECEIVING PARTY DATA

Name:	PANTECH CORPORATION
Street Address:	8 YANGJAECHEONRO-21GIL, SUITE 402, SEOCHO-GU,
City:	SEOUL
State/Country:	KOREA, REPUBLIC OF
Postal Code:	06748

PROPERTY NUMBERS Total: 234

Property Type	Number
Patent Number:	10014988
Patent Number:	9548839
Patent Number:	9048991
Patent Number:	8631297
Patent Number:	8631298
Patent Number:	8681599
Patent Number:	7894330
Patent Number:	9750054
Patent Number:	9288824
Patent Number:	10057925
Patent Number:	8611297
Patent Number:	8102804
Patent Number:	8380227
Patent Number:	8583147
Patent Number:	9357486
Patent Number:	8606303
Patent Number:	7505776
Patent Number:	7505775
Patent Number:	7853852
Patent Number:	7725796

Property Type	Number
Patent Number:	9838194
Patent Number:	9270365
Patent Number:	8873519
Patent Number:	9713095
Patent Number:	10045304
Patent Number:	9313743
Patent Number:	10609650
Patent Number:	9680590
Patent Number:	9419739
Patent Number:	8649346
Patent Number:	9860046
Patent Number:	9485072
Patent Number:	9237566
Patent Number:	9008046
Patent Number:	8588185
Patent Number:	8780860
Patent Number:	9854545
Patent Number:	9054835
Patent Number:	10299251
Patent Number:	9392582
Patent Number:	9131482
Patent Number:	9265034
Patent Number:	8538411
Patent Number:	9787514
Patent Number:	10237104
Patent Number:	9025485
Patent Number:	9742542
Patent Number:	9369251
Patent Number:	9088396
Patent Number:	8897182
Patent Number:	9136924
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Patent Number:	9893866
Patent Number:	9380581
Patent Number:	8837452
Patent Number:	8576822

Property Type	Number
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Patent Number:	9088992
Patent Number:	9730265
Patent Number:	9374213
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Patent Number:	9191833
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Patent Number:	RE42996
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Patent Number:	9178982
Patent Number:	8699987

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Patent Number:	6784829
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Patent Number:	9495730
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Patent Number:	7412262
Patent Number:	7283839
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Patent Number:	7103387
Patent Number:	9839000
Patent Number:	9319507
Patent Number:	8923927
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Patent Number:	7925242
Patent Number:	7420566
Patent Number:	7475332
Patent Number:	8588755
Patent Number:	8331920

Property Type	Number
Patent Number:	7636845
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Patent Number:	8583098
Patent Number:	10009471
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Patent Number:	10582460
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Patent Number:	8964645
Patent Number:	9794029
Patent Number:	9363801
Patent Number:	9191932
Patent Number:	9030973
Patent Number:	10004062
Patent Number:	8934440
Patent Number:	10103916
Patent Number:	9071488
Patent Number:	10162490
Patent Number:	9357363
Patent Number:	9100496
Patent Number:	10540066
Patent Number:	9256747
Patent Number:	9575631
Patent Number:	9250957
Patent Number:	9122518
Patent Number:	10282054
Patent Number:	9930499
Patent Number:	9503559
Patent Number:	9113312
Patent Number:	8634818
Patent Number:	10225697
Patent Number:	8332706

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Patent Number:	7881723
Patent Number:	8606284
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Patent Number:	8433350
Patent Number:	7890130
Patent Number:	9167534
Patent Number:	8145252
Patent Number:	7577115
Patent Number:	7167716
Patent Number:	8559480
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Patent Number:	8301151
Patent Number:	RE43930
Patent Number:	7257410
Patent Number:	RE43059
Patent Number:	7366222
Patent Number:	7904025
Patent Number:	8098624
Patent Number:	7801074
Patent Number:	7333828
Patent Number:	7123912
Application Number:	15997919
Application Number:	16394702
Application Number:	16392323
Application Number:	15820980
Application Number:	16418708
Application Number:	16272473
Application Number:	16387174
Application Number:	15911518
Application Number:	16203319
Application Number:	16275039
Application Number:	16288278

Property Type	Number
Application Number:	14061316
Application Number:	16287787
Application Number:	15801433
Application Number:	16227369
Application Number:	15705131
Application Number:	16685738
Application Number:	15017133
Application Number:	16405803
Application Number:	16290914
Application Number:	12958749
Application Number:	16452244
Application Number:	16826013
Application Number:	16733106
Application Number:	16819625
Application Number:	16813676
Application Number:	16823170
Application Number:	16806830
Application Number:	16730711
Application Number:	16711269
Application Number:	16806665
Application Number:	16826054
Application Number:	16037067
Application Number:	16184560
Application Number:	16694830

CORRESPONDENCE DATA

Fax Number: (703)643-9789

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 4349062975
Email: yoon@capitoliplaw.com
Correspondent Name: YEASUN YOON
Address Line 1: 20319 KIAWAH ISLAND DR
Address Line 4: ASHBURN, VIRGINIA 20147

ATTORNEY DOCKET NUMBER:	PA01GOLDPEAKTOPANTECHCORP
NAME OF SUBMITTER:	YEASUN YOON
SIGNATURE:	/yoon/
DATE SIGNED:	05/13/2020
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 17
source=Goldpeak Patent Assignment_20200507_actual sign#page1.tif
source=Goldpeak Patent Assignment_20200507_actual sign#page2.tif
source=Goldpeak Patent Assignment_20200507_actual sign#page3.tif
source=Goldpeak Patent Assignment_20200507_actual sign#page4.tif
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CONFIRMATORY ASSIGNMENT OF PATENT RIGHTS

This CONFIRMATORY ASSIGNMENT OF PATENT RIGHTS (this "**Assignment**") is made this _____ day of April 2020, by **GoldPeak Innovations Inc**, a Korean company ("**Assignor**"), in favor of **Pantech Corporation.**, a Korean company ("**Assignee**").

WHEREAS, Assignor and Assignee are party to that certain Patent Sale and Purchase Agreement of even date herewith (as in effect from time to time, the "**Patent Sale and Purchase Agreement**"); capitalized terms used but not otherwise defined in this Assignment shall have the respective meaning assigned thereto in the Patent Sale and Purchase Agreement; and

WHEREAS, pursuant to the Patent Sale and Purchase Agreement, Assignor has agreed to sell, convey, transfer, assign and deliver to Assignee all right, title and interest, including, without limitation, Patent Rights, in and to the patents, provisional patent applications, and patent applications listed on listed on Schedule A hereto (collectively, the "**Patents**").

NOW, THEREFORE, for good and valuable consideration, receipt of which is hereby acknowledged by Assignor, Assignor hereby sells, conveys, transfers, and assigns to Assignee, its successors, legal representatives and assigns all right, title and interest in the United States and throughout the world in and to:

The Patents and any and all letters patent that are or may be granted thereon, and any legal equivalent and counterpart thereof that may be granted in any country or countries foreign to the United States, in each case including without limitation any extensions, substitutes, continuations, continuations-in-part, divisions, reissues, reexaminations, and renewals thereof, or other equivalents thereof, and further, all rights and privileges pertaining to the Patents and any and all letters patent that are or may be granted thereon, and any legal equivalent thereof that may be granted in any country or countries foreign to the United States as well as all inventions, invention disclosures, and discoveries described in any of the foregoing and including, without limitation, the right, if any, to petition, sue or otherwise seek and recover damages, profits and any other remedy (monetary, injunctive, declaratory or other relief or remedy of any kind) in the United States and anywhere throughout the world for any past, present and future infringement thereof, conversion or misappropriation of, or other injury, offense, violation, breach of duty or wrong relating to, any of the Patents, or any license, agreement, contract or other matter relating thereto.

Assignor hereby authorizes and requests the Commissioner of Patents and Trademarks of the United States of America and the appropriate officers of all other jurisdictions in which the Patents are or may be registered or in which applications included among the Patents are pending, to record the title of Assignee, its successors, legal representatives and assigns, as owner of all right, title and interest in and to the Patents, and to issue to Assignee, its successors, legal representatives and assigns, all letters patent and any legal equivalent thereof that may be granted in any country or countries foreign to the United States and recordations of patent rights resulting from any application included among the Patents, according to this instrument.

Except to the extent that federal law preempts state law with respect to the matters covered hereby, this Assignment shall be governed by and construed in accordance with the laws of the State of Delaware, without giving effect to any of the principles of conflicts of laws thereof that would result in the application of the laws of another jurisdiction to this Assignment.

This Assignment will inure to the benefit of Assignee, its successors, assigns, and other legal representatives and will be binding upon Assignor, its successors, assigns, and other legal representatives.

Assignor has the full power and authority, and has obtained all Third Party consents, approvals and/or other authorizations required to enter into this Assignment and to carry out its obligations hereunder.

If Assignee is unable for any reason to secure Assignor's or its affiliates or their respective successors' or assigns' signature to any document it is entitled to under this Assignment, Assignor and its affiliates hereby irrevocably designate and appoint Assignee, and Assignee's duly authorized officers, agents and representatives, as its agents and attorneys-in-fact, coupled with an interest, with full power of substitution to act for and on the behalf and instead of Assignor, to execute and file any such document or documents and to do all other lawfully permitted acts to further the purposes of this Assignment with the same legal force and effect as if executed by Assignor.

IN WITNESS WHEREOF, Assignor has caused this Assignment to be executed by its duly authorized officer, as of the date first written above.

ASSIGNOR:

GoldPeak Innovations Inc.

By: Saekyung Park

Name: Saekyung Park

Title: CEO

Schedule A

Family	Country	Application #	Application Date	Issued #	Issued Date
1	U.S.A.	2017-406403	1/13/2017	10014988	7/3/2018
	U.S.A.	15/997,919	6/5/2018	Pending	
	U.S.A.	2015-726014	5/29/2015	9548839	1/17/2017
	U.S.A.	2014-184345	2/19/2014	9048991	6/2/2015
	U.S.A.	2013-750669	1/25/2013	8631297	1/14/2014
	U.S.A.	2012-750953	1/25/2013	8631298	1/14/2014
	U.S.A.	2011-012702	1/24/2011	8681599	3/25/2014
	U.S.A.	2009-388243	2/18/2009	7894330	2/22/2011
	TAIWAN	98105169	2/18/2009	I422201	1/1/2014
	SWEDEN	13170420.7	6/4/2013	2637348	6/24/2015
	NETHERLAND	13170420.7	2/18/2009	2637348	6/24/2015
	JAPAN	2016-215172	11/2/2016	6401224	9/14/2018
	JAPAN	2015-020714	2/4/2015	6038974	11/11/2016
	JAPAN	2013-221358	10/24/2013	5694479	2/13/2015
	JAPAN	2012-037585	2/23/2012	5400186	11/1/2013
	JAPAN	2009-554464	2/13/2009	4982653	5/11/2012
	ITALY	09 153 111.1	2/18/2009	2093924	8/14/2013
	U.K.	13170420.7	2/18/2009	2637348	6/24/2015
	E.P.O	09 153 111.1	2/18/2009	2093924	8/14/2013
	U.K.	09 153 111.1	2/18/2009	2093924	8/14/2013
	FRANCE	13170420.7	2/18/2009	2637348	6/24/2015
	FRANCE	09 153 111.1	2/18/2009	2093924	8/14/2013
	E.P.O	13170420.7	2/18/2009	2637348	6/24/2015
	FINLAND	13170420.7	6/4/2013	2637348	6/24/2015
	E.P.O	15166204.6	5/4/2015	2922233	11/22/2017
	GERMANY	15166204.6	11/13/2017	2922233	11/22/2017
	U.K.	15166204.6	11/13/2017	2922233	11/22/2017
	FRANCE	15166204.6	11/13/2017	2922233	11/22/2017
	GERMANY	09 153 111.1	2/18/2009	2093924	8/14/2013
	GERMANY	13170420.7	2/18/2009	2637348	6/24/2015
	CHINA	201310194226.5	5/23/2013	103354491	8/24/2016
	CHINA	200980000075.7	2/13/2009	101682489	7/24/2013
	CANADA	2715941	2/13/2009	2715941	4/11/2017
	AUSTRALIA	2009332929	2/13/2009	2009332929	11/14/2013
	KR	1020080124084	12/8/2008	925439	10/30/2009
2	U.S.A.	2016-069340	3/14/2016	9750054	8/29/2017

	U.S.A.	2013-960448	8/6/2013	9288824	3/15/2016
	U.S.A.	15/690,042	8/29/2017	10057925	8/21/2018
	U.S.A.	13/340447	12/29/2011	8611297	12/17/2013
	U.S.A.	2008-347352	12/31/2008	8102804	1/24/2012
	E.P.O	08866014	12/31/2008	2227923	7/29/2015
	SWEDEN	08866014	7/1/2010	2227923	7/29/2015
	NETHERLAND	08866014	7/1/2010	2227923	7/29/2015
	U.K.	08866014	7/1/2010	2227923	7/29/2015
	FRANCE	08866014	7/1/2010	2227923	7/29/2015
	FINLAND	08866014	7/1/2010	2227923	7/29/2015
	GERMANY	08866014	7/1/2010	2227923	7/29/2015
	CHINA	201410265062.5	6/13/2014	103997794	1/15/2019
	CHINA	200880127735	8/31/2010	101960906	4/20/2016
	KR	1020150011228	1/23/2015	1540418	7/23/2015
	KR	1020080047656	5/22/2008	1519345	5/6/2015
3	U.S.A.	12/398084	3/4/2009	8380227	2/19/2013
	U.S.A.	12/398072	3/4/2009	8583147	11/12/2013
	U.S.A.	2013-091916	11/27/2013	9357486	5/31/2016
	U.S.A.	12/371526	2/13/2009	8606303	12/10/2013
	U.S.A.	11/691410	3/26/2007	7505776	3/17/2009
	U.S.A.	11/165744	6/24/2005	7505775	3/17/2009
	TURKEY	05756764.6	1/12/2007	1767036	10/31/2012
	SLOVENIA	05756764.6	1/12/2007	1767036	10/31/2012
	SWEDEN	05756764.6	1/12/2007	1767036	10/31/2012
	RUMANIA	05756764.6	1/12/2007	1767036	10/31/2012
	PORTUGAL	05756764.6	1/12/2007	1767036	10/31/2012
	POLAND	05756764.6	1/12/2007	1767036	10/31/2012
	NETHERLAND	05756764.6	1/12/2007	1767036	10/31/2012
	MEXICO	PA/a/2006/014980	12/19/2006	263607	1/8/2009
	MONACO	05756764.6	1/12/2007	1767036	10/31/2012
	Luxembourg	05756764.6	1/12/2007	1767036	10/31/2012
	LITHUANIA	05756764.6	1/12/2007	1767036	10/31/2012
	JAPAN	2007-517968	12/20/2006	4654241	12/24/2010
	ITALY	05756764.6	1/12/2007	1767036	10/31/2012
	INDIA	0713/DELNP/2007	1/25/2007	296968	5/22/2018
	ISRAEL	180227	12/21/2006	180227	12/28/2011
	ICELAND	05756764.6	6/25/2005	1767036	10/31/2012
	IRELAND	05756764.6	1/12/2007	1767036	10/31/2012
	HUNGARY	05756764.6	1/12/2007	1767036	10/31/2012
	GREECE	05756764.6	1/12/2007	1767036	10/31/2012

	U.K.	05756764.6	1/12/2007	1767036	10/31/2012
	SLOVAKIA	05756764.6	6/25/2005	1767036	10/31/2012
	FRANCE	05756764.6	1/12/2007	1767036	10/31/2012
	SWITZERLAND	5756764.6	6/25/2005	1767036	10/31/2012
	FINLAND	05756764.6	1/12/2007	1767036	10/31/2012
	SPAIN	05756764.6	1/12/2007	1767036	10/31/2012
	E.P.O	12189742	10/24/2012	2552164	9/5/2018
	GERMANY	12189742.5	8/28/2018	2552164	9/5/2018
	FRANCE	12189742.5	8/28/2018	2552164	9/5/2018
	U.K.	12189742.5	8/28/2018	2552164	9/5/2018
	E.P.O	05756764.6	6/25/2005	1767036	10/31/2012
	ESTONIA	05756764.6	1/12/2007	1767036	10/31/2012
	DENMARK	05756764.6	1/12/2007	1767036	10/31/2012
	GERMANY	05756764.6	1/12/2007	1767036	10/31/2012
	CZ	05756764.6	1/12/2007	1767036	10/31/2012
	CYPRUS	05756764.6	1/12/2007	CY20131100062 - EP1767036	10/31/2012
	CHINA	200910224551.5	11/17/2009	ZL200910224551.5	12/7/2016
	CHINA	200580020940.6	12/25/2006	ZL 2005 8 0020940.6	3/24/2010
	CANADA	2569425	12/1/2006	2569425	6/3/2014
	BULGARIA	05756764.6	1/12/2007	1767036	10/31/2012
	Belgium	05756764.6	1/12/2007	1767036	10/31/2012
	AUSTRALIA	2005257642	11/24/2006	2005257642	11/12/2009
	AUSTRIA	05756764.6	1/12/2007	1767036	10/31/2012
	KR	1020050019211	3/8/2005	875419	12/16/2008
	KR	1020090013393	2/18/2009	935294	12/24/2009
	KR	1020040077649	9/25/2004	908260	7/10/2009
4	U.S.A.	12/684847	1/8/2010	7853852	12/14/2010
	U.S.A.	11/320374	12/27/2005	7725796	5/25/2010
	TAIWAN	94146828	12/27/2005	I416897	11/21/2013
	MEXICO	MX/a/2007/007796	6/25/2007	270303	9/23/2009
	JAPAN	2013-236045	11/14/2013	5619262	9/26/2014
	JAPAN	2012-142491	6/25/2012	5554375	6/6/2014
	JAPAN	2007-548094	6/26/2007	5055132	8/3/2012
	ISRAEL	183915	6/14/2007	183915	9/1/2011
	E.P.O	05 818 969.7	7/2/2007	1832024	6/6/2018
	U.K.	05 818 969.7	3/22/2018	1832024	6/6/2018
	GERMANY	05 818 969.7	3/22/2018	1832024	6/6/2018
	FRANCE	05 818 969.7	3/22/2018	1832024	6/6/2018
	CHINA	200580044699.0	6/25/2007	ZL200580044699.0	10/9/2012

	AUSTRALIA	2005326877	6/13/2007	2005326877	2/4/2010
	KR	1020040112929	12/27/2004	1079095	10/27/2011
	KR	1020040112926	12/27/2004	1080964	11/1/2011
5	U.S.A.	2016-014792	2/3/2016	9838194	12/5/2017
	U.S.A.	16/394,702	4/25/2019	Pending	
	U.S.A.	2014-513449	10/14/2014	9270365	2/23/2016
	U.S.A.	2012-715278	12/14/2012	8873519	10/28/2014
	JAPAN	2014-547111	6/12/2015	6212048	9/22/2017
	E.P.O	12857526.3	7/15/2014	2792093	7/11/2018
	GERMANY	12857526.3	5/30/2018	2792093	7/11/2018
	FRANCE	12857526.3	5/30/2018	2792093	7/11/2018
	U.K.	12857526.3	5/30/2018	2792093	7/11/2018
	CHINA	2012-80067029	12/14/2012	ZL201280067029.0	9/1/2017
	KR	1020200034567		Pending	
6	U.S.A.	2016-077466	3/22/2016	9713095	7/18/2017
	U.S.A.	15/653,355	7/18/2017	10045304	08/07/2018
	U.S.A.	2014-357557	5/9/2014	9313743	4/12/2016
	U.S.A.	16/293,321	5/5/2019	10609650	3/31/2020
	JAPAN	2014-540937	6/19/2014	5763845	6/19/2015
	E.P.O	12850075	6/4/2014	2782405	8/22/2018
	GERMANY	12850075	6/4/2014	2782405	8/22/2018
	FRANCE	12850075	6/4/2014	2782405	8/22/2018
	U.K.	12850075	6/4/2014	2782405	8/22/2018
	CHINA	201280056210.1	5/15/2014	ZL201280056210.1	5/15/2018
	KR	1020110119154	11/15/2011	10-1867314	6/7/2018
8	U.S.A.	2016-222068	7/28/2016	9680590	6/13/2017
	U.S.A.	2014-147295	1/3/2014	9419739	8/16/2016
	U.S.A.	2011-332089	12/20/2011	8649346	2/11/2014
	JAPAN	2014-134625	6/30/2014	6025783	10/21/2016
	JAPAN	2013-546010	6/14/2013	5575993	7/11/2014
	E.P.O	11850274.9	7/1/2013	Pending	
	CHINA	201180062059	6/21/2013	103270710	3/9/2016
	KR	1020100131864	12/21/2010	10-1867311	6/7/2018
9	U.S.A.	2016-335679	10/27/2016	9860046	1/2/2018
	U.S.A.	16/392,323	4/23/2019	Pending	
	U.S.A.	2016-992186	1/11/2016	9485072	11/1/2016
	U.S.A.	13/877,827	4/4/2013	9237566	1/12/2016
	JAPAN	2013-533775	5/31/2013	5766294	6/26/2015
	E.P.O	11832776.6	4/4/2013	Pending	
	CHINA	201610452850.4	6/21/2016	106059719	6/14/2019

	CHINA	201180049399	4/12/2013	103181109	8/3/2016
	KR	1020100100988	10/15/2010	10-1771550	8/21/2017
10	U.S.A.	14/056,474	10/17/2013	9008046	4/14/2015
	U.S.A.	2011-181456	7/12/2011	8588185	7/19/2013
	E.P.O	11807024.2	12/11/2012	Pending	
	KR	1020100068157	7/14/2010	10-1699023	1/17/2017
11	U.S.A.	2011-098056	4/29/2011	8780860	7/15/2014
12	U.S.A.	2015-733068	6/8/2015	9854545	12/26/2017
	U.S.A.	15/820,980	11/22/2017	Pending	
	U.S.A.	2012-578531	8/10/2012	9054835	6/9/2015
	JAPAN	2015-154385	8/4/2015	6175466	7/14/2017
	E.P.O	11742487.9	9/5/2012	2536227	5/8/2019
	GERMANY	11742487.9	9/5/2012	2536227	5/8/2019
	U.K.	11742487.9	9/5/2012	2536227	5/8/2019
	FRANCE	11742487.9	9/5/2012	2536227	5/8/2019
	SWITZERLAND	11742487.9	9/5/2012	2536227	5/8/2019
	IRELAND	11742487.9	9/5/2012	2536227	5/8/2019
	Luxembourg	11742487.9	9/5/2012	2536227	5/8/2019
	Monaco	11742487.9	9/5/2012	2536227	5/8/2019
	CHINA	201610908740.4	10/18/2016	Pending	
	CHINA	201180014458.7	9/18/2012	ZL201180014458.7	11/16/2016
	KR	10201100086&3	1/28/2011	10-1803015	11/23/2017
14	U.S.A.	15/206,508	7/11/2016	10299251	5/21/2019
	U.S.A.	16/418,708	5/28/2019	Pending	
	U.S.A.	13/875,808	5/2/2013	9392582	7/12/2016
	U.S.A.	13/875,869	5/2/2013	9131482	9/8/2015
	U.S.A.	2013-965837	8/13/2013	9265034	2/16/2016
	U.S.A.	2010-916203	10/29/2010	8538411	9/17/2013
	JAPAN	2014-080506	4/9/2014	5788051	8/7/2015
	JAPAN	2012-536694	4/23/2012	5525055	4/18/2014
	E.P.O	10827139.6	5/23/2012	Pending	
	KR	1020170127789	9/29/2017	10-1828917	2/7/2018
	KR	1020100088151	9/8/2010	10-1785997	10/10/2017
15	U.S.A.	2015-703360	5/4/2015	9787514	10/10/2017
	U.S.A.	16/272,473	2/11/2019	Pending	
	U.S.A.	15/729,604	10/10/2017	10237104	3/19/2019
	U.S.A.	2013-891522	5/10/2013	9025485	5/5/2015
	JAPAN	2015-511380	11/10/2014	6200944	9/1/2017
	E.P.O	13787400.4	12/3/2014	2850757	10/17/2017
	GERMANY	13787400.4	12/3/2014	2850757	10/17/2017

	FRANCE	13787400.4	12/3/2014	2850757	10/17/2017
	U.K.	13787400.4	12/3/2014	2850757	10/17/2017
	CHINA	201380036116.4	1/6/2015	ZL201380036116.4	11/3/2017
	KR	1020120050406	5/11/2012	Pending	
16	U.S.A.	2016-180153	6/13/2016	9742542	8/22/2017
	U.S.A.	2015-801116	7/16/2015	9369251	6/14/2016
	U.S.A.	16/387,174	4/17/2019	Pending	
	U.S.A.	2014-547112	11/18/2014	9088396	7/21/2015
	U.S.A.	2011-816182	2/8/2013	8897182	11/25/2014
	JAPAN	2016-115490	6/9/2016	6185116	8/4/2017
	JAPAN	2015-053011	3/17/2015	5952449	6/17/2016
	JAPAN	2013-524046	2/8/2013	5718464	3/27/2015
	GERMANY	11816634.7	3/11/2013	2605433	2/27/2019
	FRANCE	11816634.7	3/11/2013	2605433	2/27/2019
	SWITZERLAND	11816634.7	3/11/2013	2605433	2/27/2019
	Luxembourg	11816634.7	3/11/2013	2605433	2/27/2019
	MONACO	11816634.7	3/11/2013	2605433	2/27/2019
	IRELAND	11816634.7	3/11/2013	2605433	2/27/2019
	Belgium	11816634.7	3/11/2013	2605433	2/27/2019
	U.K.	11816634.7	3/11/2013	2605433	2/27/2019
	E.P.O	11816634.7	3/11/2013	2605433	2/27/2019
	CHINA	201610412657.8	8/11/2011	ZL201610412657.8	9/24/2019
	CHINA	201180049114.X	4/11/2013	103155456	6/29/2016
	KR	1020100098006	10/7/2010	1719542	3/20/2017
	KR	1020170033713	3/17/2017	1810962	12/24/2017
	KR	1020100098005	10/7/2010	1790502	
17	U.S.A.	2012-807706	12/28/2012	9136924	9/15/2015
	JAPAN	2013-518260	1/4/2013	6293482	2/23/2018
	E.P.O	11803762	2/1/2013	2592763	5/23/2018
	GERMANY	11803762	2/1/2013	2592763	5/23/2018
	FRANCE	11803762	2/1/2013	2592763	5/23/2018
	U.K.	11803762	2/1/2013	2592763	5/23/2018
	CHINA	201180037814.7	1/31/2013	ZL201180037814.7	11/17/2017
	KR	1020160171540	12/15/2016	10-1771549	8/21/2017
18	U.S.A.	2016-151296	5/10/2016	9948440	4/17/2018
	U.S.A.	2014-299679	6/9/2014	9344245	5/17/2016
	U.S.A.	15/911,518	3/5/2018	Pending	
	U.S.A.	2011-149225	5/31/2011	8787216	7/22/2014
	JAPAN	2013-513109	11/27/2012	5931056	5/13/2016
	E.P.O	11790009	12/5/2012	Pending	

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	CHINA	201180037855.6	1/31/2013	ZL201180037855.6	11/30/2016
	KR	1020100055073	6/10/2010	10-1790505	10/20/2017
19	U.S.A.	2016-192233	6/24/2016	9893866	2/13/2018
	U.S.A.	2014-464041	8/20/2014	9380581	6/28/2016
	U.S.A.	2013-043005	10/1/2013	8837452	9/16/2014
	U.S.A.	2011-008685	1/18/2011	8576822	11/5/2013
	JAPAN	2012-548900	7/11/2012	5855016	12/18/2015
	E.P.O	11733132	8/17/2012	Pending	
	U.S.A.	16/285,957	2/26/2019	10567140	2/18/2020
	U.S.A.	15/858,921	12/29/2017	10218485	2/26/2019
	CHINA	201180014290.X	9/17/2012	102804625	11/13/2018
	KR	1020100004219	1/18/2010	1740221	
20	U.S.A.	2009-505707	5/2/2012	8811518	8/19/2014
	KR	1020127011219	4/30/2012	1627393	5/30/2016
21	U.S.A.	2016-131725	4/18/2016	9825686	11/21/2017
	U.S.A.	2009-500288	4/4/2012	9319252	4/19/2016
	U.S.A.	16/203,319	11/28/2018	Pending	
	U.S.A.	15/814,605	11/16/2017	10153821	12/11/2018
	KR	1020127008173	3/29/2012	1621376	5/10/2016
22	U.S.A.	2015-279139	9/28/2016	10057940	8/21/2018
	U.S.A.	2015-801280	7/16/2015	9474025	10/18/2016
	U.S.A.	2013-847319	3/19/2013	9088992	7/21/2015
	KR	1020120027938	3/19/2012	10-1868865	6/12/2018
23	U.S.A.	2016-183158	6/15/2016	9730265	8/8/2017
	U.S.A.	16/275,039	2/13/2019	Pending	
	U.S.A.	2014-560838	12/4/2014	9374213	6/21/2016
	U.S.A.	2012-651034	10/12/2012	8917619	12/23/2014
	KR	1020110110798	10/27/2011	10-1841693	3/19/2018
24	U.S.A.	2016-341296	11/2/2016	9955376	4/24/2018
	U.S.A.	16/288,278	2/28/2019	Pending	
	U.S.A.	2015-937348	11/10/2015	9516538	12/6/2016
	U.S.A.	2013-984476	8/8/2013	9191833	11/17/2015
	E.P.O	12744488.3	8/9/2013	Notice of Allowance at 1/7/2020 (Issue fee due 5/7/2020)	
	CHINA	201610397886.7	6/7/2016	106060866B	1/7/2020
	CHINA	201280014327	9/22/2013	103444100	6/29/2016
	KR	1020170130604	10/11/2017	1860863	5/17/2018
27	U.S.A.	2014-191178	2/26/2014	9124688	9/1/2015
	U.S.A.	2009-553328	9/3/2009	8675844	3/18/2014

	U.S.A.	2003-730853	12/8/2003	7660404	2/9/2010
	HONG KONG	5101471	2/22/2005	1069062	2/12/2010
	E.P.O	06019434.7	12/5/2003	1727386	3/4/2009
	U.K.	06019434.7	9/18/2006	1727386	3/4/2009
	U.K.	03257661.3	12/5/2003	1427242	11/15/2006
	FRANCE	06019434.7	9/18/2006	1727386	3/4/2009
	E.P.O	03257661.3	12/5/2003	1427242	11/15/2006
	FRANCE	03257661.3	12/5/2003	1427242	11/15/2006
	GERMANY	06019434.7	9/18/2006	1727386	3/4/2009
	GERMANY	03257661.3	12/5/2003	1427242	11/15/2006
	CHINA	200310124920.6	12/7/2003	100558200	11/4/2009
	KR	1020020077576	12/7/2002	500670	7/1/2005
28	U.S.A.	2002-194038	7/11/2002	6809641	10/26/2004
	JAPAN	2002-196495	7/4/2002	3684373	6/10/2005
	CHINA	02140676.6	7/12/2002	101271871	8/23/2006
	KR	1020010041909	7/12/2001	420395	2/16/2004
29	U.S.A.	14/225,729	3/26/2014	8933955	12/23/2014
	U.S.A.	2013-035625	9/24/2013	8706168	4/22/2014
	U.S.A.	2012-654043	10/17/2012	8554185	10/8/2013
	U.S.A.	2009-412079	3/26/2009	8311519	11/13/2012
	JAPAN	2009-133842	6/4/2009	4764496	6/17/2011
	KR	1020080052642	6/4/2008	1481408	1/6/2015
30	U.S.A.	2004-007603	12/7/2004	7260419	8/21/2007
	KR	1020030088563	12/8/2003	603437	7/13/2006
31	U.S.A.	14/061316	10/23/2013	Pending	
	U.S.A.	2012-649539	10/11/2012	RE44620	7/9/2013
	U.S.A.	2011-300799	11/21/2011	RE43789	11/6/2012
	U.S.A.	2009-612327	11/4/2009	RE42996	12/6/2011
	U.S.A.	2004-882604	6/30/2004	7292561	11/6/2007
	KR	1020030087886	12/5/2003	633741	10/4/2006
32	U.S.A.	2013-861177	4/11/2013	9661113	5/23/2017
	U.S.A.	2010-716600	3/3/2010	8433379	4/30/2013
	U.S.A.	2005-106118	4/13/2005	7693558	4/6/2010
	KR	1020040025922	4/14/2004	598062	6/30/2006
33	U.S.A.	2011-171344	6/28/2011	8200899	6/12/2012
	U.S.A.	2009-362760	1/30/2009	7991958	8/2/2011
	KR	1020080046505	5/20/2008	985617	9/29/2010
34	U.S.A.	2005-295202	12/6/2005	7567530	7/28/2009
37	U.S.A.	2002-253256	9/24/2002	7136671	11/14/2006
38	U.S.A.	2015-929965	11/2/2015	9729699	8/8/2017

	U.S.A.	2014-196273	3/4/2014	9176982	11/3/2015
	U.S.A.	2013-746125	1/21/2013	8699987	4/15/2014
	U.S.A.	2009-625191	11/24/2009	8374572	2/12/2013
	U.S.A.	15/672,018	8/8/2017	10158752	12/18/2018
	U.S.A.	2003-749788	12/30/2003	7643815	1/5/2010
40	U.S.A.	2010-944436	11/11/2010	8060114	11/15/2011
	U.S.A.	2010-693142	1/25/2010	7912482	3/22/2011
	KR	1020040088333	11/2/2004	0632667	9/28/2006
	U.S.A.	2004-021778	12/23/2004	7668553	2/23/2010
41	U.S.A.	2004-879638	7/26/2004	7151487	12/19/2006
	U.S.A.	2003-749598	12/30/2003	6784829	8/31/2004
	CHINA	200410064136.5	8/19/2004	ZL200410064136.5	4/20/2011
	KR	1020030057848	8/21/2003	540248	12/23/2005
42	U.S.A.	2003-750000	12/30/2003	7006037	2/28/2006
	KR	1020030033022	5/23/2003	543308	1/6/2006
43	U.S.A.	16/287,787	2/27/2019	Pending	
	U.S.A.	2014-307326	6/17/2014	9495730	11/15/2016
	U.S.A.	2012-669162	11/5/2012	8767018	7/1/2014
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	U.S.A.	2010-814262	6/11/2010	8120626	2/21/2012
	U.S.A.	2006-453433	6/28/2006	7755647	7/13/2010
	CHINA	200610095738.6	6/28/2006	101982805	6/15/2011
	KR	1020050056173	6/28/2005	756129	8/30/2007
44	U.S.A.	2011-275103	10/17/2011	8446915	5/21/2013
	U.S.A.	2010-716575	3/3/2010	8054846	11/8/2011
	U.S.A.	2006-441981	5/26/2006	7693163	4/6/2010
	KR	1020050045625	5/30/2005	653527	11/27/2006
45	U.S.A.	2004-933670	9/3/2004	7102196	9/5/2006
	KR	1020030062570	9/8/2003	539960	12/22/2005
46	U.S.A.	2002-214430	8/8/2002	6801271	10/5/2004
	JAPAN	2002-214711	7/24/2002	3773472	2/24/2006
	E.P.O	02014550	7/1/2002	1 316 841	1/1/2014
	U.K.	02014550	7/1/2002	1 316 841	1/1/2014
	FRANCE	02014550	7/1/2002	1 316 841	1/1/2014
	GERMANY	02014550	7/1/2002	02 014 550.4	1/1/2014
	CHINA	02140295.7	7/4/2002	ZL02140295.7	2/2/2005
	KR	1020010075793	12/3/2001	432009	5/7/2004
47	U.S.A.	2002-071750	2/6/2002	6925313	8/2/2005
	JAPAN	2002-031225	2/7/2002	4034079	11/2/2007
	ITALY	02250854	2/7/2002	1231757	11/15/2006

	HONG KONG	02109172.9	12/18/2002	1047666	3/4/2005
	E.P.O	02250854	2/7/2002	1231757	11/15/2006
	U.K.	02250854	2/7/2002	1231757	11/15/2006
	FRANCE	02250854	2/7/2002	1231757	11/15/2006
	GERMANY	02250854	2/7/2002	1231757	11/15/2006
	CHINA	02106877.1	2/7/2002	ZL02106877.1	10/6/2004
48	U.S.A.	2009-645912	12/23/2009	8270999	9/18/2012
	U.S.A.	2006-647636	12/28/2006	7660592	2/9/2010
	KR	1020050133300	12/29/2005	651594	11/22/2006
49	U.S.A.	2013-860672	4/11/2013	9204118	8/14/2015
	U.S.A.	2010-686822	1/13/2010	8433367	4/30/2013
	U.S.A.	2008-217175	7/2/2008	7668569	2/23/2010
	U.S.A.	2005-255610	10/21/2005	7412262	8/12/2008
	JAPAN	2010-099211	4/22/2010	5210347	3/1/2013
	JAPAN	2005-309910	10/24/2005	4557864	7/30/2010
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	KR	1020040101848	12/6/2004	620741	8/29/2006
50	U.S.A.	2005-106160	4/13/2005	7283839	10/16/2007
	HONG KONG	06103630.4	3/22/2006	1083574	10/15/2010
	E.P.O	05252337	4/14/2005	1587288	11/3/2010
	U.K.	05252337	4/14/2005	1587288	11/3/2010
	FRANCE	05252337	4/14/2005	1587288	11/3/2010
	GERMANY	05252337	4/14/2005	1587288	11/3/2010
	KR	1020040083073	10/18/2004	572464	4/18/2006
	CHINA	200510079253.3	4/14/2005	101624372	5/26/2010
51	U.S.A.	2000-655036	9/5/2000	6557010	4/29/2003
	JAPAN	2000-272619	9/8/2000	3638249	1/21/2005
52	U.S.A.	2002-185141	6/27/2002	7103387	9/5/2006
	JAPAN	2002-201859	7/10/2002	3917027	2/16/2007
	E.P.O	02254584	6/28/2002	1309157	8/17/2011
	U.K.	02254584	6/28/2002	1309157	8/17/2011
	FRANCE	02254584	6/28/2002	1309157	8/17/2011
	GERMANY	02254584	6/28/2002	1309157	8/17/2011
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	KR	1020010067663	10/31/2001	438208	6/21/2004
53	U.S.A.	15/131,746	4/18/2016	9839000	12/05/2017
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	U.S.A.	2008-183506	7/31/2008	7925242	4/12/2011
	U.S.A.	2006-354608	2/14/2006	7420566	9/2/2008
	KR	1020050012498	2/15/2005	610487	8/1/2006
54	KR	1020050009451	2/2/2005	656670	12/5/2006
	U.S.A.	2005-134778	5/19/2005	7475332	1/6/2009
55	U.S.A.	2012-676214	11/14/2012	8588755	6/17/2013
	U.S.A.	12/816,688	6/16/2010	8331920	12/11/2012
	KR	1020090065796	7/20/2009	1026905	3/28/2011
56	U.S.A.	2006-580741	10/12/2006	7636845	12/22/2009
	KR	1020050123711	12/15/2005	755536	8/29/2007
57	U.S.A.	2011-311458	12/5/2011	8565724	10/22/2013
	U.S.A.	2008-150905	5/1/2008	8078145	12/13/2011
	U.S.A.	2003-602810	6/24/2003	7386297	6/10/2008
	CHINA	03127468.4	6/30/2003	ZL03127468.4	12/5/2007
	KR	1020020085938	12/28/2002	551421	2/3/2006
62	U.S.A.	2016-082832	3/28/2016	9596352	3/14/2017
	U.S.A.	14/685,143	4/13/2015	9300805	3/29/2016
	U.S.A.	2013-058968	10/21/2013	9008637	4/14/2015
	U.S.A.	2011-182024	7/13/2011	8583098	7/8/2013
	U.S.A.	15/457,560	3/13/2017	10009471	06/26/2018
	U.S.A.	15/988,020	5/24/2018	10257359	4/9/2019
	KR	1020110000808	1/5/2011	1308192	9/6/2013
63	U.S.A.	15/338,993	10/31/2016	9769776	9/19/2017
	U.S.A.	15/709,185	9/20/2017	10015759	7/3/2018
	U.S.A.	16/424,258	5/28/2019	10582460	3/3/2020
	U.S.A.	14/626,047	2/19/2015	9516614	12/6/2016
	U.S.A.	13/849,296	3/22/2013	8964645	2/24/2015
	KR	1020120030216	3/23/2012	10-1885540	7/31/2018
64	U.S.A.	2016-173139	6/3/2016	9794029	10/17/2017
	U.S.A.	16/227,369	12/20/2018	Pending	
	U.S.A.	15/705,131	9/14/2017	Pending	
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	U.S.A.	2015-707736	5/8/2015	9191932	11/17/2015
	U.S.A.	2013-888891	5/7/2013	9030973	5/12/2015
	JAPAN	2015-511358	11/7/2014	6132370	4/28/2017
	E.P.O	13788210.6	5/7/2013	2850758	9/5/2018
	GERMANY	13788210.6	5/7/2013	2850758	9/5/2018
	FRANCE	13788210.6	5/7/2013	2850758	9/5/2018
	U.K.	13788210.6	5/7/2013	2850758	9/5/2018

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65	U.S.A.	14/589971	1/5/2015	10004062	6/19/2018
	U.S.A.	16/685,738	11/15/2019	Pending	
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	KR	1020110001992	1/7/2011	10-1835023	2/27/2018
66	U.S.A.	2014-754045	6/29/2015	10103916	10/16/2018
	U.S.A.	2012-580779	8/23/2012	9071488	6/30/2015
	KR	1020100016195	2/23/2010	1652251	8/24/2016
67	U.S.A.	15/167,518	5/27/2016	10162490	12/25/2018
	U.S.A.	14/816,736	8/3/2015	9357363	5/31/2016
	U.S.A.	2009-364085	2/2/2009	9100496	8/4/2015
	U.S.A.	16/203,174	11/28/2018	10540066	1/21/2020
	GERMANY	DE200960000657T	3/26/2009	EP2117208	1/26/2011
	SPAIN	ES20090156335T	3/26/2009	ES2362448T3	7/5/2011
	E.P.O	09156335.3	3/26/2009	2117208	1/26/2011
	FRANCE	09156335.3	3/26/2009	2117208	1/26/2011
	U.K.	09156335.3	3/26/2009	2117208	1/26/2011
	NETHERLAND	09156335.3	3/26/2009	2117208	1/26/2011
	KR	1020080042843	5/8/2008	986376	10/1/2010
68	U.S.A.	15/017,133	2/5/2016	Pending	
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	KR	1020120019288	2/24/2012	1332811	11/19/2013
69	U.S.A.	2016-010629	1/29/2016	9575631	2/21/2017
	U.S.A.	2015-840844	8/31/2015	9250957	2/2/2016
	U.S.A.	2006-495863	7/28/2006	9122518	4/22/2015
	U.S.A.	15/436,299	2/17/2017	10282054	5/7/2019
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71	U.S.A.	2016-354691	11/17/2016	9930499	3/27/2018
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	U.S.A.	2014-152152	1/10/2014	9113312	8/18/2015
	U.S.A.	2011-191363	7/26/2011	8634818	1/21/2014
	E.P.O	11176526.9	8/4/2011	2424170	12/19/2018
	GERMANY	11176526.9	11/29/2018	2424170	12/19/2018
	FRANCE	11176526.9	11/29/2018	2424170	12/19/2018
	U.K.	11176526.9	11/29/2018	2424170	12/19/2018
	CHINA	201110237610.X	8/18/2011	201110237610.X	4/13/2016
	U.S.A.	15/911,495	3/5/2018	10225697	3/5/2019
	U.S.A.	16/290,914	3/3/2019	Pending	
	KR	1020100081908	8/24/2010	1333879	11/21/2013

73	U.S.A.	12/556,331	9/9/2009	8332706	12/11/2012
	KR	1020090022356	3/16/2009	1048865	7/6/2011
74	U.S.A.	2008-599463	11/9/2009	8279744	5/22/2012
	JAPAN	2013-035032	2/25/2013	5628948	9/2/2014
	CHINA	200880023808.4	1/7/2010	ZL200880023808.4	12/11/2012
	KR	1020070045848	5/11/2007	895576	4/22/2009
75	U.S.A.	2005-285960	11/23/2005	7881723	2/1/2011
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	KR	1020040096090	11/23/2004	650058	11/20/2006
76	JAPAN	2013-021345	2/6/2013	5411369	11/15/2013
	KR	1020120023831	3/8/2012	1314472	9/26/2013
77	U.S.A.	2011-195563	8/1/2011	8606284	12/10/2013
	E.P.O	11177039.2	8/10/2011	2424309	12/4/2013
	U.K.	11177039.2	8/10/2011	2424309	12/4/2013
	FRANCE	11177039.2	8/10/2011	2424309	12/4/2013
	GERMANY	11177039.2	8/10/2011	2424309	12/4/2013
	CHINA	201110253571.2	8/30/2011	102387527	12/3/2014
	KR	1020100084319	8/30/2010	1318013	10/7/2013
78	U.S.A.	2013-857294	4/5/2013	9072108	2/18/2015
	U.S.A.	2011-012753	1/24/2011	8433350	12/28/2012
	U.S.A.	2007-846093	8/29/2007	7890130	2/15/2011
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	JAPAN	2007-223594	8/30/2007	4685842	1/13/2011
	U.K.	07253398	8/29/2007	1895795	3/9/2016
	FRANCE	07253398	8/29/2007	1895795	3/9/2016
	E.P.O	07253398	8/29/2007	1895795	3/9/2016
	GERMANY	07253398	8/29/2007	1895795	3/9/2016
	CHINA	200710147192.9	8/30/2007	ZL 200710147192.9	11/16/2010
	KR	1020060082992	8/30/2006	765892	10/4/2007
79	U.S.A.	2012-412933	3/6/2012	9167534	6/8/2015
	U.S.A.	2007-846106	8/29/2007	8145252	11/16/2011
	TAIWAN	096132057	8/29/2007	I414188	7/22/2013
	MEXICO	MX/a/2007/010612	8/30/2007	10-274412	3/10/2010
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	E.P.O	07253403	8/29/2007	1895678	7/11/2018
	GERMANY	07253403	5/29/2018	1895678	7/11/2018
	FRANCE	07253403	5/29/2018	1895678	7/11/2018
	U.K.	07253403	5/29/2018	1895678	7/11/2018
	IRELAND	07253403.5	5/29/2018	1895678	7/11/2018

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81	U.S.A.	2005-285943	11/23/2005	7577115	8/18/2009
	E.P.O	05257261.7	11/25/2005	1662671	11/3/2010
	NETHERLAND	05257261.7	11/25/2005	1662671	11/3/2010
	U.K.	05257261.7	11/25/2005	1662671	11/3/2010
	FRANCE	05257261.7	11/25/2005	1662671	11/3/2010
	FINLAND	05257261.7	11/25/2005	1662671	11/3/2010
	GERMANY	05257261.7	11/25/2005	1662671	11/3/2010
	CHINA	200510121565.6	11/25/2005	ZL200510121565.6	4/30/2008
	KR	1020040097330	11/25/2004	622149	9/1/2006
83	U.S.A.	2002-330737	12/27/2002	7167716	1/23/2007
	HONG KONG	03108579.9	11/25/2003	1056450	8/18/2006
	CHINA	02154242.2	12/31/2002	ZL02154242.2	4/19/2006
84	U.S.A.	2011-143688	7/7/2011	8559480	10/15/2013
	JAPAN	2011-546214	7/19/2011	5228113	3/22/2013
	E.P.O	10733619.0	6/29/2011	2381584	8/8/2018
	FRANCE	10733619.0	1/15/2010	2381584	8/8/2018
	GERMANY	10733619.0	1/15/2010	2381584	8/8/2018
	U.K.	10733619.0	1/15/2010	2381584	8/8/2018
	CHINA	201080004784.5	7/18/2011	ZL 201080004784.5	11/26/2014
	KR	1020090004682	1/20/2009	991957	10/28/2010
85	U.S.A.	2009-629570	12/2/2009	8345867	1/1/2013
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	E.P.O	9830590.7	12/2/2009	2359512	8/24/2016
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	FRANCE	09830590.7	12/2/2009	2359512	8/24/2016
	U.K.	09830590.7	12/2/2009	2359512	8/24/2016
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86	U.S.A.	2010-383821	1/12/2012	9009207	4/14/2015
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	FRANCE	10800014.2	2/10/2012	2456117	9/9/2015
	GERMANY	10800014.2	2/10/2012	2456117	9/9/2015
	CHINA	201080037807.2	2/24/2012	ZL201080037807.2	4/15/2016
	KR	1020090063719	7/13/2009	1685173	12/5/2016
88	U.S.A.	12/582,164	10/20/2009	8675510	10/31/2013
	KR	1020080104313	10/23/2008	1041681	6/8/2011
89	U.S.A.	12/958,749	12/2/2010	Pending	

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	KR	1020120043688	4/26/2012	1341303	12/6/2013
91	U.S.A.	2011-177761	7/7/2011	8929223	12/17/2014
	KR	1020100136900	12/28/2010	1266692	5/14/2013
92	U.S.A.	12/832,665	7/8/2010	8301151	6/29/2012
	KR	1020090098752	10/16/2009	1065092	9/7/2011
93	U.S.A.	2009-539364	10/12/2009	RE43930	8/30/2012
	U.S.A.	2004-835876	4/29/2004	7257410	8/14/2007
	KR	1020030061086	9/2/2003	511554	8/24/2005
94	U.S.A.	12/759,974	4/14/2010	RE43059	1/3/2012
	U.S.A.	2003-729755	12/4/2003	7366222	4/29/2008
	KR	1020020083746	12/24/2002	470401	1/27/2005
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AO 120 (Rev. 08/10)

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

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

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
5:21-CV-00105	8/27/2021	for the Eastern District of Texas, Texarkana Division

PLAINTIFF	DEFENDANT
PANTECH CORPORATION PANTECH WIRELESS, LLC	ASUSTEK COMPUTER INC.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	9,548,839	1/17/2017	Pantech Corporation
2	10,841,142	11/17/2020	Pantech Corporation
3	9,769,776	9/19/2017	Pantech Corporation
4	9,392,582	7/12/2016	Pantech Corporation
5	10,904,714	1/26/2021	Pantech Corporation

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

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

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

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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

AO 120 (Rev. 08/10)

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PANTECH CORPORATION PANTECH WIRELESS, LLC	ASUSTEK COMPUTER INC.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	10,869,247	12/15/2020	Pantech Wireless, LLC
2			
3			
4			
5			

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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