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# UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	0465-2287PUS3
First Inventor	Sung Jun PARK
Title	DATA TRANSMISSION METHOD AND USER EQUIPMENT FOR THE SAME
Express Mail Label No.	

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1.  **Fee Transmittal Form.**  
(PTO/SB/17 or equivalent)
2.  **Applicant claims small entity status.**  
See 37 CFR 1.27.
3.  **Specification.** [Total Pages 37 ]  
Both the claims and abstract must start on a new page  
(For information on the preferred arrangement, see MPEP § 608.01(a))
4.  **Drawing(s).** (35 U.S.C. 113) [Total Sheets 11 ]
5. **Inventor's Oath or Declaration.** [Total Sheets 4 ]  
(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))
  - a.  Newly executed (original or copy)
  - b.  A copy from a prior application (37 CFR 1.63(d))
6.  **Application Data Sheet.** \*See Note below.  
See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
7.  **CD-ROM or CD-R.**  
in duplicate, large table or Computer Program (Appendix)  
 Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission.**  
(if applicable, items a. – c. are required)
  - a.  Computer Readable Form (CRF)
  - b.  Specification Sequence Listing on:
    - i.  CD-ROM or CD-R (2 copies); or
    - ii.  Paper
  - c.  Statements verifying identity of above copies

**ADDRESS TO:** Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

## ACCOMPANYING APPLICATION PARTS

9.  **Assignment Papers.**  
(cover sheet & document(s))  
Name of Assignee  
LG ELECTRONICS INC.
10.  **37 CFR 3.73(c) Statement.**  **Power of Attorney.**  
(when there is an assignee)
11.  **English Translation Document.**  
(if applicable)
12.  **Information Disclosure Statement.**  
(PTO/SB/08 or PTO-1449)  
 Copies of citations attached
13.  **Preliminary Amendment.**
14.  **Return Receipt Postcard.**  
(MPEP § 503) (Should be specifically itemized)
15.  **Certified Copy of Priority Document(s).**  
(if foreign priority is claimed)
16.  **Nonpublication Request.**  
Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17.  **Other:** PTO/AIA/82A - Transmittal of Power of Attorney to One or More Registered Practitioners

**\*Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).  
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

## 19. CORRESPONDENCE ADDRESS

The address associated with Customer Number: 02292 OR  Correspondence address below

Name			
Address			
City	State	Zip Code	
Country	Telephone	Email	

Signature		Date	MAR 13 2013
Name (Print/Type)	Esther H. Chong	Registration No. (Attorney/Agent)	40953

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Evolved Wireless

Exhibit 2008

ZTE/HTC/Samsung v. Evolved Wireless

IPR2016-00757

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<h1>FEE TRANSMITTAL</h1>	Complete if known		
	Application Number	Continuation	Conf. No.: N/A
	Filing Date	Herewith	
	First Named Inventor	Sung Jun PARK	
	Examiner Name	Not Yet Assigned	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27	Art Unit	Not Yet Assigned	
TOTAL AMOUNT OF PAYMENT	(\$)	1,260.00	Practitioner Docket No. 0465-2287PUS3

**METHOD OF PAYMENT** (check all that apply)
 Check  Credit Card  Money Order  None  Other (please identify): \_\_\_\_\_

 Deposit Account Deposit Account Number: 02-2448 Deposit Account Name: Birch, Stewart, Kolasch & Birch, LLP

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

 Charge fee(s) indicated below  Charge fee(s) indicated below, **except for the filing fee**
 Charge any additional fee(s) or underpayment of fee(s)  Credit any overpayment of fee(s)  
under 37 CFR 1.16 and 1.17
**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.**FEE CALCULATION****1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	390	195	620	310	250	125	1,260.00
Design	250	125	120	60	160	80	
Plant	250	125	380	190	200	100	
Reissue	390	195	620	310	760	380	
Provisional	250	125	0	0	0	0	

**2. EXCESS CLAIM FEES**

Fee Description	Fee (\$)	Small Entity Fee (\$)
Each claim over 20 (including Reissues)	62	31
Each independent claim over 3 (including Reissues)	250	125
Multiple dependent claims	460	230

<u>Total Claims</u>		<u>Extra Claims</u>	<u>Fee (\$)</u>	=	<u>Fee Paid (\$)</u>
<u>9</u>	-20 or HP =	<u>0</u>	<u>62.00</u>	=	<u>0.00</u>

HP = highest number of total claims paid for, if greater than 20.

<u>Indep. Claims</u>		<u>Extra Claims</u>	<u>Fee (\$)</u>	=	<u>Fee Paid (\$)</u>
<u>2</u>	-3 or HP =	<u>0</u>	<u>250.00</u>	=	<u>0.00</u>

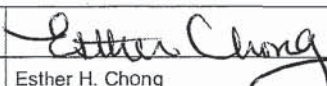
HP = highest number of independent claims paid for, if greater than 3.

**3. APPLICATION SIZE FEE**

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$320 (\$160 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).

<u>Total Sheets</u>		<u>Extra Sheets</u>	<u>Number of each additional 50 or fraction thereof</u>	<u>Fee (\$)</u>	=	<u>Fee Paid (\$)</u>
<u>48</u>	- 100 =	<u>          </u>	<u>          </u> (round up to a whole number)	<u>          </u>	=	<u>0.00</u>

**4. OTHER FEE(S)**Non-English specification, \$130 fee (no small entity discount)            0.00Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, \$400 fee (\$200 small entity)           Other (e.g., late filing surcharge):           

SUBMITTED BY		
Signature		Registration No. (Attorney/Agent) 40953
Name (Print/Type)	Esther H. Chong	Telephone 703-205-8000
		Date <b>MAR 13 2013</b>

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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Patent Application of:

Sung Jun PARK et al.

Application No.: Continuation Application

Confirmation No.: N/A

Filed: Herewith

Art Unit: Not Yet Assigned

For: DATA TRANSMISSION METHOD AND  
USER EQUIPMENT FOR THE SAME

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Examiner: Not Yet Assigned

**INFORMATION DISCLOSURE STATEMENT**

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

Dear Commissioner:

Applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the attached PTO/SB/08.

II. COPIES

a. Copies of foreign patent documents, non-patent literature and other information are provided.

b. **REFERENCES PREVIOUSLY CITED OR SUBMITTED:** Copies of any information not provided can be found in one or more of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

**U.S. Application No. and U.S. Filing Date**

**12/972,366 filed December 17, 2010**

III. **CONCISE EXPLANATION OF THE RELEVANCE/OTHER INFORMATION**

a. **NON-ENGLISH LANGUAGE DOCUMENTS:** A concise explanation of the relevance of all non-English language patents, publications, or other information listed is as follows:

b. **ENGLISH LANGUAGE SEARCH REPORT OR FOREIGN PATENT OFFICE COMMUNICATION:** An English language version of the search report or Foreign Patent Office communication that indicates the degree of relevance is attached.

c. **OTHER:** The following additional information is provided.

IV. **STATEMENT UNDER 37 C.F.R. § 1.97(e)**

The undersigned hereby states that:

a. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **30 days** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

b. Each item of information contained in the IDS 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 this IDS. This statement does not relate to English language

counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

c. No item of information contained in the IDS 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 IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than **three months** prior to the filing of the IDS; or

d. Some of the items of information in the IDS were cited in a communication from a foreign patent office. Such items were first cited in a communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office. As to the remaining items of information, to the knowledge of the person signing the certification after making reasonable inquiry, such remaining items were not known to any individual designated in 37 C.F.R. § 1.56(c) more than **three months** prior to the filing of this statement.

V. STATEMENT UNDER 37 C.F.R. § 1.704(d)(1)

**Patent Term Adjustment Reduction Should Not Apply**

The undersigned hereby states:

This Information Disclosure Statement is in compliance with 37 C.F.R. §§ 1.97 and 1.98 and will not be considered a failure to engage in reasonable efforts to conclude prosecution (processing or examination) of the present application under 37 C.F.R. § 1.704(c)(6), (c)(8), (c)(9), or (c)(10), because each item of information contained in the Information Disclosure Statement:

- (i) Was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and this communication was not received by any individual designated in § 1.56(c) more than **thirty days** prior to the filing of the information disclosure statement; or
- (ii) Is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § 1.56(c) more than **thirty days** prior to the filing of the information disclosure statement.

## VI. FEES

- a. **This Information Disclosure Statement is being filed concurrently with the filing of a new patent application or Request for Continued Examination. No fee is required.**
- b. This Information Disclosure Statement is being filed within three months of the filing date of an application. No fee is required.
- c. This Information Disclosure Statement is being filed before the mailing date of a first Action on the merits. No fee is required. If a first Office Action on the merits has issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) above. If no statement has been made, charge our deposit account for the required fee.
- d. This Information Disclosure Statement is being filed before the mailing date of a Final Office Action or before the mailing date of a Notice of Allowance or before an action that otherwise closes prosecution in the application (see 37 C.F.R. § 1.97(c)(1)).
- No statement. The fee as required by 37 C.F.R. § 1.17(p) is provided.
- or
- See the above statement. No fee is required.

e. This Information Disclosure Statement is being filed after the mailing date of a Final Office Action or after the mailing date of a Notice of Allowance or after an action that otherwise closes prosecution in the application (see 37 C.F.R. § 1.97(d)), see the statement above. The fee as required by 37 C.F.R. § 1.17(p) is provided.

VII. PAYMENT OF FEES

- The required fee is listed on the attached Fee Transmittal.
- No fee is required.**

If the Examiner has any questions concerning this IDS, please contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the USPTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 02-2448.

MAR 13 2013

Dated: \_\_\_\_\_

Respectfully submitted,

By Esther Chong  
 Esther H. Chong  
 Registration No.: 40953  
 BIRCH, STEWART, KOLASCH & BIRCH, LLP  
 8110 Gatehouse Road, Suite 100 East  
 P.O. Box 747  
 Falls Church, VA 22040-0747  
 703-205-8000

Attachment(s):

- PTO/SB/08**
- Document(s)
- Foreign Patent Office Communication(s)
- Foreign Search Report(s)
- Fee
- Other:

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Substitute for form 1449A/PTO  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>  (Use as many sheets as necessary)			<b>Complete if Known</b>		
			<b>Application Number</b>	Continuation	
			<b>Filing Date</b>		
			<b>First Named Inventor</b>	Sung Jun Park	
			<b>Art Unit</b>	Not Yet Assigned	
			<b>Examiner Name</b>	Not Yet Assigned	
			<b>Attorney Docket Number</b>	0465-2287PUS3	
<b>Sheet</b>	1	of	2		

U.S. PATENT DOCUMENTS						
Examiner initial *	Cite No.	Document Number		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number - Kind Code <sup>2</sup> (if known)				
	1	US-2007/0042784-A1		02-22-2007	Anderson	
	2	US-2007/0115871-A1		05-24-2007	Zhang et al.	
	3	US-2010/0034162 - A1		02-11-2010	Ou et al	
	4	US-2010/0037113 - A1		02-11-2010	Maheshwari et al	
	5	US-2011/0176513 - A1		07-21-2011	Yi et al.	
	6	US-7,660,279 - B2		02-09-2010	Brueck et al	

FOREIGN PATENT DOCUMENTS								
Examiner Initial *	Cite No. 1	Foreign Patent Document			Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear	T
		Country <sup>3</sup> Code	Number <sup>4</sup>	Kind Code (if known) <sup>5</sup>				
	7	KR	10-2007-0055004-A		05-30-2007			<input type="checkbox"/>
	8	KR	10-2007-0107619 - A		11-07-2007			<input type="checkbox"/>
	9	KR	10-2008-0030941 - A		04-07-2008			<input type="checkbox"/>
	10	WO	2008/023932-A1		02-28-2008			<input type="checkbox"/>
	11	JP	2008-103862 - A		05-01-2008			<input type="checkbox"/>
								<input type="checkbox"/>

<b>Examiner Signature</b>	<b>Date Considered</b>
---------------------------	------------------------

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1. Applicant's unique citation design number (optional). 2 See Kinds Codes of USPTO patent Documents. at www.uspto.gov or MPEP 901.04. 3. Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5. Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. 6. Applicant is to place a check mark here if English language Translation is attached.

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

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Substitute for form 1449B/PTO				<b>Complete if Known</b>			
				Application Number	Continuation		
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				Filing Date			
				<i>(Use as many sheets as necessary)</i>		First Named Inventor	Sung Jun Park
				Art Unit	Not Yet Assigned		
				Examiner Name	Not Yet Assigned		
				Attorney Docket Number	0465-2287PUS3		
Sheet	2	of	2				

NON PATENT LITERATURE DOCUMENTS			
Examiner initial *	Cite No. 1	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>2</sup>
	12	3GPP Draft, 3rd Generation Partnership Project (3GPP), "Enforcing New Transmission After Flushing HARQ Process", 3GPP TSG-RAN 2 Meeting #65, pp. 1-6, February 9-13, 2009, XP-050323002.	<input type="checkbox"/>
	13	3GPP TS 36.321 V8.2.0., "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) Medium Access Control (MAC) protocol specification (Release 8), pgs. 1-33, May 2008, XP-002555898.	<input type="checkbox"/>
	14	LG Electronics, "Corrections to the Random Access Response Reception"; 3GPP TSG-RAN WG2 #62, May 5-9, 2008; pp. 3, Paragraph 5.1.4, XP-050140134.	<input type="checkbox"/>
			<input type="checkbox"/>
			<input type="checkbox"/>
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			<input type="checkbox"/>
			<input type="checkbox"/>
			<input type="checkbox"/>
			<input type="checkbox"/>

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

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

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

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

**UNITED STATES PATENT APPLICATION**

**OF**

**[Sung Jun PARK, Seung June YI, Young Dae LEE and Sung Duck CHUN]**

**FOR**

**DATA TRANSMISSION METHOD AND USER EQUIPMENT FOR THE SAME**

**CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] This application is a Continuation of co-pending Application No. 12/972,366 filed on December 17, 2010, which is a Continuation of U.S. Application No. 12/538,514 filed on August 10, 2009, now U.S. Patent 7,881,236, issued on February 1, 2011, which claims the benefit of U.S. Provisional Application No. 61/087,988, filed on August 11, 2008, and which claims the benefit of Korean Patent Application No. 10-2009-0057128, filed on June 25, 2009. The entire contents of each of these applications are hereby incorporated by reference.

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

[0002] The present invention relates to a mobile communication technology, and more particularly, to a method for efficiently transmitting data stored in a message 3 (Msg3) buffer and a user equipment for the same.

**Discussion of the Related Art**

[0003] As an example of a mobile communication system to which the present invention is applicable, a 3<sup>rd</sup> Generation Partnership Project Long Term Evolution (3GPP LTE) communication system will be schematically described.

[0004] FIG. 1 is a schematic view showing the network architecture of an Evolved Universal Mobile Telecommunication System (E-UMTS) as an example of a mobile communication system.

[0005] The E-UMTS is evolved from the existing UMTS and has been currently standardized in the 3GPP. Generally, the E-UMTS may be called an LTE system.

**[0006]** An E-UMTS network may be largely divided into an Evolved UMTS Terrestrial Radio Access Network (E-UTRAN) 101 and a Core Network (CN) 102. The E-UTRAN 101 may include a User Equipment (UE) 103, a base station (hereinafter, referred to as an “eNode B” or “eNB”) 104, and an Access Gateway (AG) 105 positioned at the end of the network and connected to an external network. The AG 105 may be divided into a portion for processing user traffic and a portion for processing control traffic. At this time, an AG for processing new user traffic and an AG for processing control traffic may communicate with each other using a new interface.

**[0007]** One or more cells may exist in one eNode B. A plurality of eNode Bs may be connected by an interface for transmitting the user traffic or control traffic. The CN 102 may include the AG 105 and a node for registering a user of the UE 103. An interface for distinguishing between the E-UTRAN 101 and the CN 102 may be used.

**[0008]** Layers of radio interface protocol between the UE and the network may be classified into a first layer L1, a second layer L2 and a third layer L3 based on three lower layers of an Open System Interconnection (OSI) reference model that is widely known in the field of communication systems. A physical layer belonging to the first layer provides an information transfer service using a physical channel. A Radio Resource Control (RRC) layer belonging to the third layer serves to control radio resources between the UE and the network. The UE and the network exchange an RRC message via the RRC layer. The RRC layer may be distributed and located at network nodes of the eNode B 104 and the AG 105. Alternatively, the RRC layer may be located at only the eNode B 104 or the AG 105.

**[0009]** FIGs. 2 and 3 show the structures of radio interface protocols between the UE and the UTRAN based on a 3GPP radio access network standard.

**[0010]** The radio interface protocols of FIGs. 2 and 3 are horizontally formed of a physical layer, a data link layer and a network layer. The radio interface protocols are vertically formed of a user plane for transmitting data information and a control plane for transmitting control signals. In detail, FIG. 2 shows the layers of a radio protocol control plane and FIG. 3 shows the layers of a radio protocol user plane. The protocol layers of FIGs. 2 and 3 may be divided into a first layer (L1), a second layer (L2) and a third layer (L3) based on three lower layers of an OSI reference model that is widely known in the field of communication systems.

**[0011]** Hereinafter, the layers of the control plane of the radio protocol of FIG. 2 and the user plane of the radio protocol of FIG. 3 will be described.

**[0012]** A physical (PHY) layer of the first layer provides an information transfer service to an upper layer using a physical channel. The PHY layer is connected to an upper layer, such as a Medium Access Control (MAC) layer, via a transport channel. Data is transferred between the MAC layer and the PHY layer via the transport channel. At this time, the transport channel is largely divided into a dedicated transport channel and a common transport channel, depending on whether or not a channel is shared. Data is also transferred between different PHY layers, such as a physical layer of a transmitting side and a physical layer of a receiving side, via a physical channel using radio resources.

**[0013]** Various layers exist in the second layer. First, the MAC layer serves to map various logical channels to various transport channels and serves to multiplex several logical channels into one transport channel. The MAC layer is connected to a Radio Link Control (RLC) layer, which is an upper layer, by the logical channel. The logical channel may be largely divided into a control channel for transmitting information about the control plane and a traffic

channel for transmitting information about the user plane according to the kinds of information transmitted.

**[0014]** The RLC layer of the second layer serves to segment and concatenate data received from an upper layer so as to adjust data size such that a lower layer transmits data in a radio section. In addition, the RLC provides three modes, namely, a Transparent Mode (TM), an Unacknowledged Mode (UM) and an Acknowledged Mode (AM) in order to guarantee various Quality of Services (QoSs) requested by Radio Bearers (RBs). In particular, the AM RLC performs a retransmission function using an Automatic Repeat and Request (ARQ) function for reliable data transmission.

**[0015]** A Packet Data Convergence Protocol (PDCP) layer of the second layer performs a header compression function to reduce the size of an Internet Protocol (IP) packet header that includes unnecessary control information and has a relatively large size, for effective transmission in a radio section having a relatively small bandwidth when transmitting an IP packet such as an IPv4 packet or an IPv6 packet. Therefore, only necessary information in a header portion of data is transmitted so as to improve transmission efficiency of the radio section. In the LTE system, the PDCP layer also performs a security function, which includes ciphering for preventing data from being intercepted by a third party and integrity protection for preventing data from being handled by a third party.

**[0016]** A Radio Resource Control (RRC) located at a highest portion of the third layer is defined only in the control plane. The RRC layer handles logical channels, transport channels and physical channels for the configuration, re-configuration and release of RBs. Here, the RBs refer to logical paths provided by the first and second layers of the radio protocol, for data transfer between the UE and the UTRAN, and the configuration of the RBs refers to a process of

defining the characteristics of the radio protocol layer and channel necessary for providing a specific service, and setting detailed parameters and operation methods. Each of the RBs is divided into a signaling RB and a data RB. The SRB is used as a path for transmitting an RRC message in the control plane (C-plane), and the DRB is used as a path for transmitting user data in the user plane (U-plane).

**[0017]** Downlink transport channels for transmitting data from a network to a UE may include a Broadcast Channel (BCH) for transmitting system information and a downlink Shared Channel (SCH) for transmitting user traffic or a control message. The traffic or the control message of a downlink multicast or broadcast service may be transmitted via the downlink SCH or via a separate Downlink Multicast Channel (MCH). Uplink transport channels for transmitting data from a UE to a network may include a Random Access Channel (RACH) for transmitting an initial control message and an uplink SCH for transmitting user traffic or a control message.

**[0018]** Downlink physical channels for transmitting information transferred via the downlink transport channels in a radio section between a network and a UE may include a Physical Broadcast Channel (PBCH) for transmitting information about a BCH, a Physical Multicast Channel (PMCH) for transmitting information about an MCH, a Physical Downlink Shared Channel (PDSCH) for transmitting information about a PCH and a downlink SCH, and a Physical Downlink Control Channel (PDCCH) (also referred to as a DL L1/L2 control channel) for transmitting control information provided by the first layer and the second layer, such as downlink (DL) or uplink (UL) scheduling grant information. Uplink physical channels for transmitting information transferred via the uplink transport channels in a radio section between a network and a UE may include a Physical Uplink Shared Channel (PUSCH) for transmitting

information about an uplink SCH, a Physical Random Access Channel (PRACH) for transmitting information about an RACH, and a Physical Uplink Control Channel (PUCCH) for transmitting control information provided by the first layer and the second layer, such as a HARQ ACK or NACK, a Scheduling Request (SR), a Channel Quality Indicator (CQI) report.

**[0019]** Hereinafter, a random access procedure provided by an LTE system will be schematically described based on the above description.

**[0020]** First, a UE performs the random access procedure in the following cases.

**[0021]** - when the UE performs initial access because there is no RRC Connection with an eNode B,

**[0022]** - when the UE initially accesses a target cell in a handover procedure,

**[0023]** - when the random access procedure is requested by a command of an eNode B,

**[0024]** - when there is uplink data transmission in a situation where uplink time synchronization is not aligned or where a specific radio resource used for requesting radio resources is not allocated, and

**[0025]** - when a recovery procedure is performed in case of radio link failure or handover failure.

**[0026]** In the LTE system, there are provided two procedures in selecting a random access preamble: one is a contention based random access procedure in which the UE randomly selects one preamble within a specific group for use, and another is a non-contention based random access procedure in which the UE uses a random access preamble allocated only to a specific UE by the eNode B. The non-contention based random access procedure may be used only in the handover procedure or when it is requested by the command of the base station, as described above.



**[0027]** A random access procedure of a UE with a specific eNode B may largely include (1) a step of, at the UE, transmitting a random access preamble to the eNode B (hereinafter, referred to as a “message 1” transmitting step if such use will not lead to confusion), (2) a step of receiving a random access response from the eNode B in correspondence with the transmitted random access preamble (hereinafter, referred to as a “message 2” receiving step if such use will not lead to confusion), (3) a step of transmitting an uplink message using the information received by the random access response message (hereinafter, referred to as a “message 3” transmitting step if such use will not lead to confusion), and (4) a step of receiving a message corresponding to the uplink message from the eNode B (hereinafter, referred to as a “message 4” receiving step if such use will not lead to confusion).

**[0028]** In the random access procedure, the UE stores data to be transmitted via the message 3 in a message 3 (Msg3) buffer and transmits the data stored in the msg3 buffer in correspondence with the reception of an Uplink (UL) Grant signal. The UL Grant signal indicates information about uplink radio resources which may be used when the UE transmits a signal to the eNode B, and is received on a random access response message received on a PDCCH or a PUSCH in the LTE system. According to the current LTE system standard, it is defined that, if the UL Grant signal is received in a state in which data is stored in the Msg3 buffer, the data stored in the Msg3 buffer is transmitted regardless of the reception mode of the UL Grant signal. As described above, if the data stored in the Msg3 buffer is transmitted in correspondence with the reception of all UL Grant signals, problems may occur. Accordingly, there is a need for research to solve such problems.

**SUMMARY OF THE INVENTION**

**[0029]** Accordingly, the present invention is directed to a data transmission method and a user equipment for the same that substantially obviate one or more problems due to limitations and disadvantages of the related art.

**[0030]** An object of the present invention is to provide a data transmission method and a user equipment for the same, which is capable of solving a problem which may occur when data stored in a message 3 (Msg3) buffer is transmitted according to a reception mode of an Uplink (UL) Grant signal.

**[0031]** Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

**[0032]** To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a method of transmitting data by a user equipment through an uplink includes receiving an uplink grant (UL Grant) signal from a base station on a specific message, determining whether there is data stored in a message 3 (Msg3) buffer when receiving the UL Grant signal on the specific message, determining whether the specific message is a random access response message, and transmitting the data stored in the Msg3 buffer to the base station using the UL Grant signal received on the specific message, if there is data stored in the Msg3 buffer when receiving the UL Grant signal on the specific message and the specific message is the random access response message.

**[0033]** If there is no data stored in the Msg3 buffer when receiving the UL Grant signal on the specific message or the specific message is not the random access response message, new data may be transmitted to the base station in correspondence with the UL Grant signal received on the specific message.

**[0034]** The UL Grant signal received on the specific message may be a UL Grant signal received on a Physical Downlink Control Channel (PDCCH). In this case, the user equipment may transmit new data in correspondence with the UL Grant signal received on the PDCCH.

**[0035]** The UL Grant signal received on the specific message may be a UL Grant signal received on a random access response message received on Physical Downlink Shared Channel (PDSCH). In this case, if there is data stored in the Msg3 buffer when receiving the UL Grant signal on the random access response message, the user equipment may transmit the data stored in the buffer in the Msg3 buffer using the UL Grant signal received on the random access response message.

**[0036]** The data stored in the Msg3 buffer may be a Medium Access Control Protocol Data Unit (MAC PDU) including a user equipment identifier, and the data stored in the Msg3 buffer further include information about a buffer status report (BSR) if the user equipment starts the random access procedure for the BSR.

**[0037]** In another aspect of the present invention, a user equipment includes a reception module receiving an uplink grant (UL Grant) signal from a base station on a specific message, a transmission module transmitting data to the base station using the UL Grant signal received on the specific message, a message 3 (Msg3) buffer storing UL data to be transmitted in a random access procedure, and a Hybrid Automatic Repeat Request (HARQ) entity determining whether there is data stored in the Msg3 buffer when the reception module receives the UL Grant signal

and the specific message is a random access response message, acquiring the data stored in the Msg3 buffer if there is data stored in the Msg3 buffer when the reception module receives the UL Grant signal and the specific message is the random access response message, and controlling the transmission module to transmit the data stored in the Msg3 buffer to the base station using the UL Grant signal received by the reception module on the specific message.

**[0038]** The user equipment may further include a multiplexing and assembly entity used for transmission of new data. In this case, the HARQ entity may acquire the new data to be transmitted from the multiplexing and assembly entity if there is no data stored in the Msg3 buffer when the reception module receives the UL Grant signal on the specific message or the received message is not the random access response message, and control the transmission module to transmit the new data acquired from the multiplexing and assembly entity using the UL Grant signal received by the reception module on the specific message.

**[0039]** The user equipment may further include one or more HARQ processes, and HARQ buffers respectively corresponding to the one or more HARQ processes. In this case, the HARQ entity may transfer the data acquired from the multiplexing and assembly entity or the Msg3 buffer to a specific HARQ process of the one or more HARQ processes and control the specific HARQ process to transmit the data acquired from the multiplexing and assembly entity or the Msg3 buffer through the transmission module.

**[0040]** When the specific HARQ process transmits the data stored in the Msg3 buffer through the transmission module, the data stored in the Msg3 buffer may be controlled to be copied into a specific HARQ buffer corresponding to the specific HARQ process, and the data copied into the specific HARQ buffer may be controlled to be transmitted through the transmission module.

[0041] The UL Grant signal received by the reception module on the specific message may be a UL Grant signal received on a Physical Downlink Control Channel (PDCCH). In this case, the HARQ entity may control new data to be transmitted in correspondence with the received UL Grant signal received on the PDCCH.

[0042] The UL Grant signal received by the reception module on the specific message may be a UL Grant signal received on a random access response message received on Physical Downlink Shared Channel (PDSCH), and the HARQ entity may control the data stored in the Msg3 buffer to be transmitted using the UL Grant signal received on the random access response message if there is data stored in the Msg3 buffer when the reception module receives the UL Grant signal on the random access response message.

[0043] According to the above-described embodiments of the present invention, it is possible to transmit data stored in a Msg3 buffer according to a reception mode of a UL Grant signal, without confusion.

[0044] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0045] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

**[0046]** FIG. 1 is a schematic view showing the network architecture of an Evolved Universal Mobile Telecommunication System (E-UMTS) as an example of a mobile communication system;

**[0047]** FIGs. 2 and 3 are views showing the structures of radio interface protocols between a user equipment (UE) and a UMTS Terrestrial Radio Access Network (UTRAN) based on a 3<sup>rd</sup> Generation Partnership Project (3GPP) radio access network standard;

**[0048]** FIG. 4 is a view illustrating an operating procedure of a UE and a base station (eNode B) in a non-contention based random access procedure;

**[0049]** FIG. 5 is a view illustrating an operating procedure of a UE and an eNode B in a contention based random access procedure;

**[0050]** FIG. 6 is a view illustrating an uplink Hybrid Automatic Repeat Request (HARQ) scheme;

**[0051]** FIG. 7 is a view illustrating a method of transmitting a message 3 in a random access procedure when uplink radio resources are requested;

**[0052]** FIG. 8 is a view illustrating a problem which may occur when data stored in a message 3 buffer is transmitted by an Uplink (UL) Grant signal received on a message other than a random access response message;

**[0053]** FIG. 9 is a flowchart illustrating a method of transmitting uplink data by a UE according to a preferred embodiment of the present invention;

**[0054]** FIG. 10 is a view illustrating a method of transmitting uplink data when a Buffer status Report (BSR) is triggered in a UE, according to an embodiment of the present invention; and

**[0055]** FIG. 11 is a schematic view showing the configuration of a UE according to an embodiment of the present invention.

### **DETAILED DESCRIPTION OF THE INVENTION**

**[0056]** Hereinafter, the preferred embodiments of the present invention will be described with reference to the accompanying drawings. It is to be understood that the detailed description which will be disclosed along with the accompanying drawings is intended to describe the exemplary embodiments of the present invention, and is not intended to describe a unique embodiment which the present invention can be carried out. Hereinafter, the detailed description includes detailed matters to provide full understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention can be carried out without the detailed matters. For example, the following description will be made on the assumption that a mobile communication system is a 3<sup>rd</sup> Generation Partnership Project Long Term Evolution (3GPP LTE) system, but the present invention is applicable to other mobile communication systems excluding the 3GPP LTE system.

**[0057]** In some instances, well-known structures and devices are omitted in order to avoid obscuring the concepts of the present invention and the important functions of the structures and devices are shown in block diagram form. The same reference numbers will be used throughout the drawings to refer to the same or like parts.

**[0058]** In the following description, it is assumed that a terminal includes a mobile or fixed user end device such as a user equipment (UE) and a mobile station (MS), and a base station includes a node of a network end communicating with a terminal, such as a Node-B, an eNode B, and a base station.

**[0059]** As described above, in the following description, a problem which may occur when data stored in a message 3 (Msg3) buffer is transmitted according to a reception mode of an Uplink (UL) Grant signal will be described in detail and a method of solving the problem will be described. Transmission and reception of a signal using a random access procedure and a Hybrid Automatic Repeat Request (HARQ) scheme will be described in detail.

**[0060]** FIG. 4 is a view illustrating an operating procedure of a terminal (UE) and a base station (eNode B) in a non-contention based random access procedure.

**[0061]** (1) Random Access Preamble Assignment

**[0062]** As described above, a non-contention based random access procedure may be performed (1) in a handover procedure and (2) when the random access procedure is requested by a command of an eNode B. Even in these cases, a contention based random access procedure may be performed.

**[0063]** First, it is important that a specific random access preamble without the possibility of collision is received from the eNode B, for the non-contention based random access procedure. Methods of receiving the random access preamble may include a method using a handover command and a method using a Physical Downlink Control Channel (PDCCH) command. The UE receives an assigned random access preamble (S401).

**[0064]** (2) Message 1 Transmission

**[0065]** The UE transmits the preamble to the eNode B after receiving the assigned random access preamble from the eNode B as described above (S402).

**[0066]** (3) Message 2 Transmission

**[0067]** The UE attempts to receive a random access response within a random access response reception window indicated by the eNode B through a handover command or system



information after transmitting the random access preamble in step S402 (S403). More specifically, the random access response information may be transmitted in the form of a Medium Access Control (MAC) Packet Data Unit (PDU), and the MAC PDU may be transferred via a Physical Downlink Shared Channel (PDSCH). In addition, the UE preferably monitors the PDCCH in order to enable to the UE to properly receive the information transferred via the PDSCH. That is, the PDCCH may preferably include information about a UE that should receive the PDSCH, frequency and time information of radio resources of the PDSCH, a transfer format of the PDSCH, and the like. Here, if the PDCCH has been successfully received, the UE may appropriately receive the random access response transmitted on the PDSCH according to information of the PDCCH. The random access response may include a random access preamble identifier (e.g. Random Access-Radio Network Temporary Identifier (RA-RNTI)), an UL Grant indicating uplink radio resources, a temporary C-RNTI, a Time Advance Command (TAC), and the like.

**[0068]** As described above, the reason why the random access response includes the random access preamble identifier is because a single random access response may include random access response information of at least one UE and thus it is reported to which UE the UL Grant, the Temporary C-RNTI and the TAC are valid. In this step, it is assumed that the UE selects a random access preamble identifier matched to the random access preamble selected by the UE in step S402.

**[0069]** In the non-contention based random access procedure, it is determined that the random access procedure is normally performed, by receiving the random access response information, and the random access procedure may be finished.

[0070] FIG. 5 is a view illustrating an operating procedure of a UE and an eNode B in a contention based random access procedure.

[0071] (1) Message 1 transmission

[0072] First, the UE may randomly select a single random access preamble from a set of random access preambles indicated through system information or a handover command, and select and transmit a Physical Random Access Channel (PRACH) capable of transmitting the random access preamble (S501).

[0073] (2) Message 2 reception

[0074] A method of receiving random access response information is similar to the above-described non-contention based random access procedure. That is, the UE attempts to receive its own random access response within a random access response reception window indicated by the eNode B through the system information or the handover command, after the random access preamble is transmitted in step S501, and receives a Physical Downlink Shared Channel (PDSCH) using random access identifier information corresponding thereto (S502). Accordingly, the UE may receive a UL Grant, a Temporary C-RNTI, a TAC and the like.

[0075] (3) Message 3 transmission

[0076] If the UE has received the random access response valid for the UE, the UE may process all of the information included in the random access response. That is, the UE applies the TAC, and stores the temporary C-RNTI. In addition, data which will be transmitted in correspondence with the reception of the valid random access response may be stored in a Msg3 buffer. A process of storing the data in the Msg3 buffer and transmitting the data will be described later with reference to FIG. 7.

**[0077]** The UE uses the received UL Grant so as to transmit the data (that is, the message 3) to the eNode B (S503). The message 3 should include a UE identifier. In the contention based random access procedure, the eNode B may not determine which UEs are performing the random access procedure, but later the UEs should be identified for contention resolution.

**[0078]** Here, two different schemes for including the UE identifier may be provided. A first scheme is to transmit the UE's cell identifier through an uplink transmission signal corresponding to the UL Grant if the UE has already received a valid cell identifier allocated by a corresponding cell prior to the random access procedure. Conversely, the second scheme is to transmit the UE's unique identifier (e.g., S-TMSI or random ID) if the UE has not received a valid cell identifier prior to the random access procedure. In general, the unique identifier is longer than the cell identifier. If the UE has transmitted data corresponding to the UL Grant, the UE starts a contention resolution (CR) timer.

**[0079]** (4) Message 4 reception

**[0080]** After transmitting the data with its identifier through the UL Grant included in the random access response, the UE waits for an indication (instruction) from the eNode B for contention resolution. That is, the UE attempts to receive the PDCCH so as to receive a specific message (S504). Here, there are two schemes to receive the PDCCH. As described above, the UE attempts to receive the PDCCH using its own cell identifier if the message 3 transmitted in correspondence with the UL Grant is transmitted using the UE's cell identifier, and the UE attempts to receive the PDCCH using the temporary C-RNTI included in the random access response if the identifier is its unique identifier. Thereafter, in the former scheme, if the PDCCH is received through its own cell identifier before the contention resolution timer is expired, the UE determines that the random access procedure has been normally performed and completes

the random access procedure. In the latter scheme, if the PDCCH is received through the temporary C-RNTI before the contention resolution timer has expired, the UE checks data transferred by the PDSCH indicated by the PDCCH. If the unique identifier of the UE is included in the data, the UE determines that the random access procedure has been normally performed and completes the random access procedure.

**[0081]** Hereinafter, the LTE system, by way of example, a uplink Hybrid Automatic Repeat Request (HARQ) scheme of a MAC layer will be described, concentrating on the transmission of uplink data.

**[0082]** FIG. 6 is a view illustrating an HARQ scheme.

**[0083]** A UE may receive UL Grant information or UL scheduling information from an eNode B on a PDCCH (step S601), in order to transmit data to the eNode B by the HARQ scheme. In general, the UL scheduling information may include a UE identifier (e.g., a C-RNTI or a Semi-Persistent Scheduling C-RNTI), resource block assignment, transmission parameters (modulation, coding scheme and redundancy version), and a New Data Indicator (NDI). In the LTE system, the UE has eight HARQ processes and the HARQ processes are synchronously performed with Transmission Time Intervals (TTIs). That is, specific HARQ processes may be sequentially assigned according to points in time when data is received, in a manner of using the first HARQ process at TTI 9 and using the second HARQ process at TTI 10 after a first HARQ process is used at TTI 1, a second HARQ process is used at TTI 2, ..., and an eighth HARQ process is used at TTI 8.

**[0084]** In addition, since the HARQ processes are synchronously assigned as described above, a HARQ process connected to a TTI in which a PDCCH for initial transmission of specific data is received is used for the transmission of the data. For example, if it is assumed

that the UE has received a PDCCH including UL scheduling information at an  $N^{\text{th}}$  TTI, the UE transmits data at an  $(N+4)^{\text{th}}$  TTI. In other words, a  $K^{\text{th}}$  HARQ process assigned at the  $(N+4)^{\text{th}}$  TTI is used for the transmission of the data. That is, the UE may transmit the data to the eNode B on a PUSCH according to the UL scheduling information after checking the UL scheduling information transmitted to the UE by monitoring the PDCCH at every TTI (step S602).

**[0085]** When the data has been received, the eNode B stores the data in a soft buffer and attempts to decode the data. The eNode B transmits an ACK signal if the decoding of the data succeeds and transmits a NACK signal if the decoding of the data fails. An example in which the decoding of the data fails and the eNode B transmits the NACK signal on a Physical HARQ Indicator Channel (PHICH) is shown in FIG. 6 (step S603).

**[0086]** When the ACK signal has been received from the eNode B, the UE determines that the transmission of the data to the eNode B succeeds and transmits next data. However, when the UE receives the NACK signal as shown in FIG. 6, the UE may determine that the transmission of the data to the eNode B has failed and retransmit the same data by the same scheme or a new scheme (step S604).

**[0087]** The HARQ retransmission of the UE may be performed by a non-adaptive scheme. That is, the initial transmission of specific data may be performed when the PDCCH including the UL scheduling information should be received, but the retransmission may be performed even when the PDCCH is not received. In the non-adaptive HARQ retransmission, the data is retransmitted using the same UL scheduling information as the initial transmission at a TTI at which a next HARQ process is assigned, without receiving the PDCCH.

**[0088]** The HARQ retransmission of the UE may be performed by an adaptive scheme. In this case, transmission parameters for retransmission are received on the PDCCH, but the UL

scheduling information included in the PDCCH may be different from that of the initial transmission according to channel statuses. For example, if the channel status is better than that of the initial transmission, transmission may be performed at a high bit rate. In contrast, if the channel status is worse than that of the initial transmission, transmission may be performed at a lower bit rate than that of the initial transmission.

**[0089]** If the UE receives the UL scheduling information on the PDCCH, it is determined whether data which should be transmitted at this time is data which is initially transmitted or previous data which is retransmitted, by an NDI field included in the PDCCH. The NDI field is toggled in the order of 0, 1, 0, 1, ... whenever new data is transmitted as described above, and the NDI field of the retransmission has the same value as that of the initial transmission. Accordingly, the UE may compare the NDI field with the previously transmitted value so as to determine whether or not the data is retransmitted.

**[0090]** The UE counts the number of times of transmission (CURRENT\_TX\_NB) whenever data is transmitted by the HARQ scheme, and deletes the data stored in the HARQ buffer when CURRENT\_TX\_NB has reached a maximum transmission number set in an RRC layer.

**[0091]** When the retransmitted data is received, the eNode B attempts to combine the received data and the data stored in the soft buffer due to the failure of the decoding by various schemes and decodes the combined data. The eNode B transmits an ACK signal to the UE if the decoding succeeds and transmits a NACK signal to the UE if the decoding fails. The eNode B repeats a process of transmitting the NACK signal and receiving the retransmitted data until the decoding of the data succeeds. In the example of FIG. 6, the eNode B attempts to combine the data retransmitted in step S604 and the data which is previously received and stored and decodes

the combined data. The eNode B transmits the ACK signal to the UE on the PHICH if the decoding of the received data succeeds (step S605). The UE may transmit the UL scheduling information for the transmission of next data to the UE on the PDCCH, and may transmit the NDI toggled to 1 in order to report that the UL scheduling information is not used for the adaptive retransmission, but is used for the transmission of new data (step S606). The UE may transmit new data to the eNode B on the PUSCH corresponding to the received UL scheduling information (step S607).

**[0092]** The random access procedure may be triggered in the above-described cases as described above. Hereinafter, the case where the UE requests UL radio resources will be described.

**[0093]** FIG. 7 is a view illustrating a method of transmitting a message 3 in a random access procedure when UL radio resources are requested.

**[0094]** When new data is generated in a transfer buffer 601 of the UE, for example, an RLC buffer and a PDCP buffer, the UE should generally inform the eNode B of information about the generation of the data. More accurately, when data having priority higher than that of data stored in the transfer buffer of the UE is generated, the UE informs the eNode B that the data is generated.

**[0095]** This indicates that the UE requests radio resources to the eNode B in order to transmit the generated data. The eNode B may assign proper radio resources to the UE according to the above information. The information about the generation of the data is called a buffer status report (hereinafter, referred to as “BSR”). Hereinafter, as described above, the request for the transmission of the BSR is represented by triggering of the BSR transmission (S6100). If the BSR transmission is triggered, the UE should transmit the BSR to the eNode B.

However, if the radio resources for transmitting the BSR are not present, the UE may trigger a random access procedure and attempt to request radio resources (S6200).

[0096] As described above, if the random access procedure for requesting the radio resources to the eNode B is triggered, the UE may transmit a random access preamble to the eNode B and receive a random access response message corresponding thereto as described with reference to FIGs. 4 and 5. In addition, a message 3 (that is, a MAC PDU) including a UE identifier and a BSR may be generated and stored in a Msg3 buffer 602, in a MAC layer of the UE through a UL Grant signal included in the random access response message. The message 3 stored in the Msg3 buffer 602 may be copied and stored in a HARQ process buffer 603 indicated by the UL Grant information. FIG. 7 shows, by way of example, the case where the HARQ process A is used for the transmission of the message 3. Thus, the message 3 is copied to the HARQ buffer 603 corresponding to the HARQ process A. The message 3 stored in the HARQ buffer 603 may be transmitted to the eNode B on a PUSCH.

[0097] Meanwhile, if the UE should perform retrial of the random access procedure due to contention resolution failure, the UE may transmit the random access preamble to the eNode B again and receive a random access response (S6300). However, in the retried random access procedure, the UE uses the message 3 stored in the Msg3 buffer 602 again, without generating a new message 3. That is, the UE may copy and store the MAC PDU corresponding to the message 3 stored in the Msg3 buffer 602 in a HARQ buffer 604, and transmit the MAC PDU, according to the UL Grant signal included in the random access response received in the retried random access procedure. FIG. 7 shows the case where the reattempted random access procedure is performed by a HARQ process B. The data stored in the Msg3 buffer 602 may be copied into the HARQ buffer B and transmitted.



**[0098]** As described above, if the random access response is received while the random access procedure is performed, the UE stores the message 3 stored in the Msg3 buffer in the HARQ buffer and transmits the message 3. As described above, in the current the LTE system standard for the HARQ process, it is defined that the transmission of the data stored in the Msg3 buffer is triggered by the reception of any UL Grant signal. Accordingly, the CR timer may be erroneously driven such that an erroneous contention resolution process is performed. Due to the erroneous contention resolution procedure, the above-described BSR may not be normally transmitted and the UE may come to deadlock. This problem will be described in detail with reference to FIG. 8.

**[0099]** FIG. 8 is a view illustrating a problem which may occur when data stored in a Msg3 buffer is transmitted by an Uplink (UL) Grant signal received on a message other than a random access response message.

**[00100]** As described with reference to FIG. 7, the UE may trigger the BSR when high priority data is generated, transmit the random access preamble in order to transmit the BSR to the eNode B (S801), and receive the random access response corresponding thereto (S802).

**[00101]** Thereafter, the UE may transmit a message 3 including the BSR via UL Grant information included in the random access response message received in step S802 (S803). If the message 3 is transmitted, the CR timer is operated as described with reference to FIG. 5.

**[00102]** If the random access procedure is completed before the CR timer expires, the UE determines that the random access procedure has not been successfully completed (S804). In this case, the UE may try to restart the random access procedure from the transmission of the random access preamble.

**[00103]** At this time, since the eNode B does not yet know that the UE is performing the random access procedure, the eNode B may transmit a UL Grant signal independent of the random access procedure on a masked PDCCH (S805). In this case, according to the current LTE system standard, the UE transmits the message 3 stored in the Msg3 buffer according to the UL Grant signal received on the PDCCH in step S805 (S806). In addition, when the message 3 is transmitted, the CR timer is restarted. That is, even when the UE does not perform the transmission of the random access preamble and the reception of the random access response message, the CR timer is restarted in step S806.

**[00104]** Although the CR timer is started as the UE transmits the message 3 in step S806, the eNode B may not know that the UE is performing the random access procedure because the reception of the random access preamble and the transmission of the random access response message are not performed. If another UL Grant signal is received on the PDCCH including the UE identifier (S807), the UE determines that the ongoing random access procedure is successfully completed. Accordingly, the UE may stop the ongoing CR time (S808).

**[00105]** If the message 3 transmitted to the eNode B in step S806 is not successfully received by the eNode B (A), the UE no longer transmits the message 3 including the BSR. Accordingly, if additional data is not generated, the UE may not transmit the data generated in the transfer buffer to the eNode B.

**[00106]** The above-described problem will be described as follows.

**[00107]** According to the current LTE system standard, if the UL Grant signal is received in a state in which the data is stored in the Msg3 buffer, the UE transmits the data stored in the Msg3 buffer to the eNode B. At this time, the UL Grant signal may be transmitted by the eNode

B, not for the transmission of the data stored in the Msg3 buffer, but for the transmission of other data. Accordingly, the CR timer may be erroneously started.

**[00108]** In addition, if the eNode B does not know that the CR timer is erroneously started in the UE and transmits the UL Grant signal for the transmission of other data as described with reference to FIG. 8, information (e.g., BSR) to be transmitted through the message 3 may be lost.

**[00109]** In addition, the UE may not receive a message 4 for completing a proper contention resolution procedure even with respect to the ongoing random access procedure.

**[00110]** In a preferred embodiment of the invention for solving the above-described problem, the data stored in the Msg3 buffer is restrictively transmitted only in the case where the UL Grant signal received from the eNode B is received on the random access response message, but not in all cases where the UL Grant signal is received from the eNode B. If the UL Grant signal is received on the masked PDCCH not by the random access response message but by the UE identifier (C-RNTI or a Semi Persistent Scheduling Radio Network Temporary Identifier (SPS-RNTI)) in a state in which the data is stored in the Msg3 buffer, a method of acquiring and transmitting new data (MAC PDU) to the eNode B instead of the data stored in the Msg3 buffer is suggested.

**[00111]** FIG. 9 is a flowchart illustrating a method of transmitting UL data by a UE according to a preferred embodiment of the present invention. In more detail, FIG. 9 shows the operation of a HARQ entity of the UE according to an embodiment of the present invention at every TTI.

**[00112]** First, the HARQ entity of the UE may identify a HARQ process associated with a TTI (S901). If the HARQ process associated with the TTI is identified, the HARQ entity of the UE may determine whether or not a UL Grant signal received from the eNode B indicated at the

TTI (S902). The UE may determine whether or not a HARQ buffer corresponding to the HARQ process is empty if there is no information about the received UL Grant signal at the TTI, and perform non-adaptive retransmission as described with reference to FIG. 6 if there is data in the HARQ buffer (S903).

**[00113]** Meanwhile, if there is a UL Grant signal received from the eNode B at the TTI, it may be determined (1) whether the UL Grant signal is not received on the PDCCH indicated by the temporary C-RNTI and the NDI is toggled from the value during transmission prior to the HARQ process, (2) whether there is previous NDI and this transmission is initial transmission of the HARQ process, (3) whether the UL Grant signal is received on the PDCCH indicated by the C-RNTI and the HARQ buffer of the HARQ process is empty, or (4) whether the UL Grant signal is received on the random access response message (S904). If any one of the conditions (1) to (4) is satisfied in step S904 (A), the method progresses to step S906. In contrast, if any one of the conditions (1) to (4) is not satisfied in step S904 (B), the method progresses to step S905 of performing adaptive retransmission using the UL Grant signal (S905).

**[00114]** Meanwhile, the UE determines whether there is data in the Msg3 buffer in step S906 (S906). In addition, even when there is data in the Msg3 buffer, the UE determines whether the received UL Grant signal is received on the random access response message (S907). That is, the UE according to the present embodiment transmits the data stored in the Msg3 buffer only when there is data in the Msg3 buffer when receiving the UL Grant signal and the UL Grant signal is received on the random access response message (S908). If there is no data in the Msg3 buffer when receiving the UL Grant signal or the UL Grant is not received on the random access response message, the UE determines that the eNode B makes a request not for the transmission of the data stored in the Msg3 buffer but for transmission of new data, and performs new data

transmission (S909). In more detail, the HARQ entity of the UE may be controlled such that a MAC PDU including new data from a multiplexing and assembly entity is acquired and is transmitted through the HARQ process.

**[00115]** Hereinafter, an example applied to a process of transmitting a BSR by the UE which operates by the embodiment described with reference to FIG. 9 as shown in FIG. 8 will be described.

**[00116]** FIG. 10 is a view illustrating a method of transmitting UL data when a BSR is triggered in a UE, according to an embodiment of the present invention.

**[00117]** As described above, new data may be generated in the RLC and PDCP buffers of the UE. It is assumed that the generated new data has higher priority than that of the data already stored in the RLC and PDCP buffers. The UE may trigger the BSR transmission in order to inform an eNode B of information about the generation of the data (step 1).

**[00118]** The UE should transmit the BSR according to BSR transmission trigger, but, in a special case, there may be no radio resource for transmitting the BSR. In this case, the UE may trigger a random access procedure for transmitting the BSR. It is assumed that the random access procedure triggered in the present embodiment is the contention based random access procedure described with reference to FIG. 5.

**[00119]** The UE may transmit a random access preamble to the eNode B according to the triggering of the random access procedure (step 2).

**[00120]** The eNode B may receive the random access preamble transmitted by the UE and transmit a random access response message to the UE (step 3). The UE may receive the random access response message.

**[00121]** The UE may generate a message 3 including the BSR and a UE identifier according to a UL Grant signal included in the random access response message received in step 3 and store the message 3 in a Msg3 buffer (step 4).

**[00122]** The UE may select a HARQ process according to the UL Grant information included in the random access response message received in step 3 and copy and store the message 3 stored in the Msg3 buffer in the buffer corresponding to the selected HARQ process. Thereafter, the data stored in the HARQ buffer may be transmitted to the eNode B according to the UL HARQ procedure described with reference to FIG. 6 (step 5). The UE starts (or restarts) the CR timer by the transmission of the message 3.

**[00123]** When the CR timer expires, the UE may perform retrial of the random access procedure. That is, a random access preamble and a PRACH resource may be prepared to be selected and transmitted to the eNode B. However, in a state in which the CR timer is not operated, the UE may receive the UL Grant signal from the eNode B on a PDCCH masked by a UE identifier (step 6).

**[00124]** When the UL Grant signal has been received on the PDCCH in step 6, the UE generates new data different from the data stored in the Msg3 buffer according to the UL Grant information received in step 6 as a new MAC PDU, unlike the procedure of the embodiment of FIG. 8 for transmitting the message 3 stored in the Msg3 buffer according to the UL Grant information received in step 6 (step 7). In more detail, if the UE receives the UL Grant signal in step 6 but does not receive the UL Grant signal on the random access response message, a MAC PDU for transmitting not the data stored in the Msg3 buffer but new data from a multiplexing and assembly entity may be acquired and transmitted using a HARQ process corresponding thereto.

[00125] After the new MAC PDU is generated, the UE according to the present embodiment may select a HARQ process according to the UL Grant signal received in step 6, store the MAC PDU newly generated in step 7 in the buffer corresponding to the HARQ process, and transmit the MAC PDU to the eNode B according to the UL HARQ procedure (step 8).

[00126] Thereafter, the UE may perform a random access procedure including the transmission of the random access preamble and the reception of the random access response and transmit the BSR stored in the Msg3 buffer to the eNode B.

[00127] According to the above-described embodiment, it is possible to prevent the eNode B from erroneously operating the CR timer due to the UL Grant signal transmitted not for transmission of the data stored in the Msg3 buffer but for transmission of new data. Accordingly, the problem that the message 3 is lost may be solved. In addition, the random access procedure of the UE with the eNode B may be normally performed.

[00128] Unlike the above-described embodiment, as another embodiment of the present invention, a method of performing a process while ignoring the UL Grant signal if the UL Grant signal is received from the eNode B on the PDCCH masked by the UE identifier during the random access procedure of the UE may be implemented. In this case, the UE may transfer the message 3 to the eNode B by the normal random access procedure, and the eNode B may retransmit the UL Grant signal for the transmission of new data after the random access procedure of the UE is completed.

[00129] Hereinafter, the configuration of the UE for implementing the above-described embodiment of the present invention will be described.

[00130] FIG. 11 is a schematic view showing the configuration of a UE according to an embodiment of the present invention.

**[00131]** As shown in FIG. 11, the UE according to the present embodiment may include a reception (Rx) module 1101 for receiving a UL Grant signal from an eNode B on a specific message, a transmission (TX) module 1102 for transmitting data to the eNode B using the received UL Grant signal, a Msg3 buffer 1103 for storing UL data transmitted in a random access procedure, and a HARQ entity 1104 for controlling the transmission of UL data of the UE.

**[00132]** In particular, the HARQ entity 1104 of the UE according to the present embodiment performs a function of determining whether there is data stored in the Msg3 buffer 1103 when the Rx module 1101 receives the UL Grant signal and a function of determining whether the Rx module 1101 receives the UL Grant signal on a random access response message. If there is data stored in the Msg3 buffer 1103 when the Rx module 1101 receives the UL Grant signal and the RX module 1101 receives the UL Grant signal on the random access response message, the data stored in the Msg3 buffer 1103 is controlled to be acquired and transmitted to the eNode B. If there is no data stored in the Msg3 buffer 1103 when the Rx module 1101 receives the UL Grant signal and the RX module 1101 receives the UL Grant signal not on the random access response message but on the PDCCH, the data stored in the Msg3 buffer 1103 is not transmitted but new data is acquired from the multiplexing and assembly entity in the form of a MAC PDU and is transmitted to the eNode B.

**[00133]** In addition, in order to perform the UL HARQ procedure, the UE according to the present embodiment may include one or more HARQ processes 1106 and HARQ buffers 1107 corresponding to the HARQ processes 1106. In the current LTE system, eight independent HARQ processes are defined for use, but the present invention is not limited thereto.

**[00134]** Meanwhile, the HARQ entity 1104 according to the present embodiment may transfer the data acquired from the multiplexing and assembly entity 1105 or the msg3 buffer



1103 to a specific HARQ process 1106 using the above-described configuration, and control the specific HARQ process 1106 to transmit the data acquired from the multiplexing and assembly entity 1105 or the Msg3 buffer 1103 through the Tx module 1102. As described above, if the specific HARQ process 1106 transmits the data stored in the Msg3 buffer 1103 through the Tx module 1102 as described above, the data stored in the Msg3 buffer 1103 may be copied into the specific HARQ buffer 1107 corresponding to the specific HARQ process 1106 and the data copied into the specific HARQ buffer 1107 may be transmitted through the Tx module 1102.

**[00135]** At this time, the data stored in the Msg3 buffer 1103 is a MAC PDU including a UE identifier and may further include information such as a BSR according to the purpose of the random access procedure.

**[00136]** In the configuration of the UE shown in FIG. 11, the Tx module 1102 and the Rx module 1101 may be configured as a physical layer processing module 1108, and the HARQ entity 1104, the multiplexing and assembly entity 1105 and one or more HARQ processes 1106 may be configured as a MAC layer module 1109. However, the invention is not limited thereto. In addition, the Msg3 buffer 1103 and the HARQ buffers 1107 corresponding to the HARQ processes 1106 may be implemented using any storage medium.

**[00137]** Although the signal transmission or reception technology and the UE for the same are applied to a 3GPP LTE system, they are applicable to various mobile communication systems having a similar procedure, in addition to the 3GPP LTE system.

**[00138]** It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention covers the modifications and variations

of this invention provided they come within the scope of the appended claims and their equivalents.

**WHAT IS CLAIMED IS:**

1. A method of transmitting data by a user equipment through an uplink, the method comprising:

receiving an uplink grant (UL Grant) signal from a base station on a random access response message;

determining whether there is data stored in a message 3 (Msg3) buffer and whether the UL Grant signal was received on the random access response message; and

transmitting the data stored in the Msg3 buffer to the base station using the UL Grant signal received on the random access response message, if there is data stored in the Msg3 buffer and if the UL Grant signal was received on the random access response message.

2. The method according to claim 1, further comprising:

transmitting new data to the base station in correspondence with the UL Grant signal, if the UL Grant signal is not received on the random access response message.

3. The method according to claim 1, further comprising:

receiving another UL Grant signal on a physical downlink control channel (PDCCH); and  
transmitting new data to the base station in correspondence with the another UL Grant signal.

4. The method according to claim 2, wherein the transmitting the new data to the base station includes:

acquiring a Medium Access Control Protocol Data Unit (MAC PDU) from a multiplexing and assembly entity; and

transmitting the MAC PDU to the base station.

5. The method according to claim 3, wherein the transmitting the new data to the base station includes:

acquiring a Medium Access Control Protocol Data Unit (MAC PDU) from a multiplexing and assembly entity; and

transmitting the MAC PDU to the base station.

6. The method according to claim 3,

wherein the another UL Grant signal is received on the PDCCH related to one of Cell-Radio Network Temporary Identifier (RNTI) and Temporary Cell-RNTI.

7. The method according to claim 1, wherein the data stored in the Msg3 buffer is a Medium Access Control Protocol Data Unit (MAC PDU) including a user equipment identifier.

8. The method according to claim 7, wherein the data stored in the Msg3 buffer further includes information about a buffer status report (BSR) if the user equipment starts a random access procedure for the BSR.

9. A user equipment comprising:

a reception module adapted to receive an uplink grant (UL Grant) signal from a base station on a random access response message;

a transmission module adapted to transmit data to the base station using the UL Grant signal received on the random access response message;

a message 3 (Msg3) buffer adapted to store UL data to be transmitted in a random access procedure; and

a Hybrid Automatic Repeat Request (HARQ) entity adapted to

determine whether there is data stored in the Msg3 buffer and whether the UL Grant signal was received on the random access response message,

acquire the data stored in the Msg3 buffer if there is data stored in the Msg3 buffer and the UL Grant signal was received on the random access response message, and

control the transmission module to transmit the data stored in the Msg3 buffer to the base station using the UL Grant signal received by the reception module on the random access response message.

**ABSTRACT OF THE DISCLOSURE**

A mobile communication technology, and, more particularly, a method for efficiently transmitting data stored in a message 3 (Msg3) buffer and a user equipment for the same is disclosed. The method of transmitting data by a user equipment in uplink includes receiving an uplink (UP) Grant signal from a base station on a specific message, determining whether there is data stored in a message 3 (Msg3) buffer when receiving the UL Grant signal on the specific message, determining whether the specific message is a random access response message, and transmitting the data stored in the Msg3 buffer to the base station using the UL Grant signal received on the specific message, if there is data stored in the Msg3 buffer when receiving the UL Grant signal on the specific message and the specific message is the random access response message.

**FIG. 1**

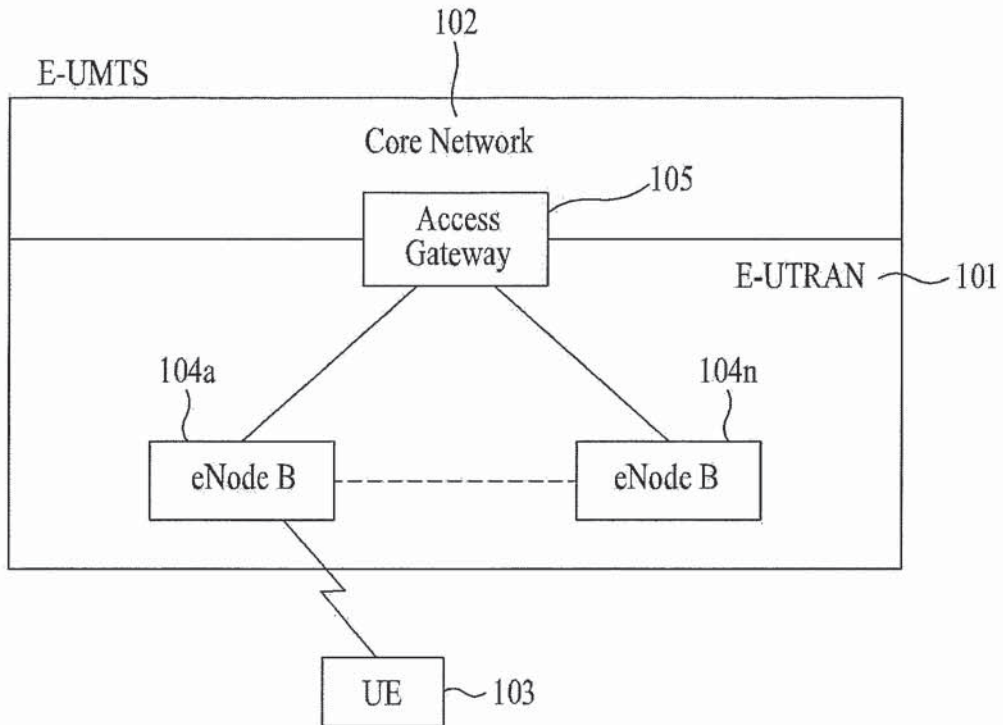


FIG. 2

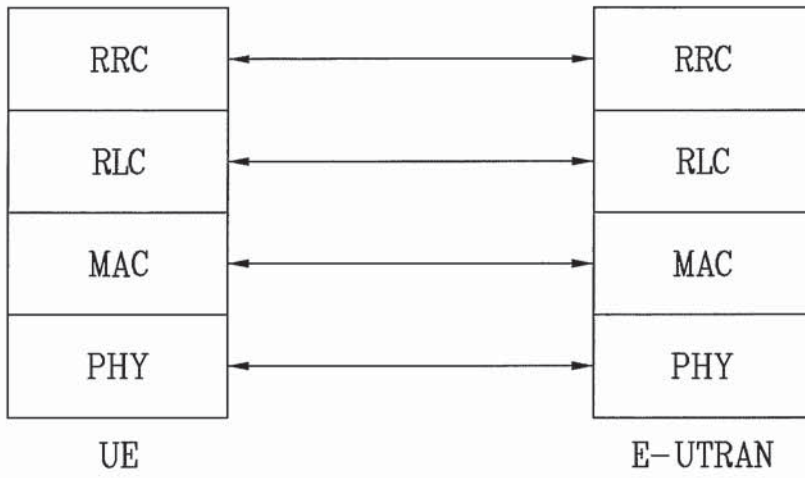
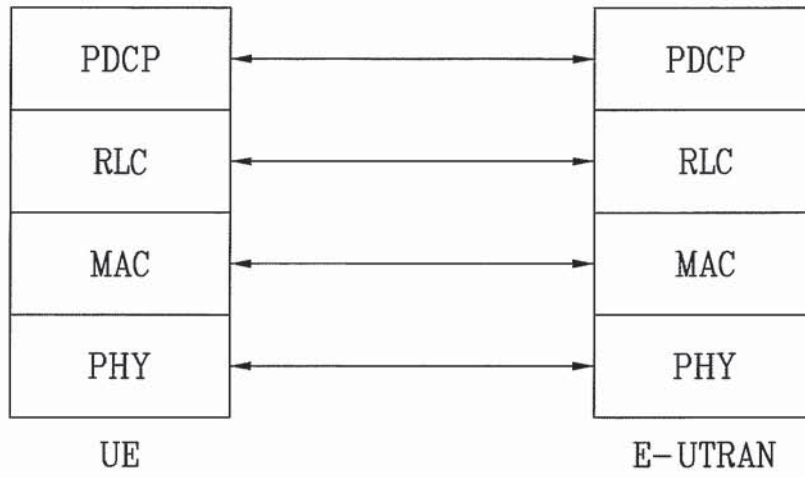
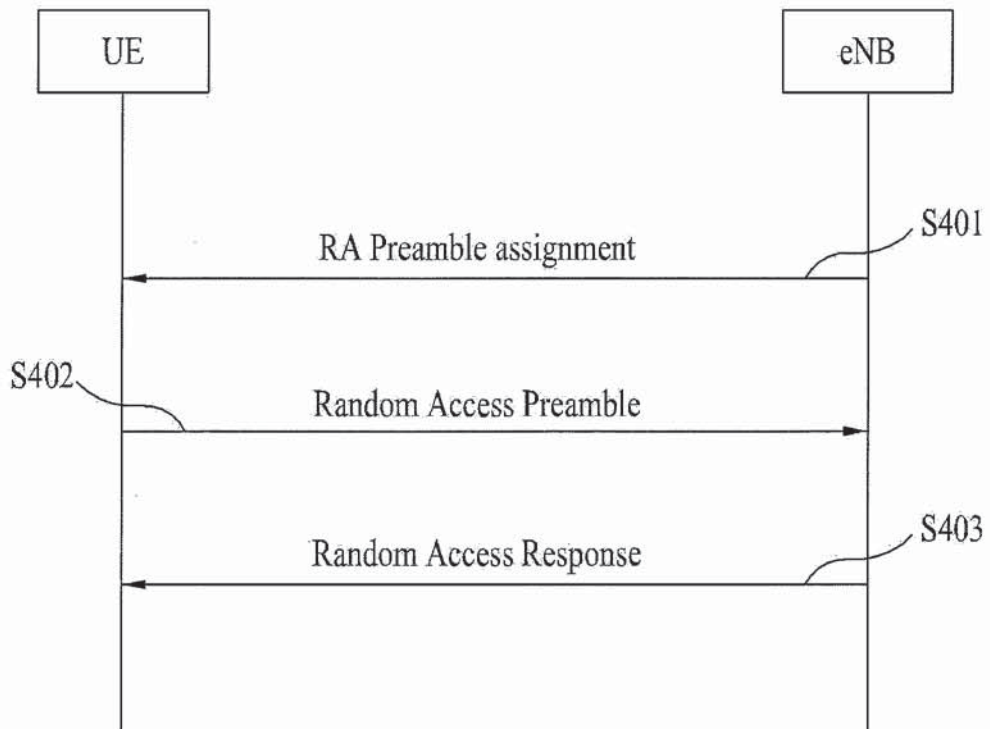




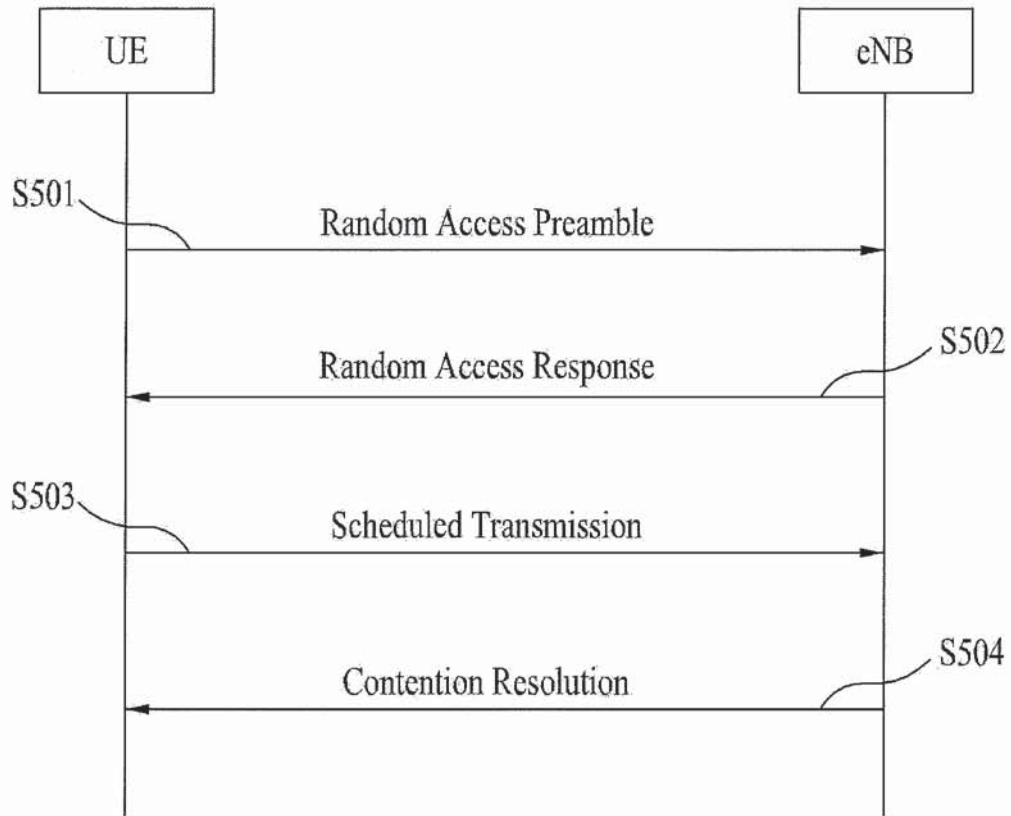
FIG. 3



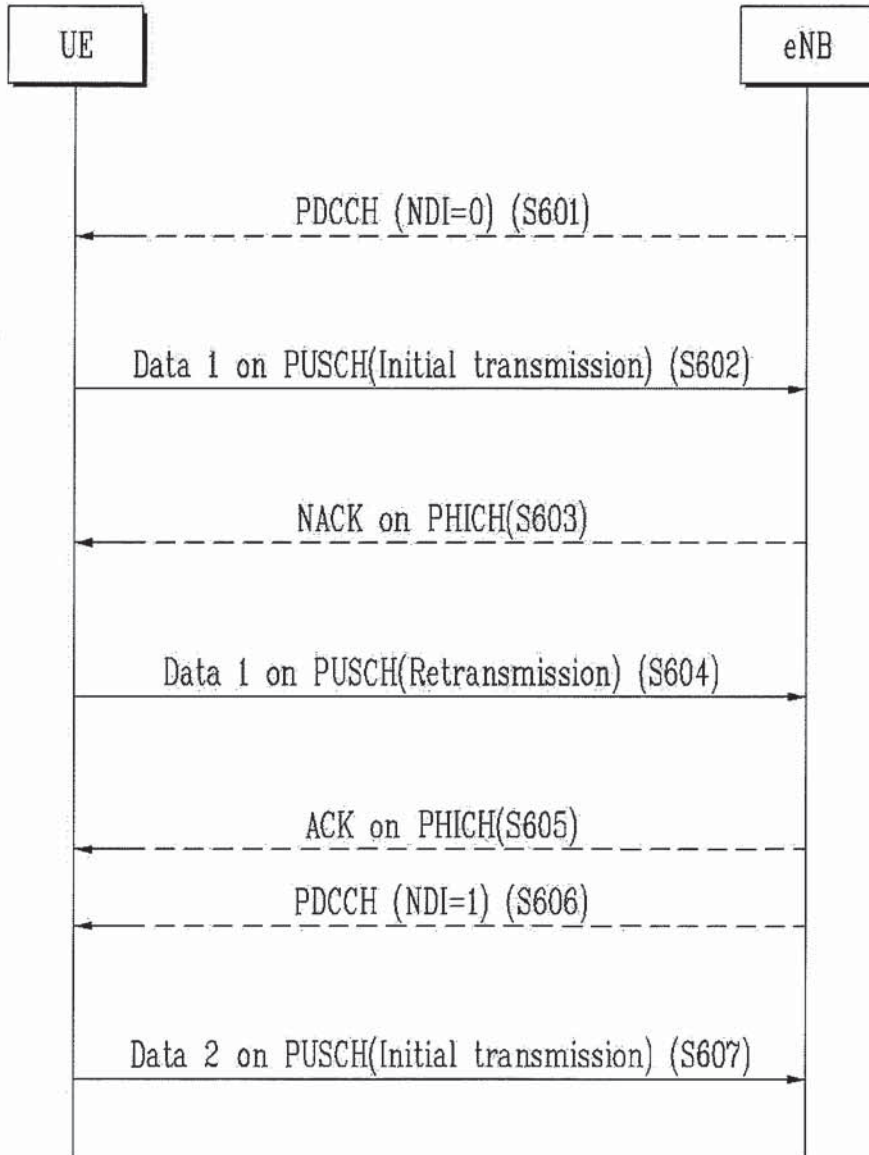
**FIG. 4**



**FIG. 5**



**FIG. 6**



**FIG. 7**

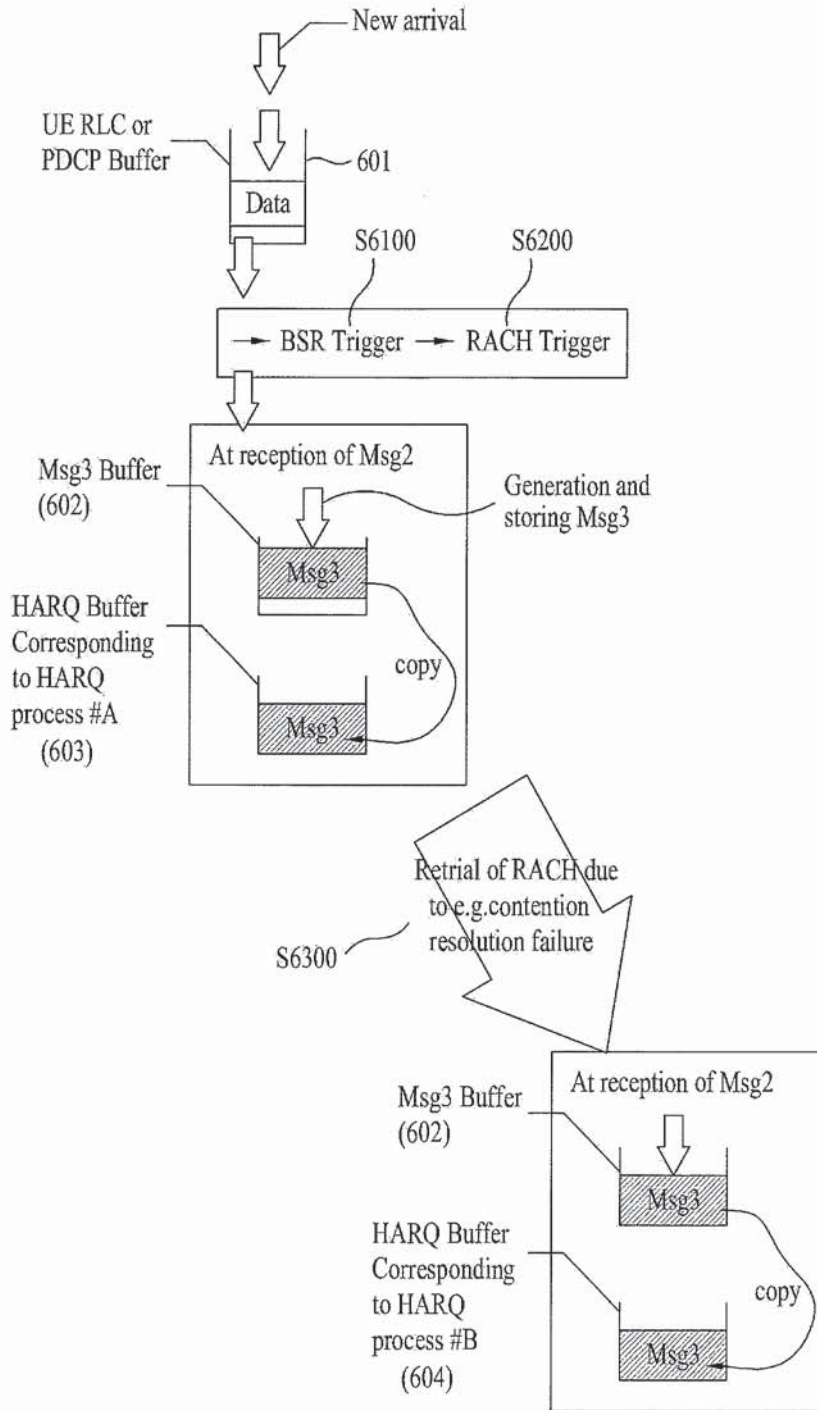


FIG. 8

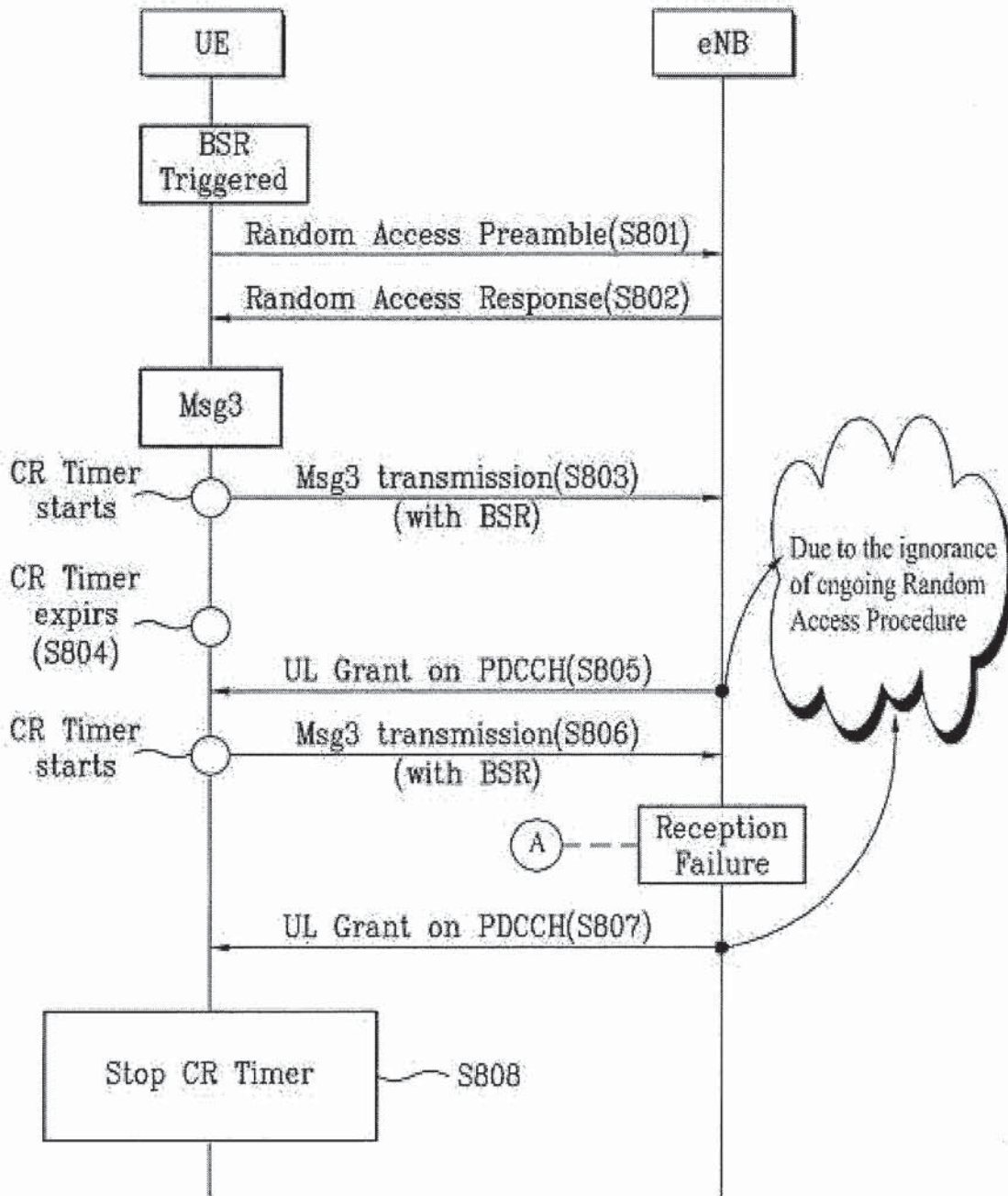


FIG. 9

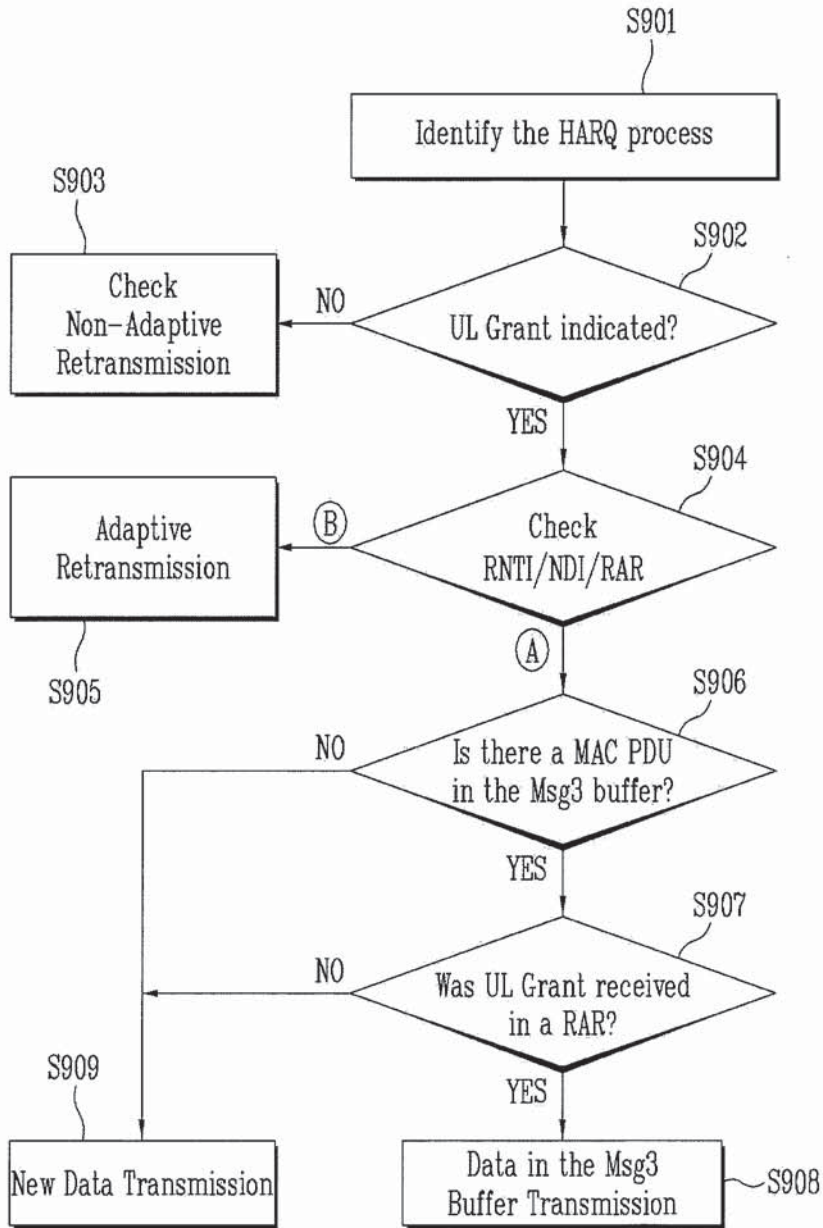


FIG. 10

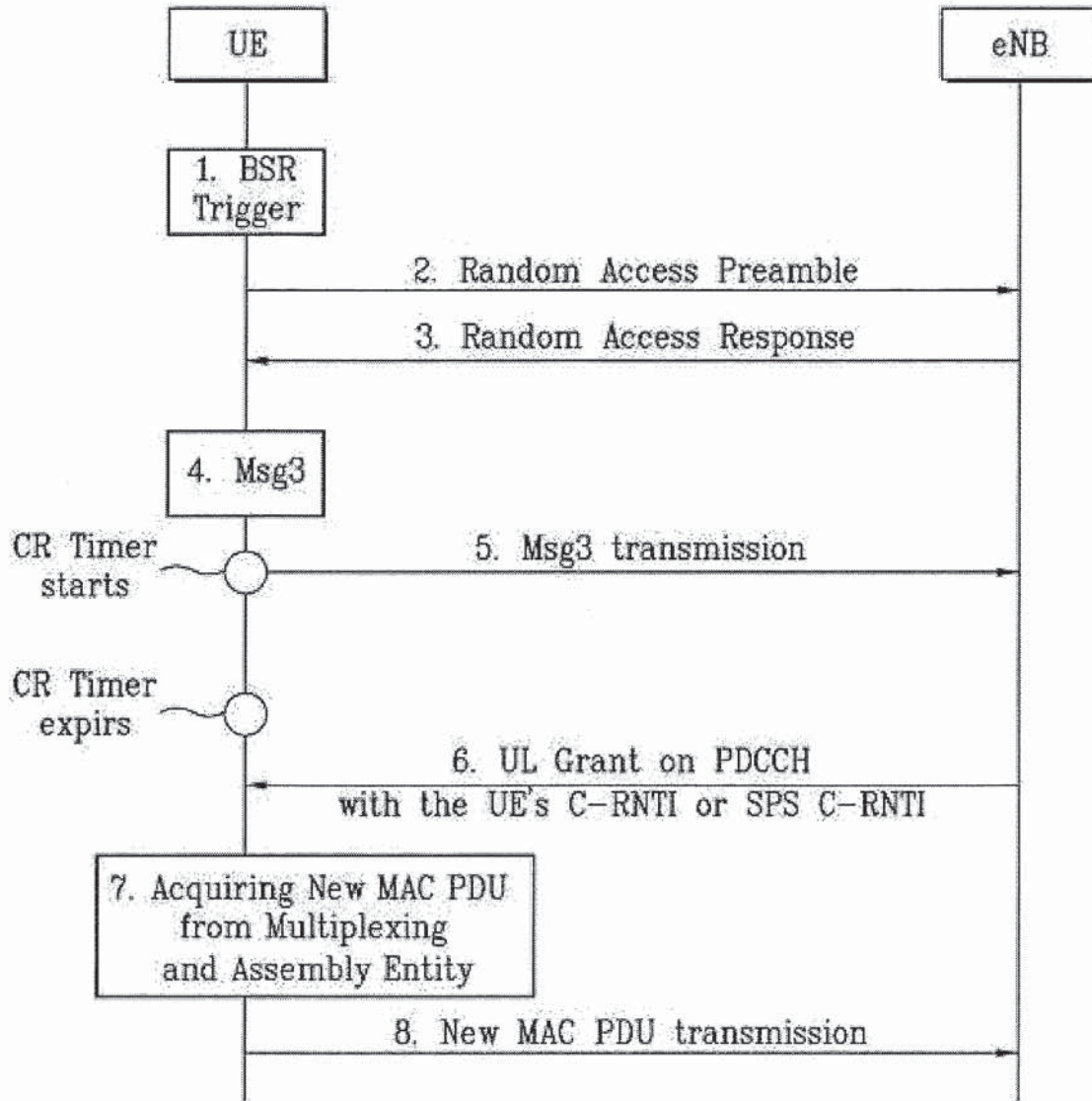
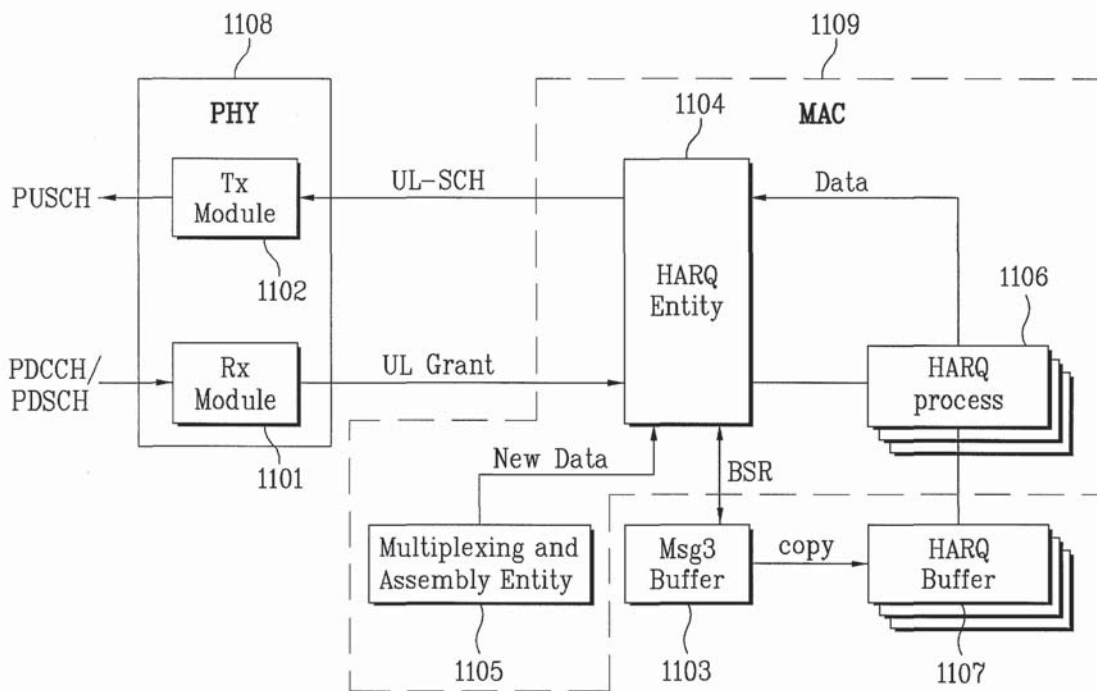




FIG. 11





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**POA ACCEPTANCE LETTER**

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**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 03/13/2013.

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.

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특 허 청

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**【서지사항】**

**【서류명】** 특허출원서  
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**【발명의 국문명칭】** 데이터 전송 방법 및 이를 위한 사용자 기기  
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**【요약서】**

**【요약】**

이하의 설명은 이동통신 기술에 대한 것으로서, 구체적으로 메시지3 버퍼(Msg3 Buffer)에 저장된 데이터를 효율적으로 전송하는 방법 및 이를 위한 사용자 기기에 대한 것이다. 구체적으로 사용자 기기가 상향링크로 데이터를 전송함에 있어서, 기지국으로부터 특정 메시지를 통해 상향링크 승인(UL Grant) 신호를 수신하고, 이 특정 메시지를 통한 상향링크 승인 신호 수신 시 메시지3 버퍼(Msg3 Buffer)에 저장된 데이터가 존재하는지 여부를 판정할뿐만 아니라 이 특정 메시지가 임의접속 응답(Random Access Response) 메시지인지 여부를 판정한 후, 이 특정 메시지를 통한 상향링크 승인 신호 수신 시 메시지3 버퍼에 저장된 데이터가 존재하며 이 특정 메시지가 임의접속 응답 메시지인 경우에 한하여, 이 특정 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 메시지3 버퍼에 저장된 데이터를 상기 기지국에 전송하는 것을 제안한다.

**【대표도】**

도 9

**【색인어】**

RACH, UL Grant, Msg 3 Buffer

**【명세서】**

**【발명의 명칭】**

데이터 전송 방법 및 이를 위한 사용자 기기{Data Transmission Method And User Equipment For the Same}

**【발명의 상세한 설명】**

**【기술분야】**

<1> 이하의 설명은 이동통신 기술에 대한 것으로서, 구체적으로 메시지3 버퍼(Msg3 Buffer)에 저장된 데이터를 효율적으로 전송하는 방법 및 이를 위한 사용자 기기에 대한 것이다.

**【배경기술】**

<2> 본 발명이 적용될 수 있는 이동통신 시스템의 일례로서 3GPP LTE (3rd Generation Partnership Project Long Term Evolution; 이하 "LTE"라 함) 통신 시스템에 대해 개략적으로 설명한다.

<3> 도 1은 이동통신 시스템의 일례로서 E-UMTS 망구조를 개략적으로 도시한 도면이다.

<4> E-UMTS(Evolved Universal Mobile Telecommunications System) 시스템은 기존 UMTS(Universal Mobile Telecommunications System)에서 진화한 시스템으로서, 현재 3GPP에서 기초적인 표준화 작업을 진행하고 있다. 일반적으로 E-UMTS는 LTE 시스템이라고 할 수도 있다.



<5> E-UMTS망은 크게 E-UTRAN(101)과 CN(Core Network: 102)으로 구분할 수 있다. E-UTRAN(Evolved-UMTS Terrestrial Radio Access Network; 101)은 단말(User Equipment; 이하 "UE"로 약칭; 103)과 기지국(이하 "eNode B" 또는 "eNB"로 약칭; 104), 망의 종단에 위치하여 외부망과 연결되는 접속게이트웨이(Access Gateway; 이하 "AG"로 약칭; 105)로 구성된다. AG(105)는 사용자 트래픽 처리를 담당하는 부분과 제어용 트래픽을 처리하는 부분으로 나누어질 수도 있다. 이 때 새로운 사용자 트래픽 처리를 위한 AG와 제어용 트래픽을 처리하는 AG 사이에 새로운 인터페이스를 사용하여 서로 통신할 수도 있다.

<6> 하나의 eNode B에는 하나 이상의 셀(Cell)이 존재할 수 있다. eNode B간에는 사용자 트래픽 혹은 제어 트래픽 전송을 위한 인터페이스가 사용될 수도 있다. CN(102)은 AG(105)와 기타 UE(103)의 사용자 등록 등을 위한 노드 등으로 구성될 수도 있다. 또한, E-UTRAN(101)과 CN(102)을 구분하기 위한 인터페이스가 사용될 수도 있다.

<7> 단말과 망사이의 무선인터페이스 프로토콜 (Radio Interface Protocol)의 계층들은 통신시스템에서 널리 알려진 개방형시스템간상호접속(Open System Interconnection; OSI) 기준모델의 하위 3개 계층을 바탕으로 L1 (제1계층), L2 (제2계층) 및 L3(제3계층)로 구분될 수 있다. 이 중에서 제 1 계층에 속하는 물리 계층은 물리채널(Physical Channel)을 이용한 정보전송서비스(Information Transfer Service)를 제공하며, 제 3 계층에 위치하는 무선자원제어(Radio Resource Control; 이하 RRC라 약칭함)계층은 단말과 망간에 무선자원을 제어하는

역할을 수행한다. 이를 위해 RRC계층은 단말과 망간에 RRC메시지를 서로 교환한다. RRC계층은 eNode B(104)와 AG(105) 등 망 노드들에 분산되어 위치할 수도 있고, eNode B(104) 또는 AG(105)에만 위치할 수도 있다.

<8> 도 2 및 도 3은 3GPP 무선접속망 규격을 기반으로 한 단말과 UTRAN 사이의 무선인터페이스 프로토콜의 구조를 나타낸다.

<9> 도 2 및 도 3의 무선인터페이스 프로토콜은 수평적으로 물리계층(Physical Layer), 데이터링크계층(Data Link Layer) 및 네트워크계층(Network Layer)으로 이루어지며, 수직적으로는 데이터정보 전송을 위한 사용자평면(User Plane)과 제어신호(Signaling)전달을 위한 제어평면(Control Plane)으로 구분된다. 구체적으로 도 2는 무선프로토콜 제어평면의 각 계층을, 도 3은 무선프로토콜 사용자평면의 각 계층을 나타낸다. 도 2 및 도 3의 프로토콜 계층들은 통신시스템에서 널리 알려진 개방시스템간상호접속(OSI) 기준모델의 하위 3개 계층을 바탕으로 L1(제1계층), L2(제2계층), L3(제3계층)로 구분될 수 있다.

<10> 이하에서 도 2의 무선프로토콜 제어평면과 도 3의 무선프로토콜 사용자평면의 각 계층을 설명한다.

<11> 제 1 계층인 물리(Physical; PHY) 계층은 물리채널(Physical Channel)을 이용하여 상위 계층에게 정보전송서비스(Information Transfer Service)를 제공한다. PHY 계층은 상위의 매체접속제어(Medium Access Control; MAC) 계층과 전송채널(Transport Channel)을 통해 연결되어 있으며, 이 전송채널을 통해 MAC 계층과 PHY 계층 사이의 데이터가 이동한다. 이때, 전송채널은 크게 채널의 공유 여부에 따라

전용(Dedicated) 전송채널과 공용(Common) 전송채널로 나뉜다. 그리고, 서로 다른 PHY 계층 사이, 즉 송신측과 수신측의 PHY 계층 사이는 무선 자원을 이용한 물리채널을 통해 데이터가 이동한다.

<12> 제 2 계층에는 여러 가지 계층이 존재한다. 먼저 매체접속제어(Medium Access Control; MAC) 계층은 다양한 논리채널(Logical Channel)을 다양한 전송채널에 매핑시키는 역할을 하며, 또한 여러 논리채널을 하나의 전송채널에 매핑시키는 논리채널 다중화(Multiplexing)의 역할을 수행한다. MAC 계층은 상위계층인 RLC(Radio Link Control) 계층과는 논리채널(Logical Channel)로 연결되어 있으며, 논리채널은 크게 전송되는 정보의 종류에 따라 제어평면(Control Plane)의 정보를 전송하는 제어채널(Control Channel)과 사용자평면(User Plane)의 정보를 전송하는 트래픽채널(Traffic Channel)로 나뉠 수 있다.

<13> 제 2 계층의 무선링크제어(Radio Link Control; RLC) 계층은 상위계층으로부터 수신한 데이터를 분할(Segmentation) 및 연결(Concatenation)하여 하위계층이 무선 구간으로 데이터를 전송하기에 적합하도록 데이터 크기를 조절하는 역할을 수행한다. 또한, 각각의 무선베어러(Radio Bearer; RB)가 요구하는 다양한 QoS(Quality of Service)를 보장할 수 있도록 하기 위해 TM(Transparent Mode, 투명모드), UM(Un-acknowledged Mode, 무응답모드), 및 AM(Acknowledged Mode, 응답모드)의 세가지 동작 모드를 제공하고 있다. 특히, AM RLC는 신뢰성 있는 데이터 전송을 위해 자동 반복 및 요청(Automatic Repeat and Request; ARQ) 기능을 통한 재전송 기능을 수행하고 있다.

<14> 제 2 계층의 패킷데이터수렴(Packet Data Convergence Protocol; PDCP) 계층은 IPv4나 IPv6와 같은 IP 패킷 전송시에 대역폭이 작은 무선 구간에서 효율적으로 전송하기 위하여 상대적으로 크기가 크고 불필요한 제어정보를 담고 있는 IP 패킷 헤더 사이즈를 줄여주는 헤더압축(Header Compression) 기능을 수행한다. 이는 데이터의 헤더(Header) 부분에서 반드시 필요한 정보만을 전송하도록 하여, 무선 구간의 전송효율을 증가시키는 역할을 한다. 또한, LTE 시스템에서는 PDCP 계층이 보안(Security) 기능도 수행하는데, 이는 제 3자의 데이터 감청을 방지하는 암호화(Ciphering)와 제 3자의 데이터 조작을 방지하는 무결성 보호(Integrity protection)로 구성된다.

<15> 제 3 계층의 가장 상부에 위치한 무선자원제어(Radio Resource Control; RRC) 계층은 제어평면에서만 정의되며, 무선베어러 (Radio Bearer; RB)들의 설정(Configuration), 재설정 (Re-configuration) 및 해제 (Release)와 관련되어 논리 채널, 전송채널 및 물리채널들의 제어를 담당한다. 여기서 RB는 단말과 UTRAN간의 데이터 전달을 위해 무선 프로토콜의 제1 및 제 2계층에 의해 제공되는 논리적 경로(path)를 의미하고, 일반적으로 RB가 설정된다는 것은 특정 서비스를 제공하기 위해 필요한 무선 프로토콜 계층 및 채널의 특성을 규정하고, 각각의 구체적인 파라미터 및 동작 방법을 설정하는 과정을 의미한다. RB는 다시 SRB(Signaling RB)와 DRB(Data RB) 두가지로 나누어 지는데, SRB는 제어 평면(C-plane)에서 RRC 메시지를 전송하는 통로로 사용되며, DRB는 사용자 평면(U-plane)에서 사용자 데이터를 전송하는 통로로 사용된다.

<16> 망에서 단말로 데이터를 전송하는 하향전송채널로는 시스템정보를 전송하는 BCH(Broadcast Channel)와 그 이외에 사용자 트래픽이나 제어메시지를 전송하는 하향 SCH(Shared Channel)가 있다. 하향 멀티캐스트 또는 방송 서비스의 트래픽 또는 제어메시지의 경우 하향 SCH를 통해 전송될 수도 있고, 또는 별도의 하향 MCH(Multicast Channel)을 통해 전송될 수도 있다. 한편, 단말에서 망으로 데이터를 전송하는 상향전송채널로는 초기 제어메시지를 전송하는 RACH(Random Access Channel)와 그 이외에 사용자 트래픽이나 제어메시지를 전송하는 상향 SCH(Shared Channel)가 있다.

<17> 그리고, 하향전송채널로 전달되는 정보를 망과 단말 사이의 무선구간으로 전송하는 하향물리채널로는, BCH의 정보를 전송하는 PBCH(Physical Broadcast Channel), MCH의 정보를 전송하는 PMCH(Physical Multicast Channel), PCH와 하향 SCH의 정보를 전송하는 PDSCH(Physical Downlink shared Channel), 그리고 하향 또는 상향 무선자원 할당정보(DL/UL Scheduling Grant)등과 같이 제1계층과 제2계층에서 제공하는 제어 정보를 전송하는 PDCCH(Physical Downlink Control Channel, 또는 DL L1/L2 control channel 이라고도 함)가 있다. 한편, 상향전송채널로 전달되는 정보를 망과 단말 사이의 무선구간으로 전송하는 상향 물리채널로는 상향 SCH의 정보를 전송하는 PUSCH(Physical Uplink Shared Channel), RACH 정보를 전송하는 PRACH(Physical Random Access Channel), 그리고 HARQ ACK 또는 NACK, 스케줄링 요청(SR; Scheduling Request), CQI(Channel Quality Indicator) 보고 등과 같이 제1계층과 제2계층에서 제공하는 제어 정보를 전송하는 PUCCH(Physical Uplink

Control Channel)이 있다.

- <18> 상술한 설명을 바탕으로 이하에서는 LTE 시스템에서 제공하는 임의 접속 과정 (Random Access procedure)에 대해 개략적으로 살펴본다.
- <19> 먼저, 단말이 임의 접속 과정을 수행하는 경우로는 다음과 같은 경우가 있다.
- <20> - 단말이 기지국과의 RRC 연결(RRC Connection)이 없어, 초기 접속 (initial access)을 하는 경우
- <21> - 단말이 핸드오버 과정에서, 타겟(target) 셀로 처음 접속하는 경우
- <22> - 기지국의 명령에 의해 임의 접속 과정이 요청되는 경우
- <23> - 상향링크의 시간 동기화 정보가 맞지 않거나, 무선자원을 요청하기 위해 사용되는 지정된 무선자원이 할당되지 않은 상황에서, 상향링크로 전송할 데이터가 발생하는 경우
- <24> - 무선 연결 실패(radio link failure) 또는 핸드오버 실패(handover failure) 시 복구 과정을 수행하는 경우
- <25> LTE 시스템에서는 임의접속 프리앰블을 선택하는 과정에서, 특정한 집합 안에서 단말이 임의로 하나의 프리앰블을 선택하여 사용하는 경쟁 기반 랜덤 액세스 과정(contention based random access procedure)과 기지국이 특정 단말에게만 할당해준 임의접속 프리앰블을 사용하는 비 경쟁 기반 랜덤 액세스 과정 (non-contention based random access procedure)을 모두 제공한다. 다만, 비 경쟁 기반

랜덤 액세스 과정은, 상술한 핸드오버 과정이나 기지국의 명령에 의해 요청되는 경우에 한하여 사용될 수 있다.

<26> 한편, 단말이 특정 기지국과 임의접속을 수행하는 과정은 크게 (1) 단말이 기지국에 임의접속 프리엠블을 전송하는 단계(이하 혼동이 없는 경우 "제 1 메시지(message 1)" 전송 단계), (2) 전송된 임의접속 프리엠블에 대응하여 기지국으로부터 임의접속 응답을 수신하는 단계(이하 혼동이 없는 경우 "제 2 메시지(message 2)" 수신 단계), (3) 임의접속 응답 메시지에서 수신된 정보를 이용하여 상향링크 메시지를 전송하는 단계(이하 혼동이 없는 경우 "제 3 메시지(message 3)" 전송 단계) 및 (4) 상기 상향링크 메시지에 대응하는 메시지를 기지국으로부터 수신하는 단계(이하 혼동이 없는 경우 "제 4 메시지(message 4)" 수신 단계)을 포함할 수 있다.

<27> 이와 같은 임의접속 과정 중 단말은 상술한 제 3 메시지를 통해 전송할 데이터를 메시지3 버퍼(Message 3 buffer; 또는 간단히 Msg3 Buffer)에 저장하고, 이 메시지3 버퍼에 저장된 데이터를 상향링크 승인(Uplink Grant; 또는 간단히 UL Grant) 신호 수신에 대응하여 전송하게 된다. 상향링크 승인 신호는 단말이 기지국으로 신호를 전송할 때 이용할 수 있는 상향링크 무선 자원에 대한 정보를 알려주는 신호로서 상술한 LTE 시스템의 경우 물리하향링크제어채널(PDCCH), 또는 물리하향링크공유채널(PUSCH)을 통해 수신되는 임의접속응답(Random Access Response) 메시지를 통해 수신된다. 현재 LTE 시스템 표준에 따르면 메시지3 버퍼에 데이터가 저장되어 있는 상태에서 상향링크 승인 신호가 수신되는 경우 상향링크 승인 신호

수신 형태에 관계없이 메시지3 버퍼에 저장되어 있는 데이터를 전송하도록 규정하고 있다. 다만, 상술한 바와 같이 모든 상향링크 승인 신호 수신에 대응하여 메시지3 버퍼에 저장된 데이터를 전송하는 경우에 어떠한 문제가 발생할 수 있으며, 이를 개선하기 위한 방안에 대해 좀더 구체적인 연구가 필요하다.

**【발명의 내용】**

**【해결하고자 하는 과제】**

<28> 이하에서는 상향링크 승인 신호의 수신 형태에 따라 메시지3 버퍼에 저장된 데이터를 전송할 때 발생할 수 있는 문제점에 대해 문제점에 대해 고찰하고, 이를 개선하기 위한 데이터 전송 방법 및 사용자 기기 구성을 제시하고자 한다.

**【과제 해결 수단】**

<29> 상술한 바와 같은 과제를 해결하기 위한 본 발명의 일측면에서는 사용자 기기가 상향링크로 데이터를 전송하는 방법에 있어서, 기지국으로부터 특정 메시지를 통해 상향링크 승인(UL Grant) 신호를 수신하는 단계; 상기 특정 메시지를 통한 상향링크 승인 신호 수신 시 메시지3 버퍼(Msg3 Buffer)에 저장된 데이터가 존재하는지 여부를 판정하는 단계; 상기 특정 메시지가 임의접속 응답(Random Access Response) 메시지인지 여부를 판정하는 단계; 및 상기 특정 메시지를 통한 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하며 상기 수신 메시지가 임의접속 응답 메시지인 경우, 상기 특정 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 상기 메시지3 버퍼에 저장된 데이터를 상기 기지국에 전송하



는 단계를 포함하는 데이터 전송 방법을 제안한다.

<30>            이때, 상기 특정 메시지를 통한 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하지 않거나, 상기 수신 메시지가 임의접속 응답 메시지가 아닌 경우에는, 상기 특정 메시지를 통해 수신된 상향링크 승인 신호에 대응하여 새로운 데이터를 상기 기지국에 전송할 수 있다.

<31>            또한, 상기 특정 메시지를 통해 수신된 상향링크 승인 신호는 물리하향링크 제어채널(PDCCH: Physical Downlink Control Channel)을 통해 수신되는 상향링크 승인 신호일 수 있으며, 이 경우 상기 사용자 기기는 상기 물리하향링크제어채널을 통해 수신된 상향링크 승인 신호에 대응하여 새로운 데이터를 전송할 수 있다.

<32>            또한, 상기 특정 메시지를 통해 수신된 상향링크 승인 신호는 물리하향링크 공유채널(PDSCH: Physical Downlink Shared Channel)을 통해 수신되는 임의접속 응답 메시지를 통해 수신되는 상향링크 승인 신호일 수 있으며, 이 경우 상기 사용자 기기는 상기 임의접속 응답 메시지를 통한 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하는 경우, 상기 임의접속 응답 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 상기 메시지 3 버퍼에 저장된 데이터를 전송할 수 있다.

<33>            여기서, 상기 메시지3 버퍼에 저장된 데이터는 상기 사용자 기기 식별자를 포함하는 MAC PDU(Medium Access Control Protocol Data Unit)일 수 있으며, 상기 사용자 기기가 버퍼 상태 보고(BSR: Buffer Status Report)를 위해 임의접속 과정을 개시한 경우에 상기 메시지3 버퍼에 저장된 데이터는 상기 버퍼 상태 보고 정보

를 더 포함할 수 있다.

<34> 한편, 상술한 바와 같은 과제를 해결하기 위한 본 발명의 다른 일 측면에서는 기지국으로부터 특정 메시지를 통해 상향링크 승인(UL Grant) 신호를 수신하는 수신 모듈; 상기 특정 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 상기 기지국에 데이터를 전송하는 전송 모듈; 임의접속 과정에서 전송되는 상향링크 데이터를 저장하는 메시지3 버퍼(Msg3 Buffer); 및 상기 수신 모듈이 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하는지 여부, 및 상기 특정 메시지가 임의접속 응답(Random Access Response) 메시지인지 여부를 판정하여, 상기 수신 모듈이 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하며 상기 특정 메시지가 임의접속 응답 메시지인 경우, 상기 메시지3 버퍼에 저장된 데이터를 획득하여, 상기 수신 모듈이 상기 특정 메시지를 통해 수신한 상향링크 승인 신호를 이용하여 상기 전송 모듈이 상기 메시지3 버퍼에 저장된 데이터를 상기 기지국에 전송하도록 제어하는 HARQ 엔터티를 포함하는 사용자 기기를 제안한다.

<35> 이때, 상기 사용자 기기는 새로운 데이터 전송에 이용되는 다중화 및 조합 엔터티(Multiplexing and Assembly Entity)를 더 포함할 수 있으며, 이 경우 상기 HARQ 엔터티는 상기 수신 모듈이 상기 특정 메시지를 통해 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하지 않거나, 상기 수신 메시지가 임의접속 응답 메시지가 아닌 경우, 상기 다중화 및 조합 엔터티로부터 전송할 새로운 데이터를 획득하여, 상기 수신 모듈이 상기 특정 메시지를 통해 수신한 상향

링크 승인 신호를 이용하여 상기 전송 모듈이 상기 다중화 및 조합 엔터티로부터 획득한 새로운 데이터를 전송하도록 제어할 수 있다.

<36> 또한, 상기 사용자 기기는 하나 이상의 HARQ 프로세스; 및 상기 하나 이상의 HARQ 프로세스 각각에 대응하는 HARQ 버퍼를 더 포함할 수 있으며, 이 경우 상기 HARQ 엔터티는 상기 메시지3 버퍼 또는 상기 다중화 및 조합 엔터티로부터 획득한 데이터를 상기 하나 이상의 HARQ 프로세스 중 특정 HARQ 프로세스에 전달하고, 상기 특정 HARQ 프로세스가 상기 메시지3 버퍼 또는 상기 다중화 및 조합 엔터티로부터 획득한 데이터를 상기 전송 모듈을 통해 전송하도록 제어할 수 있다.

<37> 또한, 상기 특정 HARQ 프로세스가 상기 메시지3 버퍼에 저장된 데이터를 상기 전송 모듈을 통해 전송하는 경우, 상기 메시지3 버퍼에 저장된 데이터를 상기 특정 HARQ 프로세스에 대응하는 특정 HARQ 버퍼에 복제하고, 상기 특정 HARQ 버퍼에 복제된 데이터를 상기 전송 모듈을 통해 전송하도록 제어할 수 있다.

<38> 또한, 상기 수신 모듈이 상기 특정 메시지를 통해 수신한 상향링크 승인 신호는 물리하향링크제어채널(PDCCH: Physical Downlink Control Channel)을 통해 수신되는 상향링크 승인 신호일 수 있으며, 이 경우 상기 HARQ 엔터티는 상기 물리하향링크제어채널을 통해 수신된 상향링크 승인 신호에 대응하여 새로운 데이터를 전송하도록 제어할 수 있다.

<39> 또한, 상기 수신 모듈이 상기 특정 메시지를 통해 수신된 상향링크 승인 신호는 물리하향링크공유채널(PDSCH: Physical Downlink Shared Channel)을 통해 수신되는 임의접속응답 메시지를 통해 수신되는 상향링크 승인 신호일 수 있으며, 상

기 HARQ 엔터티는 상기 수신 모듈이 상기 임의접속 응답 메시지를 통해 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하는 경우, 상기 임의접속 응답 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 상기 메시지 3 버퍼에 저장된 데이터를 전송하도록 제어할 수 있다.

**【효과】**

<40> 상술한 바와 같은 본 발명의 실시형태들에 따른 경우 상향링크 승인 신호의 수신 형태에 따라 메시지3 버퍼에 저장된 데이터를 혼동 없이 전송할 수 있다.

**【발명의 실시를 위한 구체적인 내용】**

<41> 이하, 본 발명에 따른 바람직한 실시 형태를 첨부된 도면을 참조하여 상세하게 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발명의 예시적인 실시형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시형태를 나타내고자 하는 것이 아니다. 이하의 상세한 설명은 본 발명의 완전한 이해를 제공하기 위해서 구체적 세부사항을 포함한다. 그러나, 당업자는 본 발명이 이러한 구체적 세부사항 없이도 실시될 수 있음을 안다. 예를 들어, 이하의 상세한 설명은 이동통신 시스템이 3GPP LTE 시스템인 경우를 가정하여 구체적으로 설명하나, 3GPP LTE의 특유한 사항을 제외하고는 다른 임의의 이동통신 시스템에도 적용 가능하다.

<42> 몇몇 경우, 본 발명의 개념이 모호해지는 것을 피하기 위하여 공지의 구조 및 장치는 생략되거나, 각 구조 및 장치의 핵심기능을 중심으로 한 블록도 형식으로

로 도시될 수 있다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

<43> 아울러, 이하의 설명에 있어서 단말은 UE(User Equipment), MS(Mobile Station) 등 이동 또는 고정형의 사용자단 기기를 통칭하는 것을 가정한다. 또한, 기지국은 Node B, eNode B, Base Station 등 단말과 통신하는 네트워크 단의 임의의 노드를 통칭하는 것을 가정한다.

<44> 상술한 바와 같이 이하의 설명에서는 상향링크 승인 신호의 수신 형태에 따라 메시지3 버퍼에 저장된 데이터를 전송할 때 발생할 수 있는 문제점에 대해 구체적으로 고찰해보고 이를 해결하기 위한 방법을 살펴본다. 이를 위해 먼저 상술한 임의접속 과정 및 HARQ 기법을 이용한 신호 송수신에 대해 각각 구체적으로 살펴본다.

<45> 도 4는 비 경쟁 기반 임의접속 과정에서의 단말과 기지국의 동작 과정을 나타낸다.

<46> (1) 임의접속 프리엠블 할당

<47> 상술한 바와 같이, 비 경쟁 기반 임의접속 과정은 (1) 핸드오버 과정의 경우, 및 (2) 기지국의 명령에 의해 요청되는 경우에서 수행될 수 있다. 물론, 상기 두 경우에도 경쟁 기반 임의접속 과정이 수행될 수도 있다.

<48> 먼저, 비 경쟁 기반 임의접속 과정을 위해서는 충돌의 가능성이 없는 지정된 임의접속 프리엠블을 기지국으로부터 수신 받는 것이 중요하다. 상기 임의접속 프

리엠블을 지시받는 방법으로는 핸드오버 명령을 통한 방법 및 PDCCH 명령을 통한 방법이 있다. 이를 통해 단말은 임의접속 프리엠블을 할당받는다(S401).

<49> (2) 제 1 메시지 전송

<50> 단말은 상술한 바와 같이 자신에게만 지정된 임의접속 프리엠블을 기지국으로 할당 받은 후에, 상기 프리엠블을 기지국으로 전송한다(S402).

<51> (3) 제 2 메시지 수신

<52> 단말은 상기 단계 S402에서와 같이 임의접속 프리엠블을 전송 후에, 기지국이 시스템 정보 또는 핸드오버 명령을 통해 지시된 임의접속 응답 수신 윈도우 내에서 자신의 임의접속 응답의 수신을 시도한다(S403). 좀더 자세하게, 임의접속 응답 정보는 MAC PDU(MAC Packet Data Unit)의 형식으로 전송될 수 있으며, 상기 MAC PDU는 PDSCH(Physical Downlink Shared Channel)을 통해 전달될 수 있다. 또한 상기 PDSCH로 전달되는 정보를 단말이 적절하게 수신하기 위해 단말은 PDCCH(Physical Downlink Control Channel)를 모니터링하는 것이 바람직하다. 즉, PDCCH에는 상기 PDSCH를 수신해야 하는 단말의 정보와, 상기 PDSCH의 무선자원의 주파수 그리고 시간 정보, 그리고 상기 PDSCH의 전송 형식 등이 포함되어 있는 것이 바람직하다. 일단 단말이 자신에게 전송되는 PDCCH의 수신에 성공하면, 상기 PDCCH의 정보들에 따라 PDSCH로 전송되는 임의접속 응답을 적절히 수신할 수 있다. 그리고 상기 임의접속 응답에는 랜덤 액세스 프리엠블 구별자(ID; 예를 들어, RA-RNTI(Random Access Preamble identifier)), 상향링크 무선자원을 알려주는 상향링크 승인 (UL Grant), 임시 셀 식별자 (Temporary C-RNTI) 그리고 시간 동기 보정

값 (Timing Advance Command: TAC)들이 포함될 수 있다.

<53> 상술한 바와 같이 임의접속 응답에서 임의접속 프리앰블 구분자가 필요한 이유는, 하나의 임의접속 응답에는 하나 이상의 단말들을 위한 임의접속 응답 정보가 포함될 수 있기 때문에, 상기 상향링크 승인(UL Grant), 임시 셀 식별자 그리고 TAC가 어느 단말에게 유효한지를 알려주기 위한 것이 필요하기 때문이다. 본 단계에서 단말은 단계 S402에서 자신이 선택한 임의접속 프리앰블과 일치하는 임의접속 프리앰블 식별자는 것을 선택하는 것을 가정한다.

<54> 비 경쟁 기반 임의접속 과정에서는 임의접속 응답 정보를 수신함으로써 임의접속 과정이 정상적으로 수행되었다고 판단하고 임의접속 과정을 종료할 수 있다.

<55> 도 5는 경쟁 기반 임의접속 과정에서 단말과 기지국의 동작 과정을 설명하기 위한 도면이다.

<56> (1) 제 1 메시지 전송

<57> 먼저, 단말은 시스템 정보 또는 핸드오버 명령(Handover Command)을 통해 지시된 임의접속 프리앰블의 집합에서 임의로(randomly) 하나의 임의접속 프리앰블을 선택하고, 상기 임의접속 프리앰블을 전송할 수 있는 PRACH(Physical RACH) 자원을 선택하여 전송할 수 있다(S501).

<58> (2) 제 2 메시지 수신

<59> 임의접속 응답 정보를 수신하는 방법은 상술한 비 경쟁 기반 임의접속 과정에서와 유사하다. 즉, 단말은 상기 단계 S501에서와 같이 임의접속 프리앰블을 전

송 후에, 기지국이 시스템 정보 또는 핸드오버 명령을 통해 지시된 임의접속 응답 수신 윈도우 내에서 자신의 임의접속 응답의 수신을 시도하며, 대응되는 임의접속 식별자 정보를 통해 PDSCH를 수신하게 된다(S502). 이를 통해 상향링크 승인 (UL Grant), 임시 셀 식별자 (Temporary C-RNTI) 및 시간 동기 보정 값 (Timing Advance Command: TAC) 등을 수신할 수 있다.

<60> (3) 제 3 메시지 전송

<61> 단말이 자신에게 유효한 임의접속 응답을 수신한 경우에는, 상기 임의접속 응답에 포함된 정보들을 각각 처리한다. 즉, 단말은 TAC을 적용시키고, 임시 셀 식별자를 저장한다. 또한 유효한 임의접속 응답 수신에 대응하여 전송할 데이터를 메시지3 버퍼에 저장할 수 있다. 이와 같은 메시지3 버퍼에 데이터를 저장하고, 이를 전송하는 과정에 대해서는 이하 도 7에서 구체적인 예를 들어 후술하기로 한다.

<62> 한편, 단말은 수신된 UL 승인을 이용하여, 데이터(즉, 제 3 메시지)를 기지국으로 전송한다(S503). 제 3 메시지는 단말의 식별자가 포함되어야 한다. 경쟁 기반 랜덤 액세스 과정에서는 기지국에서 어떠한 단말들이 상기 임의접속 과정을 수행하는지 판단할 수 없는데, 차후에 충돌해결을 하기 위해서는 단말을 식별해야 하기 때문이다.

<63> 단말의 식별자를 포함시키는 방법으로는 두 가지 방법이 논의되었다. 첫 번째 방법은 단말이 상기 임의접속 과정 이전에 이미 해당 셀에서 할당 받은 유효한 셀 식별자를 가지고 있었다면, 단말은 상기 UL 승인에 대응하는 상향링크 전송 신호를 통해 자신의 셀 식별자를 전송한다. 반면에, 만약 임의접속 과정 이전에 유효



한 셀 식별자를 할당 받지 못하였다면, 단말은 자신의 고유 식별자(예를 들면, S-TMSI 또는 임의 ID(Random Id))를 포함하여 전송한다. 일반적으로 상기의 고유 식별자는 셀 식별자보다 길다. 단말은 상기 UL 승인에 대응하는 데이터를 전송하였다면, 충돌 해결을 위한 타이머 (contention resolution timer; 이하 "CR 타이머")를 개시한다.

<64> (4) 제 4 메시지 수신

<65> 단말이 임의접속 응답에 포함된 UL 승인을 통해 자신의 식별자를 포함한 데이터를 전송 한 이후, 충돌 해결을 위해 기지국의 지시를 기다린다. 즉, 특정 메시지를 수신하기 위해 PDCCH의 수신을 시도한다(S504). 상기 PDCCH를 수신하는 방법에 있어서도 두 가지 방법이 논의되었다. 앞에서 언급한 바와 같이 상기 UL 승인에 대응하여 전송된 제 3 메시지가 자신의 식별자가 셀 식별자를 이용하여 전송된 경우, 자신의 셀 식별자를 이용하여 PDCCH의 수신을 시도하고, 상기 식별자가 고유 식별자인 경우에는, 임의접속 응답에 포함된 임시 셀 식별자를 이용하여 PDCCH의 수신을 시도할 수 있다. 그 후, 전자의 경우, 만약 상기 충돌 해결 타이머가 만료되기 전에 자신의 셀 식별자를 통해 PDCCH를 수신한 경우에, 단말은 정상적으로 임의접속 과정이 수행되었다고 판단하고, 임의접속 과정을 종료한다. 후자의 경우에는 상기 충돌 해결 타이머가 만료되기 전에 임시 셀 식별자를 통해 PDCCH를 수신하였다면, 상기 PDCCH가 지시하는 PDSCH이 전달하는 데이터를 확인한다. 만약 상기 데이터의 내용에 자신의 고유 식별자가 포함되어 있다면, 단말은 정상적으로 임의접속 과정이 수행되었다고 판단하고, 임의접속 과정을 종료한다.

<66> 한편, 이하에서는 LTE 시스템을 예를 들어 MAC 계층의 HARQ 동작을 상향링크 데이터 전송의 경우를 중심으로 설명한다.

<67> 도 6은 상향링크 HARQ 동작 방식을 설명하기 위한 도면이다.

<68> 단말은 HARQ 방식으로 데이터를 기지국에 전송하기 위해서, 먼저 기지국으로부터 PDCCH를 통해서 UL 승인 정보 또는 상향링크 스케줄링 정보(Uplink Scheduling Information; 이하 "UL 스케줄링 정보")을 수신할 수 있다(단계 S601). 일반적으로 UL 스케줄링 정보에는 단말 식별자(예를 들어, C-RNTI 또는 Semi-Persistent Scheduling C-RNTI), 할당된 무선자원의 위치(Resource block assignment), 전송 파라미터(Modulation, Coding scheme 및 redundancy version), NDI 등이 포함될 수 있다. LTE 시스템의 경우 단말은 8개의 HARQ 프로세스들을 가지고 있으며, 상기 HARQ 프로세스들은 TTI(Transmission Time Interval)와 동기적(Synchronous)으로 작동한다. 즉, TTI 1에서는 HARQ 프로세스 1번, TTI 2에서는 HARQ 프로세스 2번, ..., TTI 8에서는 HARQ 프로세스 8번이 사용된 후, 다시 TTI 9에서는 HARQ 프로세스 1번, TTI 10에서는 HARQ 프로세스 2번이 사용되는 방식으로 각 데이터 수신 시점에 따라 특정 HARQ 프로세스가 순차적으로 할당될 수 있다.

<69> 또한, HARQ 프로세스들은 상술한 바와 같이 동기적으로 할당되기 때문에, 특정 데이터의 초기 전송을 위한 PDCCH를 수신받은 TTI와 연결된 HARQ 프로세스가 상기 데이터의 전송에 이용된다. 예를 들면, 단말이 N번째 TTI에서 UL 스케줄링 정보를 포함한 PDCCH를 수신하였다고 가정하면, 단말은 N+4번째 TTI에서 데이터를 전송한다. 다시 말해, N+4번째 TTI에서 할당되는 HARQ 프로세스 K번이 상기 데이터 전

송에 이용되는 것이다. 즉, 단말은 매 TTI마다 PDCCH를 모니터링(Monitoring)해서 자신에게 오는 UL 스케줄링 정보를 확인한 후, 상기 UL 스케줄링 정보에 따라 단말은 데이터를 PUSCH 를 통해 기지국으로 전송할 수 있다(단계 S602).

<70> 기지국은 단말로부터 데이터를 수신하면 이를 소프트 버퍼(soft buffer)에 저장한 후 상기 데이터의 디코딩을 시도한다. 기지국은 이 데이터의 디코딩에 성공하면 ACK 신호를, 실패하면 NACK 신호를 단말에 전송한다. 도 6에서는 기지국이 데이터 디코딩에 실패하여 NACK 신호를 PHICH (Physical HARQ Indicator Channel)을 통해 전송하는 예를 도시하고 있다(단계 S603).

<71> 단말은 기지국으로부터 ACK 신호를 수신하면 기지국으로의 데이터 전송이 성공했음을 감지하고 다음 데이터를 전송한다. 다만, 도 6의 예에서와 같이 단말이 기지국으로부터 NACK 신호를 수신하면, 기지국으로의 데이터 전송이 실패했음을 감지하고 동일 데이터를 동일한 형식 또는 새로운 형식으로 재전송할 수 있다(단계 S604).

<72> 단말의 HARQ 재전송은 비적응적(Non-adaptive) 방식으로 동작할 수 있다. 즉, 특정 데이터의 첫번째 전송(Initial transmission)은 UL 스케줄링 정보를 포함하는 PDCCH를 수신해야만 가능하지만, 재전송은 PDCCH를 수신하지 않아도 가능하다. 상기 비 적응적 방식의 HARQ 재전송은 PDCCH 수신 없이도 다음번 해당 HARQ 프로세스가 할당된 TTI에서 첫번째 전송과 동일한 UL 스케줄링 정보를 이용하여, 상기 데이터를 재전송한다.

<73> 한편, 단말의 HARQ 재전송은 적응적(Adaptive) 방식으로 동작할 수도 있다.

이 경우 재전송에 대한 전송 파라미터를 PDCCH를 통해 수신하는데, 상기 PDCCH에 포함된 UL 스케줄링 정보는 채널 상황에 따라 초기 전송과는 다를 수 있다. 예를 들면, 채널 상황이 초기 전송 때보다 좋은 상황이라면 높은 비트 레이트(Bit Rate)로의 전송을 지시하고, 반대로 채널 상황이 좋지 않은 경우에는 초기 전송 때보다 낮은 비트 레이트로의 전송을 지시할 수 있다.

<74>            단말이 PDCCH를 통해 UL 스케줄링 정보를 수신한 경우, 이번에 전송해야 하는 데이터가 초기전송(initial transmission)되는 데이터인지 아니면 이전 데이터를 재전송(retransmission)해야 하는지는 PDCCH 안에 있는 NDI 필드를 보고 알 수 있다. 상기 NDI 필드는 상술한 바와 같이 새로운 데이터가 전송될 때마다 0 -> 1 -> 0 -> 1 -> ...과 같은 방식으로 토글링되며, 재전송에 대해서는 초기전송과 같은 값을 갖는다. 따라서, 단말은 NDI 필드가 이전에 전송된 값과 같은지를 비교하여 데이터의 재전송 여부를 알 수 있다.

<75>            단말은 HARQ 방식으로 데이터를 한 번 전송할 때마다 전송 횟수 (CURRENT\_TX\_NB)를 카운트하고, RRC 계층에서 설정한 최대 전송 횟수에 CURRENT\_TX\_NB가 도달하게 되면 HARQ 버퍼에 있는 상기 데이터를 지운다.

<76>            한편, 기지국은 재전송된 데이터를 수신하면, 이를 이전에 디코딩에 실패한 채로 소프트 버퍼에 저장되어 있는 데이터와 다양한 방식으로 결합하여 다시 디코딩을 시도하고, 디코딩에 성공했을 경우 ACK 신호를, 실패했을 경우 NACK 신호를 단말에 전송한다. 기지국은 데이터의 디코딩에 성공할 때까지 NACK 신호를 보내고 재전송을 받는 과정을 반복한다. 도 6의 예에서 기지국은 단계 S604에서 재전송된

데이터를 이전에 수신되어 저장된 데이터와 결합을 통해 디코딩을 시도한다. 기지국이 수신 데이터 디코딩에 성공한 경우 ACK 신호를 PHICH를 통해 단말에게 전송한다(단계 S605). 또한 기지국은 단말에게 다음 데이터 전송을 위한 UL 스케줄링 정보를 PDCCH를 통해 전송할 수 있으며, 이 UL 스케줄링 정보가 적응형 재전송을 위해 이용되는 것이 아니라 새로운 데이터 전송을 위해 이용하는 것임을 알려 주기 위해 NDI를 1로 토글링하여 전송할 수 있다(단계 S606). 이에 따라 단말은 기지국에 새로운 데이터를 수신된 UL 스케줄링 정보에 대응하는 PUSCH를 통해 전송할 수 있다(단계 S607).

<77> 한편, 상술한 바와 같이 임의접속 동작은 상술한 여러 경우들에 트리거(Trigger)될 수 있지만, 단말이 상향링크의 무선자원을 요청하는 경우를 위주로 설명하면 다음과 같다.

<78> 도 7은 임의접속 과정에서 제 3 메시지를 전송하는 방법을 상향링크 무선자원을 요청하는 경우의 예를 들어 설명하기 위한 도면이다.

<79> 단말은 단말의 전송 버퍼(601), 예를 들어, RLC 버퍼 및 PDCP 버퍼에 새로운 데이터가 발생하면 일반적으로 이 데이터 발생에 대한 정보를 기지국에 알려야 한다. 좀더 정확히 설명하면, 단말의 전송 버퍼에 저장된 데이터보다 우선순위가 높은 데이터가 발생하는 경우에 이 사실을 기지국으로 알리는 것이다.

<80> 이는 발생한 데이터의 전송을 위해 기지국으로 무선자원을 요청하는 것을 의미하며, 기지국은 상기 정보에 따라 단말에게 적절한 무선자원을 할당할 수 있다. 상술한 바와 같은 데이터 발생에 대한 정보는 버퍼 상태 보고(Buffer Status

Report: 이하 "BSR"이라 칭함)라고 한다. 또한, 이하에서는 상술한 바와 같이 BSR 전송이 요구되는 것을 BSR 전송이 트리거되었다고 표현하기로 한다(S6100). 이와 같이 BSR 전송이 트리거 된 경우에, 단말은 BSR을 기지국으로 전송을 해야 하지만, 만약 이 BSR을 전송하기 위한 무선자원이 없는 경우에, 단말은 임의접속 동작을 트리거하여, 무선자원요청을 시도할 수 있다(S6200).

<81> 상술한 바와 같이 기지국에 무선 자원 요청을 위한 임의접속 동작이 트리거링된 경우, 단말은 도 4 및 도 5와 관련하여 상술한 바와 같이 임의접속 프리앰블을 기지국으로 전송하고, 이에 대한 임의접속 응답 메시지를 수신할 수 있다. 또한, 임의접속 응답 메시지에 포함된 상향링크 승인 신호를 통해 단말의 MAC 계층에서 BSR 및 단말의 식별자를 포함한 제 3 메시지(즉, MAC PDU(Medium Access Control Protocol Data Unit)를 생성하여 메시지3 버퍼(Msg3 buffer; 602)에 저장할 수 있다. 그리고 상기 상향링크 승인 정보가 지시하는 HARQ 프로세스의 버퍼(603)에 다시 메시지3 버퍼(602)에 저장된 제 3 메시지를 복사하여 저장할 수 있다. 도 7에서는 제 3 메시지 전송에 HARQ 프로세스 A가 이용되는 경우를 예로 들어 도시하고 있으며 이에 따라 HARQ 프로세스A에 대응하는 HARQ 버퍼(603)에 제 3 메시지가 복사되는 것을 도시하고 있다. 이와 같이 HARQ 버퍼(603)에 저장된 제 3 메시지는 물리상향링크공유채널(PUSCH)를 통해 기지국에 전송될 수 있다.

<82> 한편, 단말이 경쟁에서 실패하여 임의접속 재시도를 수행해야 하는 경우, 단말은 다시 임의접속 프리앰블을 기지국으로 전송하고, 임의접속 응답을 수신할 수 있다(S6300). 하지만, 재시도되는 임의접속 과정인 경우에는, 단말은 새롭게 제 3

메시지를 생성하지 않고, 기존에 메시지3 버퍼(602)에 저장되어 있는 제 3 메시지를 다시 사용하게 된다. 즉, 단말은 재시도된 임의접속 과정에서 수신된 임의접속 응답에 포함된 상향링크 승인 신호에 따라, 메시지3 버퍼(602)에 저장된 제 3 메시지에 해당하는 MAC PDU를 해당 HARQ 버퍼(604)에 복사하여 저장하고, 이를 전송할 수 있다. 도 7에서는 재시도된 임의접속 과정이 HARQ 프로세스 B에 의해 수행되는 것을 도시하고 있으며, 이에 따라 메시지3 버퍼(602)에 저장된 데이터는 HARQ 버퍼 B에 복사되어 재전송될 수 있다.

<83> 상술한 바와 같이 단말은 임의접속 동작이 진행되는 과정에서 임의접속 응답이 수신하면 메시지3 버퍼에 저장된 제 3 메시지를 HARQ 버퍼에 저장하고 이를 전송한다. 다만, 상술한 바와 같이 현재 LTE 시스템의 HARQ 동작에 대한 표준에서는 임의의 상향링크 승인 신호 수신에 의해 메시지3 버퍼에 저장된 데이터의 전송이 트리거링되는 것으로 규정하고 있다. 이에 따라 CR 타이머가 잘못 구동되어 잘못된 충돌 해결 과정이 이루어질 수 있다. 이러한 잘못된 충돌 해결 과정으로 인해 상술한 바와 같은 BSR이 정상적으로 전송되지 않아 단말이 교착상태에 빠질 수 있는 문제가 발생하게 된다. 이러한 문제에 대해 아래 도 8을 참조하여 좀 더 구체적으로 설명하면 다음과 같다.

<84> 도 8은 임의접속응답 메시지 이외의 메시지를 통해 수신되는 상향링크 승인 신호에 의해 메시지3 버퍼에 저장된 데이터가 전송되는 경우의 문제를 설명하기 위한 도면이다.

<85> 도 7과 관련하여 상술한 바와 같이, 단말은 우선순위가 높은 데이터가 발생

나, 기지국의 입장에서 는 임의접속 프리앰블 수신 및 임의접속 응답 메시지의 전송의  
 단말이 단계 S807에서 제 3 메시지를 전송함에 따라 CR 타이머가 개시되었으  
 <89> 않았지만, CR 타이머를 다시 개시하게 되는 것이다.

S806에서 임의접속 프리앰블 전송 및 임의접속 응답 메시지 수신 절차를 수행하지  
 제 3 메시지를 전송함에 따라 CR 타이머가 다시 개시되게 된다. 즉, 단말은 단계  
 따라 메시지 3 번째 안에 저장되어 있는 제 3 메시지를 전송하게 된다(S806). 또한  
 후에 따른다면 단말은 단계 S805에서 PDCCH를 통해 수신된 상향링크 승인 신호에  
 (Mask)된 PDCCH를 통해 전송할 수 있다(S805). 이러한 경우, 현재 LTE 시스템 포  
 기 때문에, 임의접속 과정과는 별개의 별개의 상향링크 승인 신호를 단말의 식별자로 마스  
 <88> 다만, 이 시점에서 기지국은 아직 단말이 임의접속 과정을 수행하는지 모르

지도할 수 있다.

우 단말은 다시 임의접속 과정을 임의접속 프리앰블 전송에서부터 재개하는 것을  
 은 임의접속과정이 성공적으로 완료되지 못한 것으로 판정하게 된다(S804). 이 경  
 <87> 상기 CR 타이머가 만료될 때까지 임의접속 과정을 완료하지 못한 경우, 단말  
 작동하게 된다.

이 제 3 메시지가 전송되는 경우 도 5와 관련하여 상술한 바와 같이 CR 타이머를  
 크 승인 정보를 통해 BSR이 포함된 제 3 메시지를 전송할 수 있다(S803). 이와 같  
 <86> 그 후, 단말은 단계 S802에서 수신된 임의접속 응답 메시지에 포함된 상향링크  
 를 전송하고(S801), 이에 대해 임의접속 응답을 수신할 수 있다(S802).

함에 따라 BSR를 트리거하고, 이 BSR를 기지국으로 전송하기 위해 임의접속 프리앰



과정을 거치지 않았기 때문에 여전히 단말에서 임의접속 절차가 진행 중이라는 사실을 알지 못할 수 있다. 이에 따라 만약 또 다른 상황링크 승인 신호가 단말의 식별자를 포함한 PDCCH로 수신되는 경우(S807), 단말은 진행중인 임의접속 과정이 성공적으로 완료되었다고 판단하게 된다. 이에 따라 단말은 진행 중인 CR 타이머를 종료할 수 있다(S808).

<90> 이와 같은 상황에서 단계 S806에서 기지국에 전송된 제 3 메시지가 기지국에서 성공적으로 수신되지 않은 경우(A), 단말은 더 이상 BSR이 포함된 제3 메시지를 전송하지 못하게 된다. 따라서, 만약 추가적인 데이터 발생이 없는 경우에는, 단말이 전송 버퍼에 발생한 데이터를 기지국으로 전송하지 못하는 교착상태가 발생할 수 있다.

<91> 상술한 바와 같은 문제점을 정리하면 다음과 같다.

<92> 현재 LTE 시스템 표준에 따르면, 메시지3 버퍼에 데이터가 저장되어 있는 상태에서 상황링크 승인 신호가 수신되는 경우, 단말은 메시지3 버퍼에 저장된 데이터를 기지국에 전송하게 된다. 이때 기지국이 전송한 상황링크 승인 신호는 메시지3 버퍼에 저장된 데이터 전송을 위한 것이 아니고, 별도의 데이터 전송을 위한 경우가 존재할 수 있으며, 이에 따라 잘못된 CR 타이머가 개시될 수 있다.

<93> 또한, 기지국이 단말에서 잘못된 CR 타이머가 개시되고 있음을 알지 못하고 상기 도 8과 관련하여 상술한 바와 같이 다른 데이터 전송을 위한 상황링크 승인 신호를 전송하는 경우, 제 3 메시지를 통해 전송하고자 하는 정보(예를 들어, BSR)이 유실되는 문제가 발생할 수 있다.

<94> 또한, 단말이 진행 중인 임의접속 과정에 대해서도 올바른 충돌 해결 절차 종료를 위한 제 4 메시지의 수신에 불가능하게 될 수 있다.

<95> 상술한 바와 같은 문제를 해결하기 위한 본 발명의 바람직한 일 실시형태에서는 메시지3 버퍼에 저장된 데이터를 전송하는 경우를 기지국으로부터 상향링크 승인 신호를 수신하는 모든 경우가 아니라, 기지국으로부터 수신된 상향링크 승인 신호가 임의접속 응답 메시지를 통해 수신된 경우로 한정하는 것을 제안한다. 만일, 메시지 3 버퍼에 데이터가 저장되어 있는 상태에서 임의접속 응답 메시지가 아니라 단말의 식별자(C-RNTI(Cell Radio Network Temporary Identifier) 또는 SPS-RNTI (Semi Persistent Scheduling Radio Network Temporary Identifier))에 의해 마스킹된 PDCCH로 상향링크 승인 신호가 수신된 경우에는 메시지3 버퍼에 저장된 데이터가 아니라 새로운 데이터(MAC PDU)를 획득하여 기지국으로 전송하는 방법을 제안한다.

<96> 도 9는 본 발명의 바람직한 일 실시형태에 따라 단말이 상향링크 데이터를 전송하는 방법을 설명하기 위한 순서도이다. 구체적으로, 도 9는 매 TTI(Transmission Time Interval)에서, 본 발명의 일 실시형태에 따른 단말의 HARQ 엔터티의 동작을 설명하고 있다.

<97> 먼저, 단말의 HARQ 엔터티는 해당 TTI에 관련된 HARQ 프로세스를 지정할 수 있다(S901). 이와 같이 해당 TTI와 관련된 HARQ 프로세스가 지정된 경우, 단말의 HARQ 엔터티는 해당 TTI에 기지국으로부터 수신된 상향링크 승인 신호가 수신되었는지 여부를 판정할 수 있다(S902). 만일, 해당 TTI에 대해 수신된 상향링크 승인

신호에 대한 정보가 없는 경우 단말은 해당 HARQ 프로세스에 대응하는 HARQ 버퍼가 비어있는지 여부를 판정하고, 해당 HARQ 버퍼에 데이터가 있는 경우 도 6과 관련하여 상술한 바와 같이 비 적응형 재전송을 수행할 수 있다(S903).

<98> 한편, 해당 TTI에 대해 기지국으로부터 수신된 상향링크 승인 신호가 존재하는 경우, (1) 이 상향링크 승인 신호가 임시 셀 식별자(Temporary C-RNTI)에 의해 지칭되는 PDCCH로 수신되지 않았고, NDI가 해당 HARQ 프로세스의 이전 전송시 값에 비해 토글링되었는지 여부, (2) 이전 NDI값이 없어, 금번 전송이 해당 HARQ 프로세스의 최초 전송인지 여부, (3) 상기 상향링크 승인 신호가 셀 식별자(C-RNTI)에 대한 PDCCH로 수신되고, 해당 HARQ 프로세스의 HARQ 버퍼가 비어있는지 여부, 또는 (4) 상기 상향링크 승인 신호가 임의접속 응답 메시지를 통해 수신되었는지 여부를 판정할 수 있다(S904). 단계 S904에서 상술한 (1) 내지 (4)의 조건 중 어느 하나 이상을 만족하는 경우(A), 단계 S906으로 진행한다. 한편, 단계 S904에서 상술한 (1) 내지 (4)의 조건 중 어느 하나도 만족하지 않는 경우(B), 단계 S905로 진행하여 수신된 상향링크 승인 신호를 이용하여 적응형 재전송을 수행할 수 있다(S905).

<99> 한편, 단계 S906에서 단말은 메시지3 버퍼에 데이터가 존재하는지 여부를 판정한다(S906). 추가적으로 단말은 메시지3 버퍼에 데이터가 존재하는 경우에도, 수신된 상향링크 승인 신호가 임의접속 응답 메시지를 통해 수신된 것인지 여부를 판정한다(S907). 즉, 본 실시형태에 따른 단말은 상향링크 승인 신호 수신 시 메시지 3 버퍼에 데이터가 존재하고, 이 상향링크 승인 신호가 임의접속 응답 메시지를 통해 수신된 경우에 한하여 메시지3 버퍼에 저장된 데이터를 전송하는 것을 제안한다

(S908). 만일, 상향링크 승인 신호 수신 시 메시지3 버퍼에 저장된 데이터가 없거나, 수신된 상향링크 승인 신호가 임의접속 응답 메시지를 통해 수신되지 않은 경우 단말은 기지국이 메시지3 버퍼에 저장된 데이터의 전송이 아니라 새로운 데이터의 전송을 요청하는 것으로 판정하여 새로운 데이터를 전송하는 절차를 수행하게 된다(S909). 구체적으로 단말의 HARQ 엔터티는 다중화 및 조합 엔터티(Multiplexing and Assembly Entity)로부터 새로운 데이터를 포함하는 MAC PDU를 획득하고, 이를 해당 HARQ 프로세스를 통해 전송하도록 제어할 수 있다.

<100> 이하에서는 도 9와 관련하여 설명한 실시형태에 따라 동작하는 단말이 상기 도 8과 같이 BSR을 전송하는 과정에 적용된 예를 들어 설명한다.

<101> 도 10은 본 발명의 일 실시형태에 따른 단말에서 BSR이 트리거되는 경우, 상향링크 데이터를 전송하는 방법을 설명하기 위한 도면이다.

<102> 상술한 바와 같이 단말의 RLC 및 PDCP 버퍼에 새로운 데이터가 발생할 수 있다. 이때 발생한 새로운 데이터는 RLC 및 PDCP 버퍼에 이미 저장되어 있는 데이터보다 우선순위가 높은 것을 가정한다. 이에 따라 단말은 상기 데이터 발생에 대한 정보를 기지국으로 알리기 위해 BSR 전송을 트리거할 수 있다(단계 1).

<103> 단말은 상술한 BSR 전송 트리거에 따라 BSR을 전송해야 하지만, 특정한 경우 이와 같은 BSR을 전송하기 위한 무선자원이 없는 경우가 있을 수 있다. 이러한 경우 단말은 상기 BSR 전송을 위한 임의접속 동작을 트리거할 수 있다. 본 실시예에서 트리거되는 임의접속 동작은 도 5와 관련하여 상술한 경쟁 기반 임의접속 동작인 것을 가정한다.

- <104> 상술한 바와 같은 임의접속 동작의 트리거에 따라 단말은 임의접속 프리엠블을 기지국으로 전송할 수 있다(단계 2).
- <105> 기지국은 단계 2에서 단말이 전송한 임의접속 프리엠블을 수신함에 따라 상기 단말에게 임의접속 응답 메시지를 전송할 수 있다(단계 3). 단말은 이 임의접속 응답 메시지를 수신할 수 있다.
- <106> 단말은 단계 3에서 수신된 임의접속 응답 메시지에 포함된 상향링크 승인 신호에 따라 BSR과 단말의 식별자 등을 포함한 제 3 메시지를 생성하고, 이 제 3 메시지를 메시지3 버퍼에 저장할 수 있다(단계 4).
- <107> 단말은 단계 3에서 수신된 임의접속 응답 메시지에 포함된 상향링크 승인 정보에 따라 HARQ 프로세스를 선택하고, 선택된 HARQ 프로세스의 버퍼에 메시지3 버퍼에 저장된 제 3 메시지를 복사하여 저장할 수 있다. 그 후, 도 6과 관련하여 상술한 상향링크 HARQ 동작에 따라 HARQ 버퍼에 있는 데이터를 기지국으로 전송할 수 있다(단계 5). 또한, 단말은 제 3 메시지의 전송에 따라 CR 타이머를 개시 (또는 재 개시)하게 된다.
- <108> 상기 CR 타이머가 만료됨에 따라, 단말은 임의접속 과정을 재시도할 수 있다. 즉, 임의접속 프리엠블과 PRACH(Physical Random Access Channel) 자원을 선택하여 기지국에 전송할 것을 준비할 수 있다. 하지만, CR 타이머가 동작 중이지 않은 상황에서 단말은 단말의 식별자로 마스크된 PDCCH를 통해 기지국으로부터 상향링크 승인 신호를 수신할 수 있다(단계 6).

<109> 단말은 단계 6에서와 같이 PDCCH를 통해 상향링크 승인 신호를 수신한 경우, 메시지3 버퍼에 저장되어 있는 제 3 메시지를 단계 6에서 수신된 상향링크 승인 정보에 따라 전송하는 도 8의 실시예에서의 동작과 달리, 상기 메시지3 버퍼에 저장된 데이터와 다른 새로운 데이터를 단계 6에서 수신된 상향링크 승인 정보에 따라 새로운 MAC PDU로서 생성하게 된다(단계 7). 구체적으로 단말은 단계 6에서 상향링크 승인 신호를 수신하였으나, 이 상향링크 승인 신호가 임의접속응답 메시지를 통해 수신된 것이 아닌 경우, 메시지3 버퍼에 저장된 데이터를 전송하는 것이 아니라 다중화 및 조함(Multiplexing and Assembly) 엔티티로부터 새로운 데이터 전송을 위한 MAC PDU를 획득하여, 이를 대응하는 HARQ 프로세스를 이용하여 전송할 수 있다.

<110> 이와 같이 새로운 MAC PDU를 생성한 후, 본 실시형태에 따른 단말은 단계 6에서 수신된 상향링크 승인 정보에 따라 HARQ 프로세스를 선택하고, 상기 HARQ 프로세스의 버퍼에 단계 7에서 새롭게 만든 MAC PDU를 저장하고, 상향링크 HARQ 동작에 따라 상기 MAC PDU를 기지국으로 전송할 수 있다(단계 8).

<111> 이후 단말은 정상적으로 임의접속 프리엠블의 전송 및 임의접속응답 수신 등을 포함하는 임의접속 과정을 수행하여 메시지3 버퍼에 저장된 BSR을 기지국으로 전송할 수 있다.

<112> 상술한 바와 같은 실시형태에 따른 경우 상술한 바와 같이 기지국이 메시지3 버퍼에 저장된 데이터 전송이 아닌 새로운 데이터 전송을 위해 전송한 상향링크 승인 신호로 인하여 잘못된 CR 타이머가 동작하는 것을 방지할 수 있으며, 이로 인하

여 제 3 메시지가 유실되는 분제도 해결할 수 있다. 아울러, 단말의 임의접속 과정이 기지국과 정상적으로 이루어지도록 할 수 있다.

<113> 상술한 실시형태와 달리 본 발명의 다른 일 실시형태로서 단말의 임의접속 과정 수행 중에 기지국으로부터 단말의 식별자로 마스크된 PDCCH를 통해 상향링크 승인 신호가 수신되는 경우 이를 무시하고 처리하는 방안도 가능하다. 이 경우 단말은 정상적인 임의접속 과정을 통해 제 3 메시지를 기지국에 전달할 수 있고, 기지국은 단말의 임의접속 과정 종료 후 새로운 데이터 전송을 위한 상향링크 승인 신호를 다시 전송할 수 있다.

<114> 이하에서는 상술한 바와 같은 본 발명의 실시형태를 구현하기 위한 단말의 구성에 대해 설명한다.

<115> 도 11은 본 발명의 일 실시형태에 따른 단말 구성을 개략적으로 도시한 도면이다.

<116> 도 11에 도시된 바와 같이 본 실시형태에 따른 단말은 기지국으로부터 특정 메시지를 통해 상향링크 승인(UL Grant) 신호를 수신하기 위한 수신 모듈(Rx Module; 1101), 수신된 상향링크 승인 신호를 이용하여 기지국에 데이터를 전송하기 위한 전송 모듈(Tx Module; 1102), 임의접속 과정에서 전송되는 상향링크 데이터를 저장하는 메시지3 버퍼(Msg3 Buffer; 1103), 및 단말의 상향링크 데이터 전송을 제어하는 HARQ 엔터티(1104)를 포함할 수 있다.

<117> 특히 본 실시형태에 따른 단말의 HARQ 엔터티(1104)는 수신 모듈(1101)이 상

상향링크 승인 신호 수신 시 메시지3 버퍼(1103)에 저장된 데이터가 존재하는지 여부 및 수신 모듈(1101)이 상향링크 승인 신호를 임의접속 응답 메시지를 통해 수신하였는지 여부를 판정하는 기능을 수행하는 것을 제안한다. 이에 따라 만일 수신 모듈(1101)이 상향링크 승인 신호 수신 시 메시지3 버퍼(1103)에 저장된 데이터가 존재하며 수신 모듈(1101)이 임의접속 응답 메시지를 통해 상향링크 승인 신호를 수신한 경우에 한하여, 메시지3 버퍼(1103)에 저장된 데이터를 획득하여, 기지국으로 전송하도록 제어하는 것을 제안한다. 만일, 수신 모듈(1101)이 상향링크 승인 신호 수신 시 메시지3 버퍼(1103)에 저장된 데이터가 존재하지 않거나 수신 모듈(1101)이 임의접속 응답 메시지가 아닌 PDCCH를 통해 상향링크 승인 신호를 수신한 경우, 메시지3 버퍼(1103)에 저장된 데이터를 전송하는 것이 아니라 다중화 및 조합 엔터티(1105)로부터 새로운 데이터를 MAC PDU 형태로 획득하여 이를 기지국으로 전송하는 것을 제안한다.

<118> 또한, 상향링크 HARQ 동작을 수행하기 위해 본 실시형태에 따른 단말은 하나 이상의 HARQ 프로세스(1106)와 각 HARQ 프로세스(1106)에 대응하는 HARQ 버퍼(1107)를 포함할 수 있다. 현재 LTE 시스템의 경우 8개의 독립적인 HARQ 프로세스를 이용하는 것을 규정하고 있으나, 본 발명은 이에 한정될 필요는 없다.

<119> 한편, 본 실시형태에 따른 HARQ 엔터티(1104)는 상술한 구성을 이용하여 메시지3 버퍼(1103) 또는 다중화 및 조합 엔터티(1105)로부터 획득한 데이터를 특정 HARQ 프로세스(1106)에 전달하고, 이 특정 HARQ 프로세스(1106)가 메시지3 버퍼(1103) 또는 다중화 및 조합 엔터티(1105)로부터 획득한 데이터를 전송 모듈(110



2)을 통해 전송하도록 제어하도록 설정할 수 있다. 또한, 상술한 바와 같이 특정 HARQ 프로세스(1106)가 상술한 바와 같이 메시지3 버퍼(1103)에 저장된 데이터를 전송 모듈(1102)을 통해 전송하는 경우, 메시지3 버퍼(1103)에 저장된 데이터를 특정 HARQ 프로세스(1106)에 대응하는 특정 HARQ 버퍼(1107)에 복제하고, 이와 같이 특정 HARQ 버퍼(1107)에 복제된 데이터를 전송 모듈(1102)을 통해 전송하도록 제어하도록 설정할 수 있다.

<120>           이때 메시지3 버퍼(1103)에 저장된 데이터는 단말 식별자를 포함하는 MAC PDU이며, 각 임의접속 과정의 목적에 따라 상술한 BSR 등의 정보를 추가적으로 포함할 수 있다.

<121>           도 11에 도시된 바와 같은 단말 구성에서 전송 모듈(1102) 및 수신 모듈(1101)은 물리계층 프로세싱 모듈(1108)로서 구성할 수 있으며, HARQ 엔터티(1104), 다중화 및 조합 엔터티(1105) 및 하나 이상의 HARQ 프로세스(1106)는 MAC 계층 모듈(1109)로서 구성할 수 있으나, 본 발명은 이에 한정될 필요는 없다. 또한, 메시지3 버퍼(1103) 및 각 HARQ 프로세스(1106)에 대응하는 HARQ 버퍼(1107)는 임의의 저장 매체를 이용하여 구현할 수 있다.

<122>           상술한 바와 같이 개시된 본 발명의 바람직한 실시예들에 대한 상세한 설명은 당업자가 본 발명을 구현하고 실시할 수 있도록 제공되었다. 상기에서는 본 발명의 바람직한 실시예들을 참조하여 설명하였지만, 해당 기술 분야의 숙련된 당업자는 하기의 특허 청구의 범위에 기재된 본 발명의 사상 및 영역으로부터 벗어나지 않는 범위 내에서 본 발명을 다양하게 수정 및 변경시킬 수 있음을 이해할 수 있을

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것이다. 따라서, 본 발명은 여기에 나타난 실시형태들에 제한되려는 것이 아니라, 여기서 개시된 원리들 및 신규한 특징들과 일치하는 최광의 범위를 부여하려는 것이다.

**【산업상이용가능성】**

<123> 상술한 바와 같은 신호 송수신 기술 및 이를 위한 단말 구조는 3GPP LTE 시스템에 적용되는 예를 중심으로 설명하였으나, 3GPP LTE 시스템 이외에도 유사한 과정을 가지는 다른 다양한 이동통신 시스템에 적용하는 것이 가능하다.

**【특허 청구범위】**

**【청구항 1】**

사용자 기기가 상향링크로 데이터를 전송하는 방법에 있어서,

기지국으로부터 특정 메시지를 통해 상향링크 승인(UL Grant) 신호를 수신하는 단계;

상기 특정 메시지를 통한 상향링크 승인 신호 수신 시 메시지3 버퍼(Msg3 Buffer)에 저장된 데이터가 존재하는지 여부를 판정하는 단계;

상기 특정 메시지가 임의접속 응답(Random Access Response) 메시지인지 여부를 판정하는 단계; 및

상기 특정 메시지를 통한 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하며 상기 특정 메시지가 임의접속 응답 메시지인 경우, 상기 특정 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 상기 메시지3 버퍼에 저장된 데이터를 상기 기지국에 전송하는 단계를 포함하는, 데이터 전송 방법.

**【청구항 2】**

제 1 항에 있어서,

상기 특정 메시지를 통한 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하지 않거나, 또는 상기 수신 메시지가 임의접속 응답 메시지가 아닌 경우, 상기 특정 메시지를 통해 수신된 상향링크 승인 신호에 대응하여 새로운 데이터를 상기 기지국에 전송하는 단계를 추가적으로 포함하는, 데이터 전송

방법.

**【청구항 3】**

제 2 항에 있어서,

상기 새로운 데이터를 상기 기지국에 전송하는 단계는,

다중화 및 조합 엔티티(Multiplexing and Assembly Entity)로부터 MAC PDU(Medium Access Control Protocol Data Unit)를 획득하는 단계; 및

상기 MAC PDU를 상기 기지국에 전송하는 단계를 포함하는, 데이터 전송 방법.

**【청구항 4】**

제 1 항에 있어서,

상기 특정 메시지를 통해 수신된 상향링크 승인 신호는 물리하향링크제어채널(PDCCH: Physical Downlink Control Channel)을 통해 수신되는 상향링크 승인 신호이며,

상기 사용자 기기는 상기 물리하향링크제어채널을 통해 수신된 상향링크 승인 신호에 대응하여 새로운 데이터를 전송하는, 데이터 전송 방법.

**【청구항 5】**

제 1 항에 있어서,

상기 메시지3 버퍼에 저장된 데이터는 상기 사용자 기기 식별자를 포함하는 MAC PDU(Medium Access Control Protocol Data Unit)인, 데이터 전송 방법.

**【청구항 6】**

제 5 항에 있어서,

상기 사용자 기기가 버퍼 상태 보고(BSR: Buffer Status Report)를 위해 임의접속 과정을 개시한 경우, 상기 메시지3 버퍼에 저장된 데이터는 상기 버퍼 상태 보고 정보를 더 포함하는, 데이터 전송 방법.

**【청구항 7】**

기지국으로부터 특정 메시지를 통해 상향링크 승인(UL Grant) 신호를 수신하는 수신 모듈;

상기 특정 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 상기 기지국에 데이터를 전송하는 전송 모듈;

임의접속 과정에서 전송되는 상향링크 데이터를 저장하는 메시지3 버퍼(Message3 Buffer); 및

상기 수신 모듈이 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하는지 여부, 및 상기 특정 메시지가 임의접속 응답(Random Access Response) 메시지인지 여부를 판정하여, 상기 수신 모듈이 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하며 상기 특정 메시지가 임의접속 응답 메시지인 경우, 상기 메시지3 버퍼에 저장된 데이터를 획득하여, 상기 수신 모듈이 상기 특정 메시지를 통해 수신한 상향링크 승인 신호를 이용하여 상기 전송 모듈이 상기 메시지3 버퍼에 저장된 데이터를 상기 기지국에 전송하도록 제어

하는 HARQ 엔터티를 포함하는, 사용자 기기.

**【청구항 8】**

제 7 항에 있어서,

상기 사용자 기기는 새로운 데이터 전송에 이용되는 다중화 및 조합 엔터티 (Multiplexing and Assembly Entity)를 더 포함하며,

상기 HARQ 엔터티는 상기 수신 모듈이 상기 특정 메시지를 통해 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하지 않거나, 상기 수신 메시지가 임의접속 응답 메시지가 아닌 경우, 상기 다중화 및 조합 엔터티로부터 전송할 새로운 데이터를 획득하여, 상기 수신 모듈이 상기 특정 메시지를 통해 수신한 상향링크 승인 신호를 이용하여 상기 전송 모듈이 상기 다중화 및 조합 엔터티로부터 획득한 새로운 데이터를 전송하도록 제어하는, 사용자 기기.

**【청구항 9】**

제 8 항에 있어서,

상기 사용자 기기는

하나 이상의 HARQ 프로세스; 및

상기 하나 이상의 HARQ 프로세스 각각에 대응하는 HARQ 버퍼를 더 포함하며,

상기 HARQ 엔터티는 상기 메시지3 버퍼 또는 상기 다중화 및 조합 엔터티로부터 획득한 데이터를 상기 하나 이상의 HARQ 프로세스 중 특정 HARQ 프로세스에 전달하고, 상기 특정 HARQ 프로세스가 상기 메시지3 버퍼 또는 상기 다중화 및 조

합 엔터티로부터 획득한 데이터를 상기 전송 모듈을 통해 전송하도록 제어하는, 사용자 기기.

**【청구항 10】**

제 9 항에 있어서,

상기 특정 HARQ 프로세스가 상기 메시지3 버퍼에 저장된 데이터를 상기 전송 모듈을 통해 전송하는 경우, 상기 메시지3 버퍼에 저장된 데이터를 상기 특정 HARQ 프로세스에 대응하는 특정 HARQ 버퍼에 복제하고, 상기 특정 HARQ 버퍼에 복제된 데이터를 상기 전송 모듈을 통해 전송하도록 제어하는, 사용자 기기.

**【청구항 11】**

제 7 항에 있어서,

상기 수신 모듈이 상기 특정 메시지를 통해 수신한 상향링크 승인 신호는 물리하향링크제어채널(PDCCH: Physical Downlink Control Channel)을 통해 수신되는 상향링크 승인 신호이며,

상기 HARQ 엔터티는 상기 물리하향링크제어채널을 통해 수신된 상향링크 승인 신호에 대응하여 새로운 데이터를 전송하도록 제어하는, 사용자 기기.

**【청구항 12】**

제 7 항에 있어서,

상기 수신 모듈이 상기 특정 메시지를 통해 수신된 상향링크 승인 신호는 물리하향링크공유채널(PDSCH: Physical Downlink Shared Channel)을 통해 수신되는

임의접속응답 메시지를 통해 수신되는 상향링크 승인 신호이며,

상기 HARQ 엔터티는 상기 수신 모듈이 상기 임의접속 응답 메시지를 통해 상향링크 승인 신호 수신 시 상기 메시지3 버퍼에 저장된 데이터가 존재하는 경우, 상기 임의접속 응답 메시지를 통해 수신된 상향링크 승인 신호를 이용하여 상기 메시지 3 버퍼에 저장된 데이터를 전송하도록 제어하는, 사용자 기기.

**【청구항 13】**

제 7 항에 있어서,

상기 메시지3 버퍼에 저장된 데이터는 상기 사용자 기기 식별자를 포함하는 MAC PDU(Medium Access Control Protocol Data Unit)인, 사용자 기기.

**【도면의 간단한 설명】**

<124> 도 1은 이동통신 시스템의 일례로서 E-UMTS 망구조를 개략적으로 도시한 도면이다.

<125> 도 2 및 도 3은 3GPP 무선접속망 규격을 기반으로 한 단말과 UTRAN 사이의 무선인터페이스 프로토콜의 구조를 나타낸다.

<126> 도 4는 비 경쟁 기반 임의접속 과정에서의 단말과 기지국의 동작 과정을 나타낸다.

<127> 도 5는 경쟁 기반 임의접속 과정에서 단말과 기지국의 동작 과정을 설명하기 위한 도면이다.

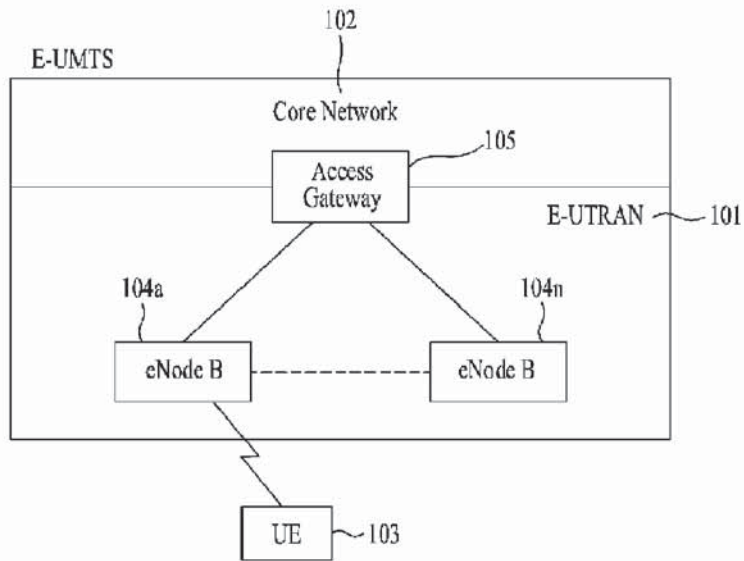
<128> 도 6은 상향링크 HARQ 동작 방식을 설명하기 위한 도면이다.



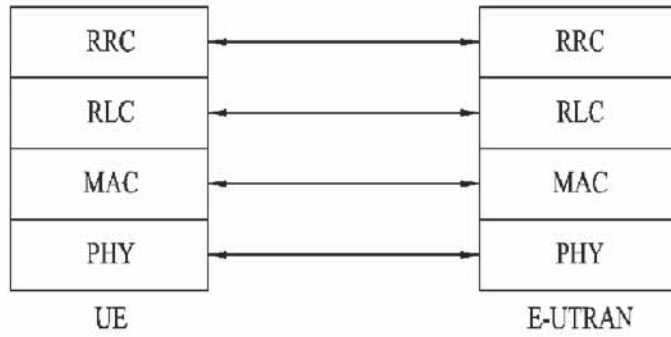
- <129> 도 7은 임의접속 과정에서 제 3 메시지를 전송하는 방법을 상향링크 무선자원을 요청하는 경우의 예를 들어 설명하기 위한 도면이다.
- <130> 도 8은 임의접속응답 메시지 이외의 메시지를 통해 수신되는 상향링크 승인 신호에 의해 메시지 버퍼에 저장된 데이터가 전송되는 경우의 문제를 설명하기 위한 도면이다.
- <131> 도 9는 본 발명의 바람직한 일 실시형태에 따라 단말이 상향링크 데이터를 전송하는 방법을 설명하기 위한 순서도이다.
- <132> 도 10은 본 발명의 일 실시형태에 따른 단말에서 BSR이 트리거되는 경우, 상향링크 데이터를 전송하는 방법을 설명하기 위한 도면이다.
- <133> 도 11은 본 발명의 일 실시형태에 따른 단말 구성을 개략적으로 도시한 도면이다.

【도면】

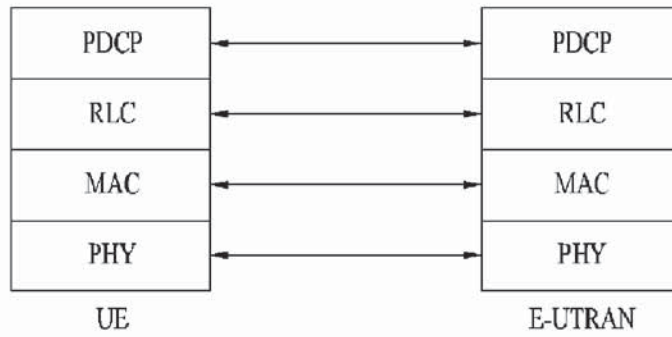
【도 1】



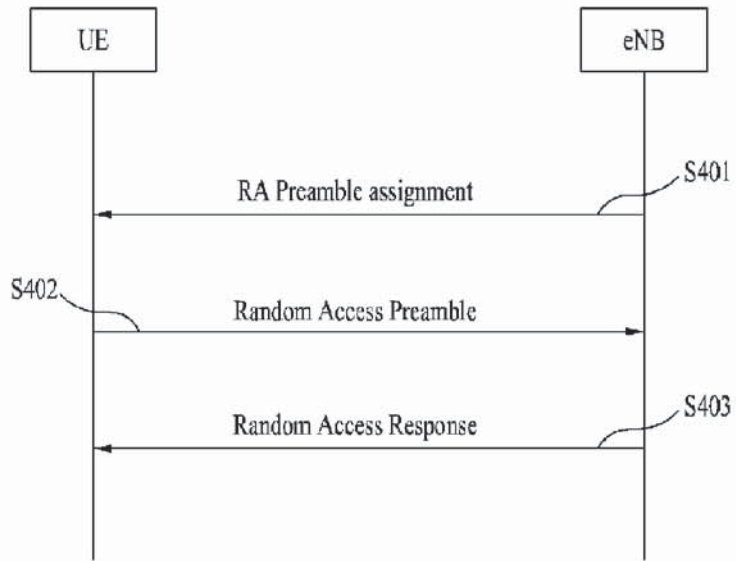
【도 2】



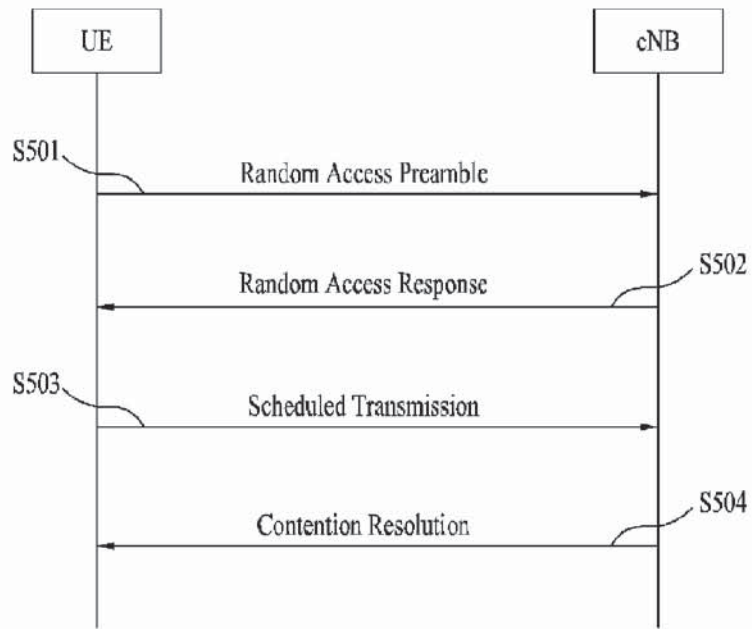
【도 3】



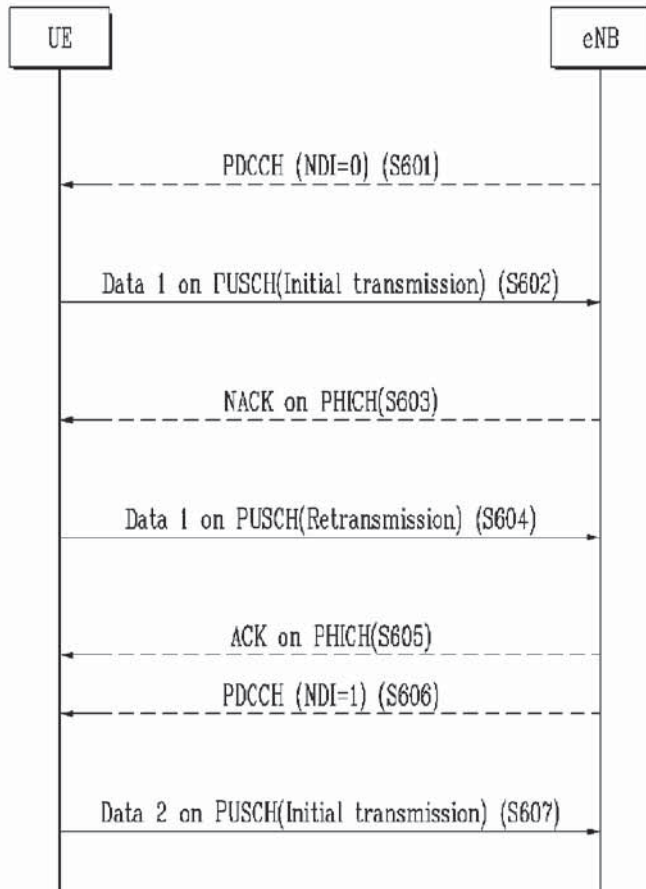
【도 4】



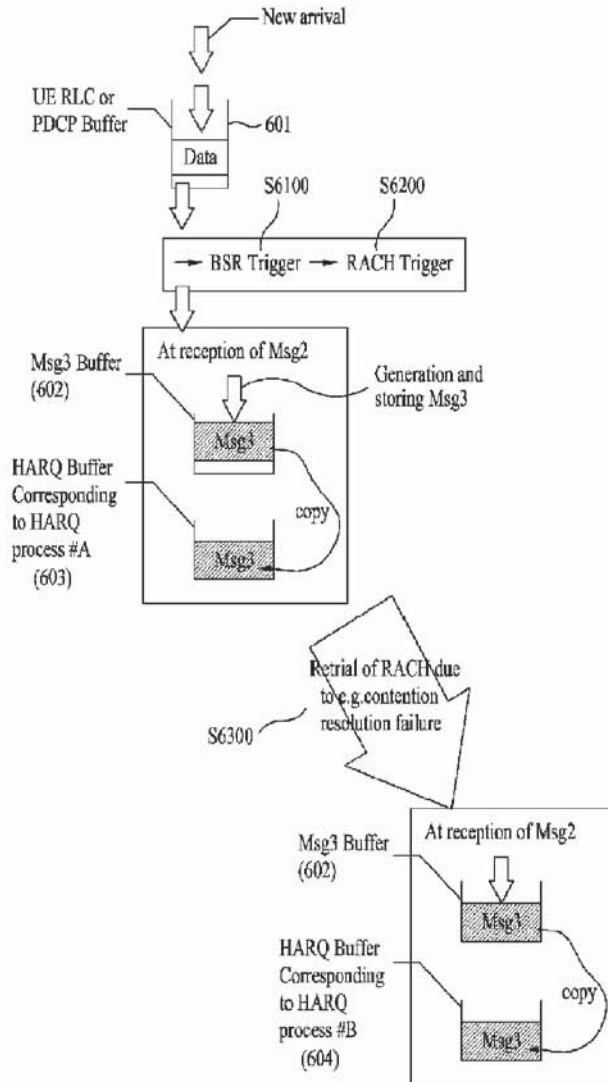
【도 5】



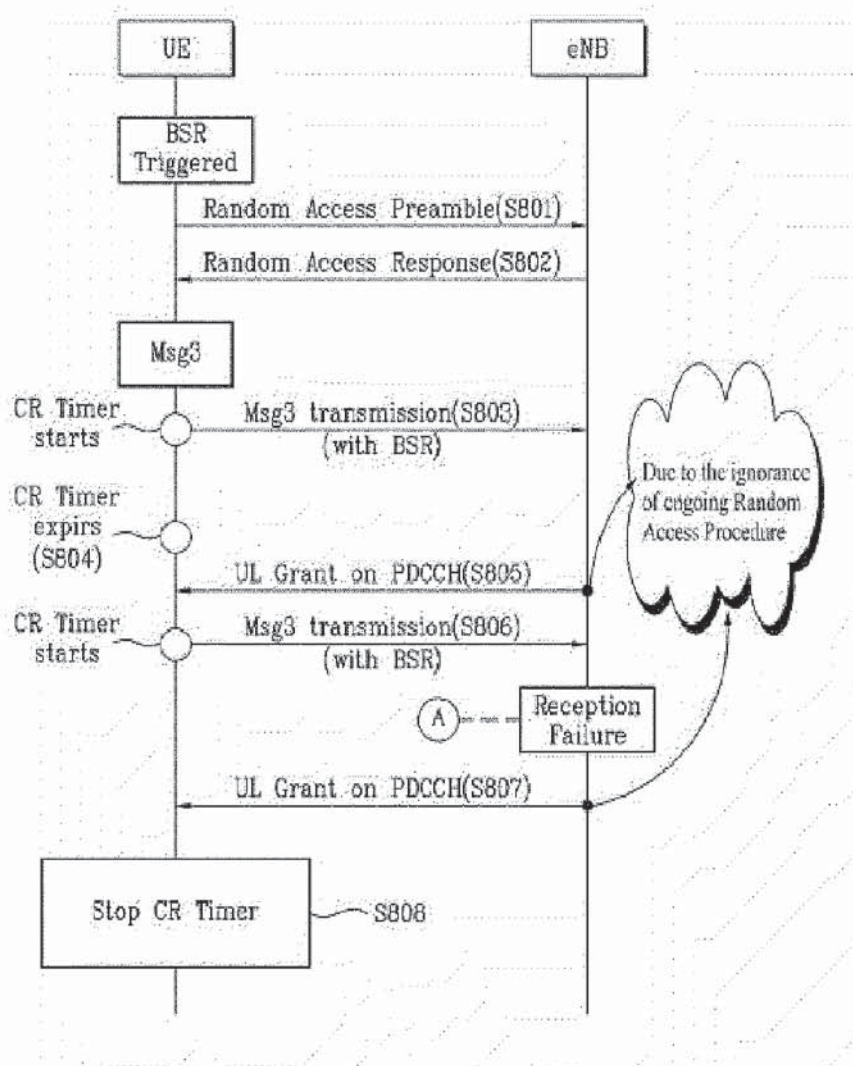
【도 6】



【도 7】

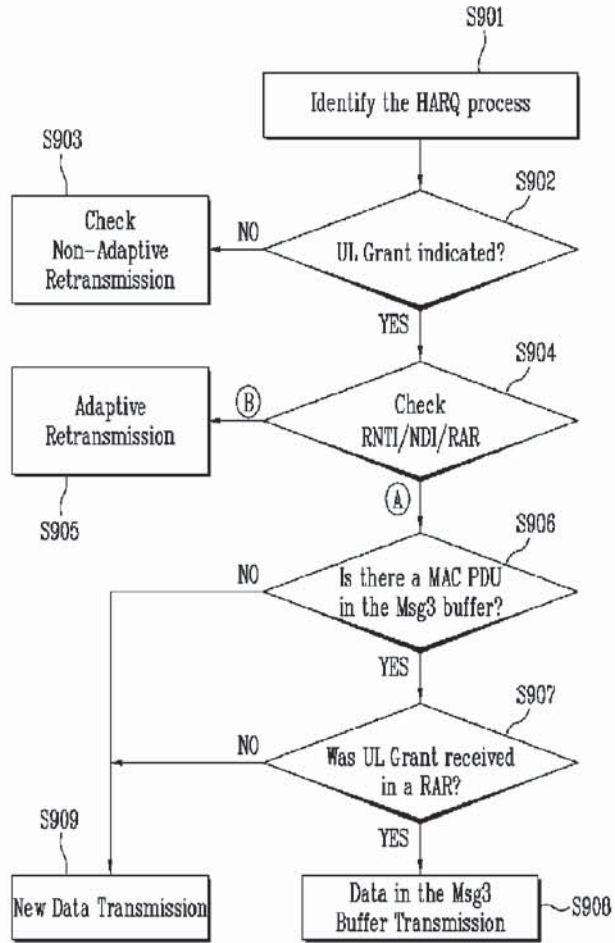


【도 8】

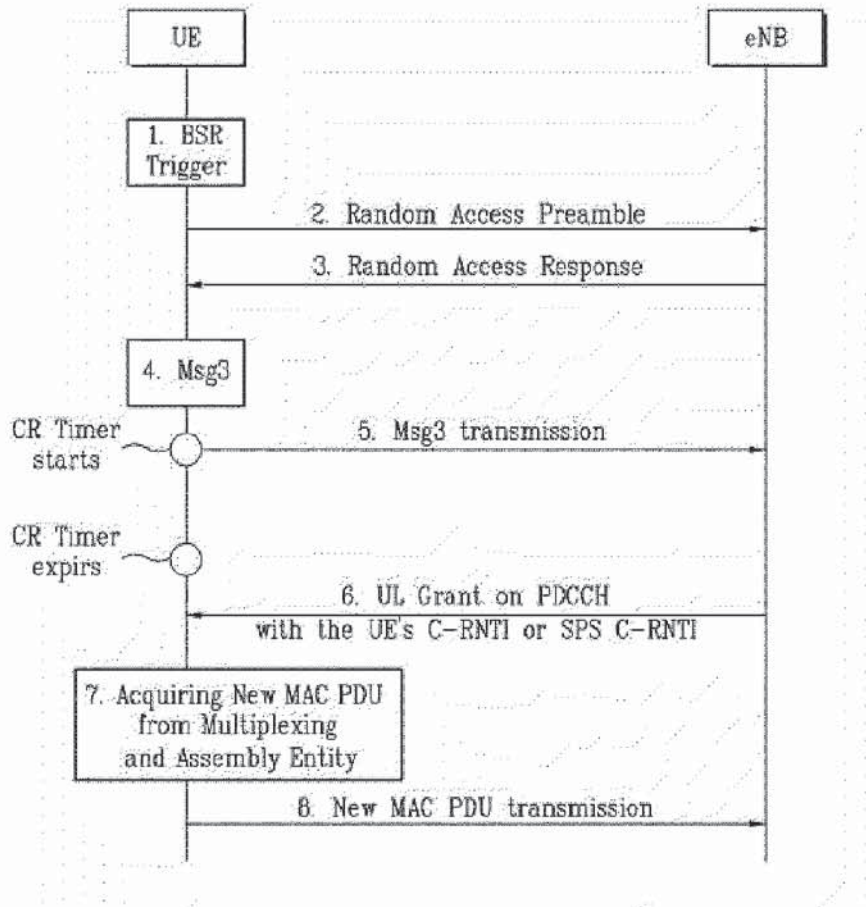




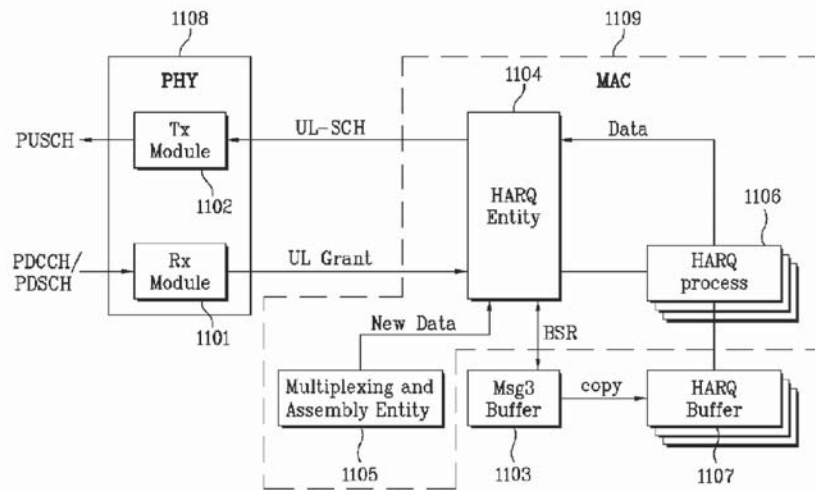
【도 9】



【도 10】



【 11 】



Substitute for form 1449A/PTO				<b>Complete if Known</b>	
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				Application Number	13/801,529
				Filing Date	March 13, 2013
				First Named Inventor	Sung Jun PARK
				Art Unit	2464
				Examiner Name	NGO, Ricky Quoc
Sheet	1	of	2	Attorney Docket Number	7836-5-CON-2

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. <sup>1</sup>	Document Number Number-kind Code <sup>2 (if known)</sup>	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	7881236	02-01-2011	Park et al.	
	2	8422410	04-16-2013	Park et al.	
	3	2008/0095094	04-24-2008	Innami	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document Country Code <sup>3</sup> ; Number <sup>4</sup> ; Kind Code <sup>5 (if known)</sup>	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T <sup>6</sup>
	4	WO 2007/126301	11/08/2007	ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE		
	5	WO 2008/041824	04/10/2008	LG ELECTRONICS INC.		

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No. <sup>1</sup>	
	6	Examination Report for Great Britain Patent Application No. GB0912850.5, mailed August 20, 2009 (Attorney Ref. No.: 7836-5-GB)
	7	Official Action for Great Britain Patent Application No. GB0912850.5, mailed Jan. 8, 2010 (Attorney Ref. No.: 7836-5-GB)
	8	Official Action for Great Britain Patent Application No. GB0912850.5, mailed June 7, 2010 (Attorney Ref. No.: 7836-5-GB)
	9	Official Action for Great Britain Patent Application No. GB0912850.5, mailed July 21, 2010 (Attorney Ref. No.: 7836-5-GB)
	10	Notification of Grant for Great Britain Patent Application No. GB0912850.5, mailed December 7, 2010 (Attorney Ref. No.: 7836-5-GB)

Examiner Signature		Date Considered	
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\*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Substitute for form 1449A/PTO				<b>Complete if Known</b>	
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				Application Number	13/801,529
				Filing Date	March 13, 2013
				First Named Inventor	Sung Jun PARK
				Art Unit	2464
				Examiner Name	NGO, Ricky Quoc
Sheet	2	of	2	Attorney Docket Number	7836-5-CON-2

11	Prior Art Search Report (including translation) for Korean Application No. 10-2009-0057128, mailed Oct. 27, 2009 (Attorney Ref. No.: 7836-5-KR)
12	Decision to Grant for Korean Application No. 10-2009-0057128, mailed Jan. 11, 2010 (Attorney Ref. No.: 7836-5-KR)
13	International Search Report for corresponding International Application No. PCT/KR2009/004002, mailed March 9, 2010 (Attorney Ref. No.: 7836-5-PCT)
14	Written Opinion for corresponding International Application No. PCT/KR2009/004002, mailed March 9, 2010 (Attorney Ref. No.: 7836-5-PCT)
15	International Preliminary Report on Patentability for corresponding International Application No. PCT/KR2009/004002, mailed February 24, 2011 (Attorney Ref. No.: 7836-5-PCT)
16	Office Action for Canadian Patent Application No. 2,720,833, mailed June 12, 2012 (Attorney Ref. No.: 7836-5-PCA)
17	Notice of Allowance for Canadian Patent Application No. 2,720,833, mailed August 8, 2013 (Attorney Ref. No.: 7836-5-PCA)
18	Office Action for Chinese Patent Application No. 200980120004.0, mailed March 5, 2013 (Attorney Ref. No.: 7836-5-PCN)
19	Office Action for Chinese Patent Application No. 200980120004.0, mailed November 21, 2013 (Attorney Ref. No.: 7836-5-PCN)
20	European Search Report for European Patent Application No. 09166620.6, mailed Nov. 27, 2009 (Attorney Ref. No.: 7836-5-PEP)
21	Office Action for European Patent Application No. 09166620.6, mailed Jan. 19, 2010 (Attorney Ref. No.: 7836-5-PEP)
22	Official Action for U.S. Patent Application No. 12/538,514, mailed June 11, 2010 (Attorney Ref. No.: 7836-5)
23	Notice of Allowance for U.S. Patent Application No. 12/538,514, mailed Sept. 20, 2010 (Attorney Ref. No.: 7836-5)
24	Notice of Allowance for U.S. Patent Application No. 12/972,366, mailed December 14, 2012 (Attorney Ref. No.: 7836-5-CON)

Examiner Signature		Date Considered	
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\*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Substitute for form 1449A/PTO				<b>Complete if Known</b>	
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				Application Number	13/801,529
				Filing Date	March 13, 2013
				First Named Inventor	Sung Jun Park
				Art Unit	2461
				Examiner Name	HALL, Teisha Danae
Sheet	1	of	1	Attorney Docket Number	7836-5-CON-2

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. <sup>1</sup>	Document Number Number-kind Code <sup>2 (if known)</sup>	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document Country Code <sup>3</sup> ; Number <sup>4</sup> ; Kind Code <sup>5 (if known)</sup>	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T <sup>6</sup>

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No. <sup>1</sup>	
	1	Office Action (including translation) for Chinese Patent Application No. 200980120004.0, mailed May 28, 2014 (Attorney Ref. No.: 7836-5-PCN)

Examiner Signature		Date Considered	
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\*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: ) Group Art Unit: 2461  
Sung Jun PARK ) Confirmation No.: 4046  
Serial No.: 13/801,529 ) Examiner: HALL, Teisha Danae  
Filed: March 13, 2013 )  
Atty. File No.: 7836-5-CON-2 )  
Entitled: "DATA TRANSMISSION METHOD )  
AND USER EQUIPMENT FOR THE SAME" )  
) SUPPLEMENTAL  
) INFORMATION DISCLOSURE  
) STATEMENT  
) Electronically Submitted

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

Dear Sir:

The references cited on attached Form PTO-1449 are being called to the attention of the Examiner.

- Copies of the cited non-patent and/or foreign references are enclosed herewith.
- Copies of the cited U.S. patents and/or patent applications are enclosed herewith.
- Copies of the cited U.S. patents/unpublished patent applications/patent application publications are not enclosed in accordance with 37 C.F.R. § 1.98(a).
- Copies of the cited references are not enclosed, in accordance with 37 C.F.R. § 1.98(d), because the references were cited by or submitted to the U.S. Patent and Trademark Office in prior application Serial No. \_\_\_\_\_ filed \_\_\_\_\_, which is relied upon for an earlier filing date under 35 U.S.C. § 120.
- To the best of applicants' belief, the pertinence of the foreign-language references are believed to be summarized in the attached English translation/abstracts and/or in the figures, although applicants do not necessarily vouch for the accuracy of the translation.
- Examiner's attention is drawn to the following related applications:
  - Serial No. \_\_\_\_\_ filed \_\_\_\_\_ (Attorney Ref. No. \_\_\_\_\_)
- Other: \_\_\_\_\_

Submission of the above information is not intended as an admission that any item is citable under the statutes or rules to support a rejection, that any item disclosed represents analogous art, or that those skilled in the art would refer to or recognize the pertinence of any reference without the benefit of hindsight, nor should an inference be drawn as to the pertinence of the references based on the order in which they are presented.

Submission of this statement should not be taken as an indication that a search has been conducted, or that no better art exists.

It is respectfully requested that the cited information be expressly considered during the prosecution of this application and the references made of record therein.

**FEES**

<input checked="" type="checkbox"/>	<p><b>37 CFR 1.97(b):</b> No fee is believed due in connection with this submission, because the information disclosure statement submitted herewith is satisfied by one of the following conditions ("X" indicates satisfaction):</p> <p><input type="checkbox"/> Within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d), or</p> <p><input type="checkbox"/> Within three months of the date of entry into the national stage of an international application as set forth in 37 CFR 1.491 or</p> <p><input checked="" type="checkbox"/> Before the mailing date of a first Office Action on the merits, or</p> <p><input type="checkbox"/> Before the mailing of a first Office action after the filing of a request for continued examination under 37 CFR 1.114.</p> <p>Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.</p>
<input type="checkbox"/>	<p><b>37 CFR 1.97(e):</b> The information disclosure statement transmitted herewith is being filed after all the above conditions (37 CFR 1.97(b)), but before the mailing date of one of the following conditions:</p> <p>(1) a final action under 37 C.F.R. 1.113 or</p> <p>(2) a notice of allowance under 37 C.F.R. 1.311, or</p> <p>(3) an action that otherwise closes prosecution in the application.</p> <p>This Information Disclosure Statement is accompanied by:</p> <p><input type="checkbox"/> A Certification (below) as specified by 37 C.F.R. 1.97(e). Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.</p> <p style="text-align: center;">OR</p> <p><input type="checkbox"/> Please charge Deposit Account 19-1970 in the amount of \$180.00 for the fee set forth in 37 C.F.R. 1.17(p) for submission of an information disclosure statement. Please credit any overpayment or charge any underpayment to Deposit Account 19-1970.</p>
<input type="checkbox"/>	<p><b>37 CFR 1.97(d):</b> This Information Disclosure Statement is being submitted after the period specified in 37 CFR 1.97(c).</p> <p><input type="checkbox"/> This information Disclosure Statement includes a Certification (below) as specified by 37 C.F.R. 1.97(e)</p> <p style="text-align: center;">AND</p> <p><input type="checkbox"/> Applicants hereby requests consideration of the reference(s) disclosed herein. Please charge Deposit Account 19-1970 in the amount of \$180.00 under 37 C.F.R. 1.17(p). Please credit any overpayment or charge any underpayment to Deposit Account 19-1970. Election to pay the fee should not be taken as an indication that applicant(s) cannot execute a certification.</p>



**Certification (37 C.F.R. 1.97(e))**  
(Applicable only if checked)

The undersigned certifies that:

- Each item of information contained in this 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 this statement. 37 C.F.R. 1.97(e)(1).
- A copy of the communication from the foreign patent office is enclosed.

OR

- No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(2).

Respectfully submitted,

SHERIDAN ROSS P.C.

By: 

Jason H. Vick  
Registration No. 45,285  
1560 Broadway, Suite 1200  
Denver, Colorado 80202-5141  
(303) 863-9700

Date: 21<sup>st</sup> 11

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	20492038
<b>Application Number:</b>	13801529
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4046
<b>Title of Invention:</b>	DATA TRANSMISSION METHOD AND USER EQUIPMENT FOR THE SAME
<b>First Named Inventor/Applicant Name:</b>	Sung Jun PARK
<b>Customer Number:</b>	62574
<b>Filer:</b>	Jason Vick/Joanne Vos
<b>Filer Authorized By:</b>	Jason Vick
<b>Attorney Docket Number:</b>	7836-5-CON-2
<b>Receipt Date:</b>	22-OCT-2014
<b>Filing Date:</b>	13-MAR-2013
<b>Time Stamp:</b>	19:16:46
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS_04.pdf	542994 9f6f3e26c8a54848b9e1a0fb13a807ef86fe25d1	yes	4

Multipart Description/PDF files in .zip description			
	Document Description	Start	End
	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Form (SB08)	4	4

**Warnings:**

**Information:**

2	Non Patent Literature	7836-5-PCN_NOA_09-4-2014.pdf	736789	no	4
			24a5018dd0103c2c7aca58861b202e9bf6e16503		

**Warnings:**

**Information:**

<b>Total Files Size (in bytes):</b>	1279783
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**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

Table with columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO., EXAMINER, ART UNIT, PAPER NUMBER, NOTIFICATION DATE, DELIVERY MODE. Includes application details for Sung Jun PARK and examiner HALL, TEISHA DANEA.

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):

jvick@sheridanross.com

### Office Action Summary

**Application No.**  
13/801,529

**Applicant(s)**  
PARK ET AL.

**Examiner**  
TEISHA D. HALL

**Art Unit**  
2461

**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 03/13/2013.  
 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) 1-9 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) 1-9 is/are rejected.
- 8)  Claim(s)        is/are objected to.
- 9)  Claim(s)        are subject to restriction and/or election requirement.

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

#### Application Papers

- 10)  The specification is objected to by the Examiner.
- 11)  The drawing(s) filed on        is/are: a)  accepted or b)  objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

#### Priority under 35 U.S.C. § 119

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

#### Certified copies:

- a)  All    b)  Some\*\*    c)  None of the:
1.  Certified copies of the priority documents have been received.
2.  Certified copies of the priority documents have been received in Application No.       .
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

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

#### Attachment(s)

- 1)  Notice of References Cited (PTO-892)
- 2)  Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)  
Paper No(s)/Mail Date       .
- 3)  Interview Summary (PTO-413)  
Paper No(s)/Mail Date       .
- 4)  Other:       .

Art Unit: 2461

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

#### DETAILED ACTION

##### *Claim Rejections - 35 USC § 103*

**Claims 1-9** are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ou et al, US Patent Number: 8,199,730.

Regarding **claim 1**, Ou et al. discloses a method of transmitting data by a user equipment through an uplink, the method comprising: receiving an uplink grant (UL Grant) signal from a base station on a random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE); determining whether there is data stored in a message 3 (Msg3) buffer (Abstract discloses, a medium access protocol data unit in the message 3 buffer) and whether the UL Grant signal was received on the random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE); and transmitting the data stored in the Msg3 buffer to the base station using the UL Grant signal received on the random access response message, if there is data stored in the Msg3 buffer and if the UL Grant signal was received on the random access response message (Column1, lines 62-67 disclose the UEs using the same Random Access Preamble in Message 1 would receive the same uplink grant in Message 2 (random access response) and use the same uplink grant to transmit Message 3).

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Regarding **claim 2**, the method according to claim 1, further comprising: transmitting new data to the base station in correspondence with the UL Grant signal, if the UL Grant signal is not received on the random access response message (Column 7, lines 5-10 disclose an uplink grant signal received on a PDCCH (not random access response message), ).

Regarding **claim 3**, the method according to claim 1, further comprising: receiving another UL Grant signal on a physical downlink control channel (PDCCH) (Column 2, lines 4-25); and transmitting new data to the base station in correspondence with the another UL Grant signal (Column 2, lines 4-25).

Regarding **claim 4**, the method according to claim 2, wherein the transmitting the new data to the base station includes: acquiring a Medium Access Control Protocol Data Unit (MAC PDU) from a multiplexing and assembly entity (It is well known in the art that MAC PDU are assembled within an entity); and transmitting the MAC PDU to the base station (Column1, lines 62-67 disclose the UEs using the same Random Access Preamble in Message 1 would receive the same uplink grant in Message 2 (random access response) and use the same uplink grant to transmit Message 3).

Regarding **claim 5**, the method according to claim 3, wherein the transmitting the new data to the base station includes: acquiring a Medium Access Control Protocol Data Unit (MAC

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PDU) from a multiplexing and assembly entity (); and transmitting the MAC PDU to the base station ().

Regarding **claim 6**, the method according to claim 3, wherein the another UL Grant signal is received on the PDCCH related to one of Cell-Radio Network Temporary Identifier (RNTI) and Temporary Cell-RNTI (Column 2, lines 4-25).

Regarding **claim 7**, the method according to claim 1, wherein the data stored in the Msg3 buffer is a Medium Access Control Protocol Data Unit (MAC PDU) including a user equipment identifier (Abstract discloses a MAC PDU in the Msg3 buffer).

Regarding **claim 8**, the method according to claim 7, wherein the data stored in the Msg3 buffer further includes information about a buffer status report (BSR) if the user equipment starts a random access procedure for the BSR (The abstract discloses a Msg3 buffer, however a buffer status report is well known in the art for the purpose of adaptive traffic flows).

Regarding **claim 9**, a user equipment comprising: a reception module adapted to receive an uplink grant (UL Grant) signal from a base station on a random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE); a transmission module adapted to



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transmit data to the base station using the UL Grant signal received on the random access response message (Column1, lines 62-67 disclose the UEs using the same Random Access Preamble in Message 1 would receive the same uplink grant in Message 2 (random access response) and use the same uplink grant to transmit Message 3); a message 3 (Msg3) buffer adapted to store UL data to be transmitted in a random access procedure (Abstract discloses, a medium access protocol data unit in the message 3 buffer); and a Hybrid Automatic Repeat Request (HARQ) entity adapted to determine whether there is data stored in the Msg3 buffer and whether the UL Grant signal was received on the random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE), acquire the data stored in the Msg3 buffer if there is data stored in the Msg3 buffer and the UL Grant signal was received on the random access response message (Abstract discloses, a medium access protocol data unit in the message 3 buffer), and control the transmission module to transmit the data stored in the Msg3 buffer to the base station using the UL Grant signal received by the reception module on the random access response message (Column1, lines 62-67 disclose the UEs using the same Random Access Preamble in Message 1 would receive the same uplink grant in Message 2 (random access response) and use the same uplink grant to transmit Message 3).

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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TEISHA D. HALL whose telephone number is (571)272-9463. The examiner can normally be reached on Monday - Friday 8:00AM-5:30PM EST alt. Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy D. Vu can be reached on 571-272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/T. D. H./

Examiner, Art Unit 2461

/HUY D VU/

Supervisory Patent Examiner, Art Unit 2461

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Sung Jun PARK	)	Group Art Unit: 2461
Application No.: 13/801,529	)	Examiner: HALL, Teisha Danae
Filed: March 13, 2013	)	Confirmation No.: 4046
Atty. File No.: 7836-5-CON-2	)	

For: DATA TRANSMISSION METHOD AND USER EQUIPMENT FOR THE SAME

**AMENDMENT AND RESPONSE**

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

Madam:

Applicants submit this Amendment and Response to address the Office Action having a mailing date of February 3, 2015. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

**Amendments to the Claims** are shown in the listing of claims which begins on page 2 of this paper.

**Remarks** begin on page 5 of this paper.

### **Amendments to the Claims:**

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

### **Listing of Claims:**

1. (Currently Amended) A method of transmitting data by a user equipment through an uplink, the method comprising:

receiving an uplink grant (UL Grant) signal from a base station on a random access response message;

determining whether there is data stored in a message 3 (Msg3) buffer and whether the UL Grant signal was received on the random access response message; and

transmitting, if there is data stored in the Msg3 buffer and if the UL Grant signal was received on the random access response message, the data stored in the Msg3 buffer to the base station using the UL Grant signal received on the random access response message;~~if there is data stored in the Msg3 buffer and if the UL Grant signal was received on the random access response message.~~

2. (Original) The method according to claim 1, further comprising:  
transmitting new data to the base station in correspondence with the UL Grant signal, if the UL Grant signal is not received on the random access response message.

3. (Original) The method according to claim 1, further comprising:  
receiving another UL Grant signal on a physical downlink control channel (PDCCH); and  
transmitting new data to the base station in correspondence with the another UL Grant signal.

4. (Original) The method according to claim 2, wherein the transmitting the new data to the base station includes:  
acquiring a Medium Access Control Protocol Data Unit (MAC PDU) from a multiplexing and assembly entity; and  
transmitting the MAC PDU to the base station.

5. (Currently Amended) The method according to claim 34 further includes performing at least an HARQ procedure ~~wherein when~~ the transmitting the new data with the MAC PDU to the base station ~~includes:~~

~~acquiring a Medium Access Control Protocol Data Unit (MAC PDU) from a multiplexing and assembly entity; and  
transmitting the MAC PDU to the base station.~~

6. (Original) The method according to claim 3,  
wherein the another UL Grant signal is received on the PDCCH related to one of Cell-Radio Network Temporary Identifier (RNTI) and Temporary Cell-RNTI.

7. (Original) The method according to claim 1, wherein the data stored in the Msg3 buffer is a Medium Access Control Protocol Data Unit (MAC PDU) including a user equipment identifier.

8. (Original) The method according to claim 7, wherein the data stored in the Msg3 buffer further includes information about a buffer status report (BSR) if the user equipment starts a random access procedure for the BSR.

9. (Original) A user equipment comprising:  
a reception module adapted to receive an uplink grant (UL Grant) signal from a base station on a random access response message;  
a transmission module adapted to transmit data to the base station using the UL Grant signal received on the random access response message;  
a message 3 (Msg3) buffer adapted to store UL data to be transmitted in a random access procedure; and  
a Hybrid Automatic Repeat Request (HARQ) entity adapted to  
determine whether there is data stored in the Msg3 buffer and whether the UL Grant signal was received on the random access response message,

acquire the data stored in the Msg3 buffer if there is data stored in the Msg3 buffer and the UL Grant signal was received on the random access response message, and control the transmission module to transmit the data stored in the Msg3 buffer to the base station using the UL Grant signal received by the reception module on the random access response message.

## REMARKS

Claims 1-9 are pending. Claims 1 and 5 are amended. No new matter has been added by these amendments. Applicants respectfully requests reconsideration of this application as amended.

Applicant would like to thank Examiner Hall for her time during the April 8, 2015 interview with Raquel Buckley and Jason Vick. During the interview, the Applicant's representatives discussed the above claim amendments, the current rejections and cited art, and other possible amendments. Examiner Hall indicated that the above amendments appear to overcome the cited references and that an additional search will be required upon Applicant's formal submission.

As such, Applicant respectfully submits the rejection in view of Ou under 35 U.S.C. §102 is moot. Withdrawal of the rejection is respectfully requested.

A Notice of Allowance is respectfully solicited.

Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is encouraged to contact Applicants undersigned representative at the telephone number listed below.

The Commissioner is hereby authorized to charge to deposit account number 19-1970 any fees under 37 CFR § 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: April 9, 2015

By: /Raquel F. Buckley/

Raquel F. Buckley  
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Date: April 9, 2015

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Table with columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO., EXAMINER, ART UNIT, PAPER NUMBER, NOTIFICATION DATE, DELIVERY MODE. Includes application details for Sung Jun PARK and examiner HALL, TEISHA DANEA.

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):

jvick@sheridanross.com

**Office Action Summary**

**Application No.**  
13/801,529

**Applicant(s)**  
PARK ET AL.

**Examiner**  
TEISHA D. HALL

**Art Unit**  
2461

**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 04/09/2015.  
 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) 1-9 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) 1-9 is/are rejected.
- 8)  Claim(s) \_\_\_\_\_ is/are objected to.
- 9)  Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

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

**Application Papers**

- 10)  The specification is objected to by the Examiner.
- 11)  The drawing(s) filed on \_\_\_\_\_ is/are: a)  accepted or b)  objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

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

**Certified copies:**

- a)  All    b)  Some\*\*    c)  None of the:
1.  Certified copies of the priority documents have been received.
2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

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

**Attachment(s)**

- 1)  Notice of References Cited (PTO-892)
- 2)  Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)  
Paper No(s)/Mail Date \_\_\_\_\_
- 3)  Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4)  Other: \_\_\_\_\_

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

### DETAILED ACTION

#### *Claim Rejections - 35 USC § 112*

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**Claims 1-9** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Claim 1 recites the limitation “if there is data stored in the Msg3 buffer and if the UL Grant signal was received on the random access response.” The limitation is directed to the action to transmit the UL Grant, however, there is no language to limit the claim to only this scenario or the claim language does not provide an alternative for what if the statement is not true. The Applicant's invention is not being claimed in independent claims 1 and 9. Please amend the claims to further specify the Applicant's invention (See Figure 10 of the Specification).

**Claims 2 and 3** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject

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matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Claims 2 and 3 recite the limitation "with the UL Grant signal, if the UL Grant Signal is not received on the random access response." The UL Grant recited in claim 1 from which claims 2 and 3 receive antecedent basis specifically states that the UL Grant is received on a random access response message. The statement in claims 2 and 3 is contradictory of claim 1. Please provide correction to claim language to correct this matter.

***Claim Rejections - 35 USC § 103***

**Claims 1 and 9** are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over **Ou et al, US Patent Number: 8,199,730**.

Regarding **claim 1**, Ou et al. discloses a method of transmitting data by a user equipment through an uplink, the method comprising: receiving an uplink grant (UL Grant) signal from a base station on a random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE); determining whether there is data stored in a message 3 (Msg3) buffer (Abstract discloses, a medium access protocol data unit in the message 3 buffer) and whether the UL Grant signal was received on the random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE); and transmitting the data stored in the Msg3 buffer to the base station using the UL Grant signal received on the random access response message,

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if there is data stored in the Msg3 buffer and if the UL Grant signal was received on the random access response message (Column1, lines 62-67 disclose the UEs using the same Random Access Preamble in Message 1 would receive the same uplink grant in Message 2 (random access response) and use the same uplink grant to transmit Message 3).

Regarding **claim 9**, a user equipment comprising: a reception module adapted to receive an uplink grant (UL Grant) signal from a base station on a random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE); a transmission module adapted to transmit data to the base station using the UL Grant signal received on the random access response message (Column1, lines 62-67 disclose the UEs using the same Random Access Preamble in Message 1 would receive the same uplink grant in Message 2 (random access response) and use the same uplink grant to transmit Message 3); a message 3 (Msg3) buffer adapted to store UL data to be transmitted in a random access procedure (Abstract discloses, a medium access protocol data unit in the message 3 buffer); and a Hybrid Automatic Repeat Request (HARQ) entity adapted to determine whether there is data stored in the Msg3 buffer and whether the UL Grant signal was received on the random access response message (Column 1, lines 58-62 discloses Message 2, also called a Random Access Response Message carrying an uplink grant is transmitted to network UE), acquire the data stored in the Msg3 buffer if there is data stored in the Msg3 buffer and the UL Grant signal was received on the random access response message (Abstract discloses, a medium access protocol data unit in

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the message 3 buffer), and control the transmission module to transmit the data stored in the Msg3 buffer to the base station using the UL Grant signal received by the reception module on the random access response message (Column1, lines 62-67 disclose the UEs using the same Random Access Preamble in Message 1 would receive the same uplink grant in Message 2 (random access response) and use the same uplink grant to transmit Message 3).

### ***Response to Arguments***

Applicant's arguments filed 04/09/2015 have been fully considered but they are not persuasive. The Applicant argues that the Examiner's rejection does not apply to the claimed invention. The Examiner disagrees, the message 3 buffer disclosed by the claimed invention is not new and the disclosure states that the message 3 buffer is simply a transmit buffer. It is obvious to one of ordinary skill in the art that the grounds for rejection under *Ou et al.* still applies. *Ou et al.* does disclose a message 3 within the provisional. The rejection has been maintained.

### ***Conclusion***

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

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of

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the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TEISHA D. HALL whose telephone number is (571)272-9463. The examiner can normally be reached on Monday - Friday 8:00AM-5:30PM EST alt. Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy D. Vu can be reached on 571-272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/T. D. H./

Examiner, Art Unit 2461

/HUY D VU/

Supervisory Patent Examiner, Art Unit 2461



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Sung Jun PARK        )  
Application No.: 13/801,529                    )  
Filed: March 13, 2013                         )  
Atty. File No.: 7836-5-CON-2                 )

Group Art Unit: 2461  
Examiner: HALL, Teisha Danae  
Confirmation No.: 4046

For: DATA TRANSMISSION METHOD AND USER EQUIPMENT FOR THE SAME

AMENDMENT AFTER FINAL

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

Madam:

Applicants submit this Amendment After Final to address the Final Office Action having a mailing date of October 16, 2015. Please credit any overpayment or charge any underpayment to Deposit Account No. 19-1970.

Please amend the above-identified patent application as follows:

**Amendments to the Claims** are shown in the listing of claims which begins on page 2 of this paper.

**Remarks** begin on page 8 of this paper.

**Amendments to the Claims:**

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

**Listing of Claims:**

1. (Currently Amended) A method of transmitting data by a user equipment through an uplink, the method comprising:

receiving an uplink grant (UL Grant) ~~signal~~ from a base station ~~on a random access response message;~~

determining whether there is data stored in a message 3 (Msg3) buffer and whether the UL Grant ~~signal~~ was received on ~~the~~ random access response message; and

transmitting, ~~if only when~~ there is data stored in the Msg3 buffer and ~~if when~~ the UL Grant ~~signal~~ was received on the random access response message, the data stored in the Msg3 buffer to the base station using the UL Grant ~~signal~~ received on the random access response message.

2. (Currently Amended) The method according to claim 1, further comprising: transmitting new data to the base station in correspondence with the UL Grant ~~signal~~, ~~if when~~ the UL Grant ~~signal~~ is not received on the random access response message.

3. (Currently Amended) The method according to claim 1, further comprising: receiving another UL Grant ~~signal~~ on a physical downlink control channel (PDCCH); and transmitting new data to the base station in correspondence with the another UL Grant ~~signal~~.

4. (Original) The method according to claim 2, wherein the transmitting the new data to the base station includes:

acquiring a Medium Access Control Protocol Data Unit (MAC PDU) from a multiplexing and assembly entity; and

transmitting the MAC PDU to the base station.

5. (Currently Amended) The method according to claim 4, further ~~includes comprising~~ performing at least an HARQ procedure when ~~the~~ transmitting the new data with the MAC PDU to the base station.

6. (Currently Amended) The method according to claim 3, wherein the another UL Grant ~~signal~~ is received on the PDCCH related to one of Cell-Radio Network Temporary Identifier (RNTI) and Temporary Cell-RNTI.

7. (Original) The method according to claim 1, wherein the data stored in the Msg3 buffer is a Medium Access Control Protocol Data Unit (MAC PDU) including a user equipment identifier.

8. (Currently Amended) The method according to claim 7, wherein the data stored in the Msg3 buffer further includes information about a buffer status report (BSR) ~~if~~when the user equipment starts a random access procedure for the BSR.

9. (Currently Amended) A user equipment comprising:  
a reception module ~~associated with a physical layer adapted to that receive~~receives over a physical channel an uplink grant (UL Grant)-~~signal from a base station on a random access response message;~~  
a transmission module ~~also associated with the physical layer adapted to that transmit~~transmits data to the base station using the UL Grant-~~signal received on the random access response message;~~  
a message 3 (Msg3) buffer ~~adapted to store~~that stores UL data to be transmitted in a random access procedure; and  
a Hybrid Automatic Repeat Request (HARQ) entity ~~adapted to that:~~  
~~determine~~determines whether there is data stored in the Msg3 buffer and whether the UL Grant ~~signal~~ was received on the random access response message, and only when there is data stored in the Msg3 buffer and the UL Grant was received on the random access response message;

~~acquire~~acquires the data stored in the Msg3 buffer if ~~there is data stored in the Msg3 buffer and the UL Grant signal was received on the random access response message,~~  
and

~~control~~controls the transmission module to transmit the data stored in the Msg3 buffer to the base station using the UL Grant ~~signal~~received by the reception module on the random access response message.

10. (New) The method of claim 1, wherein the uplink grant (UL Grant) is received over a physical channel.

11. (New) The method of claim 10, wherein a physical layer is connected to the physical channel and the physical layer is connected to a Medium Access Control (MAC) layer.

12. (New) The method of claim 1, wherein the UL Grant indicates information about uplink radio resources.

13. (New) The method of claim 1, wherein the user equipment includes the following connected elements: a HARQ entity, a buffer and a multiplexing assembly entity.

14. (New) The method of claim 1, wherein the uplink grant is a signal.

15. (New) The method of claim 1, wherein the uplink grant is information.

16. (New) A system for transmitting data by a user equipment through an uplink comprising:

means for receiving an uplink grant (UL Grant) from a base station;

means for determining whether there is data stored in a message 3 (Msg3) buffer and whether the UL Grant was received on a random access response message; and

means for transmitting, only when there is data stored in the Msg3 buffer and when the UL Grant was received on the random access response message, the data stored in the Msg3 buffer to the base station using the UL Grant received on the random access response message.

17. (New) The system according to claim 16, further comprising:  
means for transmitting new data to the base station in correspondence with the UL Grant,  
when the UL Grant is not received on the random access response message.

18. (New) The system according to claim 16, further comprising:  
means for receiving another UL Grant on a physical downlink control channel (PDCCH);  
and  
means for transmitting new data to the base station in correspondence with the another  
UL Grant.

19. (New) The system according to claim 17, wherein the means for transmitting the  
new data to the base station includes:

means for acquiring a Medium Access Control Protocol Data Unit (MAC PDU) from a  
multiplexing and assembly entity; and

means for transmitting the MAC PDU to the base station.

20. (New) The system according to claim 19, further including means for performing  
at least an HARQ procedure when transmitting the new data with the MAC PDU to the base  
station.

21. (New) The system according to claim 18, wherein the another UL Grant is  
received on the PDCCH related to one of Cell-Radio Network Temporary Identifier (RNTI) and  
Temporary Cell-RNTI.

22. (New) The system according to claim 16, wherein the data stored in the Msg3  
buffer is a Medium Access Control Protocol Data Unit (MAC PDU) including a user equipment  
identifier.

23. (New) The system according to claim 22, wherein the data stored in the Msg3 buffer further includes information about a buffer status report (BSR) when the user equipment starts a random access procedure for the BSR.

24. (New) A user equipment comprising:  
means for receiving over a physical channel an uplink grant (UL Grant) from a base station;  
means for transmitting data to the base station using the UL Grant;  
means for storing UL data to be transmitted in a random access procedure; and  
means for determining whether there is data stored in the means for storing and whether the UL Grant was received on the random access response message, and only when there is data stored in the means for storing and the UL Grant was received on the random access response message:

means for acquiring the data stored in the means for storing, and  
means for transmitting the data stored in the means for storing to the base station using the UL Grant received on the random access response message.

25. (New) A mobile LTE communications system comprising:  
a reception module associated with a physical layer that receives over a physical channel an uplink grant (UL Grant) from a base station;  
a transmission module also associated with the physical layer that transmits data to the base station using the UL Grant;  
a message 3 (Msg3) buffer that stores UL data to be transmitted in a random access procedure; and  
a Hybrid Automatic Repeat Request (HARQ) entity that:  
determines whether there is data stored in the Msg3 buffer and whether the UL Grant was received on the random access response message, and only when there is data stored in the Msg3 buffer and the UL Grant was received on the random access response message:

acquires the data stored in the Msg3 buffer, and