PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6105570

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
GOLDPEAK INNOVATIONS INC	05/07/2020

RECEIVING PARTY DATA

Name:	PANTECH CORPORATION
Street Address:	8 YANGJAECHEONRO-21GIL, SUITE 402, SEOCHO-GU,
City:	SEOUL
State/Country:	KOREA, REPUBLIC OF
Postal Code:	06748

PROPERTY NUMBERS Total: 234

Property Type	Number
Patent Number:	10014988
Patent Number:	9548839
Patent Number:	9048991
Patent Number:	8631297
Patent Number:	8631298
Patent Number:	8681599
Patent Number:	7894330
Patent Number:	9750054
Patent Number:	9288824
Patent Number:	10057925
Patent Number:	8611297
Patent Number:	8102804
Patent Number:	8380227
Patent Number:	8583147
Patent Number:	9357486
Patent Number:	8606303
Patent Number:	7505776
Patent Number:	7505775
Patent Number:	7853852
Patent Number:	7725796

Property Type	Number
Patent Number:	9838194
Patent Number:	9270365
Patent Number:	8873519
Patent Number:	9713095
Patent Number:	10045304
Patent Number:	9313743
Patent Number:	10609650
Patent Number:	9680590
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Patent Number:	8787216
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Patent Number:	8837452
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Patent Number:	10567140
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Application Number:	15997919
Application Number:	16394702
Application Number:	16392323
Application Number:	15820980
Application Number:	16418708
Application Number:	16272473
Application Number:	16387174
Application Number:	15911518
Application Number:	16203319
Application Number:	16275039
Application Number:	16288278

Property Type	Number
Application Number:	14061316
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Application Number:	16685738
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Application Number:	16405803
Application Number:	16290914
Application Number:	12958749
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Application Number:	16733106
Application Number:	16819625
Application Number:	16813676
Application Number:	16823170
Application Number:	16806830
Application Number:	16730711
Application Number:	16711269
Application Number:	16806665
Application Number:	16826054
Application Number:	16037067
Application Number:	16184560
Application Number:	16694830

CORRESPONDENCE DATA

Fax Number: (703)643-9789

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

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Correspondent Name: YEASUN YOON
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Address Line 4: ASHBURN, VIRGINIA 20147

ATTORNEY DOCKET NUMBER:	PA01GOLDPEAKTOPANTECHCORP
NAME OF SUBMITTER:	YEASUN YOON
SIGNATURE:	/yoon/
DATE SIGNED:	05/13/2020
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 17
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CONFIRMATORY ASSIGNMENT OF PATENT RIGHTS

This CONFIRMATORY ASSIGNMENT OF PATENT RIGHTS (this "**Assignment**") is made this ____ day of April 2020, by **GoldPeak Innovations Inc,** a Korean company ("**Assignor**"), in favor of **Pantech Corporation.**, a Korean company ("**Assignee**").

WHEREAS, Assignor and Assignee are party to that certain Patent Sale and Purchase Agreement of even date herewith (as in effect from time to time, the "**Patent Sale and Purchase Agreement**"); capitalized terms used but not otherwise defined in this Assignment shall have the respective meaning assigned thereto in the Patent Sale and Purchase Agreement; and

WHEREAS, pursuant to the Patent Sale and Purchase Agreement, Assignor has agreed to sell, convey, transfer, assign and deliver to Assignee all right, title and interest, including, without limitation, Patent Rights, in and to the patents, provisional patent applications, and patent applications listed on listed on Schedule A hereto (collectively, the "**Patents**").

NOW, THEREFORE, for good and valuable consideration, receipt of which is hereby acknowledged by Assignor, Assignor hereby sells, conveys, transfers, and assigns to Assignee, its successors, legal representatives and assigns all right, title and interest in the United States and throughout the world in and to:

The Patents and any and all letters patent that are or may be granted thereon, and any legal equivalent and counterpart thereof that may be granted in any country or countries foreign to the United States, in each case including without limitation any extensions, substitutes, continuations, continuations-in-part, divisions, reissues, reexaminations, and renewals thereof, or other equivalents thereof, and further, all rights and privileges pertaining to the Patents and any and all letters patent that are or may be granted thereon, and any legal equivalent thereof that may be granted in any country or countries foreign to the United States as well as all inventions, invention disclosures, and discoveries described in any of the foregoing and including, without limitation, the right, if any, to petition, sue or otherwise seek and recover damages, profits and any other remedy (monetary, injunctive, declaratory or other relief or remedy of any kind) in the United States and anywhere throughout the world for any past, present and future infringement thereof, conversion or misappropriation of, or other injury, offense, violation, breach of duty or wrong relating to, any of the Patents, or any license, agreement, contract or other matter relating thereto.

Assignor hereby authorizes and requests the Commissioner of Patents and Trademarks of the United States of America and the appropriate officers of all other jurisdictions in which the Patents are or may be registered or in which applications included among the Patents are pending, to record the title of Assignee, its successors, legal representatives and assigns, as owner of all right, title and interest in and to the Patents, and to issue to Assignee, its successors, legal representatives and assigns, all letters patent and any legal equivalent thereof that may be granted in any country or countries foreign to the United States and recordations of patent rights resulting from any application included among the Patents, according to this instrument.

Except to the extent that federal law preempts state law with respect to the matters covered hereby, this Assignment shall be governed by and construed in accordance with the laws of the State of Delaware, without giving effect to any of the principles of conflicts of laws thereof that would result in the application of the laws of another jurisdiction to this Assignment.

This Assignment will inure to the benefit of Assignee, its successors, assigns, and other legal representatives and will be binding upon Assignor, its successors, assigns, and other legal representatives.

Assignor has the full power and authority, and has obtained all Third Party consents, approvals and/or other authorizations required to enter into this Assignment and to carry out its obligations hereunder.

If Assignee is unable for any reason to secure Assignor's or its affiliates or their respective successors' or assigns' signature to any document it is entitled to under this Assignment, Assignor and its affiliates hereby irrevocably designate and appoint Assignee, and Assignee's duly authorized officers, agents and representatives, as its agents and attorneys-in-fact, coupled with an interest, with full power of substitution to act for and on the behalf and instead of Assignor, to execute and file any such document or documents and to do all other lawfully permitted acts to further the purposes of this Assignment with the same legal force and effect as if executed by Assignor.

IN WITNESS WHEREOF, Assignor has caused this Assignment to be executed by its duly authorized officer, as of the date first written above.

ASSIGNOR:

GoldPeak Innovations Inc.

By: Saekyung Park

Name: Saekyung Park

Title: CEO

Schedule A

Family	Country	Application #	Application Date	Issued #	Issued Date
1	U.S.A.	2017-406403	1/13/2017	10014988	7/3/2018
	U.S.A.	15/997,919	6/5/2018	Pending	
	U.S.A.	2015-726014	5/29/2015	9548839	1/17/2017
	U.S.A.	2014-184345	2/19/2014	9048991	6/2/2015
	U.S.A.	2013-750669	1/25/2013	8631297	1/14/2014
	U.S.A.	2012-750953	1/25/2013	8631298	1/14/2014
	U.S.A.	2011-012702	1/24/2011	8681599	3/25/2014
	U.S.A.	2009-388243	2/18/2009	7894330	2/22/2011
	TAIWAN	98105169	2/18/2009	I422201	1/1/2014
	SWEDEN	13170420.7	6/4/2013	2637348	6/24/2015
	NETHERLAND	13170420.7	2/18/2009	2637348	6/24/2015
	JAPAN	2016-215172	11/2/2016	6401224	9/14/2018
	JAPAN	2015-020714	2/4/2015	6038974	11/11/2016
	JAPAN	2013-221358	10/24/2013	5694479	2/13/2015
	JAPAN	2012-037585	2/23/2012	5400186	11/1/2013
	JAPAN	2009-554464	2/13/2009	4982653	5/11/2012
	ITALY	09 153 111.1	2/18/2009	2093924	8/14/2013
	U.K.	13170420.7	2/18/2009	2637348	6/24/2015
	E.P.O	09 153 111.1	2/18/2009	2093924	8/14/2013
	U.K.	09 153 111.1	2/18/2009	2093924	8/14/2013
	FRANCE	13170420.7	2/18/2009	2637348	6/24/2015
	FRANCE	09 153 111.1	2/18/2009	2093924	8/14/2013
	E.P.O	13170420.7	2/18/2009	2637348	6/24/2015
	FINLAND	13170420.7	6/4/2013	2637348	6/24/2015
	E.P.O	15166204.6	5/4/2015	2922233	11/22/2017
	GERMANY	15166204.6	11/13/2017	2922233	11/22/2017
	U.K.	15166204.6	11/13/2017	2922233	11/22/2017
	FRANCE	15166204.6	11/13/2017	2922233	11/22/2017
	GERMANY	09 153 111.1	2/18/2009	2093924	8/14/2013
	GERMANY	13170420.7	2/18/2009	2637348	6/24/2015
	CHINA	201310194226.5	5/23/2013	103354491	8/24/2016
	CHINA	200980000075.7	2/13/2009	101682489	7/24/2013
	CANADA	2715941	2/13/2009	2715941	4/11/2017
	AUSTRALIA	2009332929	2/13/2009	2009332929	11/14/2013
	KR	1020080124084	12/8/2008	925439	10/30/2009
2	U.S.A.	2016-069340	3/14/2016	9750054	8/29/2017

	U.S.A.	2013-960448	8/6/2013	9288824	3/15/2016
	U.S.A.	15/690,042	8/29/2017	10057925	8/21/2018
	U.S.A.	13/340447	12/29/2011	8611297	12/17/2013
	U.S.A.	2008-347352	12/31/2008	8102804	1/24/2012
	E.P.O	08866014	12/31/2008	2227923	7/29/2015
	SWEDEN	08866014	7/1/2010	2227923	7/29/2015
	NETHERLAND	08866014	7/1/2010	2227923	7/29/2015
	U.K.	08866014	7/1/2010	2227923	7/29/2015
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	FINLAND	08866014	7/1/2010	2227923	7/29/2015
	GERMANY	08866014	7/1/2010	2227923	7/29/2015
	CHINA	201410265062.5	6/13/2014	103997794	1/15/2019
	CHINA	200880127735	8/31/2010	101960906	4/20/2016
	KR	1020150011228	1/23/2015	1540418	7/23/2015
	KR	1020080047656	5/22/2008	1519345	5/6/2015
3	U.S.A.	12/398084	3/4/2009	8380227	2/19/2013
	U.S.A.	12/398072	3/4/2009	8583147	11/12/2013
	U.S.A.	2013-091916	11/27/2013	9357486	5/31/2016
	U.S.A.	12/371526	2/13/2009	8606303	12/10/2013
	U.S.A.	11/691410	3/26/2007	7505776	3/17/2009
	U.S.A.	11/165744	6/24/2005	7505775	3/17/2009
	TURKEY	05756764.6	1/12/2007	1767036	10/31/2012
	SLOVENIA	05756764.6	1/12/2007	1767036	10/31/2012
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	PORTUGAL	05756764.6	1/12/2007	1767036	10/31/2012
	POLAND	05756764.6	1/12/2007	1767036	10/31/2012
	NETHERLAND	05756764.6	1/12/2007	1767036	10/31/2012
	MEXICO	PA/a/2006/014980	12/19/2006	263607	1/8/2009
	MONACO	05756764.6	1/12/2007	1767036	10/31/2012
	Luxembourg	05756764.6	1/12/2007	1767036	10/31/2012
	LITHUANIA	05756764.6	1/12/2007	1767036	10/31/2012
	JAPAN	2007-517968	12/20/2006	4654241	12/24/2010
	ITALY	05756764.6	1/12/2007	1767036	10/31/2012
	INDIA	0713/DELNP/2007	1/25/2007	296968	5/22/2018
	ISRAEL	180227	12/21/2006	180227	12/28/2011
	ICELAND	05756764.6	6/25/2005	1767036	10/31/2012
	IRELAND	05756764.6	1/12/2007	1767036	10/31/2012
	HUNGARY	05756764.6	1/12/2007	1767036	10/31/2012
	GREECE	05756764.6	1/12/2007	1767036	10/31/2012

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	E.P.O	12189742	10/24/2012	2552164	9/5/2018
	GERMANY	12189742.5	8/28/2018	2552164	9/5/2018
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	DENMARK	05756764.6	1/12/2007	1767036	10/31/2012
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	CZ	05756764.6	1/12/2007	1767036	10/31/2012
	CYPRUS	05756764.6	1/12/2007	CY20131100062 - EP1767036	10/31/2012
	CHINA	200910224551.5	11/17/2009	ZL200910224551.5	12/7/2016
	CHINA	200580020940.6	12/25/2006	ZL 2005 8 0020940.6	3/24/2010
	CANADA	2569425	12/1/2006	2569425	6/3/2014
	BULGARIA	05756764.6	1/12/2007	1767036	10/31/2012
	Belgium	05756764.6	1/12/2007	1767036	10/31/2012
	AUSTRALIA	2005257642	11/24/2006	2005257642	11/12/2009
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	KR	1020050019211	3/8/2005	875419	12/16/2008
	KR	1020090013393	2/18/2009	935294	12/24/2009
	KR	1020040077649	9/25/2004	908260	7/10/2009
4	U.S.A.	12/684847	1/8/2010	7853852	12/14/2010
	U.S.A.	11/320374	12/27/2005	7725796	5/25/2010
	TAIWAN	94146828	12/27/2005	I416897	11/21/2013
	MEXICO	MX/a/2007/007796	6/25/2007	270303	9/23/2009
	JAPAN	2013-236045	11/14/2013	5619262	9/26/2014
	JAPAN	2012-142491	6/25/2012	5554375	6/6/2014
	JAPAN	2007-548094	6/26/2007	5055132	8/3/2012
	ISRAEL	183915	6/14/2007	183915	9/1/2011
	E.P.O	05 818 969.7	7/2/2007	1832024	6/6/2018
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	CHINA	200580044699.0	6/25/2007	ZL200580044699.0	10/9/2012

	AUSTRALIA	2005326877	6/13/2007	2005326877	2/4/2010
	KR	1020040112929	12/27/2004	1079095	10/27/2011
	KR	1020040112926	12/27/2004	1080964	11/1/2011
5	U.S.A.	2016-014792	2/3/2016	9838194	12/5/2017
	U.S.A.	16/394,702	4/25/2019	Pending	
	U.S.A.	2014-513449	10/14/2014	9270365	2/23/2016
	U.S.A.	2012-715278	12/14/2012	8873519	10/28/2014
	JAPAN	2014-547111	6/12/2015	6212048	9/22/2017
	E.P.O	12857526.3	7/15/2014	2792093	7/11/2018
	GERMANY	12857526.3	5/30/2018	2792093	7/11/2018
	FRANCE	12857526.3	5/30/2018	2792093	7/11/2018
	U.K.	12857526.3	5/30/2018	2792093	7/11/2018
	CHINA	2012-80067029	12/14/2012	ZL201280067029.0	9/1/2017
	KR	1020200034567		Pending	
6	U.S.A.	2016-077466	3/22/2016	9713095	7/18/2017
	U.S.A.	15/653,355	7/18/2017	10045304	08/07/2018
	U.S.A.	2014-357557	5/9/2014	9313743	4/12/2016
	U.S.A.	16/293,321	5/5/2019	10609650	3/31/2020
	JAPAN	2014-540937	6/19/2014	5763845	6/19/2015
	E.P.O	12850075	6/4/2014	2782405	8/22/2018
	GERMANY	12850075	6/4/2014	2782405	8/22/2018
	FRANCE	12850075	6/4/2014	2782405	8/22/2018
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	CHINA	201280056210.1	5/15/2014	ZL201280056210.1	5/15/2018
	KR	1020110119154	11/15/2011	10-1867314	6/7/2018
8	U.S.A.	2016-222068	7/28/2016	9680590	6/13/2017
	U.S.A.	2014-147295	1/3/2014	9419739	8/16/2016
	U.S.A.	2011-332089	12/20/2011	8649346	2/11/2014
	JAPAN	2014-134625	6/30/2014	6025783	10/21/2016
	JAPAN	2013-546010	6/14/2013	5575993	7/11/2014
	E.P.O	11850274.9	7/1/2013	Pending	
	CHINA	201180062059	6/21/2013	103270710	3/9/2016
	KR	1020100131864	12/21/2010	10-1867311	6/7/2018
9	U.S.A.	2016-335679	10/27/2016	9860046	1/2/2018
	U.S.A.	16/392,323	4/23/2019	Pending	
	U.S.A.	2016-992186	1/11/2016	9485072	11/1/2016
	U.S.A.	13/877,827	4/4/2013	9237566	1/12/2016
	JAPAN	2013-533775	5/31/2013	5766294	6/26/2015
	E.P.O	11832776.6	4/4/2013	Pending	
	CHINA	201610452850.4	6/21/2016	106059719	6/14/2019

	CHINA	201180049399	4/12/2013	103181109	8/3/2016
	KR	1020100100988	10/15/2010	10-1771550	8/21/2017
10	U.S.A.	14/056,474	10/17/2013	9008046	4/14/2015
	U.S.A.	2011-181456	7/12/2011	8588185	7/19/2013
	E.P.O	11807024.2	12/11/2012	Pending	
	KR	1020100068157	7/14/2010	10-1699023	1/17/2017
11	U.S.A.	2011-098056	4/29/2011	8780860	7/15/2014
12	U.S.A.	2015-733068	6/8/2015	9854545	12/26/2017
	U.S.A.	15/820,980	11/22/2017	Pending	
	U.S.A.	2012-578531	8/10/2012	9054835	6/9/2015
	JAPAN	2015-154385	8/4/2015	6175466	7/14/2017
	E.P.O	11742487.9	9/5/2012	2536227	5/8/2019
	GERMANY	11742487.9	9/5/2012	2536227	5/8/2019
	U.K.	11742487.9	9/5/2012	2536227	5/8/2019
	FRANCE	11742487.9	9/5/2012	2536227	5/8/2019
	SWITZERLAND	11742487.9	9/5/2012	2536227	5/8/2019
	IRELAND	11742487.9	9/5/2012	2536227	5/8/2019
	Luxembourg	11742487.9	9/5/2012	2536227	5/8/2019
	Monaco	11742487.9	9/5/2012	2536227	5/8/2019
	CHINA	201610908740.4	10/18/2016	Pending	
	CHINA	201180014458.7	9/18/2012	ZL201180014458.7	11/16/2016
	KR	1020110008683	1/28/2011	10-1803015	11/23/2017
14	U.S.A.	15/206,508	7/11/2016	10299251	5/21/2019
	U.S.A.	16/418,708	5/28/2019	Pending	
	U.S.A.	13/875,808	5/2/2013	9392582	7/12/2016
	U.S.A.	13/875,869	5/2/2013	9131482	9/8/2015
	U.S.A.	2013-965837	8/13/2013	9265034	2/16/2016
	U.S.A.	2010-916203	10/29/2010	8538411	9/17/2013
	JAPAN	2014-080506	4/9/2014	5788051	8/7/2015
	JAPAN	2012-536694	4/23/2012	5525055	4/18/2014
	E.P.O	10827139.6	5/23/2012	Pending	
	KR	1020170127789	9/29/2017	10-1828917	2/7/2018
	KR	1020100088151	9/8/2010	10-1785997	10/10/2017
15	U.S.A.	2015-703360	5/4/2015	9787514	10/10/2017
	U.S.A.	16/272,473	2/11/2019	Pending	
	U.S.A.	15/729,604	10/10/2017	10237104	3/19/2019
	U.S.A.	2013-891522	5/10/2013	9025485	5/5/2015
	JAPAN	2015-511380	11/10/2014	6200944	9/1/2017
	E.P.O	13787400.4	12/3/2014	2850757	10/17/2017
	GERMANY	13787400.4	12/3/2014	2850757	10/17/2017

	FRANCE	13787400.4	12/3/2014	2850757	10/17/2017
	U.K.	13787400.4	12/3/2014	2850757	10/17/2017
	CHINA	201380036116.4	1/6/2015	ZL201380036116.4	11/3/2017
	KR	1020120050406	5/11/2012	Pending	
16	U.S.A.	2016-180153	6/13/2016	9742542	8/22/2017
	U.S.A.	2015-801116	7/16/2015	9369251	6/14/2016
	U.S.A.	16/387,174	4/17/2019	Pending	
	U.S.A.	2014-547112	11/18/2014	9088396	7/21/2015
	U.S.A.	2011-816182	2/8/2013	8897182	11/25/2014
	JAPAN	2016-115490	6/9/2016	6185116	8/4/2017
	JAPAN	2015-053011	3/17/2015	5952449	6/17/2016
	JAPAN	2013-524046	2/8/2013	5718464	3/27/2015
	GERMANY	11816634.7	3/11/2013	2605433	2/27/2019
	FRANCE	11816634.7	3/11/2013	2605433	2/27/2019
	SWITZERLAND	11816634.7	3/11/2013	2605433	2/27/2019
	Luxembourg	11816634.7	3/11/2013	2605433	2/27/2019
	MONACO	11816634.7	3/11/2013	2605433	2/27/2019
	IRELAND	11816634.7	3/11/2013	2605433	2/27/2019
	Belgium	11816634.7	3/11/2013	2605433	2/27/2019
	U.K.	11816634.7	3/11/2013	2605433	2/27/2019
	E.P.O	11816634.7	3/11/2013	2605433	2/27/2019
	CHINA	201610412657.8	8/11/2011	ZL201610412657.8	9/24/2019
	CHINA	201180049114.X	4/11/2013	103155456	6/29/2016
	KR	1020100098006	10/7/2010	1719542	3/20/2017
	KR	1020170033713	3/17/2017	1810962	12/24/2017
	KR	1020100098005	10/7/2010	1790502	
17	U.S.A.	2012-807706	12/28/2012	9136924	9/15/2015
	JAPAN	2013-518260	1/4/2013	6293482	2/23/2018
	E.P.O	11803762	2/1/2013	2592763	5/23/2018
	GERMANY	11803762	2/1/2013	2592763	5/23/2018
	FRANCE	11803762	2/1/2013	2592763	5/23/2018
	U.K.	11803762	2/1/2013	2592763	5/23/2018
	CHINA	201180037814.7	1/31/2013	ZL201180037814.7	11/17/2017
	KR	1020160171540	12/15/2016	10-1771549	8/21/2017
18	U.S.A.	2016-151296	5/10/2016	9948440	4/17/2018
	U.S.A.	2014-299679	6/9/2014	9344245	5/17/2016
	U.S.A.	15/911,518	3/5/2018	Pending	
	U.S.A.	2011-149225	5/31/2011	8787216	7/22/2014
	JAPAN	2013-513109	11/27/2012	5931056	5/13/2016
	E.P.O	11790009	12/5/2012	Pending	

	CHINA	201610951696.5	11/2/2016	Pending	
	CHINA	201180037855.6	1/31/2013	ZL201180037855.6	11/30/2016
	KR	1020100055073	6/10/2010	10-1790505	10/20/2017
19	U.S.A.	2016-192233	6/24/2016	9893866	2/13/2018
	U.S.A.	2014-464041	8/20/2014	9380581	6/28/2016
	U.S.A.	2013-043005	10/1/2013	8837452	9/16/2014
	U.S.A.	2011-008685	1/18/2011	8576822	11/5/2013
	JAPAN	2012-548900	7/11/2012	5855016	12/18/2015
	E.P.O	11733132	8/17/2012	Pending	
	U.S.A.	16/285,957	2/26/2019	10567140	2/18/2020
	U.S.A.	15/858,921	12/29/2017	10218485	2/26/2019
	CHINA	201180014290.X	9/17/2012	102804625	11/13/2018
	KR	1020100004219	1/18/2010	1740221	
20	U.S.A.	2009-505707	5/2/2012	8811518	8/19/2014
	KR	1020127011219	4/30/2012	1627393	5/30/2016
21	U.S.A.	2016-131725	4/18/2016	9825686	11/21/2017
	U.S.A.	2009-500288	4/4/2012	9319252	4/19/2016
	U.S.A.	16/203,319	11/28/2018	Pending	
	U.S.A.	15/814,605	11/16/2017	10153821	12/11/2018
	KR	1020127008173	3/29/2012	1621376	5/10/2016
22	U.S.A.	2015-279139	9/28/2016	10057940	8/21/2018
	U.S.A.	2015-801280	7/16/2015	9474025	10/18/2016
	U.S.A.	2013-847319	3/19/2013	9088992	7/21/2015
	KR	1020120027938	3/19/2012	10-1868865	6/12/2018
23	U.S.A.	2016-183158	6/15/2016	9730265	8/8/2017
	U.S.A.	16/275,039	2/13/2019	Pending	
	U.S.A.	2014-560838	12/4/2014	9374213	6/21/2016
	U.S.A.	2012-651034	10/12/2012	8917619	12/23/2014
	KR	1020110110798	10/27/2011	10-1841693	3/19/2018
24	U.S.A.	2016-341296	11/2/2016	9955376	4/24/2018
	U.S.A.	16/288,278	2/28/2019	Pending	
	U.S.A.	2015-937348	11/10/2015	9516538	12/6/2016
	U.S.A.	2013-984476	8/8/2013	9191833	11/17/2015
	E.P.O	12744486.3	8/9/2013	Notice of Allowance at 1/7/2020 (Issue fee due 5/7/2020)	
	CHINA	201610397886.7	6/7/2016	106060866B	1/7/2020
	CHINA	201280014327	9/22/2013	103444100	6/29/2016
	KR	1020170130604	10/11/2017	1860863	5/17/2018
27	U.S.A.	2014-191178	2/26/2014	9124688	9/1/2015
	U.S.A.	2009-553328	9/3/2009	8675844	3/18/2014

	U.S.A.	2003-730853	12/8/2003	7660404	2/9/2010
	HONG KONG	5101471	2/22/2005	1069062	2/12/2010
	E.P.O	06019434.7	12/5/2003	1727386	3/4/2009
	U.K.	06019434.7	9/18/2006	1727386	3/4/2009
	U.K.	03257661.3	12/5/2003	1427242	11/15/2006
	FRANCE	06019434.7	9/18/2006	1727386	3/4/2009
	E.P.O	03257661.3	12/5/2003	1427242	11/15/2006
	FRANCE	03257661.3	12/5/2003	1427242	11/15/2006
	GERMANY	06019434.7	9/18/2006	1727386	3/4/2009
	GERMANY	03257661.3	12/5/2003	1427242	11/15/2006
	CHINA	200310124920.6	12/7/2003	100558200	11/4/2009
	KR	1020020077576	12/7/2002	500670	7/1/2005
28	U.S.A.	2002-194038	7/11/2002	6809641	10/26/2004
	JAPAN	2002-196495	7/4/2002	3684373	6/10/2005
	CHINA	02140676.6	7/12/2002	101271871	8/23/2006
	KR	1020010041909	7/12/2001	420395	2/16/2004
29	U.S.A.	14/225,729	3/26/2014	8933955	12/23/2014
	U.S.A.	2013-035625	9/24/2013	8706168	4/22/2014
	U.S.A.	2012-654043	10/17/2012	8554185	10/8/2013
	U.S.A.	2009-412079	3/26/2009	8311519	11/13/2012
	JAPAN	2009-133842	6/4/2009	4764496	6/17/2011
	KR	1020080052642	6/4/2008	1481408	1/6/2015
30	U.S.A.	2004-007603	12/7/2004	7260419	8/21/2007
	KR	1020030088563	12/8/2003	603437	7/13/2006
31	U.S.A.	14/061316	10/23/2013	Pending	
	U.S.A.	2012-649539	10/11/2012	RE44620	7/9/2013
	U.S.A.	2011-300799	11/21/2011	RE43789	11/6/2012
	U.S.A.	2009-612327	11/4/2009	RE42996	12/6/2011
	U.S.A.	2004-882604	6/30/2004	7292561	11/6/2007
	KR	1020030087886	12/5/2003	633741	10/4/2006
32	U.S.A.	2013-861177	4/11/2013	9661113	5/23/2017
	U.S.A.	2010-716600	3/3/2010	8433379	4/30/2013
	U.S.A.	2005-106118	4/13/2005	7693558	4/6/2010
	KR	1020040025922	4/14/2004	598062	6/30/2006
33	U.S.A.	2011-171344	6/28/2011	8200899	6/12/2012
	U.S.A.	2009-362760	1/30/2009	7991958	8/2/2011
	KR	1020080046505	5/20/2008	985617	9/29/2010
34	U.S.A.	2005-295202	12/6/2005	7567530	7/28/2009
37	U.S.A.	2002-253256	9/24/2002	7136671	11/14/2006
38	U.S.A.	2015-929965	11/2/2015	9729699	8/8/2017

	U.S.A.	2014-196273	3/4/2014	9178982	11/3/2015
	U.S.A.	2013-746125	1/21/2013	8699987	4/15/2014
	U.S.A.	2009-625191	11/24/2009	8374572	2/12/2013
	U.S.A.	15/672,018	8/8/2017	10158752	12/18/2018
	U.S.A.	2003-749788	12/30/2003	7643815	1/5/2010
40	U.S.A.	2010-944436	11/11/2010	8060114	11/15/2011
	U.S.A.	2010-693142	1/25/2010	7912482	3/22/2011
	KR	1020040088333	11/2/2004	0632667	9/28/2006
	U.S.A.	2004-021778	12/23/2004	7668553	2/23/2010
41	U.S.A.	2004-899638	7/26/2004	7151487	12/19/2006
	U.S.A.	2003-749598	12/30/2003	6784829	8/31/2004
	CHINA	200410064136.5	8/19/2004	ZL200410064136.5	4/20/2011
	KR	1020030057848	8/21/2003	540248	12/23/2005
42	U.S.A.	2003-750000	12/30/2003	7006037	2/28/2006
	KR	1020030033022	5/23/2003	543308	1/6/2006
43	U.S.A.	16/287,787	2/27/2019	Pending	
	U.S.A.	2014-307326	6/17/2014	9495730	11/15/2016
	U.S.A.	2012-669162	11/5/2012	8767018	7/1/2014
	U.S.A.	13/363,428	2/1/2012	8319799	11/27/2012
	U.S.A.	2010-814262	6/11/2010	8120626	2/21/2012
	U.S.A.	2006-453433	6/28/2006	7755647	7/13/2010
	CHINA	200610095738.6	6/28/2006	101982805	6/15/2011
	KR	1020050056173	6/28/2005	756129	8/30/2007
44	U.S.A.	2011-275103	10/17/2011	8446915	5/21/2013
	U.S.A.	2010-716575	3/3/2010	8054846	11/8/2011
	U.S.A.	2006-441981	5/26/2006	7693163	4/6/2010
	KR	1020050045625	5/30/2005	653527	11/27/2006
45	U.S.A.	2004-933670	9/3/2004	7102196	9/5/2006
	KR	1020030062570	9/6/2003	539960	12/22/2005
46	U.S.A.	2002-214430	8/8/2002	6801271	10/5/2004
	JAPAN	2002-214711	7/24/2002	3773472	2/24/2006
	E.P.O	02014550	7/1/2002	1 316 841	1/1/2014
	U.K.	02014550	7/1/2002	1 316 841	1/1/2014
	FRANCE	02014550	7/1/2002	1 316 841	1/1/2014
	GERMANY	02014550	7/1/2002	02 014 550.4	1/1/2014
	CHINA	02140295.7	7/4/2002	ZL02140295.7	2/2/2005
	KR	1020010075793	12/3/2001	432009	5/7/2004
47	U.S.A.	2002-071750	2/6/2002	6925313	8/2/2005
	JAPAN	2002-031225	2/7/2002	4034079	11/2/2007
	ITALY	02250854	2/7/2002	1231757	11/15/2006

	HONG KONG	02109172.9	12/18/2002	1047666	3/4/2005
	E.P.O	02250854	2/7/2002	1231757	11/15/2006
	U.K.	02250854	2/7/2002	1231757	11/15/2006
	FRANCE	02250854	2/7/2002	1231757	11/15/2006
	GERMANY	02250854	2/7/2002	1231757	11/15/2006
	CHINA	02106877.1	2/7/2002	ZL02106877.1	10/6/2004
48	U.S.A.	2009-645912	12/23/2009	8270999	9/18/2012
	U.S.A.	2006-647636	12/28/2006	7660592	2/9/2010
	KR	1020050133300	12/29/2005	651594	11/22/2006
49	U.S.A.	2013-860672	4/11/2013	9204118	8/14/2015
	U.S.A.	2010-686822	1/13/2010	8433367	4/30/2013
	U.S.A.	2008-217175	7/2/2008	7668569	2/23/2010
	U.S.A.	2005-255610	10/21/2005	7412262	8/12/2008
	JAPAN	2010-099211	4/22/2010	5210347	3/1/2013
	JAPAN	2005-308910	10/24/2005	4557864	7/30/2010
	GERMANY	102005053671.9	11/10/2005	102005053671	12/24/2008
	CHINA	200510120388.x	11/11/2005	ZL200510120388.X	4/1/2009
	KR	1020040101848	12/6/2004	620741	8/29/2006
50	U.S.A.	2005-106160	4/13/2005	7283839	10/16/2007
	HONG KONG	06103630.4	3/22/2006	1083574	10/15/2010
	E.P.O	05252337	4/14/2005	1587288	11/3/2010
	U.K.	05252337	4/14/2005	1587288	11/3/2010
	FRANCE	05252337	4/14/2005	1587288	11/3/2010
	GERMANY	05252337	4/14/2005	1587288	11/3/2010
	KR	1020040083073	10/18/2004	572464	4/18/2006
	CHINA	200510079253.3	4/14/2005	101694372	5/26/2010
51	U.S.A.	2000-655036	9/5/2000	6557010	4/29/2003
	JAPAN	2000-272619	9/8/2000	3638249	1/21/2005
52	U.S.A.	2002-185141	6/27/2002	7103387	9/5/2006
	JAPAN	2002-201859	7/10/2002	3917027	2/16/2007
	E.P.O	02254584	6/28/2002	1309157	8/17/2011
	U.K.	02254584	6/28/2002	1309157	8/17/2011
	FRANCE	02254584	6/28/2002	1309157	8/17/2011
	GERMANY	02254584	6/28/2002	1309157	8/17/2011
	CHINA	02140907.2	7/9/2002	ZL02140907.2	6/4/2008
	KR	1020010067663	10/31/2001	438208	6/21/2004
53	U.S.A.	15/131,746	4/18/2016	9839000	12/05/2017
	U.S.A.	15/801,433	11/2/2017	Pending	
	U.S.A.	14/563,058	12/8/2014	9319507	4/19/2016
	U.S.A.	2013-972475	8/21/2013	8923927	12/10/2014

	U.S.A.	2011-052836	3/21/2011	8532626	9/10/2013
	U.S.A.	2008-183506	7/31/2008	7925242	4/12/2011
	U.S.A.	2006-354608	2/14/2006	7420566	9/2/2008
	KR	1020050012498	2/15/2005	610487	8/1/2006
54	KR	1020050009451	2/2/2005	656670	12/5/2006
	U.S.A.	2005-134778	5/19/2005	7475332	1/6/2009
55	U.S.A.	2012-676214	11/14/2012	8588755	6/17/2013
	U.S.A.	12/816,688	6/16/2010	8331920	12/11/2012
	KR	1020090065796	7/20/2009	1026905	3/28/2011
56	U.S.A.	2006-580741	10/12/2006	7636845	12/22/2009
	KR	1020050123711	12/15/2005	755536	8/29/2007
57	U.S.A.	2011-311458	12/5/2011	8565724	10/22/2013
	U.S.A.	2008-150905	5/1/2008	8078145	12/13/2011
	U.S.A.	2003-602810	6/24/2003	7386297	6/10/2008
	CHINA	03127468.4	6/30/2003	ZL03127468.4	12/5/2007
	KR	1020020085938	12/28/2002	551421	2/3/2006
62	U.S.A.	2016-082832	3/28/2016	9596352	3/14/2017
	U.S.A.	14/685,143	4/13/2015	9300805	3/29/2016
	U.S.A.	2013-058968	10/21/2013	9008637	4/14/2015
	U.S.A.	2011-182024	7/13/2011	8583098	7/8/2013
	U.S.A.	15/457,560	3/13/2017	10009471	06/26/2018
	U.S.A.	15/988,020	5/24/2018	10257359	4/9/2019
	KR	1020110000808	1/5/2011	1308192	9/6/2013
63	U.S.A.	15/338,993	10/31/2016	9769776	9/19/2017
	U.S.A.	15/709,185	9/20/2017	10015759	7/3/2018
	U.S.A.	16/424,258	5/28/2019	10582460	3/3/2020
	U.S.A.	14/626,047	2/19/2015	9516614	12/6/2016
	U.S.A.	13/849,296	3/22/2013	8964645	2/24/2015
	KR	1020120030216	3/23/2012	10-1885540	7/31/2018
64	U.S.A.	2016-173139	6/3/2016	9794029	10/17/2017
	U.S.A.	16/227,369	12/20/2018	Pending	
	U.S.A.	15/705,131	9/14/2017	Pending	
	U.S.A.	2015-942519	11/16/2015	9363801	6/7/2016
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	U.S.A.	2013-888891	5/7/2013	9030973	5/12/2015
	JAPAN	2015-511358	11/7/2014	6132370	4/28/2017
	E.P.O	13788210.6	5/7/2013	2850758	9/5/2018
	GERMANY	13788210.6	5/7/2013	2850758	9/5/2018
	FRANCE	13788210.6	5/7/2013	2850758	9/5/2018
	U.K.	13788210.6	5/7/2013	2850758	9/5/2018

	CHINA	201380035640.X	1/4/2015	ZL201380035640.X	1/5/2018
65	U.S.A.	14/589971	1/5/2015	10004062	6/19/2018
	U.S.A.	16/685,738	11/15/2019	Pending	
	U.S.A.	13/978524	7/5/2013	8934440	1/13/2015
	KR	1020110001992	1/7/2011	10-1835023	2/27/2018
66	U.S.A.	2014-754045	6/29/2015	10103916	10/16/2018
	U.S.A.	2012-580779	8/23/2012	9071488	6/30/2015
	KR	1020100016195	2/23/2010	1652251	8/24/2016
67	U.S.A.	15/167,518	5/27/2016	10162490	12/25/2018
	U.S.A.	14/816,736	8/3/2015	9357363	5/31/2016
	U.S.A.	2009-364085	2/2/2009	9100496	8/4/2015
	U.S.A.	16/203,174	11/28/2018	10540066	1/21/2020
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	SPAIN	ES200901563357	3/26/2009	ES2362448T3	7/5/2011
	E.P.O	09156335.3	3/26/2009	2117208	1/26/2011
	FRANCE	09156335.3	3/26/2009	2117208	1/26/2011
	U.K.	09156335.3	3/26/2009	2117208	1/26/2011
	NETHERLAND	09156335.3	3/26/2009	2117208	1/26/2011
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68	U.S.A.	15/017,133	2/5/2016	Pending	
	U.S.A.	2013-758444	2/4/2013	9256747	2/9/2016
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69	U.S.A.	2016-010629	1/29/2016	9575631	2/21/2017
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	NETHERLAND	05257261.7	11/25/2005	1662671	11/3/2010
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	FINLAND	05257261.7	11/25/2005	1662671	11/3/2010
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96	U.S.A.	12/861,637	8/23/2010	8098624	1/17/2012
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	KR	1020040059401	7/28/2004	620713	8/29/2006
97	U.S.A.	2003-744321	12/22/2003	7333828	2/19/2008
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	KR	1020030026991	4/29/2003	0592885	6/16/2006

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/340,447	12/29/2011	Min Seok Noh	FP11-392-1

CONFIRMATION NO. 1869

90228
IP & T GROUP LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182

POWER OF ATTORNEY NOTICE

OC000000093556886

Date Mailed: 08/18/2017

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/16/2017.

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

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

/cvorachack/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/340,447	12/29/2011	Min Seok Noh	FP11-392-1

CONFIRMATION NO. 1869

146410
Fidelis Law Group , PLLC
444 W Broad ST UNIT 426
Falls Church, VA 22046

POA ACCEPTANCE LETTER

OC000000093556903

Date Mailed: 08/18/2017

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/16/2017.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

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

/cvorachack/

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 146410

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

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

☒ The address associated with Customer Number: 146410

OR

☐	Firm or Individual Name	Fidelis Law Group, PLLC		
	Address	444 W Broad St unit 426		
	City	Falls Church	State VA	Zip 22046
	Country	USA		
	Telephone	571.730.4572	Email	edward.park@fidelis-laws.com

Assignee Name and Address: GOLDPEAK INNOVATIONS INC
SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU
SEOUL, REPUBLIC OF KOREA

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

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

Signature		Date	27 / Mar / 2017
Name	Youngjoon Rhee	Telephone	+82.10.8929.1905
Title	CEO		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	30100607
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	90228
Filer:	Seong Jun Park
Filer Authorized By:	
Attorney Docket Number:	FP11-392-1
Receipt Date:	16-AUG-2017
Filing Date:	29-DEC-2011
Time Stamp:	17:52:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	13340447.pdf	122246 38c4772e9bcdb533bfdbb16911e117a21153cfcc	no	3

Warnings:

Information:					
2	Power of Attorney	POA.pdf	1045958 a87949d5c25ca9a30afe1aff1de0bb07b1b67cde	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1168204	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

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

Applicant/Patent Owner: GOLDPEAK INNOVATIONS INC

Application No./Patent No.: 13/340,447 Filed/Issue Date: 12/17/2013

Titled: METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

GOLDPEAK INNOVATIONS INC, a Corporation

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

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

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

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

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

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

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

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

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

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

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

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

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

1. From: LG ELECTRONICS, INC To: PANTECH CO., LTD.

   The document was recorded in the United States Patent and Trademark Office at Reel 027877, Frame 0074, or for which a copy thereof is attached.

2. From: PANTECH CO., LTD. To: PANTECH INC.

   The document was recorded in the United States Patent and Trademark Office at Reel 039428, Frame 0268, or for which a copy thereof is attached.

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

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

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: PANTECH INC. To: GOLDPEAK INNOVATIONS INC

The document was recorded in the United States Patent and Trademark Office at
Reel 042098, Frame 0653, or for which a copy thereof is attached.

4. From: _____ To: _____

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

5. From: _____ To: _____

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

6. From: _____ To: _____

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

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

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

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

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

/Seong Jun PARK/	2018-08-16
Signature	Date
Seong Jun PARK	73,534
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT4338128

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
PANTECH INC	10/31/2016

RECEIVING PARTY DATA

Name:	GOLDPEAK INNOVATIONS INC
Street Address:	SUITE #806, DIGITAL-RO 34-GIL, 55, GURO-GU
City:	SEOUL
State/Country:	KOREA, REPUBLIC OF

PROPERTY NUMBERS Total: 96

Property Type	Number
Patent Number:	9548839
Patent Number:	9048991
Patent Number:	8631297
Patent Number:	8631298
Patent Number:	8681599
Patent Number:	9288824
Patent Number:	8611297
Patent Number:	8380227
Patent Number:	8583147
Patent Number:	9357486
Patent Number:	8606303
Patent Number:	7505776
Patent Number:	7853852
Patent Number:	9270365
Patent Number:	9419739
Patent Number:	9485072
Patent Number:	8588185
Patent Number:	9392582
Patent Number:	9131482
Patent Number:	9265034
Patent Number:	9369251

Property Type	Number
Patent Number:	8897182
Patent Number:	9344245
Patent Number:	9380581
Patent Number:	8576822
Patent Number:	9474025
Patent Number:	9516538
Patent Number:	9531574
Patent Number:	9264273
Patent Number:	8531939
Patent Number:	9124688
Patent Number:	8675844
Patent Number:	8933955
Patent Number:	8706168
Patent Number:	8554185
Patent Number:	RE44620
Patent Number:	RE42996
Patent Number:	7292561
Patent Number:	8433379
Patent Number:	7991958
Patent Number:	9178982
Patent Number:	8699987
Patent Number:	7643815
Patent Number:	8260349
Patent Number:	9237278
Patent Number:	8750927
Patent Number:	8271035
Patent Number:	7894854
Patent Number:	7912482
Patent Number:	7668553
Patent Number:	6784829
Patent Number:	9495730
Patent Number:	8767018
Patent Number:	8120626
Patent Number:	7755647
Patent Number:	8446915
Patent Number:	7693163
Patent Number:	7660592
Patent Number:	9204118

Property Type	Number
Patent Number:	7668569
Patent Number:	7412262
Patent Number:	9319507
Patent Number:	8923927
Patent Number:	8532626
Patent Number:	7420566
Patent Number:	8588755
Patent Number:	8565724
Patent Number:	7386297
Application Number:	15406403
Application Number:	15069340
Application Number:	15167367
Application Number:	15014792
Application Number:	15077466
Application Number:	14493673
Application Number:	15222068
Application Number:	15335679
Application Number:	14733068
Application Number:	15206508
Application Number:	14703360
Application Number:	15180153
Application Number:	15151296
Application Number:	15192233
Application Number:	15131725
Application Number:	15279139
Application Number:	15183158
Application Number:	14560838
Application Number:	15341296
Application Number:	15200980
Application Number:	15390278
Application Number:	14061316
Application Number:	13861177
Application Number:	14929965
Application Number:	14993007
Application Number:	15349218
Application Number:	15131746
Application Number:	15399077

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Email:	edward.park@fidelis-laws.com
Correspondent Name:	FIDELIS LAW GROUP, PLLC
Address Line 1:	444 W BROAD ST UNIT 426
Address Line 4:	FALLS CHURCH, VIRGINIA 22046

NAME OF SUBMITTER:	EDWARD PARK
SIGNATURE:	/sjp/
DATE SIGNED:	03/27/2017
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 4

source=Patent Assignment Agreement_2016.11 executed_Redacted#page1.tif
source=Patent Assignment Agreement_2016.11 executed_Redacted#page2.tif
source=Patent Assignment Agreement_2016.11 executed_Redacted#page3.tif
source=Patent Assignment Agreement_2016.11 executed_Redacted#page4.tif

PATENT ASSIGNMENT

This Patent Assignment (the "Assignment") is made from **PANTECH INC** ("Assignor"), a corporation organized and existing under the laws of Korea with its principal place at Pantech Building, 179 Seongam-ro Mapo-go, Seoul, Korea, to **GoldPeak Innovations Inc** ("Assignee"), a corporation organized under the laws of the Republic of Korea, having an address at suite # 806, Digital-ro 34-gil, 55, Guro-gu, Seoul, Korea.

WHEREAS, Assignor and Assignee have entered into that certain Patent Assignment Agreement dated as of October 31, 2016 (the "Agreement"), whereby, among other things, Assignor has agreed to assign, and Assignee has agreed to accept, all of those patents and patent applications listed on Annex A hereto, and all existing and any future Patents that may be granted therefore throughout the world, all of their foreign counterparts, reissues, re-examinations, renewals, extensions, provisional, divisional and continuation applications including continuation in part, and any United States and foreign applications and patents that claimed, claim and will claim priorities to those listed above, as well as all patents and applications from which those listed above derive, relate, or claim priority (collectively, the "Patent Rights").

NOW THEREFORE, in exchange for good and valuable consideration under the Agreement, the receipt and sufficiency of which Assignor hereby acknowledges, and as a condition to Assignee entering into the Agreement, Assignor hereby assigns and transfers to Assignee and Assignee accepts, all of the right, title and interest of Assignor throughout the world in and to any and all inventions claimed or disclosed in the Patent Rights.

This Assignment includes all of Assignor's right, title and interest in, to and under each of the Patent Rights (including without limitation, rights to damages and payments for past, present and future infringements or misappropriations, including the right to collect and receive any royalties, or settlements for such infringements, all rights to sue for injunctive or other equitable relief, and any and all causes of action relating to any of the inventions or discoveries thereof), and, as agreed to between the parties, all continuations, continuations-in-part, divisionals, substitutes, reexaminations, post-opposition foreign counterpart patents and applications, reissues and extensions thereof, if any; and, Assignor requests the Commissioner of Patents of the United States (and all foreign officials, whose duty it is to issue patents and applications as aforesaid) to record Assignee as the owner of such Patent Rights, to the same extent as held by Assignor, and to issue the Letters Patent for such Patent Rights in the name of Assignee, as assignee of the Patent Rights.

This instrument shall inure to the benefit of Assignee and its successors and assigns, and shall be binding upon Assignor and its successors and assigns.

Assignor hereby covenants that it has full right to convey the entire interest herein assigned, and that it has not executed, and will not execute, any agreement in conflict with this Assignment. Assignor hereby further covenants and agrees that it will communicate to Assignee any and all facts known to it respecting the Patent Rights, including the existing licenses, encumbrances or other restrictions that are expressly binding on successors to the Patent Rights, and testify in any

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legal proceeding, sign all lawful papers, execute and deliver all papers and take any actions that may be necessary or desirable to perfect the title to any aforementioned patents and inventions, execute all divisional, continuation, reexamination, reissue, substitute applications, and any similar and equivalent procedure under current and future legislations and regulations throughout the world, and make all rightful oaths to aid Assignee to obtain and enforce proper patent protection for said inventions in all countries.

Date of: _____

PANTECH INC.

_____
Signature

Jeon CHANG
Name

CEO
Title

GoldPeak Innovations Inc.

_____
Signature

Youngjoon Rhee
Name

CEO
Title

JC

K

Annex A

Patents and/or Patent Applications

NO	Category	Application No	Filing Date	Patent No	Issued Date
1	[redacted]	12/388,243	2/18/2009	US 7894330	2/22/2011
2		12/347,352	12/31/2008	US 8102804	1/24/2012
3		11/165,744	6/24/2005	US 7505775	3/17/2009
4		11/320,374	12/27/2005	US 7725796	9/29/2010
5		13/715,278	12/14/2012	US 8873519	10/28/2014
6		14/357,557	5/9/2014	US 9313743	4/12/2016
7		13/481,481	5/25/2012	US 8848674	9/30/2014
8		13/332,089	12/20/2011	US 8649346	2/11/2014
9		13/877,827	4/4/2013	US 9237566	1/12/2016
10		14/056,434	10/17/2013	US 9008046	4/14/2015
11		13/098,056	4/29/2011	US 8780860	7/15/2014
12		13/578,531	8/10/2012	US 9054835	6/9/2015
13		13/504,908	4/27/2012	US 9077510	7/7/2015
14		12/916,203	10/29/2010	US 8538411	9/17/2013
15		13/891,522	5/10/2013	US 9025485	5/5/2015
16		14/547,112	11/18/2014	US 9088396	7/21/2015
17		13/807,706	12/28/2012	US 9136924	9/15/2015
18		13/149,228	5/31/2011	US 8787216	7/22/2014
19		14/043,005	10/1/2013	US 8837452	9/16/2014
20		13/505,707	5/2/2012	US 8811518	8/19/2014
21		13/500,288	4/4/2012	US 9319252	4/19/2016
22		13/847,319	3/19/2013	US 9088992	7/21/2015
23		13/651,034	10/12/2012	US 8917619	12/23/2014
24		13/984,476	8/8/2013	US 9191853	11/17/2015
25		13/978,519	7/5/2013	US 9386600	7/5/2016
26		13/961,380	8/7/2013	US 8964520	2/24/2015
27		10/730,853	12/8/2003	US 7680404	2/9/2010
28		10/194,038	7/11/2002	US 6809641	10/26/2004
29		12/412,079	3/26/2009	US 8311519	11/13/2012
30		11/007,603	12/7/2004	US 7260419	8/21/2007
31		13/300,799	11/21/2011	US RE43789	11/6/2012
32		11/106,118	4/13/2005	US 7693558	4/6/2010

33	[redacted]	13/171,344	6/28/2011	US 8200899	6/12/2012
34		11/295,202	12/6/2005	US 7567530	7/28/2009
35		11/479,567	6/30/2006	US 7599487	10/6/2009
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37		10/253,256	9/24/2002	US 7136671	11/14/2006
38		12/635,191	11/24/2009	US 8374572	2/12/2013
39		13/015,922	1/28/2011	US 8090405	1/3/2012
40		12/944,636	11/11/2010	US 8060114	11/15/2011
41		10/899,638	7/26/2004	US 7151487	12/19/2006
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43		13/363,428	2/1/2012	US 8319799	11/27/2012
44		12/716,575	3/3/2010	US 8054846	11/8/2011
45		10/923,670	9/3/2004	US 7102196	9/5/2006
46		10/214,430	8/8/2002	US 6801771	10/5/2004
47		10/071,750	2/6/2002	US 6925313	8/2/2005
48		12/645,912	12/23/2009	US 8270999	9/18/2012
49		12/686,822	1/13/2010	US 8433367	4/30/2013
50		11/106,160	4/13/2005	US 7283839	10/16/2007
51		09/655,036	9/5/2000	US 6857010	4/29/2003
52		10/185,141	6/27/2002	US 7103387	9/5/2006
53		12/183,506	7/31/2008	US 7925242	4/12/2011
54		11/134,778	5/19/2005	US 7475332	1/6/2009
55		12/816,688	6/16/2010	US 8331920	12/11/2012
56		11/580,741	10/12/2006	US 7636845	12/22/2009
57		12/150,905	5/1/2008	8078145	12/13/2011
58		14/368,224	6/23/2014		
59		14/356,218	5/5/2014		
60		14/348,840	3/31/2014		
61		14/394,248	10/13/2014		

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 8,611,297 B2
APPLICATION NO. : 13/340447
DATED : December 17, 2013
INVENTOR(S) : Min Seok Noh et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 18 line 56 - Column 19 line 4 should read --

13. A method for performing a random access procedure by a base station, the method comprising:
receiving a random access preamble from a user equipment (UE);
determining a first subframe in which the random access preamble was transmitted;
generating a random access response responsive to the random access preamble, the random access response comprising information associated with the subframe number of the first subframe; and
transmitting the random access response within a time period,
wherein the time period starts at a second subframe, the second subframe having a subframe number that corresponds to a subframe number of the first subframe plus a predetermined number.

Signed and Sealed this
Seventeenth Day of June, 2014

Michelle K. Lee

Michelle K. Lee
Deputy Director of the United States Patent and Trademark Office

PTO/SB/44 (09-07)
Approved for use through 08/31/2010. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 8,611,297

APPLICATION NO.: 13/340,447

ISSUE DATE : December 17, 2013

INVENTOR(S) : Min Seok Noh et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Change the claim section as follows:

13. A method for performing a random access procedure by a base station, the method comprising:

receiving a random access preamble from a user equipment (UE);

determining a first subframe in which the random access preamble was transmitted;

generating a random access response responsive to the random access preamble, the random access response comprising information associated with the subframe number of the first subframe; and

transmitting the random access response within a time period,

wherein the time period starts at a second subframe, the second subframe having a subframe number that corresponds to a subframe number of the first subframe plus a predetermined number.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

IP & T GROUP LLP
8230 Leesburg Pike Suite 650
Vienna, VA 22182

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, 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.

Electronic Patent Application Fee Transmittal

Application Number:	13340447
Filing Date:	29-Dec-2011
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Filer:	Jun Jeong Park/Aerin Kim
Attorney Docket Number:	FP11-392-1

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Certificate of Correction	1811	1	100	100
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**100**

Electronic Acknowledgement Receipt

EFS ID:	18784055
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	90228
Filer:	Jun Jeong Park/Aerin Kim
Filer Authorized By:	Jun Jeong Park
Attorney Docket Number:	FP11-392-1
Receipt Date:	16-APR-2014
Filing Date:	29-DEC-2011
Time Stamp:	17:44:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$100
RAM confirmation Number	6839
Deposit Account	505025
Authorized User	IP&T GROUP LLP
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		FP11-392-1-C.pdf	114614 124922c945c625257ec6b901f95de5dc4419ffcb	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Request for Certificate of Correction	2	2

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Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30119 fc5e4dacc9c886aed6078cd4f3c82af260717628	no	2

Warnings:

Information:

Total Files Size (in bytes):	144733

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.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

In The U.S. Patent and Trademark Office

In Re the Application of:

Inventor(s):	Min Seok Noh et al.	**Confirmation No.:**	1869
Serial No.:	13/340,447	**Examiner:**	Sai Ming CHAN
Patent No.:	8,611,297		
Filed:	December 29, 2011	**Group Art Unit:**	2462
Title:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE		

REQUEST FOR CERTIFICATE OF CORRECTION

Applicant requests that a certificate of correction be issued for this patent, pursuant to 35 U.S.C. § 255. Attached is PTO Form SB/44. The mistake identified in the attached form is of a clerical or typographical nature, or of minor character, and resulted from an error made in good faith by applicant.

The mistake is that claim 13 of this patent includes a clerical error. More specifically, an article "a" recited in line 9 of claim 13 should be changed to an article --the--. No new matter has been added by the way of filing a request for certificate of correction.

Please grant any required extensions of time and charge any fees due in connection with this request to deposit account no. 50-5025.

Respectfully submitted,

Dated: April 16, 2014 By

Myung Soo Kim
Registration No.: 69,173
(571) 327-5450

IP & T Group LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182
(571) 327-5452 (facsimile)

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/17/2013	8611297	FP11-392-1	1869

90228 7590 11/26/2013

IP & T GROUP LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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

Min Seok Noh, Gyeonggi-do, KOREA, REPUBLIC OF;
Yeong Hyeon Kwon, Gyeonggi-do, KOREA, REPUBLIC OF;
Jin Sam Kwak, Gyeonggi-do, KOREA, REPUBLIC OF;
Dong Cheol Kim, Gyeonggi-do, KOREA, REPUBLIC OF;
Sung Ho Moon, Gyeonggi-do, KOREA, REPUBLIC OF;
Seung Hee Han, Gyeonggi-do, KOREA, REPUBLIC OF;
Hyun Woo Lee, Gyeonggi-do, KOREA, REPUBLIC OF;
Dragan Vujcic, Limours, FRANCE;

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

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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

90228 7590 08/12/2013
IP & T GROUP LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/29/2011	Min Seok Noh	FP11-392-1	1869

TITLE OF INVENTION: METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	11/12/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHAN, SAI MING	2462	370-329000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 IP & T GROUP LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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

(A) NAME OF ASSIGNEE: PANTECH CO., LTD.
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Seoul, Republic of Korea

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

4a. The following fee(s) are submitted:
☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☒ Advance Order - # of Copies two (2)

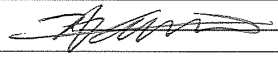
4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☒ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-5025 (enclose an extra copy of this form).

PTOL-85 (Rev. 02/11)

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29	NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
☐ Applicant asserting small entity status. See 37 CFR 1.27	NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
☐ Applicant changing to regular undiscounted fee status.	NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature  Date November 11, 2013

Typed or printed name Myung Soo Kim Registration No. 69,173

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	13340447
Filing Date:	29-Dec-2011
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Filer:	Jun Jeong Park/Aerin Kim
Attorney Docket Number:	FP11-392-1

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	1780	1780
Publ. Fee- Early, Voluntary, or Normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
Printed Copy of Patent - No Color	8001	2	3	6
		Total in USD ($)		**2086**

Electronic Acknowledgement Receipt

EFS ID:	17369598
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	90228
Filer:	Jun Jeong Park/Aerin Kim
Filer Authorized By:	Jun Jeong Park
Attorney Docket Number:	FP11-392-1
Receipt Date:	11-NOV-2013
Filing Date:	29-DEC-2011
Time Stamp:	18:04:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$2086
RAM confirmation Number	16386
Deposit Account	505025
Authorized User	IP&T GROUP LLP

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	FP11-392-1-IssueFee.pdf	145334 4e7c618e9f29cdec1e7b473ebdc00512f2db48ad	no	2
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	33968 2c26913fd64009188e37465412d41cf8480cef23	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	179302		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

90228 7590 08/12/2013

IP & T GROUP LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182

EXAMINER
CHAN, SAI MING

ART UNIT	PAPER NUMBER
2462	

DATE MAILED: 08/12/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/29/2011	Min Seok Noh	FP11-392-1	1869

TITLE OF INVENTION: METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	11/12/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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

90228 7590 08/12/2013

IP & T GROUP LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/29/2011	Min Seok Noh	FP11-392-1	1869

TITLE OF INVENTION: METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	11/12/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHAN, SAI MING	2462	370-329000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

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

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27

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

❑ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/29/2011	Min Seok Noh	FP11-392-1	1869

90228 7590 08/12/2013

IP & T GROUP LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182

EXAMINER	
CHAN, SAI MING	
ART UNIT	PAPER NUMBER
2462	

DATE MAILED: 08/12/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/340,447	Applicant(s) NOH ET AL.	
	Examiner SAI-MING CHAN	Art Unit 2462	AIA (First Inventor to File) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to *8/5/2013*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *12-28*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

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

   * Certified copies not received: _____.

   Interim copies:

   a) ☐ All b) ☐ Some c) ☐ None of the: Interim copies of the priority documents have been received.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

EXAMINER'S COMMENT

Continued Prosecution Application

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 8/5/2013 has been entered.

Information Disclosure Statement

The information disclosure statements (IDS) submitted on 8/5/2013 has been considered by the Examiner and made of record in the application file.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Claims 12-28 are allowed.

Claim 12 includes limitations that are not taught or fairly suggested by the art of record in this application. The references are completely silent regarding the claimed aspect of:

"identifying the random access response responsive to the random access preamble based on the information associated with the subframe number of the first subframe,

wherein the time period starts at a second subframe, the second subframe having a subframe number that corresponds to the subframe number of the first subframe plus a predetermined number," in addition to the other limitations explicitly recited in claim 12.

Because the above limitations of claim 21 patentably define over the art of record, claim 12 is allowable. Independent claim 18 and 24 include similar limitations as claim 12 and as a result are allowable for similar reasons as claim 12. Dependent claims 13-17 ultimately depends from claim 12 and are therefore also allowable for at least similar reasons as claim 12. Dependent claims 19-23 ultimately depend from claim 18 and are therefore also allowable for at least similar reasons as claim 18. Dependent claims 25-28 ultimately depend from claim 24 and are therefore also allowable for at least similar reasons as claim 24.

Response to Arguments

Applicant's arguments filed on 3/18/2013 have been fully considered and persuasive.

Conclusion

Any response to this Office Action should be **faxed to** (571) 273-8300 **or mailed to**:

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

Hand-delivered responses should be brought to

Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Sai-Ming Chan whose telephone number is (571) 270-1769. The Examiner can normally be reached on Monday-Thursday from 8:00 am to 5:00 pm.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Yemane Mesfin can be reached on (571) 272-3927. 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) or 571-272-4100.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist/customer service whose telephone number is (571) 272-2600.

/Sai-Ming Chan/

Primary Examiner, Art Unit 2462

August 8, 2013

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	**Art Unit**
	SAI-MING CHAN	2462

CPC		
Symbol	**Type**	**Version**

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

NONE (Assistant Examiner) (Date)		**Total Claims Allowed:** 17	
/SAI-MING CHAN/ Primary Examiner.Art Unit 2462 (Primary Examiner)	8/5/2013 (Date)	O.G. Print Claim(s) 12	O.G. Print Figure 1a

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	**Art Unit**
	SAI-MING CHAN	2462

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	329	H	0	4	W	4 / 00 (2009.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
370	462				

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	17	
/SAI-MING CHAN/ Primary Examiner.Art Unit 2462	8/5/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	12	1a

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	**Art Unit**
	SAI-MING CHAN	2462

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

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

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 17	
/SAI-MING CHAN/ Primary Examiner.Art Unit 2462 8/5/2013 (Primary Examiner) (Date)	O.G. Print Claim(s) 12	O.G. Print Figure 1a

PTO/SB/08a (12-08)
Approved for use through 01/31/2009. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	13/340,447
Filing Date	December 29, 2011
First Named Inventor	Min Seok NOH
Art Unit	2462
Examiner Name	Sai Ming CHAN
Attorney Docket Number	FP11-392-1

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 8,000,294	08-16-2011	Uemura et al.	
		US- 8,054,791	11-08-2011	Vujcic	
		US- 8,102,804	01-24-2012	Noh et al.	
		US- 8,213,370	07-03-2012	Fischer	
		US- 8,218,500	07-10-2012	Kangude et al.	
		US- 2007/0291696	12-20-2007	Zhang et al.	
		US- 2008/0316961	12-25-2008	Bertrand et al.	
		US- 2010/0172299	07-08-2010	Fischer et al.	
		US- 2010/0195522	08-05-2010	Lee et al.	
		US- 2010/0195640	08-05-2010	Park et al.	
		US- 2010/0309877	12-09-2010	Damnjanovic et al.	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
		WO 2007/083230	07-26-2007			
		WO 2007/091831	08-16-2007			
		WO 99/60812	11-25-1999			
		WO 2008/024788	02-28-2008			
		CN 101529831	09-09-2009			

Examiner Signature	/Sai Ming Chan/	Date Considered	08/08/2013

*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 designation 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 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.C./

PTO/SB/08B (04-07)
Approved for use through 09/30/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	13/340,447
Filing Date	December 29, 2011
First Named Inventor	Min Seok NOH
Art Unit	2462
Examiner Name	Sai Ming CHAN
Attorney Docket Number	FP11-392-1

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	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[2]
		Supplementary European Search Report issued from the European Patent Office on January 8, 2013.	
		Ericsson, E-UTRA Random Access, 3rd Generation Partnership Project, Technical Specification Group Radio Access Network, Working Group 1, November 7, 2005, pp.1-4.	
		GHOSH, A., et al., Random Access Design for UMTS Air-Interface Evolution, IEEE 65th Vehicular Technology Conference, 2007, pp. 1041-1045, IEEE.	
		KISHIYAMA, Y., et al., Investigations on Random Access Channel Structure in Evolved UTRA Uplink, 3rd International Symposium on Wireless Communication Systems, 2006, IEEE.	
		3GPP TS 36.211, V8.1.0, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 8), November 2007.	
		3GPP TS 36.321, V8.0.0, 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), December 2007.	
		Notice of Preliminary Rejection issued from the State Intellectual Property Office of China on August 24, 2012.	

Examiner Signature	/Sai Ming Chan/	Date Considered	08/08/2013

*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 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 1.98. 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 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.C./

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"20090175292"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 15:05
S2	585	(@rlad<"20080101" or @ad<"20080101") and (preamble with (random adj3 access))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:05
S3	155	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:06
S4	103	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:06
S5	32	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:07
S6	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:08
S7	20	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and (preamble near8 time)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:09
S8	9	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and (response with (preamble near8 time))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:27
S9	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and ((rach near3 slot) with modulo)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S10	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and ((rach near3 slot) same modulo)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S11	3	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and (rach near3 slot) and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S12	25	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S13	0	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot)	US-PGPUB; USPAT; EPO;	OR	ON	2010/05/06 20:38

		with modulo	JPO			
S14	1	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) same modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S15	1	hon near2 min near2 seok	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:11
S16	106	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response)))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:15
S17	42	(@rlad<"20080101" or @ad<"20080101") and (preamble with associated) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:17
S18	80	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:30
S19	69	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:31
S20	46	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) and (random adj3 access adj response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:34
S21	27	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:35
S22	25	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:35
S23	13	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) and pre$determin$2 not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:40
S24	7	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) and (pre$determin$2 adj2 (time period)) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:41
S25	382	noh near3 ("m." min)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:12
S26	188	noh near3 ("m." min) and lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S27	46	noh near3 ("m." min) and lg and preamble	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S28	20	noh near3 ("m." min) and lg and (random adj access adj preamble)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13

S29	3	noh near3 ("m." min) and lg and ((random adj access adj preamble) with response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:14
S30	1	noh near3 ("m." min) and lg and ((random adj access adj preamble) with response) and harq	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:15
S31	23	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) and (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:12
S32	8	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) same (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:13
S33	3	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) with (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:13
S34	0	("2010/0275086").URPN.	USPAT	OR	ON	2011/05/01 13:45
S35	1766	(@rlad<"20080101" or @ad<"20080101") and((preamble with (random adj3 access adj response)) rach) and pre$determin$2 not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:45
S36	28	(@rlad<"20080101" or @ad<"20080101") and (preamble same ((random adj3 access adj (request response) rach))) with (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:46
S37	11	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj (request response)) with (sequence near5 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:57
S38	1	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj (request response)) with (number near frame))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 18:06
S39	4	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj (request response)) and (preamble with (frame near5 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 18:16
S40	3	(@rlad<"20080101" or @ad<"20080101") and ((preamble with (random adj3 access adj response)) rach) and (rach with response with identifier) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 14:46
S41	1	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with predetermined) and (rach with response with identifier) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:22
S42	16	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 predetermined) and (response with identifier)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:24

S43	479	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with frame)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S44	59	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with (frame near2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S45	40	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 (frame near2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S46	14	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S47	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:35
S48	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:36
S49	23	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:36
S50	6	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with rnti with harq)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:11
S51	10	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with harq)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:18
S52	8	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with harq) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:18
S53	95	(@rlad<"20080101" or @ad<"20080101") and (preamble with (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:54
S54	54	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:55
S55	2	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number)) and (random adj access adj preamble)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:55
S56	0	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number)) and (re$number$3 with (frame adj2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:39
S57	0	(@rlad<"20080101" or @ad<"20080101") and preamble and (re$number$3 with (frame adj2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:40
S58	2	(@rlad<"20080101" or @ad<"20080101") and preamble and (re$number$3 with (frame with	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:40

		number))				
S59	0	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 with (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S60	42	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S61	5	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S62	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and (renumber$3 and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:42
S63	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and ((renumber$3 re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:44
S64	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:44
S65	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj access) with preamble) and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:45
S66	1	(@rlad<"20080101" or @ad<"20080101") and ((rach (random adj access)) with (request preamble)) and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 18:06
S67	5	(@rlad<"20080101" or @ad<"20080101") and (RACH with response$1 with identifier$1)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:14
S68	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (renumber$3 and (sub$frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:45
S69	17	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:46
S70	6	(@rlad<"20080101" or @ad<"20080101") and ((rach with preamble) same response) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:46
S71	0	(@rlad<"20080101" or @ad<"20080101") and ((rach with preamble) same response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:52
S72	0	("2009/0175292").URPN.	USPAT	OR	ON	2011/10/06 00:34
S73	0	("2009/0175292").URPN.	USPAT	OR	ON	2011/10/06 00:34
S74	0	(@rlad<"20080101" or @ad<"20080101") and (rach with	US-PGPUB; USPAT; EPO;	OR	ON	2011/10/06 00:50

		response) and (sub$frame with re$number$3)	JPO			
S75	0	(@rlad<"20080101" or @ad<"20080101") and (rach and response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:50
S76	0	(@rlad<"20080101" or @ad<"20080101") and (rach and response) and ((rach sub$frame) with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:51
S77	5	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble with response) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:58
S78	19	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble with response) and (sub$frame and number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 01:06
S79	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (sub$frame and re$number$2)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:07
S80	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (re$number$2)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:08
S81	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (re$number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:08
S82	1	"7433342"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:43
S83	10	(@rlad<"20080101" or @ad<"20080101") and (preamble with (frame adj number)) and (370/329,462.ccls. or 455/450.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/30 17:39
S90	13	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with preamble with (time near5 transmi$5)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:09
S91	85	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time transmi$5))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:15
S92	9	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time near5 transmi$5))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:16
S93	2	"20120093713"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/13 00:18
S94	2	"20120093173"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/13 00:18
S95	18	(@rlad<"20080101" or	US-PGPUB;	OR	ON	2013/05/02

		@ad<"20080101") and (rach with preamble with response) and (sub$frame and number) and (370/329,462.ccls.)	USPAT; EPO; JPO			01:22
S96	37	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time transmi$5)) and (370/329,462.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2013/05/02 01:22
S97	8	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with preamble with (time near5 transmi$5) and (370/329,462.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2013/05/02 01:23
S98	6	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame with number)) and (370/329,462.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2013/05/02 01:23

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	(@rlad<"20080101" or @ad<"20080101") and (time adj period adj start$3 near5 (second adj subframe)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/08/08 17:36
L2	0	(@rlad<"20080101" or @ad<"20080101") and (subframe adj number adj5 (first adj subframe adj plus adj3 predetermined adj number)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/08/08 17:37
S84	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((radndom adj access adj number) with (renumbered adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:41
S85	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((transmi$5) with (re$number$2 adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:42
S86	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((receiv$3) with (re$number$2 adj sub$frame adj number) with (predetermined adj time)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S87	0	(@rlad<"20080101" or @ad<"20080101") and ((radndom adj access adj number) with (renumbered adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S88	0	(@rlad<"20080101" or @ad<"20080101") and ((transmi$5) with (re$number$2 adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S89	0	(@rlad<"20080101" or @ad<"20080101") and ((receiv$3) with (re$number$2 adj sub$frame adj number) with (predetermined adj time)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S99	0	(@rlad<"20080101" or @ad<"20080101") and (time adj period adj start$3 near5 (second adj subframe)).clm.	US-PGPUB; USPAT;	OR	ON	2013/05/02 01:32

			UPAD			
S100	0	(@rlad<"20080101" or @ad<"20080101") and (subframe adj number adj5 (first adj subframe adj plus adj3 predetermined adj number)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/05/02 01:33

8/ 8/ 2013 5:38:09 PM
C:\ Users\ schan1\ Documents\ EAST\ Workspaces\ 13340447 Random access req & resp.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	Art Unit
	SAI-MING CHAN	2462

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	462	11/12/2012	SC
370	329, 462	5/2/2013	SC
Updated	search	8/5/2013	SC

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Image and keyword search in USPAT, US-PGPUB, DERWENT, EPO, JPO and IBM-TD	11/12/2012	SC
Inventor name and Assignee search in PALM EXPO and EAST	11/12/2012	SC
Updated search	5/2/2013	SC
Updated search	8/5/2013	SC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
370	329	8/5/2013	SC
370	462	8/5/2013	SC

PTO/SB/30 (02-09)
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Request for Continued Examination (RCE) Transmittal

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

Application Number	13/340,447
Filing Date	December 29, 2011
First Named Inventor	Min Seok NOH
Art Unit	2462
Examiner Name	Sai Ming CHAN
Attorney Docket Number	FP11-392-1

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

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

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      Ii. ☐ Other _____

   b. ☑ Enclosed

      I. ☐ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☑ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

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

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 50-5025.

      i. ☐ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

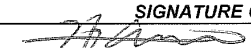
      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☑ Payment by credit card (Form PTO-2038 enclosed)

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.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	August 5, 2013
Name (Print/Type)	Myung Soo Kim	Registration No.	69,173

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)		Date	

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IN THE U.S. PATENT AND TRADEMARK OFFICE

In Re the Application of:

Inventor(s):	Min Seok NOH et al.	**Confirmation No.:**	1869
Serial No.:	13/340,447	**Examiner:**	Sai Ming CHAN
Filed:	December 29, 2011	**Group Art Unit:**	2462
Title:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE		

INFORMATION DISCLOSURE STATEMENT

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

Dear Sir:

This Information Disclosure Statement is submitted with a Request for Continued Examination for the above-identified application.

Please grant any required extensions of time and charge any fees due in connection with this request to deposit account no. 50-5025.

Respectfully submitted,

Dated: August 5, 2013 By

Myung Soo Kim
Registration No.: 69,173
(571) 327-5450

IP & T Group LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182
(571) 327-5452 (facsimile)

PTO/SB/08a (12-08)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	13/340,447
Filing Date	December 29, 2011
First Named Inventor	Min Seok NOH
Art Unit	2462
Examiner Name	Sai Ming CHAN
Attorney Docket Number	FP11-392-1

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 8,000,294	08-16-2011	Uemura et al.	
		US- 8,054,791	11-08-2011	Vujcic	
		US- 8,102,804	01-24-2012	Noh et al.	
		US- 8,213,370	07-03-2012	Fischer	
		US- 8,218,500	07-10-2012	Kangude et al.	
		US- 2007/0291696	12-20-2007	Zhang et al.	
		US- 2008/0316961	12-25-2008	Bertrand et al.	
		US- 2010/0172299	07-08-2010	Fischer et al.	
		US- 2010/0195522	08-05-2010	Lee et al.	
		US- 2010/0195640	08-05-2010	Park et al.	
		US- 2010/0309877	12-09-2010	Damnjanovic et al.	
		US-			
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		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
		WO 2007/083230	07-26-2007			
		WO 2007/091831	08-16-2007			
		WO 99/60812	11-25-1999			
		WO 2008/024788	02-28-2008			
		CN 101529831	09-09-2009			

Examiner Signature		Date Considered	

*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 designation 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 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, 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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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 2 of 2

Complete if Known	
Application Number	13/340,447
Filing Date	December 29, 2011
First Named Inventor	Min Seok NOH
Art Unit	2462
Examiner Name	Sai Ming CHAN
Attorney Docket Number	FP11-392-1

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	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[2]
		Supplementary European Search Report issued from the European Patent Office on January 8, 2013.	
		Ericsson, E-UTRA Random Access, 3rd Generation Partnership Project, Technical Specification Group Radio Access Network, Working Group 1, November 7, 2005, pp.1-4.	
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		Notice of Preliminary Rejection issued from the State Intellectual Property Office of China on August 24, 2012.	

Examiner Signature		Date Considered	

*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 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 1.98. 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 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, 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 (1-800-786-9199) and select option 2.

US008000294B2

(12) **United States Patent**
Uemura et al.

(10) **Patent No.: US 8,000,294 B2**
(45) **Date of Patent: Aug. 16, 2011**

(54) **METHOD FOR CONNECTING MOBILE STATION TO BASE STATION, MOBILE STATION, BASE STATION, MULTI-CARRIER MOBILE COMMUNICATION SYSTEM, AND RANDOM ACCESS CHANNEL MAPPING METHOD**

(75) Inventors: **Katsunari Uemura**, Chiba (JP); **Wahoh Oh**, Chiba (JP); **Yasuyuki Kato**, Chiba (JP); **Shohei Yamada**, Chiba (JP)

(73) Assignee: **Sharp Kabushiki Kaisha**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 438 days.

(21) Appl. No.: **12/302,854**

(22) PCT Filed: **May 31, 2007**

(86) PCT No.: **PCT/JP2007/061102**

§ 371 (c)(1),
(2), (4) Date: **Nov. 28, 2008**

(87) PCT Pub. No.: **WO2007/139188**

PCT Pub. Date: **Dec. 6, 2007**

(65) **Prior Publication Data**

US 2009/0201865 A1 Aug. 13, 2009

(30) **Foreign Application Priority Data**

Jun. 1, 2006 (JP) 2006-153956

(51) **Int. Cl.**
H04W 72/04 (2009.01)

(52) **U.S. Cl.** **370/329**

(58) **Field of Classification Search** 370/328, 370/329, 330; 455/509, 522

See application file for complete search history.

(56) **References Cited**

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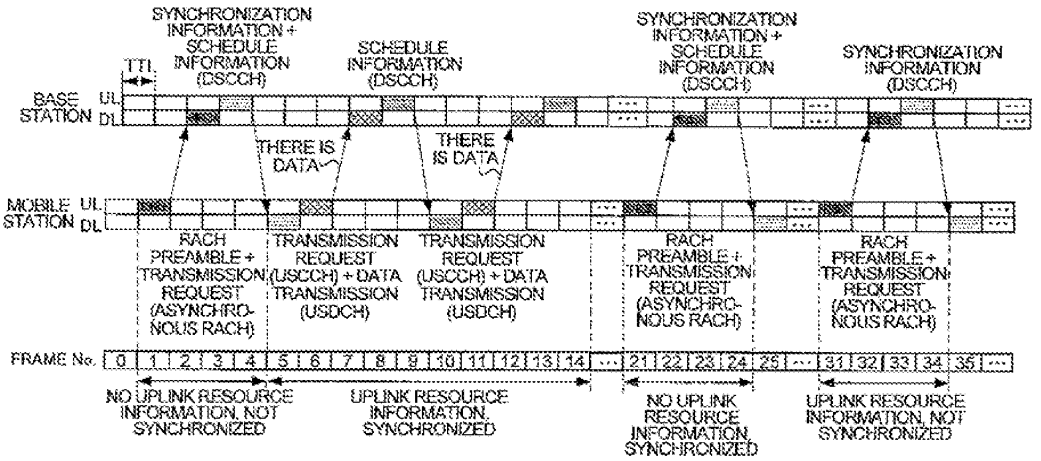
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Primary Examiner — Seema S Rao
Assistant Examiner — Henry Baron
(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

As a random access channel (RACH), two types of RACHs, a synchronous RACH and an asynchronous RACH are prepared, condition of a mobile station is classified depending on whether there is temporal synchronization in the mobile station and whether a resource is allocated, and depending on each case, any one of the synchronous RACH/the asynchronous RACH/uplink shared control channel (USCCH) is adaptively selected to carry out connection processing.

6 Claims, 18 Drawing Sheets



US008054791B2

(12) **United States Patent**
Vujcic

(10) **Patent No.: US 8,054,791 B2**
(45) **Date of Patent: Nov. 8, 2011**

(54) **METHOD AND PROCEDURES FOR UNSYNCHRONIZED, SYNCHRONIZED, AND SYNCHRONIZATION STAND BY COMMUNICATIONS IN E-UTRA SYSTEMS**

(75) Inventor: **Dragan Vujcic**, Limours (FR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 642 days.

(21) Appl. No.: **12/158,933**

(22) PCT Filed: **Nov. 20, 2006**

(86) PCT No.: **PCT/KR2006/004881**

§ 371 (c)(1),
(2), (4) Date: **Jun. 23, 2008**

(87) PCT Pub. No.: **WO2007/073040**

PCT Pub. Date: **Jun. 28, 2007**

(65) **Prior Publication Data**

US 2009/0252125 A1 Oct. 8, 2009

(51) **Int. Cl.**
H04W 4/00 (2009.01)

(52) **U.S. Cl.** **370/329**; 370/337; 455/434; 455/435.1; 398/53

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

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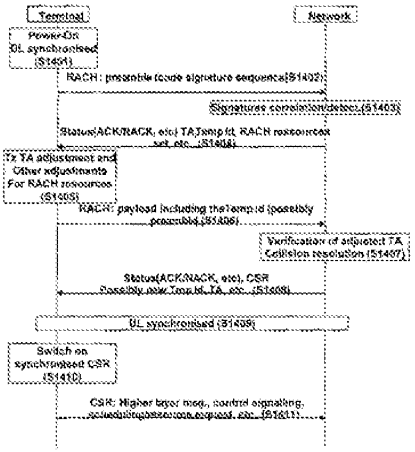
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Primary Examiner — Chi Pham
Assistant Examiner — David S Andreasen
(74) *Attorney, Agent, or Firm* — Lee, Hong, Degerman, Kang & Waimey

(57) **ABSTRACT**

An improved method of processing random access procedures, wherein the network receives at least one access burst to allow a network to estimate uplink received timing, the access burst containing at least a preamble, and transmits information for responding to the at least one access burst, while the mobile terminal configures at least one access burst containing at least a preamble and transmits the at least one access burst to allow a network to at least estimate uplink received timing.

18 Claims, 7 Drawing Sheets



US008102804B2

(12) **United States Patent**
Noh et al.

(10) **Patent No.: US 8,102,804 B2**
(45) **Date of Patent: Jan. 24, 2012**

(54) **METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE**

(75) Inventors: **Min Seok Noh**, Gyeonggi-do (KR); **Yeong Hyeon Kwon**, Gyeonggi-do (KR); **Jin Sam Kwak**, Gyeonggi-do (KR); **Dong Cheol Kim**, Gyeonggi-do (KR); **Sung Ho Moon**, Gyeonggi-do (KR); **Seung Hee Han**, Gyeonggi-do (KR); **Hyun Woo Lee**, Gyeonggi-do (KR); **Dragan Vujcic**, Limours (FR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 94 days.

(21) Appl. No.: **12/347,352**

(22) Filed: **Dec. 31, 2008**

(65) **Prior Publication Data**

US 2009/0175292 A1 Jul. 9, 2009

Related U.S. Application Data

(60) Provisional application No. 61/018,492, filed on Jan. 1, 2008.

(30) **Foreign Application Priority Data**

May 22, 2008 (KR) 10-2008-0047656

(51) **Int. Cl.**
H04W 4/00 (2009.01)

(52) **U.S. Cl.** **370/329**; 370/462; 455/450

(58) **Field of Classification Search** 370/462, 370/329; 455/450
See application file for complete search history.

(56) **References Cited**

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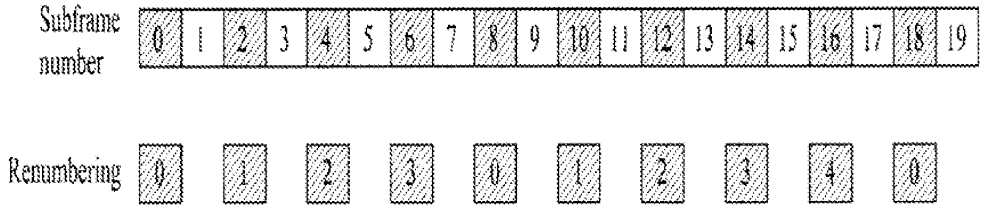
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Primary Examiner — Kevin C Harper
Assistant Examiner — Sai-Ming Chan
(74) *Attorney, Agent, or Firm* — Lee, Hong, Degerman, Kang & Waimey

(57) **ABSTRACT**

A base station transmits a random access response in response to a random access request (random access preamble) of a user equipment. The random access response includes information about a time when the random access request is transmitted and sequence number information of the random access request (random access preamble). The user equipment checks whether the received random access response is the response of the random access request transmitted by the user equipment, using the information about the time when the random access request is transmitted and the sequence number information included in the received random access response.

8 Claims, 17 Drawing Sheets



< Renumbering and grouping (or modulo operation) >

US008213370B2

(12) **United States Patent**
Fischer

(10) **Patent No.: US 8,213,370 B2**
(45) **Date of Patent: Jul. 3, 2012**

(54) **METHOD OF TRANSMITTING ON A RANDOM ACCESS CHANNEL BASED ON PARAMETER RELATING TO PERFORMANCE OF PERSISTENCE TEST**

(75) Inventor: **Patrick Fischer**, Bourg la Reine (FR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 855 days.

(21) Appl. No.: **12/066,243**

(22) PCT Filed: **Sep. 22, 2006**

(86) PCT No.: **PCT/KR2006/003782**
§ 371 (c)(1),
(2), (4) Date: **Mar. 7, 2008**

(87) PCT Pub. No.: **WO2007/052900**
PCT Pub. Date: **May 10, 2007**

(65) **Prior Publication Data**

US 2008/0253323 A1 Oct. 16, 2008

Related U.S. Application Data

(60) Provisional application No. 60/732,288, filed on Oct. 31, 2005.

(51) **Int. Cl.**
H04W 4/00 (2009.01)

(52) **U.S. Cl.** **370/329**; 370/341; 370/431; 370/437; 455/434; 455/450; 455/464; 455/511; 455/509

(58) **Field of Classification Search** 370/329, 370/341, 431, 437; 455/434, 450, 464, 511, 455/509
See application file for complete search history.

(56) **References Cited**

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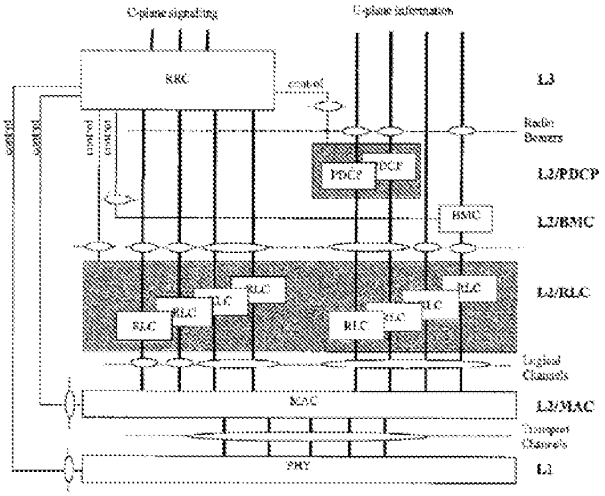
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Primary Examiner — Jeffrey Pwu
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(74) *Attorney, Agent, or Firm* — Lee, Hong, Degerman, Kang & Waimey

(57) **ABSTRACT**

Optimizing call setup procedures by determining whether a trigger for a random access procedure is independent for a restricted number of terminals, and performing a preamble transmission with or without a delay based upon the determining.

13 Claims, 2 Drawing Sheets



US008218500B2

(12) **United States Patent**
Kangude et al.

(10) **Patent No.: US 8,218,500 B2**
(45) **Date of Patent: Jul. 10, 2012**

(54) **PRE-SYNCHRONIZATION METHOD FOR HARD HANDOVERS IN WIRELESS NETWORKS**

(75) Inventors: **Shantanu Kangude**, Dallas, TX (US); **Pierre Bertrand**, Antibes (FR); **Ariton E. Xhafa**, Plano, TX (US)

(73) Assignee: **Texas Instruments Incorporated**, Dallas, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 813 days.

(21) Appl. No.: **12/112,422**

(22) Filed: **Apr. 30, 2008**

(65) **Prior Publication Data**

US 2008/0267131 A1 Oct. 30, 2008

Related U.S. Application Data

(60) Provisional application No. 60/914,937, filed on Apr. 30, 2007.

(51) **Int. Cl.**
H04W 36/00 (2009.01)

(52) **U.S. Cl.** **370/331**; 455/436

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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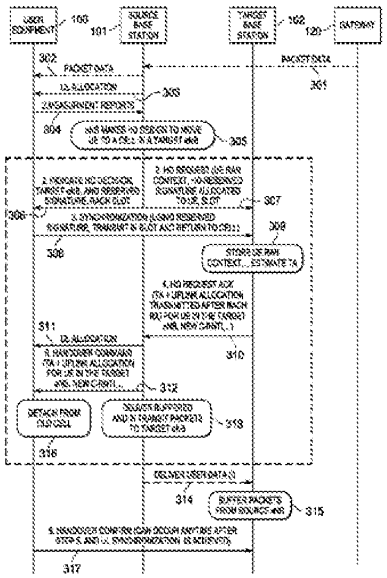
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Primary Examiner — Robert Scheibel
(74) *Attorney, Agent, or Firm* — Ronald D. Marshall, Jr.; Wade James Brady, III; Frederick J. Telecky, Jr.

(57) **ABSTRACT**

A pre-synchronization method in which the source cell chooses a signature for the user equipment (mobile) to use in the target cell for RACH access, and instructs the user equipment to perform RACH access and return to the current cell before a handover command (break command) is issued. This causes parallel execution of the UL synchronization process with the context transfer process among the two base stations.

15 Claims, 4 Drawing Sheets



US 20070291696A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2007/0291696 A1

Zhang et al. (43) Pub. Date: Dec. 20, 2007

(54) METHOD AND APPARATUS FOR PERFORMING RANDOM ACCESS IN A WIRELESS COMMUNICATION SYSTEM

(75) Inventors: **Guodong Zhang**, Farmingdale, NY (US); **Kyle Jung-Lin Pan**, Smithtown, NY (US); **Allan Yingming Tsai**, Boontown, NJ (US)

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(73) Assignee: **INTERDIGITAL TECHNOLOGY CORPORATION**, Wilmington, DE (US)

(21) Appl. No.: **11/763,862**

(22) Filed: **Jun. 15, 2007**

Related U.S. Application Data

(60) Provisional application No. 60/815,246, filed on Jun. 19, 2006.

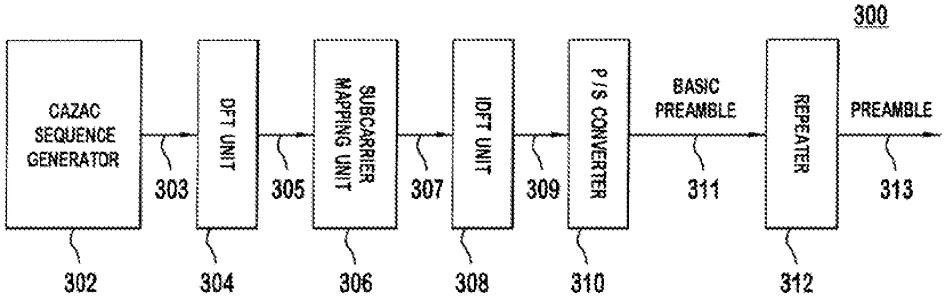
Publication Classification

(51) **Int. Cl.**
H04Q 7/00 (2006.01)

(52) **U.S. Cl.** **370/331**

(57) **ABSTRACT**

A method and apparatus for random access in an evolved universal terrestrial radio access (E-UTRA) system are disclosed. For code division multiplexing (CDM), a basic preamble is generated using a constant amplitude zero auto-correlation (CAZAC) sequence. The basic preamble is repeated for M time for generating a random access channel (RACH) preamble. For time division multiplexing/frequency division multiplexing (TDM/FDM), an extended CAZAC sequence is used to generate the basic preamble. Alternatively, a hybrid RACH access period including at least one CDM random access slot and at least one TDM/FDM random access slot may be provided. For synchronized random access, a RACH burst including a preamble part, a message part, and two cyclic prefixes may be generated and transmitted



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(19) **United States**

(12) **Patent Application Publication**

Bertrand et al.

(10) **Pub. No.: US 2008/0316961 A1**

(43) **Pub. Date: Dec. 25, 2008**

(54) **SIGNALING OF RANDOM ACCESS PREAMBLE PARAMETERS IN WIRELESS NETWORKS**

(76) Inventors: **Pierre Bertrand**, Antibes (FR); **Jing Jiang**, Allen, TX (US)

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(21) Appl. No.: **11/970,239**

(22) Filed: **Jan. 7, 2008**

Related U.S. Application Data

(60) Provisional application No. 60/944,913, filed on Jun. 19, 2007, provisional application No. 61/017,542, filed on Dec. 29, 2007.

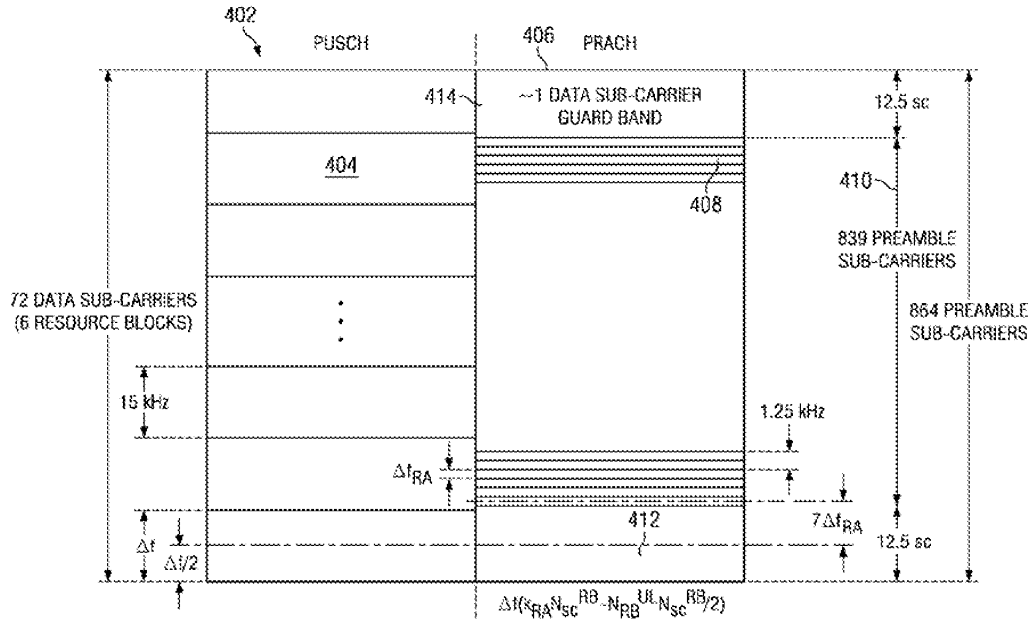
Publication Classification

(51) **Int. Cl.**
H04Q 7/20 (2006.01)

(52) **U.S. Cl.** **370/329**

(57) **ABSTRACT**

User equipment (UE)-initiated accesses within a cellular network are optimized to account for cell size and to reduce signaling overhead. A fixed set of preamble parameter configurations for use across a complete range of cell sizes within the cellular network is established and stored within each UE. A UE located in a given cell receives a configuration number transmitted from a nodeB serving the cell, the configuration number being indicative of a size of the cell. The UE selects a preamble parameter configuration from the fixed set of preamble parameter configurations in response to the received configuration number and then transmits a preamble from the UE to the nodeB using the preamble parameter configuration indicated by the configuration number.



US 20100172299A1

(19) **United States**

(12) **Patent Application Publication**

Fischer et al.

(10) **Pub. No.: US 2010/0172299 A1**

(43) **Pub. Date: Jul. 8, 2010**

(54) **ENHANCEMENT OF LTE RANDOM ACCESS PROCEDURE**

(76) Inventors: **Patrick Fischer**, Bourg La Reine (FR); **Remi Feuillette**, Paris (FR); **Dragan Vujcic**, Orsay (FR)

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(21) Appl. No.: **12/664,654**

(22) PCT Filed: **Jun. 19, 2008**

(86) PCT No.: **PCT/KR08/03487**

§ 371 (c)(1),
(2), (4) Date: **Dec. 14, 2009**

Related U.S. Application Data

(60) Provisional application No. 60/945,071, filed on Jun. 19, 2007, provisional application No. 61/023,196, filed on Jan. 24, 2008.

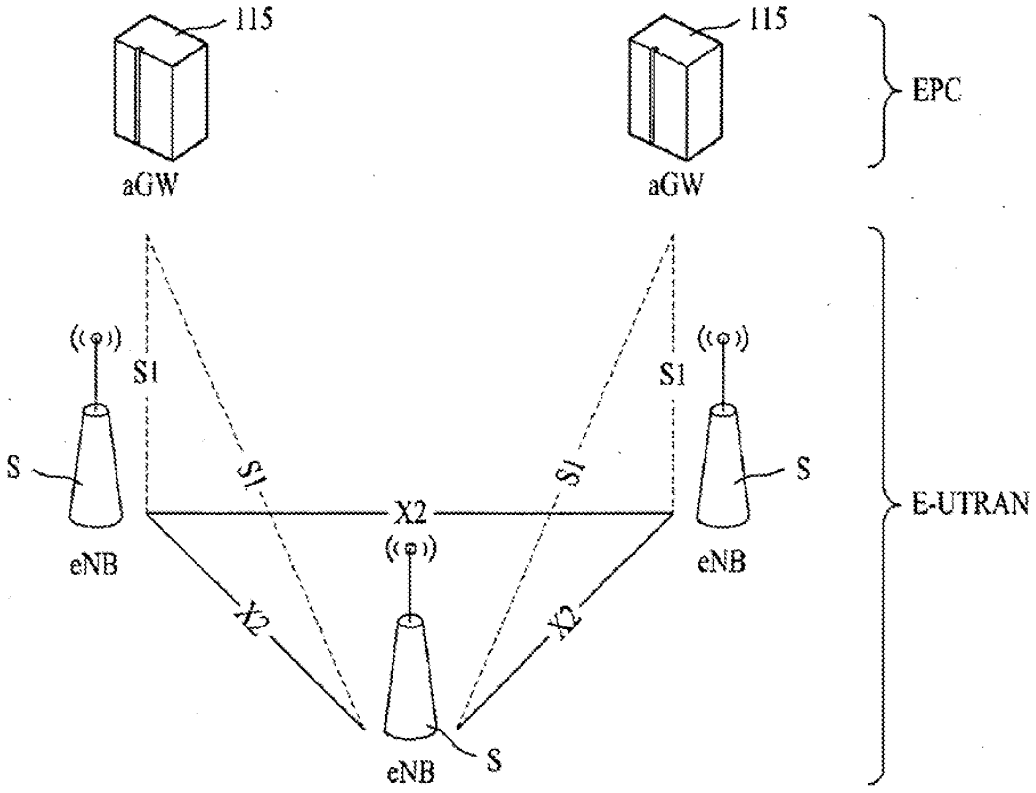
Publication Classification

(51) **Int. Cl.**
H04W 74/08 (2009.01)

(52) **U.S. Cl.** **370/328**

(57) **ABSTRACT**

A method and apparatus for enhancement of the random access procedure of a Long-Term Evolution (LTE) system are provided. Enhancements include modeling one cycle in the random access procedure since only one counter is necessary and controlling the delay prior to the preamble transmission in order to reduce conflicts by multiple mobile terminals using the random access channel.



US 20100195522A1

(19) **United States**

(12) **Patent Application Publication**

Lee et al.

(10) **Pub. No.: US 2010/0195522 A1**

(43) **Pub. Date: Aug. 5, 2010**

(54) **CONTROL METHOD FOR UPLINK CONNECTING OF IDLE TERMINAL**

(76) Inventors: **Young Dae Lee**, Anyang-Si (KR); **Seung Jun YI**, Anyang-Si (KR); **Sung Jun Park**, Anyang-Si (KR); **Sung Duck Chun**, Anyang-Si (KR)

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(21) Appl. No.: **12/671,020**

(22) PCT Filed: **Aug. 11, 2008**

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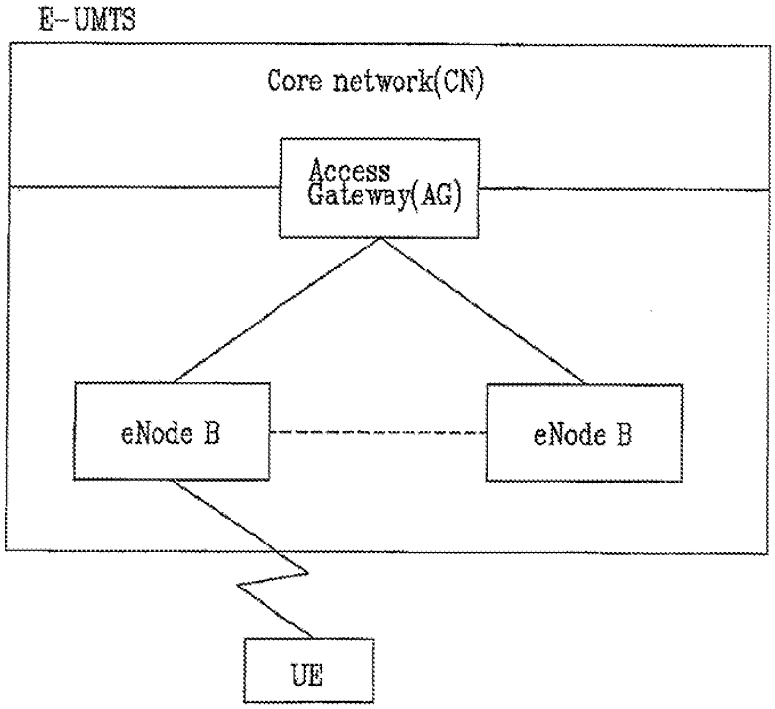
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(57) **ABSTRACT**

A method for controlling an uplink connection of an idle UE in a wireless communication system is disclosed. In a method for performing a random access procedure by an idle-mode user equipment (UE) which desires to receive a specific broadcast/multicast service in a wireless communication system, the method includes, receiving a first message transmitted from a network, so as to count the number of UEs which desire to receive the broadcast/multicast service, transmitting a preamble for a random access to the network, receiving a second message including uplink (UL) radio resource allocation information from the network in response to the preamble, transmitting a third message selected according to a connection indication information contained in the first or second message to the network using the uplink (UL) radio resource allocation information, wherein the connection indication information indicates whether a connection to the network is required or not, and receiving a contention resolution message from the network.



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Park et al.

(54) METHOD OF PERFORMING UPLINK TIME ALIGNMENT IN WIRELESS COMMUNICATION SYSTEM

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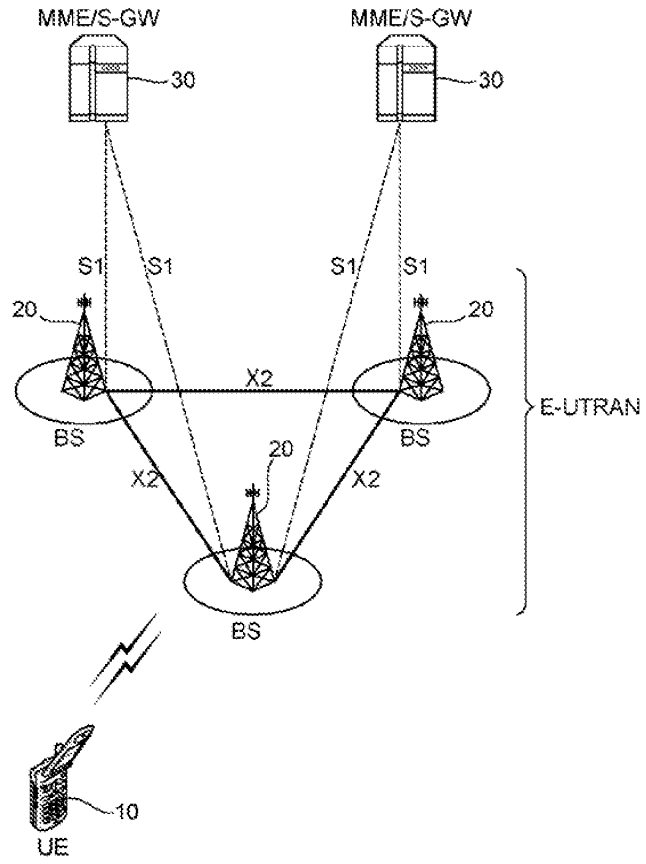
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(57) **ABSTRACT**

A method of performing uplink time alignment in wireless communication system includes transmitting a random access preamble, receiving a random access response, the random access response comprising a random access preamble identifier corresponding to the random access preamble but no time alignment value, and restarting a time alignment timer according to receiving the random access response.



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(54) **RANDOM ACCESS SIGNALING TRANSMISSION FOR SYSTEM ACCESS IN WIRELESS COMMUNICATION**

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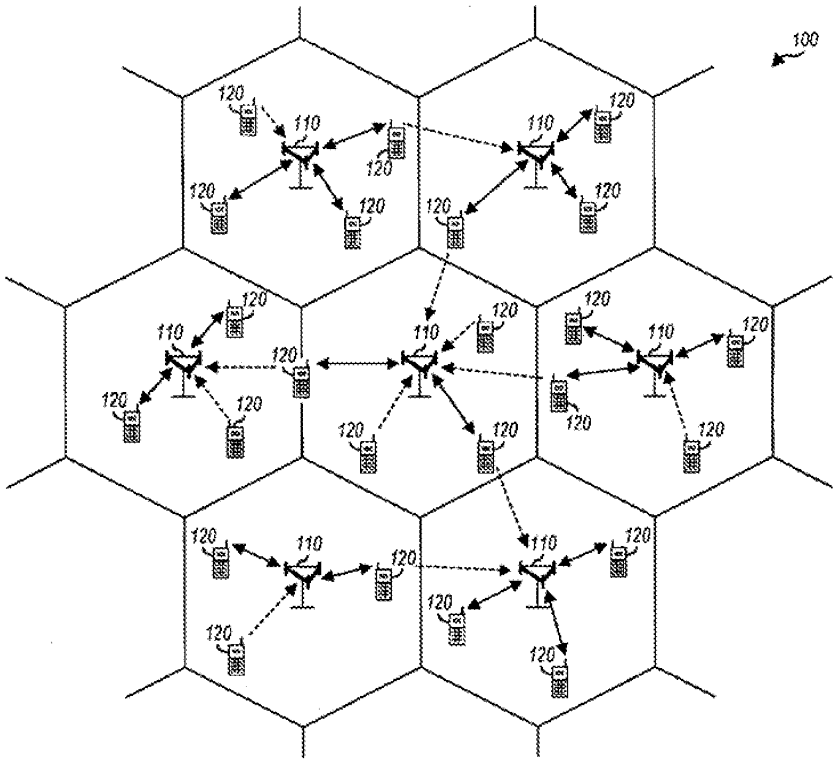
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(57) **ABSTRACT**

Techniques for transmitting random access signaling for system access are described. In an aspect, random access signaling may be sent based on at least one transmission parameter having different values for different user equipment (UE) classes. At least one parameter value may be determined based on a particular UE class, and the random access signaling may be sent based on the determined parameter value(s). The random access signaling may be a random access preamble, and the at least one transmission parameter may include a target SNR, a backoff time, and/or a power ramp. The random access preamble may then be sent based on a target SNR value, a power ramp value, and/or a backoff time value for the particular UE class. In another aspect, a message for system access may be sent based on a power control correction received in a random access response for the random access preamble.



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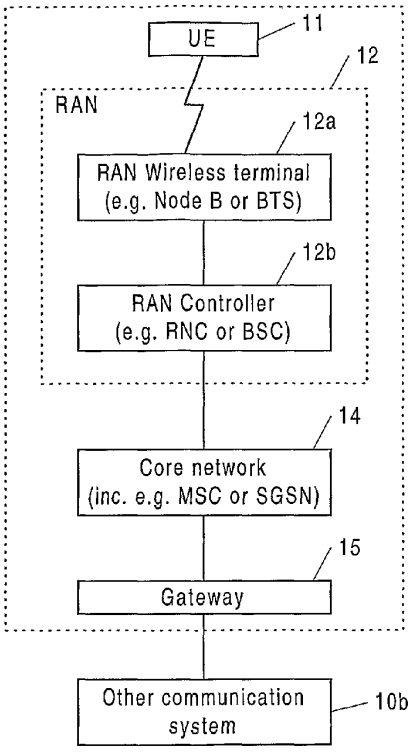
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(54) Title: RANDOM ACCESS PROCEDURE WITH ENHANCED COVERAGE



(57) Abstract: A random access procedure for use by a UE wireless communication terminal in communicating with a base station (or Node-B or eNB) of a radio access network, and in particular a E-UTRA network. A random access preamble is sent by the UE via RACH separate and prior to a random access message burst, which is sent on SCH but not until the UE receives one or more messages indicating an acknowledgment of the preamble and providing an allocation on SCH for use in transmitting the message burst, and also providing a preamble identifier, which the radio access network can then use to request retransmission of the message burst if necessary.

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RANDOM ACCESS PROCEDURE WITH ENHANCED COVERAGE

CROSS REFERENCE TO RELATED APPLICATION

Reference is made to and priority claimed from U.S. provisional application Ser. No. 60/760,474, filed Jan. 20, 2006.

BACKGROUND OF THE INVENTION

1. *Technical Field*

The present invention pertains to the field of wireless communication. More particularly, the present invention pertains to the random access procedure that a User Equipment (UE) (wireless communication terminal) follows for (among other uses) initial network access.

2. *Discussion of related art*

The evolved UTRA (E-UTRA or evolved UMTS (Universal Mobile Telecommunication System) Terrestrial Radio Access) network architecture includes a radio access network (providing UEs access to a core network of a cellular communication system) where the radio resources are divided into blocks of time (sub-frames) and frequency (frequency blocks). In the uplink, these blocks are used either for what is called here the Shared CHannel (SCH) or the contention-based Random Access CHannel (RACH). (The designation SCH is used here only to indicate uplink radio resources from which a base station can allocate a share for each individual UE, not any particular channel that may be designated by the acronym SCH.) The E-UTRA network includes entities that are called here base stations, and are elsewhere sometimes called Node-Bs, or eNBs. A base station of an E-UTRA network allocates SCH resources for UEs and RACH is used by the UEs to access the network or request SCH resources (or possibly to communicate a small amount of user data in some networks under some circumstances). RACH is also used in networks other than E-UTRA type radio network. RACH is in general a contention-based resource (as opposed to a shared resource) used by UEs to access a radio access network typically for initial access and bursty data transmission.

In the prior art, the random access procedure is used (i.e. RACH is used or an analogous contention-based resource) when a UE needs to transmit user traffic (voice or data) or send a synchronization burst but the UE does not have an allocation of system resources on SCH. The UE may want to perform initial network access, make a location area update, move from the idle mode to the active state, or request capacity while in the active state. The random access procedure ends in an E-UTRA network when the radio access network gives the UE a timing advance value (to compensate for the time between sending a message to the radio access network and the latter receiving the message, and vice versa) and an allocation on SCH (for use as a traffic channel for sending voice or user data to the radio access network).

The problem is to design a random access procedure that provides good coverage and low delay, with minimum use of resources.

The prior art teaches transmitting the random access message (over RACH) on a constant frequency band. It can be advantageous to use a non-constant frequency band. In addition, it can be advantageous to use HARQ (hybrid automatic repeat request processing) in connection with the random access procedure.

The invention can involve what is called here a temporary cell specific address, and now in the art sometimes called a C-RNTI (Cell Radio Network Temporary Identity). The temporary cell specific address/ C-RNTI is shorter (e.g. 16 bits) than other unique identifiers such as TMSI (temporary mobile subscriber identifier), IMSI (international mobile subscriber identity), and IMEI (international mobile equipment identity), and so can be used more easily. All the resource allocations are made using the temporary cell specific address (to identity the receiver of the resources). A UE can receive a temporary cell specific address when it first establishes communication with a cell.

DISCLOSURE OF INVENTION

Accordingly, in a first aspect of the invention, a method is provided for use by a user equipment wireless communication terminal in communicating with a base station of a radio access network of a

wireless communication system, comprising: (a) providing for transmission over a random access channel of the wireless communication system a message burst preamble, and including a signature with the preamble; (b) receiving from the base station in response one or more messages indicating an acknowledgment of having received the preamble and providing a preamble identifier and a resource allocation of a shared channel; and (c) providing a message burst for transmission on the shared channel according to the resource allocation, but not until receiving the messages indicating an acknowledgment and providing a resource allocation, and including an address in the message burst for use in identifying the user equipment.

In accord with the first aspect of the invention, the resource allocation may be provided in a message separate from the message indicating the acknowledgment.

Also in accord with the first aspect of the invention, the address may be a temporary cell specific address or a random address.

Also in accord with the first aspect of the invention, the method may further comprise: receiving a request for retransmission from the base station indicating the preamble identifier; and providing the message burst for retransmission to the base station. In this, the request for retransmission may be a signal from the base station on a downlink shared control channel indicating an uplink resource allocation and including the preamble identifier.

Also in accord with the first aspect of the invention, the method may further comprise receiving an acknowledgement of the base station having received the message burst. In this, the acknowledgement may be a signal from the base station on a downlink shared control channel indicating a downlink resource allocation and including the preamble identifier, and the user equipment may be configured to decode the signal and obtain an address indicated by the signal, and then compare the address with the address included by the user equipment in the message burst to determine if the acknowledgement is an acknowledgement of the message burst or

instead the acknowledgement of a message burst from another user equipment.

Also in accord with the first aspect of the invention, the method may further comprise frequency-hopping the message burst preamble, i.e.: providing for transmission a portion of the message burst using a first narrow frequency range of the shared channel frequency range; and providing for transmission another portion of the message burst using a second narrow frequency range of the shared channel frequency range different from the first narrow frequency range. The preamble may also be frequency-hopped (but on the random access channel).

Also in accord with the first aspect of the invention, the method may further comprise obtaining from the one or more messages indicating the acknowledgement (of the preamble) a digest of the signature or a signature number, and determining whether the acknowledgment is an acknowledgement of the preamble sent by the user equipment or an acknowledgment of a message from another user equipment wireless communication device.

Also in accord with the first aspect of the invention, the method may further comprise receiving from the base station a further allocation of the shared channel for uplink of user data in response to the message burst, wherein the allocation is provided with the address provided by the user equipment, and wherein the message burst includes information bits providing information useable by the base station in determining the further allocation to assign to the user.

In a second aspect of the invention, a method is provided for use by a base station of a radio access network of a wireless communication system in communicating with a user equipment wireless communication terminal, comprising: (a) receiving over a random access channel of the wireless communication system a message burst preamble and a signature; (b) providing for transmission one or more messages in response to the message burst preamble, wherein the one or more messages indicate an acknowledgment of having received the preamble and include a preamble identifier and a resource allocation of at least a portion of a shared channel; and (c) receiving a

message burst on the shared channel according to the resource allocation, decoding the message burst, and obtaining an address in the message burst for use in identifying the user equipment.

Equipment (for a user and for a radio access network) and computer program products (for user equipment and for radio access network equipment) corresponding to the first and second aspects of the invention are also provided.

Brief Description of the Drawings

The above and other objects, features and advantages of the invention will become apparent from a consideration of the subsequent detailed description presented in connection with accompanying drawings, in which:

Figure 1 is a block diagram/ flow diagram of a wireless communication system in which the present invention may be implemented, including various communication terminals, and in particular a user equipment (UE) wireless communication terminal and a wireless communication terminal of a radio access network (RAN) used for wireless coupling to user equipment.

Figure 2 is a reduced block diagram (only portions relevant to the invention being shown) of the UE terminal or the wireless terminal of the RAN of Figure 1.

Figure 3 is a schematic showing a random access preamble on RACH and a subsequent random access message burst on SCH, according to an embodiment of the invention.

Figure 4 is a signaling flow for the random access procedure according to an embodiment of the invention, including one retransmission of a (random access) message burst shown as an example.

Best Mode For Carrying Out The Invention

The invention involves or is related to cooperation between elements of a wireless communication system, and in particular between a user equipment (UE) wireless communication terminal and the element of a radio access network of a wireless communication system by which the UE connects to the wireless communication

system. Examples of a wireless communication system include implementations of GSM (Global System for Mobile Communication) and implementations of UMTS (Universal Mobile Telecommunication System). Each such wireless communication system includes a radio access network (RAN). In UMTS, the RAN is called UTRAN (UMTS Terrestrial RAN). A UTRAN includes one or more Radio Network Controllers (RNCs), each having control of one or more Node Bs, which are wireless terminals configured to communicatively couple to one or more UE terminals. The combination of an RNC and the Node Bs it controls is called a Radio Network System (RNS). A GSM RAN includes one or more base station controllers (BSCs), each controlling one or more base transceiver stations (BTSs). The combination of a BSC and the BTSs it controls is called a base station system (BSS).

Referring now to Figure 1, a wireless communication system 10a in which the present invention may be implemented is shown, including a UE (wireless communication) terminal 11, a radio access network 12, a core network 14 and a gateway 15, coupled via the gateway to another communications system 10b, such as the Internet, wireline communication systems (including the so-called plain old telephone system), and/or other wireless communication systems. The radio access network includes a wireless terminal 12a (e.g. a Node B or a BTS, both of which are called here simply a base station) and a controller 12b (e.g. a RNC or a BSC). The controller is in wireline communication with the core network. The core network typically includes a mobile switching center (MSC) for circuit-switched communication, and a serving general packet radio service (GPRS) support node (SGSN) for packet-switched communication.

LTE, or Long Term Evolution (also known as 3.9G), refers to research and development involving the Third Generation Partnership Project (3GPP) aimed at identifying technologies and capabilities that can improve systems such as the UMTS. Generally speaking, a prefix of the letter "E" in upper or lower case signifies LTE. The E-UTRAN consists of eNBs (E-UTRAN or enhanced Node Bs), providing the E-UTRA user plane (RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The eNBs are interconnected with each other by means of a so-called X2 interface, and are also connected by means of a so-called S1 interface to an EPC (evolved packet

core), e.g. to the MME (mobility management entity) and the UPE (user plane entity) which may form an access gateway (aGW). The S1 interface supports a many-to-many relation between MMEs/UPEs and eNBs, and provides a functional split between the MME and the UPE.

Figure 2 shows some components of a communication terminal 20, which could be either the UE terminal 11 or the RAN wireless terminal 12a of Figure 1, i.e. what is called here a base station (and so what encompasses a base transceiver station, a Node-B or a eNB). The communication terminal includes a processor 22 for controlling operation of the device, including all input and output. The processor, whose speed/timing is regulated by a clock 22a, may include a BIOS (basic input/output system) or may include device handlers for controlling user audio and video input and output as well as user input from a keyboard. The BIOS/ device handlers may also allow for input from and output to a network interface card. The BIOS and/or device handlers also provide for control of input and output to a radio front end 25 including a transceiver (TRX) 25b and a TRX interface 25a, the TRX interface including possibly one or more digital signal processors (DSPs), application specific integrated circuits (ASICs), and/or field programmable gate arrays (FPGAs). The TRX enables communication over the air with another similarly equipped communication terminal. The communication terminal may also include (depending on the application) other I/O devices, such as a keyboard and a mouse or other pointing device, a video display, a speaker/ microphone, and also a network interface (card), allowing wireline communication with other communication terminals, and in particular such communication over the Internet.

Still referring to Figure 2, the communication terminal includes volatile memory, i.e. so-called executable memory 23, and also non-volatile memory 24, i.e. storage memory. The processor 22 may copy applications (e.g. a calendar application or a game) stored in the non-volatile memory into the executable memory for execution by the processor. The processor functions according to an operating system, and to do so, the processor may load at least a portion of the operating system from the storage memory to the executable memory in order to activate a corresponding portion of the operating system. Other parts of the operating system, and in particular

often at least a portion of the BIOS, may exist in the communication terminal as firmware, and are then not copied into executable memory in order to be executed. The booting up instructions are such a portion of the operating system.

The functionality described below (for both a base station of the radio access network and for the UE) can be implemented as software modules stored in a non-volatile memory, and executed as needed by a processor, after copying all or part of the software into executable RAM (random access memory). Alternatively, the logic provided by such software can also be provided by an ASIC (application specific integrated circuit). In case of a software implementation, the invention can be provided as a computer program product including a computer readable storage structure embodying computer program code--i.e. the software--thereon for execution by a computer processor. An example is a so-called floppy disk having instructions for performing a method according to the invention encoded on the disk in machine (processor) readable form.

Now the invention in particular provides a random access procedure for use by a UE in obtaining a resource allocation on SCH for uplinking user data, and for use by a base station of a radio access network in providing the allocation. One or more embodiments of the invention provide one or more of the following (independent) features for the random access procedure in a radio access network such as, for example, the E-UTRA network, i.e. an evolved version of a UTRA network now under development by the 3GPP (third generation partnership program):

A. *Preamble identifier in acknowledgment to preamble.* To obtain an allocation on SCH, a UE transmits to a base station using RACH a preamble to a random access message burst, including in the preamble a signature (a signature being typically a pseudo-random code, conveyed typically as a 1 ms long waveform, intended as a temporary means of identifying the UE and/or the random access message). The UE then sends the base station the random access message burst itself, on SCH, but only after the base station has acknowledged (on DSCCH, i.e. downlink shared control channel) having received the preamble and has provided an allocation on SCH for

uplinking the message burst, and further, the base station provides a preamble identifier with (one or more messages indicating) the acknowledgment. (The preamble may consist of only the signature, in which case the signature serves as the preamble, or may also include other components.) Using the preamble identifier, the base station can ask the UE to retransmit the random access message burst in case of an error in reception. The base station can then improve detection probability by combining the repeated transmissions (in what is called soft combining). More specifically:

- The UE transmits the preamble including (possibly only) a signature on the random access channel in one of the time-frequency resources reserved for preambles.
- If the base station (or Node-B or eNB) of the radio access network observes the signature, it associates a preamble identifier with the signature and the time-frequency resource, i.e. it keeps in a data store a table or other data structure relating the preamble identifier to the signature and the time-frequency resource.
- The base station then sends the signature index, and if needed, also the time and frequency index of the preamble, and also the preamble identifier as an acknowledgment.
- The UE receives the one or more messages indicating the acknowledgment (and providing the preamble identifier, and so on). The UE checks the signature, frequency and time indexes, and if the indexes correspond to the signature, frequency and transmission time of the preamble, the UE identifies itself with the preamble identifier and checks if resources are allocated with the acknowledgement.
- The base station can immediately allocate a resource, i.e. a time and frequency on SCH for the random access message burst, or it can postpone allocation. When a suitable resource (time and frequency on SCH) becomes free, the base station allocates the resource to the UE for transmission of the message burst, using the preamble identifier to direct the allocation to the UE.

- The UE transmits the message burst on the resource (a time and frequency on SCH) allocated by the base station, and includes in it a temporary address for the UE. The base station associates the message burst with its preamble based on the time and frequency used by the UE to transmit the message burst.
- The UE continues to check whether the base station requires retransmission by checking for retransmission requests including the preamble identifier. The checking continues until the UE receives an acknowledgment for the message burst (i.e. that the base station has succeeded in decoding the message burst) or until the preamble identifier expires, which might typically occur 10 ms after transmission of the preamble.
- The message burst includes, at least in some embodiments, an information field providing information useable by the radio access network in determining a further allocation to make to the UE to uplink user data. The message burst may also, itself, convey user data, and the UE may not require a further allocation on SCH. If a further allocation is required, the radio access network uses the information field in determining what further allocation on SCH to assign to the UE, and provides the allocation to the UE on DSCCH, possibly using the temporary address included in the message burst (in case the UE has a CRNTI), a CRNTI given for the UE in response to the random access message burst (in case the UE sent a random id in message) or even the preamble identifier (in case the Node-B allocates a CRNTI in the preamble response, i.e. in case the preamble identifier is a new CRNTI for the UE).

B. *Hopping*. Transmission of the random access message is extended over a few sub-frames using a narrow frequency band during each sub-frame but hopping the frequency between the sub-frames.

From the standpoint of the user equipment then, noteworthy features of a random access procedure according to the invention are first, that the UE obtains a preamble identifier from an acknowledgement of the preamble, and second, that the resource allocation for the random access message can be separate from the preamble acknowledgement, and third, that after sending the random

access message, the UE must try to detect not only an acknowledgement of the message but also any request for retransmission of the random access message burst. Further, the separate preamble and/ or the random access message burst may be frequency hopped.

From the standpoint of the base station, noteworthy features of a random access procedure according to the invention are that the base station assigns a preamble identifier for addressing the UE, and uses the preamble identifier to request retransmissions as needed, and utilizes HARQ (soft-combining) for decoding the random access message burst (on SCH).

Advantages

An advantage accruing from the use of a separate preamble and a preamble identifier is that HARQ can be used in the reception of the random access message burst. HARQ improves detection probability. Coverage is improved and also any delay is reduced since a UE does not have to restart a random access process from the preamble phase if the base station does not succeed in decoding after the first transmission; the UE just retransmits the message burst, using the preamble identifier to determine what to retransmit.

An advantage accruing from the use of frequency hopping is that good frequency diversity and coverage are obtained using fewer resources than in prior art systems, where the message is transmitted on a constant and wide frequency band. Frequency hopping randomizes both the fading of the UE's own signal and also interference: it is unlikely that fading and interference conditions are unfavorable on all the frequencies in a hopping pattern.

Preamble identifier and temporary address and determining whether a message burst has been acknowledged

Note that the invention uses a preamble identifier and a temporary address, but for different purposes. The preamble identifier is given by the base station for asking for retransmissions of the random access message burst. The temporary address, which can be a random address or a temporary cell specific

address, is included by the UE in the message burst for the UE to be able to unambiguously identify messages intended for the UE. If the UE does not have a temporary cell specific address, the UE chooses a random address as a temporary address. After the UE sends the temporary address to the base station in the random access message burst, the UE then reads the downlink shared control channel (DSCCH), searching for uplink and downlink resource allocations that are directed to the UE using the UE's preamble identifier. An uplink resource allocation is understood by the UE as indicating that the UE must retransmit its random access message burst. A downlink resource allocation means that the base station has correctly decoded a random access message burst (per a CRC check), but not necessarily the message burst from the UE. The downlink resource allocation indicates a downlink shared channel resource the UE is to decode so as to obtain a temporary address. If the temporary address in the downlink message agrees with the UE's temporary address, the UE knows that the procedure was successful. On the other hand, if the temporary addresses do not agree, the UE is configured to terminate the procedure, since if the temporary addresses are not the same, the UE's preamble likely collided with the preamble of another UE (i.e. both the UE and another UE used the same access slot). To obtain a random address for use as a temporary cell specific address, the UE selects an address randomly from a set of addresses provided by a System Info message broadcast by the base station, which the UE reads after it has approximately synchronized to the base station (by procedures not the subject of the invention), i.e. synchronized except for taking into account propagation delays based on the UE to base station separation.

Content of the Random access message burst

The probability that UEs might collide on the SCH after the RACH process should be made very small because such collisions would mean that there are UEs transmitting with a wrong timing advance and causing intra cell interference. In order to reach a low enough collision probability, a long enough random or an unambiguous UE address should be acknowledged during the random access procedure.

Therefore, according to some embodiments of the invention, the random access message burst (which is sent on SCH) includes:

- A temporary address (from 10 to 16 bits) that is the temporary cell specific address or a long enough random address serving as the temporary cell specific address. The temporary cell specific address would be used instead of the IMSI (International Mobile Subscriber Identity) stored in the Subscriber Identity Module (SIM) because transmission of the IMSI would unnecessarily prolong the message.
- A small number (of the order of a byte or less) of information bits useable by the radio access network in making a further SCH allocation to the UE.
- A Cyclic Redundancy Check (CRC) word.

The information bits could be used to indicate the need for (further) SCH communication resources, such as for an emergency call. Furthermore, the amount of data to be transmitted on the SCH could be roughly indicated.

Frequency hopping and Frame format of the random access message burst

Good frequency diversity is essential for obtaining short delays in the random access procedure. If the random access message burst has to be prolonged over a few sub-frames in order to give sufficient coverage, frequency diversity can be obtained economically by transmitting on the smallest possible bandwidth during each sub-frame but hopping the frequency between the sub-frames. This is illustrated in Figure 3, showing a message burst extending over four sub-frames of SCH, i.e. comprising four sections, each occupying a respective sub-frame. The message burst consumes four resource blocks on SCH of 0.5 ms by 312.5 kHz. (This minimum frequency allocation of 312.5 kHz is just an example. The time frame could be two sub-frames or could be instead even less than a subframe.) As illustrated, a section of the message comprises a pilot or signature part, and data symbols, i.e. the payload, and each section is followed by a guard time/ period (a portion of a sub-frame). The total length of a section of the

message burst is therefore less than 0.5 ms (i.e. less than one sub-frame on SCH) because of the guard time, which is needed because of the UE not (at least sometimes) having a timing advance at this stage in the communication. Figure 3 also show frequency hopping of the preamble (on RACH).

The encoding scheme for the message burst should preferably be such that each sub-frame is self-decodable. In the simplest example, identical symbols are transmitted during each sub-frame. In good conditions, the base station would succeed in decoding the message burst from the first sub-frame, which could speed-up the random access procedure, save resources and reduce interference if the base station could communicate an acknowledgment before the UE has sent the remainder of the message burst.

Other options for the length of the sections of a random access message burst can be considered. For example, a section can be longer than one sub-frame or even shorter than one sub-frame. Also, there can be gaps in the transmission of a message burst by a UE, so that the UE is silent during one or more sub-frames between transmitted sections of the message burst. This would allow time for the base station to terminate the message burst transmission if the base station succeeds in decoding the message burst after only the first section.

The frame format of a random access message burst according to the invention can be utilized in other cases when the timing advance for communication between a UE and a base station is uncertain but the UE has obtained a cell specific temporary address. Such a case is handover when handover is handled as in GSM (Global System for Mobile communication). Then the UE would get the address for the target cell through the serving base station. The target base station would start to allocate uplink resources when the UE should be ready to read the downlink shared control channel (DSCCH) carrying information on uplink communication channel allocations. The first transmission by the UE would be made with a frame format allowing uncertainty of timing advance, as in the frame format of a random access message burst according to the invention, i.e. the UE would start transmission in the target cell using the frame format

of the invention even though there is no contention of the uplink communication resource in the case of handover.

Detail of illustrative embodiment of random access procedure with a separate preamble phase, i.e. preamble identifier provided with ACK by base station (Figure 4)

The signaling flow of a random access procedure according to an embodiment of the invention is shown in Figure 4. In this embodiment access slots of RACH are reserved for sending preambles. The UE chooses an access slot and sends to the (serving) base station (eNB in E-UTRA) a preamble with a signature selected from a small set (e.g. 16). After a fixed period of time from reception of the preamble by the base station, i.e. after the base station actually receives the preamble, the base station sends a first feedback message (indicated as feedback 1 in Figure 4) on DSCCH one or more messages serving to acknowledge receipt of the preamble, and includes in the first feedback a digest of the signature or an index of the signature (serving to identify to the UE the preamble being acknowledged, and so the first feedback is understood by the user equipment to be an acknowledgement because the first feedback identifies the preamble via the signature included in the preamble), a transmit power adjustment field, and a short identifier called here a preamble identifier (indicated as preamble-id in Figure 4), and also a pointer to a resource on SCH for sending the random access message burst (i.e. the data/ payload). The pointer need not necessarily be given in the same message as the preamble identifier, because the pointer can be provided to the UE in a follow-up message (still part of feedback 1) addressed also to the UE using the preamble identifier. Note that the resources for the message burst are reserved only after the base station observes a preamble, and note also that UEs with different signatures would be given different resources for transmission of their respective message bursts. The resources for the preambles and the cell specific access parameters are given in the System Info broadcast by the base station.

Now one or more UEs may recognize themselves from the preamble identifier of the first feedback and would then associate themselves

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with the preamble identifier (because it is possible for more than one UE to transmit a preamble at the same time, since the RACH is a contention-based resource, i.e. it is not shared via a multiple access mechanism). Each such UE will read the downlink shared control channel (DSCCH), and when a resource on (uplink) SCH is pointed to on the DSCCH using the preamble identifier, the UE will send its random access message burst via the resource, using a zero timing advance. The message burst fields are as explained above, i.e. a temporary address, information bits, and a CRC word. The probability that two UEs would have the same temporary address field is small because the address is either a unique or at least relatively long random bit sequence. After a successful reception of the message burst, the base station sends a second feedback (indicated as feedback 2 in Figure 4), which contains the temporary address, the timing advance value, and a pointer to a further SCH resource to continue the uplink/ message exchange, as needed. After this second feedback, only the UE terminals that find their temporary address in the second feedback would continue the message exchange. Terminals that succeed in decoding the second feedback but that do not find their temporary address in it must start the random access procedure from the beginning.

If the base station does not succeed in decoding the random access message burst from a particular one of the one or more UEs, it can ask the UE to retransmit the message burst by addressing the UE again with the preamble identifier, which is used for allowing the base station to request retransmission, whereas the temporary address is for separating UE's that have chosen the same signature and access slot. The base station can then soft combine the symbols of the latest received random access message burst from the UE with the symbols of the earlier transmissions, i.e. the base station can use HARQ processing in the random access procedure. This greatly improves the probability of detection. The base station may also optimize for delay by asking the UE to repeat transmission of the random access message before trying to decode it.

The preamble identifier can be short (e.g. 5 bits) if it is predetermined that the preamble identifier is to be valid only for a relatively short time (e.g. 10 ms) after it has been associated by

the base station with a signature observed by the base station in a certain time and frequency resource. A time period of 10 ms would still allow time for a few retransmissions of the message part.

It may not be useful to send the timing advance to a UE terminal in the first feedback since two UE terminals, say terminal X and terminal Y, might have sent a preamble with the same signature but the base station has only detected the preamble sent by terminal X. The timing advance suitable for terminal Y could be completely different from the one for terminal X. When terminal Y transmits with the timing advance meant for terminal X, the transmission could overlap a previous or later timeslot. After the UEs address has been indicated in the second feedback, the collision probability becomes sufficiently small for the application of timing advance. So the timing advance is advantageously provided in the second feedback, as indicated in Figure 4.

Note that with a random access procedure according to the invention, two UEs send their respective random access message bursts on the same resource (of SCH) only if they have chosen the same preamble signature.

Utilization of frequency hopping during transmission of the random access message burst is advantageous, too. Both the (separate) preamble and the message burst can be divided into sections that are transmitted at different frequencies.

An illustrative example

The following is an example of the use of the random access procedure according to one embodiment of the invention, in the case where a UE uses the random access procedure to request an allocation on the shared channel SCH for uplinking user data. (Although in this example, the UE uses the random access message burst only for indicating the need for an allocation on SCH, so that the base station can determine how much of a resource is needed, the invention also allows a UE to use the information bits in the random access message burst itself to uplink user data.)

Preamble

The preamble is transmitted on RACH in a narrow BW (e.g. resource chunk of 1.25MHz/3) of RACH. See Figure 3. Its length is set to two sub-frames. The frequency is hopped between the sub-frames in order to gain diversity.

The symbol sequence is chosen randomly from a set of signatures. The random selection is repeated for every retransmission. The set of available signatures is given in the so-called System Info broadcast by the base station.

Open loop power control is utilized: the transmission power is tuned according to the measured downlink attenuation and the desired power level in the base station receiver. In addition, power ramp-up is done if the preamble transmission has to be repeated. The parameters are given in the System Info.

The density of access slots is chosen according to the RACH load and the delay requirements (waiting for the first access slot must not take too long).

The time window for selection of the access slot is growing exponentially with each repeated transmission of the preamble, or some other way of randomizing transmission times is utilized.

Preamble acknowledgment

Preamble acknowledgment is provided in the Allocation Table transmitted on the downlink shared control channel (DSCCH).

The base station measures impulse response for each signature and access slot and sends an acknowledgment in downlink, if it observes a preamble.

The fields in the positive acknowledgment are:

- The signature number or a digest of the signature sent by the UE. The access slot number is not necessary if the acknowledgment can be sent in the downlink sub-frame with fixed offset in relation to the access slot. Even with the largest system bandwidth, (time) overlapping access slots that can be separated only by the frequency are likely not needed.

- The resource allocation (on SCH) for the message burst (i.e. time and frequency slots on SCH, for the UE to uplink the random access message burst). As noted above, the resource allocation can be postponed to be sent separately from the rest of the acknowledgement.
- A short identifier preamble identifier (preamble-id) for the base station would to use to ask for a repeat transmission of the message burst.
- Power adjustment relative to the preamble power.

Providing a timing advance (value) may not be useful in this stage because, depending on the load and the number of signatures and access slots, it can become too probable that two or more UEs might send preambles in the same access slot with the same signature. The timing advance value would be correct for only one of them.

The base station can also send a NACK: UEs that had sent a preamble in the access slot have to stop the RACH procedure. This provides means to recover from RACH overload.

The random access message burst

The random access message burst is sent on SCH using a narrow bandwidth (e.g. resource chunk of 1.25 MHz/3) and extending over a few sub-frames, hopping the frequency between the sub-frames. A tentative value for the length of the burst is 4 sub-frames. The prolonging over a few sub-frames seems necessary in order to fulfill the coverage requirements.

Exemplary content of the random access message burst is:

- Temporary cell specific address or a random address (e.g. 16 bits), if the temporary cell specific address does not exist;
- Information bits, i.e. up to 10 bits (or possibly more) for informing the base station of the need for the requested communication resources; and
- a CRC word (e.g. 12 or 16 bits).

The random address has to be long enough since it separates all UEs that have sent preambles in the same access slot with the same signature.

Acknowledgment of the random access message burst

Acknowledgement of the random access message burst is provided in the Allocation Table that is transmitted on the shared control channel in downlink. If the CRC fails, the base station can ask for retransmission of the message burst by using the preamble identifier it provided in acknowledgment of the preamble. If the CRC succeeds, the UE's address (temporary cell specific or random) is acknowledged. A temporary cell specific address is given if the UE sent a random address.

The timing advance can be used after receiving the acknowledgment of the random access message burst because the temporary cell specific address has identified the UE uniquely and the random address nearly uniquely.

A resource allocation (on SCH) for the uplink message can be given as a regular SCH entry in the Allocation Table.

Discussion

So in this illustrative example of a UE attempting to obtain an allocation on SCH, a UE sends a preamble with a signature on RACH. The base station acknowledges on DSCCH with a preamble identifier, an index (also called a signature number) of the signature (although a digest of the signature could be sent instead) so that the UE knows the ACK is to its preamble, and a SCH (shared channel) allocation (a time slot and frequency on SCH) for transmission of the random access message burst (which may be given in a different message than the preamble identifier). The UE then sends the message burst (including the info field, indicating the need for a further allocation on SCH) with the preamble identifier on the allocated time slot and frequency. There can be a collision, since another UE could have sent a preamble with identical parameters and thus obtained the same SCH allocation for the random access message. In the message burst, the UE includes a temporary address the base station can use to identify the UE. The base

station asks the UE for repeats as necessary, using the DSCCH, if it cannot decode the message burst (possibly using soft-combining/ HARQ in its attempts to decode), and the base station uses the preamble identifier to address the repeat request to the UE. (The base station knows what preamble identifier to use based on the time slot and frequency used by the UE to transmit the message burst). The base station succeeds in decoding the message burst, and then makes a further SCH allocation to the UE (via DSCCH), and the further SCH allocation is addressed to the UE using the address the UE included in the message burst or using the preamble identifier or a temporary cell specific identifier that the base station provides for the UE in the acknowledgement of the random access message.

Conclusion

It is to be understood that the above-described arrangements are only illustrative of the application of the principles of the present invention. Numerous modifications and alternative arrangements may be devised by those skilled in the art without departing from the scope of the present invention, and the appended claims are intended to cover such modifications and arrangements.

What is claimed is:

1. A method for use by a user equipment wireless communication terminal in communicating with a base station of a radio access network of a wireless communication system, comprising:

(a) providing for transmission over a random access channel of the wireless communication system a message burst preamble, and including a signature with the preamble;

(b) receiving from the base station in response one or more messages indicating an acknowledgment of having received the preamble and providing a preamble identifier and a resource allocation of a shared channel; and

(c) providing a message burst for transmission on the shared channel according to the resource allocation, but not until receiving the messages indicating the acknowledgment and providing the resource allocation, and including an address in the message burst for use in identifying the user equipment.

2. The method of claim 1, wherein the resource allocation is provided in a message separate from the message indicating the acknowledgment.

3. The method of claim 1, wherein if the user equipment has a temporary cell specific address then the user equipment uses the temporary cell specific address as the address.

4. The method of claim 1, further comprising:

receiving a request for retransmission from the base station indicating the preamble identifier; and

providing the message burst for retransmission to the base station.

5. The method of claim 4, wherein the request for retransmission is a signal from the base station on a downlink shared control channel indicating an uplink resource allocation and including the preamble identifier.

6. The method of claim 1, further comprising receiving an acknowledgement of the base station having received the message burst, wherein the acknowledgement is a signal from the base station on a downlink shared control channel indicating a downlink resource allocation and including the preamble identifier, and wherein the user equipment is configured to decode the signal and obtain an address indicated by the signal, and then compare the address with the address included by the user equipment in the message burst to determine if the acknowledgement is an acknowledgement of the message burst or instead the acknowledgement of a message burst from another user equipment.

7. The method of claim 1, further comprising:

providing for transmission a portion of the message burst using a first narrow frequency range of the shared channel frequency range; and

providing for transmission another portion of the message burst using a second narrow frequency range of the shared channel frequency range different from the first narrow frequency range.

8. The method of claim 1, further comprising providing the preamble for transmission in part using a first narrow frequency range of the random access channel frequency range and in part using a second narrow frequency range of the random access channel frequency range different from the first.

9. The method of claim 1, further comprising obtaining from the one or more messages indicating the acknowledgement a digest of the signature or a signature number, and determining whether the acknowledgment is an acknowledgement of the preamble sent by the user equipment or an acknowledgment of a message from another user equipment wireless communication device.

10. The method of claim 1, further comprising receiving from the base station a further allocation of the shared channel for uplink of user data in response to the message burst, wherein the allocation is provided with the address provided by the user equipment, and wherein

the message burst includes information bits providing information useable by the base station in determining the further allocation to assign to the user.

11. A computer program product comprising a computer readable storage structure embodying computer program code thereon for execution by a computer processor, wherein said computer program code comprises instructions for performing a method according to any of claims 1-10.

12. An apparatus for use by a user equipment wireless communication terminal in communicating with a base station of a radio access network of a wireless communication system, comprising means for performing the method of any of claims 1-10.

13. An apparatus for use by a user equipment wireless communication terminal in communicating with a base station of a radio access network of a wireless communication system, comprising a processor configured to:

(a) provide for transmission over a random access channel of the wireless communication system a message burst preamble, and including a signature with the preamble;

(b) receive from the base station in response one or more messages indicating an acknowledgment of having received the preamble and providing a preamble identifier and a resource allocation of a shared channel; and

(c) provide a message burst for transmission on the shared channel according to the resource allocation, but not until receiving the messages indicating the acknowledgment and providing the resource allocation, and to include an address in the message burst for use in identifying the user equipment.

14. The apparatus of claim 13, wherein the processor is configured to receive the resource allocation in a message separate from the message indicating the acknowledgment.

15. The apparatus of claim 13, wherein the processor is so

configured that if the user equipment has a temporary cell specific address then the user equipment uses the temporary cell specific address as the address.

16. The apparatus of claim 13, wherein the processor is further configured to:

receive a request for retransmission from the base station indicating the preamble identifier; and

provide the message burst for retransmission to the base station.

17. The apparatus of claim 16, wherein the request for retransmission is a signal from the base station on a downlink shared control channel indicating an uplink resource allocation and including the preamble identifier.

18. The apparatus of claim 13, wherein the processor is further configured to receive an acknowledgement of the base station having received the message burst, wherein the acknowledgement is a signal from the base station on a downlink shared control channel indicating a downlink resource allocation and including the preamble identifier, and wherein the processor is configured to decode the signal and obtain an address indicated by the signal, and then compare the address with the address included by the user equipment in the message burst to determine if the acknowledgement is an acknowledgement of the message burst or instead the acknowledgement of a message burst from another user equipment.

19. The apparatus of claim 13, wherein the processor is further configured to:

provide for transmission a portion of the message burst using a first narrow frequency range of the shared channel frequency range; and

provide for transmission another portion of the message burst using a second narrow frequency range of the shared channel frequency range different from the first narrow frequency range.

20. The apparatus of claim 13, wherein the processor is further configured to provide the preamble for transmission in part using a first narrow frequency range of the random access channel frequency range and in part using a second narrow frequency range of the random access channel frequency range different from the first.

21. The apparatus of claim 13, wherein the processor is further configured to obtain from the one or more messages indicating the acknowledgement a digest of the signature or a signature number, and determine whether the acknowledgment is an acknowledgement of the preamble sent by the user equipment or an acknowledgment of a message from another user equipment wireless communication device.

22. The apparatus of claim 13, wherein the processor is further configured to receive from the base station a further allocation of the shared channel for uplink of user data in response to the message burst, wherein the allocation is provided with the address provided by the user equipment, and wherein the message burst includes information bits providing information useable by the base station in determining the further allocation to assign to the user.

23. A user equipment wireless communication terminal, comprising:

an apparatus as in claim 13; and

a radio front end for transmitting the preamble and the message burst, and for receiving the acknowledgement.

24. A method for use by a base station of a radio access network of a wireless communication system in communicating with a user equipment wireless communication terminal, comprising:

(a) receiving over a random access channel of the wireless communication system a message burst preamble and a signature; and

(b) providing for transmission one or more messages in response to the message burst preamble, wherein the one or more messages indicate an acknowledgment of having received the preamble and include a preamble identifier and a resource allocation of at least a portion of a shared channel; and

(c) receiving a message burst on the shared channel according to the resource allocation, decoding the message burst, and obtaining an address in the message burst for use in identifying the user equipment.

25. The method of claim 24, wherein the resource allocation is provided in a message separate from the message indicating the acknowledgment.

26. The method of claim 24, wherein when the user equipment has a temporary cell specific address the address included in the message burst is the temporary cell specific address.

27. The method of claim 24, further comprising:

providing for transmission to the user equipment a request to retransmit the message burst, and including the preamble identifier in the request in order to identify the message burst; and

receiving the retransmitted message burst and soft-combining the retransmitted message burst with previous transmissions of the message burst.

28. The method of claim 27, wherein the request to retransmit the message burst is a signal from the base station on a downlink shared control channel indicating an uplink resource allocation and including the preamble identifier.

29. The method of claim 24, further comprising providing an acknowledgement of the base station having received the message burst, wherein the acknowledgement is a signal from the base station on a downlink shared control channel indicating a downlink resource allocation and including the preamble identifier.

30. The method of claim 24, further comprising:

receiving a portion of the message burst using a first narrow frequency range of the shared channel frequency range; and

receiving another portion of the message burst using a second narrow frequency range of the shared channel frequency range different from the first narrow frequency range.

31. The method of claim 24, further comprising receiving the preamble in part in a first narrow frequency range of the random access channel frequency range and in part in a second narrow frequency range of the random access channel frequency range different from the first.

32. The method of claim 24, further comprising providing in the acknowledgement a digest of the signature or a signature number.

33. The method of claim 24, further comprising providing to the user equipment a further allocation of the shared channel for uplink of user data in response to the message burst, wherein the allocation is provided with the address provided by the user equipment, and wherein the base station decodes information bits included in the message burst and determines the further allocation at least in part based on the information bits.

34. A computer program product comprising a computer readable storage structure embodying computer program code thereon for execution by a computer processor, wherein said computer program code comprises instructions for performing a method according to any of claims 24-33.

35. An apparatus for use by a base station of a radio access network of a wireless communication system in communicating with a user equipment wireless communication terminal, comprising means for performing a method according to any of claims 24-33.

36. An apparatus for use by a base station of a radio access network of a wireless communication system in communicating with a user equipment wireless communication terminal, comprising a processor configured to:

(a) receive over a random access channel of the wireless communication system a message burst preamble and a signature; and

(b) provide for transmission one or more messages in response to the message burst preamble, wherein the one or more messages indicate an acknowledgment of having received the preamble and include a preamble identifier and a resource allocation of at least a portion of a shared channel; and

(c) receive a message burst on the shared channel according to the resource allocation, decode the message burst, and obtain an address from the message burst for use in identifying the user equipment.

37. The apparatus of claim 36, wherein the processor is further configured to provide the resource allocation in a message separate from the message indicating the acknowledgment.

38. The apparatus of claim 36, wherein when the user equipment has a temporary cell specific address the address included in the message burst is the temporary cell specific address.

39. The apparatus of claim 36, wherein the processor is further configured to:

provide for transmission to the user equipment a request to retransmit the message burst, and include the preamble identifier in the request in order to identify the message burst; and

receive the retransmitted message burst and soft-combine the retransmitted message burst with previous transmissions of the message burst.

40. The apparatus of claim 39, wherein the request to retransmit the message burst is a signal from the base station on a downlink shared control channel indicating an uplink resource allocation and including the preamble identifier.

41. The apparatus of claim 36, wherein the processor is further configured to provide an acknowledgement of the base station having

received the message burst, wherein the acknowledgement is a signal from the base station on a downlink shared control channel indicating a downlink resource allocation and including the preamble identifier.

42. The apparatus of claim 36, wherein the processor is further configured to:

receive a portion of the message burst using a first narrow frequency range of the shared channel frequency range; and

receive another portion of the message burst using a second narrow frequency range of the shared channel frequency range different from the first narrow frequency range.

43. The apparatus of claim 36, wherein the processor is further configured to receive the preamble in part in a first narrow frequency range of the random access channel frequency range and in part in a second narrow frequency range of the random access channel frequency range different from the first.

44. The apparatus of claim 36, wherein the processor is further configured to provide in the acknowledgement a digest of the signature or a signature number.

45. The apparatus of claim 36, wherein the processor is further configured to provide to the user equipment a further allocation of the shared channel for uplink of user data in response to the message burst, wherein the allocation is provided with the address provided by the user equipment, and wherein the base station is further configured to decode information bits included in the message burst and determine the further allocation at least in part based on the information bits.

46. A base station of a radio access network of a wireless communication system, comprising:

an apparatus as in any of claims 36-45; and

a radio front end for receiving the preamble and the message burst, and for transmitting the acknowledgment.

47. A system, comprising:

a plurality of base stations as in claim 46; and

a plurality of user equipment terminals, configured for wirelessly coupling to the base stations.

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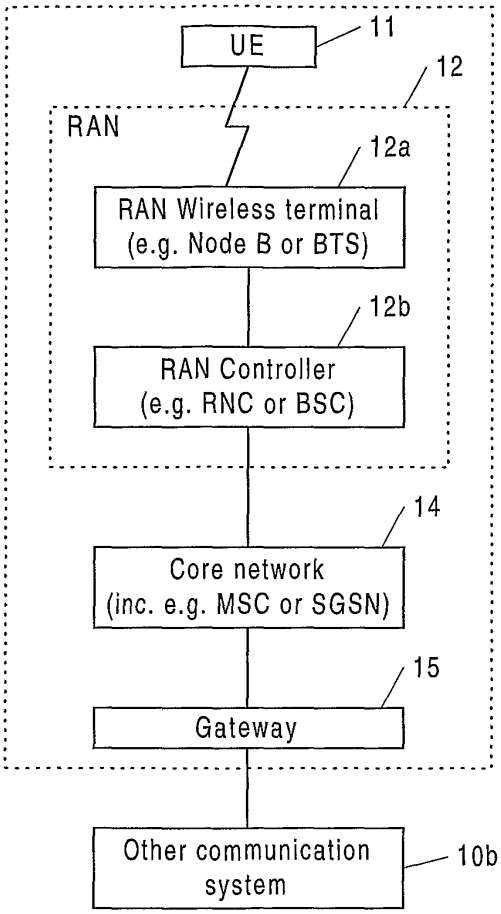

UE
11
12
RAN
12a
RAN Wireless terminal
(e.g. Node B or BTS)
12b
RAN Controller
(e.g. RNC or BSC)
14
Core network
(inc. e.g. MSC or SGSN)
15
Gateway
Other communication
system
10b

Fig. 1

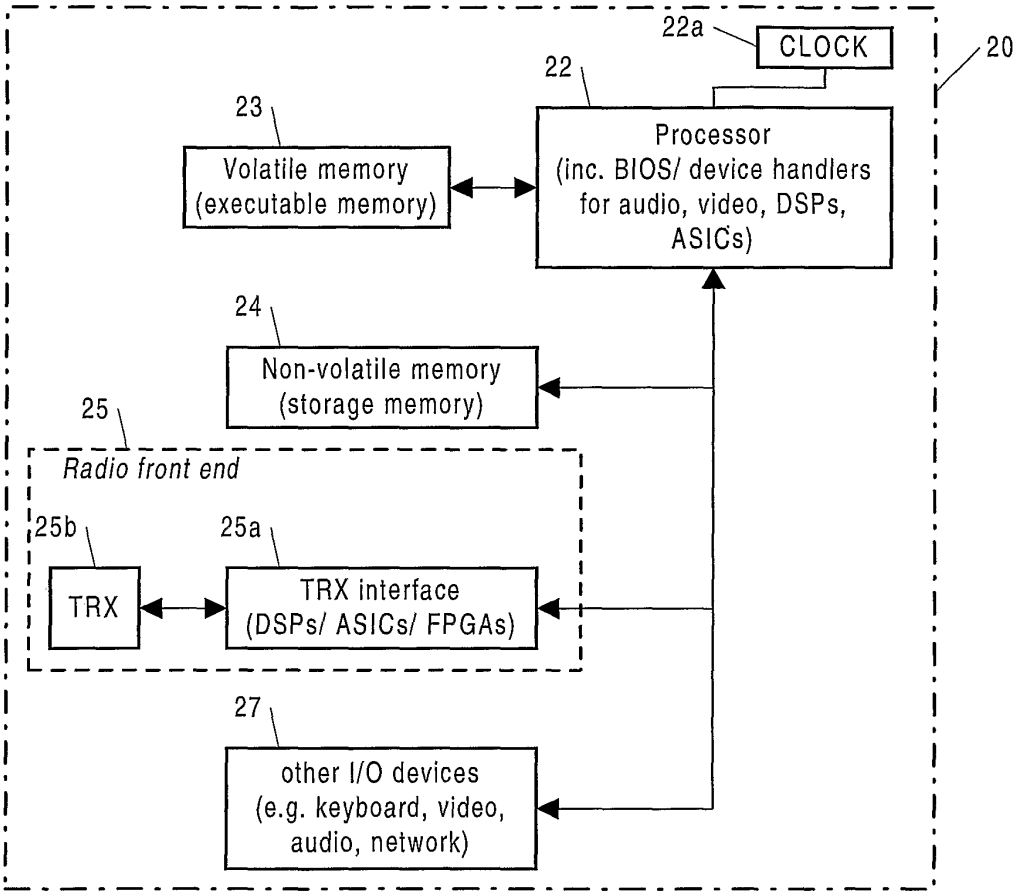

22a
CLOCK
20
22
23
Volatile memory
(executable memory)
Processor
(inc. BIOS/ device handlers
for audio, video, DSPs,
ASICs)
24
Non-volatile memory
(storage memory)
25
Radio front end
25b
25a
TRX
TRX interface
(DSPs/ ASICs/ FPGAs)
27
other I/O devices
(e.g. keyboard, video,
audio, network)

FIG. 2

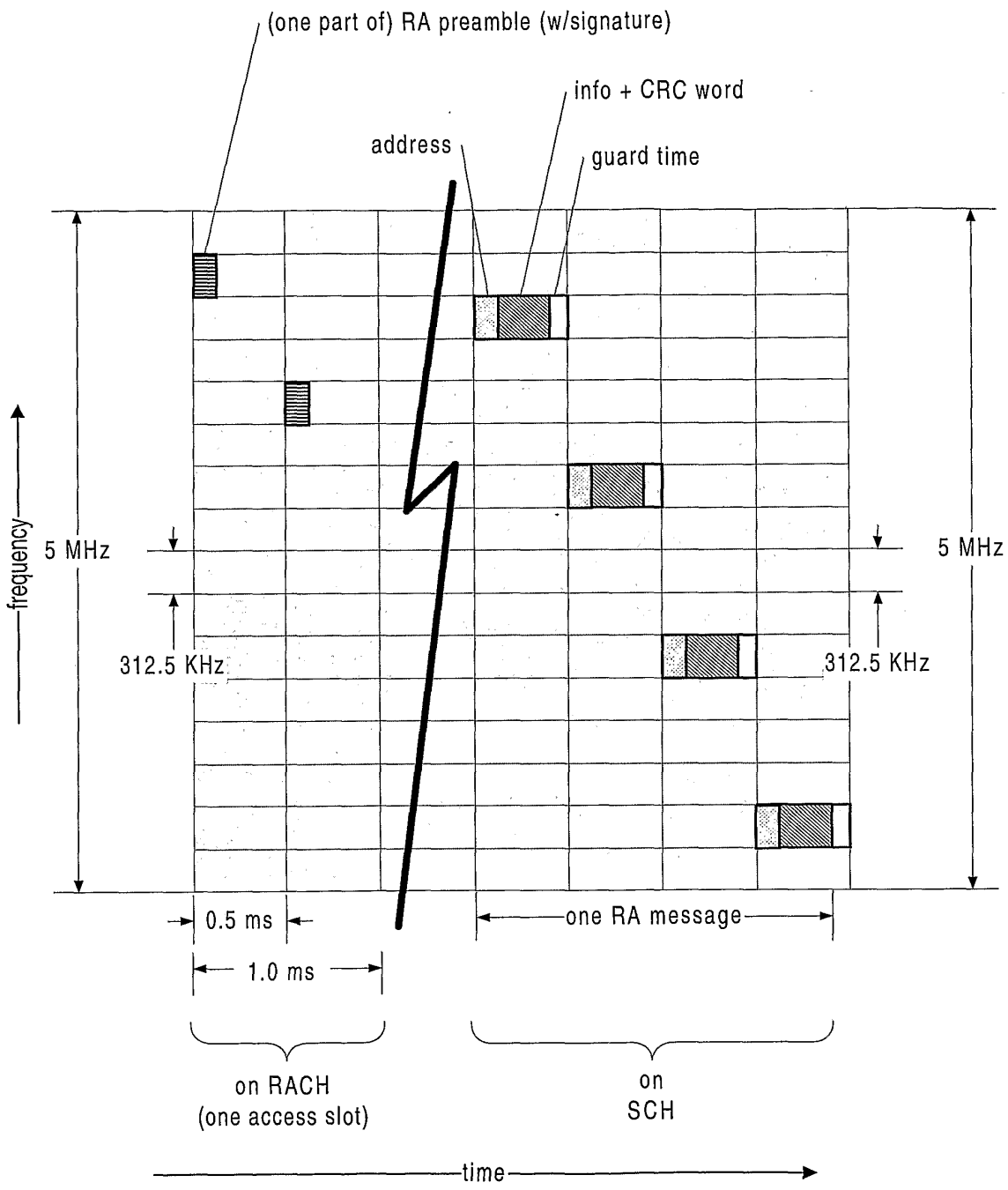

(one part of) RA preamble (w/signature)
info + CRC word
address
guard time
frequency
5 MHz
312.5 KHz
5 MHz
312.5 KHz
0.5 ms
one RA message
1.0 ms
on RACH
(one access slot)
on
SCH
time

FIG. 3

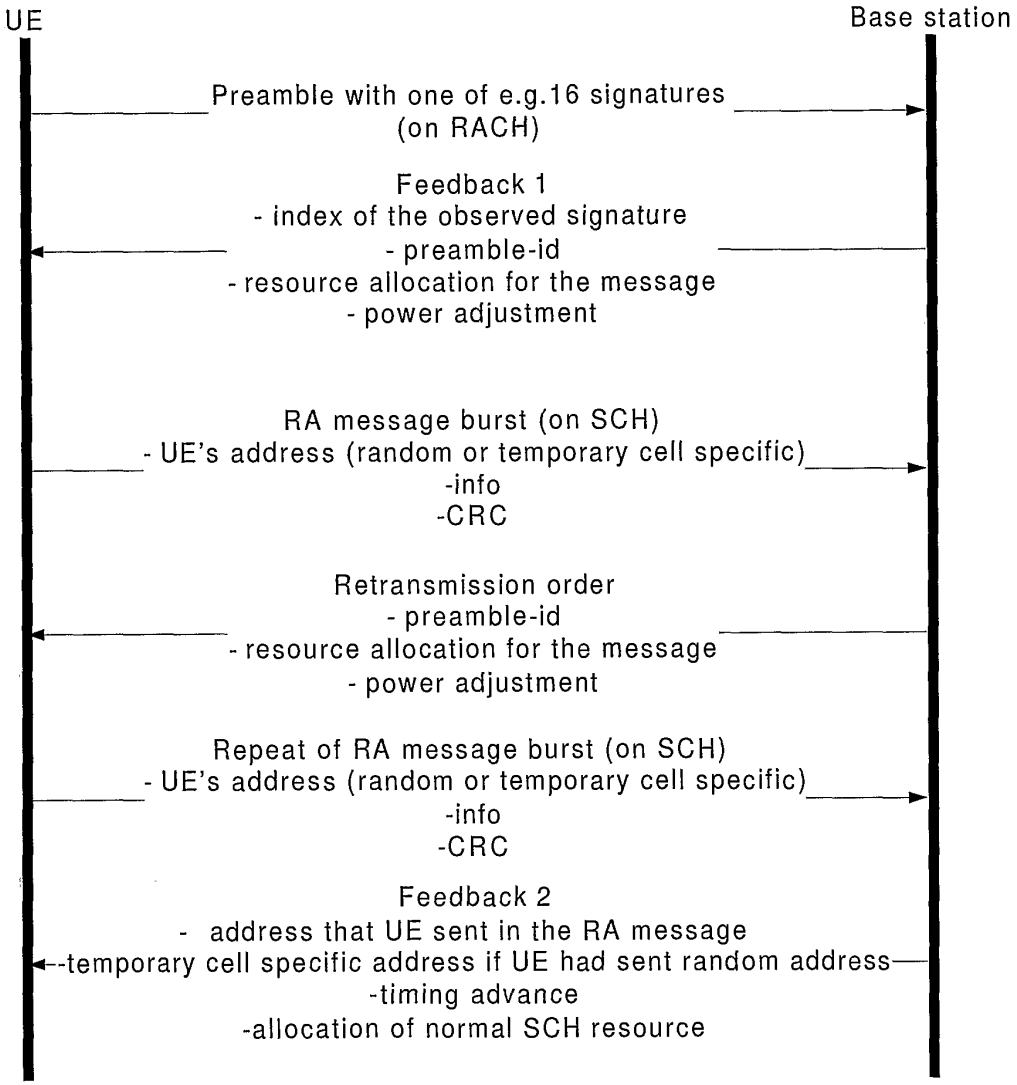

UE
Base station
Preamble with one of e.g.16 signatures
(on RACH)
Feedback 1
- index of the observed signature
- preamble-id
- resource allocation for the message
- power adjustment
RA message burst (on SCH)
- UE's address (random or temporary cell specific)
-info
-CRC
Retransmission order
- preamble-id
- resource allocation for the message
- power adjustment
Repeat of RA message burst (on SCH)
- UE's address (random or temporary cell specific)
-info
-CRC
Feedback 2
- address that UE sent in the RA message
-temporary cell specific address if UE had sent random address
-timing advance
-allocation of normal SCH resource

FIG. 4

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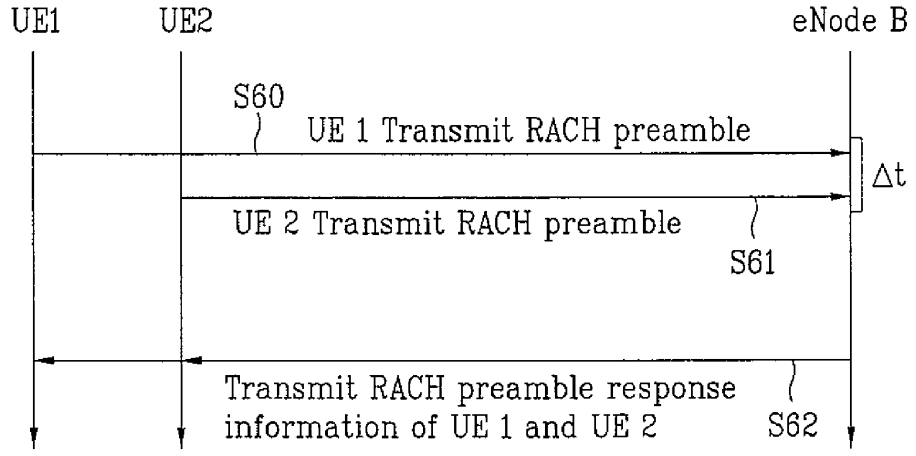
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[Continued on next page]

(54) Title: METHOD FOR TRANSMITTING RESPONSE INFORMATION IN MOBILE COMMUNICATIONS SYSTEM



(57) Abstract: A method for transmitting radio resources in a mobile communication system is disclosed. The method includes receiving a random access channel (RACH) preamble from a plurality of UEs and transmitting response information associated with the received preambles over a common channel wherein the plurality UEs can access the common channel and receive corresponding information. If a HARQ scheme is used when a UE transmits data to the eNode-B using uplink radio resources allocated over the RACH, the eNode-B does not pre-allocate uplink radio resources required for re-transmission and performs allocation of radio resources for a first transmission of HARQ. If the re-transmission is required, the eNode-B allocates the radio resources required for the re-transmission with the NACK signal. If re-transmission is not required, the present invention can reduce an amount of wasted radio resources.

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Description

METHOD FOR TRANSMITTING RESPONSE INFORMATION IN MOBILE COMMUNICATIONS SYSTEM

Technical Field

[1] The present invention is directed to a mobile communication system, and, specifically to a method for transmitting response information in a mobile communication system.

[2]

Background Art

[3] FIG. 1 is a structural diagram illustrating a Long Term Evolution (LTE) system which is a mobile communication system. The LTE system is an evolved version of a conventional UMTS system and has been standardized by the 3GPP (3rd Generation Partnership Project).

[4] The LTE network may be generally classified into an Evolved UMTS Terrestrial Radio Access Network (E-UTRAN) and a Core Network (CN). The E-UTRAN includes at least one eNode-B serving as a base station and an Access Gateway (AG) located at the end of the network so that it is connected to an external network.

[5] The AG may be classified into a portion for processing user traffic and a portion for processing control traffic. The AG portion for processing user traffic and the AG portion for processing control traffic may be connected to each other via a new interface for communication. One or more cells may exist in an eNode-B. The eNode-Bs may be connected by an interface for the transmission of user traffic or control traffic.

[6] The CN includes the AG and a node for registering a user of the user equipment (UE). An interface may also be provided in the E-UMTS in order to classify the E-UTRAN and the CN.

[7] Radio interface protocol layers may be classified into the first layer (L1), the second layer (L2), and the third layer (L3) on the basis of three lower layers of an Open System Interconnection (OSI) reference model that is well known in the art. A physical layer of the first layer (L1) provides an information transfer service over a physical channel. A radio resource control (RRC) layer located at the third layer (L3) controls radio resources between the UE and the network.

[8] The RRC layer exchanges RRC messages between the UE and the network for this purpose. The RRC layer may be distributed to a plurality of network nodes, such as eNode-B and AG, and may also be located at the eNode-B or the AG.

[9] FIG. 2 is a conceptual diagram illustrating a control plane of a radio interface

protocol structure between the UE and the UTRAN (UMTS Terrestrial Radio Access Network) based on the 3GPP radio access network standard. The radio interface protocol is horizontally represented by a physical layer, a data link layer and a network layer. The radio interface protocol is vertically represented by a user plane for transmitting data and the control plane for transmitting control signals.

[10] The protocol layers of Fig. 2 may be classified into a physical layer, a Medium Access Control (MAC) layer, a Radio Link Control (RLC) layer and a Radio Resource Control (RRC) layer.

[11] The physical layer, which is a first layer, provides an information transfer service to an upper layer over a physical channel. The physical layer is connected to a Medium Access Control (MAC) layer located there above via a transport channel.

[12] The MAC layer communicates with the physical layer over the transport channel such that data is communicated between the MAC layer and the physical layer. Data is communicated among different physical layers, such as between a first physical layer of a transmission side and a second physical layer of a reception side.

[13] The MAC layer of the second layer (L2) transmits a variety of services to the RLC (Radio Link Control) layer, which is its upper layer, over a logical channel. The RLC layer of the second layer (L2) supports reliable data transmission.

[14] It should be noted that the RLC layer is depicted in dotted lines, because if the RLC functions are implemented in and performed by the MAC layer, the RLC layer itself may not need to exist.

[15] The RRC (Radio Resource Control) layer located at the lowest portion of the third layer (L3) is defined by only the control plane. The RRC layer controls logical channels, transport channels and physical channels for the configuration, reconfiguration and release of Radio Bearers (RBs). An RB denotes a service provided by the second layer (L2) for data transfer between the UE and the E-UTRAN.

[16] FIG. 3 is a conceptual diagram illustrating a user plane of a radio interface protocol structure between the UE and the UTRAN according to the 3GPP radio access network standard. The radio protocol user plane classifies into a physical layer, a MAC layer, a RLC layer and a PDCP(Packet Data Convergence Protocol) layer.

[17] The physical layer of the first layer (L1) and the MAC and RLC layers of the second layer (L2) is used to effectively transmit data using an IP packet, such as IPv4 or IPv6, on a radio interface with a relatively narrow bandwidth. The PDCP layer performs header compression to reduce the size of a relatively-large IP packet header containing unnecessary control information.

[18] Uplink and downlink channels for transmitting data between the network and the UE will hereinafter be described in detail. Downlink channels transmit data from the network to the UE. Uplink channels transmit data from the UE to the network.

[19] Examples of downlink channels are a Broadcast Channel (BCH) for transmitting system information and a downlink Shared Channel (SCH) and a Shared Control Channel (SCCH) for transmitting user traffic or control messages. The use traffic or control messages of a downlink multicast service or broadcast service may be transmitted over the downlink shared channel (SCH) or may be transmitted over an additional multicast channel (MCH).

[20] Examples of uplink channels are a Random Access Channel (RACH) and an uplink shared channel (SCH) and a shared control channel (SCCH) for transmitting user traffic or control messages.

[21] FIG. 4 is a conceptual diagram illustrating a hybrid automatic repeat and request (HARQ) scheme. A method for implementing HARQ in the downlink physical layer of a radio packet communication system will be described with reference to FIG. 4.

[22] Referring to FIG. 4, the eNode-B determines a UE that is to receive packets and the type of packet that is to be transmitted to the UE, such as a code rate, a modulation scheme and an amount of data. The eNode-B informs the UE of the determined information over a High-Speed Downlink Shared Control Channel(HS-SCCH) and transmits a corresponding data packet via High-Speed Downlink Shared Channel(HS-DSCH) at a time associated with the transmission of the information over the HS-SCCH.

[23] The UE receives the downlink control channel, identifies a packet type to be transmitted and a transmission time point, and receives the corresponding packet. The UE then attempts to decode the received packet data.

[24] The UE transmits a negative acknowledgement (NACK) signal to the eNode-B if the UE fails to decode a specific packet, such as data1. The eNode-B recognizes that packet transmission has failed and re-transmits the same data, such as data1, using the same packet format or a new packet format at a suitable time point. The UE combines the re-transmitted packet, such as data1, and a previously received packet for which packet decoding failed and re-attempts packet decoding.

[25] The UE transmits an acknowledgement (ACK) signal to the eNode-B if the packet is received and decoded successfully. The eNode-B recognizes successful packet transmission and performs transmission of the next packet, such as data2.

[26] A random access channel (RACH) indicates a channel for transmitting an initial control message from the UE to the network. The RACH is adapted to implement synchronization between the UE and the network. Furthermore, if there is no more data for transmission left in a UE that desires to transmit data in an uplink direction, the UE can acquire necessary radio resources over the RACH.

[27] For example, when the UE is powered on it attempts to access a new cell. The UE performs downlink synchronization and receives system information from a target cell

desired by the UE.

[28] Upon receiving the system information, the UE must transmit an access request message to access the RRC layer. However, the UE is not synchronized with a current network and there is no guarantee of uplink radio resources since it uses the RACH.

[29] In other words, the UE requests radio resources capable of transmitting the access request message to the network. If the eNode-B receives the radio-resource request signal from the UE, it allocates suitable radio resources to the UE to transmit a RRC connection request message. The UE can then transmit the RRC connection request message to the network using the allocated radio resources.

[30] In another example, it is assumed that an RRC connection is established between the UE and the network. The UE receives radio resources from the network according to the radio resource scheduling process of the network such that data from the UE is transmitted to the network using the radio resources.

[31] However, if there is no more data for transmission left in a buffer of the UE, the network no longer allocates uplink radio resources to the UE. If the network allocates the uplink radio resources to the UE, this allocation is considered to be ineffective. The buffer state of the UE is periodically or accidentally reported to the network.

[32] Therefore, if new data is stored in the buffer of the UE having no radio resources, the UE utilizes the RACH since there are no uplink radio resources allocated to the UE. In other words, the UE requests radio resources required for data transmission to the network.

[33] RACH as used in a Wideband Code Division Multiple Access (WCDMA) system will hereinafter be described in detail. The RACH is used for transmission of data with short length. Some RRC messages, such as an RRC connection request message, a cell update message, and a URA update message, are transmitted over the RACH.

[34] A plurality of logic channels can be mapped to the RACH. For example, a common control channel (CCCH), a dedicated control channel (DCCH), and a dedicated traffic channel (DTCH) may be mapped to the RACH. The RACH is mapped to a physical random access channel (PRACH).

[35] FIG. 5 is a conceptual diagram illustrating an example of a PRACH (Physical Random Access Channel) transmission method. As illustrated in FIG. 5, the PRACH which is an uplink physical channel is divided into a preamble part and a message part.

[36] The preamble part performs a power-ramping function for adjusting power required for transmitting a message and an anti-collision function for preventing transmissions from several UEs from colliding with each other. The message part performs transmission of a MAC Protocol Data Unit (MAC PDU) to the physical channel from the MAC layer.

[37] If the MAC layer of the UE indicates the physical layer of the UE to transmit the

PRACH transmission, the physical layer of the UE selects a single access slot and a single signature and transmits the PRACH preamble in the uplink. The preamble can be transmitted during an access slot period of 1.33 ms and selects a single signature from among 16 signatures during an initial predetermined period of the access slot such that it can transmit the selected signature.

[38] When the UE transmits the preamble, the eNode-B can transmit a response signal over an acquisition indicator channel (AICH) which is a downlink physical channel. The eNode-B transmits a positive response(ACK) or negative response(NACK) to the UE using a response signal transmitted over the AICH.

[39] If the UE receives an ACK response signal, it transmits the message part. If the UE receives a NACK response signal, the MAC layer of the UE indicates the physical layer of the UE to perform PRACH retransmission after a predetermined time. If the UE does not receive a response signal corresponding to the transmitted preamble, it transmits a new preamble at a power level that is higher than that of a previous preamble by one level after a designated access slot.

[40] Although the above-mentioned description has disclosed a response signal to the RACH preamble, it should be noted that the eNode-B can transmit data or control signals to the UE. There are a variety of control signals transmitted from the eNode-B to the UE, such as downlink scheduling information, uplink scheduling grant information, and response information associated with the UE s RACH preamble transmission.

[41]

Disclosure of Invention

Technical Problem

[42] According to the conventional art, when the UE transmits data over the RACH, it transmits the RACH preamble to the eNode-B and the eNode-B transmits response information associated with the RACH preamble to the UE. However, if at least two UEs transmit their RACH preambles in order to use the RACH at the same or similar time, the eNode-B must inform each of the two UEs regarding response information associated with the respective preambles, thereby requiring the allocation of radio resources for transmitting the response information to each UE and wasting radio resources.

[43] Provided that the UE uses the HARQ scheme when transmitting data to the eNode-B using the radio resources allocated over the RACH, the eNode-B pre-allocates not only first radio resources associated with initial transmission data but also second radio resources associated with re-transmission data. Therefore, the second radio resources for the re-transmission data are unnecessarily wasted if the UE successfully transmits

data at a first transmission time.

[44]

Technical Solution

[45] An object of the present invention is to provide a method for transmitting response information in a mobile communication system that reduces an amount of wasted radio resources and effectively uses radio resources. Another object of the present invention is to provide a mobile communication system which does not transmit response information associated with UEs separately when two or more UEs have transmitted RACH preambles at the same or similar time, but rather transmits RACH preamble response information to a specific UE, configures the associated response information in the form of a single data unit over a common channel, and transmits the configured data unit to the specific UE.

[46] In one aspect of the present invention, a method for transmitting a specific preamble and receiving information in response to the specific preamble in a mobile communication system is provided. The method includes transmitting the specific preamble over a random access channel (RACH), receiving response information over a common channel, the response information including at least one response and identification information corresponding to the at least one response, the at least one response corresponding to at least one preamble transmitted during a specific time interval and processing the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble.

[47] It is contemplated that the method further includes transmitting data using radio resources allocated in the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble. It is further contemplated that the method further includes receiving a first message including an indication that the transmitted data was not properly received and retransmitting the data using newly allocated radio resources.

[48] It is contemplated that the first message includes the newly allocated radio resources. It is further contemplated that the method further includes receiving a second message including the newly allocated radio resources. Preferably, the common channel is a downlink shared channel (DL-SCH).

[49] In another aspect of the present invention, a method for transmitting a preamble and receiving information in response to the preamble in a mobile communication system is provided. The method includes receiving at least one preamble over a random access channel (RACH) during a specific time interval and transmitting response information over a common channel, the response information including a response corresponding to the at least one preamble received during the specific time interval and identification

information identifying a mobile communication terminal from which the at least one preamble was received,

[50] It is contemplated that the method further includes allocating radio resources in the response, the radio resources associated with transmitting data from the mobile communication terminal from which the at least one preamble was received. It is further contemplated that the method further includes receiving data from the mobile communication terminal from which the at least one preamble was received, the data transmitted using the allocated radio resources, determining that the data was not properly received, transmitting a first message including additional allocated radio resources associated with retransmitting the data and receiving the data retransmitted using the radio resources allocated in the message.

[51] It is contemplated that the method further includes including an indication in the first message that the data was not properly received. It is further contemplated that the method further includes transmitting a second message including an indication that the data was not properly received. Preferably, the common channel is a downlink shared channel (DL-SCH).

[52] In another aspect of the present invention, a method for transmitting a specific preamble and receiving information in response to the specific preamble in a mobile communication system is provided. The method includes a specific mobile communication terminal transmitting the specific preamble over a random access channel (RACH), a network transmitting response information over a common channel, the response information including a response corresponding to at least one preamble received during a specific time interval and identification information identifying a mobile communication terminal from which the at least one preamble was received, the specific mobile communication terminal receiving the response information and the specific mobile communication terminal processing the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble.

[53] It is contemplated that the method further includes the network allocating radio resources in the response, the radio resources associated with transmitting data from the mobile communication terminal from which the at least one preamble was received. It is further contemplated that the method further includes the specific mobile communication terminal transmitting data using the radio resources allocated in the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble.

[54] It is contemplated that the method further includes the network receiving data from the mobile communication terminal from which the at least one preamble was received, the data transmitted using the allocated radio resources, the network de-

termining that the data was not properly received, the network transmitting a first message including additional allocated radio resources associated with retransmitting the data, the specific mobile communication terminal retransmitting the data using the radio resources allocated in the first message and the network receiving the data re-transmitted using the radio resources allocated in the message. It is further contemplated that the method further includes the network including an indication in the first message that the data was not properly received.

[55] It is contemplated that the method further includes the network transmitting a second message including an indication that the data was not properly received. It is further contemplated that the common channel is a downlink shared channel (DL-SCH).

[56] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. 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.

[57] These and other embodiments will also become readily apparent to those skilled in the art from the following detailed description of the embodiments having reference to the attached figures, the invention not being limited to any particular embodiments disclosed.

Brief Description of the Drawings

[58] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention. Features, elements, and aspects of the invention that are referenced by the same numerals in different figures represent the same, equivalent, or similar features, elements, or aspects in accordance with one or more embodiments.

[59] FIG. 1 is a structural diagram illustrating a Long Term Evolution (LTE) system which is a mobile communication system.

[60] FIG. 2 is a conceptual diagram illustrating each layer of a control plane of radio interface protocols

[61] FIG. 3 is a conceptual diagram illustrating each layer of a user plane of radio interface protocols.

[62] FIG. 4 is a conceptual diagram illustrating a hybrid ARQ (HARQ) scheme.

[63] FIG. 5 is a conceptual diagram illustrating an example of a PRACH (Physical

Random Access Channel) transmission method.

[64] FIG. 6 is a flow chart illustrating a method for transmitting response information in a mobile communication system according to one embodiment of the present invention.

[65] FIG. 7 is a conceptual diagram illustrating a method for transmitting response information to a UE over a common channel according to one embodiment of the present invention.

[66] FIG. 8 is a flow chart illustrating a method for transmitting response information in a mobile communication system according to another embodiment of the present invention.

[67] FIG. 9 is a flow chart illustrating a method for transmitting response information in a mobile communication system according to another embodiment of the present invention.

[68]

Best Mode for Carrying Out the Invention

[69] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[70] A method for transmitting response information in a mobile communication system according to the present invention will hereinafter be described with reference to the accompanying drawings. For the convenience of description and better understanding of the present invention, the term "UE"will be used to indicate a transmission entity of an uplink signal and the term "eNode-B" will be used to indicate a reception entity of the uplink signal. However, it should be noted that the scope of the terminal and the base station is not limited to the above-mentioned terms and the term "UE" and the term "eNode-B" may also be used to indicate, respectively, a terminal and a base station.

[71] FIG. 6 is a flow chart illustrating a method for transmitting response information in a mobile communication system according to one embodiment of the present invention. A method for transmitting response information associated with preamble transmission of at least one UE at a time will hereinafter be described.

[72] The UE uses the RACH to perform a RRC connection request, a cell update, a handover, an uplink radio resource request and maintenance of synchronization associated with the eNode-B. The UE transmits a preamble prior to the transmitting of data. The preamble uses for adjusting transmission power required for data transmission and for preventing several UEs from colliding with each other.

[73] When using RACH, the UE transmits the RACH preamble to the eNode-B and the eNode-B transmits RACH preamble response information to the UE. The eNode-B does not independently transmit response information associated with other UEs, each of which transmits RACH preambles at the same or similar time, but rather transmits the response information associated with the other UEs over a common channel at the same time.

[74] For example, if a first UE, a second UE, and a third UE transmit their RACH preambles to the eNode-B within a predetermined period of time, the eNode-B configures response information associated with the first through third UEs in the form of a single data unit and transmits the single data unit to the first through third UEs over a common channel in order to reply to the RACH preambles of the first through third UEs.

[75] As illustrated in FIG. 6, the first UE (UE1) transmits its RACH preamble to the eNode-B at step S60 and the second UE (UE2) transmits its RACH preamble to the eNode-B at the same time or a similar time as the RACH preamble of the first UE is transmitted. In other words, the first UE (UE1) and the second UE (UE2) transmit their RACH preambles to the eNode-B at the same or similar time.

[76] Therefore, the eNode-B receives at least one RACH preamble from at least two UEs during a predetermined time (Δt). Although FIG. 6 illustrates only the first (UE1) and second (UE2) UEs, it is obvious to those skilled in the art that the number of UEs may be N and the present invention may also be applied to N UEs.

[77] The eNode-B receives RACH preambles of the first (UE1) and second (UE2) UEs and transmits response information of the received RACH preambles at step S62. The eNode-B transmits the response information over a common channel without allocating unique radio frequency RF channels to the first (UE1) and second (UE2) UEs in order to reply to the RACH preambles. The common channel allows all UEs within a cell to receive or read data from the eNode-B.

[78] FIG. 7 is a conceptual diagram illustrating a method for transmitting response information to a UE over a downlink shared channel (DL-SCH) which is a common channel according to the one embodiment of the present invention. Generally, the DL-SCH is used to transmit data from the eNode-B to predetermined UEs or is used to transmit data to all UEs in a cell. Therefore, different UEs may receive data over the DL-SCH.

[79] Although the eNode-B simultaneously transmits response information associated with a plurality of UEs over the DL-SCH, each UE can receive its response information from the eNode-B. The eNode-B transmits response information associated

with the RACH preambles to the UEs over the DL-SCH. The single data unit of response information includes a plurality of response information associated with a plurality of UEs.

[80] As illustrated in FIG. 7, the UE must first read the downlink shared control channel (DL-SCCH) in order to read data of the DL-SCH. The location information of the DL-SCH is transmitted over the DL-SCCH.

[81] In other words, after transmitting the RACH preamble, the UE reads the DL-SCCH to receive response information from the eNode-B and then recognizes location information of the DL-SCH associated with the DL-SCCH. Control signals associated with the physical layer and/or the second layer are transmitted from the eNode-B to the UE over the DL-SCCH.

[82] The DL-SCCH carries a variety of information, such as a UE ID (Identifier) for indicating which one of UEs will receive the data, location information related to frequency or time that indicates which DL-SCH data will be read by the UEs, specific information required by UEs that desire to read the DL-SCH data, and decoding information. In this way, it can be recognized which one of UEs will receive specific DL-SCH data by means of the UE ID included in DL-SCCH.

[83] As illustrated in FIG. 6, the DL-SCH carries first response information for the first UE (UE1) and second response information for the second UE (UE2). In other words, the first UE (UE1) and the second UE (UE2) read the same DL-SCCH and determine the same DL-SCH location.

[84] The first UE (UE1) and the second UE (UE2) read their unique response information over the same DL-SCH. The response information of the RACH preambles transmitted from the UEs at the same or similar time transmits to the UEs by multiplexing each response information for each UE at the second layer of the eNode-B.

[85] The eNode-B configures the response information of the RACH preambles having been transmitted by the UEs at the same or similar time. The response information is configured in the form of a single MAC Protocol Data Unit (PDU).

[86] A method for multiplexing the response information of the UEs to configure a single MAC PDU and transmitting the single MAC PDU will hereinafter be described with reference to Tables 1 and 2.

[87] A representative example of a PDU configured by multiplexing of response information is shown in Table 1:

[88] Table 1

First UE' header	First UE' response informatio	Second UE' header	Second UE' response	...	N-thUE' header	N-th UE' response information

	n		information			

[89] As illustrated in Table 1, the eNode-B configures a first UE' header prior to the first UE' response information. The header includes a UE ID indicating for which UE the response information is intended to read and also includes specific information indicating the length of the response information.

[90] The eNode-B configures the first UE' response information after the first UE header. The response information for the first UE includes uplink radio resources allocated to the first UE, an identifier within a cell, a temporary identifier of the first UE, and a compensation value associated with synchronization with the eNode-B.

[91] After configuring the first UE header and the first UE' response information, the eNode-B configures the second UE' header and the second UE' response information. In this way, the PDU generated by including response information of several UEs in single response information may be configured.

[92] Another example of a single PDU configured by the multiplexing of response information is shown in Table 2.

[93] As illustrated in Table 2, a header including the first UE' identifer and the length of response information is attached to the MAC PDU. The header serves the same function as that of the header illustrated in the Table 1.

[94] Table 2

First UE' header	Second UE' header	....	N-thUE' header	Indicator header end	First UE' response information	Second UE' response information	.... .	N-th UE' response information

[95] The second UE' header is the attached to the PDU after the first UE' header. In this way, the PDU includes as many headers as the number (N) of UEs for which response information is to be included in single response information.

[96] An indication indicating the end of the header is attached to the end of the header. The eNode-B can recognize the beginning of the response information using this header. Thereafter, the MAC PDU is formed by sequentially attaching response information of individual UEs.

[97] The response information of each UE includes information of uplink radio resources allocated to the each UE, an identifier within a cell, a temporary identifier of the UE, and a compensation value associated with synchronization a with the eNode-B. Each UE recognizes its own response information from among a plurality of response information that have been multiplexed into the single response information and

transmitted over the common channel. Each UE transmits data to the eNode-B using uplink radio resources allocated to the each UE in the response information associated with its RACH preamble.

[98] FIG. 8 is a flow chart illustrating a method for transmitting response information in a mobile communication system according to another embodiment of the present invention. Specifically, FIG. 8 illustrates a scheduling method for a specific case in which a HARQ (Hybrid ARQ) scheme is used when data is transmitted to the eNode-B.

[99] As illustrated in FIG. 8, a first UE (UE1) transmits its RACH preamble to the eNode-B at step S70 and a second UE (UE2) transmits its RACH preamble to the eNode-B at step S71 in a manner similar to that illustrated in FIG. 6. The first UE (UE1) and second UE (UE2) receive response information configured in the form of a single data unit over a common channel, such as a DL-SCH, at step S72.

[100] Each UE then transmits data to the eNode-B using uplink radio resources allocated to the each UE in the response information associated with each RACH preamble. It should be noted that FIG. 8 illustrates only a data transmission/reception process between the second UE (UE2) and the eNode-B after reception of the response information. It is obvious to those skilled in the art that the above-mentioned process can also be applied to the case of the first UE (UE1) in the same manner as for the second UE (UE2).

[101] Provided that the HARQ scheme is used when each UE transmits data to the eNode-B using the uplink radio resources allocated over the RACH, uplink radio resources for data re-transmission are not pre-allocated but rather allocated and transmitted to each UE with a NACK signal when data re-transmission is required due to a decoding failure of the eNode-B. The uplink radio resources for data re-transmission may be included in the NACK signal. A specific control signal may be used to allocate the uplink radio resources for re-transmission to the UE.

[102] As illustrated in FIG. 8, the second UE (UE2) transmits data to the eNode-B at step S73 after receiving the response information from the eNode-B. The second UE (UE2) employs a HARQ scheme when transmitting the above-mentioned data to the eNode-B. The eNode-B informs the UEs of the setup of the HARQ scheme through system information.

[103] The eNode-B receives the data from the second UE (UE2) and decodes the received data. If the eNode-B does not decode the data correctly, it transmits a NACK signal to the second UE (UE2) to indicate a decoding error at step S74.

[104] The eNode-B allocates radio resources required for data re-transmission to the second UE (UE2), and transmits information associated with the allocated radio resources along with the NACK signal at the same time. In other words, the uplink

radio resource allocation information in the response information is related only to the first transmission of the HARQ when the eNode-B transmits response information of the RACH preamble to the UE.

[105] For example, if the radio resources required for data transmission after the RACH preamble have a specific value of 100 and the data requires re-transmission due to the HARQ operation, the UE re-requires the radio resources of 100. If the data re-transmission is applied to a case in which the eNode-B allocates uplink radio resources according to the UE s RACH preamble, radio resources of 200 will be allocated to the UE.

[106] However, when allocating radio resources as response information of the UE s RACH preamble, the eNode-B allocates only the 100 radio resources associated with the first transmission to the UE according to the present invention. Thereafter, if data re-transmission is required due to failure of a UE s data transmission, the eNode-B additionally allocates not only the NACK signal but also the 100 additional radio resources to the UE.

[107] The specific control signal including the radio-resource allocation information required for data re-transmission may be transmitted according to the same format as that for the RACH preamble s response information. Also, a channel used when the eNode-B allocates radio resources to the UE may also be used as an example of the present invention.

[108] The second UE (UE2) re-transmits the data at step S75 according to uplink radio resource allocation information that was transmitted with the NACK signal.

[109] FIG. 9 is a flow chart illustrating a method for transmitting response information in a mobile communication system according to another embodiment of the present invention. Specifically, FIG. 9 illustrates a scheduling method for a specific case in which a HARQ (Hybrid ARQ) scheme is used when data is transmitted to the eNode-B. One of differences with the case of FIG.8 is that uplink radio resources for data re-transmission may not be included in the NACK signal but be transmitted separately with the NACK signal at the same or another time.

[110] As illustrated in FIG. 9, a first UE (UE1) transmits its RACH preamble to the eNode-B at step S80 and a second UE (UE2) transmits its RACH preamble to the eNode-B at step S81 in a manner similar to that illustrated in FIG. 6 and FIG.8. The first UE (UE1) and second UE (UE2) receive response information configured in the form of a single data unit over a common channel, such as a DL-SCH, at step S82.

[111] Each UE then transmits data to the eNode-B by using uplink radio resources allocated to the each UE in the response information associated with each RACH preamble at the step S83. It should be also noted that FIG. 9 illustrates only a data transmission/reception process between the second UE (UE2) and the eNode-B after

reception of the response information. It is obvious to those skilled in the art that the above-mentioned process can also be applied to the case of the first UE (UE1) in the same manner as for the second UE (UE2).

[112] The second UE (UE2) employs a HARQ scheme when transmitting the above-mentioned data to the eNode-B. The eNode-B preferably informs the UEs of the setup of the HARQ scheme through system information.

[113] Provided that the HARQ scheme is used when each UE transmits data to the eNode-B by using the uplink radio resources allocated over the RACH, uplink radio resources for data re-transmission are not pre-allocated but rather allocated and transmitted to each UE with a NACK signal when data re-transmission is required due to a decoding failure of the eNode-B. The NACK signal transmitted when data re-transmission is required due to a decoding failure of the eNode-B at the step S84. And the uplink radio resources for data re-transmission are allocated. Namely, the uplink radio resources for data re-transmission are not pre-allocated but rather allocated and transmitted to each UE when re-transmission is necessary. A specific control signal may be used to allocate the uplink radio resources for re-transmission to the UE. The specific control signal may be a signal for SR (Scheduling Resources) from the eNode-B at the step S85. The specific control signal may be also a signal for scheduling information or any other signals.

[114] The specific control signal including the radio resource allocation information required for data re-transmission may be transmitted according to the same format as that for the RACH preamble s response information. Also, a channel used when the eNode-B allocates radio resources to the UE may also be used as an example of the present invention.

[115] The second UE (UE2) re-transmits the data at step S86 according to uplink radio resource allocation information that was transmitted with the specific control signal for example, SR.

[116] As described herein, the method for transmitting response information in a mobile communication system according to the present invention can more effectively use radio resources, thereby reducing the amount of wasted radio resources.

[117] 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 inventions. 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.

[118] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing de-

scription, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims. Therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are intended to be embraced by the appended claims.

[119]

Industrial Applicability

[120] The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present invention. The present teaching can be readily applied to other types of apparatuses.

[121] The description of the present invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. In the claims, means-plus-function clauses are intended to cover the structure described herein as performing the recited function and not only structural equivalents but also equivalent structures.

[122]

[123]

[124]

Claims

[1] A method for transmitting a specific preamble and receiving information in response to the specific preamble in a mobile communication system, the method comprising:
transmitting the specific preamble over a random access channel (RACH);
receiving response information over a common channel, the response information comprising at least one response and identification information corresponding to the at least one response, the at least one response corresponding to at least one preamble transmitted during a specific time interval; and
processing the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble.

[2] The method of claim 1, further comprising:
transmitting data using radio resources allocated in the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble.

[3] The method of claim 2, further comprising:
receiving a first message comprising an indication that the transmitted data was not properly received; and
retransmitting the data using newly allocated radio resources.

[4] The method of claim 3, wherein the first message comprises the newly allocated radio resources.

[5] The method of claim 3, further comprising:
receiving a second message comprising the newly allocated radio resources.

[6] The method of claim 1, wherein the common channel is a downlink shared channel (DL-SCH).

[7] A method for transmitting a preamble and receiving information in response to the preamble in a mobile communication system, the method comprising:
receiving at least one preamble over a random access channel (RACH) during a specific time interval; and
transmitting response information over a common channel, the response information comprising a response corresponding to the at least one preamble received during the specific time interval and identification information identifying a mobile communication terminal from which the at least one preamble was received.

[8] The method of claim 7, further comprising:
allocating radio resources in the response, the radio resources associated with transmitting data from the mobile communication terminal from which the at

least one preamble was received.

[9] The method of claim 8, further comprising:
receiving data from the mobile communication terminal from which the at least one preamble was received, the data transmitted using the allocated radio resources;
determining that the data was not properly received;
transmitting a first message comprising additional allocated radio resources associated with retransmitting the data; and
receiving the data retransmitted using the radio resources allocated in the message.

[10] The method of claim 9, further comprising including an indication in the first message that the data was not properly received.

[11] The method of claim 9, further comprising:
transmitting a second message comprising an indication that the data was not properly received.

[12] The method of claim 9, wherein the common channel is a downlink shared channel (DL-SCH).

[13] A method for transmitting a specific preamble and receiving information in response to the specific preamble in a mobile communication system, the method comprising:
a specific mobile communication terminal transmitting the specific preamble over a random access channel (RACH);
a network transmitting response information over a common channel, the response information comprising a response corresponding to at least one preamble received during a specific time interval and identification information identifying a mobile communication terminal from which the at least one preamble was received;
the specific mobile communication terminal receiving the response information; and
the specific mobile communication terminal processing the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble.

[14] The method of claim 13, further comprising:
the network allocating radio resources in the response, the radio resources associated with transmitting data from the mobile communication terminal from which the at least one preamble was received.

[15] The method of claim 14, further comprising:
the specific mobile communication terminal transmitting data using the radio

resources allocated in the at least one response if the identification information indicates that the at least one response corresponds to the specific preamble.

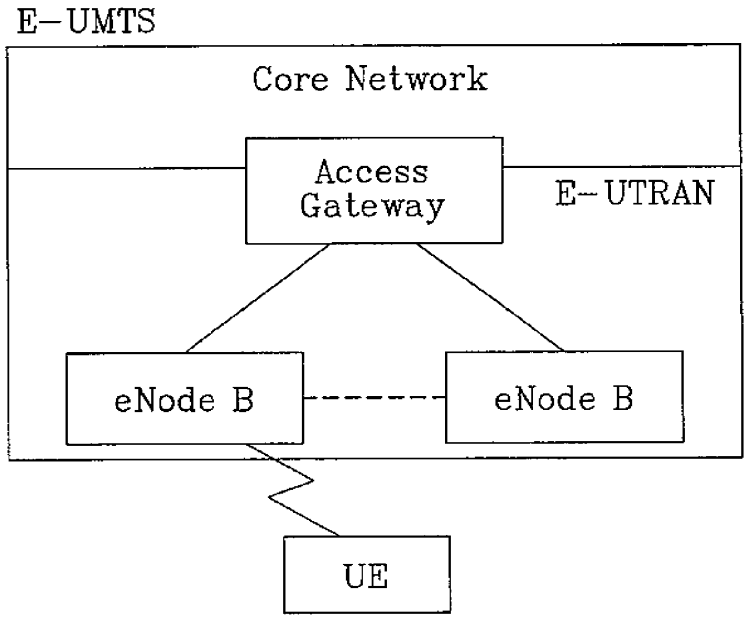
[16] The method of claim 15, further comprising:
the network receiving data from the mobile communication terminal from which the at least one preamble was received, the data transmitted using the allocated radio resources;
the network determining that the data was not properly received;
the network transmitting a first message comprising additional allocated radio resources associated with retransmitting the data;
the specific mobile communication terminal retransmitting the data using the radio resources allocated in the first message; and
the network receiving the data retransmitted using the radio resources allocated in the message.

[17] The method of claim 16, further comprising:
the network including an indication in the first message that the data was not properly received.

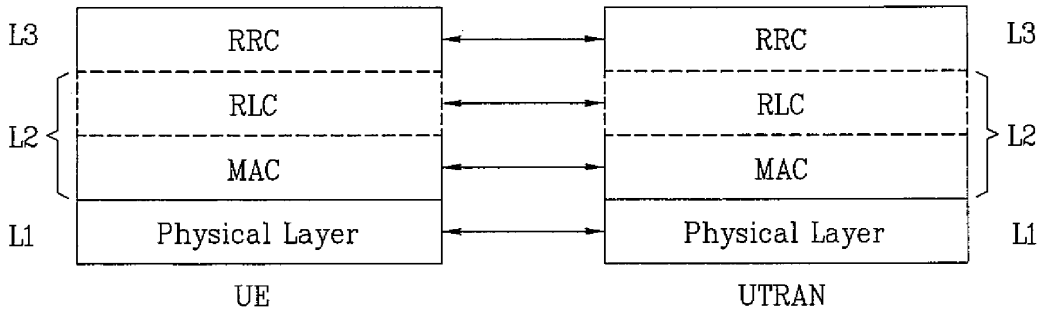
[18] The method of claim 16, further comprising:
the network transmitting a second message comprising an indication that the data was not properly received.

[19] The method of claim 13, wherein the common channel is a downlink shared channel (DL-SCH).

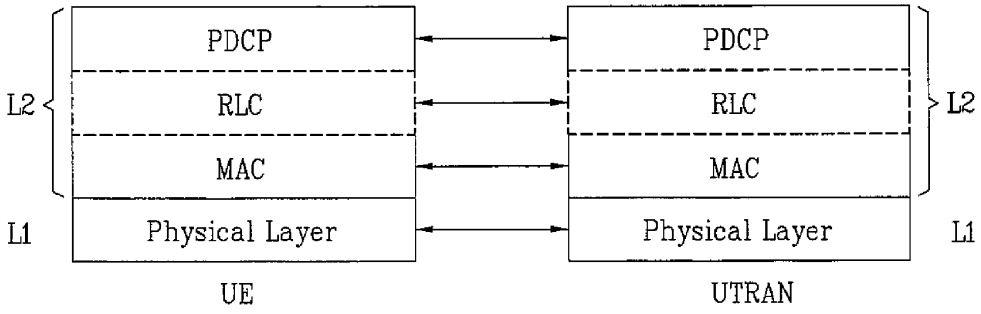
[Fig. 1]


E-UMTS
Core Network
Access Gateway
E-UTRAN
eNode B
eNode B
UE

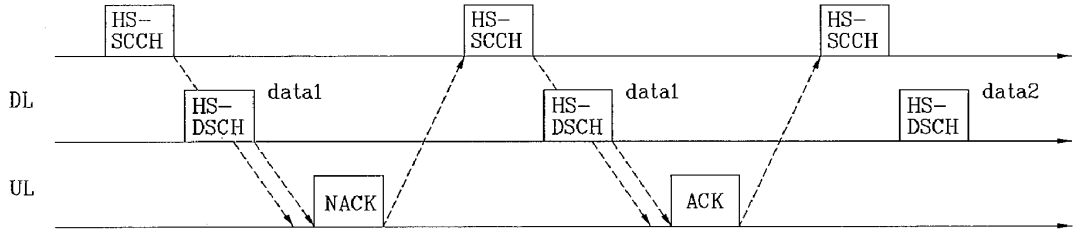
[Fig. 2]


L3
RRC
RRC
L3
L2
RLC
RLC
L2
MAC
MAC
L1
Physical Layer
Physical Layer
L1
UE
UTRAN

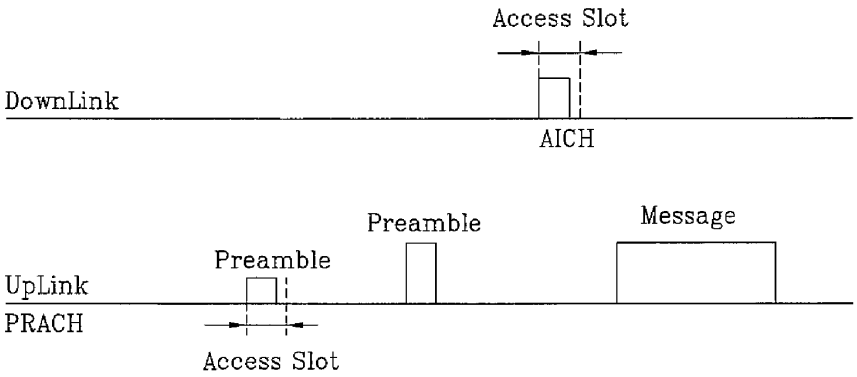
[Fig. 3]



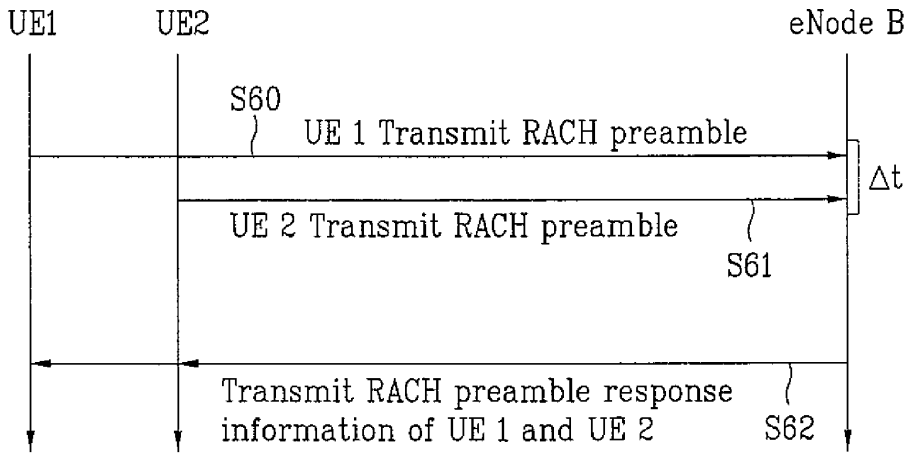
[Fig. 4]



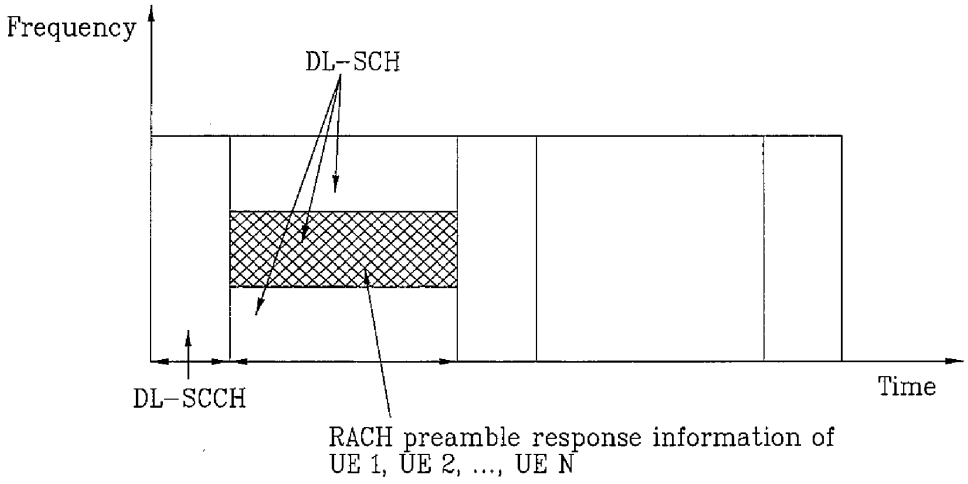
[Fig. 5]



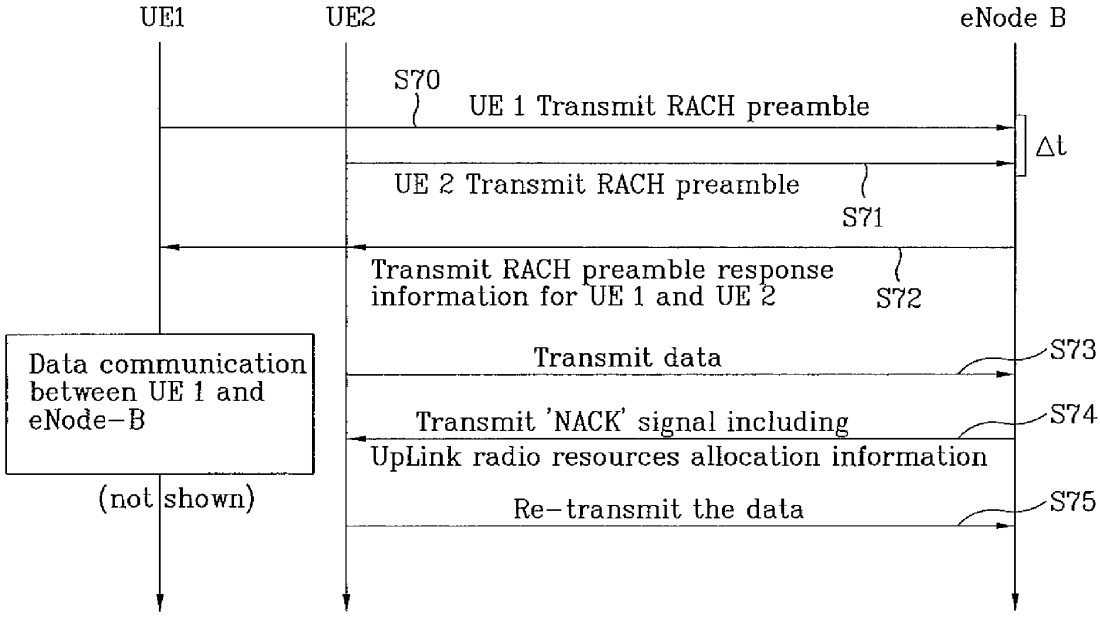
[Fig. 6]


UE1
UE2
eNode B
S60
UE 1 Transmit RACH preamble
Δt
UE 2 Transmit RACH preamble
S61
Transmit RACH preamble response
information of UE 1 and UE 2
S62

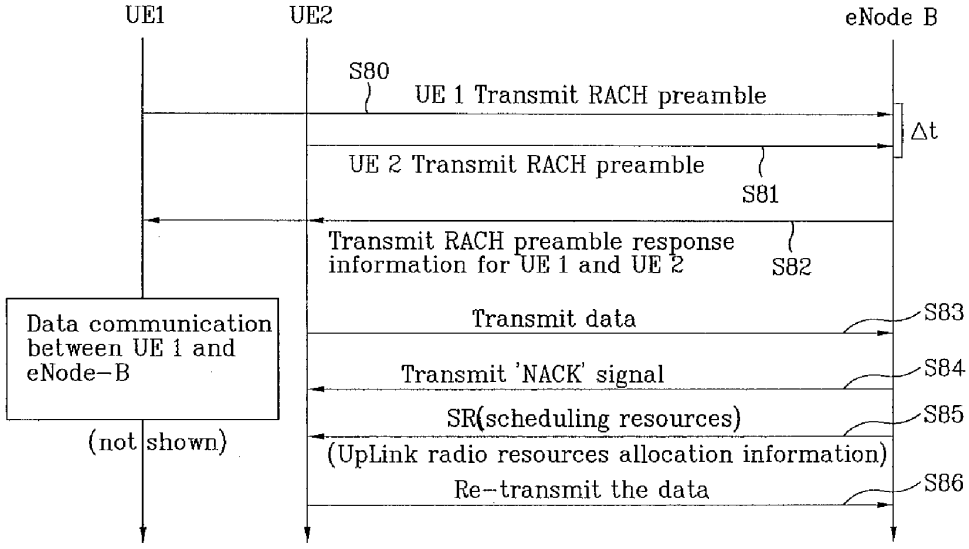
[Fig. 7]


Frequency
DL-SCH
DL-SCCH
Time
RACH preamble response information of
UE 1, UE 2, ..., UE N

[Fig. 8]


UE1
UE2
eNode B
S70
UE 1 Transmit RACH preamble
Δt
UE 2 Transmit RACH preamble
S71
Transmit RACH preamble response information for UE 1 and UE 2
S72
Data communication between UE 1 and eNode-B
Transmit data
S73
Transmit 'NACK' signal including UpLink radio resources allocation information
S74
(not shown)
Re-transmit the data
S75

[Fig. 9]


UE1
UE2
eNode B
S80
UE 1 Transmit RACH preamble
Δt
UE 2 Transmit RACH preamble
S81
Transmit RACH preamble response information for UE 1 and UE 2
S82
Data communication between UE 1 and eNode-B
Transmit data
S83
Transmit 'NACK' signal
S84
SR(scheduling resources)
S85
(not shown)
(UpLink radio resources allocation information)
Re-transmit the data
S86

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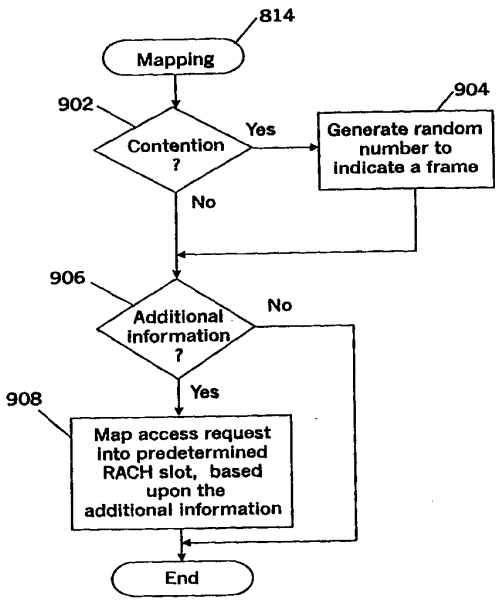
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(54) Title: ACCESS REQUEST IN A PREDETERMINED RANDOM ACCESS CHANNEL SLOT TO CONVEY ADDITIONAL INFORMATION

(57) **Abstract**

An access request by a radiotelephone for one of a plurality of radiotelephone traffic channels is mapped into a predetermined one of a repeating series of Random Access CHannel (RACH) slots, based upon information concerning the access request by the radiotelephone. Accordingly, the RACH slot in which the access request is placed, conveys additional information about the access request. This additional information can be conveyed and decoded without the need to modify the RACH protocol or to extend the length of the RACH slots.



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ACCESS REQUEST IN A PREDETERMINED RANDOM ACCESS CHANNEL SLOT TO CONVEY ADDITIONAL INFORMATION

Field of the Invention

This invention relates to communications systems and methods, in particular, to radiotelephone communication systems and methods.

Background of the Invention

Cellular radiotelephone systems are commonly employed to provide voice and data communications to a plurality of subscribers. For example, analog cellular radiotelephone systems, such as designated AMPS, ETACS, NMT-450, and NMT-900, have been deployed successfully throughout the world. More recently, digital cellular radiotelephone systems such as designated IS-54B in North America and the pan-European GSM system have been introduced. These systems, and others, are described, for example, in the book titled *Cellular Radio Systems* by Balston, et al., published by Artech House, Norwood, MA., 1993.

Figure 1 illustrates a conventional terrestrial cellular radiotelephone communication system **20**. The cellular radiotelephone system may include one or more radiotelephones **21**, communicating with a plurality of cells **36** served by base stations **23** and a mobile telephone switching office (MTSO) **25**. Although only three cells **36** are shown in Figure 1, a typical cellular network may comprise hundreds of cells, may include more than one MTSO, and may serve thousands of radiotelephones.

The cells **36** generally serve as nodes in the communications system **20**, from which links are established between radiotelephones **21** and the MTSO **25**, by way of the base stations **23** serving the cells **36**. Each cell will have allocated to it one or more dedicated control channels and one or more traffic channels. The control channel is a dedicated channel used for transmitting cell identification and paging

information. The traffic channels carry the voice and data information. Through the cellular network **20**, a duplex radio communication link **32** may be effected between two mobile stations **21** or between a radiotelephone **21** and a landline telephone user **33**. The function of the base station **23** is commonly to handle the radio communication between the cell and the mobile station **21**. In this capacity, the base station **23** functions chiefly as a relay station for data and voice signals.

As illustrated in Figure 2, satellites **110** may be employed to perform similar functions to those performed by base stations in a conventional terrestrial radiotelephone system, for example, in areas where population is sparsely distributed over large areas or where rugged topography tends to make conventional landline telephone or terrestrial cellular telephone infrastructure technically or economically impractical. A satellite radiotelephone system **100** typically includes one or more satellites **110** which serve as relays or transponders between one or more earth stations **130** and radiotelephones **21**. The satellite communicates with radiotelephones **21** and earth stations **130** over duplex links **170**. The earth station may in turn be connected to a public switched telephone network **140**, allowing communications between satellite radiotelephones, and communications between satellite radio telephones and conventional terrestrial cellular radiotelephones or landline telephones. The satellite radiotelephone system may utilize a single antenna beam covering the entire area served by the system, or, as shown, the satellite may be designed such that it produces multiple minimally-overlapping beams **150**, each serving distinct geographical coverage areas **160** in the system's service region. A satellite **110** and coverage area **160** serve functions similar to that of a base station **23** and cell **36**, respectively, in a terrestrial cellular system.

Traditional analog radiotelephone systems generally employ a system referred to as frequency division multiple access (FDMA) to create communications channels. As a practical matter well-known to those skilled in the art, radiotelephone communication signals, being modulated waveforms, typically are communicated over predetermined frequency bands in a spectrum of carrier frequencies. These discrete frequency bands serve as traffic channels over which cellular radiotelephones communicate with a cell, through the base station or satellite serving the cell. In the United States, for example, Federal authorities have allocated to cellular communications a block of the UHF frequency spectrum further subdivided into pairs

of narrow frequency bands, a system designated EIA-553 or IS-19B. Channel pairing results from the frequency duplex arrangement wherein the transmit and receive frequencies in each pair are offset by 45 Mhz. At present there are 832, 30-Khz wide, radio channels allocated to cellular mobile communications in the United States.

The limitations on the number of available frequency bands may present several challenges as the number of subscribers increases. Increasing the number of subscribers in a cellular radiotelephone system may require more efficient utilization of the limited available frequency spectrum in order to provide more total channels while maintaining communications quality. This challenge is heightened because subscribers may not be uniformly distributed among cells in the system. More channels may be needed for particular cells to handle potentially higher local subscriber densities at any given time. For example, a cell in an urban area might conceivably contain hundreds or thousands of subscribers at any one time, easily exhausting the number of frequency bands available in the cell.

For these reasons, conventional cellular systems employ frequency reuse to increase potential channel capacity in each cell and increase spectral efficiency. Frequency reuse involves allocating frequency bands to each cell, with cells employing the same frequencies geographically separated to allow radiotelephones in different cells to simultaneously use the same frequency without interfering with each other. By so doing, many thousands of subscribers may be served by a system of only several hundred frequency bands.

Another technique which may further increase channel capacity and spectral efficiency is time division multiple access (TDMA). A TDMA system may be implemented by subdividing the frequency bands employed in conventional FDMA systems into sequential time slots, as illustrated in Figure 3. Although communication on frequency bands $\mathbf{f_1}$ - $\mathbf{f_m}$ typically occur on a common TDMA frame **310** that includes a plurality of time slots $\mathbf{t_1}$ -$\mathbf{t_n}$, as shown, communications on each frequency band may occur according to a unique TDMA frame, with time slots unique to that band. Examples of systems employing TDMA are the dual analog/digital IS-54B standard employed in the United States, in which each of the original frequency bands of EIA-553 is subdivided into 3 time slots, and the European GSM standard, which divides each of its frequency bands into 8 time slots. In these TDMA systems, each user communicates with the base station using bursts of digital data transmitted during

the user's assigned time slots. A channel in a TDMA system typically includes one or more time slots on one or more frequency bands.

Because it generally would be inefficient to permanently assign TDMA time slots to a radiotelephone, typical radiotelephone systems assign time slots on an as-needed basis to more efficiently use the limited carrier frequency spectrum available to the system. Therefore, a task in radiotelephone communication is providing a radiotelephone with access to the system, i.e., assigning time slots corresponding to a traffic (voice or data) channel to a radiotelephone when it desires to communicate with another radiotelephone or with a landline telephone or conventional cellular radiotelephone via the PSTN. This task is generally encountered both when a radiotelephone attempts to place a call and when a radiotelephone attempts to respond to a page from another radiotelephone or conventional telephone.

Access to a radiotelephone communication system may be provided in a number of ways. For example, a polling technique may be utilized whereby a central or base station serially polls users, giving each an opportunity to request access in an orderly fashion, without contention. However, serial polling may be impractical for radiotelephone systems because typical radiotelephone systems may have hundreds, if not thousands, of users. Those skilled in the art will appreciate that serially polling this many users may be extremely inefficient, especially when one considers that many of the users may not desire access at all, or may not desire access at the particular moment they are polled.

For this reason, radiotelephone systems typically use random access techniques, whereby a radiotelephone desiring a traffic channel randomly sends an access request to the base or hub station, which the base station acknowledges by establishing a communications channel to the requesting radiotelephone, if available. An example of a random access technique for a TDMA radiotelephone communication system is that used in the GSM system. In the GSM system, a set of Common Control Channels (CCCHs) is shared by radiotelephones in the system and includes one or more Random Access CHannels (RACH).

Radiotelephones typically monitor the status of the RACH to determine whether other radiotelephones are currently requesting access. If a radiotelephone desires access and senses that the RACH is idle, the radiotelephone typically transmits a random access channel signal, typically including the radiotelephone's identification

and an identification of the telephone the radiotelephone desires to contact, in what is often referred to as a "RACH burst." As illustrated in Figures 4A and 4B, a RACH burst **410** typically contains several fields, including a plurality of guard bits **420**, a sequence of synchronization bits **430**, and a sequence of information bits **440**. The guard bits **420** are used to prevent overlap of communications occurring on adjacent time slots. The synchronization sequence **430** is used by the receiving station to synchronize with the RACH burst, in order to decode the information contained in the information sequence **440**. The information sequence **440** may also include a number of sub-fields, for example, a random reference number field **450** which serves as a "tag" for identifying a particular random access request from a particular radiotelephone.

In a GSM system, a RACH is a dedicated TDMA time slot on a carrier frequency band, used by radiotelephones to request access to the communications system. Radiotelephones typically time their RACH bursts to fall within an assigned TDMA time slot for the RACH, for example, by waiting a predetermined period after a transition in a synchronization signal transmitted by the base station and then transmitting the RACH burst. However, because radiotelephones conventionally use a common TDMA time slot for transmitting RACH burst, there is a possibility of collisions between access requests which are transmitted simultaneously or nearly simultaneously by neighboring radiotelephones. To deal with these collisions, the base station may implement some form of contention-resolving protocol. For example, the base station may refuse to acknowledge simultaneous requests, requiring a requesting radiotelephone to reassert its request if it continues to desire access after failing to establish a channel. Contention-resolving protocols may also use a variety of random delays and similar techniques to reduce the likelihood of radiotelephones engaging in repeated collisions subsequent to a first collision. Contention logic used in the European GSM system is described in *The GSM System for Mobile Communications* published by M. Mouly and M. B. Pautet, 1992, at pages 368-72.

As the complexity of a radiotelephone communication system increases, it may be desirable to provide additional information to a radiotelephone communication system, as part of the RACH message. For example, in a satellite radiotelephone system, as described in Figure 2, the RACH message may be designed to allow the radiotelephone to transmit the National Country Code (NCC) and the

Destination Code for the called number in a radiotelephone originated call. This information may be generally sufficient to efficiently route radiotelephone-originated calls through the radiotelephone system ground stations and network.

However, there may be cases where this information may not be sufficient in order to route the call efficiently. For example, more than one gateway **130** may be provided in a particular country. It may be desirable to route the radiotelephone originated call from the satellite through the gateway that is closest to the radiotelephone. Unfortunately, the RACH message protocol may not provide a field to use in providing this additional information.

Additional information may be provided by redesigning the protocol for the RACH message, to allow encoding of the additional information. Thus, for example, the information content of the RACH message can be increased to include identification of the nearest gateway. Unfortunately, modification of the RACH protocols may require modification of both layer 1 (physical) and layer 3 (signaling) protocols. This may be difficult to implement in radiotelephone communication, in which protocols have already been standardized. Moreover, modification of these protocols may impact the backward compatibility with existing radiotelephones. Finally, if the RACH message is increased in length, additional delay may be produced in obtaining access to the radiotelephone communication system. Accordingly, there is a need to provide additional information within a RACH message, without requiring modification of the RACH message protocol, and without requiring expansion of the RACH slot length.

Summary of the Invention

It is therefore an object of the present invention to provide improved radiotelephone communication systems, methods, radiotelephones and base stations.

It is another object of the present invention to provide improved systems, methods, radiotelephones and base stations that access radiotelephone traffic channels.

It is still another object of the present invention to provide additional information in a RACH message, without requiring redesign of the protocol of the RACH message and without requiring an increase in the length of the RACH slot.

These and other objects are provided according to the present invention by mapping an access request by a radiotelephone for one of a plurality of radiotelephone traffic channels, into a predetermined one of a repeating series of Random Access CHannel (RACH) slots, based upon information concerning the access request by the radiotelephone. Accordingly, the RACH slot in which the access request is placed, conveys additional information about the access request. This additional information can be conveyed and decoded in a base station without the need to modify the RACH protocol or to extend the length of the RACH slots.

More specifically, according to the present invention, a radiotelephone communication system includes a plurality of radiotelephones and at least one base station. A plurality of radiotelephone traffic channels are used by the radiotelephones for radiotelephone communication via the at least one base station. A RACH including repeating frames of RACH slots is used by the radiotelephones to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot. An access request by a radiotelephone is mapped into a predetermined one of the RACH slots, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request. The base station decodes the additional information about the access request based upon identification of the RACH slot in which the access request message is received.

In an embodiment of the present invention, the radiotelephone communication is a satellite radiotelephone communication system including at least one satellite. A plurality of gateways is provided. In this embodiment, an access request by a radiotelephone is mapped into a predetermined one of the RACH slots based upon the nearest gateway to the radiotelephone, such that the RACH slot in which an access request is received identifies the nearest gateway to the radiotelephone.

For example, the satellite radiotelephone communication system may include first and second gateways. The repeating frames of RACH slots are repeating frames of odd and even RACH slots. An access request by a radiotelephone is mapped into an odd RACH slot, to indicate that the first gateway is nearest to the radiotelephone. An access request by the radiotelephone is mapped into an even RACH slot to indicate that the second gateway is nearest to the radiotelephone. Accordingly, rather than randomly placing a RACH message in an available RACH slot as is

conventional, the particular slot in which the RACH message is placed is chosen to convey additional information about the access request.

The present invention is compatible with contention-resolving protocols. For example, in a contention-resolving protocol, if two radiotelephones request access in the same RACH slot, a random number generator in each radiotelephone may randomly indicate a selected frame in which each radiotelephone will repeat the access request. According to the invention, an access request by the radiotelephone is then mapped into a predetermined one of the RACH slots in the selected frame of RACH slots that was indicated by the random number generator. Accordingly, the RACH slot in which an access request is placed conveys additional information about the access request, while still allowing conflict-resolution with multiple access requests in the same RACH slot.

It will be understood by those having skill in the art that the present invention may be provided by radiotelephone communication systems and methods by radiotelephones and methods of operating radiotelephones and by base stations and methods of operating base stations. Additional information may be provided concerning an access request, without requiring modification of the RACH protocol or lengthening of the RACH frame.

Brief Description of the Drawings

Figure 1 illustrates conventional terrestrial cellular radiotelephone communication systems;

Figure 2 illustrates conventional satellite radiotelephone communication systems;

Figure 3 illustrates conventional allocation of carrier frequency spectrum for radiotelephone communication systems;

Figures 4A-4B illustrate time slots and frames utilized in conventional TDMA radiotelephone communication systems;

Figure 5 illustrates satellite radiotelephone communication systems according to the present invention.

Figures 6 and 7 illustrate mapping into a RACH slot according to the present invention.

Figure 8 is a block diagram of radiotelephones according to the present invention.

Figure 9 is a flowchart illustrating mapping according to the present invention.

Detailed Description of Preferred Embodiments

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

The present invention will now be described in connection with a satellite radiotelephone communication system that includes two gateways wherein it is desirable to communicate the identity of the nearest gateway in a RACH message. However, it will be understood that the present invention may be used with other radiotelephone communication systems, including but not limited to cellular and satellite radiotelephone communication systems. It will also be understood that the information that is conveyed by mapping an access request by a radiotelephone into a predetermined one of the RACH slots may be information other than the identity of the nearest gateway. Finally, it will also be understood by those having skill in the art that the term "radiotelephone" is used to cover analog and digital radiotelephones, multiple mode radiotelephones and high function Personal Communications Systems (PCS) devices that may include large displays, scanners, full-size keyboards and the like.

Referring now to Figure 5, a satellite radiotelephone communication system **510** includes at least one satellite **520**, a network control center **530**, and a plurality of gateways **550** and **560**. It will be understood by those having skill in the art that although one satellite **520**, one network control center **530** and two gateways **550** and **560** are shown, a satellite radiotelephone communication system **510** may include many more satellites, network control centers and gateways.

Still referring to Figure 5, in sending RACH signals via the downlink, the system transmits data from the satellite **520** to the network control signal center **530**, which in turn relays the RACH information to the first gateway **550** or the second gateway **560** using switch **540**. From a cost standpoint, and/or from a network loading standpoint, it may be desirable to route the call from the satellite **520** through the gateway that is closest to the radiotelephone **570**. As shown in Figure 5, the first gateway **550** is closer to radiotelephone **570** than the second gateway **560**. Unfortunately, standard satellite air interface specifications for satellite radiotelephone communication systems **510** that include multiple gateways, may not include a provision within the RACH protocol to provide an identification of the nearest gateway to the radiotelephone that is requesting access. See for example, the Satellite Air Interface Specification for the Asia Cellular Satellite System, January 1998, Document No. PS-SAI13100 Rev. C, copyright 1996, 1997, 1998, Lockheed Martin Corporation, PT Asia Cellular Satellite and Ericsson Mobile Communications AB, pp. 30, 65 and 149-152, the disclosure of which is hereby incorporated herein by reference.

The RACH protocol in the Satellite Air Interface Specification can be modified to include an identification of the nearest gateway. However, this modification may impact compatibility with existing radiotelephones, and may also increase the length of the RACH message, thereby increasing access delays.

According to the invention, an identification of the nearest gateway may be provided by mapping an access request by a radiotelephone into a predetermined one of the RACH slots, based upon the nearest gateway to the radiotelephone, such that the RACH slot in which an access request is placed identifies the nearest gateway to the radiotelephone.

Referring now to Figure 6, mapping into a RACH slot according to the invention will now be illustrated. As shown in Figure 6, a RACH **600** includes repeating frames **602** of RACH slots **604** and **606** that are used by the radiotelephones **570** to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot. In Figure 6, the RACH **600** is illustrated as a unique control channel. However, it will be understood by those having skill in the art that the RACH channel **600** can be interleaved with other control channels and/or traffic channels.

In Figure 6, the RACH frame **600** includes two RACH slots **604, 606**. According to the invention, an access request by a radiotelephone **570** is mapped into a predetermined one of the RACH slots **604** or **606**, based upon the nearest gateway to the radiotelephone **570**, such that the RACH slot **604** or **606** in which an access request is placed identifies a nearest gateway to the radiotelephone. For example, the odd RACH slots **604** may be used to indicate that the first gateway **550** is nearest to the radiotelephone **570**. The even RACH slots **606** may be used to indicate that the second gateway **560** is nearest to the radiotelephone **570**.

Thus, referring to Figures 5 and 6, in order to indicate that radiotelephone **570** is nearest gateway **550**, a RACH message is mapped into odd RACH slot **604** rather than using a random mapping into the next available RACH slot. The network control center **530** uses the information concerning which time slot a RACH message was received to control switch **540** to switch the message to the first gateway **550**.

It will be understood by those having skill in the art that in order to define the odd and even slots **604** and **606**, a known starting point, referred to as an Absolute Frame Number (AFN) **608** is identified to both the radiotelephone and the network control center. In Figure 6, the alternating RACH slots may be identified as odd or even, 1 or 0, A or B, or any other identification. The slots of one phase can be mapped to first gateway, and those of the other phase to second gateway. Accordingly, the network control center **530** can route the RACH messages to the nearest gateway based on the time slot in which the information arrives relative to the known AFN **608**.

Figure 7 illustrates a RACH **700** having a RACH frame **702** with three slots **704, 706, 710**, and an AFN **708**. RACH **700** may be used to route a RACH access request to one of three gateways. Alternatively, the RACH mapping may be used to provide other information in addition to or separate from the nearest gateway identification.

RACHs **600** and **700** may be generalized to any AFN modulo N and any number of defined slot positions M. In Figure 6, M is equal to 2, and in Figure 7 M is equal to 3. Accordingly, the RACH slot in which an access request is placed conveys additional information about the access request, without the need to change the access protocol or to lengthen the RACH frame.

The present invention is also compatible with contention-resolving protocols that are used to reduce the likelihood that a second access request by two radiotelephones will also take place in the same RACH slot. In such contention-resolving schemes, a random number generator may be used to randomly delay the second access request by a number of RACH frames that is determined by the random number. Accordingly, when two radiotelephones generate an access request in the same RACH slot, each telephone may generate a random number to determine the subsequent RACH frame in which the access request will be retransmitted. In the subsequent frame, the above-described mapping is used to map an access request into a predetermined one of the RACH slots in the frame of RACH slots indicated by the random number generator, based upon information concerning the access request by the radiotelephone.

Referring now to Figure 8, a simplified block diagram of radiotelephones according to the present invention is shown. As shown in Figure 8, radiotelephone **800** can be a cellular telephone, a satellite telephone, or a high function terminal that provides functions in addition to those of a cellular telephone, such as facsimile, data communications, data processing, word processing, and other personal communications systems functions. These high function terminals are often referred to as Personal Communications Systems (PCS). Multiple mode wireless communication terminals that embody two or more of these functions are also included.

As shown in Figure 8, radiotelephone **800** includes a transceiver **801** that is coupled to antenna **806**. Radiotelephone **800** also includes a control processor **804** and storage (memory) **805** that is coupled to control processor **804** to provide storage capacity for program and data information. As further shown in Figure 8, radiotelephone **800** also generally includes a user interface including a keypad **807**, a display **808**, a speaker **809** and a microphone **811**. In order to provide a wireless communications terminal for receiving transmission of audio, video data and/or multimedia signals, keypad **807** may be a full scale personal computer keyboard, and display **808** may be a large graphics display. A scanner **810** may also be provided, as may other devices **812**, such as disk drives and modems to provide a PCS terminal. Transmit circuit **802** and receive circuit **803** are also coupled to transceiver **801** and to control processor **804**, to perform transmit and receive signal processing respectively.

It will be recognized that the elements of radiotelephone **800** as heretofore described are well known to those having skill in the art and need not be described further herein. Moreover, any and all of the elements of Figure 2 may be embodied using one or more analog or digital integrated circuits, integrated circuit microprocessors that run a stored program, Application-Specific Integrated Circuits (ASIC), or any other combination of hardware and/or software.

Still referring to Figure 8, control processor **804** includes mapping **814** and random number generation (RNG) **816** according to the present invention. It will be understood that the mapping **814** and random number generation **816** may be provided as independent elements of radiotelephone **800** and need not be included within control processor **804**. It will also be understood that mapping **814** and random number generation **816** may be embodied using one or more analog or digital integrated circuits, integrated circuit microprocessors that run a stored program, ASICs, or any other combination of hardware and/or software. Accordingly, the mapping **814** and random number generation **816** may also be referred to as "circuits".

Mapping **814** maps an access request by the radiotelephone **800** for one of the radiotelephone traffic channels into a predetermined RACH slot based upon information concerning the access request by the radiotelephone. Accordingly, the RACH slot in which an access request is placed conveys additional information about the access request. Random number generation **816** may be used as part of contention-resolving protocol to generate a random number to indicate a selected frame of RACH slots to be used by the radiotelephone **800** to request access to one of the radiotelephone traffic channels. Mapping **814** is responsive to the random number generator **816** to map an access request by the radiotelephone into a predetermined one of the RACH slots in the selected frame of RACH slots indicated by the random number, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

Figure 9 illustrates mapping according to the present invention. It will be understood that each block of the flowchart illustrations, and combinations of blocks in the flowchart illustrations, can be implemented by computer program instructions. These computer program instructions may be provided to a processor or other programmable data processing apparatus to produce a machine, such that the

instructions which execute on the processor or other programmable data processing apparatus create means for implementing the functions specified in the flowchart block or blocks. These computer program instructions may also be stored in a computer-readable memory that can direct a processor or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the functions specified in the flowchart block or blocks.

Accordingly, blocks of the flowchart illustrations support combinations of means for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the flowchart illustrations, and combinations of blocks in the flowchart illustrations, can be implemented by special purpose hardware-based computer systems which perform the specified functions or steps such as is described in Figure 9, or by combinations of special purpose hardware and computer instructions.

Referring now to Figure 9, mapping according to the present invention (Block **814** of Figure 8) will now be described. At Block **902**, a test is made as to whether mapping should be made for contention-resolving. In other words, it is determined whether a previous access attempt resulted in an access failure due to multiple requests in the same RACH slot. If contention was present, then at Block **904** a random number is generated to indicate a selected frame for requesting access in a second request.

Then at Block **906**, it is determined whether additional information is to be conveyed with the access request. This additional information may be, for example, an identification of a nearest gateway. It will be understood by those having skill in the art that the identification of the nearest gateway may be obtained from the satellite of Figure 5, from the gateway of Figure 5, from the radiotelephone itself or from other sources using techniques known to those having skill in the art. If additional information is to be conveyed, then at Block **908**, the access request is mapped into a predetermined RACH slot; based upon the additional information. Decoding takes place at the base station by decoding the additional information concerning the access

request, based upon identification of the RACH slot in which the access request message is received.

Accordingly, an access request by a radiotelephone for one of a plurality of radiotelephone traffic channels is mapped into a predetermined RACH slot based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is received conveys additional information about the access request. Thus, additional information may be transmitted within the existing RACH channel structure and protocol.

The present invention may be used to convey any amount of additional information about the access request. However, large amounts of information may increase the number of RACH frames that are used in order to map the information. This may cause delays in gaining access. Accordingly, the present invention may preferably be used when small amounts of additional information, such as a nearest gateway identification, are desired. Thus, the position of the RACH slot may be used to convey information that is not internally included in the RACH message content. Although the present invention may add delay to the transmission of the access request by the radiotelephone, the amount of delay may be negligible, particularly where the present invention is only used to convey one or two additional pieces of information. There may be no processing delay in the network control center, because the RACH mapping can be determined in parallel with RACH content processing.

Finally, it will also be understood that although mapping was described herein as being performed by the radiotelephone, it may be performed by other portions of the radiotelephone communication system, alone or in combination with the radiotelephone.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

What is Claimed is:

1. A radiotelephone communication system comprising:

a plurality of radiotelephones;

at least one base station;

a plurality of radiotelephone traffic channels that are used by the radiotelephones for radiotelephone communication via the at least one base station;

a Random Access CHannel (RACH) including repeating frames of RACH slots that are used by the radiotelephones to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot; and

means for mapping an access request by a radiotelephone into a predetermined one of the RACH slots based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

2. A radiotelephone communication system according to Claim 1 wherein the radiotelephone communication system is a satellite radiotelephone communication system including at least one satellite.

3. A radiotelephone communication system according to Claim 2 wherein the at least one base station comprises a plurality of gateways, the means for mapping comprising:

means for mapping an access request by a radiotelephone into a predetermined one of the RACH slots based upon a nearest gateway to the radiotelephone, such that the RACH slot in which an access request is placed identifies the nearest gateway to the radiotelephone.

4. A radiotelephone communication system according to Claim 3 wherein the plurality of gateways is a first and a second gateway, and wherein the repeating frames of RACH slots are repeating frames of odd and even RACH slots, the means for mapping comprising:

means for mapping an access request by a radiotelephone into an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone, and for mapping

the access request by the radiotelephone into an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

5. A radiotelephone communication system according to Claim 1 further comprising:

means for generating a random number to indicate a selected frame of RACH slots to be used by the radiotelephone to request access to one of the radiotelephone traffic channels;

the means for mapping comprising means for mapping an access request by the radiotelephone into a predetermined one of the RACH slots in the selected frame of RACH slots indicated by the random number, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

6. A radiotelephone communication system comprising:

a plurality of radiotelephones;

at least one base station;

a plurality of radiotelephone traffic channels that are used by the radiotelephones for radiotelephone communication via the at least one base station;

a Random Access CHannel (RACH) including repeating frames of RACH slots that are used by the radiotelephones to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot; and

a circuit that maps an access request by a radiotelephone into a predetermined one of the RACH slots based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

7. A radiotelephone communication system according to Claim 6 wherein the radiotelephone communication system is a satellite radiotelephone communication system including at least one satellite.

8. A radiotelephone communication system according to Claim 7 wherein the at least one base station comprises a plurality of gateways, the circuit comprising:

a circuit that maps an access request by a radiotelephone into a predetermined one of the RACH slots based upon a nearest gateway to the radiotelephone, such that the RACH slot in which an access request is placed identifies the nearest gateway to the radiotelephone.

9. A radiotelephone communication system according to Claim 8 wherein the plurality of gateways is a first and a second gateway, and wherein the repeating frames of RACH slots are repeating frames of odd and even RACH slots, the circuit comprising:

a circuit that maps an access request by a radiotelephone into an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone, and that maps the access request by the radiotelephone into an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

10. A radiotelephone communication system according to Claim 6 further comprising:

a random number generator that indicates a selected frame of RACH slots to be used by the radiotelephone to request access to one of the radiotelephone traffic channels;

the circuit comprising a circuit that maps an access request by the radiotelephone into a predetermined one of the RACH slots in the selected frame of RACH slots indicated by the random number, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

11. An access requesting method for a radiotelephone communication system comprising a plurality of radiotelephones, at least one base station, a plurality of radiotelephone traffic channels that are used by the radiotelephones for radiotelephone communication via the at least one base station, and a Random Access CHannel (RACH) including repeating frames of RACH slots that are used by the

radiotelephones to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot, the access requesting method comprising the step of:

mapping an access request by a radiotelephone into a predetermined one of the RACH slots based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

12. A method according to Claim 11 wherein the radiotelephone communication system is a satellite radiotelephone communication system including at least one satellite.

13. A method according to Claim 12 wherein the at least one base station comprises a plurality of gateways, the mapping step comprising the step of:

mapping an access request by a radiotelephone into a predetermined one of the RACH slots based upon a nearest gateway to the radiotelephone, such that the RACH slot in which an access request is placed identifies the nearest gateway to the radiotelephone.

14. A method according to Claim 13 wherein the plurality of gateways is a first and a second gateway, and wherein the repeating frames of RACH slots are repeating frames of odd and even RACH slots, the mapping step comprising the steps of:

mapping an access request by a radiotelephone into an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone; and

mapping the access request by the radiotelephone into an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

15. A method according to Claim 11 wherein the mapping step is preceded by the step of:

generating a random number to indicate a selected frame of RACH slots to be used by the radiotelephone to request access to one of the radiotelephone traffic channels;

the mapping step comprising the step of mapping an access request by the radiotelephone into a predetermined one of the RACH slots in the selected frame of RACH slots indicated by the random number, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

16. A radiotelephone comprising:

means for communicating with at least one base station of a radiotelephone communication system using one of a plurality of radiotelephone traffic channels; and

means for mapping an access request by the radiotelephone for one of the radiotelephone traffic channels into a predetermined Random Access CHannel (RACH) slot based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

17. A radiotelephone according to Claim 16 wherein the radiotelephone communication system is a satellite radiotelephone communication system including at least one satellite.

18. A radiotelephone according to Claim 17 wherein the at least one base station comprises a plurality of gateways, the means for mapping comprising:

means for mapping an access request by a radiotelephone into a predetermined RACH slot based upon a nearest gateway to the radiotelephone, such that the RACH slot in which an access request is placed identifies the nearest gateway to the radiotelephone.

19. A radiotelephone according to Claim 18 wherein the plurality of gateways is a first and a second gateway, and wherein the RACH slots are odd and even RACH slots, the means for mapping comprising:

means for mapping an access request by a radiotelephone into an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone, and for mapping the access request by the radiotelephone into an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

20. A radiotelephone according to Claim 16 wherein the RACH slots are arranged in repeating frames of RACH slots, the radiotelephone further comprising:

means for generating a random number to indicate a selected frame of RACH slots to be used by the radiotelephone to request access to one of the radiotelephone traffic channels;

the means for mapping comprising means for mapping an access request by the radiotelephone into a predetermined RACH slot in the selected frame of RACH slots indicated by the random number, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

21. A radiotelephone comprising:

a transceiver that communicates with at least one base station of a radiotelephone communication system using one of a plurality of radiotelephone traffic channels; and

a circuit that maps an access request by the radiotelephone for one of the radiotelephone traffic channels into a predetermined Random Access CHannel (RACH) slot based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

22. A radiotelephone according to Claim 21 wherein the radiotelephone communication system is a satellite radiotelephone communication system including at least one satellite.

23. A radiotelephone according to Claim 22 wherein the at least one base station comprises a plurality of gateways, the circuit comprising:

a circuit that maps an access request by a radiotelephone into a predetermined RACH slot based upon a nearest gateway to the radiotelephone, such that the RACH slot in which an access request is placed identifies the nearest gateway to the radiotelephone.

24. A radiotelephone according to Claim 23 wherein the plurality of gateways is a first and a second gateway, and wherein the RACH slots are odd and even RACH slots, the circuit comprising:

a circuit that maps an access request by a radiotelephone into an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone, and that maps the access request by the radiotelephone into an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

25. A radiotelephone according to Claim 21 wherein the RACH slots are arranged in repeating frames of RACH slots, the radiotelephone further comprising:

a random number generator that indicates a selected frame of RACH slots to be used by the radiotelephone to request access to one of the radiotelephone traffic channels;

the circuit comprising a circuit that maps an access request by the radiotelephone into a predetermined RACH slot in the selected frame of RACH slots indicated by the random number, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

26. A method of operating a radiotelephone comprising the step of:

mapping an access request by the radiotelephone for one of a plurality of radiotelephone traffic channels of a radiotelephone communication system into a predetermined Random Access CHannel (RACH) slot based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

27. A method according to Claim 26 wherein the radiotelephone communication system is a satellite radiotelephone communication system including at least one satellite.

28. A method according to Claim 27 wherein the radiotelephone communication system comprises a plurality of gateways, the mapping step comprising the step of:

mapping an access request by the radiotelephone into a predetermined RACH slot based upon a nearest gateway to the radiotelephone, such that the RACH slot in which an access request is placed identifies the nearest gateway to the radiotelephone.

29. A method according to Claim 28 wherein the plurality of gateways is a first and a second gateway, and wherein the RACH slots are odd and even RACH slots, the mapping step comprising the steps of:

mapping an access request by a radiotelephone into an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone; and

mapping the access request by the radiotelephone into an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

30. A method according to Claim 26 wherein the RACH slots are arranged in repeating frames of RACH slots and wherein the mapping step is preceded by the step of:

generating a random number to indicate a selected frame of RACH slots to be used by the radiotelephone to request access to one of the radiotelephone traffic channels;

a mapping step comprising the step of mapping an access request by the radiotelephone into a predetermined RACH slot in the selected frame of RACH slots indicated by the random number, based upon information concerning the access request by the radiotelephone, such that the RACH slot in which an access request is placed conveys additional information about the access request.

31. A radiotelephone communication system base station that communicates with a plurality of radiotelephones, the base station comprising:

means for receiving a plurality of radiotelephone traffic channels that are used by the radiotelephone for radiotelephone communication with the base station;

means for receiving a Random Access CHannel (RACH) including repeating frames of RACH slots that are used by the radiotelephones to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot; and

means for decoding additional information concerning an access request by a radiotelephone based upon identification of the RACH slot in which the access request message is received, such that the RACH slot in which an access request is received conveys additional information about the access request.

32. A base station according to Claim 31 wherein the base station is a satellite radiotelephone communication system base station.

33. A base station according to Claim 32 further comprising a plurality of gateways, the means for decoding comprising:

means for decoding an identification of a nearest gateway to the radiotelephone based upon identification of the RACH slot in which the access request message is received, such that the RACH slot in which an access request is received identifies the nearest gateway to the radiotelephone.

34. A base station according to Claim 33 wherein the plurality of gateways is a first and a second gateway, and wherein the repeating frames of RACH slots are repeating frames of odd and even RACH slots, the means for decoding comprising:

means for decoding an access request by a radiotelephone in an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone, and for decoding the access request by the radiotelephone in an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

35. A radiotelephone communication system base station that communicates with a plurality of radiotelephones, using a plurality of radiotelephone traffic channels and a Random Access CHannel (RACH) including repeating frames of RACH slots that are used by the radiotelephones to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot, the base station comprising:

a circuit that decodes additional information concerning an access request by a radiotelephone based upon identification of the RACH slot in which the access message is received, such that the RACH slot in which an access request is received conveys additional information about the access request.

36. A base station according to Claim 35 wherein the base station is a satellite radiotelephone communication base station.

37. A base station according to Claim 36 further comprising a plurality of gateways, the circuit comprising:

a circuit that decodes an identification of a nearest gateway to the radiotelephone based on identification of the RACH slot in which the access request message is received, such that the RACH slot in which an access request is received identifies the nearest gateway to the radiotelephone.

38. A base station according to Claim 37 wherein the plurality of gateways is a first and a second gateway, and wherein the repeating frames of RACH slots are repeating frames of odd and even RACH slots, the circuit comprising:

a circuit that decodes an access request by a radiotelephone in an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone, and that decodes the access request by the radiotelephone in an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

39. A method of operating a radiotelephone communication system base station that communicates with a plurality of radiotelephones using a plurality of radiotelephone traffic channels and a Random Access CHannel (RACH) including repeating frames of RACH slots that are used by the radiotelephone to request access to one of the radiotelephone traffic channels by placing an access request message in a RACH slot, the method comprising the step of:

decoding additional information concerning an access request by a radiotelephone based upon identification of the RACH slot in which the access request message is received, such that the RACH slot in which an access request is received conveys additional information about the access request.

40. A method according to Claim 39 wherein the base station is a satellite radiotelephone communication system base station.

41. A method according to Claim 40 wherein the at least one base station comprises a plurality of gateways, the decoding step comprising the step of:

decoding an identification of a nearest gateway to the radiotelephone based upon identification of the RACH slot in which the access request message is received, such that the RACH slot in which an access request is received identifies the nearest gateway to the radiotelephone.

42. A method according to Claim 41 wherein the plurality of gateways is a first and a second gateway, and wherein the repeating frames of RACH slots are repeating frames of odd and even RACH slots, the decoding step comprising the steps of:

decoding an access request by a radiotelephone in an odd RACH slot to indicate that the first gateway is nearest to the radiotelephone; and

decoding the access request by the radiotelephone in an even RACH slot to indicate that the second gateway is nearest to the radiotelephone.

FIG. 1
PRIOR ART

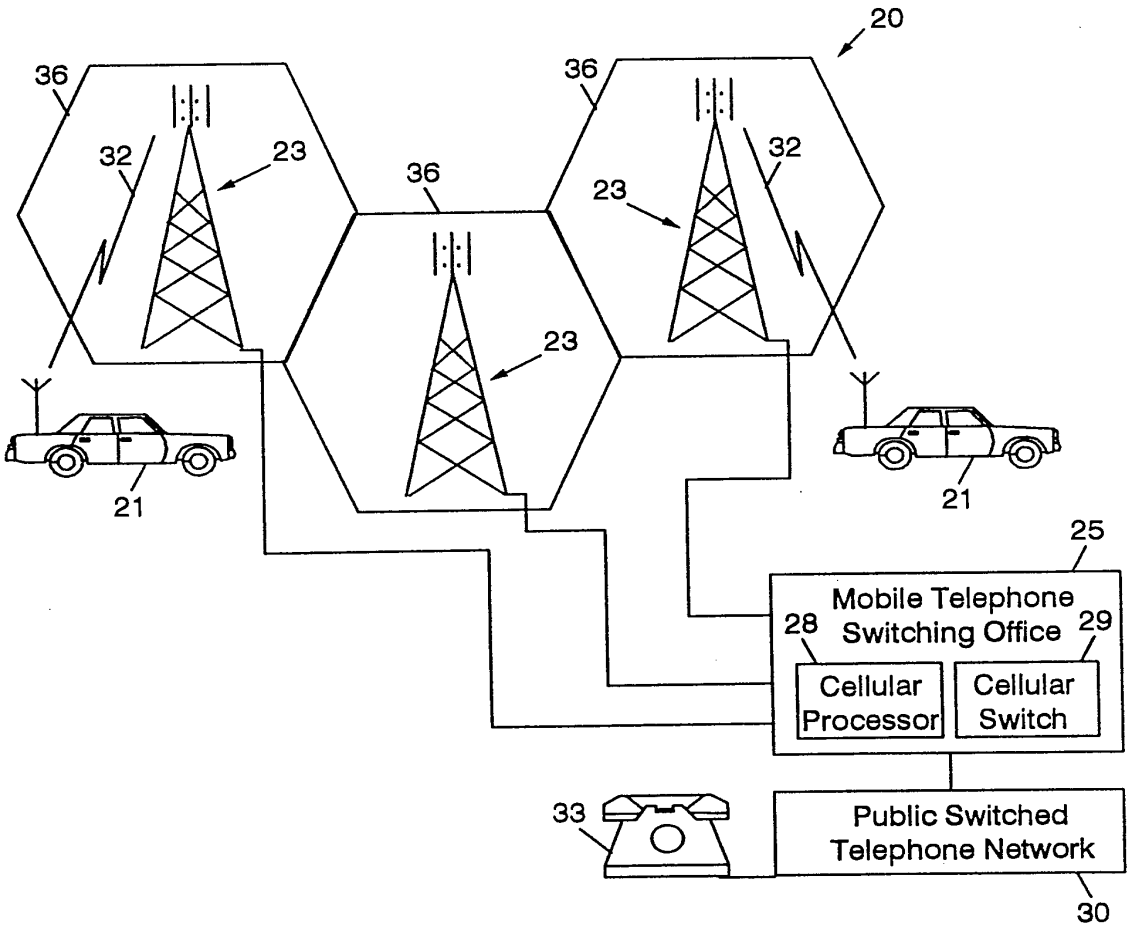


FIG. 2
PRIOR ART

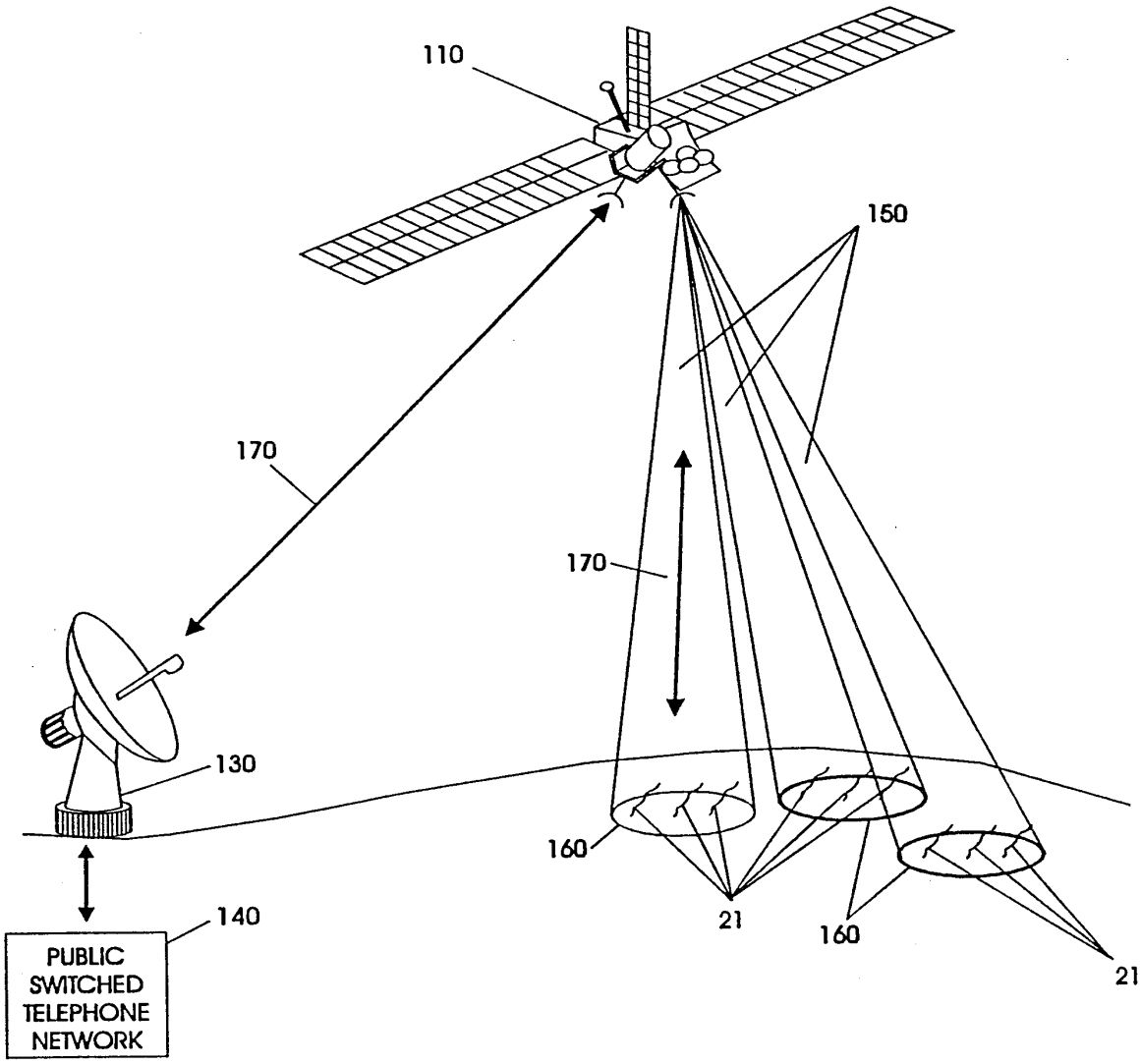


FIG. 3
PRIOR ART

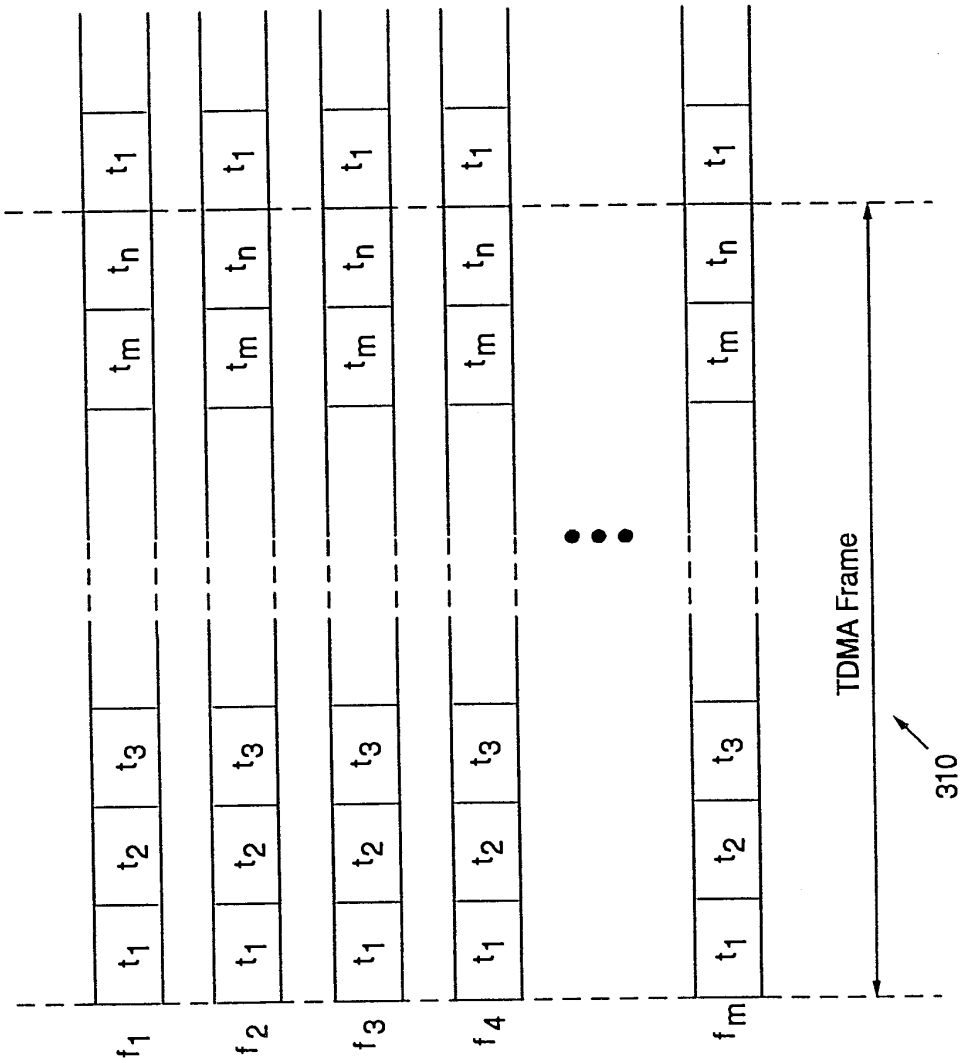


FIG. 4A
PRIOR ART

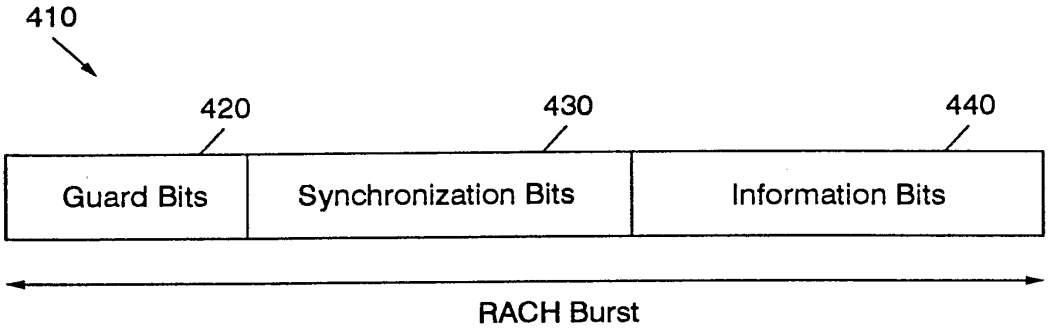


FIG. 4B
PRIOR ART

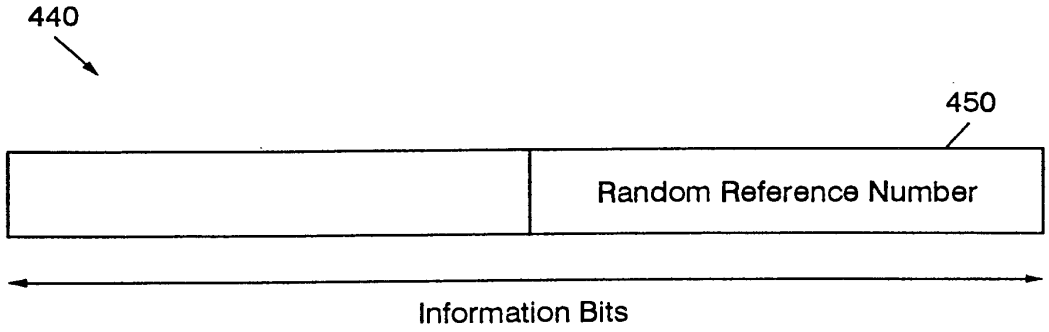


FIG. 5

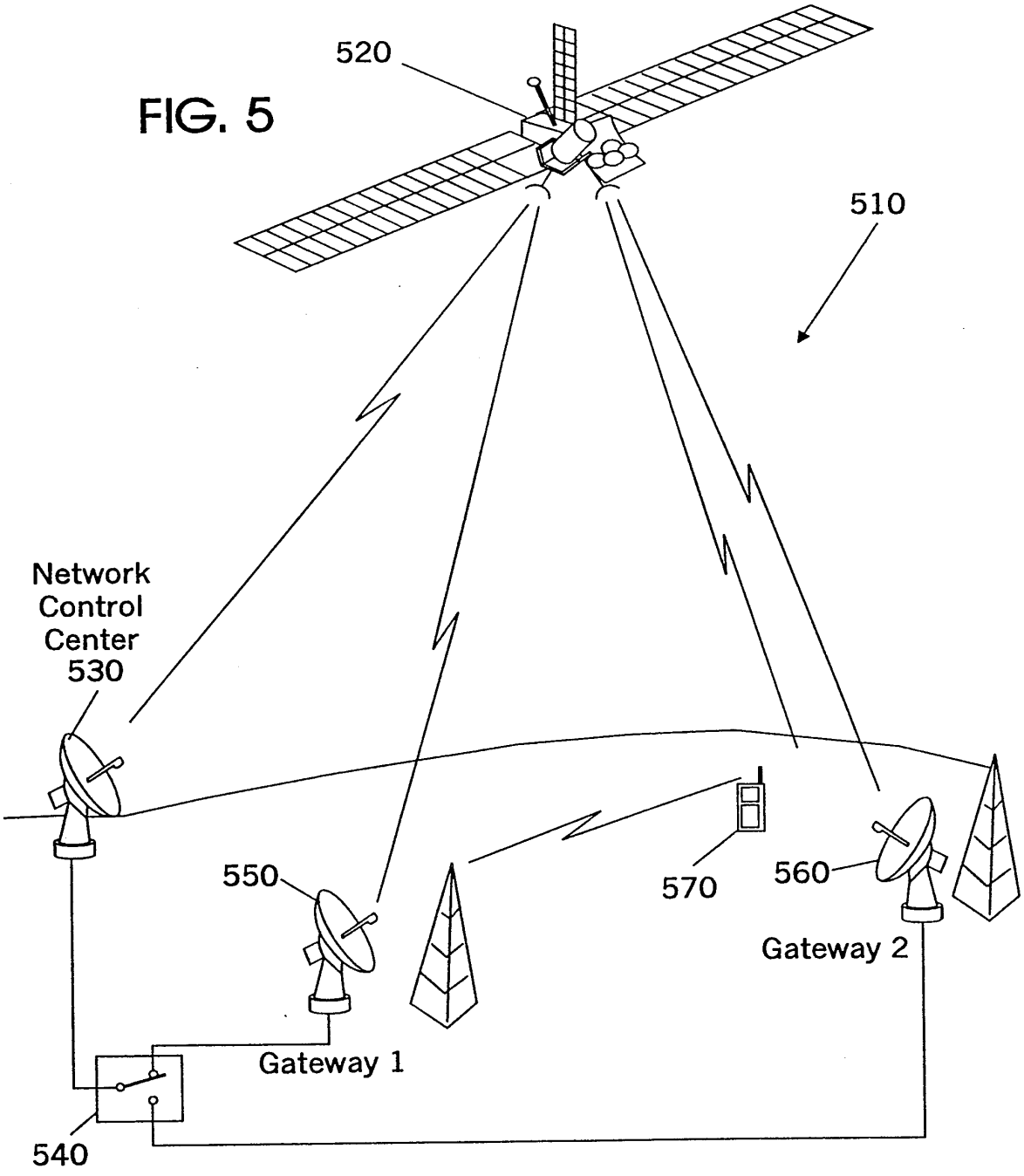

520
510
Network
Control
Center
530
550
570
560
Gateway 2
Gateway 1
540

FIG. 6

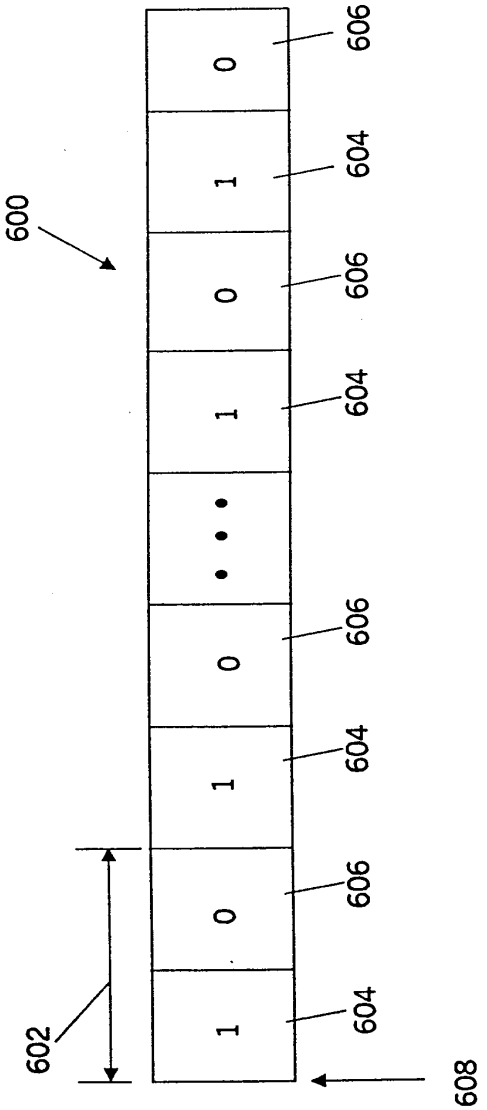


FIG. 7

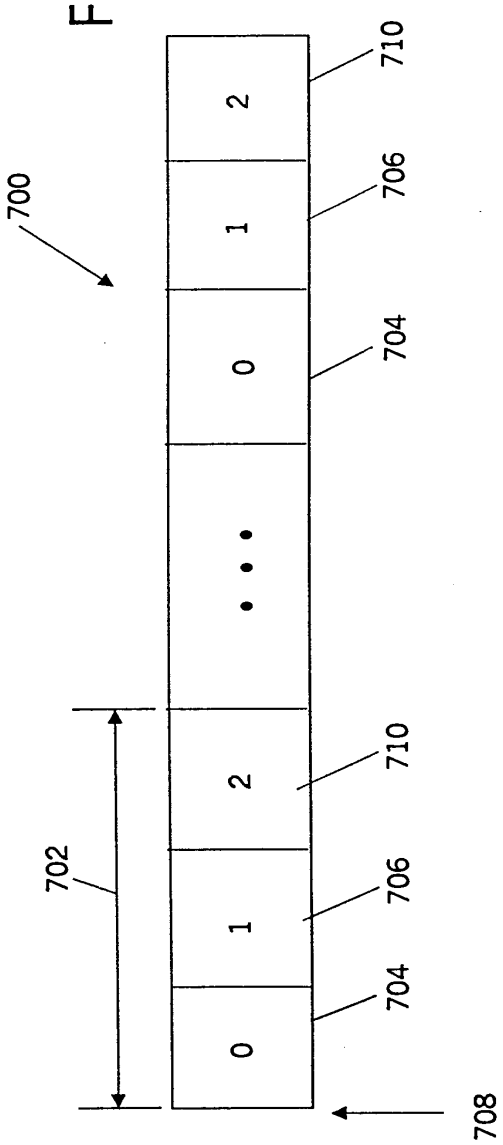


FIG. 8

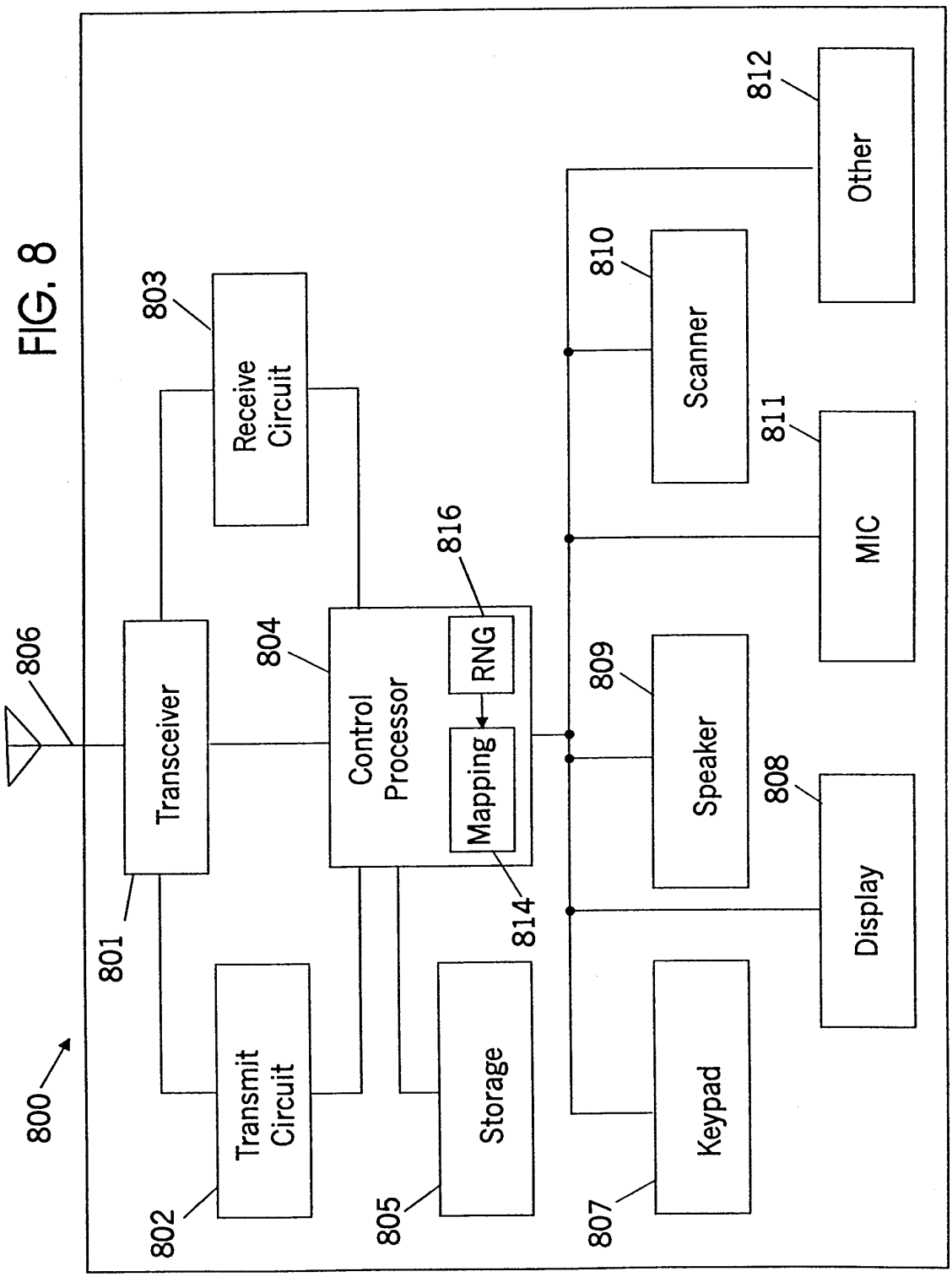
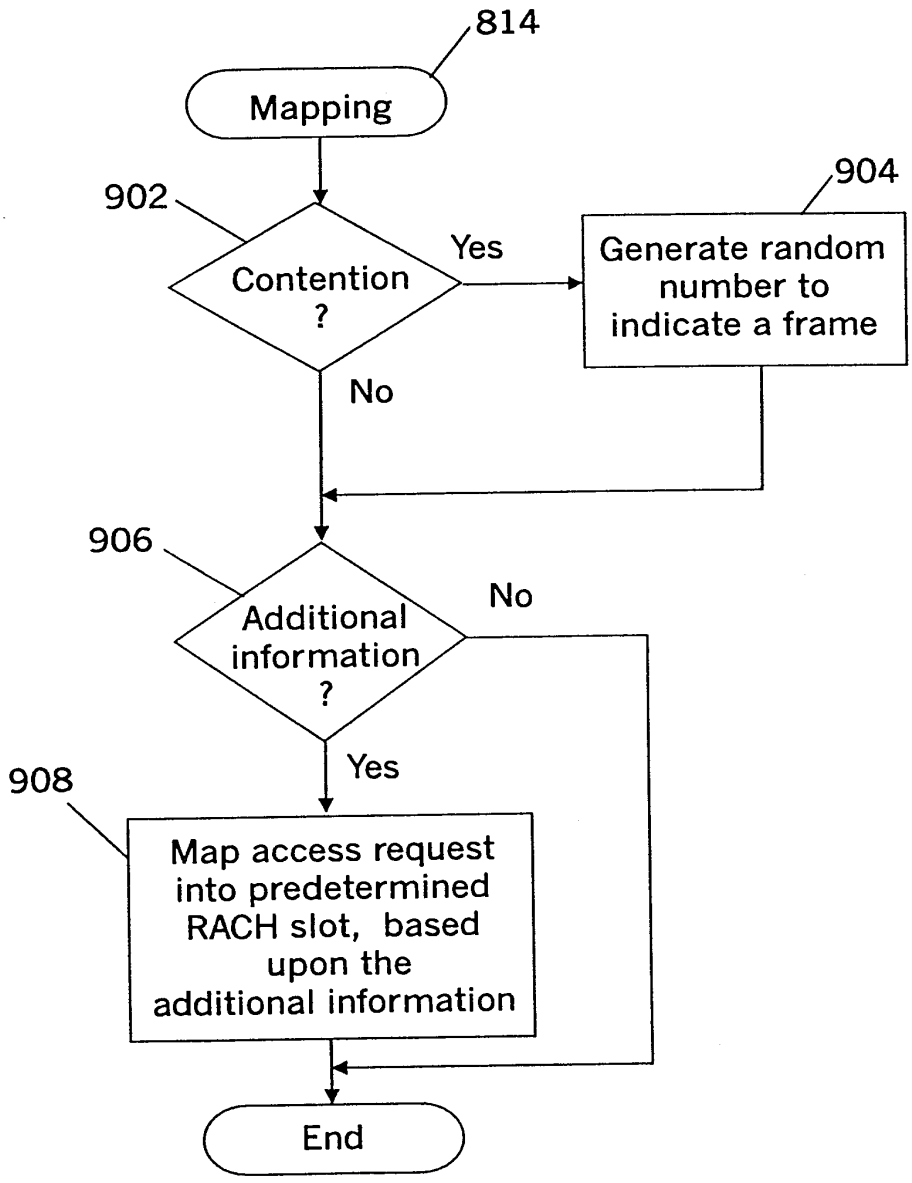

800
806
801
Transceiver
803
Receive Circuit
804
Control Processor
816
RNG
Mapping
814
802
Transmit Circuit
805
Storage
807
Keypad
809
Speaker
808
Display
811
MIC
810
Scanner
812
Other

FIG. 9


814
Mapping
902
Contention ?
Yes
904
Generate random number to indicate a frame
No
906
Additional information ?
No
Yes
908
Map access request into predetermined RACH slot, based upon the additional information
End

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 99/08224

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 38502 A (ERICSSON GE MOBILE INC ;HASSAN AMER (US); RAMESH RAJARAM (US); REI) 16 October 1997 (1997-10-16) page 18, line 1 - page 23, line 9	1,2,6,7, 11,12, 16,17, 21,22, 26,27, 31,32, 35,36, 39,40
A	MICHEL MOULY ET AL: "Power Control" , GSM SYSTEM FOR MOBILE COMMUNICATIONS, PAGE(S) 366 - 373, 424 - 42 , MOULY M;PAUTET M-B XP002079145 page 367, line 25 - page 373, line 20	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

information on patent family members

Intl onal Application No
PCT/US 99/08224

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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11/841,609	20 August 2007 (20.08.2007)	US

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(74) Agent: **BACHAND, Richard, A.**; 5775 Morehouse Drive, San Diego, California 92121 (US).

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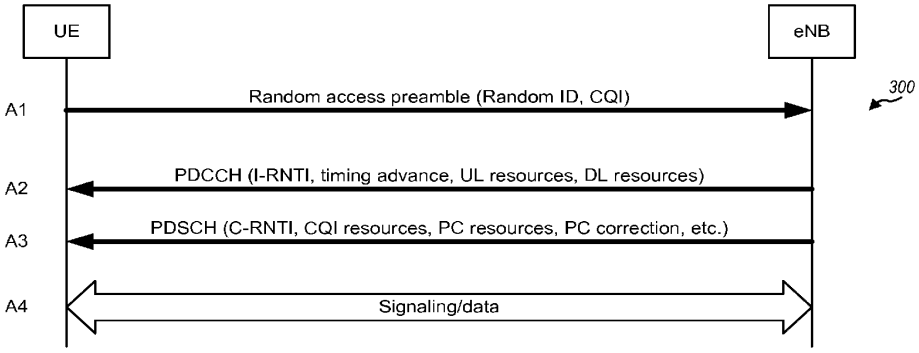
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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR RANDOM ACCESS IN AN ORTHOGONAL MULTIPLE-ACCESS COMMUNICATION SYSTEM



(57) Abstract: Techniques for accessing a wireless communication system are described. A user equipment (UE) sends a random access preamble for system access. The random access preamble may include a random identifier (ID), a channel quality indicator (CQI), etc. The UE may randomly select the random ID or may be assigned this random ID. The UE receives a random access response from a base station. The random access response may include control channel resources (e.g., CQI and PC resources), uplink resources, and/or control information (e.g., timing advance and PC correction) for the UE. The random access response may be sent in two parts using two messages. A first message may be sent on a control channel and may include identification information and possibly other information. A second message may be sent on a shared data channel and may include remaining information for the random access response.

WO 2008/024788 A2

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *without international search report and to be republished upon receipt of that report*

METHOD AND APPARATUS FOR RANDOM ACCESS IN AN ORTHOGONAL MULTIPLE-ACCESS COMMUNICATION SYSTEM

[0001] The present application claims priority to provisional U.S. Application Serial No. 60/839,220, entitled "A METHOD AND APPARATUS FOR ACCESS PROCEDURE FOR ORTHOGONAL MULTIPLE ACCESS SYSTEMS," filed August 21, 2006, U.S. Application Serial No. 60/828,058, entitled "A METHOD AND APPARATUS FOR ACCESS PROCEDURE," filed October 3, 2006, and U.S. Application Serial No. 60/863,610, entitled "A METHOD AND APPARATUS FOR ACCESS PROCEDURE FOR ORTHOGONAL MULTIPLE ACCESS SYSTEMS," filed October 31, 2006, all assigned to the assignee hereof and incorporated herein by reference.

BACKGROUND

I. Field

[0002] The present disclosure relates generally to communication, and more specifically to techniques for accessing a wireless communication system.

II. Background

[0003] Wireless communication systems are widely deployed to provide various communication content such as voice, video, packet data, messaging, broadcast, etc. These wireless systems may be multiple-access systems capable of supporting multiple users by sharing the available system resources. Examples of such multiple-access systems include Code Division Multiple Access (CDMA) systems, Time Division Multiple Access (TDMA) systems, Frequency Division Multiple Access (FDMA) systems, Orthogonal FDMA (OFDMA) systems, and Single-Carrier FDMA (SC-FDMA) systems.

[0004] A wireless communication system may include any number of base stations that can support communication for any number of user equipments (UEs). Each UE may communicate with one or more base stations via transmissions on the downlink and uplink. The downlink (or forward link) refers to the communication link from the base

stations to the UEs, and the uplink (or reverse link) refers to the communication link from the UEs to the base stations.

[0005] A UE may send an access probe on the uplink when the UE desires to gain access to the system. A base station may receive the access probe and respond with an access grant that may contain pertinent information for the UE. Uplink resources are consumed to send access probes, and downlink resources are consumed to send access grants. There is therefore a need in the art for techniques to support system access with as little overhead as possible in order to improve system capacity.

SUMMARY

[0006] Techniques for efficiently accessing a wireless communication system are described herein. In one design, a UE may send a random access preamble (or access probe) for system access. The random access preamble may include a random identifier (ID), a downlink channel quality indicator (CQI), etc. The UE may randomly select the random ID or may be assigned the random ID directly or indirectly (in an assigned random access preamble/access sequence), e.g., during handover. The random ID may be used as identification information for the random access preamble and may allow a base station to asynchronously respond to the random access preamble.

[0007] The UE may receive a random access response (or access grant) from the base station. The random access response may include control channel resources, uplink resources, control information, an assigned ID, etc., for the UE. The control channel resources may include CQI resources used to send CQI on the uplink by the UE, power control (PC) resources used to send PC corrections on the downlink to the UE, etc. The control information may include timing advance used to adjust transmit timing of the UE, PC correction used to adjust transmit power of the UE, etc. The random access response may be sent in two parts using two messages. A first message may be sent on a control channel (e.g., a PDCCH) for a shared data channel (e.g., a PDSCH). A second message may be sent on the shared data channel. The first message may include the identification information for the random access preamble or a random access channel used to send the random access preamble, downlink resources for the shared data channel, and possibly other information. The second message may include remaining information for the random access response. The UE may exchange control

information using the assigned control channel resources and may send data using the assigned uplink resources.

[0008] Various aspects and features of the disclosure are described in further detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 shows a wireless multiple-access communication system.

[0010] FIG. 2 shows a block diagram of a base station and a UE.

[0011] FIGS. 3 through 9 show message flows for various random access procedures.

[0012] FIGS. 10 through 25 show various processes and apparatuses for the UE and the base station for system access by the UE.

DETAILED DESCRIPTION

[0013] The techniques described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, SC-FDMA and other systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as Universal Terrestrial Radio Access (UTRA), cdma2000, etc. UTRA includes Wideband-CDMA (W-CDMA) and Low Chip Rate (LCR). cdma2000 covers IS-2000, IS-95 and IS-856 standards. A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), Ultra Mobile Broadband (UMB), IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM®, etc. UTRA, E-UTRA and GSM are part of Universal Mobile Telecommunication System (UMTS). 3GPP Long Term Evolution (LTE) is an upcoming release of UMTS that uses E-UTRA, which employs OFDMA on the downlink and SC-FDMA on the uplink. UTRA, E-UTRA, GSM, UMTS and LTE are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). cdma2000 and UMB are described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). These various radio technologies and standards are known in the art. For clarity, certain aspects of the techniques are described below for system access in LTE, and LTE terminology is used in much of the description below.

[0014] **FIG. 1** shows a wireless multiple-access communication system according to one design. For simplicity, FIG. 1 shows only two evolved Node B (eNB) 100 and 102. eNB 100 includes multiple antenna groups, one group including antennas 104 and 106, another group including antennas 108 and 110, and an additional group including antennas 112 and 114. In FIG. 1, only two antennas are shown for each antenna group. However, more or fewer antennas may also be utilized for each antenna group. In general, an eNB may be a fixed station used for communicating with the UEs and may also be referred to as a Node B, a base station, an access point, etc.

[0015] A UE 116 is in communication with antennas 112 and 114, where antennas 112 and 114 transmit information to UE 116 via downlink 120 and receive information from UE 116 via uplink 118. A UE 122 is in communication with antennas 106 and 108, where antennas 106 and 108 transmit information to UE 122 via downlink 126 and receive information from UE 122 via uplink 124. In general, a UE may be stationary or mobile and may also be referred to as a mobile station, a terminal, an access terminal, a subscriber unit, a station, etc. A UE may be a cellular phone, a personal digital assistant (PDA), a wireless communication device, a handheld device, a wireless modem, a laptop computer, etc. In a frequency division duplex (FDD) system, communication links 118, 120, 124 and 126 may use different frequencies for communication. For example, downlink 120 and 126 may use one frequency, and uplink 118 and 124 may use another frequency.

[0016] The overall coverage area of eNB 100 may be partitioned into multiple (e.g., three) smaller areas. These smaller areas may be served by different groups of antennas of eNB 100. In 3GPP, the term "cell" can refer to the smallest coverage area of an eNB and/or an eNB subsystem serving this coverage area. In other systems, the term "sector" can refer to the smallest coverage area and/or the subsystem serving this coverage area. For clarity, 3GPP concept of cell is used in the description below. In one design, the three antenna groups of eNB 100 support communication for UEs in three cells of eNB 100.

[0017] **FIG. 2** shows a block diagram of a design of eNB 100 and UE 116. In this design, eNB 100 is equipped with T antennas 224a through 224t, and UE 116 is equipped with R antennas 252a through 252r, where in general $T \geq 1$ and $R \geq 1$.

[0018] At eNB 100, a transmit (TX) data processor 214 may receive traffic data for one or more UEs from a data source 212. TX data processor 214 may process (e.g.,

format, encode, and interleave) the traffic data for each UE based on one or more coding schemes selected for that UE to obtain coded data. TX data processor 214 may then modulate (or symbol map) the coded data for each UE based on one or more modulation schemes (e.g., BPSK, QSPK, M-PSK or M-QAM) selected for that UE to obtain modulation symbols.

[0019] A TX MIMO processor 220 may multiplex the modulation symbols for all UEs with pilot symbols using any multiplexing scheme. Pilot is typically known data that is processed in a known manner and may be used by a receiver for channel estimation and other purposes. TX MIMO processor 220 may process (e.g., precode) the multiplexed modulation symbols and pilot symbols and provide T output symbol streams to T transmitters (TMTR) 222a through 222t. In certain designs, TX MIMO processor 220 may apply beamforming weights to the modulation symbols to spatially steer these symbols. Each transmitter 222 may process a respective output symbol stream, e.g., for orthogonal frequency division multiplexing (OFDM), to obtain an output chip stream. Each transmitter 222 may further process (e.g., convert to analog, amplify, filter, and upconvert) the output chip stream to obtain a downlink signal. T downlink signals from transmitters 222a through 222t may be transmitted via T antennas 224a through 224t, respectively.

[0020] At UE 116, antennas 252a through 252r may receive the downlink signals from eNB 100 and provide received signals to receivers (RCVR) 254a through 254r, respectively. Each receiver 254 may condition (e.g., filter, amplify, downconvert, and digitize) a respective received signal to obtain samples and may further process the samples (e.g., for OFDM) to obtain received symbols. A MIMO detector 260 may receive and process the received symbols from all R receivers 254a through 254r based on a MIMO receiver processing technique to obtain detected symbols, which are estimates of the modulation symbols transmitted by eNB 100. A receive (RX) data processor 262 may then process (e.g., demodulate, deinterleave, and decode) the detected symbols and provide decoded data for UE 116 to a data sink 264. In general, the processing by MIMO detector 260 and RX data processor 262 is complementary to the processing by TX MIMO processor 220 and TX data processor 214 at eNB 100.

[0021] On the uplink, at UE 116, traffic data from a data source 276 and signaling messages may be processed by a TX data processor 278, further processed by a modulator 280, conditioned by transmitters 254a through 254r, and transmitted to eNB

100. At eNB 100, the uplink signals from UE 116 may be received by antennas 224, conditioned by receivers 222, demodulated by a demodulator 240, and processed by an RX data processor 242 to obtain the traffic data and messages transmitted by UE 116.

[0022] Controllers/processors 230 and 270 may direct the operation at eNB 100 and UE 116, respectively. Memories 232 and 272 may store data and program codes for eNB 100 and UE 116, respectively. A scheduler 234 may schedule UEs for downlink and/or uplink transmission and may provide assignments of resources for the scheduled UEs.

[0023] The system may support one set of transport channels for the downlink and another set of transport channels for the uplink. These transport channels may be used to provide information transfer services to Medium Access Control (MAC) and higher layers. The transport channels may be described by *how* and with what characteristics information is sent over a radio link. The transport channels may be mapped to physical channels, which may be defined by various attributes such as modulation and coding, mapping of data to resource blocks, etc. Table 1 lists some physical channels used for the downlink (DL) and uplink (UL) in LTE in accordance with one design.

Table 1

Link	Channel	Channel Name	Description
DL	PBCH	Physical Broadcast Channel	Carry control information broadcast over a cell.
DL	PDCCH	Physical Downlink Control Channel	Carry UE-specific control information for the PDSCH.
DL	PDSCH	Physical Downlink Shared Channel	Carry data for UEs in a shared manner.
UL	PRACH	Physical Random Access Channel	Carry random access preambles from UEs attempting to access the system.
UL	PUCCH	Physical Uplink Control Channel	Carry control information from UEs such as CQI, ACK/NAK, resource requests, etc.
UL	PUSCH	Physical Uplink Shared Channel	Carry data sent by a UE on uplink resources assigned to the UE.

[0024] Other physical channels may also be used for paging, multicast, etc. The physical channels may also be referred to by other names. For example, the PDCCH may also be referred to as a Shared Downlink Control Channel (SDCCH), Layer

1/Layer 2 (L1/L2) control, etc. The PDSCH may also be referred to as a downlink PDSCH (DL-PDSCH). The PUSCH may also be referred to as an uplink PDSCH (UL-PDSCH).

[0025] The transport channels may include a Downlink Shared Channel (DL-SCH) used to send data to UEs, an Uplink Shared Channel (UL-SCH) used to send data by UEs, a Random Access Channel (RACH) used to access the system, etc. The DL-SCH may be mapped to the PDSCH and may also be referred to as a Downlink Shared Data Channel (DL-SDCH). The UL-SCH may be mapped to the PUSCH and may also be referred to as an Uplink Shared Data Channel (UL-SDCH). The RACH may be mapped to the PRACH.

[0026] A UE may transmit a random access preamble on the uplink whenever the UE desires to access the system, e.g., if the UE has data to send or if the UE is paged by the system. A random access preamble may also be referred to as an access signature, an access probe, a random access probe, a signature sequence, a RACH signature sequence, etc. The random access preamble may include various types of information and may be sent in various manners, as described below. An eNB may receive the random access preamble and may respond by sending a random access response to the UE. A random access response may also be referred to as an access grant (AGCH), an access response, etc. The random access response may carry various types of information and may be sent in various manners, as described below. The UE and Node B may further exchange signaling to set up a radio connection and may thereafter exchange data.

[0027] It may be beneficial to provide assigned resources and control information in the random access response in order to expedite communication between the UE and eNB. However, a large number of bits may be used to convey the resource assignment and control information. In an aspect, the random access response may be partitioned into multiple parts that may be efficiently sent on the PDCCH and PDSCH, as described below. In another aspect, the eNB may asynchronously respond to the random access preamble and may identify this random access preamble using various mechanisms, as also described below.

[0028] **FIG. 3** shows a message flow for a design of a random access procedure 300. In this design, the UE may access the system by sending a random access preamble, e.g., in response to data arriving at a UE transmit buffer (step A1). The

random access preamble may include L bits, where L may be any integer value. An access sequence may be selected from a pool of 2^L available access sequences and sent for the random access preamble. In one design, the random access preamble may include $L = 6$ bits, and one access sequence may be selected from a pool of 64 access sequences. The access sequences may be of any length and may be designed to have good detection properties.

[0029] In one design, the random access preamble may include (i) a random ID that may be pseudo-randomly selected by the UE and (ii) a downlink CQI indicative of the downlink channel quality as measured by the UE. The random ID may be used to identify the random access preamble from the UE. The downlink CQI may be used to send subsequent downlink transmission to the UE and/or to assign uplink resources to the UE. In one design, a 6-bit random access preamble may include a 4-bit random ID and a 2-bit CQI. In another design, a 6-bit random access preamble may include a 5-bit random ID and a 1-bit CQI. The random access preamble may also include different and/or additional information, and each type of information may include any number of bits.

[0030] The UE may determine an Implicit Radio Network Temporary Identifier (I-RNTI) that may be used as a temporary ID for the UE during system access. The UE may be identified by the I-RNTI until a more permanent ID such as a Cell RNTI (C-RNTI) is assigned to the UE. In one design, the I-RNTI may include the following:

- System time (8 bits) - time when the access sequence is sent by the UE, and
- RA-preamble identifier (6 bits) - index of the access sequence sent by the UE.

[0031] The RA-preamble identifier may be an L-bit value for the random access preamble being sent by the UE. The RA-preamble identifier may also be referred to as a random access preamble identifier, an access signature index, etc.

[0032] The I-RNTI may have a fixed length (e.g., 16 bits) and may be padded with a sufficient number of zeros (e.g., 2 zeros) to achieve the fixed length. The UE may send the access sequence in an access slot that is present in each frame. The system time may then be given in units of frames. An 8-bit system time may be unambiguous over 256 frames. If a frame has a duration of 10 milliseconds (ms), then the I-RNTI may be valid for 2560 ms with the 8-bit system time. In another design, the I-RNTI is composed of 4-bit system time, 6-bit RA-preamble identifier, and padding bits (if needed). In this design, the I-RNTI may be valid for 160 ms. In yet another design, a

frequency slot may be used for either the RA-preamble identifier or the system time. In general, the I-RNTI may be formed with any information that may (i) allow the UE or random access preamble to be individually addressed and (ii) reduce the likelihood of collision with another UE using the same I-RNTI. The lifetime of the I-RNTI may be selected based on the maximum expected response time for an asynchronous response to the random access preamble.

[0033] An eNB may receive the random access preamble from the UE and may respond by sending a random access response to the UE. The eNB may determine the I-RNTI of the UE in the same manner as the UE. Since the I-RNTI is valid for a particular time window or lifetime (e.g., 2560 ms with the 8-bit system time), the eNB may respond any time within this time window. However, the eNB may typically respond in a much shorter interval (e.g., in 40 to 80 ms) in order to save on complexity and improve system access response time. The I-RNTI may thus allow the eNB to address the UE and to asynchronously respond to the random access preamble from the UE.

[0034] The eNB may send the random access response on the PDCCH and PDSCH to the UE (steps A2 and A3). In one design, the PDCCH may carry a message containing the following:

- I-RNTI - identify the UE as the recipient of the access grant sent by the eNB,
- Timing advance - indicate adjustment to the transmit timing of the UE,
- UL resources - indicate resources granted to the UE for uplink transmission, and
- DL resources - indicate PDSCH resources used to send remaining information in the random access response to the UE.

[0035] The timing advance may also be referred to as timing alignment information, timing adjustment, timing correction, etc. The eNB may determine the timing of the random access preamble, as received at the eNB. The eNB may generate the timing advance such that subsequent uplink transmissions from the UE are properly time-aligned at the eNB.

[0036] The UL and DL resources may be conveyed in various manners. In one design, the available resources for a given link may be partitioned into resource blocks, and the granted resources may be conveyed by a resource block index. In another design, the grant resources may be conveyed by the size and time-frequency location of the granted resources. The access grant may also convey the modulation and coding to

use for the granted resources. Alternatively, the modulation and coding may be fixed/predefined or may be advertised on a broadcast channel. In general, the PDCCH may convey any information used by the UE to transmit on the UL resources and any information used by the UE to receive the transmission sent on the PDSCH to the UE.

[0037] The I-RNTI may be sent explicitly in a designated field. Alternatively, the I-RNTI may be sent implicitly and embedded with other information, which may reduce the amount of information to send on the PDCCH. For example, a cyclic redundancy check (CRC) may be generated based on all information being sent on the PDCCH (except for the I-RNTI). The CRC may be exclusive ORed (XORed) with the I-RNTI, and the XORed CRC may be sent on the PDCCH. The recipient UE would be able to recover the CRC by applying the correct I-RNTI, while other UEs would generate erroneous CRCs by applying wrong I-RNTIs.

[0038] In one design, the PDSCH may carry a message containing the following:

- C-RNTI - included by the eNB if one is being assigned to the UE,
- CQI resources - indicate UL resources granted to the UE to send CQI,
- PC resources - indicate DL resources used to send PC corrections to the UE, and
- PC correction - indicate adjustment to the transmit power of the UE.

[0039] The C-RNTI may be used to identify the UE for a communication session. A MAC ID or some other type of ID may also be used instead of the C-RNTI to identify the UE. The C-RNTI may be sent on the PDSCH as part of the random access response, if it is available, or may be sent at any time within the lifetime of the I-RNTI. The I-RNTI may be used to identify the UE until the C-RNTI is assigned. The CQI and PC resources may be conveyed in various manners. In one design, the CQI or PC resources may be conveyed by a resource block index, the size and time-frequency location of the granted resources, the frequency of the granted resources, etc. In one design, the PC correction may be either (i) an up command to increase the UE's transmit power by a predetermined up step size or (ii) a down command to decrease the UE's transmit power by a predetermined down step size. In another design, the PC correction may indicate the amount of increase or decrease in transmit power.

[0040] The messages sent on the PDCCH and PDSCH may also carry different and/or other information. The eNB may transmit the PDCCH in a broadcast manner so that it can be reliably received by all UEs within the coverage of the eNB, e.g., by using sufficiently low code rate and modulation order and sufficiently high transmit power.

The eNB may transmit the message for the UE on the PDSCH in a broadcast manner. Alternatively, the eNB may transmit this message using a modulation and coding scheme (MCS) selected based on the CQI received from the UE in the random access preamble. This may result in more efficient use of the available resources for the PDSCH.

[0041] The UE may receive and decode the messages sent on the PDCCH and PDSCH to the UE. After decoding these two messages, the UE has sufficient resources configured and can exchange Layer 3 signaling and/or data with the eNB (step A4). The UE may send an acknowledgement (ACK) to the eNB using on-off keying (OOK) to indicate successful reception of the messages. For OOK, an ACK may be sent as 1 (or "on"), and a negative acknowledgement (NAK) may be sent as 0 (or "off"). If the eNB asynchronously responds to the random access preamble from the UE, then the use of OOK would result in the UE transmitting on the uplink only for the ACK and not for the NAK. After achieving synchronization, the UE may transmit ACKs/NAKs using other modulation techniques, e.g., 3-state modulation.

[0042] Multiple UEs may randomly select the same random ID and may also send random access preambles in the same frame. When such a collision occurs, a mechanism may be implemented in the signaling exchange in step A4 to resolve the access contention.

[0043] The UE may operate in one of several states such as LTE Detached, LTE Idle and LTE Active states, which may be associated with RRC_NULL, RRC_IDLE and RRC_CONNECTED states, respectively. Radio Resource Control (RRC) may perform various functions for establishment, maintenance and termination of calls. In the LTE Detached state, the UE has not accessed the system and is not known by the system. The UE may power up in the LTE Detached state and may operate in the RRC_NULL state. The UE may transition to either the LTE Idle state or LTE Active state upon accessing the system and performing registration. In the LTE Idle state, the UE may have performed registration but may not have any data to exchange on the downlink or uplink. The UE may thus be idle and operate in the RRC_IDLE state. In the LTE Idle state, the UE and system may have pertinent context information to allow the UE to quickly transition to the LTE Active state. The UE may transition to the LTE Active state when there is data to send or receive. In the LTE Active state, the UE may

actively communicate with the system on the downlink and/or uplink and may operate in the RRC_CONNECTED state.

[0044] **FIG. 4** shows a message flow for a design of a random access procedure 400. The UE may access the system by sending a random access preamble that may include a random ID, a downlink CQI, and an access type (step B1). The access type may indicate whether the UE is accessing the system from the RRC_NULL, RRC_IDLE or RRC_CONNECTED state. The UE may go through an authentication procedure when accessing the system from the RRC_NULL or RRC_IDLE state and may thus need different resource assignment than for system access from the RRC_CONNECTED state. The UE may communicate with an eNB in the RRC_CONNECTED state and may access another eNB for handover. The random access preamble may also include different and/or additional information. The UE may determine an I-RNTI as described above for FIG. 3.

[0045] An eNB may receive the random access preamble from the UE and may respond by sending a random access response on the PDCCH and PDSCH to the UE (steps B2 and B3). The eNB may determine the I-RNTI of the UE based on the random access preamble. In one design, the PDCCH may carry a message containing the I-RNTI and the DL resources for the PDSCH, which is used to send remaining information to the UE. In one design, the PDSCH may carry a message containing a C-RNTI (if available), timing advance, UL resources, CQI resources, PC resources, PC correction, etc. The messages sent on the PDCCH and PDSCH may also carry different and/or other information.

[0046] The eNB may transmit the PDCCH and PDSCH as described above for FIG. 3. The UE may receive and decode the messages sent on the PDCCH and PDSCH to the UE. After decoding these two messages, the UE has sufficient resources configured and can exchange Layer 3 signaling and/or data with the eNB (step B4).

[0047] **FIG. 5** shows a message flow for a design of a random access procedure 500. The UE may access the system by sending a random access preamble that may include a random ID and a downlink CQI (step C1). The random access preamble may also include different and/or additional information.

[0048] An eNB may receive the random access preamble from the UE and may respond by sending a random access response on the PDCCH and PDSCH to the UE (steps C2 and C3). In one design, the PDCCH may carry a message containing an RA-

preamble identifier for the received random access preamble, timing advance, UL resources, DL resources, and a validity field. The validity field may support asynchronous access response and may indicate the frame for which the random access response is applicable. In one design, the validity field may include two bits and may be set to 00 to indicate that the current response is for the random access preamble sent in the current frame, to 01 to indicate that the current response is for the random access preamble sent in the previous frame, etc. To save bits, the RA-preamble identifier may mask a CRC generated based on all information sent on the PDCCH. In one design, the PDSCH may carry a message containing a C-RNTI (if available), CQI resources, PC resources, PC correction, etc. The messages sent on the PDCCH and PDSCH may also carry different and/or other information.

[0049] The eNB may transmit the PDCCH and PDSCH as described above for FIG. 3. The UE may receive and decode the messages sent on the PDCCH and PDSCH to the UE. After decoding these two messages, the UE has sufficient resources configured and can exchange Layer 3 signaling and/or data with the eNB (step C4).

[0050] In general, the random access preamble and the random access response may include any parameters, which may have any sizes. In one design, the random access preamble and the random access response may include the parameters given below:

- Random access preamble may include the following:
  Random ID - 4 bits
  Downlink CQI - 2 bits
- Random access response may include the following:
  C-RNTI - 16 bits
  Timing advance - 8 bits
  CQI resources & PC resources - 16 bits
  UL resources - 7 bits for resource block ID and 5 bits for MCS
  CRC - 16 bits (possibly masked with the I-RNTI or RA-preamble identifier)

[0051] In the design given above, a total of 68 bits may be sent for the random access response. A 68-bit message may be too large to efficiently send on the PDCCH. Improved efficiency may be achieved by splitting the information in the random access response into two parts and sending them on the PDCCH and PDSCH. In one design, the messages for the two parts may be as follows:

- Message for part I sent on the PDCCH may include the following:
  Timing advance - 8 bits
  DL resources - 7 bits for resource block ID
  UL resources - 7 bits for resource block ID
  Validity - 2 bits
  CRC masked with the RA-preamble identifier - 16 bits
- Message for part II sent on the PDSCH may include the following:
  C-RNTI - 16 bits
  CQI resources - 16 bits
  PC resources - 16 bits

[0052] In the design given above, the DL and UL resources are conveyed by a resource block ID or index. A predetermined modulation scheme (e.g., QPSK) and/or a predetermined coding scheme (e.g., code rate 1/3) may be used for the UL resources. Alternatively, the modulation and coding for the UL resources may be sent on the PDCCH or PDSCH. Similarly, a predetermined modulation scheme (e.g., QPSK) and/or a predetermined coding scheme (e.g., code rate 1/3) may be used for the DL resources. Alternatively, the modulation and coding for the DL resources may be sent on the PDCCH. For both the UL and DL resources, the code rate may be dependent on the number of assigned resource blocks.

[0053] In the design given above, a 40-bit message may be sent on the PDCCH, which may be the standard message size for the PDCCH. In general, the message sent on the PDCCH for part I may be defined such that it can be sent like other messages on the PDCCH. The remaining information for the random access response may be sent on the PDSCH.

[0054] A specific design for various parameters that may be sent for the random access preamble and the random access response has been described above. In general, the random access preamble and the random access response may each include any set of parameters that may have any suitable sizes.

[0055] **FIG. 6** shows a message flow for a design of a random access procedure 600. In this design, multiple RACHs may be available, and the UE may randomly select one of the available RACHs for use. Each RACH may be associated with a different Random Access RNTI (RA-RNTI). The available RACHs and/or their RA-RNTIs may be sent in the broadcast channel or conveyed in other manners. The UE

may access the system by sending a random access preamble on the selected RACH (step D1). The random access preamble may include a random ID, a downlink CQI, an access type, some other information, or any combination thereof. The UE may be identified by a combination of the RA-preamble identifier and the RA-RNTI of the selected RACH during the system access. In effect, an I-RNTI may be defined based on the RA-preamble identifier and the RA-RNTI (instead of system time).

[0056] An eNB may receive the random access preamble from the UE and may respond by sending a random access response on the PDCCH and PDSCH to the UE (steps D2 and D3). In one design, the PDCCH may carry a message containing the RA-RNTI and the DL resources for the PDSCH. In one design, the PDSCH may carry a message containing the RA-preamble identifier, a C-RNTI (if available), timing advance, UL resources, CQI resources, PC resources, PC correction, etc. The messages sent on the PDCCH and PDSCH may also carry different and/or other information. The eNB may transmit the PDCCH and PDSCH as described above for FIG. 3.

[0057] The UE may receive and decode the message sent on the PDCCH. The UE may recognize that a message might be sent on the PDSCH to the UE based on the RA-RNTI included in the message sent on the PDCCH. The UE may then receive and decode the message sent on the PDSCH. The UE may recognize that this message might be addressed to the UE based on the RA-preamble identifier included in the message. After decoding these two messages, the UE has sufficient resources configured and can exchange Layer 3 signaling and/or data with the eNB (step D4).

[0058] **FIG. 7** shows a message flow for a design of a random access procedure 700. In this design, the UE may be in an RRC_NULL or RRC_IDLE state and may access the system by sending a random access preamble (step E1). The random access preamble may include a random ID and possibly one or more additional bits for downlink CQI and/or other information. The UE may determine an I-RNTI as described above for FIG. 3.

[0059] An eNB may receive the random access preamble from the UE and may respond by sending a random access response on the PDCCH and/or PDSCH to the UE (steps E2). The random access response may include timing advance, UL resources, and a CRC. The CRC may be XORed with the I-RNTI (as shown in FIG. 7), an RA-preamble identifier, an RA-RNTI, and/or other information to identify the UE being

addressed. Different and/or other information may also be sent on the PDCCH/PDSCH in step E2.

[0060] The UE may then respond with a unique UE ID in order to resolve possible collision (steps E3). The unique UE ID may be an International Mobile Subscriber Identity (IMSI), a Temporary Mobile Subscriber Identity (TMSI), an International Mobile Equipment Identity (IMEI), an Electronic Serial Number (ESN), a Mobile Equipment Identifier (MEID), an IP address, etc. The unique UE ID may also be a registration area ID if the UE has already registered in a given area. The UE may also send downlink CQI, pilot measurement report, etc., along with the unique UE ID.

[0061] The eNB may receive a unique "handle" or pointer to the unique UE ID. The eNB may then assign a C-RNTI and control channel resources to the UE. The eNB may send a response on the PDCCH and PDSCH (steps E4 and E5). In one design, the PDCCH may carry a message containing the I-RNTI and the DL resources for the PDSCH. In one design, the PDSCH may carry a message containing the unique UE ID, the C-RNTI (if assigned), CQI resources, PC resources, PC correction, etc. The messages sent on the PDCCH and PDSCH may also carry different and/or other information.

[0062] The UE may receive and decode the messages sent on the PDCCH and PDSCH to the UE. After decoding these two messages, the UE has sufficient resources configured and can exchange Layer 3 signaling with the eNB (steps E6 and E7). The Layer 3 signaling may include Non-Access Stratum (NAS) messages for authentication of the UE, configuration of the radio link between the UE and eNB, connection management, etc. The UE and eNB may exchange data after completing the Layer 3 signaling (step E8).

[0063] The system may support hybrid automatic retransmission (HARQ) in order to improve reliability of data transmission. For HARQ, a transmitter may send a transmission for a message and may send one or more retransmissions, if needed, until the message is decoded correctly by a receiver, or the maximum number of retransmissions has been sent, or some other termination condition is encountered. A message may also be referred to as a packet, a data frame, a data unit, a data block, etc. Each transmission and each retransmission of a message may also be referred to as an HARQ transmission.

[0064] As shown in FIG. 7, HARQ may be used for the messages sent in steps E3 and later. A transmitter may send an HARQ transmission for a message, and a receiver may send an ACK if the message is decoded correctly or a NAK if the message is decoded in error. For an HARQ transmission sent on assigned DL resources, an ACK or NAK may be sent on UL control resources associated with the assigned DL resources. Similarly, for an HARQ transmission sent on assigned UL resources, an ACK or NAK may be sent on DL control resources associated with the assigned UL resources. The location of the ACKs/NAKs may thus be implicit and known *a priori* based on the assigned DL or UL resources.

[0065] **FIG. 8** shows a message flow for a design of a random access procedure 800. In this design, the UE may be in an RRC_IDLE or RRC_CONNECTED state and may already have an C-RNTI assigned to the UE. The UE may access the system from the RRC_IDLE state in response to receiving data to send or from the RRC_CONNECTED state in response to a handover command. The UE may send a random access preamble, which may include a random ID and possibly one or more additional bits for downlink CQI and/or other information (step F1).

[0066] An eNB may receive the random access preamble from the UE and may respond by sending a random access response on the PDCCH and/or PDSCH to the UE (steps F2). The random access response may include timing advance, UL resources, and a CRC that may be XORed with an I-RNTI (as shown in FIG. 8), an RA-preamble identifier, an RA-RNTI, and/or other information to identify the UE. Different and/or other information may also be sent on the PDCCH/PDSCH in step F2.

[0067] The UE may then send its C-RNTI, downlink CQI, pilot measurement report and/or other information to the eNB (steps F3). The eNB does not need to assign a C-RNTI but may assign control channel resources to the UE. The eNB may then send a response on the PDCCH and PDSCH (steps F4 and F5). In one design, the PDCCH may carry a message containing the C-RNTI and the DL resources for the PDSCH. In one design, the PDSCH may carry a message containing the CQI resources, PC resources, PC correction, etc. The messages sent on the PDCCH and PDSCH may also carry different and/or other information.

[0068] The UE may receive and decode the messages sent on the PDCCH and PDSCH to the UE. After decoding these two messages, the UE has sufficient resources configured and can exchange data with the eNB (step F6). Since the UE has already

been authenticated prior to being assigned the C-RNTI, the Layer 3 signaling exchange may be omitted, and the UE and eNB may exchange data immediately.

[0069] FIG. 8 may also be used when the UE does not have an assigned C-RNTI. In this case, a registration area ID or some other identification information may be sent instead of the C-RNTI.

[0070] **FIG. 9** shows a message flow for a design of a random access procedure 900 for handover. In this design, the UE may be communicating with a source eNB and may be handed over to a target eNB. The UE may be assigned a random ID by the source eNB for use to access the target eNB. To avoid collision, a subset of all possible random IDs may be reserved for handover, and the random ID assigned to the UE may be selected from this reserved subset. Information regarding the subset of reserved random IDs (or the remaining random IDs usable for normal system access) may be broadcast to all UEs or made known to the UEs in other manners.

[0071] The source eNB may inform the target eNB of the C-RNTI, random ID, CQI resources, PC resources and/or other information for the UE. Collision resolution may not be necessary due to a one-to-one mapping between the assigned random ID and the C-RNTI of the UE. The target eNB may thus have pertinent information for the UE prior to the random access procedure. For simplicity, FIG. 9 shows the random access procedure between the UE and the target eNode B.

[0072] The UE may send a random access preamble, which may include the random ID assigned to the UE and possibly other information (step G1). The target eNB may receive the random access preamble and may respond by sending a random access response on the PDCCH and/or PDSCH to the UE (steps G2). The random access response may include timing advance, UL resources, and a CRC that may be XORed with the C-RNTI of the UE. Different and/or other information may also be sent on the PDCCH/PDSCH in step G2.

[0073] After receiving the information sent in step G2, the UE has sufficient resources configured and can exchange data with the eNB. The UE may send a Layer 2 ACK for the information received in step G2 and may also send data and/or other information (steps G3). The eNB may then send data to the UE on the PDSCH (step G5) and may send signaling for the PDSCH on the PDCCH (step G4).

[0074] The random access procedure in FIG. 9 may also be used for initial system access. For example, the UE may operate in the RRC_IDLE state and may receive a

page from the system, e.g., for an incoming call or for downlink data available for the UE. The page may include the assigned random ID, which may be selected from the reserved subset.

[0075] FIGS. 3 through 9 show various random access procedures that may be used for initial system access (e.g., from the RRC_NULL state), system access while idle (e.g., from the RRC_IDLE state), and system access for handover (e.g., from the RRC_CONNECTED state). For these random access procedures, the UE may transmit a random access preamble, and an eNB may respond with a random access response that may assign various types of resources and/or provide various types of information. In general, the eNB may assign any resources such as C-RNTI, UL resources, CQI resources, PC resources, etc., which may allow the UE to quickly transmit on the uplink. The eNB may also send control information such as timing advance, PC correction, etc., to control the uplink transmission from the UE.

[0076] **FIG. 10** shows a design of a process 1000 for system access by a UE. The UE may send a random access preamble for system access (block 1012). The random access preamble may include or may be determined based on a random ID, a downlink CQI, an access type, etc., or any combination thereof. An access sequence may be selected for the random access preamble from a pool of available access sequences. The selected access sequence may be sent to convey the random access preamble.

[0077] The UE may receive a random access response comprising control channel resources assigned to the UE (block 1014). The control channel resources may include CQI resources used to send CQI on the uplink by the UE, PC resources used to send PC corrections on the downlink to the UE, etc. The UE may also receive control information (e.g., timing advance and/or PC correction), UL resources, a C-RNTI, etc., from the random access response (block 1016). The UE may receive a first message for the random access response on a control channel (e.g., the PDCCH) for a shared data channel (e.g., the PDSCH) and may receive a second message for the random access response on the shared data channel. The first message may include identification information for the random access preamble, DL resources for the shared data channel, etc. The second message may include the assigned control channel resources, control information, UL resources, C-RNTI, etc. The random access response may also be sent in other manners. The UE may exchange control information using the assigned control

channel resources (block 1018). The UE may also send data using the assigned uplink resources (block 1020).

[0078] **FIG. 11** shows a design of an apparatus 1100 for a UE. Apparatus 1100 includes means for sending a random access preamble for system access (module 1112), means for receiving a random access response comprising control channel resources assigned to the UE (module 1114), means for receiving control information, UL resources, a C-RNTI, etc., from the random access response (module 1116), means for exchanging control information using the assigned control channel resources (module 1118), and means for sending data using the assigned uplink resources (module 1120).

[0079] **FIG. 12** shows a design of a process 1200 performed by a base station, e.g., an eNB, to support system access. The base station may receive a random access preamble sent by a UE for system access (block 1212). The base station may send a random access response comprising control channel resources (e.g., CQI resources, PC resources, etc.) assigned to the UE (block 1214). The base station may also send control information (e.g., timing advance and/or PC correction), UL resources, a C-RNTI, etc., in the random access response (block 1216). The base station may exchange control information with the UE using the assigned control channel resources (block 1218). The base station may also receive data from the UE via the assigned uplink resources (block 1220).

[0080] **FIG. 13** shows a design of an apparatus 1300 for a base station. Apparatus 1300 includes means for receiving a random access preamble sent by a UE for system access (module 1312), means for sending a random access response comprising control channel resources assigned to the UE (module 1314), means for sending control information, UL resources, a C-RNTI, etc., in the random access response (module 1316), means for exchanging control information with the UE using the assigned control channel resources (module 1318), and means for receiving data from the UE via the assigned uplink resources (module 1320).

[0081] **FIG. 14** shows a design of a process 1400 for system access by a UE. The UE may send a random access preamble for system access, with the random access preamble comprising identification information (block 1412). The UE may receive a random access response from a base station, with the random access response being asynchronous with respect to the random access preamble and addressing the random access preamble based on the identification information (block 1414). The

identification information may comprise a random ID and/or some other information. The random access response may comprise a temporary ID (e.g., an I-RNTI), an RA-preamble identifier, a C-RNTI, and/or some other ID associated with or derived from the identification information. The UE may receive the random access response within a predetermined time window from when the random access preamble was sent.

[0082] The UE may select a random ID for use as the identification information. The UE may also be directly or indirectly assigned a random ID, which may be selected from a pool of reserved random IDs. For example, the UE may be assigned a random access preamble or access sequence determined based on the selected random ID and additional information such as CQI. The UE may determine the random access preamble based on the random ID and additional information, e.g., a downlink CQI, an access type, etc. The UE may receive a temporary ID (e.g., an I-RNTI) formed based on the random ID, an RA-preamble identifier determined based on the random ID, a C-RNTI assigned to the UE and associated with the random ID, and/or some other ID from the random access response.

[0083] For the design shown in FIG. 6, the UE may send the random access preamble on a random access channel selected from among a plurality of available random access channels. The UE may receive a first message for the random access response on a control channel for a shared data channel, with the first message including an RA-RNTI for the selected random access channel. The UE may receive a second message for the random access response on the shared data channel, with the second message including the random access preamble identifier.

[0084] **FIG. 15** shows a design of an apparatus 1500 for a UE. Apparatus 1500 includes means for sending a random access preamble for system access, with the random access preamble comprising identification information (module 1512), and means for receiving a random access response from a base station, with the random access response being asynchronous with respect to the random access preamble and addressing the random access preamble based on the identification information (module 1514).

[0085] **FIG. 16** shows a design of a process 1600 performed by a base station to support system access. The base station may receive a random access preamble sent by a UE for system access, with the random access preamble comprising identification information (block 1612). The base station may send a random access response to the

UE, with the random access response being asynchronous with respect to the random access preamble and addressing the random access preamble based on the identification information (block 1614). The identification information may comprise a random ID and/or other information. The random access response may comprise a temporary ID (e.g., I-RNTI), an RA-preamble identifier, a C-RNTI, and/or some other ID associated with or derived from the identification information.

[0086] **FIG. 17** shows a design of an apparatus 1700 for a base station. Apparatus 1700 includes means for receiving a random access preamble sent by a UE for system access, with the random access preamble comprising identification information (module 1712), and means for sending a random access response to the UE, with the random access response being asynchronous with respect to the random access preamble and addressing the random access preamble based on the identification information (module 1714).

[0087] **FIG. 18** shows a design of a process 1800 for system access by a UE during handover. The UE may communicate with a first/source base station (block 1812). The UE may receive a random ID directly or indirectly for handover of the UE from the first base station to a second/target base station (block 1814). The UE may receive the random ID from the first base station, with the random ID being selected from a pool of reserved random IDs. The UE may also be assigned a random access preamble/access sequence composed of the random ID selected by the first base station and additional information such as CQI. The UE may send a random access preamble comprising the random ID to access the second base station, with the random ID being used to identify the UE (block 1816). The UE may receive a random access response comprising UL resources, timing advance, etc. (block 1818). The UE may determine that the random access response is intended for the UE based on a CRC masked with a C-RNTI assigned to the UE. The UE may exchange data with the second base station after receiving the random access response (block 1820).

[0088] **FIG. 19** shows a design of an apparatus 1900 for a UE. Apparatus 1900 includes means for communicating with a first/source base station (module 1912), means for receiving a random ID for handover of the UE from the first base station to a second/target base station (module 1914), means for sending a random access preamble comprising the random ID to access the second base station, with the random ID being used to identify the UE (module 1916), means for receiving a random access response

comprising UL resources, timing advance, etc. (module 1918), means for determining that the random access response is intended for the UE based on a CRC masked with a C-RNTI assigned to the UE, and means for exchanging data with the second base station after receiving the random access response (module 1920).

[0089] **FIG. 20** shows a design of a process 2000 performed by a target base station to support system access during handover. The target base station may receive from a source base station a random ID assigned to a UE for handover from the source base station to the target base station (block 2012). The target base station may also receive other information for the UE such as a C-RNTI, CQI resources, PC resources, etc. from the source base station. The target base station may receive a random access preamble comprising the random ID from the UE (block 2014). The target base station may identify the random access preamble as being from the UE based on the random ID (block 2016). The target base station may send to the UE a random access response including UL resources, timing advance, a CRC masked with the C-RNTI, etc. (block 2018). The target base station may exchange data with the UE after sending the random access response (block 2020).

[0090] **FIG. 21** shows a design of an apparatus 2100 for a target base station. Apparatus 2100 includes means for receiving from a source base station a random ID assigned to a UE for handover from the source base station to the target base station (module 2112), means for receiving a random access preamble comprising the random ID from the UE (module 2114), means for identifying the random access preamble as being from the UE based on the random ID (module 2116), means for sending to the UE a random access response including UL resources, timing advance, a CRC masked with the C-RNTI, etc. (module 2118), and means for exchanging data with the UE after sending the random access response (module 2120).

[0091] **FIG. 22** shows a design of a process 2200 for system access by a UE. The UE may send a random access preamble to access a base station (block 2212). The UE may receive a random access response from the base station (block 2214). The random access response may include timing advance, UL resources, etc. The UE may send to the base station a first message comprising a unique ID for the UE (block 2216). The unique ID may be an IMSI, a TMSI, a C-RNTI, a registration area ID, or some other ID assigned to the UE. The UE may receive from the base station a second message addressed to the UE based on the unique ID (block 2218). The second message may

include CQI resources, PC resources, etc. The UE may exchange signaling and/or data with the base station after sending the second message (block 2220).

[0092] The UE may operate in an idle state prior to sending the random access preamble and may send the random access preamble to transition from the idle state to an active state. The UE may exchange Layer 3 signaling with the base station after receiving the second message and may exchange data with the base station after completing the Layer 3 signaling exchange, as shown in FIG. 8.

[0093] The UE may send the random access preamble to perform handover to the base station. The UE may send its C-RNTI in the first message and may receive control channel resources from the second message. The UE may then exchange data with the base station after receiving the second message, as shown in FIG. 9.

[0094] The random access preamble and the random access response may be sent without HARQ. The first and second messages may be sent with HARQ, as shown in FIGS. 8 and 9.

[0095] **FIG. 23** shows a design of an apparatus 2300 for a UE. Apparatus 2300 includes means for sending a random access preamble to access a base station (module 2312), means for receiving a random access response from the base station (module 2414), means for sending to the base station a first message comprising a unique ID for the UE (module 2316), means for receiving from the base station a second message addressed to the UE based on the unique ID (module 2328), and means for exchanging signaling and/or data with the base station after sending the second message (module 2320).

[0096] **FIG. 24** shows a design of a process 2400 performed by a base station to support system access. The base station may receive a random access preamble sent by a UE to access the base station (block 2412). The base station may send a random access response to the UE (block 2414). The base station may receive a first message comprising a unique ID for the UE (block 2416). The base station may send a second message addressed to the UE based on the unique ID (block 2418). The base station may exchange signaling and/or data with the UE after sending the second message (block 2420).

[0097] **FIG. 25** shows a design of an apparatus 2500 for a base station. Apparatus 2500 includes means for receiving a random access preamble sent by a UE to access the base station (module 2512), means for sending a random access response to the UE

(module 2514), means for receiving a first message comprising a unique ID for the UE (module 2516), means for sending a second message addressed to the UE based on the unique ID (module 2518), and means for exchanging signaling and/or data with the UE after sending the second message (module 2520).

[0098] The modules in FIGS. 11, 13, 15, 17, 19, 21, 23 and 25 may comprise processors, electronics devices, hardware devices, electronics components, logical circuits, memories, etc., or any combination thereof.

[0099] Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[00100] Those of skill would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the disclosure herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

[00101] The various illustrative logical blocks, modules, and circuits described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of

a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[00102] The steps of a method or algorithm described in connection with the disclosure herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.

[00103] In one or more exemplary designs, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage media may be any available media that can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code means in the form of instructions or data structures and that can be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where disks usually

reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media.

[00104] The previous description of the disclosure is provided to enable any person skilled in the art to make or use the disclosure. Various modifications to the disclosure will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other variations without departing from the spirit or scope of the disclosure. Thus, the disclosure is not intended to be limited to the examples and designs described herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

[00105] WHAT IS CLAIMED IS:

CLAIMS

1. An apparatus for wireless communication, comprising:

at least one processor configured to send a random access preamble for system access by a user equipment (UE), to receive a random access response comprising control channel resources assigned to the UE, and to exchange control information using the assigned control channel resources; and

a memory coupled to the at least one processor.

2. The apparatus of claim 1, wherein the assigned control channel resources comprise at least one of channel quality indicator (CQI) resources used to send CQI on uplink by the UE and power control (PC) resources used to send PC corrections on downlink to the UE.

3. The apparatus of claim 1, wherein the at least one processor is configured to receive a first message for the random access response on a control channel for a shared data channel, and to receive a second message for the random access response on the shared data channel, the first message comprising identification information for the random access preamble, and the second message comprising the control channel resources assigned to the UE.

4. The apparatus of claim 1, wherein the at least one processor is configured to determine the random access preamble based on at least one of a random identifier (ID), a channel quality indicator (CQI), and an access type.

5. The apparatus of claim 1, wherein the at least one processor is configured to receive control information in the random access response, the control information comprising at least one of timing advance and power control (PC) correction.

6. The apparatus of claim 1, wherein the at least one processor is configured to receive a Cell Radio Network Temporary Identifier (C-RNTI) in the random access response.

7. The apparatus of claim 1, wherein the at least one processor is configured to receive uplink resources assigned to the UE in the random access response, and to send data using the assigned uplink resources.

8. The apparatus of claim 1, wherein the at least one processor is configured to select an access sequence for the random access preamble from a pool of available access sequences, and to send the selected access sequence to convey the random access preamble.

9. A method for wireless communication, comprising:

sending a random access preamble for system access by a user equipment (UE);

receiving a random access response comprising control channel resources assigned to the UE; and

exchanging control information using the assigned control channel resources.

10. The method of claim 9, further comprising:

receiving at least one of channel quality indicator (CQI) resources and power control (PC) resources for the control channel resources assigned to the UE, the CQI resources being used to send CQI on uplink by the UE, and the PC resources being used to send PC corrections on downlink to the UE.

11. The method of claim 9, wherein the receiving the random access response comprises

receiving a first message for the random access response on a control channel for a shared data channel, the first message comprising identification information for the random access preamble, and

receiving a second message for the random access response on the shared data channel, the second message comprising the control channel resources assigned to the UE.

12. An apparatus for wireless communication, comprising:

means for sending a random access preamble for system access by a user equipment (UE);

means for receiving a random access response comprising control channel resources assigned to the UE; and

means for exchanging control information using the assigned control channel resources.

13. The apparatus of claim 12, further comprising:

means for receiving at least one of channel quality indicator (CQI) resources and power control (PC) resources for the control channel resources assigned to the UE, the CQI resources being used to send CQI on uplink by the UE, and the PC resources being used to send PC corrections on downlink to the UE.

14. The apparatus of claim 12, wherein the means for receiving the random access response comprises

means for receiving a first message for the random access response on a control channel for a shared data channel, the first message comprising identification information for the random access preamble, and

means for receiving a second message for the random access response on the shared data channel, the second message comprising the control channel resources assigned to the UE.

15. A machine-readable medium comprising instructions which, when executed by a machine, cause the machine to perform operations including:

sending a random access preamble for system access by a user equipment (UE);

receiving a random access response comprising control channel resources assigned to the UE; and

exchanging control information using the assigned control channel resources.

16. The machine-readable medium of claim 15 which, when executed by the machine, cause the machine to perform operations further including:

receiving at least one of channel quality indicator (CQI) resources and power control (PC) resources for the control channel resources assigned to the UE, the CQI

resources being used to send CQI on uplink by the UE, and the PC resources being used to send PC corrections on downlink to the UE.

17. The machine-readable medium of claim 15 which, when executed by the machine, cause the machine to perform operations further including:

receiving a first message for the random access response on a control channel for a shared data channel, the first message comprising identification information for the random access preamble; and

receiving a second message for the random access response on the shared data channel, the second message comprising the control channel resources assigned to the UE.

18. An apparatus for wireless communication, comprising:

at least one processor configured to receive a random access preamble sent by a user equipment (UE) for system access, to send a random access response comprising control channel resources assigned to the UE, and to exchange control information with the UE using the assigned control channel resources; and

a memory coupled to the at least one processor.

19. The apparatus of claim 18, wherein the assigned control channel resources comprise at least one of channel quality indicator (CQI) resources used to send CQI on uplink by the UE and power control (PC) resources used to send PC corrections on downlink to the UE.

20. The apparatus of claim 18, wherein the at least one processor is configured to send a first message for the random access response on a control channel for a shared data channel, and to send a second message for the random access response on the shared data channel, the first message comprising identification information for the random access preamble, and the second message comprising the control channel resources assigned to the UE.

21. An apparatus for wireless communication, comprising:

at least one processor configured to send a random access preamble for system access by a user equipment (UE), and to receive a random access response from a base station, the random access preamble comprising identification information, and the random access response being asynchronous with respect to the random access preamble and addressing the random access preamble based on the identification information; and

a memory coupled to the at least one processor.

22. The apparatus of claim 21, wherein the at least one processor is configured to receive the random access response within a predetermined time window from when the random access preamble was sent.

23. The apparatus of claim 21, wherein the at least one processor is configured to select a random identifier (ID) for use as the identification information, and to receive the random access response comprising a temporary ID formed based on the random ID.

24. The apparatus of claim 23, wherein the temporary ID is formed further based on system time when the random access preamble was sent.

25. The apparatus of claim 21, wherein the at least one processor is configured to select a random identifier (ID) for use as the identification information, to determine the random access preamble based on the random ID and additional information, and to receive the random access response comprising a random access preamble identifier for the random access preamble.

26. The apparatus of claim 21, wherein the at least one processor is configured to send the random access preamble on a random access channel selected from among a plurality of available random access channels, to receive a first message for the random access response on a control channel for a shared data channel, and to receive a second message for the random access response on the shared data channel, the first message comprising a Random Access Radio Network Temporary Identifier

(RA-RNTI) for the selected random access channel, and the second message comprising a random access preamble identifier including the identification information.

27. The apparatus of claim 21, wherein the at least one processor is configured to receive an assigned random identifier (ID) for use as the identification information, to send the random access preamble comprising the assigned random ID, and to receive the random access response comprising a Cell Access Radio Network Temporary Identifier (C-RNTI) associated with the assigned random ID, the assigned random ID being selected from a pool of reserved random IDs.

28. A method for wireless communication, comprising:

sending a random access preamble for system access by a user equipment (UE), the random access preamble comprising identification information; and

receiving a random access response from a base station, the random access response being asynchronous with respect to the random access preamble and addressing the random access preamble based on the identification information.

29. The method of claim 28, further comprising:

obtaining a random identifier (ID) for use as the identification information, and wherein the random access response comprises a temporary ID formed based on the random ID.

30. The method of claim 28, wherein the sending the random access preamble comprises sending the random access preamble on a random access channel selected from among a plurality of available random access channels, and wherein the receiving the random access response comprises receiving a first message for the random access response on a control channel for a shared data channel, and receiving a second message for the random access response on the shared data channel, the first message comprising a Random Access Radio Network Temporary Identifier (RA-RNTI) for the selected random access channel, and the second message comprising a random access preamble identifier including the identification information.

31. An apparatus for wireless communication, comprising:

at least one processor configured to receive a random access preamble sent by a user equipment (UE) for system access, and to send a random access response to the UE, the random access preamble comprising identification information, the random access response being asynchronous with respect to the random access preamble and addressing the random access preamble based on the identification information; and

a memory coupled to the at least one processor.

32. The apparatus of claim 31, wherein the at least one processor is configured to receive from the random access preamble a random identifier (ID) used as the identification information, to determine a temporary ID based on the random ID, and to send the random access response comprising the temporary ID.

33. The apparatus of claim 31, wherein the at least one processor is configured to receive the random access preamble on a random access channel selected from among a plurality of available random access channels, to send a first message for the random access response on a control channel for a shared data channel, and to send a second message for the random access response on the shared data channel, the first message comprising a Random Access Radio Network Temporary Identifier (RA-RNTI) for the selected random access channel, and the second message comprising a random access preamble identifier including the identification information.

34. An apparatus for wireless communication, comprising:

at least one processor configured to communicate with a first base station, to receive a random identifier (ID) for handover of a user equipment (UE) from the first base station to a second base station, and to send a random access preamble comprising the random ID to access the second base station, the random ID being used to identify the UE; and

a memory coupled to the at least one processor.

35. The apparatus of claim 34, wherein the at least one processor is configured to receive the random ID from the first base station, the random ID being selected from a pool of reserved random IDs.

36. The apparatus of claim 34, wherein the at least one processor is configured to receive a random access response comprising at least one of uplink resources assigned to the UE and timing advance to adjust transmit timing of the UE.

37. The apparatus of claim 34, wherein the at least one processor is configured to receive a random access response comprising a cyclic redundancy check (CRC) masked with a Cell Radio Network Temporary Identifier (C-RNTI) assigned to the UE.

38. The apparatus of claim 36, wherein the at least one processor is configured to exchange data with the second base station after receiving the random access response.

39. A method for wireless communication, comprising:

communicating with a first base station;

receiving a random identifier (ID) for handover of a user equipment (UE) from the first base station to a second base station; and

sending a random access preamble comprising the random ID to access the second base station, the random ID being used to identify the UE.

40. The method of claim 39, wherein the receiving the random ID comprises

receiving the random ID from the first base station, the random ID being selected from a pool of reserved random IDs.

41. The method of claim 39, further comprising:

receiving a random access response comprising at least one of uplink resources assigned to the UE and timing advance to adjust transmit timing of the UE.

42. An apparatus for wireless communication, comprising:

at least one processor configured to receive from a first base station a random identifier (ID) assigned to a user equipment (UE) for handover from the first base station to a second base station, to receive from the UE a random access preamble

comprising the random ID, to identify the random access preamble as being from the UE based on the random ID, and to send a random access response to the UE; and

a memory coupled to the at least one processor.

43. The apparatus of claim 42, wherein the at least one processor is configured to send at least one of uplink resources and timing advance for the UE in the random access response.

44. The apparatus of claim 42, wherein the at least one processor is configured to receive a Cell Radio Network Temporary Identifier (C-RNTI) for the UE from the first base station, to generate a cyclic redundancy check (CRC) for the random access response, to mask the CRC with the C-RNTI, and to send the masked CRC in the random access response to the UE.

45. An apparatus for wireless communication, comprising:

at least one processor configured to send a random access preamble from a user equipment (UE) to access a base station, to receive a random access response from the base station, to send to the base station a first message comprising a unique identifier (ID) for the UE, and to receive from the base station a second message addressed to the UE based on the unique ID; and

a memory coupled to the at least one processor.

46. The apparatus of claim 45, wherein the at least one processor is configured to determine the unique ID for the UE based on at least one of an International Mobile Subscriber Identity (IMSI), a Temporary Mobile Subscriber Identity (TMSI), a Cell Radio Network Temporary Identifier (C-RNTI), and a registration area ID assigned to the UE.

47. The apparatus of claim 45, wherein the at least one processor is configured to receive at least one of timing advance and uplink resources in the random access response, and to receive at least one of channel quality indicator (CQI) resources and power control (PC) resources in the second message.

48. The apparatus of claim 45, wherein the at least one processor is configured to operate in an idle state prior to sending the random access preamble, and to send the random access preamble to transition from the idle state to an active state.

49. The apparatus of claim 48, wherein the at least one processor is configured to exchange Layer 3 signaling with the base station after receiving the second message, and to exchange data with the base station after completing the Layer 3 signaling exchange.

50. The apparatus of claim 45, wherein the at least one processor is configured to send the random access preamble to perform handover to the base station, to send the first message comprising a Cell Radio Network Temporary Identifier (C-RNTI) as the unique ID for the UE, to receive control channel resources assigned to the UE in the second message, and to exchange data with the base station after receiving the second message.

51. The apparatus of claim 45, wherein the random access preamble and the random access response are sent without hybrid automatic retransmission (HARQ), and wherein the first and second messages are sent with HARQ.

52. A method for wireless communication, comprising:

sending a random access preamble from a user equipment (UE) to access a base station;

receiving a random access response from the base station;

sending to the base station a first message comprising a unique identifier (ID) for the UE; and

receiving from the base station a second message addressed to the UE based on the unique ID.

53. The method of claim 52, further comprising:

determining the unique ID for the UE based on at least one of an International Mobile Subscriber Identity (IMSI), a Temporary Mobile Subscriber Identity (TMSI), a

Cell Radio Network Temporary Identifier (C-RNTI), and a registration area ID assigned to the UE.

54. The method of claim 52, wherein the random access preamble is sent to perform handover to the base station, wherein the unique ID for the UE comprises a Cell Radio Network Temporary Identifier (C-RNTI) assigned to the UE, the method further comprising:

receiving control channel resources assigned to the UE in the second message; and

exchanging data with the base station after receiving the second message.

55. An apparatus for wireless communication, comprising:

at least one processor configured to receive a random access preamble sent by a user equipment (UE) to access a base station, to send a random access response to the UE, to receive a first message comprising a unique identifier (ID) for the UE, and to send a second message addressed to the UE based on the unique ID; and

a memory coupled to the at least one processor.

56. The apparatus of claim 55, wherein the at least one processor is configured to receive at least one of an International Mobile Subscriber Identity (IMSI), a Temporary Mobile Subscriber Identity (TMSI), a Cell Radio Network Temporary Identifier (C-RNTI), and a registration area ID assigned to the UE as the unique ID for the UE.

57. The apparatus of claim 55, wherein the at least one processor is configured to receive the random access preamble from the UE for handover to the base station, to receive the first message comprising a Cell Radio Network Temporary Identifier (C-RNTI) as the unique ID for the UE, to send control channel resources assigned to the UE for the UE in the second message, and to exchange data with the UE after sending the second message.

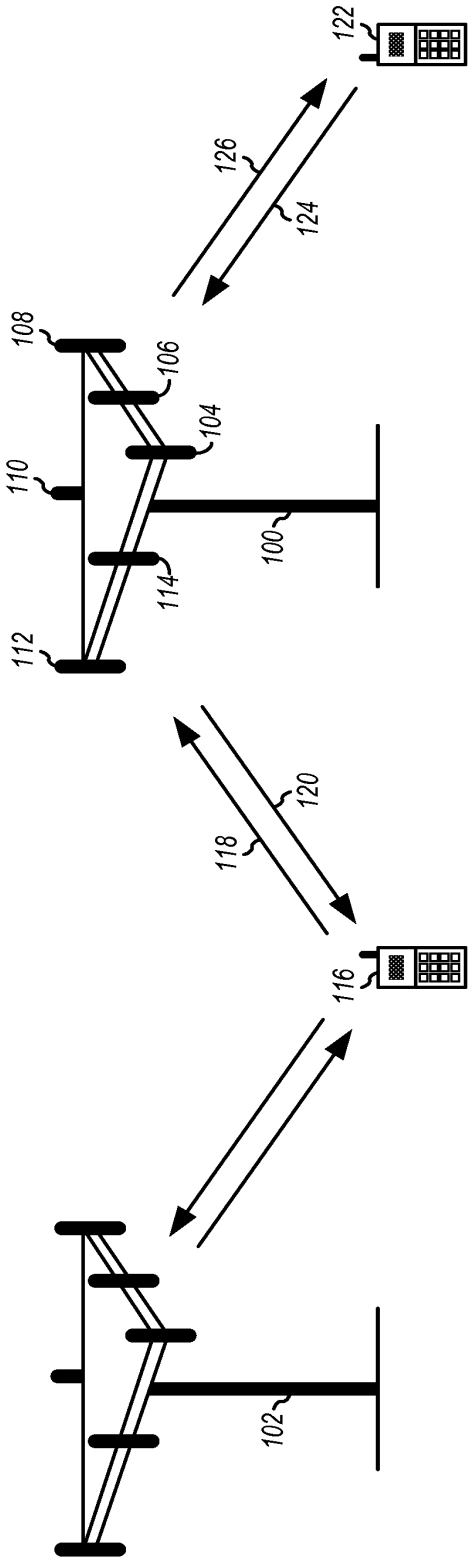


FIG. 1

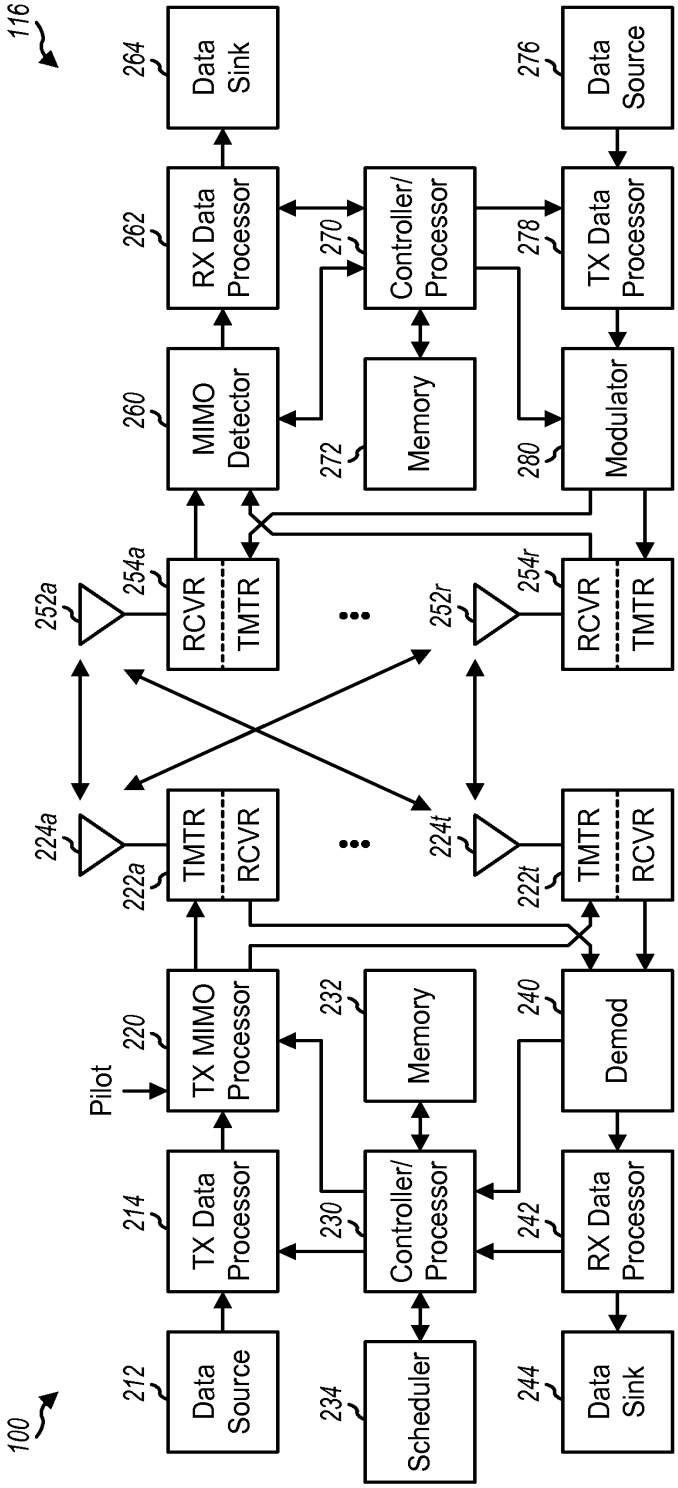

116
264
Data Sink
276
Data Source
262
RX Data Processor
270
Controller/ Processor
278
TX Data Processor
260
MIMO Detector
272
Memory
280
Modulator
252a
254a
RCVR
TMTR
252r
254r
RCVR
TMTR
224a
222a
TMTR
RCVR
224t
222t
TMTR
RCVR
Pilot
220
TX MIMO Processor
232
Memory
240
Demod
214
TX Data Processor
230
Controller/ Processor
242
RX Data Processor
212
Data Source
234
Scheduler
244
Data Sink
100

FIG. 2

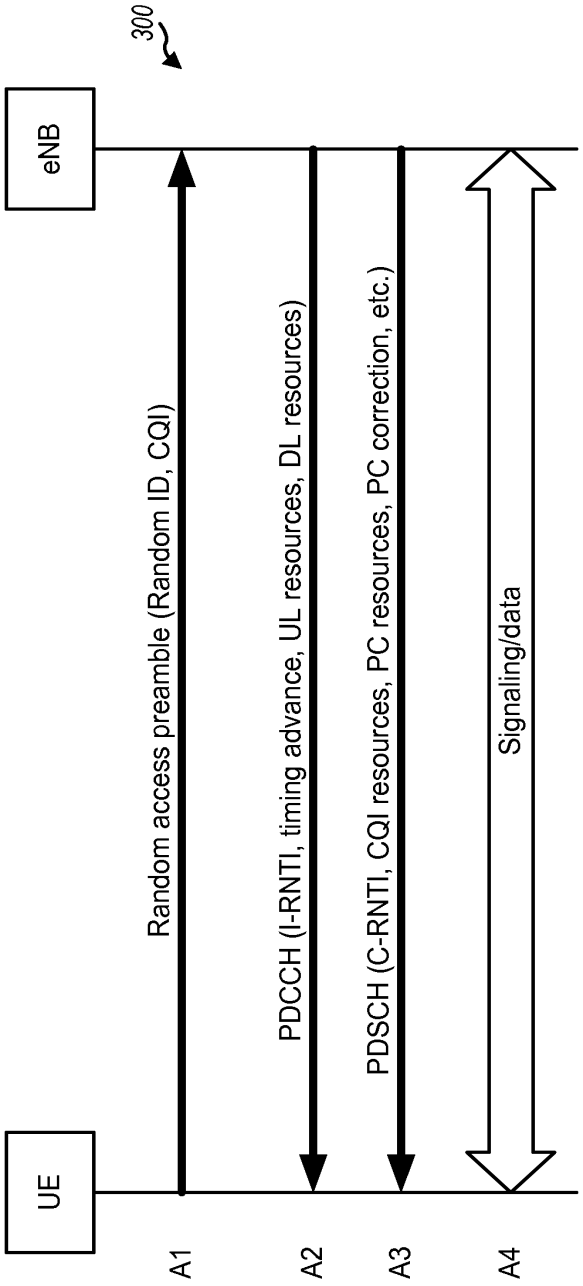

300
eNB
UE
Random access preamble (Random ID, CQI)
PDCCH (I-RNTI, timing advance, UL resources, DL resources)
PDSCH (C-RNTI, CQI resources, PC resources, PC correction, etc.)
Signaling/data
A1
A2
A3
A4

FIG. 3

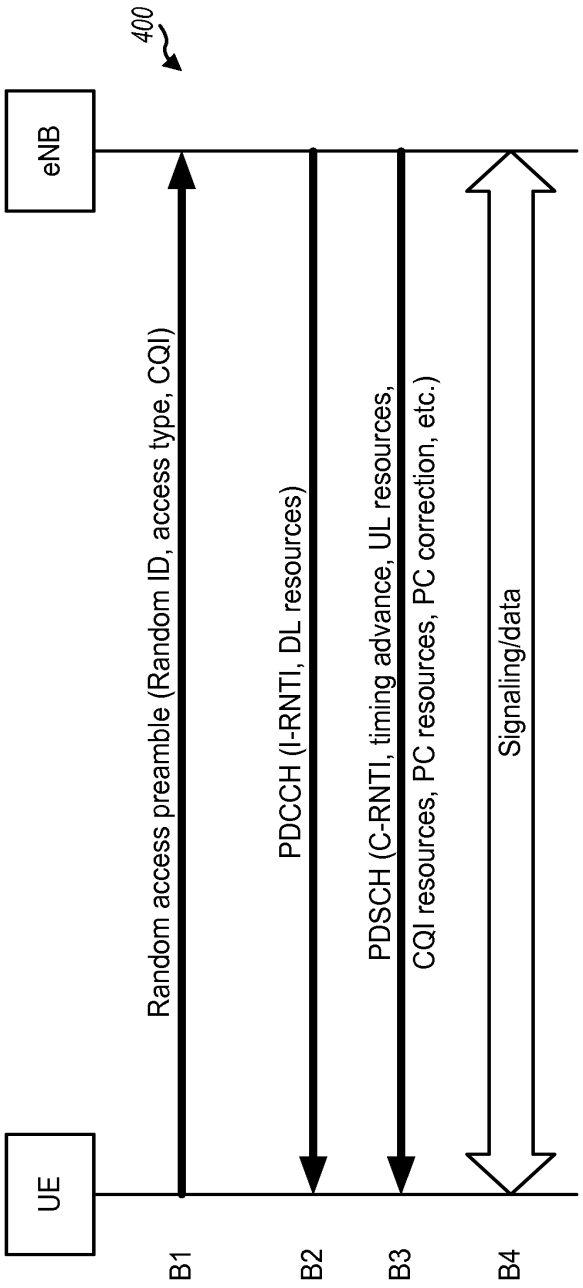

400
eNB
UE
Random access preamble (Random ID, access type, CQI)
PDCCH (I-RNTI, DL resources)
PDSCH (C-RNTI, timing advance, UL resources,
CQI resources, PC resources, PC correction, etc.)
Signaling/data
B1
B2
B3
B4

FIG. 4

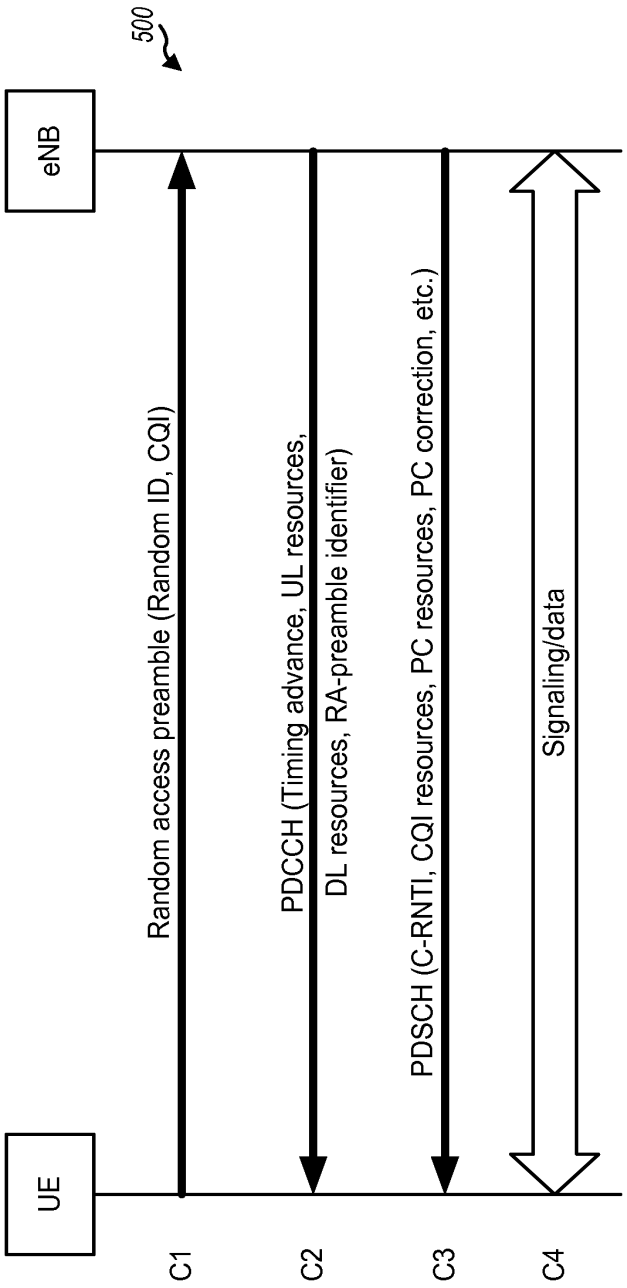

500
eNB
UE
Random access preamble (Random ID, CQI)
PDCCH (Timing advance, UL resources,
DL resources, RA-preamble identifier)
PDSCH (C-RNTI, CQI resources, PC resources, PC correction, etc.)
Signaling/data
C1
C2
C3
C4

FIG. 5

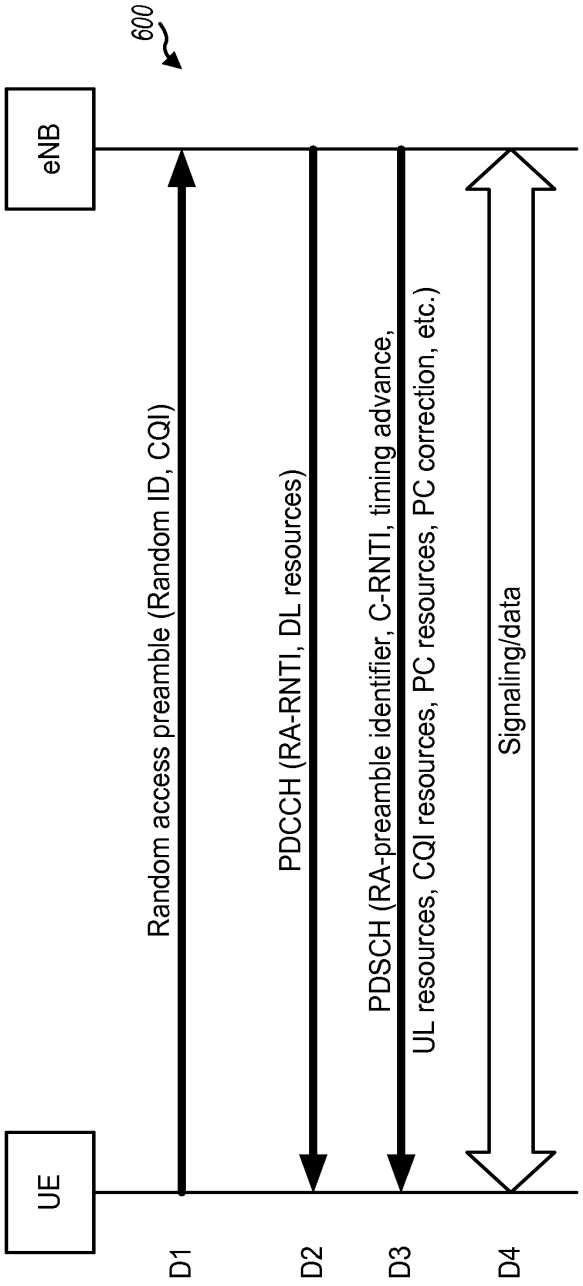

600
eNB
UE
Random access preamble (Random ID, CQI)
PDCCH (RA-RNTI, DL resources)
PDSCH (RA-preamble identifier, C-RNTI, timing advance,
UL resources, CQI resources, PC resources, PC correction, etc.)
Signaling/data
D1
D2
D3
D4

FIG. 6

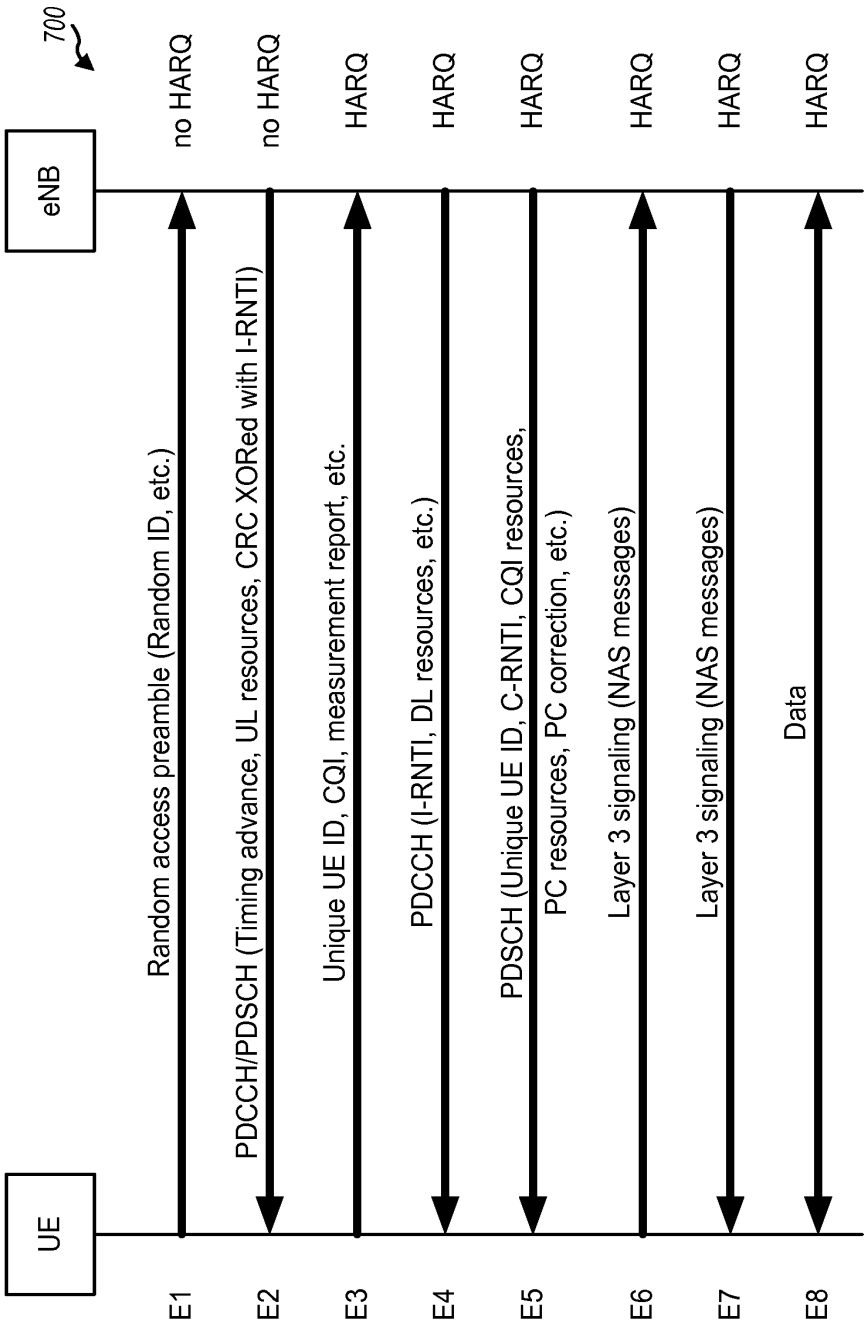

700
eNB
UE
no HARQ
no HARQ
HARQ
HARQ
HARQ
HARQ
HARQ
HARQ
Random access preamble (Random ID, etc.)
PDCCH/PDSCH (Timing advance, UL resources, CRC XORed with I-RNTI)
Unique UE ID, CQI, measurement report, etc.
PDCCH (I-RNTI, DL resources, etc.)
PDSCH (Unique UE ID, C-RNTI, CQI resources, PC resources, PC correction, etc.)
Layer 3 signaling (NAS messages)
Layer 3 signaling (NAS messages)
Data
E1
E2
E3
E4
E5
E6
E7
E8

FIG. 7

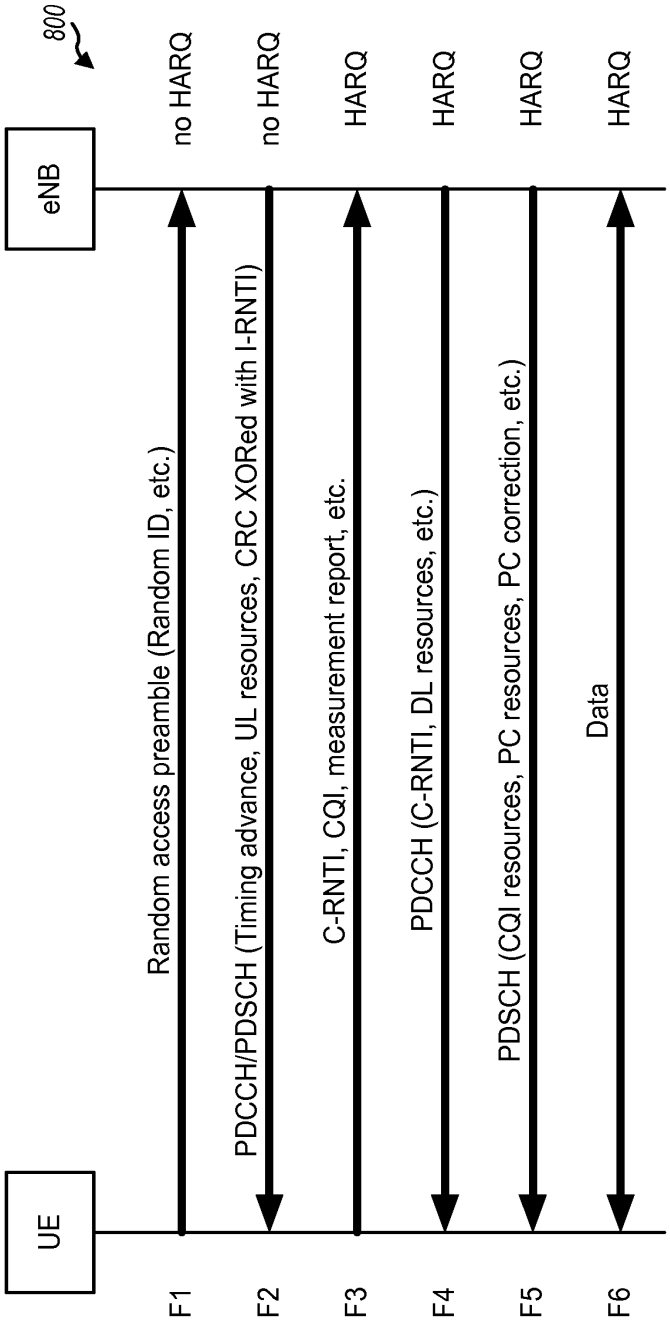

800
eNB
UE
no HARQ
no HARQ
HARQ
HARQ
HARQ
HARQ
Random access preamble (Random ID, etc.)
PDCCH/PDSCH (Timing advance, UL resources, CRC XORed with I-RNTI)
C-RNTI, CQI, measurement report, etc.
PDCCH (C-RNTI, DL resources, etc.)
PDSCH (CQI resources, PC resources, PC correction, etc.)
Data
F1
F2
F3
F4
F5
F6

FIG. 8

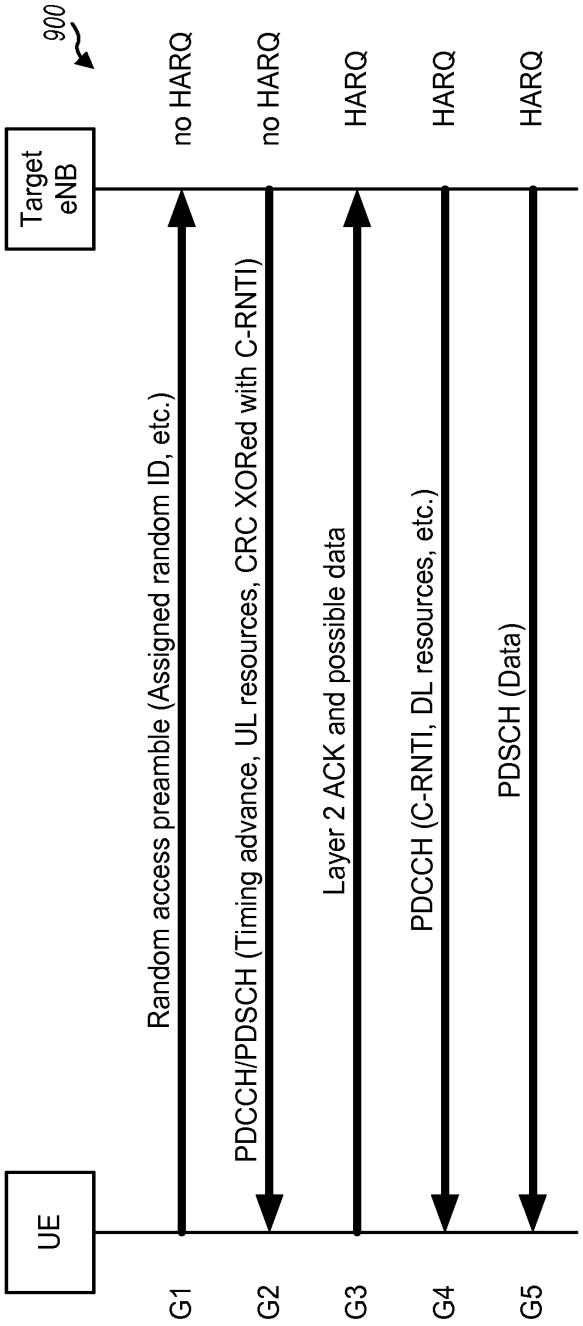

900
Target eNB
UE
no HARQ
no HARQ
HARQ
HARQ
HARQ
Random access preamble (Assigned random ID, etc.)
PDCCH/PDSCH (Timing advance, UL resources, CRC XORed with C-RNTI)
Layer 2 ACK and possible data
PDCCH (C-RNTI, DL resources, etc.)
PDSCH (Data)
G1
G2
G3
G4
G5

FIG. 9

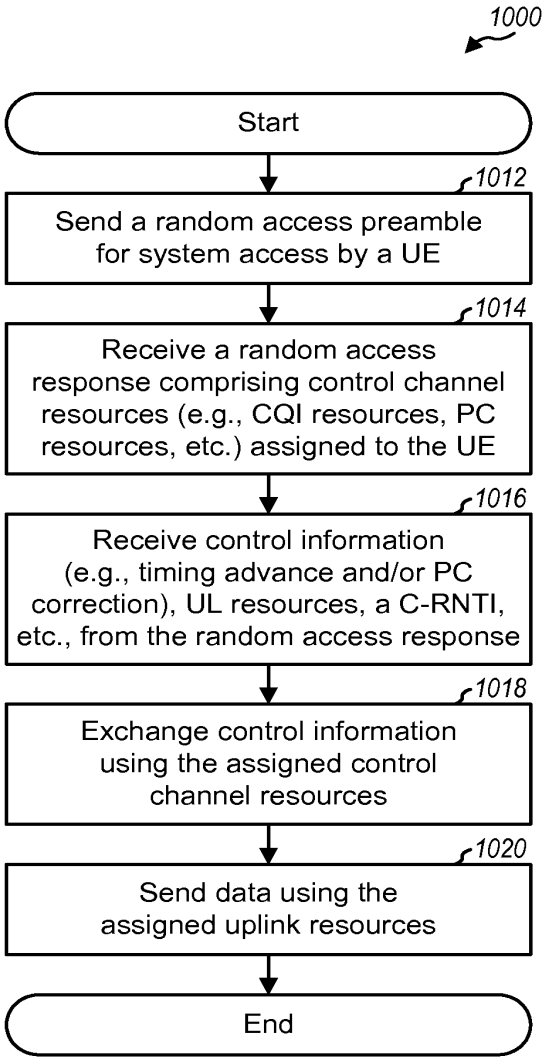

1000
Start
1012
Send a random access preamble for system access by a UE
1014
Receive a random access response comprising control channel resources (e.g., CQI resources, PC resources, etc.) assigned to the UE
1016
Receive control information (e.g., timing advance and/or PC correction), UL resources, a C-RNTI, etc., from the random access response
1018
Exchange control information using the assigned control channel resources
1020
Send data using the assigned uplink resources
End

FIG. 10

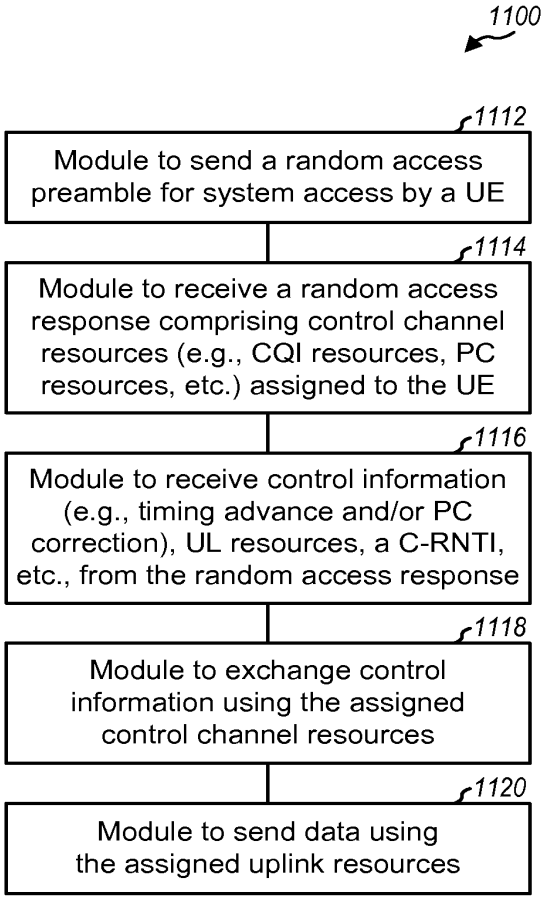

1100
1112
Module to send a random access preamble for system access by a UE
1114
Module to receive a random access response comprising control channel resources (e.g., CQI resources, PC resources, etc.) assigned to the UE
1116
Module to receive control information (e.g., timing advance and/or PC correction), UL resources, a C-RNTI, etc., from the random access response
1118
Module to exchange control information using the assigned control channel resources
1120
Module to send data using the assigned uplink resources

FIG. 11

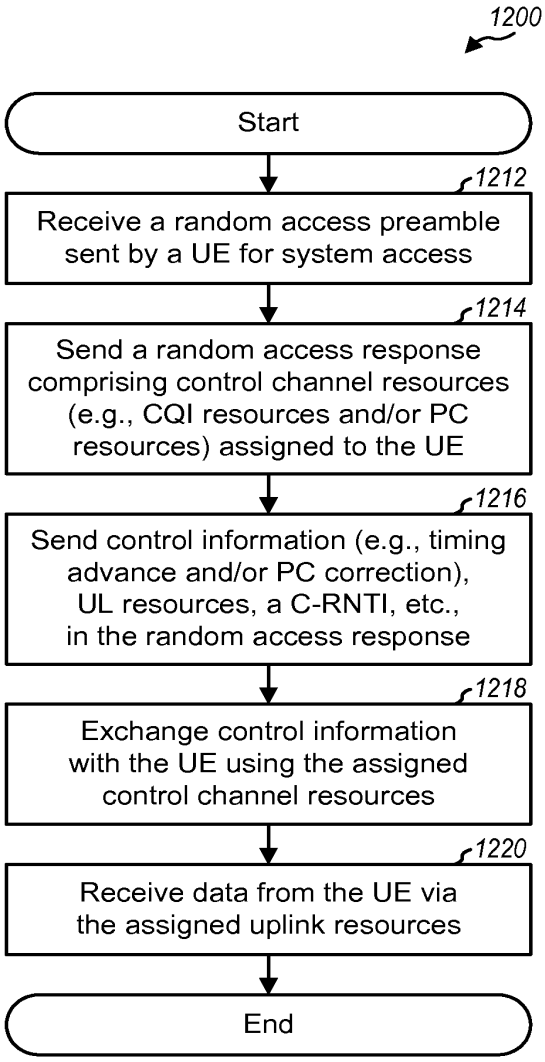

1200
Start
1212
Receive a random access preamble sent by a UE for system access
1214
Send a random access response comprising control channel resources (e.g., CQI resources and/or PC resources) assigned to the UE
1216
Send control information (e.g., timing advance and/or PC correction), UL resources, a C-RNTI, etc., in the random access response
1218
Exchange control information with the UE using the assigned control channel resources
1220
Receive data from the UE via the assigned uplink resources
End

FIG. 12

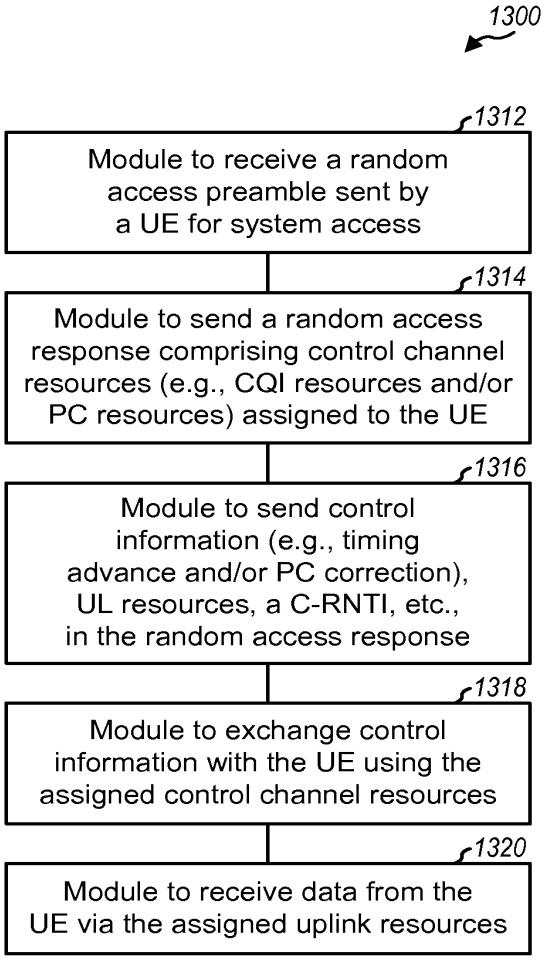

1300
1312
Module to receive a random access preamble sent by a UE for system access
1314
Module to send a random access response comprising control channel resources (e.g., CQI resources and/or PC resources) assigned to the UE
1316
Module to send control information (e.g., timing advance and/or PC correction), UL resources, a C-RNTI, etc., in the random access response
1318
Module to exchange control information with the UE using the assigned control channel resources
1320
Module to receive data from the UE via the assigned uplink resources

FIG. 13

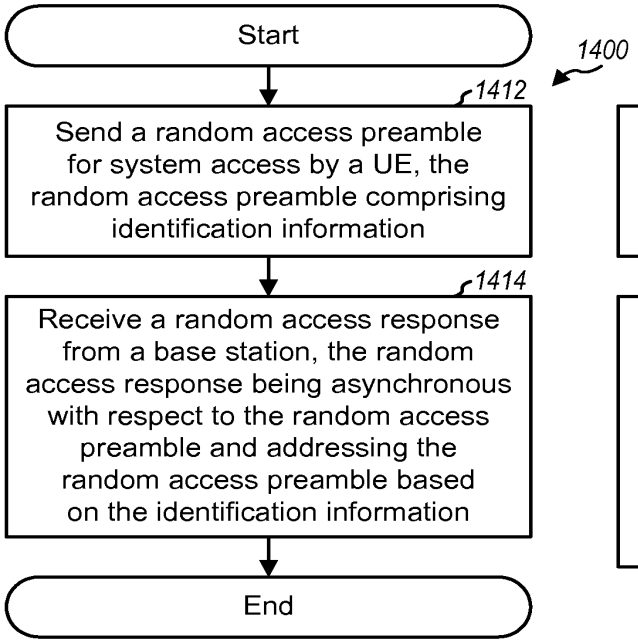


FIG. 14

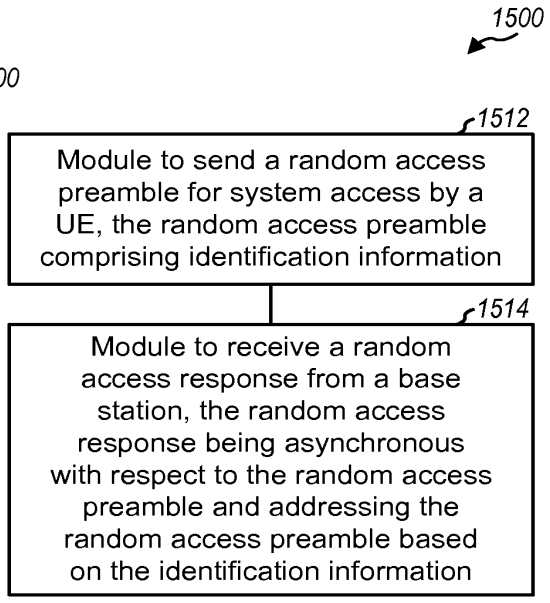


FIG. 15

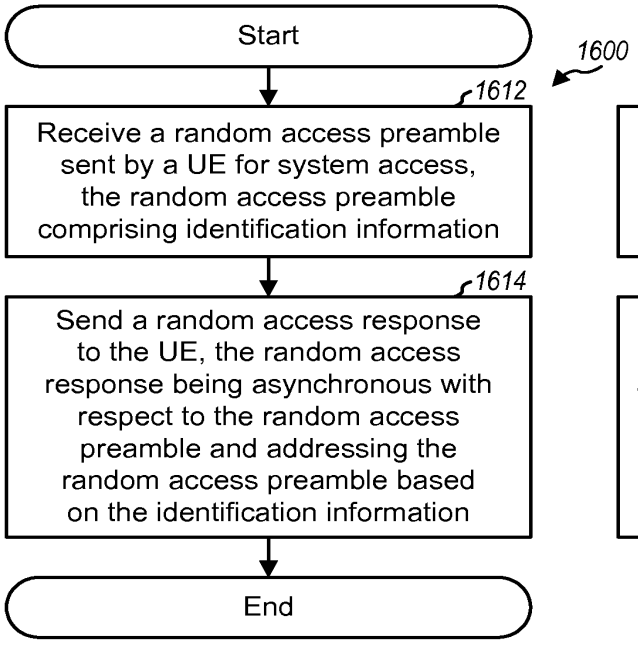


FIG. 16

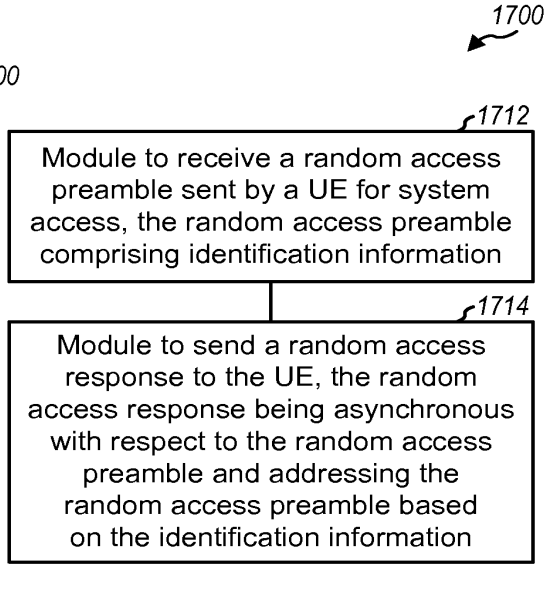


FIG. 17

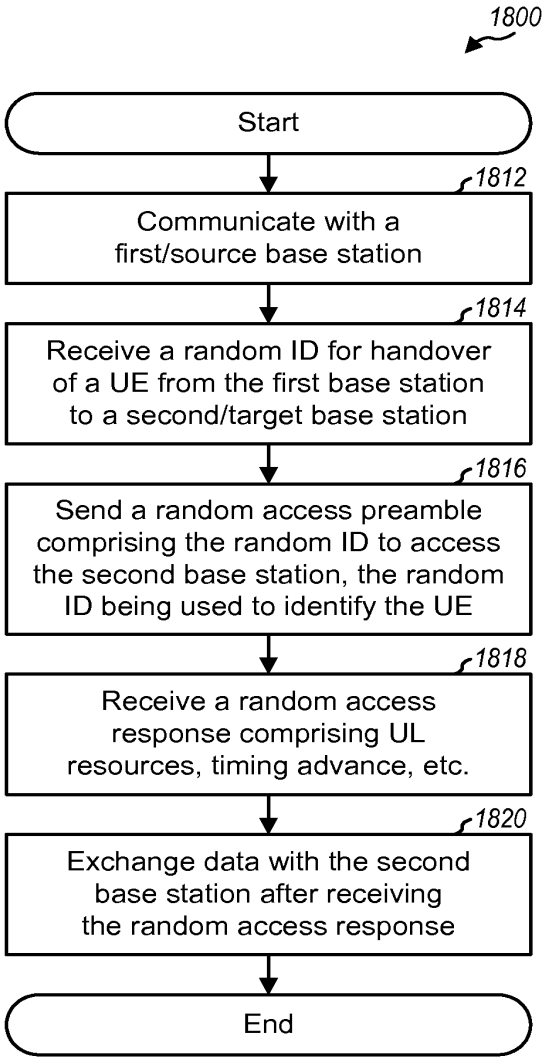

1800
Start
1812
Communicate with a first/source base station
1814
Receive a random ID for handover of a UE from the first base station to a second/target base station
1816
Send a random access preamble comprising the random ID to access the second base station, the random ID being used to identify the UE
1818
Receive a random access response comprising UL resources, timing advance, etc.
1820
Exchange data with the second base station after receiving the random access response
End

FIG. 18

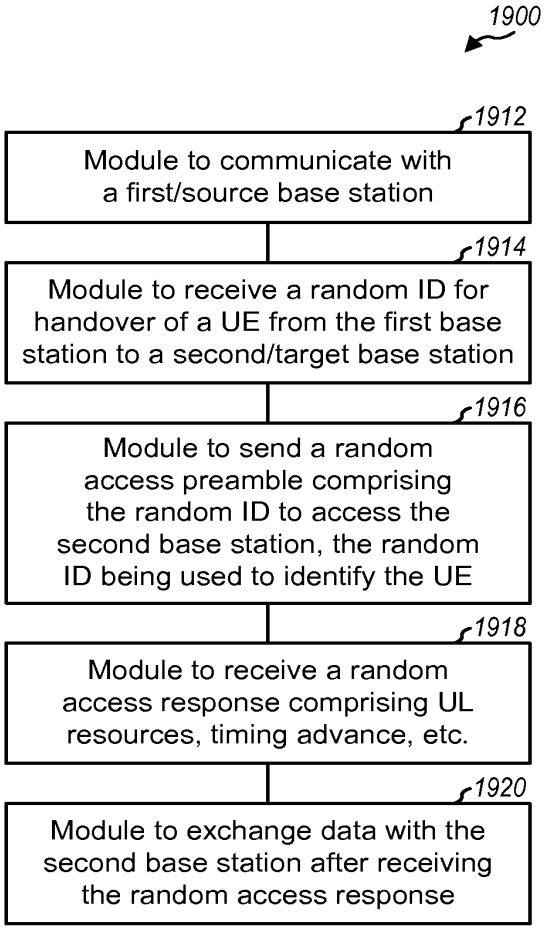

1900
1912
Module to communicate with a first/source base station
1914
Module to receive a random ID for handover of a UE from the first base station to a second/target base station
1916
Module to send a random access preamble comprising the random ID to access the second base station, the random ID being used to identify the UE
1918
Module to receive a random access response comprising UL resources, timing advance, etc.
1920
Module to exchange data with the second base station after receiving the random access response

FIG. 19

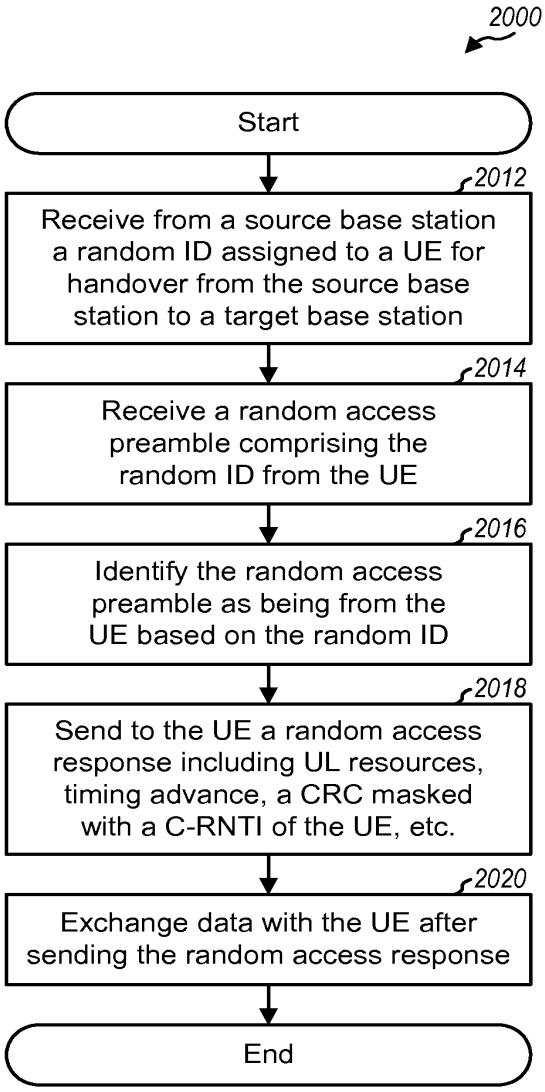

2000
Start
2012
Receive from a source base station a random ID assigned to a UE for handover from the source base station to a target base station
2014
Receive a random access preamble comprising the random ID from the UE
2016
Identify the random access preamble as being from the UE based on the random ID
2018
Send to the UE a random access response including UL resources, timing advance, a CRC masked with a C-RNTI of the UE, etc.
2020
Exchange data with the UE after sending the random access response
End

FIG. 20

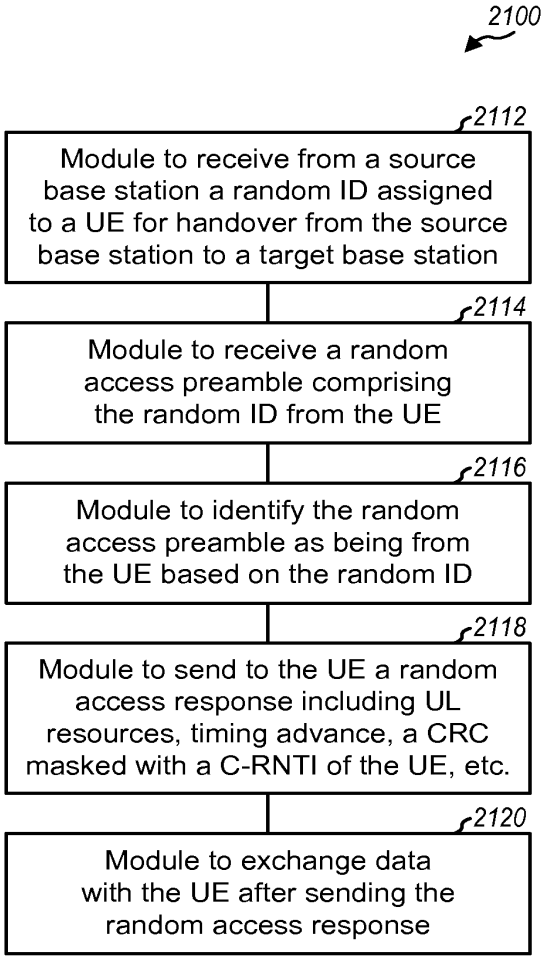

2100
2112
Module to receive from a source base station a random ID assigned to a UE for handover from the source base station to a target base station
2114
Module to receive a random access preamble comprising the random ID from the UE
2116
Module to identify the random access preamble as being from the UE based on the random ID
2118
Module to send to the UE a random access response including UL resources, timing advance, a CRC masked with a C-RNTI of the UE, etc.
2120
Module to exchange data with the UE after sending the random access response

FIG. 21

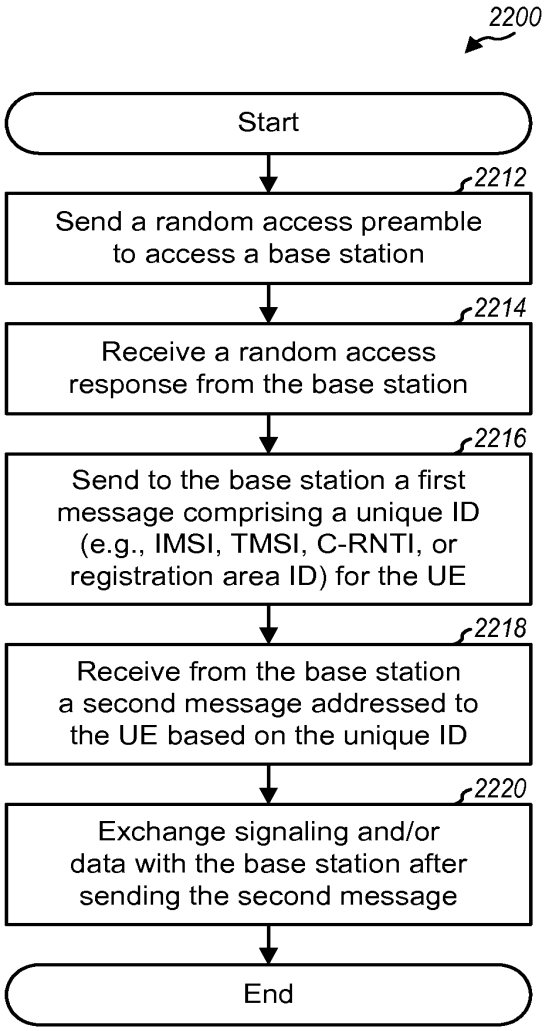

2200
Start
2212
Send a random access preamble to access a base station
2214
Receive a random access response from the base station
2216
Send to the base station a first message comprising a unique ID (e.g., IMSI, TMSI, C-RNTI, or registration area ID) for the UE
2218
Receive from the base station a second message addressed to the UE based on the unique ID
2220
Exchange signaling and/or data with the base station after sending the second message
End

FIG. 22

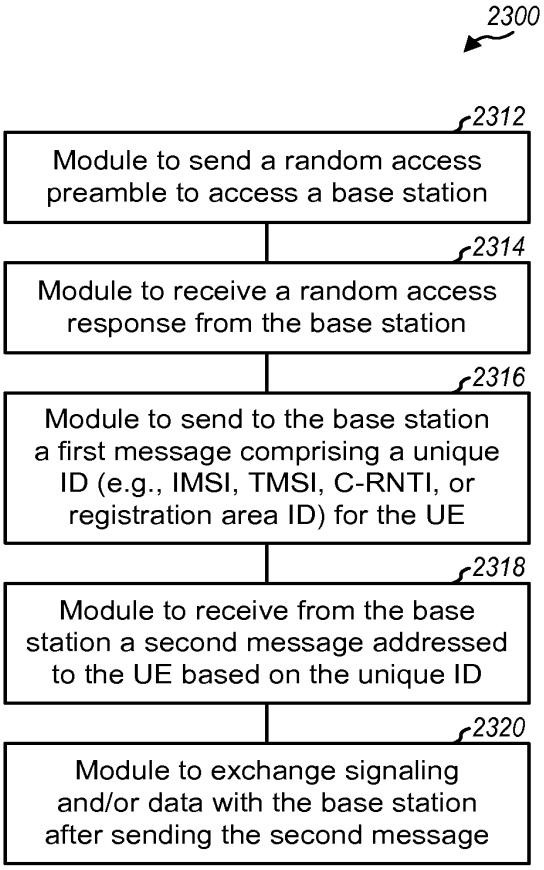

2300
2312
Module to send a random access preamble to access a base station
2314
Module to receive a random access response from the base station
2316
Module to send to the base station a first message comprising a unique ID (e.g., IMSI, TMSI, C-RNTI, or registration area ID) for the UE
2318
Module to receive from the base station a second message addressed to the UE based on the unique ID
2320
Module to exchange signaling and/or data with the base station after sending the second message

FIG. 23

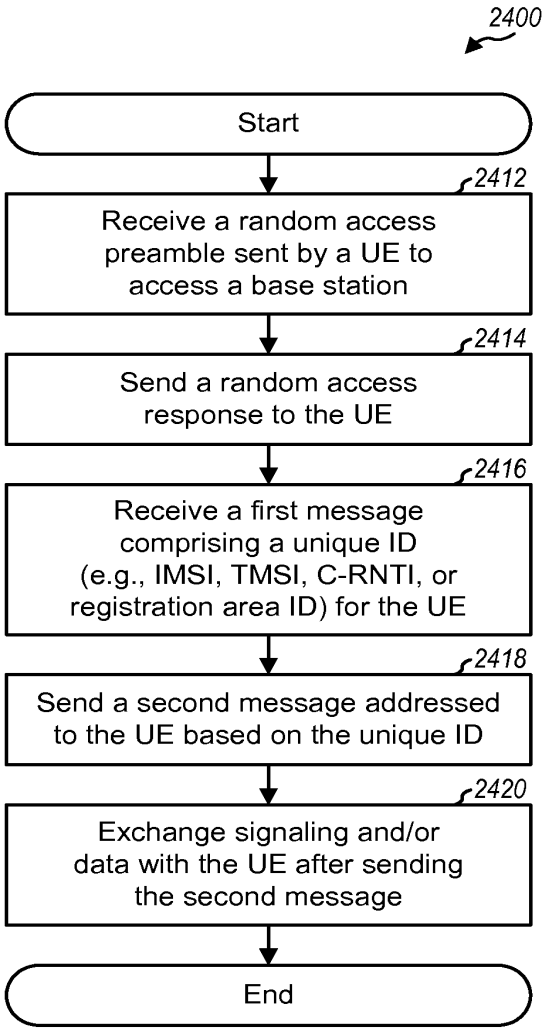

2400
Start
2412
Receive a random access preamble sent by a UE to access a base station
2414
Send a random access response to the UE
2416
Receive a first message comprising a unique ID (e.g., IMSI, TMSI, C-RNTI, or registration area ID) for the UE
2418
Send a second message addressed to the UE based on the unique ID
2420
Exchange signaling and/or data with the UE after sending the second message
End

FIG. 24

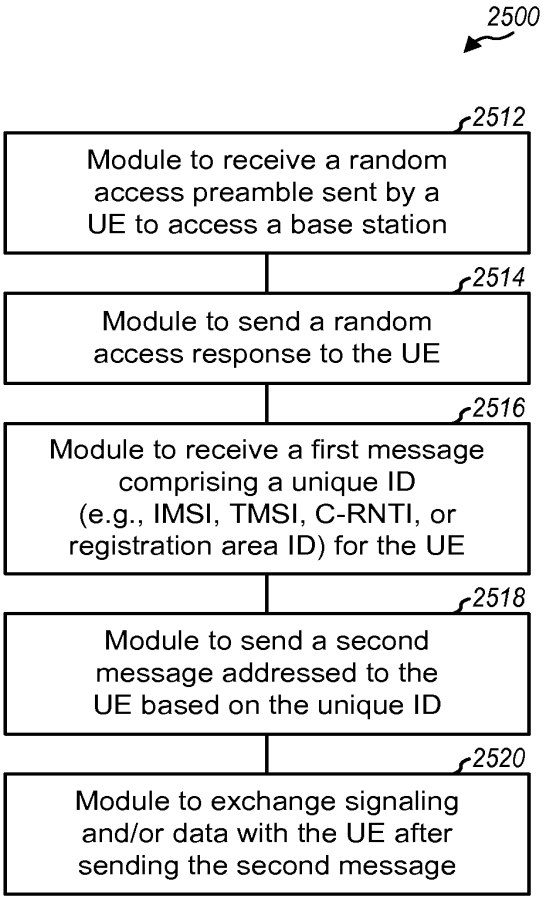

2500
2512
Module to receive a random access preamble sent by a UE to access a base station
2514
Module to send a random access response to the UE
2516
Module to receive a first message comprising a unique ID (e.g., IMSI, TMSI, C-RNTI, or registration area ID) for the UE
2518
Module to send a second message addressed to the UE based on the unique ID
2520
Module to exchange signaling and/or data with the UE after sending the second message

FIG. 25

(Abstract for CN 101529831 A)

Techniques for sending messages for system access are described. In one aspect, a user equipment (UE) sends a first message with power headroom and/or buffer size information for system access. A Node B determines at least one parameter (e.g., a resource grant, power control information, etc.) based on the power headroom and/or buffer size information. The Node B sends a second message with the parameter(s). The UE sends a third message based on the parameter(s), e.g., with uplink resources indicated by the resource grant, with transmit power determined based on the power control information, etc. In another aspect, the UE sends a radio environment report in the third message. The report may be used to select a cell and/or a frequency for the UE. In yet another aspect, the second message includes power control information, and the UE sends the third message based on the power control information.

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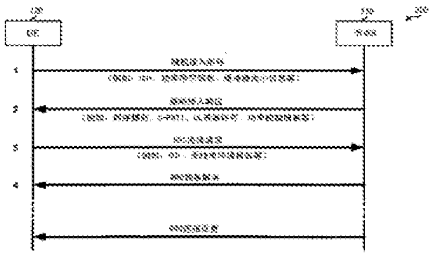
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用于无线通信的随机接入装置和方法

[57] 摘要

描述了用于发送消息以进行系统接入的技术。在一个方面，用户设备(UE)发送包括功率净空信息和/或缓冲器大小信息的第一消息，以用于系统接入。节点 B 根据功率净空信息和/或缓冲器大小信息确定至少一个参数(例如，资源许可、功率控制信息等)。节点 B 发送包括所述参数的第二消息。UE 根据所述参数发送第三消息，例如，使用资源许可所指示的上行链路资源、使用根据功率控制信息而确定的发射功率等来发送第三消息。在另一方面，UE 在第三消息中发送无线电环境报告。该报告可用于为 UE 选择小区和/或频率。在另一方面，第二消息包括功率控制信息，UE 根据该功率控制信息来发送第三消息。



1、一种用于无线通信的装置，包括：

至少一个处理器，用于：由用户设备（UE）发送用于系统接入的、包括功率净空信息的第一消息；接收包括根据所述功率净空信息而确定的至少一个参数的第二消息；根据所述至少一个参数来发送第三消息；以及

耦接到所述至少一个处理器的存储器。

2、根据权利要求 1 所述的装置，其中，所述功率净空信息指示所述 UE 的最大发射功率与用于所述第一消息的发射功率之间的差值。

3、根据权利要求 1 所述的装置，其中，所述功率净空信息指示所述 UE 的最大发射功率与用于所述第一消息的发射功率之间的差值是否超过了阈值。

4、根据权利要求 1 所述的装置，其中，所述第一消息还包括缓冲器大小信息，并且其中所述至少一个参数还根据所述缓冲器大小信息来确定。

5、根据权利要求 4 所述的装置，其中，所述至少一个处理器用于：组合所述功率净空信息和所述缓冲器大小信息；根据所述组合的功率净空信息和缓冲器大小信息，为所述第三消息选择消息大小；以及在所述第一消息中发送所述选择的消息大小。

6、根据权利要求 1 所述的装置，其中，所述至少一个参数包括资源许可，并且其中所述至少一个处理器用于使用由所述资源许可指示的上行链路资源来发送所述第三消息。

7、根据权利要求 1 所述的装置，其中，所述至少一个参数包括功率控制信息，并且其中所述至少一个处理器用于使用根据所述功率控制信息而确定的发射功率来发送所述第三消息。

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8、根据权利要求 1 所述的装置，其中，所述第一消息包括随机接入前导，并且由所述 UE 首先发送用于系统接入。

9、根据权利要求 1 所述的装置，其中，所述至少一个处理器用于：由所述 UE 发送用于所述系统接入的随机接入前导；接收随机接入响应；以及响应于接收到所述随机接入响应而发送所述第一消息。

10、一种用于无线通信的方法，包括：

由用户设备（UE）发送用于系统接入的、包括功率净空信息的第一消息；

接收包括根据所述功率净空信息而确定的至少一个参数的第二消息；以及

根据所述至少一个参数来发送第三消息。

11、根据权利要求 10 所述的方法，其中，发送所述第一消息包括：

发送包括所述功率净空信息和缓冲器大小信息的所述第一消息，并且其中，所述至少一个参数还根据所述缓冲器大小信息来确定。

12、根据权利要求 11 所述的方法，还包括：

组合所述功率净空信息和所述缓冲器大小信息；以及

根据所述组合的功率净空信息和缓冲器大小信息，为所述第三消息选择消息大小；并且其中，在所述第一消息中发送所述选择的消息大小。

13、根据权利要求 10 所述的方法，其中，所述至少一个参数包括资源许可，并且其中，发送所述第三消息包括使用由所述资源许可指示的上行链路资源来发送所述第三消息。

14、一种用于无线通信的装置，包括：

第一消息发送模块，用于由用户设备（UE）发送用于系统接入的、包

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括功率净空信息的第一消息；

接收模块，用于接收包括根据所述功率净空信息而确定的至少一个参数的第二消息；

第三消息发送模块，用于根据所述至少一个参数来发送第三消息。

15、根据权利要求 14 所述的装置，其中，所述第一消息发送模块包括：用于发送包括所述功率净空信息和缓冲器大小信息的所述第一消息的模块，并且其中，所述至少一个参数还根据所述缓冲器大小信息来确定。

16、根据权利要求 15 所述的装置，还包括：

组合模块，用于组合所述功率净空信息和所述缓冲器大小信息；以及

选择模块，用于根据所述组合的功率净空信息和缓冲器大小信息来为第三消息选择消息大小；并且其中，在所述第一消息中发送所述选择的消息大小。

17、根据权利要求 14 所述的装置，其中，所述至少一个参数包括资源许可，并且其中，所述第三消息发送模块包括：用于使用由所述资源许可指示的上行链路资源来发送所述第三消息的模块。

18、一种包括指令的机器可读介质，当由机器执行所述指令时使所述机器执行以下操作：

由用户设备（UE）发送用于系统接入的、包括功率净空信息的第一消息；

接收包括根据所述功率净空信息而确定的至少一个参数的第二消息；以及

根据所述至少一个参数来发送第三消息。

19、一种用于无线通信的装置，包括：

至少一个处理器，用于：接收由用户设备（UE）发送的、用于系统接入的包括功率净空信息的第一消息；根据所述功率净空信息确定至少一个

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参数；发送包括所述至少一个参数的第二消息；以及接收由所述 UE 根据所述至少一个参数发送的第三消息；以及

耦接到所述至少一个处理器的存储器。

20、根据权利要求 19 所述的装置，其中，所述第一消息还包括缓冲器大小信息，并且其中，所述至少一个处理器用于还根据所述缓冲器大小信息来确定所述至少一个参数。

21、根据权利要求 20 所述的装置，其中，所述至少一个处理器用于根据所述净空信息和所述缓冲器大小信息来确定对所述 UE 的资源许可。

22、一种用于无线通信的装置，包括：

至少一个处理器，用于：由用户设备（UE）执行用于系统接入的随机接入过程；以及在所述随机接入过程期间发送包括无线电环境报告的消息；以及

耦合到所述至少一个处理器的存储器。

23、根据权利要求 22 所述的装置，其中，所述无线电环境报告包括对于多个小区、多个频率和多个系统中的至少一个的导频测量。

24、根据权利要求 22 所述的装置，其中，所述至少一个处理器用于：发送随机接入前导；接收随机接入响应；以及响应于接收到所述随机接入响应，发送包括所述无线电环境报告的所述消息。

25、根据权利要求 22 所述的装置，其中，所述至少一个处理器用于执行所述随机接入过程，以便从第一基站切换到第二基站。

26、一种用于无线通信的装置，包括：

至少一个处理器，用于：接收由用户设备（UE）发送的、用于系统接入的随机接入前导；向所述 UE 发送随机接入响应；以及从所述 UE 接收包

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括无线电环境报告的消息；以及

耦合到所述至少一个处理器的存储器。

27、根据权利要求 26 所述的装置，其中，所述至少一个处理器用于根据所述无线电环境报告来为所述 UE 确定小区或频率。

28、一种用于无线通信的装置，包括：

至少一个处理器，用于：由用户设备（UE）发送用于系统接入的第一消息；接收包括功率控制信息的第二消息；以及使用根据所述功率控制信息而确定的发射功率来发送第三消息；以及

耦合到所述至少一个处理器的存储器。

29、根据权利要求 28 所述的装置，其中，所述至少一个处理器用于：在所述第一消息中发送功率净空信息，并且其中，所述功率控制信息是根据所述功率净空信息来确定的。

30、根据权利要求 28 所述的装置，其中，所述至少一个处理器用于：根据所述功率控制信息和用于所述第一消息的发射功率来确定用于所述第三消息的发射功率。

31、根据权利要求 28 所述的装置，其中，所述功率控制信息指示发射功率的增加量或减少量，或者指示是否将发射功率增加或减少预定的量。

32、根据权利要求 28 所述的装置，其中，所述至少一个处理器用于：在所述第一消息中发送信道质量指示符（CQI）；以及接收使用根据所述 CQI 确定的调制和编码方案（MCS）或发射功率来发送的所述第二消息。

33、一种用于无线通信的方法，包括：

由用户设备（UE）发送用于系统接入的第一消息；

接收包括功率控制信息的第二消息；以及

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使用根据所述功率控制信息而确定的发射功率来发送第三消息。

34、根据权利要求 33 所述的方法，其中，发送所述第一消息包括在所述第一消息中发送功率净空信息，并且其中，所述功率控制信息是根据所述功率净空信息来确定的。

35、根据权利要求 33 所述的方法，还包括：

根据所述功率控制信息和用于所述第一消息的发射功率来确定所述第三消息的发射功率。

36、一种用于无线通信的装置，包括：

至少一个处理器，用于：接收由用户设备（UE）发送的、用于系统接入的第一消息；向所述 UE 发送包括功率控制信息的第二消息；以及接收由所述 UE 使用根据所述功率控制信息而确定的发射功率来发送的第三消息；以及

耦合到所述至少一个处理器的存储器。

37、根据权利要求 36 所述的装置，其中，所述至少一个处理器用于：接收所述第一消息中的功率净空信息；确定所述第一消息的接收信号质量；以及根据所述接收信号质量和所述功率净空信息来确定所述功率控制信息。

38、根据权利要求 36 所述的装置，其中，所述至少一个处理器用于：接收所述第一消息中的信道质量指示符（CQI）；以及根据所述 CQI 确定用于所述第二消息的调制和编码方案（MCS）或发射功率。

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用于无线通信的随机接入装置和方法

本专利申请要求于2006年10月31日递交的、名称为“用于无线通信的随机接入”（RANDOM ACCESS FOR WIRELESS COMMUNICATION）、序号为 60/855,903 的美国临时申请的优先权，该申请已转让给本申请的受让人，故以引用方式将其并入本文。

技术领域

本发明一般涉及通信，特别涉及用于接入无线通信系统的技术。

背景技术

无线通信系统广泛地部署以提供各种类型的通信内容（例如，语音、视频、分组数据、消息、广播等）。这些无线系统可以是多址系统，所述多址系统通过共享可用系统资源能够支持多个用户。这种多址系统的例子包括码分多址（CDMA）系统、时分多址（TDMA）系统、频分多址（FDMA）系统、正交FDMA（OFDMA）系统以及单载波FDMA（SC-FDMA）系统。

无线通信系统可以包括能够支持任何数量的用户设备（UE）的通信的任何数量的节点B。UE可以经由下行链路和上行链路上的传输与节点B通信。下行链路（或前向链路）指的是从节点B到UE的通信链路，上行链路（或反向链路）指的是从UE到节点B的通信链路。

当UE想要接入系统时，UE可以在上行链路上发射随机接入前导（或接入探测）。节点B可以接收该随机接入前导，并以可以包含UE的相关信息的随机接入响应（或接入许可）作为响应。UE和节点B可以交换其它消息以完成UE的系统接入。为了系统接入，在上行链路上发射消息消耗上行链路资源，在下行链路上发射消息消耗下行链路资源。因此，本领域需要能够高效地发送消息以进行系统接入的技术。

发明内容

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本文描述了用于发送消息以进行系统接入的技术。在一个方面，UE 可以发送包括功率净空信息和/或缓冲器大小信息的第一消息（例如，随机接入前导），以用于系统接入。节点 B 可以根据所述功率净空信息和/或缓冲器大小信息确定至少一个参数（例如，资源许可、功率控制信息等）。节点 B 可以返回包括所述至少一个参数的第二消息（例如，随机接入响应）。UE 随后可以根据所述至少一个参数发送第三消息。例如，UE 使用资源许可所指示的上行链路资源、使用根据所述功率控制信息确定的发射功率等来发送第三消息。

在另一个方面，UE 可以在第三消息中发送无线电环境报告。该报告可以包括对多个小区、多个频率和/或多个系统的导频测量。该报告可用来为 UE 选择频率和/或小区。

在另一个方面，UE 可以接收第二消息中的功率控制信息，并使用根据该功率控制信息而确定的发射功率来发送第三消息。节点 B 可以根据第一消息的接收信号质量、在第一消息中发送的功率净空信息等来确定功率控制信息。UE 可以根据接收到的第二消息中的功率控制信息和用于第一消息的发射功率来确定用于第三消息的发射功率。

下文对本发明公开内容的各个方面和特征进行了更详尽的描述。

附图说明

图 1 示出了无线多址通信系统。

图 2 示出了节点 B 和 UE 的框图。

图 3 示出了起始接入过程。

图 4 示出了前向切换的接入过程。

图 5 示出了基本切换的接入过程。

图 6 和图 7 分别示出了用于由 UE 来执行系统接入的处理过程和装置。

图 8 和图 9 分别示出了用于由节点 B 来支持系统接入的处理过程和装置。

图 10 和图 11 分别示出了用于由 UE 来执行系统接入的另一处理过程和装置。

图 12 和图 13 分别示出了用于由节点 B 来支持系统接入的另一处理过

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程和装置。

图 14 和图 15 分别示出了用于由 UE 来执行系统接入的另一处理过程和装置。

图 16 和图 17 分别示出了用于由节点 B 来支持系统接入的另一处理过程和装置。

具体实施方式

本文所描述的技术可以用于各种无线通信系统，例如 CDMA、TDMA、FDMA、OFDMA、SC-FDMA 和其它系统。术语“系统”和“网络”经常互换使用。CDMA 系统可以实现诸如通用陆地无线接入（UTRA）、cdma2000 等的无线技术。UTRA 包括宽带 CDMA（W-CDMA）和其它 CDMA 的变形。cdma2000 涵盖了 IS-2000、IS-95 和 IS-856 标准。TDMA 系统可以实现诸如全球移动通信系统（GSM）等的无线技术。OFDMA 系统可以实现诸如演进型 UTRA（E-UTRA）、超移动宽带（UMB）、IEEE 802.11（Wi-Fi）、IEEE 802.16（WiMAX）、IEEE 802.20、Flash-OFDM®等的无线技术。UTRA、E-UTRA 和 GSM 是通用移动电信系统（UMTS）的一部分。3GPP 长期演进（LTE）是使用 E-UTRA 的 UMTS 的新版本，其在下行链路上采用 OFDMA，在上行链路上采用 SC-FDMA。在来自名为“第三代合作伙伴计划（3GPP）”的组织的文档中描述了 UTRA、E-UTRA、GSM、UMTS 和 LTE。另外，在来自名为“第三代合作伙伴计划 2（3GPP2）”的组织的文档中描述了 cdma2000 和 UMB。这些不同的无线技术和标准在本领域中是已知的。为简明起见，在下文中描述了所述技术中的用于 LTE 中的系统接入的某些方面，并在下文的描述中大量使用 3GPP 术语。

图 1 示出了具有多个节点 B 110 的无线多址通信系统 100。节点 B 可以是用来与 UE 通信的固定站，其也可以称作演进节点 B（eNB）、基站、接入点等等。每个节点 B 110 提供特定地理区域的通信覆盖。每个节点 B 110 的全部覆盖区域可以划分成多个（例如，三个）小区域。在 3GPP 中，术语“小区”指的是节点 B 的最小覆盖区域和/或服务于该覆盖区域的节点 B 子系统。在其它的系统中，术语“扇区”可以指最小覆盖区域和/或服务于该覆盖区域的子系统。为了简便，在下文的描述中使用小区这个 3GPP 概念。

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UE 120 散布在系统中。UE 可以是固定的或移动的，其还可以称为移动站、终端、接入终端、用户单元、站等等。UE 可以是蜂窝电话、个人数字助理（PDA）、无线调制解调器、无线通信设备、手持设备、膝上型计算机、无绳电话等等。UE 可以经由在下行链路和上行链路上的传输与一个或多个节点 B 通信。

系统控制器 130 可以耦合到节点 B 110，并对节点 B 进行调节和控制。系统控制器 130 可以是单个网络实体，也可以是网络实体的集合。

图 2 示出了节点 B 110 和 UE 120 的设计的框图，其中，节点 B 110 是图 1 中的多个节点 B 中之一，UE 120 是图 1 中的多个 UE 中之一。在该设计方案中，节点 B 110 配备有 T 个天线 226a 到 226t，UE 120 配备有 R 个天线 252a 到 252r，其中，一般而言，$T \geq 1$ 且 $R \geq 1$ 。每个天线可以是实体天线，也可以是天线阵列。

在节点 B 110 处，发射（TX）数据处理器 220 可以从数据源 212 接收一个或多个 UE 的业务数据。TX 数据处理器 220 可以根据为该 UE 选择的一种或多种调制和编码方案，对每个 UE 的业务数据进行处理（例如，格式处理、编码、交织和符号映射），以获得数据符号。TX 数据处理器 220 还可以从控制器/处理器 240 接收信令消息并对其进行处理，以提供信令符号。TX 数据处理器 220 还可以生成导频符号，并将导频符号与数据和信令符号复用。TX MIMO 处理器 222 根据直接 MIMO 映射、预编码/波束形成等对数据、信令和/或导频符号执行空间处理。符号可以从一个天线发出，以用于直接 MIMO 映射；符号也可以从多个天线发出，以用于预编码/波束形成。TX MIMO 处理器 222 可以向 T 个调制器（MOD）224a 到 224t 提供 T 路输出符号流。每个调制器 224 可以对其输出符号流进行处理（例如，用于 OFDM），以获得输出码片流。每个调制器 224 进一步调节（例如，转换为模拟、滤波、放大和上变频）其输出码片流，以获得下行链路信号。来自调制器 224a 到 224t 的 T 个下行链路信号分别经由 T 个天线 226a 到 226t 来发射。

在 UE 120 处，天线 252a 到 252r 可以从节点 B 110 接收下行链路信号，并分别向解调器（DEMOD）254a 到 254r 提供接收到的信号。每个解调器 254 可以调节（例如，滤波、放大、下变频和数字化）其接收到的信号，以

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获得采样，并对这些采样进行进一步处理（例如，用于 OFDM），以获得接收到的符号。MIMO 检测器 260 可以对来自所有 R 个解调器 254a 到 254r 的接收到的符号执行 MIMO 检测，并提供已检测的符号。接收（RX）数据处理器 262 可以对已检测的符号进行处理（例如，符号解映射、解交织和解码），并向数据宿 264 提供解码数据，向控制器/处理器 280 提供解码信令消息。

在上行链路上，在 UE 120 处，来自数据源 272 的业务数据以及来自控制器/处理器 280 的信令消息可以由 TX 数据处理器 274 处理，再进一步由 TX MIMO 处理器 276 处理，由调制器 254a 到 254r 调节并被发射到节点 B 110。在节点 B 110 处，来自 UE 120 的上行链路信号可以由天线 226 接收，由解调器 224 调节，由 MIMO 检测器 230 检测，由 RX 数据处理器 232 处理，以获得 UE 120 所发射的业务数据和信令消息。

控制器/处理器 240 和 280 可以分别指挥节点 B 110 和 UE 120 的操作。存储器 242 和 282 分别存储用于节点 B 110 和 UE 120 的数据和程序代码。调度器 244 可以调度 UE 以进行下行链路传输和/或上行链路传输，并可以为所调度的 UE 分配资源。

图 3 示出了初始接入过程 300 的设计方案。当 UE 想要接入系统时（例如，在通电时、在 UE 有数据要发送时、在系统寻呼 UE 时等），UE 120 在随机接入信道（RACH）上发射随机接入前导。随机接入前导是最先发送以用于系统接入的消息，其也可以称为消息 1、接入签名、接入探测、随机接入探测、签名序列、RACH 签名序列等等。随机接入前导可以包括各种类型的信息，且可以用多种方式来发送，如下文所描述的。

节点 B 110 可以从 UE 120 接收随机接入前导，并可以通过向 UE 120 发送随机接入响应来进行响应。随机接入响应还可以称为消息 2、接入许可、接入响应等等。随机接入响应可以携带各种类型的信息，且可以用多种方式来发送，如下文所描述的。UE 120 可以接收随机接入响应，并且可以发送消息 3 用于无线电资源控制（RRC）连接请求。消息 3 可以包含如下文所描述的各种类型的信息。节点 B 110 以消息 4 作为响应，以进行竞争解决。节点 B 110 还可以发送消息以用于 RRC 连接设置等。UE 120 和节点 B 110 可以自此开始交换数据。

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图 3 示出了用于系统接入的一般的消息流程。通常，每个消息可以携带有各种类型的信息，且可以用多种方式来发送。

系统可以支持用于下行链路的一组传输信道和用于上行链路的另一组传输信道。这些传输信道可用来向介质接入控制（MAC）层以及更高层提供信息传输服务。传输信道可以通过如何在无线链路上发送信息以及具备哪些特征来描述。传输信道可以映射到物理信道，这可以通过诸如调制和编码、将数据映射到资源块之类的各种属性来定义。传输信道可以包括：下行链路共享信道（DL-SCH），用于向 UE 发送数据；上行链路共享信道（UL-SCH），由 UE 用来发送数据；一个或多个 RACH，由 UE 用来接入系统等等。DL-SCH 还可以称为下行链路共享数据信道（DL-SDCH），并可以被映射到物理下行链路共享信道（PDSCH）。UL-SCH 还可以称为上行链路共享数据信道（UL-SDCH），并可以被映射到物理上行链路共享信道（PUSCH）。RACH 可以被映射到物理随机接入信道（PRACH）。

图 3 中的消息 1 可以携带随机接入前导，并且可以包括 L 比特的信息，其中，L 可以是任意整数值。消息 1 可以包括下述信息中的任何信息：

- 随机标识符（ID）— UE 120 所选择的伪随机值；
- 接入类型 — 指示初始系统接入或切换；
- 信道质量指示符（CQI）— 用于更高效地发送消息 2；
- 功率净空（headroom）信息 — 用于控制对消息 3 的传输；
- 缓冲器大小信息 — 用于控制对消息 3 的传输；以及
- 其它信息。

随机 ID 可用来在系统接入过程中标识 UE 120，但该 ID 可能并不是唯一的，因为多个 UE 可以选择相同的随机 ID。在随机 ID 冲突的情况下，可以使用竞争解决过程来解决竞争问题。

CQI 可以指示 UE 120 所测量的下行链路信道质量，并且可以用于向 UE 发送下一个下行链路传输和/或给 UE 分配上行链路资源。CQI 可以使用 1 比特、2 比特或任何其它数目的比特来传送。一般而言，当消息 2 比较大时，在消息 1 中发送 CQI 的好处更多。在消息 1 中包括 CQI 还使得能够根据不同的 UE 的 CQI 而将来自这些 UE 的随机接入前导编组，从而实现对发往这些 UE 的消息 2 的更好的功率控制。如果消息 2 相对较小且消息 4 较大，

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那么可以在消息 3 中而不是在消息 1 中发送 CQI。

功率净空信息可以包括在消息 1 中，并可用于传送 UE 120 的可用发射功率。在一种设计方案中，功率净空信息包括：单个比特，用于指示 UE 120 的最大发射功率与UE用来发射消息1的发射功率之间的差值是否超过了阈值（例如，5 分贝或一些其它值）。在另一种设计方案中，功率净空信息包括：多个比特，用于指示 UE 120 的最大发射功率和用来发射消息 1 的发射功率之间的差值。

除消息 1 的接收功率以外，功率净空信息可以具有比路径损耗更多的信息。例如，两个 UE 可以测量给定节点 B 的相同的路径损耗，并可以用相同的发射功率发送它们的消息 1。然而，最大发射功率为 24dBm 的 UE 具有比最大发射功率为 21dBm 的 UE 更多的功率净空。因此，UE 120 可以在消息 1 中向节点 B 110 发送功率净空信息，节点 B 110 可以使用该信息来控制 UE 120 对消息 3 的传输，例如，为消息 3 分配上行链路资源。

缓冲器大小信息可以包括在消息 1 中，并可以指示 UE 120 在消息 3 中所发送的数据量。消息 3 可以携带有诸如 RRC 消息、无线电环境报告等的各种类型的信息，并且其大小可变。在一种设计方案中，对每种类型的信息，使用足够数目的比特来分别发送缓冲器大小和功率净空信息。在另一种设计方案中，可以将缓冲器大小和功率净空信息结合起来。例如，如果 UE 120 具有足够的发射功率和足够的数据量，则可以选择较大的消息 3；反之，则选择较小的消息 3。在这两种设计方案中，$\log_2(N)$个比特可用于支持消息 3 的 N 种不同的大小。在任何情况下，缓冲器大小和/或功率净空信息可以使节点 B 110 能够为消息 3 分配适当的上行链路资源。

可以从具有 2^L 个可用接入序列的池中选择接入序列，并将该接入序列发送用于消息 1 中的随机接入前导。在一种设计方案中，L = 6，并且可以从具有 64 个接入序列的池中选择接入序列，并将该接入序列发送用于 6 比特随机接入前导。所选择的接入序列的 L 比特索引可以称为 RA 前导标识符。

在称为接入过程选项 1 的一种设计方案中，可以支持下述特征中的一项或多项：

- 在 L1/L2 控制和 DL-SCH 上发送消息 2；

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• 在消息 2 中向 UE 120 分配小区无线网络临时标识符（C-RNTI）；

• 在分配 C-RNTI 之前，根据随机接入 RNTI（RA-RNTI）来识别 UE 120；

• 消息 3 的大小是变化的；

• 可以合并消息 4（竞争解决）和 RRC 连接设置。

由于节点 B 110 能够使用较大的消息 2 对来自 UE 120 的随机接入前导作出响应，所以选项 1 能够提供更多的灵活性，其中，消息 2 可以在 L1/L2 控制和 DL-SCH 上发送。L1/L2 控制指的是一种层 1/层 2 用来发送信令/控制信息的机制。L1/L2 控制可以用物理下行链路控制信道（PDCCH）、共享下行链路控制信道（SDCCH）等实现。

C-RNTI 由节点 B 110 用来唯一地标识 UE 120，并且可以在接入过程中（例如，在消息 2 或消息 4 中）或在一些其它的时间将 C-RNTI 分配给 UE。C-RNTI 还可以称为 MAC ID 等。在分配 C-RNTI 之前，可以使用临时 ID 来标识 UE 120。多个 RACH 可用，UE 120 可以随机选择多个可用的 RACH 中之一。每个 RACH 可以与不同的 RA-RNTI 相关联。在系统接入过程中，可以通过以下两者的组合来识别 UE 120：UE 所发送的接入序列的 RA 前导标识符以及所选择的 RACH 的 RA-RNTI。

节点 B 110 可以使用消息 2 来响应来自 UE 120 的消息 1，其中，消息 2 可以是能够携带各种类型的信息的大消息。节点 B 110 可以在消息 2 中向 UE 120 传送下述信息：

• 时序提前（~8 比特）— 用于调整 UE 120 的时序；

• RA-RNTI（~16 比特）— 标识节点 B 110 所响应的 RACH；

• RA 前导标识符（6 比特）— 标识节点 B 110 所响应的随机接入前导；以及

• 上行链路资源（~24 比特）— 标识分配给 UE 120 的上行链路资源。

此外，消息 2 还可以包括下述信息中的任何信息：

• C-RNTI （16 比特）— 分配给 UE 120 的 C-RNTI；

• MAC 头（~8 比特）；

• 消息类型（~8 比特）；

• 用于消息 3 的功率调整/功率控制信息（~4-6 比特）；以及

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• 其它信息，诸如 CQI 资源等等。

在消息 2 中可以向 UE 120 分配 C-RNTI。多个 UE 可以在相同的 RACH 上发送相同的随机接入前导，因此，会发生冲突。在发生冲突的情况下，这些 UE 可能分配有相同的 C-RNTI。然而，只有成功地解决了竞争的 UE 才保留所分配的 C-RNTI，而其它 UE 则要再次接入系统，并且当它们重复接入过程时获得新的 C-RNTI。也可以在消息 4 中将 C-RNTI 分配给 UE 120。

在将 C-RNTI 分配给 UE 120 之前，可以将 RA-RNTI 用作临时 UE ID。RA-RNTI 可以标识 RACH，而不是随机接入前导。消息 2 可以寻址到特定的 RA-RNTI，因此实质上可以被广播。另外，使用 RA-RNTI 意味着：由于 L1/L2 控制独自的容量太小，所以消息 2 在 L1/L2 控制和 DL-SCH 上发送。如果 L1/L2 控制和 DL-SCH 都用来发送消息 2，那么使用 RA-RNTI 的一个好处是：单个 L1/L2 控制信道可用来寻址多个 UE，其中，这些 UE 的随机接入前导由节点 B 110 在相关联的 RACH 上成功地接收。然而，考虑到系统的设计方案应当确保在 RACH 上的冲突相对不频繁，所以应当根据在节点 B 110 在相同的 RACH 上接收到多个随机接入前导的低可能性来评价这些好处。

在消息 2 中分配 C-RNTI 以及使用针对消息 2 的 RA-RNTI 使得能够对消息 4 使用混合自动重传请求（HARQ）。HARQ 通常用于向单个 UE 进行单播传输。HARQ 还可以与 RA-RNTI（其标识 RACH）一起使用，而不是与 C-RNTI（用于标识特定 UE）一起使用。在这种情况下，RA-RNTI 用于标识单个 UE，其中，向该 UE 进行对消息 4 的 HARQ 传输。

在称为接入过程选项 2 的另一种设计方案中，支持下述特征中的一项或多项：

• 在 L1/L2 控制上发送消息 2；

• 在消息 4 中或随后将 C-RNTI 分配给 UE 120；

• 在分配 C-RNTI 之前，使用隐式 RNTI（I-RNTI）来标识 UE 120；

• 消息 3 的大小可以是固定的，也可以是变化的；以及

• 可以合并消息 4（竞争解决）和 RRC 连接设置。

选项 2 可以非常高效并且可以允许节点 B 110 使用非常高效的消息 2 来响应来自 UE 120 的随机接入前导，其中，消息 2 是使用 L1/L2 控制消息

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来发送的。由于 L1/L2 控制消息可以相对较小，所以可以限制上行链路资源许可，以便为时序提前和/或其它信息留空间。在将 C-RNTI 分配给 UE 之前，可以使用 I-RNTI 来标识 UE 120。可以根据如下参数来形成 I-RNTI：（i）RA 前导标识符和 UE 120 接入系统时的系统时间；（ii）所选择的 RACH 和 RA 前导标识符；或者（iii）所选择的 RACH、RA 前导标识符、系统时间的组合等。I-CRNTI 可以占据用于 C-RNTI 的全部空间中的一部分（例如，若干百分比）。

节点 B 110 可以在消息 2 中向 UE 120 传送下述信息：

- 时序提前（~8 比特）；
- RA 前导标识符（0 比特）— 用于 UE 120 的 I-CRNTI 的一部分；以及
- 上行链路资源的位置（~5 比特）— 对于消息 3 的固定大小是足够的。

可以将 I-CRNTI 与为消息 2 生成的循环冗余校验（CRC）进行异或（XOR）运算，或者可以用其它方式来传送 I-CRNTI。消息 3 大小固定，并且可以与固定的传输块大小、固定的调制和编码方案（MCS）等相关联。在这种情况下，节点 B 110 可以简单地传送上行链路资源的位置，该上行链路资源可由 UE 120 用来发送消息 3。

此外，消息 2 还可以包括下述信息中的任何信息：

- 上行链路资源的大小（~2-3 比特）— 消息 3 的大小可以变化；
- 用于消息 3 的功率调整/功率控制信息（~4-6 比特）；
- 针对消息 4 的计时值（3 比特）；以及
- 其它信息。

受限的数值集可用于上行链路资源大小。随后可以使用较少的比特来传送分配给 UE 120 的上行链路资源。

可以仅使用 L1/L2 控制消息来发送消息 2，L1/L2 控制消息总共有 40 比特。该 40 比特中的 16 比特可以用于 CRC，24 比特可用于传送时序提前、上行链路资源许可和用于消息 3 的其它信息（例如，功率调整）。L1/L2 控制消息还可以传送针对消息 4 的计时值，该计时值可以用于确定 UE 120 将要等待来自节点 B 110 的消息 4 的时间。下行链路确认信道（ACKCH）的位置可以是隐式的，并且可以基于所分配的上行链路资源的位置。由于消

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息 2 的大小有限，所以可以在消息 4 中或随后将 C-RNTI 分配给 UE 120。在将 C-RNTI 分配给 UE 120 之前，可以将 I-CRNTI 用作临时 UE ID。

对于接入过程选项 1、2 而言，消息 2 可以包括对 UE 120 的资源许可。一般而言，资源许可能够显式地和/或隐式地传送所分配的下行链路资源和/或上行链路资源。例如，在所分配的下行链路传输资源和相应的上行链路信令资源（例如，用于 ACK、CQI 等的）之间存在着映射关系。类似地，在所分配的上行链路传输资源和相应的下行链路信令资源之间存在着映射关系。这种映射关系可以避免显式地传送信令资源的需要，因为所分配的信令资源可以从所分配的传输资源到相应的信令资源的映射关系中推断出。

消息 3 可以包括下述信息中的任何信息：

- CQI — 用于更高效地发送消息 4；
- 功率净空信息 — 用于控制消息 4 的传输；
- 缓冲器大小信息 — 用于控制消息 4 的传输；
- 无线电环境报告 — 对不同的小区和/或频率的测量。
- 非接入层（NAS）消息；以及
- 其它信息。

CQI、功率净空信息、缓冲器大小信息中的每一个可以仅在消息 1 或仅在消息 3 中发送，或在消息 1 和消息 3 中发送。可以根据以下因素来确定使用哪个（哪些）特定消息来发送每种类型的信息：用来发送信息的消息的大小、所述信息对下一个消息的有用程度等等。例如，如果消息 2 相对较大，则可以在消息 1 中发送 CQI（例如，选项 1）；或者如果消息 1 和消息 2 都相对较小，则可以在消息 3 中发送 CQI（例如，选项 2）。在消息 3 较大和/或大小可变时，功率净空信息和缓冲器大小信息是有益的，并且可以在消息 1 中发送，并用来为消息 3 分配上行链路资源。功率净空信息和/或缓冲器大小信息也可以在消息 3 中发送，并用来控制随后的上行链路消息的传输。CQI、功率净空信息和/或缓冲器大小信息还可以用其它方式来发送。

无线电环境报告可以在消息 3 中发送，并且可以包括 UE 120 对不同的小区和/或不同的频率进行的导频测量。无线电环境报告还可以包括对其它

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系统（例如，GSM、W-CDMA、cdma2000 和/或其它系统）中的小区和/或频率的导频测量。节点 B 110 可以使用该无线电环境报告将 UE 120 引导至合适的小区和/或合适的频率。无线电环境报告还可以称为测量报告等。

期望消息 3 包括 NAS 消息，以便加速接入过程。NAS 消息可用来配置 UE 120 和节点 B 110 之间的无线链路，并且可以在消息 3 中发送（这会加快接入过程）和/或在随后的消息中发送。

可以对消息 3 进行功率控制，以便降低消息 3 对其它 UE 的干扰量。当消息 3 较大时和/或在节点 B 110 处的时序对准很差的情况下发送消息 3 时，进行功率控制的好处将更加明显。很差的时序对准可能是由在消息 2 中发送的不准确的时序提前导致的，其可以进而是由在 RACH 上的冲突或者对 UE 120 所发送的接入序列的不正确的检测（例如，高速度所导致的）或一些其它原因而导致的。为降低对其它 UE 的干扰，可以用根据在消息 2 中发送的功率调整而确定的发送功率来发送消息 3。

功率调整还可以称为功率控制信息，其可以具有多种形式。在一种设计方案中，功率调整可以指示发射功率的增加量或减少量，其可以以合适数目的比特（例如，4 比特）来给出。在另一种设计方案中，功率调整可以简单地指示是否应当按照预定的量来增加或减少发射功率。功率调整还可以用其它形式来给出。

可以将用于竞争解决的消息 4 和 RRC 连接设置合并。如果 UE 120 没有接收到指示其已成功接入系统的具有唯一 ID 的消息 4，则 UE 120 可以重复接入过程。期望确保 UE 120 使用合适的计时值，从而如果消息 4 没有包括成功的竞争解决，则 UE 120 能够在计时器到期后重新开始接入过程。将消息 4 和 RRC 连接设置合并会影响计时值。在一种设计方案中，可以对计时器使用默认值，默认值可以重置为在广播信道（BCH）上广播的值或在消息 2 中指定的值。

图 4 示出了接入过程 400 的设计方案，用于 UE 120 从源/旧节点 B 到目标/新节点 B 的前向切换。在进行切换时，UE 120 可以工作在 RRC_CONNECTED 状态。UE 120 可以通过在所选择的 RACH 上发送消息 1 的接入序列来接入系统（例如，由于与服务小区之间的无线链路恶化或失效）。可以从为切换预留的接入序列池中选择接入序列。消息 1 还可以包括

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图 3 中所示的用于消息 1 的任何信息。目标节点 B 可以从 UE 120 接收消息 1，并可以通过发送消息 2 来响应，其中，消息 2 包括对 UE 120 的上行链路资源许可。该上行链路资源许可可以传送分配给 UE 120 的上行链路资源。在图 4 中的用于前向切换的消息 2 的形式可以与在图 3 中的用于起始系统接入的消息 2 的形式相匹配，也可以不匹配。

UE 120 然后可以发送消息 3，其可以包括旧的 C-RNTI、旧的节点 B 的 ID，以便解决可能的冲突、标识 UE 以及使得目标节点 B 能够接入旧节点 B。消息 3 还可以包括 CQI，以便协助目标节点 B 控制消息 4 的发射功率。消息 3 还可以包括无线电环境报告，其可以包括对不同小区、不同频率和/或不同系统的导频测量。目标节点 B 可以使用该无线电环境报告来为 UE 120 选择合适的小区和/或合适的频率。目标节点 B 可以接收唯一的指向 UE ID 的“句柄”或指针，并且可以能够解决可能的竞争。然后目标节点 B 可以发送用于 RRC 竞争解决的消息 4。UE 120 可以发送对消息 4 的层 2 ACK 和可能的数据（如果有的话）。UE 120 此后可以与目标节点 B 交换数据。

图 5 示出了接入过程 500 的设计方案，用于 UE 120 从源节点 B 到目标节点 B 的基本切换。在进行切换时，UE 120 可以工作在 RRC_CONNECTED 状态。在进行接入过程 500 之前，服务节点 B 可以向目标节点 B 发送 UE 120 的切换请求，目标节点 B 可以接受或拒绝该切换请求。如果接受了该切换请求，则目标节点 B 可以向 UE 120 分配接入序列、C-RNTI、CQI 资源、功率控制资源，并可以向源节点 B 提供该信息。源节点 B 可以将该信息转发给 UE 120，随后，UE 120 将具有来自目标节点 B 的所分配的 C-RNTI、CQI 资源和功率控制资源。

对于接入过程 500，UE 120 可以向目标节点 B 发送所分配的接入序列。可以为切换预留所有可用的接入序列的一个子集，可以从该预留的接入序列子集中选择分配给 UE 120 的接入序列。由于接入序列和分配给 UE 120 的 C-RNTI 之间具有一一映射的关系，所以可能无需竞争解决。因此，接入过程 500 可以包括图 4 所示的接入过程 400 中的消息 1、2 和 5，并且可以省略消息 3 和 4。

可以在 BCH 上广播用于图 3 所示的起始系统接入和图 4 所示的前向切换的接入序列空间。该广播的接入序列空间可以排除为图 5 所示的基本切

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换而预留的接入序列空间。接入过程 400 也可以用于基本切换。

图 6 示出了 UE 所执行的用于系统接入的处理过程 600 的设计方案。UE 可以发送包括功率净空信息的第一消息，以进行系统接入（框 612）。功率净空信息可以指示 UE 的最大发射功率与用于第一个消息的发射功率之间的差值。功率净空信息还可以指示这种差值是否超过了阈值。可以接收包括根据功率净空信息而确定的至少一个参数的第二消息（框 614）。第一消息可以还包括缓冲器大小信息，并且该至少一个参数可以还根据缓冲器大小信息来确定。例如，第三消息的消息大小可以根据组合的功率净空信息和缓冲器大小信息来选择，并且可以在第一消息中发送所选择的消息大小。

可以根据所述至少一个参数来发送第三消息（框 616）。所述参数可以包括资源许可，第三消息可以使用由该资源许可所指示的上行链路资源来发送。参数可以包括功率控制信息，第三消息可以使用根据该功率控制信息所确定的发射功率来发送。

第一消息可以包括随机接入前导，并且可以由 UE 最先发送，以用于系统接入。或者，UE 可以发送随机接入前导以用于系统接入，接收随机接入响应，并响应于接收到随机接入响应而发送第一消息。

图 7 示出了用于执行系统接入的装置 700 的设计。装置 700 包括：第一消息发送模块（模块 712），用于由 UE 发送包括功率净空信息的第一消息，以进行系统接入；第二消息接收模块（模块 714），用于接收包括根据功率净空信息而确定的至少一个参数的第二消息；第三消息发送模块（模块 716），用于根据该至少一个参数来发送第三消息。

图 8 示出了节点 B 所执行的处理过程 800 的设计方案，用于支持系统接入。可以接收 UE 所发送的、用于系统接入的包括功率净空信息的第一消息（框 812）。可以根据功率净空信息确定至少一个参数（框 814）。第一消息还可以包括缓冲器大小信息，所述参数还可以根据缓冲器大小信息来确定。所述参数可以包括上行链路资源许可、功率控制信息等。可以向 UE 发送包括所述至少一个参数的第二消息（框 816）。可以接收 UE 根据所述至少一个参数而发送的第三消息（框 818）。

图 9 示出了用于支持系统接入的装置 900 的设计方案。装置 900 包括：

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第一消息接收模块（模块 912），用于接收 UE 所发送的、用于系统接入的包括功率净空信息的第一消息；确定模块（模块 914），用于根据功率净空信息确定至少一个参数；第二消息发送模块（模块 916），用于向 UE 发送包括所述至少一个参数的第二消息；第三消息接收模块（模块 918），用于接收 UE 根据所述至少一个参数而发送的第三消息。

图 10 示出了 UE 所执行的处理过程 1000 的设计方案，用于系统接入。UE 可以执行随机接入过程，以用于系统接入，例如，用于从一个节点 B 到另一个节点 B 的切换（框 1012）。对于随机接入过程，初始可以由 UE 发送随机接入前导（框 1014）。接收对随机接入前导的随机接入响应（框 1016）。可以在随机接入过程中（例如，在接收到随机接入响应之后）发送包括无线电环境报告的消息（框 1018）。无线电环境报告可以包括对多个小区、多个频率和/或多个系统的导频测量。无线电环境报告可以用于为 UE 选择频率和/或小区。

图 11 示出了用于执行系统接入的装置 1100 的设计方案。装置 1100 包括：执行模块（模块 1112），用于由 UE 执行用于系统接入的随机接入过程；用于发送随机接入前导的模块（模块 1114）；接收模块（模块 1116），用于接收随机接入响应；用于在随机接入过程中发送包括无线电环境报告的消息的模块（模块 1118）。

图 12 示出了节点 B 所执行的处理过程 1200 的设计方案，用于支持系统接入。可以接收由 UE 发送的、用于系统接入的随机接入前导（框 1212）。可以向 UE 发送随机接入响应（框 1214）。可以从 UE 接收包括无线电环境报告的消息（框 1216）。可以根据该无线电环境报告来为 UE 确定小区和/或频率（框 1218）。可以将 UE 引导至所选择的小区和/或频率（框 1220）。

图 13 示出了装置 1300 的设计方案，用于支持节点 B 所执行的系统接入。装置 1300 包括：用于接收 UE 所发送的、用于系统接入的随机接入前导的模块（模块 1312）；发送模块（模块 1314），用于发送随机接入响应；用于从 UE 接收包括无线电环境报告的消息的模块（模块 1316）；确定模块（模块 1318），用于根据无线电环境报告来为 UE 确定小区和/或频率；引导模块（模块 1320），用于将 UE 引导至所选择的小区和/或频率。

图 14 示出了 UE 所执行的处理过程 1400 的设计方案，用于系统接入。

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可以由 UE 发送第一消息，以进行系统接入（框 1412）。可以由 UE 接收包括功率控制信息的第二消息（框 1414）。可以根据第一消息的接收信号质量、在第一消息中发送的功率净空信息等来确定功率控制信息。功率控制信息可以指示：发射功率的增加量或减少量、是否将发射功率增加或减少预定的量等。可以由 UE 使用根据功率控制信息和用于第一消息的发射功率而确定的发射功率来发送第三消息（框 1416）。

图 15 示出了用于执行系统接入的装置 1500 的设计方案。装置 1500 包括：第一消息发送模块（模块 1512），用于由 UE 发送用于系统接入的第一消息；接收模块（模块 1514），用于接收包括功率控制信息的第二消息；第三消息发送模块（模块 1516），用于使用根据功率控制信息和用于第一消息的发射功率而确定的发射功率来发送第三消息。

图 16 示出了节点 B 所执行的处理过程 1600 的设计方案，用于支持系统接入。可以接收 UE 所发送的、用于系统接入的第一消息（框 1612）。可以根据所述第一消息（例如，根据第一消息的接收信号质量、在第一消息中发送的功率净空消息等）来确定功率控制信息（框 1614）。可以向 UE 发送包括功率控制信息的第二消息（框 1616）。可以接收 UE 使用根据功率控制信息而确定的发射功率来发送的第三消息（框 1618）。

图 17 示出了装置 1700 的设计方案，用于由节点 B 支持系统接入。装置 1700 包括：用于接收 UE 所发送的、用于系统接入的第一消息的模块（模块 1712）；用于根据第一消息来确定功率控制信息的模块（模块 1714）；用于发送包括功率控制信息的第二消息的模块（模块 1716）；用于接收 UE 使用根据功率控制信息而确定的发射功率来发送的第三消息的模块（模块 1718）。

图 7、图 9、图 11、图 13、图 15 和图 17 中的模块可以包括：处理器、电子设备、硬件设备、电子部件、逻辑电路、存储器等或它们的任何组合。

本领域技术人员应当理解，信息和信号可以使用多种不同的技术和方法来表示。例如，在上文的描述中提及的数据、指令、命令、信息、信号、比特、符号和码片可以用电压、电流、电磁波、磁场或粒子、光场或粒子或者其任意组合来表示。

本领域技术人员还应当明白，结合本文公开描述的各种示例性的逻辑

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块、模块、电路和算法步骤均可以实现成电子硬件、计算机软件或它们的组合。为了清楚地表示硬件和软件之间的可互换性，上面对各种示例性的部件、块、模块、电路和步骤均围绕其功能进行了一般性描述。至于这种功能是实现成硬件还是实现成软件，则取决于特定的应用和对整个系统所施加的设计约束条件。熟练的技术人员可以针对每个特定应用，以不同的方式实现所描述的功能，但是，这种实现决策不应解释为脱离本发明的保护范围。

可以使用用于执行本文所述功能的通用处理器、数字信号处理器（DSP）、专用集成电路（ASIC）、现场可编程门阵列（FPGA）或其它可编程逻辑器件、分立门电路或者晶体管逻辑器件、分立硬件部件或者其任意组合，来实现或执行结合本文公开所描述的各种示例性的逻辑块、模块和电路。通用处理器可以是微处理器，或者，该处理器也可以是任何常规的处理器、控制器、微控制器或者状态机。处理器也可以实现为计算设备的组合，例如，DSP 和微处理器的组合、多个微处理器、一个或多个微处理器与 DSP 内核的结合，或者任何其它这种结构。

结合本文公开所描述的方法或者算法的步骤可直接体现为硬件、由处理器执行的软件模块或两者的组合。软件模块可以驻留于 RAM 存储器、闪存、ROM 存储器、EPROM 存储器、EEPROM 存储器、寄存器、硬盘、移动硬盘、CD-ROM 或者本领域熟知的任何其它形式的存储介质中。一种示例性的存储介质耦合至处理器，从而使处理器能够从该存储介质读取信息，且可向该存储介质写入信息。或者，存储介质可以集成到处理器。处理器和存储介质可以位于 ASIC 中。ASIC 可以位于用户终端中。或者，处理器和存储介质可以作为分立组件存在于用户终端中。

在一个或多个示例性设计方案中，所描述的功能可以用硬件、软件、固件或它们的组合来实现。当使用软件实现时，可以将这些功能作为计算机可读介质上的一个或多个指令或代码来存储或者进行传输。计算机可读介质包括计算机存储介质和通信介质，其中通信介质包括便于从一个地方向另一个地方传送计算机程序的任何介质。存储介质可以是可由通用或专用计算机存取的任何可用介质。通过示例的方式而非限制的方式，这种计算机可读介质可以包括 RAM、ROM、EEPROM、CD-ROM 或其它光盘存

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储设备、磁盘存储设备或其它磁存储设备、或者能够用于携带或存储期望的指令或数据结构形式的程序代码模块并能够由通用或专用计算机，或通用或专用处理器进行存取的任何其它介质。此外，任何连接可以适当地称为计算机可读介质。例如，如果软件是使用同轴电缆、光纤电缆、双绞线、数字用户线（DSL）或者诸如红外线、无线电和微波之类的无线技术从网站、服务器或其它远程源传输的，那么同轴电缆、光纤电缆、双绞线、DSL 或者诸如红外线、无线电和微波之类的无线技术包括在所述介质的定义中。本文所使用的磁盘和光盘包括压缩光碟（CD）、激光光碟、光碟、数字多用途光碟 (DVD)、软盘和蓝光碟，其中磁盘通常通过磁性复制数据，而光盘则用激光以光学方式复制数据。上面的组合也应当包括在计算机可读介质的范围之内。

提供以上描述以使得本领域技术人员能够实现或者使用本公开。对于本领域技术人员来说，对这些公开内容的各种修改都是显而易见的，并且，本文定义的一般原理可以在不脱离这些公开内容的精神或范围的情况下被应用于其它变形。因此，本公开并不限于本文描述的例子和设计方案，而是应符合与本文公开的原理和新颖性特征一致的最广范围。

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Page 277 of 555

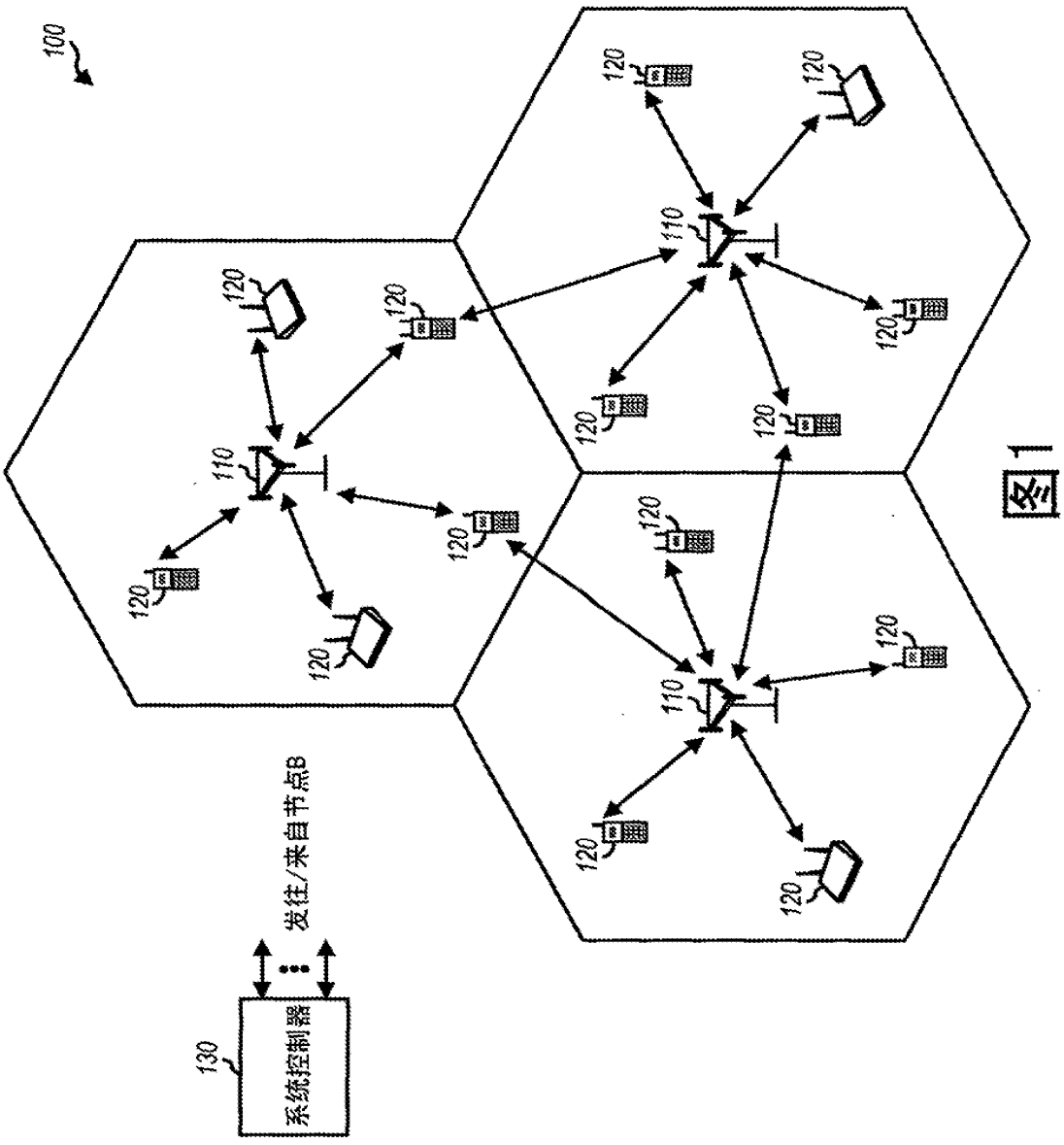


图 1

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Page 278 of 555

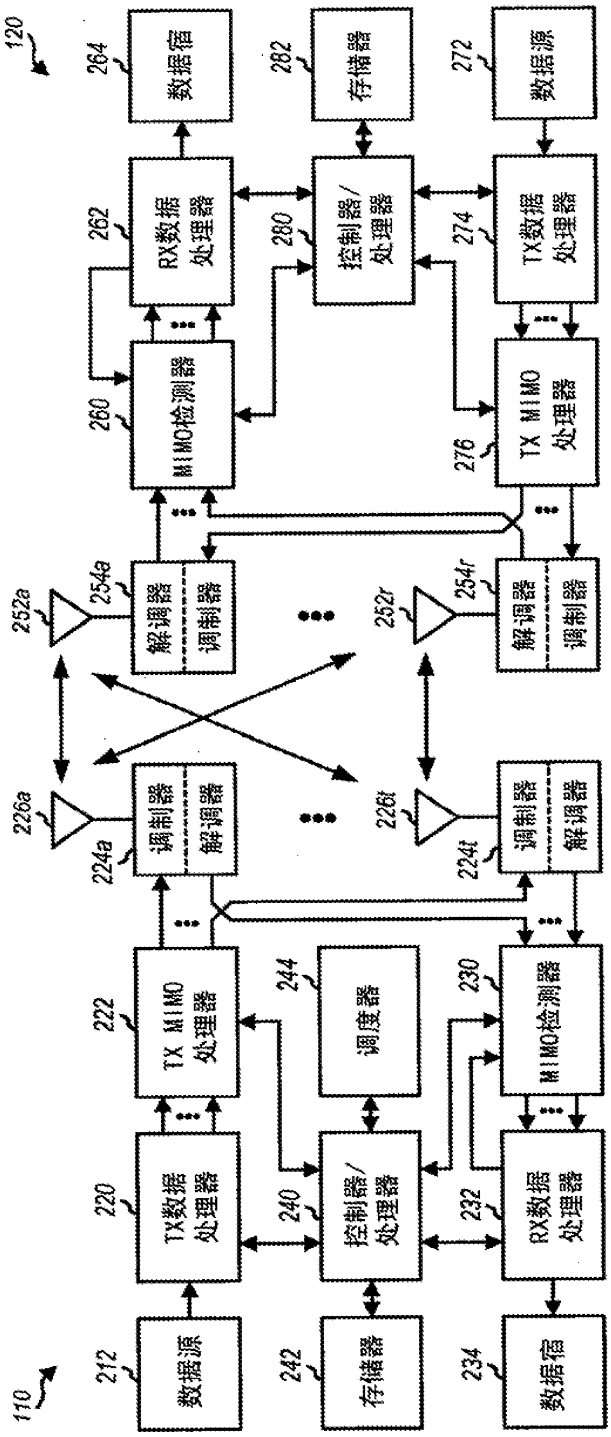


图2

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Page 279 of 555

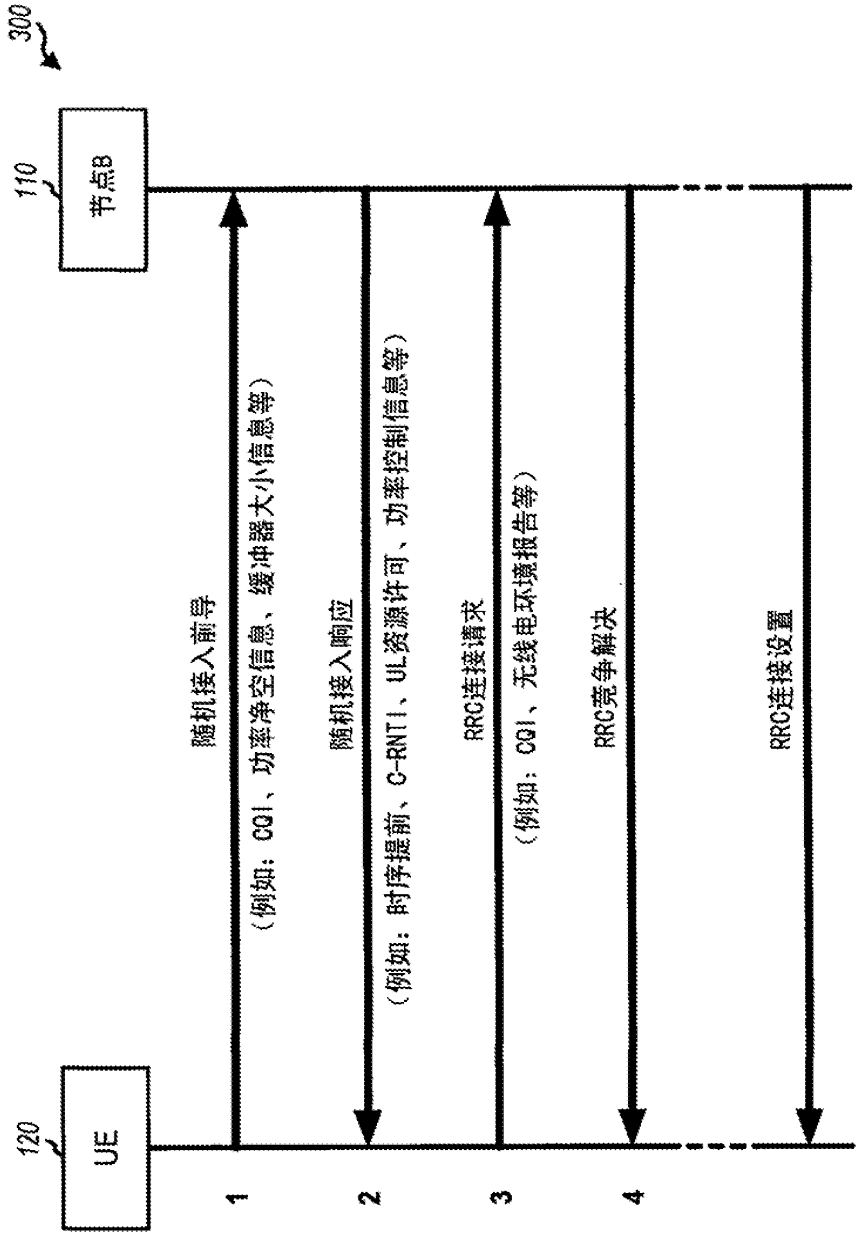


图3

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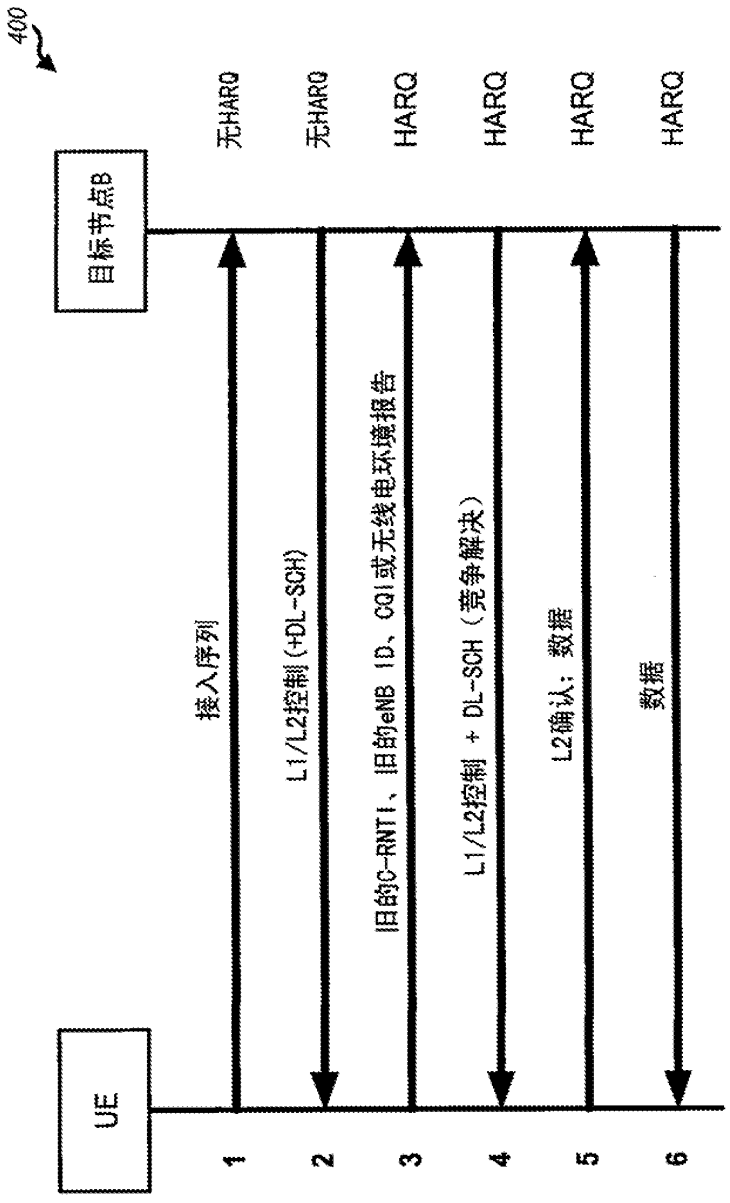


图4

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Page 281 of 555

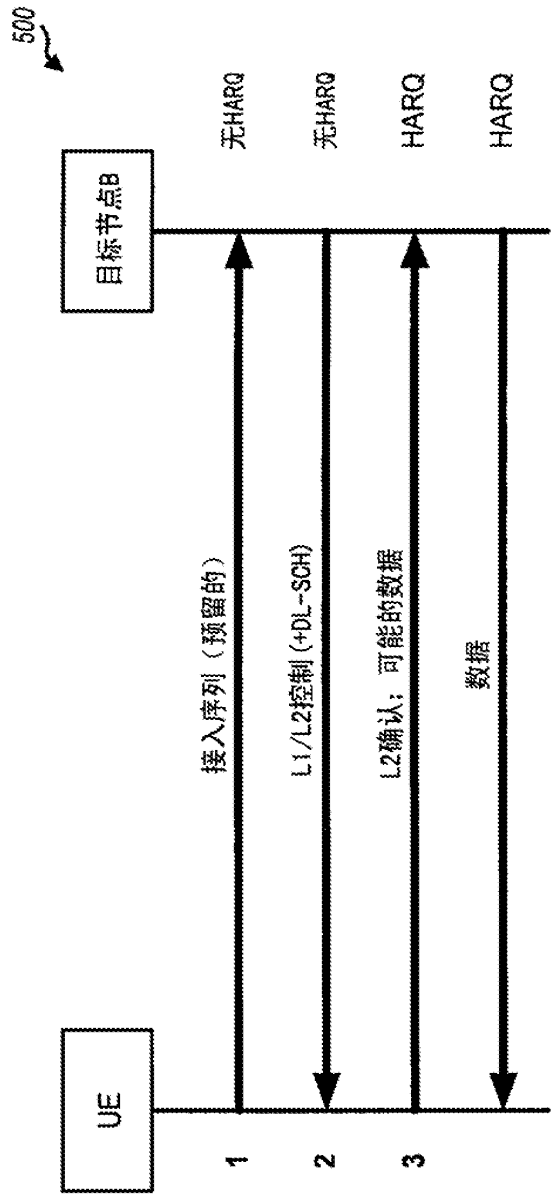


图5

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Page 282 of 555

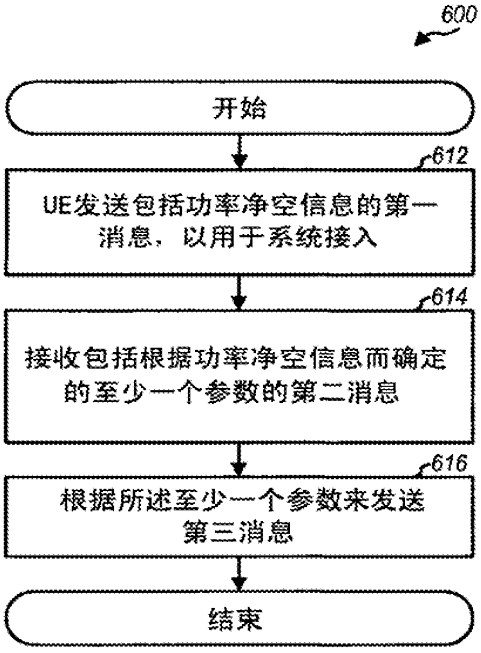


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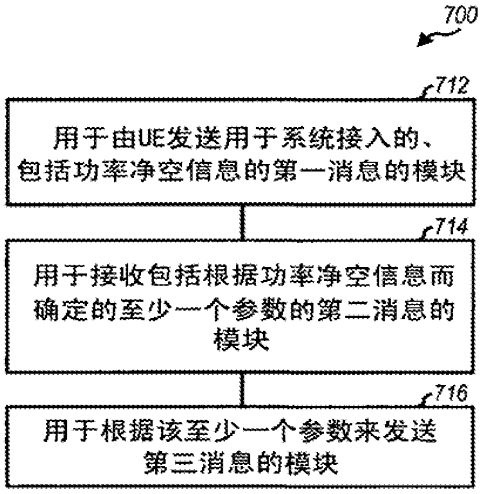


图7

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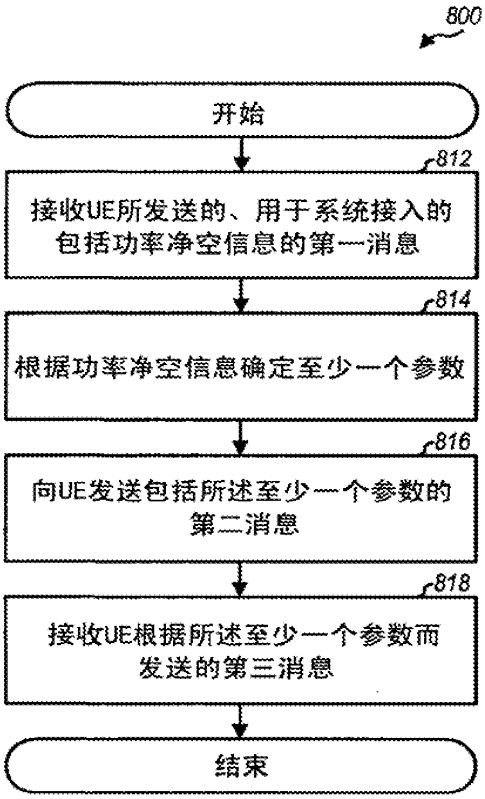


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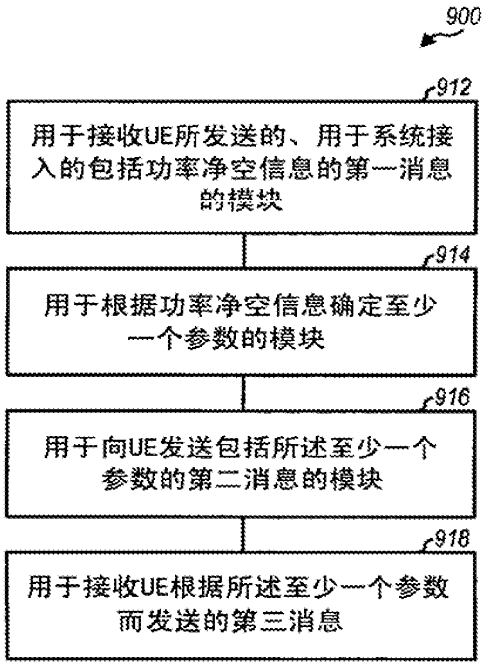


图9

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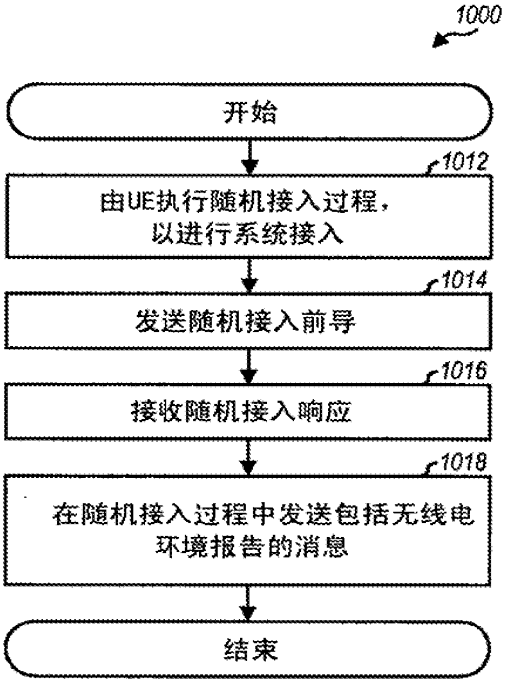


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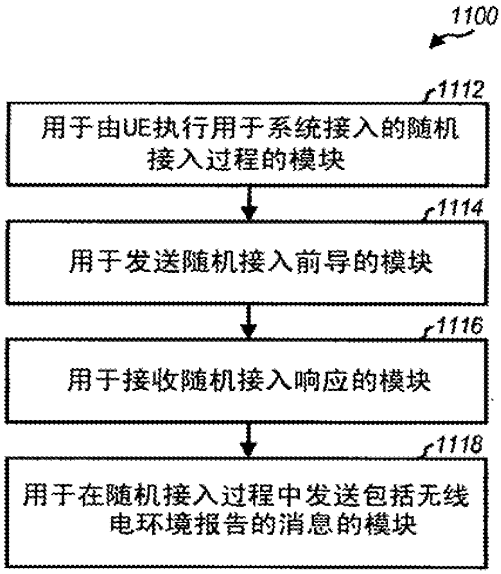


图11

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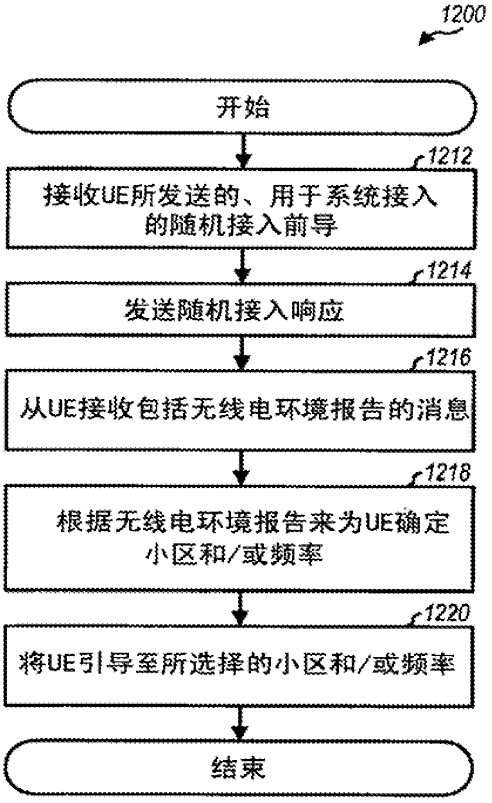


图12

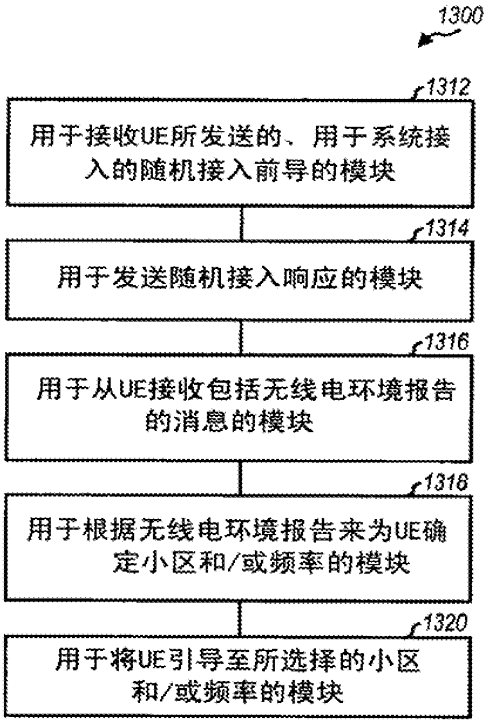


图13

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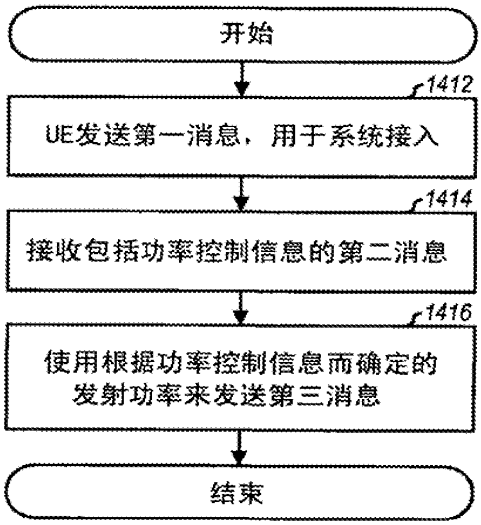


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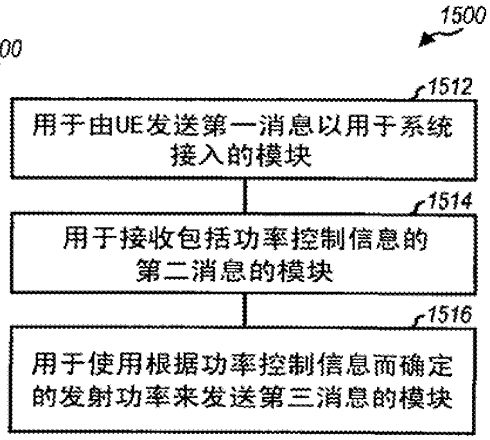


图15

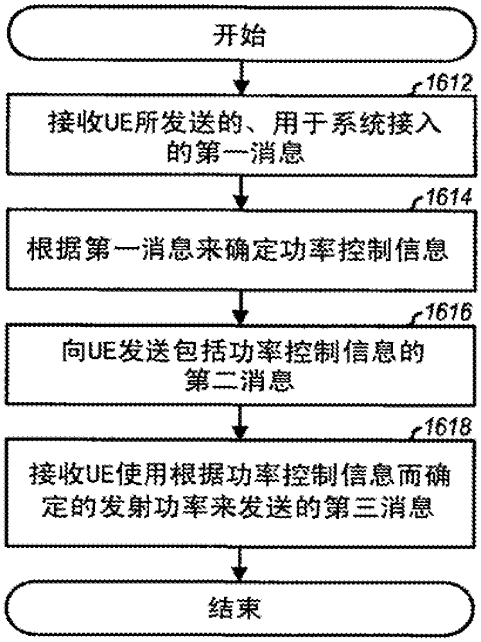


图16

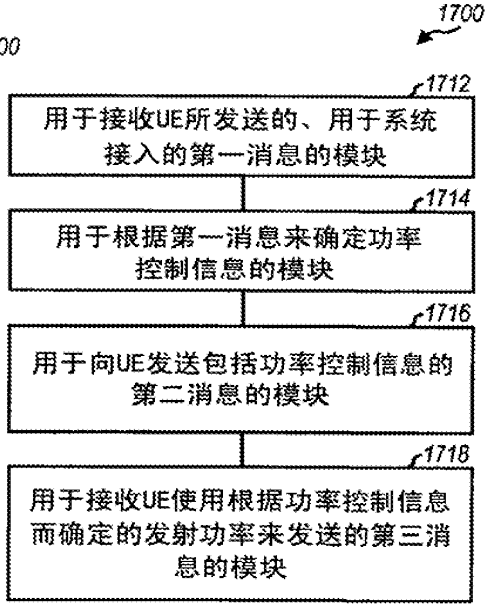


图17

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Page 287 of 555

Electronic Patent Application Fee Transmittal	
Application Number:	13340447
Filing Date:	29-Dec-2011
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Filer:	Jun Jeong Park/Aerin Kim
Attorney Docket Number:	FP11-392-1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt	
EFS ID:	16503189
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	90228
Filer:	Jun Jeong Park/Aerin Kim
Filer Authorized By:	Jun Jeong Park
Attorney Docket Number:	FP11-392-1
Receipt Date:	05-AUG-2013
Filing Date:	29-DEC-2011
Time Stamp:	16:38:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1200
RAM confirmation Number	3628
Deposit Account	505025
Authorized User	IP&T GROUP LLP
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		FP11-392-1-IDS.pdf	2463974 e7f2f033705cc6963c0a76c72189410a7b039328	yes	15

Multipart Description/PDF files in .zip description

Document Description	Start	End
Request for Continued Examination (RCE)	1	1
Transmittal Letter	2	2
Information Disclosure Statement (IDS) Form (SB08)	3	4
Miscellaneous Incoming Letter	5	5
Miscellaneous Incoming Letter	6	6
Miscellaneous Incoming Letter	7	7
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2		FP11-392-1-IDS2.pdf	14081325 98892229908b744f0ef4b58c25bc742e74b788a1	yes	192

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	Foreign Reference	38	62
	Foreign Reference	63	100
	Foreign Reference	101	156
	Foreign Reference	157	192

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3		FP11-392-1-IDS3.pdf	9175949 9c4559b0e49fa99942baaa09269bf27853c05641	yes	29

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	Non Patent Literature	16	19
	Non Patent Literature	20	24
	Non Patent Literature	25	29

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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.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/340,447	12/29/2011	Min Seok Noh	P4730USC1

CONFIRMATION NO. 1869

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

POWER OF ATTORNEY NOTICE

OC000000062392677

Date Mailed: 07/09/2013

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/28/2013.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/sleutchit/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/340,447	12/29/2011	Min Seok Noh	FP11-392-1

CONFIRMATION NO. 1869

90228
IP & T GROUP LLP
8230 Leesburg Pike
Suite 650
Vienna, VA 22182

POA ACCEPTANCE LETTER

OC00000062392704

Date Mailed: 07/09/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/28/2013.

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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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

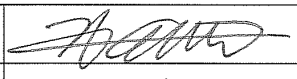
Attorney Docket No.: FP11-392-1

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	13/340,447
Filing Date	December 29, 2011
First Named Inventor	Min Seok NOH
Title	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
Art Unit	2462
Examiner Name	Sai Ming CHAN
Attorney Docket Number	FP11-392-1

SIGNATURE of Applicant for Patent Practitioner

Signature		Date	6/28/2013
Name	Myung Soo Kim	Telephone	571-327-5450
Registration Number	69,173		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.

☐ *Total of _____ forms are submitted.

IP&T GROUP LLP

Attorney Docket No.: _____

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

90228

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

☒ The address associated with the above-mentioned Customer Number.

I am the Applicant:

- ☐ Inventor or Joint Inventor
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign
- ☐ Person Who Otherwise Shows Sufficient *Proprietary* Interest (*e.g.*, a petition under 37 CFR 1.46 (b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

Signature		Date	2014. 6. 15
Name	Cha Dong HWANG	Telephone	82-2-2030-0510
Title and Company	IP Team Leader of PANTECH CO., LTD.		

NOTE: Signature - This form must be signed by the applicant or applicant's representative in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below*.

IP&T GROUP LLP

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Electronic Acknowledgement Receipt

EFS ID:	16195124
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	58027
Filer:	Jun Jeong Park/Aerin Kim
Filer Authorized By:	Jun Jeong Park
Attorney Docket Number:	P4730USC1
Receipt Date:	28-JUN-2013
Filing Date:	29-DEC-2011
Time Stamp:	18:55:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	FP11-392-1-POA.pdf	121277 ff44d6f271376492 3ccdf383c314bf8759b44c1d	no	2

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Total Files Size (in bytes):	121277

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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NOTICE OF ALLOWANCE AND FEE(S) DUE

58027 7590 05/06/2013

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

EXAMINER
CHAN, SAI MING

ART UNIT	PAPER NUMBER
2462	

DATE MAILED: 05/06/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/29/2011	Min Seok Noh	P4730USC1	1869

TITLE OF INVENTION: METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	08/06/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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

58027 7590 05/06/2013
H.C. PARK & ASSOCIATES, PLC
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RESTON, VA 20191

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/29/2011	Min Seok Noh	P4730USC1	1869

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APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1780	$300	$0	$2080	08/06/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHAN, SAI MING	2462	370-329000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

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

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27

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

❑ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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58027 7590 05/06/2013

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RESTON, VA 20191

EXAMINER	
CHAN, SAI MING	
ART UNIT	**PAPER NUMBER**
2462	

DATE MAILED: 05/06/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/340,447	Applicant(s) NOH ET AL.	
	Examiner SAI-MING CHAN	Art Unit 2462	AIA (First Inventor to File) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to *3/18/2013*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *12-28*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

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

   * Certified copies not received: _____.

   Interim copies:

   a) ☐ All b) ☐ Some c) ☐ None of the: Interim copies of the priority documents have been received.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

EXAMINER'S COMMENT

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Claims 12-28 are allowed.

Claim 12 includes limitations that are not taught or fairly suggested by the art of record in this application. The references are completely silent regarding the claimed aspect of:

"identifying the random access response responsive to the random access preamble based on the information associated with the subframe number of the first subframe,

wherein the time period starts at a second subframe, the second subframe having a subframe number that corresponds to the subframe number of the first subframe plus a predetermined number," in addition to the other limitations explicitly recited in claim 12.

Because the above limitations of claim 21 patentably define over the art of record, claim 12 is allowable. Independent claim 18 and 24 include similar limitations as claim 12 and as a result are allowable for similar reasons as claim 12. Dependent claims 13-17 ultimately depends from claim 12 and are therefore also allowable for at least similar reasons as claim 12. Dependent claims 19-23 ultimately depend from claim 18 and are

therefore also allowable for at least similar reasons as claim 18. Dependent claims 25-28 ultimately depend from claim 24 and are therefore also allowable for at least similar reasons as claim 24.

Response to Arguments

Applicant's arguments filed on 3/18/2013 have been fully considered and persuasive.

Conclusion

Any response to this Office Action should be **faxed to** (571) 273-8300 **or mailed to**:

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

Hand-delivered responses should be brought to

Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the

Examiner should be directed to Sai-Ming Chan whose telephone number is (571) 270-1769. The Examiner can normally be reached on Monday-Thursday from 8:00 am to 5:00 pm.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Yemane Mesfin can be reached on (571) 272-3927. 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) or 571-272-4100.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist/customer service whose telephone number is (571) 272-2600.

/Sai-Ming Chan/

Primary Examiner, Art Unit 2462

May 2, 2013

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	Art Unit
	SAI-MING CHAN	2462

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	462	11/12/2012	SC
370	329, 462	5/2/2013	SC

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Image and keyword search in USPAT, US-PGPUB, DERWENT, EPO, JPO and IBM-TD	11/12/2012	SC
Inventor name and Assignee search in PALM EXPO and EAST	11/12/2012	SC
Updated search	5/2/2013	SC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
370	329	5/2/2013	SC
370	462	5/2/2013	SC

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	18	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble with response) and (sub$frame and number) and (370/329,462.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2013/05/02 01:22
L2	37	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time transmi$5)) and (370/329,462.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2013/05/02 01:22
L3	8	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with preamble with (time near5 transmi$5) and (370/329,462.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2013/05/02 01:23
L4	6	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame with number)) and (370/329,462.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2013/05/02 01:23
S1	1	"20090175292"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 15:05
S2	585	(@rlad<"20080101" or @ad<"20080101") and (preamble with (random adj3 access))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:05
S3	155	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:06
S4	103	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:06
S5	32	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:07
S6	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:08
S7	20	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and (preamble near8 time)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:09
S8	9	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and (response with	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:27

		(preamble near8 time))				
S9	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and ((rach near3 slot) with modulo)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S10	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and ((rach near3 slot) same modulo)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S11	3	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and (rach near3 slot) and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S12	25	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S13	0	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) with modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S14	1	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) same modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S15	1	hon near2 min near2 seok	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:11
S16	106	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response)))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:15
S17	42	(@rlad<"20080101" or @ad<"20080101") and (preamble with associated) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:17
S18	80	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:30
S19	69	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:31
S20	46	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) and (random adj3 access adj response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:34
S21	27	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:35
S22	25	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:35
S23	13	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) and pre$determin$2 not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:40

S24	7	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) and (pre$determin$2 adj2 (time period)) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:41
S25	382	noh near3 ("m." min)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:12
S26	188	noh near3 ("m." min) and lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S27	46	noh near3 ("m." min) and lg and preamble	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S28	20	noh near3 ("m." min) and lg and (random adj access adj preamble)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S29	3	noh near3 ("m." min) and lg and ((random adj access adj preamble) with response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:14
S30	1	noh near3 ("m." min) and lg and ((random adj access adj preamble) with response) and harq	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:15
S31	23	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) and (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:12
S32	8	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) same (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:13
S33	3	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) with (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:13
S34	0	("2010/0275086").URPN.	USPAT	OR	ON	2011/05/01 13:45
S35	1766	(@rlad<"20080101" or @ad<"20080101") and((preamble with (random adj3 access adj response)) rach) and pre$determin$2 not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:45
S36	28	(@rlad<"20080101" or @ad<"20080101") and (preamble same ((random adj3 access adj (request response) rach))) with (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:46
S37	11	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj (request response)) with (sequence near5 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:57
S38	1	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj (request response)) with (number near frame))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 18:06

S39	4	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj (request response)) and (preamble with (frame near5 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 18:16
S40	3	(@rlad<"20080101" or @ad<"20080101") and ((preamble with (random adj3 access adj response)) rach) and (rach with response with identifier) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 14:46
S41	1	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with predetermined) and (rach with response with identifier) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:22
S42	16	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 predetermined) and (response with identifier)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:24
S43	479	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with frame)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S44	59	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with (frame near2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S45	40	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 (frame near2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S46	14	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S47	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:35
S48	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:36
S49	23	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:36
S50	6	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with rnti with harq)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:11
S51	10	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with harq)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:18
S52	8	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with harq) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:18
S53	95	(@rlad<"20080101" or @ad<"20080101") and (preamble with (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:54

S54	54	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:55
S55	2	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number)) and (random adj access adj preamble)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:55
S56	0	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number)) and (re$number$3 with (frame adj2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:39
S57	0	(@rlad<"20080101" or @ad<"20080101") and preamble and (re$number$3 with (frame adj2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:40
S58	2	(@rlad<"20080101" or @ad<"20080101") and preamble and (re$number$3 with (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:40
S59	0	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 with (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S60	42	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S61	5	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S62	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and (renumber$3 and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:42
S63	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and ((renumber$3 re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:44
S64	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:44
S65	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj access) with preamble) and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:45
S66	1	(@rlad<"20080101" or @ad<"20080101") and ((rach (random adj access)) with (request preamble)) and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 18:06
S67	5	(@rlad<"20080101" or @ad<"20080101") and (RACH with response$1 with identifier$1)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:14
S68	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (renumber$3 and (sub$frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:45

S69	17	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:46
S70	6	(@rlad<"20080101" or @ad<"20080101") and ((rach with preamble) same response) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:46
S71	0	(@rlad<"20080101" or @ad<"20080101") and ((rach with preamble) same response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:52
S72	0	("2009/0175292").URPN.	USPAT	OR	ON	2011/10/06 00:34
S73	0	("2009/0175292").URPN.	USPAT	OR	ON	2011/10/06 00:34
S74	0	(@rlad<"20080101" or @ad<"20080101") and (rach with response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:50
S75	0	(@rlad<"20080101" or @ad<"20080101") and (rach and response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:50
S76	0	(@rlad<"20080101" or @ad<"20080101") and (rach and response) and ((rach sub$frame) with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:51
S77	5	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble with response) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:58
S78	19	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble with response) and (sub$frame and number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 01:06
S79	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (sub$frame and re$number$2)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:07
S80	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (re$number$2)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:08
S81	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (re$number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:08
S82	1	"7433342"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:43
S83	10	(@rlad<"20080101" or @ad<"20080101") and (preamble with (frame adj number)) and (370/329,462.ccls. or 455/450.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/30 17:39
S90	13	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with preamble with (time near5 transmi$5)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:09
S91	85	(@rlad<"20080101" or	US-PGPUB;	OR	ON	2012/11/13

		@ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time transmi$5))	USPAT; EPO; JPO			00:15
S92	9	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time near5 transmi$5))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:16
S93	2	"20120093713"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/13 00:18
S94	2	"20120093173"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/13 00:18

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	0	(@rlad<"20080101" or @ad<"20080101") and (time adj period adj start$3 near5 (second adj subframe)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/05/02 01:32
L6	0	(@rlad<"20080101" or @ad<"20080101") and (subframe adj number adj5 (first adj subframe adj plus adj3 predetermined adj number)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/05/02 01:33
S84	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((radndom adj access adj number) with (renumbered adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:41
S85	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((transmi$5) with (re$number$2 adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:42
S86	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((receiv$3) with (re$number$2 adj sub$frame adj number) with (predetermined adj time)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S87	0	(@rlad<"20080101" or @ad<"20080101") and ((radndom adj access adj number) with (renumbered adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S88	0	(@rlad<"20080101" or @ad<"20080101") and ((transmi$5) with (re$number$2 adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S89	0	(@rlad<"20080101" or @ad<"20080101") and ((receiv$3) with (re$number$2 adj sub$frame adj number) with (predetermined adj time)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44

5/2/2013 1:33:55 AM
C:\Users\schan1\Documents\EAST\Workspaces\13340447 Random access req & resp.wsp

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	**Art Unit**
	SAI-MING CHAN	2462

| CPC | | |

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	**Art Unit**
	SAI-MING CHAN	2462

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 17	
/SAI-MING CHAN/ Primary Examiner.Art Unit 2462 (Primary Examiner)	5/2/2013 (Date)	O.G. Print Claim(s) 12	O.G. Print Figure 1a

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	**Art Unit**
	SAI-MING CHAN	2462

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

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

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 17	
/SAI-MING CHAN/ Primary Examiner.Art Unit 2462 (Primary Examiner)	5/2/2013 (Date)	O.G. Print Claim(s) 12	O.G. Print Figure 1a

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit: 2462
Examiner: Sai Ming Chan

In Re PATENT APPLICATION of:

Inventors:	Min Seok NOH et al.	
Serial No.:	13/340,447	
Filing date:	December 29, 2011	**AMENDMENT**
For:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE	
Atty. ref.:	HIGH 103 (P4730USC1)	

March 18, 2013

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

Sir:

In response to the Examiner's Action mailed on November 16, 2012, the period for response to which is extended by a Petition for a One-month Extension of Time filed herewith, please amend the above-identified application as follows:

CLAIM AMENDMENTS:

The following listing replaces all previous versions of the claims:

1-11. (Cancelled)

12. (New) A method for performing a random access procedure by a user equipment (UE), the method comprising:

transmitting a random access preamble in a first subframe;

determining a time period for receiving a random access response responsive to the random access preamble;

monitoring for the random access response responsive to the random access preamble within the time period, the random access response comprising information associated with a subframe number of the first subframe;

receiving the random access response within the time period; and

identifying the random access response responsive to the random access preamble based on the information associated with the subframe number of the first subframe,

wherein the time period starts at a second subframe, the second subframe having a subframe number that corresponds to the subframe number of the first subframe plus a predetermined number.

13. (New) The method of claim 12, wherein the predetermined number

is determined based on a data processing time and a processing time of the random access procedure.

14. (New) The method of claim 12, wherein the predetermined number is determined by subtracting one subframe from a half of a round trip time of a hybrid automatic repeat request (HARQ) process, the round trip time of the HARQ process corresponding to eight subframes.

15. (New) The method of claim 12, wherein the predetermined number equals three.

16. (New) The method of claim 12, wherein the transmission of the random access preamble ends in the first subframe.

17. (New) The method of claim 12, further comprising:

storing information associated with the subframe number of the first subframe if the random access preamble is transmitted in the first subframe; and

comparing the information included in the random access response with the stored information.

18. (New) A user equipment (UE) to perform a random access procedure, the UE comprising:

a transmitter to transmit a random access preamble in a first subframe;

a processor configured to determine a time period for receiving a random access response responsive to the random access preamble, and to monitor for the random access response responsive to the random access preamble within the time period, the random access response comprising information associated with a subframe number of the first subframe; and

a receiver to receive the random access response within the time period,

wherein the processor is configured to identify the random access response responsive to the random access preamble based on the information associated with the subframe number of the first subframe, and

wherein the time period starts at a second subframe, the second subframe having a subframe number that corresponds to the subframe number of the first subframe plus a predetermined number.

19. (New) The user equipment of claim 18, wherein the predetermined number is determined based on a data processing time and a processing time of the random access procedure.

20. (New) The user equipment of claim 18, wherein the predetermined number is determined by subtracting one subframe from a half of a round trip time of a hybrid automatic repeat request (HARQ) process, the round trip time of the HARQ process corresponding to eight subframes.

21. (New) The user equipment of claim 18, wherein the predetermined number equals three.

22. (New) The user equipment of claim 18, wherein the transmission of the random access preamble ends in the first subframe.

23. (New) The user equipment of claim 18, further comprising:

a memory to store information associated with the subframe number of the first subframe if the random access preamble is transmitted in the first subframe,

wherein the processor is configured to compare the information included in the random access response with the stored information.

24. (New) A method for performing a random access procedure by a base station, the method comprising:

receiving a random access preamble from a user equipment (UE);

determining a first subframe in which the random access preamble was transmitted;

generating a random access response responsive to the random access preamble, the random access response comprising information associated with a subframe number of the first subframe; and

transmitting the random access response within a time period,

wherein the time period starts at a second subframe, the second subframe having a subframe number that corresponds to a subframe number of the first subframe plus a predetermined number.

25. (New) The method of claim 24, wherein the predetermined number is determined based on a data processing time and a processing time of the random access procedure.

26. (New) The method of claim 24, wherein the predetermined number is determined by subtracting one subframe from a half of a round trip time of a hybrid automatic repeat request (HARQ) process, the round trip time of the HARQ process corresponding to eight subframes.

27. (New) The method of claim 24, wherein the predetermined number equals three.

28. (New) The method of claim 24, wherein the transmission of the random access preamble ends in the first subframe.

REMARKS

The Examiner's Action mailed on November 16, 2012, has been received and its contents carefully considered. Additionally attached to this Amendment is a Petition for a One-month Extension of Time, extending the period for response to March 16, 2013.

In this Amendment, Applicants have added new claims 12-28, and cancelled claim 1 without prejudice. Claims 12, 18 and 24 are the independent claims, and claims 12-28 are pending in the application. For at least the following reasons, it is submitted that this application is in condition for allowance.

Claim 1 was rejected under 35 USC §102(e) as anticipated by *Fischer et al.* (US 2001/0323736 A1). This rejection is respectfully moot, claim 1 having been cancelled.

In the present invention, in a non-limiting example, a random access response occurs within a time period, in response to a random access preamble in a first subframe, where the random access response includes "information associated with a subframe number of the first subframe" and where "the time period starts at a second subframe, the second subframe having a subframe number that corresponds to the subframe number of the first subframe plus a predetermined number" as recited in claims 12, 18 and 24.

Fischer et al., however, fails to disclose all of the above features recited in claims 12, 18 and 24.

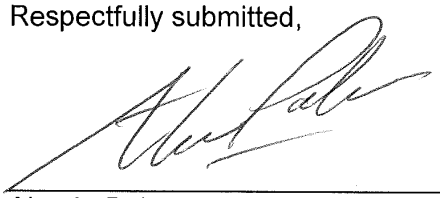
Newly added independent claims 12, 18 and 24 therefore patentably define over *Fischer et al.* and are therefore allowable, together with newly added dependent claims 13-17, 19-23 and 25-28 that depend respectively therefrom.

It is submitted that this application is in condition for allowance. Such action and the passing of this case to issue are requested.

Should the Examiner feel that a conference would help to expedite the prosecution of this application, the Examiner is hereby invited to contact the undersigned counsel to arrange for such an interview.

An extension fee of $150 is submitted herewith. Should the remittance be accidentally missing or insufficient, the Commissioner is hereby authorized to charge the fee to our Deposit Account No. 18-0002, and advise us accordingly.

Respectfully submitted,



March 18, 2013
Date

Alun L. Palmer – Reg. No. 47,838
RABIN & BERDO, PC – Cust. No. 23995
Facsimile: 202-408-0924
Telephone: 202-371-8976

ALP/pq

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit: 2462
Examiner: Sai Ming Chan

In Re PATENT APPLICATION Of:

Inventors:	Min Seok NOH et al.	)	
		)	
Serial No.:	13/340,447	)	**PETITION FOR ONE-MONTH**
		)	
Filed:	December 29, 2011	)	**EXTENSION OF TIME**
		)	
For:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE	)	
Docket No.:	HIGH 103 (P4730USC1)	)	

March 18, 2013

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

Sir:

It is respectfully requested that the period for replying to the Office Action dated November 16, 2012, be extended for one month under the provisions of 37 C.F.R. § 1.136(a). The applicable extension fee of $150.00 under the provisions of 37 C.F.R. §1.17(a)(1) is submitted herewith.

Should any additional fees be required please charge the same to our Deposit Account No. 18-0002 and advise us accordingly.

Respectfully submitted,

/Alun L. Palmer/
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ALP/pq

Electronic Patent Application Fee Transmittal

Application Number:	13340447
Filing Date:	29-Dec-2011
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Filer:	ROBERT BERDO/Phuong Quan
Attorney Docket Number:	P4730USC1

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	1251	1	150	150

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**150**

Electronic Acknowledgement Receipt

EFS ID:	15287130
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	58027
Filer:	ROBERT BERDO/Phuong Quan
Filer Authorized By:	ROBERT BERDO
Attorney Docket Number:	P4730USC1
Receipt Date:	18-MAR-2013
Filing Date:	29-DEC-2011
Time Stamp:	16:36:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$150
RAM confirmation Number	5169
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Amendment/Req. Reconsideration-After Non-Final Reject	HIGH-103_Amendment_3-18-13.pdf	584289 0de0eb7ce70cfe2b3611063e1c2d1a21b7658b1c	no	8
Warnings:					
Information:					
2	Extension of Time	HIGH-103_Petition1EOT_3-18-13.pdf	13858 9b2493cc5f1047e404f33ee76ad64b31bdbc0337	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30425 717f8fd632a0e6760ac9d9c7b1862dba4a4b856b	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	628572	

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.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
13/340,447	12/29/2011	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	03/18/2013	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0	X $ =		OR	X $62=	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $ =		OR	X $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/DORRETTA BROOKS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/340,447	12/29/2011	Min Seok Noh	P4730USC1	1869

58027 7590 11/16/2012

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

EXAMINER	
CHAN, SAI MING	
ART UNIT	PAPER NUMBER
2462	

NOTIFICATION DATE	DELIVERY MODE
11/16/2012	ELECTRONIC

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

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

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

PATENT@PARK-LAW.COM

Office Action Summary	Application No.	Applicant(s)	
	13/340,447	NOH ET AL.	
	Examiner	Art Unit	
	SAI-MING CHAN	2462	

-- 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* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 *29 December 2011*.

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

3)☐ 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

4)☒ Claim(s) *1* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1* is/are rejected.

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

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

Application Papers

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

10)☒ The drawing(s) filed on *12/29/2011* 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).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

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).

a)☐ All b)☐ Some * c)☐ None of:

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) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

The information disclosure statements (IDS) submitted on 1/24/2012 has been considered by the Examiner and made of record in the application file.

Claim Rejections - 35 USC § 102

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

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by **Fischer et al. (U.S. PG-Publication #20100323736)**.

Consider **claim 1**, Fischer et al. clearly disclose a method of receiving a random access response, the method comprising:

transmitting a random access preamble (fig. 14 (message 1) (RACH), par. 89); and

receiving the random access response corresponding to the random access preamble (fig. 14 (message 2) (Random access response), par. 91),

wherein the received random access response includes information of a transmission time when the random access preamble is transmitted (fig. 14 (2), pars. 90 (timing alignment information) & 91; EN: In order to align timing, the response must contain information regarding when the preamble is transmitted).

Conclusion

Any response to this Office Action should be **faxed to** (571) 273-8300 **or mailed to**:

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

Hand-delivered responses should be brought to

Customer Service Window

Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Sai-Ming Chan whose telephone number is (571) 270-1769. The Examiner can normally be reached on Monday-Thursday from 8:00 am to 5:00 pm.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, yemane Mesfin can be reached on (571) 272-3927. 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) or 571-272-4100.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist/customer service whose telephone number is (571) 272-2600.

/Sai-Ming Chan/

Primary Examiner, Art Unit 2462

November 12, 2012

Notice of References Cited	Application/Control No. 13/340,447	Applicant(s)/Patent Under Reexamination NOH ET AL.	
	Examiner SAI-MING CHAN	Art Unit 2462	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0323736	12-2010	Fischer et al.	455/509
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13340447
Filing Date	2011-12-29
First Named Inventor	Min Seok Noh
Art Unit	2473
Examiner Name	
Attorney Docket Number	2101-3617C1

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7301921		2007-11-27	Heo	
	2	6014562		2000-01-11	Weiss	

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

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100323736		2010-12-23	Fischer et al.	
	2	20080232317		2008-09-25	Jen	
	3	20080139214		2008-06-12	SUN et al.	
	4	20080273610		2008-11-06	Malladi et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.C./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13340447
	Filing Date	2011-12-29
	First Named Inventor	Min Seok Noh
	Art Unit	2473
	Examiner Name	
	Attorney Docket Number	2101-3617C1

	5	20100093386		2010-04-15	Damnjanovic et al.	
	6	20070206531		2007-09-06	Pajukoski et al.	

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

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	10-2007-0080552	KR		2007-08-10	LG Electronics Inc.		☐
	2	10-2007-0065101	KR		2007-06-22	Samsung Electronics Co., Ltd.		☐
	3	2007078165	WO		2007-07-12	LG Electronics Inc.		☐

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

NON-PATENT LITERATURE DOCUMENTS Remove

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

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

EXAMINER SIGNATURE

Examiner Signature	/Sai Ming Chan/	Date Considered	11/12/2012

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

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.C./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13340447
	Filing Date	2011-12-29
	First Named Inventor	Min Seok Noh
	Art Unit	2473
	Examiner Name	
	Attorney Docket Number	2101-3617C1

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

EFS Web 2.1.17

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13340447
	Filing Date	2011-12-29
	First Named Inventor	Min Seok Noh
	Art Unit	2473
	Examiner Name	
	Attorney Docket Number	2101-3617C1

CERTIFICATION STATEMENT

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

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

OR

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

☐ See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/David Majdali/	Date (YYYY-MM-DD)	2012-01-24
Name/Print	David Majdali	Registration Number	53,257

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

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Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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

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

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

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

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

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

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

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

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BIB DATA SHEET

CONFIRMATION NO. 1869

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/340,447	12/29/2011	370	2462	P4730USC1

APPLICANTS

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

This application is a CON of 12/347,352 12/31/2008 PAT 8,102,804
which claims benefit of 61/018,492 01/01/2008

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

REPUBLIC OF KOREA 10-2008-0047656 05/22/2008

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

01/11/2012

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☑ Yes ☐ No	☑ Yes ☐ No	/SAI-MING CHAN/ Examiner's Signature	☐ SC Initials	KOREA, REPUBLIC OF	17	1	1

ADDRESS

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TITLE

METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

FILING FEE RECEIVED		
1250	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	13	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with preamble with (time near5 transmi$5)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:09
L3	85	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time transmi$5))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:15
L4	9	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj3 response) with (preamble near5 (time near5 transmi$5))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2012/11/13 00:16
L5	2	"20120093713"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/13 00:18
L6	2	"20120093173"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/13 00:18
S1	1	"20090175292"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 15:05
S2	585	(@rlad<"20080101" or @ad<"20080101") and (preamble with (random adj3 access))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:05
S3	155	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:06
S4	103	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:06
S5	32	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:07
S6	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:08
S7	20	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and (preamble near8 time)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:09

S8	9	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and rach and harq and (response with (preamble near8 time))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 16:27
S9	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and ((rach near3 slot) with modulo)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S10	0	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and ((rach near3 slot) same modulo)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S11	3	(@rlad<"20080101" or @ad<"20080101") and ((preamble and response) with (random adj3 access)) and (rach near3 slot) and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:34
S12	25	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) and modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S13	0	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) with modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S14	1	(@rlad<"20080101" or @ad<"20080101") and (rach near3 slot) same modulo	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/05/06 20:38
S15	1	hon near2 min near2 seok	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:11
S16	106	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response)))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:15
S17	42	(@rlad<"20080101" or @ad<"20080101") and (preamble with associated) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:17
S18	80	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:30
S19	69	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) and (random adj3 access adj (request response))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:31
S20	46	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) and (random adj3 access adj response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:34
S21	27	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:35
S22	25	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:35
S23	13	(@rlad<"20080101" or	US-PGPUB;	OR	ON	2010/11/12

		@ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) and pre$determin$2 not lg	USPAT; EPO; JPO			00:40
S24	7	(@rlad<"20080101" or @ad<"20080101") and (preamble with uplink with transmi$5) same (random adj3 access adj response) and (pre$determin$2 adj2 (time period)) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2010/11/12 00:41
S25	382	noh near3 ("m." min)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:12
S26	188	noh near3 ("m." min) and lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S27	46	noh near3 ("m." min) and lg and preamble	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S28	20	noh near3 ("m." min) and lg and (random adj access adj preamble)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:13
S29	3	noh near3 ("m." min) and lg and ((random adj access adj preamble) with response)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:14
S30	1	noh near3 ("m." min) and lg and ((random adj access adj preamble) with response) and harq	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/04/30 20:15
S31	23	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) and (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:12
S32	8	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) same (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:13
S33	3	(@rlad<"20080101" or @ad<"20080101") and (preamble same (random adj3 access adj (request response))) with (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 01:13
S34	0	("2010/0275086").URPN.	USPAT	OR	ON	2011/05/01 13:45
S35	1766	(@rlad<"20080101" or @ad<"20080101") and((preamble with (random adj3 access adj response)) rach) and pre$determin$2 not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:45
S36	28	(@rlad<"20080101" or @ad<"20080101") and (preamble same ((random adj3 access adj (request response) rach))) with (sequence near5 number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:46
S37	11	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj (request response)) with (sequence near5 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 17:57

S38	1	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj (request response)) with (number near frame))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 18:06
S39	4	(@rlad<"20080101" or @ad<"20080101") and (random adj3 access adj (request response)) and ((preamble with (frame near5 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/01 18:16
S40	3	(@rlad<"20080101" or @ad<"20080101") and ((preamble with (random adj3 access adj response)) rach) and (rach with response with identifier) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 14:46
S41	1	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with predetermined) and (rach with response with identifier) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:22
S42	16	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 predetermined) and (response with identifier)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:24
S43	479	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with frame)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S44	59	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) with (frame near2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S45	40	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 (frame near2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S46	14	(@rlad<"20080101" or @ad<"20080101") and (((random adj3 access adj response) rach) near10 (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:34
S47	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:35
S48	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:36
S49	23	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 15:36
S50	6	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with rnti with harq)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:11
S51	10	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with harq)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:18
S52	8	(@rlad<"20080101" or @ad<"20080101") and ((random adj3 access adj response) with harq) not lg	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:18

S53	95	(@rlad<"20080101" or @ad<"20080101") and (preamble with (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:54
S54	54	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:55
S55	2	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number)) and (random adj access adj preamble)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 16:55
S56	0	(@rlad<"20080101" or @ad<"20080101") and (preamble near10 (frame adj number)) and (re$number$3 with (frame adj2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:39
S57	0	(@rlad<"20080101" or @ad<"20080101") and preamble and (re$number$3 with (frame adj2 number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:40
S58	2	(@rlad<"20080101" or @ad<"20080101") and preamble and (re$number$3 with (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:40
S59	0	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 with (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S60	42	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S61	5	(@rlad<"20080101" or @ad<"20080101") and preamble and (renumber$3 and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:41
S62	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and (renumber$3 and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:42
S63	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and ((renumber$3 re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:44
S64	1	(@rlad<"20080101" or @ad<"20080101") and (random adj access) and preamble and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:44
S65	0	(@rlad<"20080101" or @ad<"20080101") and ((random adj access) with preamble) and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/05/08 17:45
S66	1	(@rlad<"20080101" or @ad<"20080101") and ((rach (random adj access)) with (request preamble)) and ((re$index$3) and (frame adj number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 18:06
S67	5	(@rlad<"20080101" or @ad<"20080101") and (RACH with response$1 with identifier$1)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:14

S68	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (renumber$3 and (sub$frame with number))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:45
S69	17	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:46
S70	6	(@rlad<"20080101" or @ad<"20080101") and ((rach with preamble) same response) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:46
S71	0	(@rlad<"20080101" or @ad<"20080101") and ((rach with preamble) same response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/05 23:52
S72	0	("2009/0175292").URPN.	USPAT	OR	ON	2011/10/06 00:34
S73	0	("2009/0175292").URPN.	USPAT	OR	ON	2011/10/06 00:34
S74	0	(@rlad<"20080101" or @ad<"20080101") and (rach with response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:50
S75	0	(@rlad<"20080101" or @ad<"20080101") and (rach and response) and (sub$frame with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:50
S76	0	(@rlad<"20080101" or @ad<"20080101") and (rach and response) and ((rach sub$frame) with re$number$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:51
S77	5	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble with response) and (sub$frame with number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 00:58
S78	19	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble with response) and (sub$frame and number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/06 01:06
S79	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (sub$frame and re$number$2)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:07
S80	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (re$number$2)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:08
S81	0	(@rlad<"20080101" or @ad<"20080101") and (rach with preamble) and (re$number)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:08
S82	1	"7433342"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/09 16:43
S83	10	(@rlad<"20080101" or @ad<"20080101") and (preamble with (frame adj number)) and (370/329,462.ccls. or 455/450.ccls.)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2011/10/30 17:39

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S84	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((radndom adj access adj number) with (renumbered adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:41
S85	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((transmi$5) with (re$number$2 adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:42
S86	0	(@rlad<"20080101" or @ad<"20080101") and (370/329,462.ccls. or 455/450.ccls.) and ((receiv$3) with (re$number$2 adj sub$frame adj number) with (predetermined adj time)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S87	0	(@rlad<"20080101" or @ad<"20080101") and ((radndom adj access adj number) with (renumbered adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S88	0	(@rlad<"20080101" or @ad<"20080101") and ((transmi$5) with (re$number$2 adj sub$frame adj number)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44
S89	0	(@rlad<"20080101" or @ad<"20080101") and ((receiv$3) with (re$number$2 adj sub$frame adj number) with (predetermined adj time)).clm.	USPAT; UPAD	OR	ON	2011/10/30 17:44

11/13/2012 1:08:56 AM
C:\Users\schan1\Documents\EAST\Workspaces\13340447 Random access req & resp.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13340447	NOH ET AL.
	Examiner	Art Unit
	SAI-MING CHAN	2462

SEARCHED			
Class	Subclass	Date	Examiner
370	462	11/12/2012	SC

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Image and keyword search in USPAT, US-PGPUB, DERWENT, EPO, JPO and IBM-TD	11/12/2012	SC
Inventor name and Assignee search in PALM EXPO and EAST	11/12/2012	SC

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/340,447	12/29/2011	Min Seok Noh	P4730USC1

CONFIRMATION NO. 1869

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PUBLICATION NOTICE

OC000000053809432

Title:METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

Publication No.US-2012-0093173-A1
Publication Date:04/19/2012

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/340,447	12/29/2011	Min Seok Noh	2101-3617C1

CONFIRMATION NO. 1869

58027
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8500 LEESBURG PIKE
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VIENNA, VA 22182

POA ACCEPTANCE LETTER

OC000000053376828

Date Mailed: 03/29/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/21/2012.

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.

/ttkim/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/340,447	12/29/2011	Min Seok Noh	2101-3617C1

CONFIRMATION NO. 1869

35884
LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

POWER OF ATTORNEY NOTICE

OC000000053376807

Date Mailed: 03/29/2012

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/21/2012.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/ttkim/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PTO/SB/80 (01-06)
Approved for use through 12/31/2008. OMB 0651-0035
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

[X] Practitioners associated with the Customer Number: 58027

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

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

[X] The address associated with Customer Number: 58027

OR

[ ] Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:
PANTECH CO., LTD.
Pantech R&D Center, I-2, DMC Sangam-dong,
Mapo-gu, Seoul 121-270, Republic of Korea

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

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

Signature		Date	July 22, 2008
Name	Hwang, Chanbong	Telephone	82-2-2030-0519
Title	IP Team Leader		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/SB/96 (07-09)
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Min Seok Noh, et al.

Application No./Patent No.: 13/340,447 Filed/Issue Date: December 29, 2011

Titled: METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

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

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

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

OR

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

1. From: Min Seok Noh, Yeong Hyeon Kwon, Jin Sam K To: LG ELECTRONICS INC.

The document was recorded in the United States Patent and Trademark Office at
Reel 027630 , Frame 0255 , or for which a copy thereof is attached.

2. From: LG ELECTRONICS INC. To: Pantech Co., Ltd.

The document was recorded in the United States Patent and Trademark Office at
Reel 027877 , Frame 0074 , or for which a copy thereof is attached.

3. From: _____ To: _____

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

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

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

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

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

/hae-chan park/ March 21, 2012
Signature Date

Hae-Chan Park, Reg. 50,114 Attorney
Printed or Typed Name Title

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

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

Electronic Acknowledgement Receipt

EFS ID:	12356005
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	35884
Filer:	Hae-Chan Park/Wayne Helge
Filer Authorized By:	Hae-Chan Park
Attorney Docket Number:	2101-3617C1
Receipt Date:	21-MAR-2012
Filing Date:	29-DEC-2011
Time Stamp:	14:51:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	P4730USC1_POA_373.pdf	93928 401cf25df7da68c99bb60577ecc5be6422dfe0ca	no	2

Warnings:	
Information:	

Total Files Size (in bytes):	93928

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.

대 한 민 국 특 허 청
KOREAN INTELLECTUAL PROPERTY OFFICE

별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office

출 원 번 호 : 10-2008-0047656
Application Number

출 원 년 월 일 : 2008년 05월 22일
Filling Date MAY 22, 2008

출 원 인 : 주식회사 팬택
Applicant(s) PANTECH CO.,LTD.

2012년 03월 14일

특 허 청
COMMISSIONER

제출 일자 : 2008-05-22

【서지사항】

【서류명】 특허출원서

【참조번호】 0003

【출원구분】 특허출원

【출원인】

【명칭】 엘지전자 주식회사

【출원인코드】 1-2002-012840-3

【대리인】

【성명】 김용인

【대리인코드】 9-1998-000022-1

【포괄위임등록번호】 2007-001879-5

【대리인】

【성명】 박영복

【대리인코드】 9-2006-001451-3

【포괄위임등록번호】 2007-001886-1

【발명의 국문명칭】 랜덤 액세스 요청 송수신 및 랜덤 액세스 응답 송수신 방법

【발명의 영문명칭】 A METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESSREQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESSRESPONSE

【발명자】

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【성명의 영문표기】 LEE,Hyun Woo

【주민등록번호】 770601-1XXXXXX

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【국적】 KR

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【성명】 한승희

【성명의 영문표기】 HAN,Seung Hee

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【성명의 영문표기】 NOH,Min Seok

【주민등록번호】 770911-1XXXXXX

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【성명의 영문표기】 MOON,Sung Ho

【주민등록번호】 761114-1XXXXXX

【우편번호】 431-080

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【성명의 영문표기】 Dragan VUJCIC

【주소】 프랑스 91470 리무어 루 데 센드리에 8떼르

【국적】 FR

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Page 365 of 555

제출 일자 : 2008-05-22

【발명자】

【성명】 곽진삼

【성명의 영문표기】 KWAK,Jin Sam

【주민등록번호】 740908-1XXXXXX

【우편번호】 431-080

【주소】 경기 안양시 동안구 호계동 533번지 LG제1연구단지

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【주민등록번호】 781009-1XXXXXX

【우편번호】 431-080

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【성명의 영문표기】 KWON,Yeong Hyeon

【주민등록번호】 740611-1XXXXXX

【우편번호】 431-080

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【국적】 KR

【우선권 주장】

【출원국명】 US

【출원번호】 61/018,492

【출원일자】 2008.01.01

【증명서류】 미첨부

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제출 일자 : 2008-05-22

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 김용인

(인)대리인 박영복

(인)

【수수료】

【출원료】	0	면	38,000 원
【가산출원료】	55	면	0 원
【우선권주장료】	1	건	20,000 원
【심사청구료】	0	항	0 원
【합계】	58,000 원		

제출 일자 : 2008-05-22

【요약서】

【요약】

단말기의 랜덤 액세스 요청(랜덤 액세스 프리앰블)에 대하여, 기지국은 랜덤 액세스 응답을 전송한다. 랜덤 액세스 응답에는 랜덤 액세스 요청이 전송된 시간에 관한 정보 및 랜덤 액세스 요청 프리앰블의 시퀀스 번호 정보가 포함된다. 단말기는, 수신된 랜덤 액세스 응답에 포함된 시퀀스 번호 정보 및 랜덤 액세스 요청이 전송된 시간에 관한 정보를 이용하여, 수신된 랜덤 액세스 응답이 자신이 전송한 랜덤 액세스 요청에 대한 응답인지를 확인한다.

【대표도】

도 3a

【색인어】

랜덤 액세스, 기지국, 단말기, 서브프레임 번호

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【명세서】

【발명의 명칭】

랜덤 액세스 요청 송수신 및 랜덤 액세스 응답 송수신 방법{A METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE}

【발명의 상세한 설명】

【기술분야】

<1> 본 발명은 광대역 무선 접속 시스템에 관한 것으로서, 보다 상세하게는, 광대역 무선 접속 시스템에서의 랜덤 액세스 요청(랜덤 액세스 프리앰블)의 송수신 및 랜덤 액세스 응답의 송수신 방법에 관한 것이다.

【배경기술】

<2> 광대역 무선 접속 시스템에 관한 기술에 있어서, 각 단말기는 각각의 RACH(Random Access Channel) 슬롯에서 무작위로 선택된 시퀀스(sequence or opportunity)를 가지고 시스템에 액세스를 시도할 수 있다. 기지국이 랜덤 액세스 시퀀스(또는, RACH 시퀀스)를 검출하면 그에 대한 랜덤 액세스 응답(또는, RACH 응답)을 전송한다. 각 단말기는 기지국으로부터 전송된 랜덤 액세스 응답을 수신하여, 자신이 전송한 시퀀스를 포함한 응답이 오면 자신에 대한 응답으로 간주하여 타이밍 어드밴스(timing advance) 등의 동작을 수행한다.

<3> 이 분야의 기술에 있어서, 각 단말기는 각각의 RACH 슬롯에서 무작위로 선택

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된 시퀀스(sequence or opportunity)를 가지고 액세스를 시도할 수 있다. 기지국이 RACH 시퀀스를 검출하면 그에 대한 응답을 전송한다. 각 단말은 기지국으로부터 전송된 RACH 응답을 수신하여, 자신이 보낸 시퀀스를 포함한 응답이 오면 자신에 대한 응답으로 간주하여 타이밍 어드밴스 등의 동작을 수행한다. 이때 각 단말이 응답을 기다리는 정확한 시간 간격이 없으면 다른 단말의 응답을 자신에 대한 응답으로 잘못 수신하는 경우가 발생할 수 있다. 이와 같은 상황을 도 1a에 나타내었다. 도 1a는 RACH 응답(RACH response; 랜덤 액세스 응답)이 이루어지는 일 예이다. 이러한 상황은 모든 RACH 주기에 대하여 나타날 수 있다. 광대역 무선 접속 시스템에서의 랜덤 액세스에 관한 "3GPP TS 36.211 v. 8.1.0, 'Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation', 2007-12-20"를 참조하면, 랜덤 액세스 프리앰블 포맷, 랜덤 액세스 프리앰블 파라미터, 및 프리앰블 포맷 0-3에 대한 랜덤 액세스 프리앰블 타이밍에 관한 표가 제시되어 있다. 도 1a는 프리앰블 포맷 0, 및 1ms 주기의 RACH 슬롯의 경우를 나타낸 것이다.

<4> 도 1a에서 업링크 서브프레임 0(UL sub-frame 0)에서 첫 번째 단말기(1)가 무작위로 선택된 시퀀스 1을 가지고 액세스를 시도한다(S110). 업링크 서브프레임 1에서는 두 번째 단말기(2)가 무작위로 선택된 시퀀스 1을 가지고 액세스를 시도한다(S120). 두 단말기의 시퀀스가 기지국에서 모두 검출된 경우, 기지국은 검출된 시퀀스에 대한 응답을 전송한다(S130). 이때 액세스를 시도한 두 단말기(1, 2)는 모두 자신에게 오는 응답을 기다리고 있다. 업링크 서브프레임 7에서 시퀀스 1에

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대한 응답이 도달할 경우, 단말기(1)(UE1)와 단말기(2)(UE2)는 모두, 업링크 서브프레임 7에서 도달한 응답이 자신이 액세스를 시도한 시퀀스에 대한 응답이라고 판단할 수 있다. 이 경우 두 단말기 중 하나는 업링크 서브프레임 7에서 도달한 응답이 자신에 대한 응답이라고 잘못 판단하게 된다. 두 단말기가 모두 업링크 서브프레임 7에서 도달한 응답에 의해 시간 동기를 맞추게 되므로, 하나의 단말기는 잘못된 시간 동기를 맞추게 된다. 또한, 응답에서 가리키는 동일한 리소스를 이용하여 상향링크로 데이터 혹은 제어신호를 다시 전송하게 되므로, 두 단말기가 동일 리소스를 사용하는 문제점이 발생하게 된다.

<5> 상술한 도 1a 및 도 1a에 관련된 설명은 셀 반경을 고려하지 않은 것으로서, 본 발명과 관련된 기술의 문제점을 이해하기 쉽도록 도시하고 기술한 것이다. 그러나, 실제로 50km정도의 셀 반경을 가정하고, 전자기파의 전파 속도를 고려한다면, 업링크 서브프레임 0에서 단말기(1)가 송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 0 또는 다운링크 서브프레임 1에 기지국에 도달할 수 있고, 업링크 서브프레임 1에서 단말기(2)가 송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 1 또는 다운링크 서브프레임 2에 기지국에 도달할 수 있다는 것을 이해할 수 있다. 또한, 다운링크 서브프레임 1에서 기지국이 송신한 랜덤 액세스 응답은 업링크 서브프레임 1 또는 업링크 서브프레임 2에서 단말기(1) 및/또는 단말기(2)에 도달 할 수 있으며, 다운링크 서브프레임 2에서 기지국이 송신한 랜덤 액세스 응답은 업링크 서브프레임 2 또는 업링크 서브프레임 3에서 단말기(1) 및/또는 단말기(2)에 도달 할 수 있다는 것을 이해할 수 있다(도 1b 참고).

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<6> 또한 앞서 예와 달리 기지국에서 응답을 보내야 할 시간 영역에서 이용 가능한 리소스(resource)가 없을 경우, 응답을 제시간에 할 수 없는 문제점이 발생하게 된다. 이러한 경우, 그에 해당하는 RACH 슬롯의 응답은 전송되지 않거나 지연되어 전송되게 된다. 이때, 지연되어 전송된 응답과 제시간에 전송된 응답 혹은 지연되어 전송된 응답들을 서로 구별할 수 있는 방법이 필요하다.

<7> 또한 여러 개의 RACH 슬롯에 걸친 응답을 모아서 한번에 보내는 경우, 각 RACH 슬롯을 구별하는 방법이 필요하다.

【발명의 내용】

【해결하고자 하는 과제】

<8> 본 발명은 상술한 관련기술의 문제점을 해결하기 위한 것으로서, 본 발명의 목적은, 임의로 선택된 시퀀스를 사용하여 액세스를 시도하는 단말기가, 이 단말기와 동일한 시퀀스를 가지고 액세스를 시도하는 다른 단말기의 액세스에 대한 응답을 자신의 액세스 시도에 대한 응답으로 잘못 수신하는 것을 방지할 수 있는 랜덤 액세스 응답의 송신 및 수신 기법을 제공하는 것이다.

【과제 해결 수단】

<9> 상술한 과제를 해결하기 위해, 본 발명에 의한 랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법은, 단말기가 랜덤 액세스 프리앰블을 전송하는 단계, 및 상기 단말기가 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 수신하는 단계를 포함하며, 상기 단말기가 수신하는 상기 랜덤 액세스 응답에는, 상기 수

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신하는 랜덤 액세스 응답에 대응되는 랜덤 액세스 프리앰블이 전송된 시점에 관한 시간 관련 정보가 포함되어 있다. 상기 시간 관련 정보는, 상기 단말기가 상기 랜덤 액세스 프리앰블을 전송하는 시점의 서브프레임에 관련된 번호일 수 있다. 상기 서브프레임에 관련된 번호는, 서브프레임 중 RACH 슬롯이 존재하는 서브프레임에 대하여만 할당된 번호일 수 있다. 상기 할당은, 서브프레임 중 RACH 슬롯이 존재하는 서브프레임의 번호에 대한 모듈로(modulo) 연산에 의해 이루어질 수 있다. 상기 모듈로 연산은, 모듈로 4 연산일 수 있다. 또한, 상기 단말기가 전송하는 상기 랜덤 액세스 프리앰블에는, 상기 단말기가 상기 랜덤 액세스 프리앰블을 전송하는 시점에 관한 시간 관련 정보가 포함되어 있을 수 있다.

<10> 상술한 과제를 해결하기 위한 본 발명의 다른 양상으로서, 본 발명에 의한 랜덤 액세스 프리앰블의 수신 및 랜덤 액세스 응답의 전송 방법은, 기지국이 랜덤 액세스 프리앰블을 수신하는 단계, 및 상기 기지국이 상기 수신된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 전송하는 단계를 포함하고, 상기 전송하는 상기 랜덤 액세스 응답에는, 상기 수신된 랜덤 액세스 프리앰블이 전송된 시점에 관한 시간 관련 정보, 또는 상기 기지국이 상기 랜덤 액세스 프리앰블을 수신한 때로부터 상기 랜덤 액세스 응답을 전송하는데 소요되는 처리 지연 시간에 관련된 지연 오프셋 정보가 포함되어 있다. 상기 전송된 시점은 셀 크기를 기초로 하여 상기 기지국이 추정한 것일 수 있다. 상기 수신된 랜덤 액세스 프리앰블에는, 상기 수신된 랜덤 액세스 프리앰블이 전송된 시점에 관한 시간 관련 정보가 포함되어 있고, 상기 전송하는 상기 랜덤 액세스 응답에 포함되어 있는 시간 관련 정보는,

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상기 수신된 랜덤 액세스 요청에 포함되어 있는 시간 관련 정보와 연관된 것일 수 있다.

<11> 상술한 과제를 해결하기 위한 본 발명의 다른 양상으로서, 본 발명에 의한 랜덤 액세스 송신 및 랜덤 액세스 응답 수신 방법은, 단말기가 랜덤 액세스 프리앰블을 전송하는 단계, 상기 단말기가 랜덤 액세스 응답을 수신하는 단계를 포함하며, 상기 단말기가 상기 랜덤 액세스 응답을 수신하는 단계는, 상기 랜덤 액세스 프리앰블이 전송되는 시점 이후의 미리 결정된 시각을 포함하는 미리 결정된 시구간에서 수행되며, 상기 미리 결정된 시각은, 상기 랜덤 액세스 프리앰블이 전송되는 시점 이후로부터, HARQ(Hybrid Automatic Repeat Request) 프로세스 수의 절반에 대응하는 시간에 미리 결정된 오프셋(offset) 시간을 가산한 시간이 경과한 시각이다. 또한, 상기 랜덤 액세스 응답에는 지연 오프셋 정보가 포함되어 있고, 상기 지연 오프셋 정보는, 상기 미리 결정된 시구간을 변경하는데 사용될 수 있다.

【효과】

<12> 본 발명에 의해, 각 단말은, 다른 단말기가 전송한 랜덤 액세스 요청에 대한 랜덤 액세스 응답을 자신이 전송한 랜덤 액세스 요청에 대한 응답으로서 인식하는 문제점을 해결할 수 있다.

【발명의 실시를 위한 구체적인 내용】

<13> 이하에서 첨부된 도면을 참조하여 설명되는 본 발명의 바람직한 실시예들에 의해 본 발명의 구성, 작용 및 다른 특징들이 용이하게 파악될 수 있을 것이다.

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이하에서 설명되는 실시예는 본 발명의 기술적 특징이 광대역 무선 접속 시스템에 적용된 예로서, 광대역 무선 접속 시스템에서의 랜덤 액세스에 관한 "3GPP TS 36.211 v. 8.1.0, 'Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation', 2007-12-20"를 참조할 수 있다.

<14> 광대역 무선 접속 시스템에 있어서, '채널'은 각 송수신기 쌍(pair)에 할당된 부분의 통로를 말하며, 물리적인 전송로의 뜻보다는 논리적인 신호의 통로를 의미한다. 따라서, 하나의 전송로에 여러 개의 채널이 존재할 수 있다.

<15> 비동기식 WCDMA(비동기식 광대역 CDMA 방식)에서는 계층별로 세 종류의 채널을 정의하고 있다. 첫 번째는 RLC와 MAC 계층 사이의 논리 채널로, 어떠한 종류의 정보가 포함되어 있느냐, 즉 '정보의 유형'에 따라 채널을 구분하고 있다. 두 번째 전송 채널은 MAC 계층과 물리 계층 사이의 채널로서 '전달정보의 특징'에 따라 채널을 구분하고 있으며, 크게 지정 전송 채널(dedicated transport channel)과 공통 전송 채널(common transport channel)로 나뉜다. 세 번째 물리 채널은 실제 안테나를 통하여 전송되는 채널로서 '무선 자원, 특히 코드와 RF 출력의 효율성'에 따라 채널을 구분하고 있다(도 15, 도 16 참조). 전송의 신뢰성을 담당하는 RLC 계층은 논리 채널 단위로 재전송이 이루어진다. 즉, 수신측에서 에러가 발생 시 물리 계층에서 구성된 프레임 단위가 아닌 정보의 단위(TTI)의 논리 채널 재전송이 이루어진다.

<16> 전송 채널은 물리 계층과 상위 계층간의 전달 채널로서 전송 데이터의 특징과 전송방법에 따라 채널을 정의하고 있다. 전송 채널은 논리 채널로부터 전달된

데이터의 전송을 담당하지만, 논리 채널과 전송 채널은 일 대 일의 대응관계에 있지 않으며, 여러 개의 논리 채널이 하나의 전송 채널을 사용하여 전송될 수 있다. 따라서, 논리 채널과 전송 채널의 사이에 있는 MAC 계층이 이들의 매핑(mapping)을 담당한다.

<17> 전송 채널도 논리 채널과 마찬가지로, 물리적으로 구분되는 채널이라기보다는 데이터의 흐름이라고 생각할 수 있다. 특히, 단말에서는 모든 프로토콜이 동일한 위치에 있으므로, 단말의 전송 채널은 MAC 계층과 물리 계층 사이에서 내부적으로만 정의된다. UTRAN(UMTS Terrestrial Radio Access Network)의 경우에는 물리 계층이 노드 B(Node B)에 위치하므로, RNC에 위치한 MAC 계층과의 데이터 교환을 위해 적절한 인터페이스가 정의되어야 한다.

<18> 전송 채널은 전달정보의 특징에 따라 지정 전송 채널과 공통 전송 채널로 나뉘어진다. DCH(Dedicated Channel)은 지정 전송 채널에 해당하며, BCH(Broadcasting Channel), FACH(Forward Access Channel), PCH(Paging Channel), RACH(Random Access Channel), DSCH(Downlink Shared Channel), CPCH(Common Packet Channel), HS-DSCH(High Speed-Downlink Shared Channel)는 공통 전송 채널에 해당한다.

<19> RACH는 상향링크로 SMS와 같은 짧은 패킷 데이터와 호 설정 등의 제어정보를 전송하는 채널로서 슬롯된 알로하 랜덤 액세스(slotted ALOHA random access) 방식에 의거하여 동기식에서의 랜덤 액세스 채널(random access channel)과 유사한 절차로 동작한다. 따라서, 타 단말의 신호와의 충돌의 위험(collision risk)이 있으

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며, 개루프(open loop) 전력 제어가 사용된다. 동기식 CDMA 시스템에서는 9.6kbps의 전송속도인 것과 달리 비동기에서는 120kbps까지의 전송을 정의하고 있다. 그러나 실제로는 15kbps 정도로 제한되어 사용된다.

<20> 물리 채널은 실제 안테나를 통하여 전송되는 채널로서 여러 종류의 정보가 한 개의 물리 채널로 합쳐져서 전송되거나 혹은 여러 개의 물리 채널로 전송이 이루어진다. 일부 오버헤드 물리 채널들은 상위계층과 무관하게 순수히 물리 채널들의 송수신을 도와주는 목적으로 사용되는 것이므로 기지국 자체에서 전송 채널과 직접적인 매핑 관계(mapping relation)없이 생성된다. 전송 채널 중 RACH는 물리 채널의 PRACH(Physical Random Access Channel)에 매핑된다.

<21> 상향링크 랜덤 액세스에서는, 기지국에 접속하지 않은 단말이 기지국에 접속을 시도하기 위하여 슬롯된 알로하 랜덤 액세스(slotted ALOHA random access) 접속방식을 사용하며, 프로브(일반적으로 어떤 존재의 확인 및 탐색하는 행위) 전송 실패 시, 접속 성공 시까지 점차적으로 프로브 출력을 올려 반복 송신한다. WCDMA에서는 매 프로브에서 프리앰블 파트만을 전송한 후 하향링크의 AICH(Acquisition Indication Channel)를 통해서 기지국으로부터 액세스 프리앰블에 대한 동기 획득이 이루어졌음을 회신 받은 후 메시지 파트를 전송하는 AiSMA(Acquisition Indication Sense Multiple Access) 방식을 채택하고 있다. 따라서 WCDMA에서는 랜덤 액세스 프로브의 전송시간이 동기식에 비하여 매우 짧기 때문에 기지국 접속에 실패한 프로브들에 의한 기지국 수신 잡음 현상이 현저하게 개선된 특성을 나타낼 수 있게 된다. 랜덤 액세스 프리앰블 파트에 사용 가능한 코드와 서브그룹

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(subgroup)에 관한 정보는 상위 계층인 무선 자원 관리로부터 SIB 5 메시지를 통하여 액세스 서비스 등급에 따라 지정이 되며 메시지 부분의 전송 포맷과 시스템 프레임 번호 등의 정보는 MAC으로부터 전달받는다. 랜덤 액세스 채널은 이와 같은 기지국으로의 호 설정 요청과 관련된 동작과 함께 상향링크로 한두 개 프레임 정도의 짧은 단방향 패킷 데이터 전송을 목적으로 한다.

<22> 프리앰블 신호에 대한 ACK을 수신한 이후에 전송되는 메시지 파트는 10msec 또는 20msec로 구성되며, 실질적인 데이터 파트와 제어 파트가 I/Q 채널 다중화되어 각각 BPSK 변조되어 동시에 전송된다.

<23> 여러 단말로부터의 RACH 신호들의 충돌 확률을 최소화하기 위하여 RACH 신호는 각각 단말별로 지정된 액세스 슬롯(Access Slot)에서 송신을 시작하도록 한다. 자신의 액세스 슬롯 번호는 상위계층에서 고유하게 지정이 된다. RACH 관련한 파라미터들은 BCH의 SIB5를 통하여 모든 수신대기 단말들에게 브로드캐스트(broadcast)된다.

<24> 도 2a는, 광대역 무선 접속 시스템에서 사용되는 프레임 구조의 일 예를 나타낸 것이다.

<25> "3GPP TS 36.211 v. 8.1.0, "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation", 2007-12-20."에서는 evolved UTRA에 대한 물리 채널이 기술되어 있다. 두 가지의 프레임 구조가 사용될 수 있는데, 그 중 첫 번째 프레임 구조(도 2a 참조)는 풀 듀플렉스 FDD(full duplex FDD) 및 하프 듀플렉스 FDD(half duplex FDD)에 적용 가능하다. 각각의 라디오 프레임

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(radio frame)은 10ms의 길이를 가지며, 각각 0.5ms의 길이를 갖는 슬롯 20개로 구성되어 있다. 각 슬롯은 0 내지 19의 번호를 갖는다. 하나의 서브프레임(subframe)은 두 개의 연속적인 슬롯이다. FDD에 있어서, 10ms 동안 각각 10개의 서브프레임이 업링크 전송 및 다운링크 전송에 이용된다.

<26> 도 2b는, 랜덤 액세스 프리앰블의 포맷의 일 예를 나타낸 것이다.

<27> 도 2b에 도시된 바와 같이, 물리 계층 랜덤 액세스 프리앰블은 T_{CP}의 길이를 갖는 순환전치(cyclic prefix) 및 T_{SEQ}의 길이를 갖는 시퀀스(sequence) 부로 이루어진다. 이에 대한 파라미터가 표 1에 열거되어 있는데 이러한 파라미터들은 프레임 구조 및 랜덤 액세스 구성에 의해 결정된다. 프리앰블 포맷은 상위 계층에 의해 제어된다.

<28> <표 1>

<29>

프리앰블 포맷	T_{CP}	T_{SEQ}
0	$3618 \cdot T_S$	$24576 \cdot T_S$
1	$21024 \cdot T_S$	$24576 \cdot T_S$
2	$6240 \cdot T_S$	$2 \cdot 24576 \cdot T_S$
3	$21024 \cdot T_S$	$2 \cdot 24576 \cdot T_S$
4 (프레임 구조 타입 2에만 해당)	$448 \cdot T_S$	$4096 \cdot T_S$

<30> 프리앰블 포맷 0-3에 대하여 하나의 서브프레임당 최대 1개의 랜덤 액세스

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리소스가 존재한다. 표 2는, 주어진 구성에서, 랜덤 액세스 프리앰블 전송이 허용되는 서브프레임들을 나타낸다. 타이밍 어드밴스(timing advance)가 0(zero)임을 가정할 때에, 랜덤 액세스 프리앰블의 시작은 사용자 기기(UE; 또는 단말기)에서의 대응하는 업링크 서브프레임의 시작과 나란히 정렬될 것이다. 표 2를 살펴보면 랜덤 액세스 채널은 최소 1ms에서 최대 20ms의 주기를 가질 수 있다.

<31> <표 2>

<32>

PRACH 구성	시스템 프레임 번호	서브프레임 번호
0	Even	1
1	Even	4
2	Even	7
3	Any	1
4	Any	4
5	Any	7
6	Any	1, 6
7	Any	2, 7
8	Any	3, 8
9	Any	1, 4, 7
10	Any	2, 5, 8
11	Any	3, 6, 9
12	Any	0, 2, 4, 6, 8
13	Any	1, 3, 5, 7, 9
14	Any	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
15	Even	9

<33> 이하의 설명에서는 1ms 주기의 RACH 구성에 대하여 설명한다. 그러나 이러한 RACH 주기는 본 발명에 제약을 주지 않는다. 또한 본 발명의 효과는 주기가 짧은 경우에 보다 큰 효과가 있으므로, 주기가 짧은 특정 RACH 구성에서만 사용하는 것도 가능하다. 또한 편의상 3GPP LTE(이하, 'LTE') 시스템을 예를 들어 설명하나

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이는 편의상의 이유일 뿐이며 본 발명에 제약을 주지 않는다. 예를 들어, IEEE 802.16(이하 802.16)의 레인징 채널에서도 본 발명의 적용이 가능하다. 다시 말해서, 본 발명에서 언급하는 LTE의 RACH 응답을 802.16의 레인징 응답으로서 해석하는 것이 가능하다.

<34> 도 3a는, 본 발명의 일 실시예에 의한, 시간 정보를 포함하는 랜덤 액세스 응답 방법을 설명하기 위한 도면이다.

<35> 도 3a에 의한 본 발명의 일 실시예에서는, 랜덤 액세스 응답에 시간 위치 정보를 포함하여 송신하는 방법을 사용하므로, 랜덤 액세스 응답을 잘못 수신하는 경우를 방지할 수 있다. 이 경우에는 추가적인 정보를 더 전송하는 것이기 때문에, 시그널링 오버헤드를 다소 감수해야 한다. 예를 들어, 도 3a에 나타내었듯이, 기지국이 랜덤 액세스 응답을 송신할 때에, 단말기가 랜덤 액세스 요청(랜덤 액세스 프리앰블)을 전송한 시점의 업링크 서브프레임 번호(UL sub-frame number)를 함께 전송하는 것이 가능하다(이하, 예를 들어, 업링크 서브프레임 0의 업링크 서브프레임 번호는 '0'으로 표기한다). 도 3a에 의한 실시예와 같이, 각 서브프레임은 시간영역에서 1ms의 길이를 갖는 것으로 가정할 수 있다. 또한, 랜덤 액세스 프리앰블이 송신되는 RACH 슬롯은 1ms의 주기를 갖는 것으로 가정할 수 있다. 단말기(1)(User Equipment 1)는 무작위로 선택된 시퀀스 번호 1을 갖는 랜덤 액세스 프리앰블을 업링크 서브프레임 0에서 전송할 수 있다(S310). 단말기(2)는, 무작위로 선택되었지만 단말기(1)에서 전송한 시퀀스와 동일한 시퀀스 번호 1을 갖는 랜덤 액세스 프리앰블을 업링크 서브프레임 1에서 전송할 수 있다(S320). 기지국은, 단

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말기(1)가 전송한 랜덤 액세스 시퀀스를 다운링크 서브프레임 3에서 수신한 후, 이에 대한 랜덤 액세스 응답을 전송할 수 있다(S330). 이 랜덤 액세스 응답에는 시퀀스 번호 1과 업링크 서브프레임 0에 관한 정보가 포함될 수 있다. 그 후, 기지국은, 단말기(2)가 전송한 랜덤 액세스 시퀀스를 다운링크 서브프레임 4에서 수신한 후, 이에 대한 랜덤 액세스 응답을 전송할 수 있다(S340). 이 랜덤 액세스 응답에는 시퀀스 번호 1과 업링크 서브프레임 1에 관한 정보가 포함될 수 있다. 단말기(1)와 단말기(2)는 업링크 서브프레임 7에서, 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 수신할 수 있다. 그 후, 단말기(1)와 단말기(2)는, 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임의 번호 정보가, 단말기(1)와 단말기(2)가 각각 전송한 랜덤 액세스 프리앰블의 업링크 서브프레임 번호와 일치하는지 확인할 수 있다. 만일 단말기(1)에 의해 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임의 번호가 단말기(1)가 전송한 랜덤 액세스 프리앰블의 업링크 서브프레임 번호와 일치한다면, 단말기(1)에 의해 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스에 대한 응답으로 인정할 수 있다. 그러나, 만일 단말기(1)에 의해 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임의 번호가 단말기(1)가 전송한 랜덤 액세스 프리앰블의 업링크 서브프레임 번호와 일치하지 않는다면, 단말기(1)에 의해 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스에 대한 응답이 아닌 것으로 인정할 수 있다. 마찬가지로, 만일 단말기(2)에 의해 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임의 번호가 단말기(2)가 전송한 랜덤 액세스 프리앰블의 업링크 서브프레임 번호와 일치

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한다면, 단말기(2)에 의해 수신된 랜덤 액세스 응답은 단말기(2)가 전송한 랜덤 액세스에 대한 응답인 것으로 판단할 수 있다. 그러나, 만일 단말기(2)에 의해 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임의 번호가 단말기(2)가 전송한 랜덤 액세스 프리앰블의 업링크 서브프레임 번호와 일치하지 않는다면, 단말기(2)에 의해 수신된 랜덤 액세스 응답은 단말기(2)가 전송한 랜덤 액세스에 대한 응답이 아닌 것으로 판단할 수 있다.

<36> 상술한 도 3a 및 도 3a에 관련된 설명은 셀 반경을 고려하지 않은 것으로서, 본 발명의 사상을 이해하기 쉽도록 기술한 것이다. 그러나, 실제로 50km정도의 셀 반경을 가정하고 전자기파의 전파 속도를 고려한다면, 단말기(1)가 업링크 서브프레임 0에서 송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 0 또는 다운링크 서브프레임 1에 기지국에 도착할 수 있고, 단말기(2)가 업링크 서브프레임 1에서 송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 1 또는 다운링크 서브프레임 2에 기지국에 도착할 수 있다. 마찬가지로, 기지국이 랜덤 액세스 응답을 다운링크 서브프레임 1에 전송하는 경우 이 랜덤 액세스 응답은 업링크 서브프레임 1 또는 업링크 서브프레임 2에 단말기(1) 및/또는 단말기(2)에 도달할 수 있고, 기지국이 랜덤 액세스 응답을 다운링크 서브프레임 2에서 전송하는 경우 이 랜덤 액세스 응답은 업링크 서브프레임 2 또는 업링크 서브프레임 3에 단말기(1) 및/또는 단말기(2)에 도달할 수 있다는 것을 이해할 수 있다(도 3b 참고).

<37> 도 4는 본 발명의 일 실시예에 따른 단말기(1), 단말기(2), 및 기지국 간의 랜덤 액세스 송수신 과정을 나타낸 도면이다.

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<38> 단말기(1)와 단말기(2)는 각각, 단계 S410 및 S410'에서, PRACH 구성 및 프리앰블 포맷과 같은, 랜덤 액세스 채널 파라미터를 선택한다. PRACH 구성 및 프리앰블 포맷은 상기 표 1 및 표 2에 나타난 구성 중 하나를 선택할 수 있다. 단말기(1)와 단말기(2)는 각각, 전송할 랜덤 액세스 프리앰블의 시퀀스 번호를 결정하여 프리앰블에 반영할 수 있다. 단말기(1)와 단말기(2)가 전송하는 랜덤 액세스 프리앰블 시퀀스 번호는 동일할 수도 있고 서로 다를 수도 있다. 이 실시예에서, 단말기(1)와 단말기(2)가 전송하는 시퀀스 번호는 모두 '1'로 동일한 것으로 가정한다. 단말기(1)와 단말기(2)는 각각, 단계 S420 및 S420'에서, 랜덤 액세스 프리앰블이 전송될 시각의 업링크 서브프레임 번호를 추출하여 저장한다. 단말기(1)가 랜덤 액세스 프리앰블을 전송하는 시각은 단말기(2)가 랜덤 액세스 프리앰블을 전송하는 시각과 서로 다를 수 있다. 이하, 단말기(1) 및 단말기(2)가 각각 저장하는 업링크 서브프레임 번호는 sf_F_N으로 표기한다. 이 실시예에서, 단말기(1) 및 단말기(2)가 전송하는 랜덤 액세스 프리앰블(RAP1, RAP2)들은, 각각 업링크 서브프레임 번호 sf_F_N=1 및 sf_F_N=2에 대응되는 시각에서 전송된다. 단말기(1)와 단말기(2)는 각각 랜덤 액세스 프리앰블을 단계 S430 및 단계 S430'에서 전송한다.

<39> 만일 기지국(3)이 임의의 랜덤 액세스 프리앰블(예컨대, RAP1, RAP2)을 수신하게 되면, 기지국(3)은, 수신된 랜덤 액세스 프리앰블의 시퀀스 번호를 추출하고, 셀 반경(셀 크기)을 고려하여 수신된 랜덤 액세스 프리앰블이 전송되었을 업링크 서브프레임 번호(sf_F_N=j)를 추정한다. 기지국(3)은 추정된 정보를 수신된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답에 포함시킨다(S440). 그 후, 기지국

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(3)은 랜덤 액세스 응답을 전송한다(S450). 전송되는 랜덤 액세스 응답은 단말기(1)와 단말기(2)에 모두 도달할 수 있다. 이 실시예에서, 기지국(3)은, 단말기(2)에 의해 전송된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 전송하기 이전에, 단말기(1)에 의해 전송된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 먼저 전송한다. 단말기(1)와 단말기(2)는, 각각 단계 S450에서 전송된 랜덤 액세스 응답을 수신한다. 단말기(1)와 단말기(2)는, 각각, 단계 S460 및 S460'에서, 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임 번호를 추출하고, 그 후, 추출된 업링크 서브프레임 번호를, 단계 S420(단계 S420')에서 저장된 업링크 서브프레임 번호와 동일한지를 비교한다. 단말기(1)에서는, 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임 번호 sf_R_N=1이, 자신이 전송한 랜덤 액세스 프리앰블의 업링크 서브프레임 번호의 저장된 번호 sf_F_N=1과 동일하므로, 수신된 랜덤 액세스 응답이 자신이 전송한 랜덤 액세스 프리앰블에 대한 응답이라고 결정할 수 있다. 단말기(2)에서는, 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임 번호 sf_R_N=1이, 자신이 전송한 랜덤 액세스 프리앰블의 업링크 서브프레임 번호의 저장된 번호인 sf_F_N=2과 상이하므로, 수신된 랜덤 액세스 응답이 자신이 전송한 랜덤 액세스 프리앰블에 대한 응답이 아니라고 결정할 수 있다. 각각의 단말기는, 각각의 단말기에 의해 수신된 랜덤 액세스 응답이 자신이 전송한 랜덤 액세스 프리앰블에 대한 응답인지를 확인하기 위해, 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임 번호뿐만 아니라 수신된 랜덤 액세스 응답에 포함된 시퀀스 정보를 더 이용할 수 있다. 임의의 단말기에 의해 수신된 랜덤 액세스 응답에 포함된 시퀀스

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정보 및 업링크 서브프레임 번호 모두가, 상기 임의의 단말기가 전송한 랜덤 액세스 프리앰블에 포함된 시퀀스 정보 및 상기 임의의 단말기가 랜덤 액세스 프리앰블을 전송한 시점의 업링크 서브프레임 번호와 일치하면, 수신된 랜덤 액세스 응답이 자신이 전송한 랜덤 액세스 프리앰블에 대한 응답이라고 결정할 수 있다.

<40> 도 5a는, 각 서브프레임은 시간영역에서 1ms의 길이를 갖되, 랜덤 액세스 프리앰블이 송신되는 RACH 슬롯은 2ms의 주기를 갖는 경우를 나타낸 것이다.

<41> 단말기(1)는 무작위로 선택된 시퀀스 번호 1을 갖는 랜덤 액세스 프리앰블을 업링크 서브프레임 0에서 전송한다(S510). 단말기(2)는, 무작위로 선택되었지만, 단말기(1)에서 전송한 시퀀스와 동일한 시퀀스 번호 1을 갖는 랜덤 액세스 프리앰블을 업링크 서브프레임 2에서 전송한다(S520). 기지국은, 단말기(1)가 전송한 랜덤 액세스 시퀀스를 다운링크 서브프레임 3에서 수신한 후, 이에 대한 랜덤 액세스 응답을 전송한다(S530). 이 랜덤 액세스 응답(S630)에는, 기지국이 셀 반경(셀 크기)을 고려하여 추정한, 다운링크 서브프레임 3에서 수신된 랜덤 액세스 프리앰블이 전송되었을 업링크 서브프레임 번호(sf_F_N=0) 및 시퀀스 번호 1이 포함되어 있다.. 그 후, 기지국은, 단말기(2)가 전송한 랜덤 액세스 시퀀스를 다운링크 서브프레임 5에서 수신한 후, 이에 대한 랜덤 액세스 응답을 전송한다(S540). 이 랜덤 액세스 응답(S540)에는, 기지국이 셀 반경(셀 크기)을 고려하여 추정한, 다운링크 서브프레임 5에서 수신된 랜덤 액세스 프리앰블이 전송되었을 업링크 서브프레임 번호(sf_F_N=2) 및 시퀀스 번호 1이 포함되어 있다.

<42> 도 5a에 의한 실시예는, 랜덤 액세스 시퀀스가 짝수 번호를 갖는 업링크 서

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브프레임에서만 전송된다는 점에서 도 3a에 의한 실시예와 다르다. 즉, 도 5a의 빗금 친 부분인, 업링크 서브프레임 0, 2, 4, 6, 8에서만 랜덤 액세스 시퀀스가 전송된다. 따라서, 기지국이 업링크 서브프레임 번호를 추정하여 그 번호를 이진수로 표현하려면 4개의 시그널링 비트가 필요하다. 그런데 만일 원래의 업링크 서브프레임 번호 Original={0, 2, 4, 6, 8}을 재정의하여 Renumbered={0, 1, 2, 3, 4}로 바꾸어주면 3개의 시그널링 비트만으로도 표현할 수 있기 때문에 시그널링 비트의 개수를 줄일 수 있다. 이러한 개념을, 도 4에 의한 실시예에 적용할 수 있다.

<43> 상술한 도 5a 및 도 5a에 관련된 설명은 셀 반경을 고려하지 않은 것으로서, 본 발명의 사상을 이해하기 쉽도록 기술한 것이다. 그러나, 실제로 50km정도의 셀 반경을 가정하고 전자기파의 전파 속도를 고려한다면, 단말기(1)가 업링크 서브프레임 0에서 송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 0 또는 다운링크 서브프레임 1에 기지국에 도착할 수 있고, 단말기(2)가 업링크 서브프레임 2에서 송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 2 또는 다운링크 서브프레임 3에 기지국에 도착할 수 있다. 마찬가지로, 기지국이 랜덤 액세스 응답을 다운링크 서브프레임 1에 전송하는 경우 이 랜덤 액세스 응답은 업링크 서브프레임 1 또는 업링크 서브프레임 2에 단말기(1) 및/또는 단말기(2)에 도달할 수 있고, 기지국이 랜덤 액세스 응답을 다운링크 서브프레임 3에서 전송하는 경우 이 랜덤 액세스 응답은 업링크 서브프레임 3 또는 업링크 서브프레임 4에 단말기(1) 및/또는 단말기(2)에 도달할 수 있다는 것을 이해할 수 있다(도 5b 참고).

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<44> 도 6a는, 도 5a에 의한 실시예에서, RACH 슬롯이 2ms의 주기를 가지는 경우에, 지연된 랜덤 액세스 응답에 관한 도면이다.

<45> 즉, 업링크 서브프레임 0의 랜덤 액세스 응답이 지연되는 경우의 예를 들었다. 기지국이 다운링크 서브프레임 3에서 랜덤 액세스 프리앰블을 수신(S610)한 경우에, 기지국은 하향링크로 전송할 리소스를 가지고 있지 않을 수 있다. 이런 상황은 여러 가지 경우에 발생할 수 있다. 예를 들어, 지정(dedicated) MBSFN (multicast broadcast single frequency network)로 사용되는 경우, 유니캐스트(unicast)용 하향링크 리소스를 할당할 수 없다. 이와 달리, 특정 용도로 사용되는 경우가 아니더라도, 특정 시간에 모든 리소스가 이미 다른 제어 신호와 데이터 신호로 이미 모두 사용되고 있을 수 있다. 이러한 경우 랜덤 액세스 응답의 전송이 지연될 수 있다. 또한 하나의 리소스에 여러 개의 랜덤 액세스 응답을 동시에 전송하는 것도 가능하다. 따라서, 랜덤 액세스 응답에 지연된 시간에 관련된 시간 정보(즉, 지연 오프셋 정보)를 포함시키는 것이 바람직하다. 이 시간 정보(또는, 시간 관련 정보)로서 서브프레임의 번호 및/또는 시간과 관련된 그 밖의 정보들을 사용할 수 있다.

<46> 상술한 도 6a 및 도 6a에 관련된 설명은 셀 반경을 고려하지 않은 것으로서, 본 발명의 사상을 이해하기 쉽도록 기술한 것이다. 그러나, 실제로 50km정도의 셀 반경을 가정하고 전자기파의 전파 속도를 고려한다면, 단말기(1)가 업링크 서브프레임 0에서 송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 0 또는 다운링크 서브프레임 1에 기지국에 도착할 수 있고, 단말기(2)가 업링크 서브프레임 2에서

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송신한 랜덤 액세스 프리앰블은 다운링크 서브프레임 2 또는 다운링크 서브프레임 3에 기지국에 도착할 수 있다. 마찬가지로, 기지국이 랜덤 액세스 응답을 다운링크 서브프레임 3에 전송하는 경우 이 랜덤 액세스 응답은 업링크 서브프레임 3 또는 업링크 서브프레임 4에 단말기(1) 및/또는 단말기(2)에 도달할 수 있다는 것을 이해할 수 있다(도 6b 참고).

<47> 도 7a 및 도 7b는, 본 발명의 다른 실시예에 의한, 번호 재정의(renumbering) 및 그룹화(grouping)를 설명하는 도면이다.

<48> 지금까지 랜덤 액세스 응답에 포함되는 시간 정보로써 업링크 서브프레임 번호 또는 재정의된 업링크 서브프레임 번호를 사용하였다. 그런데, 업링크 서브프레임 번호를 재정의할 때에, 그룹화하는 방법을 사용할 수 있다. 여기서, 그룹화하는 방법으로서 모듈로 연산(modulo operation) 및/또는 알려진 여러 가지 방법을 사용할 수 있다(모듈로 연산은 한 숫자를 다른 숫자로 나누었을 때에 나머지 값을 찾는 연산이다. 예를 들어 모듈로 4 연산은 임의의 수를 4로 나누었을 때 나오는 나머지 값을 그 결과값으로 하는 연산이다). 예를 들어, 서브프레임 번호가 10ms 이하의 주기를 가지면서 반복되도록 재정의할 수 있다. 예를 들어, 표 2의 15번째 PRACH 구성을 사용할 경우 4비트의 시그널링이 필요하지만, 업링크 서브프레임의 번호를 4개 단위로 모듈로 연산할 경우 2비트의 시그널링이 필요하게 된다. 다르게는, 표 2의 다양한 PRACH 구성을 사용하여 응용할 수 있다. 도 7a 및 도 7b는 그러한 예들 중 하나를 나타낸다. 도 7a 및 도 7b는, 1ms의 업링크 서브프레임 길이를 갖고, 2ms 주기로 RACH 슬롯이 반복되는 구성에 있어서, RACH 슬롯이 존재하

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는 업링크 서브프레임의 번호를 재정의(renumbering) 한 것이다. 여기서, 업링크 서브프레임의 번호는 모듈로 4 연산에 의해 그룹화되어 반복되는 것을 볼 수 있다.

<49> 도 8은, 도 7에 의한 실시예를 도 4에 의한 실시예에 적용시킨 것으로서, 도 4의 단계 S420 내부에서 행해지는 처리를 자세히 나타낸 것이다.

<50> 단계 S810에서는 RACH 슬롯이 존재하는 서브프레임을 검출한다. 단계 S820에서는, RACH 슬롯이 존재하는 업링크 서브프레임에만 번호를 재할당한다. 단계 S830에서는 랜덤 액세스가 전송될 시점의 업링크 서브프레임의 재할당된 번호를 결정한다. 단계 S840에서는, 검색된 재할당된 번호를 저장한다. 이 실시예에서는 짝수 번호의 프레임에만 RACH 슬롯이 존재하지만, 임의의 번호의 프레임에 RACH 슬롯이 존재할 수도 있다. 즉, 단계 S830에서의 번호의 재할당은, 그룹화하는 방법을 사용할 수도 있고, 더 구체적으로는 모듈로 연산(modulo operation)에 의한 것일 수 있다.

<51> 도 9는, 본 발명의 다른 실시예에 의한, 랜덤 액세스 요청 및 랜덤 액세스 응답의 송수신 방법에 관한 순서도로서, 단말기(1), 단말기(2), 및 기지국 간의 랜덤 액세스 송수신 과정을 나타낸 도면이다.

<52> 단말기(1)와 단말기(2)는 각각, 단계 S910 및 S910'에서, PRACH 구성 및 프리앰블 포맷과 같은, 랜덤 액세스 채널 파라미터를 선택할 수 있다. PRACH 구성 및 프리앰블 포맷은 표 1 및 표 2에 나타난 구성 중 하나를 선택할 수 있다. 단말기(1)와 단말기(2)는 각각, 전송할 랜덤 액세스 프리앰블의 시퀀스 번호를 결정하여 랜덤 액세스 프리앰블에 반영한다. 이 실시예에서, 단말기(1)와 단말기(2)가

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전송하는 랜덤 액세스 프리앰블 시퀀스 번호는 동일할 수도 있고 서로 다를 수도 있다. 단말기(1)와 단말기(2)는 각각, 단계 S920 및 S920'에서, 랜덤 액세스 프리앰블이 전송될 시각의 업링크 서브프레임 번호를 추출하여, 추출된 업링크 서브프레임 번호를 전송될 랜덤 액세스 프리앰블에 포함시킬 수 있다. 단말기(1)가 랜덤 액세스 프리앰블을 전송하는 시점은 단말기(2)가 랜덤 액세스 프리앰블을 전송하는 시점과 서로 다를 수 있다. 이하, 단말기(1) 및 단말기(2)에 의해 전송되는 랜덤 액세스 프리앰블에 포함되는 업링크 서브프레임 번호는 sf_F_N으로 표기한다. 이 실시예에서, 단말기(1) 및 단말기(2)가 전송하는 랜덤 액세스 프리앰블(RAP1, RAP2)들은, 각각 업링크 서브프레임 번호 sf_F_N=1 및 sf_F_N=2에 대응되는 시점에서 전송된다. 단말기(1)와 단말기(2)는 각각 랜덤 액세스 프리앰블을 단계 S930 및 단계 S930'에서 전송한다. 이 실시예에서, 단말기(1)와 단말기(2)가 전송하는 랜덤 액세스 프리앰블은 모두 시퀀스 번호 1을 갖는 것으로 가정한다.

<53> 만일 기지국(3)이 임의의 랜덤 액세스 프리앰블(예컨대, RAP1, RAP2)을 수신하게 되면, 기지국(3)은 수신된 랜덤 액세스 프리앰블에 포함된 업링크 서브프레임 번호(sf_F_N=j) 및 시퀀스 번호를 추출한 후, 추출된 정보를 수신된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답에 포함시킬 수 있다(S940). 이하, 랜덤 액세스 응답에 포함되는 업링크 서브프레임 번호는 sf_R_N으로 표기한다. 그 후, 기지국(3)은 랜덤 액세스 응답(RAR1)을 전송한다(S950). 전송되는 랜덤 액세스 응답(RAR1)은 단말기(1)와 단말기(2)에 모두 도달할 수 있다. 이 실시예에서, 기지국(3)은, 단말기(2)에 의해 전송된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을

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전송하기에 앞서, 단말기(1)에 의해 전송된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답(RAR1)을 먼저 전송할 수 있다. 단말기(1)와 단말기(2)는, 각각 단계 S950에서 전송된 랜덤 액세스 응답(RAR1)을 수신한다. 단말기(1)와 단말기(2)는, 각각, 단계 S960 및 S960'에서, 수신된 랜덤 액세스 응답(RAR1)에 포함된 업링크 서브프레임 번호를 추출하고, 그 후, 추출된 업링크 서브프레임 번호가 자신이 전송한 랜덤액세스에 포함된 업링크 서브프레임 번호와 동일한지를 비교한다. 단말기(1)에서는, 수신된 랜덤 액세스 응답(RAR1)에 포함된 업링크 서브프레임 번호 sf_R_N=1이, 자신이 전송한 랜덤 액세스 프리앰블(RAP1)의 업링크 서브프레임 번호 sf_F_N=1과 동일하므로, 수신된 랜덤 액세스 응답(RAR1)이 자신이 전송한 랜덤 액세스 프리앰블(RAP1)에 대한 응답이라고 결정할 수 있다. 단말기(2)에서는, 수신된 랜덤 액세스 응답(RAR1)에 포함된 업링크 서브프레임 번호 sf_R_N=1이, 자신이 전송한 랜덤 액세스 프리앰블(RAP2)의 업링크 서브프레임 번호 sf_F_N=2과 상이하므로, 수신된 랜덤 액세스 응답(RAR1)이 자신이 전송한 랜덤 액세스 프리앰블(RAP2)에 대한 응답이 아니라고 결정할 수 있다. 각각의 단말기는, 각각의 단말기에 의해 수신된 랜덤 액세스 응답이 자신이 전송한 랜덤 액세스 프리앰블에 대한 응답인지를 확인하기 위해, 수신된 랜덤 액세스 응답에 포함된 업링크 서브프레임 번호뿐만 아니라 수신된 랜덤 액세스 응답에 포함된 시퀀스 정보를 이용할 수 있다. 임의의 단말기에 의해 수신된 랜덤 액세스 응답에 포함된 시퀀스 정보 및 업링크 서브프레임 번호 모두가, 상기 임의의 단말기가 전송한 랜덤 액세스 프리앰블에 포함된 시퀀스 정보 및 업링크 서브프레임 번호와 일치하는 경우에는, 수신된

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랜덤 액세스 응답이 자신이 전송한 랜덤 액세스 프리앰블에 대한 응답이라고 결정할 수 있다.

<54> 도 10는, 도 9의 단계 S920(또는 S920') 내에서 행해지는 처리의 일 실시예를 자세히 나타낸 것이다.

<55> 단말기(1, 2)는, 단계 S1010에서, 랜덤 액세스 프리앰블이 전송될 시점의 업링크 서브프레임 번호를 결정한다. 그 후, 단말기(1, 2)는 단계 S1020에서, 단계 S1010에서 결정된 업링크 서브프레임 번호를 전송될 프리앰블에 추가한다.도 11, 도 12, 및 도 13은 본 발명의 다른 실시예의 이해를 돕기 위한 도면으로서, 각각, ARQ의 원리, HARQ의 원리, 및 HARQ 처리의 구체적인 예를 나타낸 도면이다.

<56> 본 발명의 다른 실시예에서, 단말기는 미리 정해진 타이밍 구간에서 응답을 기다린다. 랜덤 액세스 프리앰블을 전송한 각각의 단말기는, 미리 정해진 타이밍 구간에 기초하여, 어느 시점에 자신이 전송한 랜덤 액세스 프리앰블에 대한 응답이 전송될지를 미리 알도록 할 수 있다.

<57> 예를 들어, 이러한 미리 정해진 타이밍 구간을 HARQ 타이밍과 연계하여 정할 수 있다. HARQ는 MAC 계층의 ARQ 기술과 물리 계층의 채널코딩 기술이 결합된 하이브리드 기술이다. ARQ는 피드백을 기반으로 한 폐루프 오류 정정 기법이다. 물리 계층에서 우선적으로 FEC(forward error correction)로 최대한 전송에 오류가 나지 않도록 노력을 하여, 그럼에도 불구하고 오류가 발생한 경우에는, RLC 계층에서 ARQ에 의하여 오류가 발생한 패킷을 재전송함으로써, 결과적으로 RLC 계층 상위로 데이터를 올려줄 때에는 오류가 없는 패킷들만으로 정보를 복원하여 올려줄 수

있다.

<58> 도 11은 ARQ의 원리를 나타낸 도면이다. 전송단(Tx)에서 송신된 패킷(P_1)을 수신단(Rx)이 수신할 때에 오류가 발생한 경우(S1110), 수신단(Rx)은 네거티브 회신응답(NAK; negative acknowledgement)을 전송한다(S1120). 네거티브 회신응답을 수신한 전송단(Tx)은 전송시 오류가 발생했던 패킷(P_1)과 동일한 패킷(P_1)을 재전송한다(S1130). 수신단(Rx)이 재전송된 패킷에 오류가 없음을 확인하게 되면, 수신단(Rx)은 회신응답(ACK)을 송신단(Tx)에게 전송한다(S1140). 회신응답을 수신한 송신단(Tx)은 새로운 패킷(P_2)을 전송한다(1150).

<59> 도 12은 HARQ의 원리를 나타낸 도면이다. HARQ는 ARQ에 물리 계층의 채널코딩이 결합된다는 점에서 ARQ와 다르다. 전송단(Tx)에서 송신된 패킷(P_{1A})을 수신단(Rx)가 수신할 때에 오류가 발생한 경우(S1210), 수신단(Rx)은 네거티브 회신응답을 전송한다(S1220). 네거티브 회신응답을 수신한 전송단(Tx)은 패킷(P_{1B})을 전송한다(S1230). 도 12에서 패킷(P_{1A})와 패킷(P_{1B})은 동일한 정보 비트, 즉, 동일한 채널 인코더 입력 패킷(P_{1A})으로부터 만들어진 것으로서, 동일하거나 혹은 약간 다른 형태를 갖는다. HARQ에서는 최초 전송되었던 패킷(P_{1A})에 오류가 존재하더라도 어느 정도는 정보량을 지닌 신호이므로 이를 버리지 않고 재전송된 신호가 수신될 때까지 저장하고 있다가 재전송된 신호(P_{1B})와 함께 소프트 조합(soft combining)을

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하거나 또는 다른 방법을 함께 사용하여 신호를 복조한다. 에러가 발생했던 패킷들과 새로 재전송된 패킷들을 활용하는 방법은 Chase combining(CC) 및 Incremental redundancy(IR) 방법 등이 있다.

<60> 각 단말기는 자신이 전송한 RACH 슬롯의 시간 위치에서 HARQ 타이밍에 기초하여 랜덤 액세스 응답 위치를 추정하여 특정 시간 위치 구간에서의 하향링크 신호만을 수신하는 방법이 가능하다. 예를 들어, HARQ의 처리과정의 일 예를 나타낸 도 13과 같이, 1개의 HARQ 프로세스의 소요시간이 1ms이라고 가정하고, HARQ 프로세스의 수가 8이라고 가정한다면, 기지국에서 하향링크로 전송한 신호를 단말기가 처리하고, 다시 단말기가 상향링크로 신호를 전송하여 기지국이 처리하는 데는 8ms의 시간이 소요된다. 도 13에서 T_{prop}은 전파지연시간(propagation delay)을 의미한다. 수신된 신호의 처리 시간을 제외하고, 전송한 신호에 대한 응답을 수신하는데 약 HARQ 왕복 시간(HARQ round trip)의 절반 또는 전체 HARQ 프로세스 수의 절반이 소요된다.

<61> 랜덤 액세스를 시도한 단말은, 랜덤 액세스 프리앰블을 전송한 시점으로부터 HARQ 왕복 시간의 절반 또는 전체 HARQ 프로세스 수의 절반을 기다리고, HARQ 왕복 시간의 절반 또는 전체 HARQ 프로세스 수의 절반이 지난 시점부터 일정 시간 구간 내에서 응답을 기다리는 것이 가능하다. 또는, 데이터 처리와 랜덤 액세스 처리 시간의 차이를 고려하여 오프셋(offset)(지연 오프셋)을 주는 방법도 가능하다. 예를 들어 HARQ 왕복 시간 또는 전체 HARQ 프로세스의 수에 의해 정해진 시간으로

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부터, 한 개의 서브프레임만큼 오프셋을 두고 단말기가 하향링크 신호를 수신하는 방법이 가능하다. 이러한 오프셋은 일정한 수의 가산 혹은 감산으로써 나타낼 수도 있고, HARQ 프로세스의 배수로써 표현될 수도 있다.

<62> 위의 방법에서 RACH가 2ms 혹은 3ms의 길이를 갖고 전송되는 경우, 항상 RACH 슬롯의 시작시간 위치에 대한 시간 위치에서부터 응답을 기다리는 시간을 추정하는 방법이 가능하다. 혹은 항상 RACH 슬롯이 끝나는 시간 위치에 대한 시간위치에서부터 응답을 기다리는 시간을 추정하는 방법이 가능하다.

<63> 이와 같이 미리 정해진 응답 수신 시간 위치를 통해서 각 단말기가 다른 단말기에 대한 응답을 자신에 대한 응답으로 잘못 수신하는 것을 방지할 수 있다. 이 방법을 사용할 경우, 오버헤드가 송수신되는 랜덤 데이터에 시그널링 오버헤드(signaling overhead)가 더 포함되지 않는다.

<64> 도 14는 본 발명의 일 실시예에 따른 단말기(1), 단말기(2), 및 기지국(3) 간의 랜덤 액세스 송수신 과정을 나타낸 도면이다.

<65> 단말기(1)와 단말기(2)는 각각, 단계 S1410 및 S1410'에서, PRACH 구성 및 프리앰블 포맷과 같은, 랜덤 액세스 채널 파라미터를 선택한다. PRACH 구성 및 프리앰블 포맷은 표 1 및 표 2에 나타난 구성 중 하나를 선택할 수 있다. 단말기(1)와 단말기(2)는 각각, 전송할 랜덤 액세스 프리앰블의 시퀀스 번호를 결정하여 랜덤 액세스 프리앰블에 반영한다. 이 실시예에서, 단말기(1)와 단말기(2)가 전송하는 랜덤 액세스 프리앰블 시퀀스 번호는 동일할 수도 있고 서로 다를 수도 있다. 단말기(1)와 단말기(2)는 각각, 단계 S1420 및 S1420'에서, 전송될 랜덤 액세스 프

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리앰블에 대한 랜덤 액세스 응답이 수신될 디폴트 시간 또는 디폴트 상향 서브프레임 구간을 미리 정한다. 이 디폴트 시간 또는 디폴트 상향 서브프레임 구간은, 기지국에서 처리 지연이 발생할 경우에는 변경될 수 있다. 이러한 변경은, 아래에 설명하겠지만, 기지국에서 처리 지연이 발생한 경우, 기지국에서 처리 지연 시간에 관한 정보를 랜덤 액세스 응답에 포함하여 전송함으로써 행해질 수 있다. 단말기(1)가 랜덤 액세스 프리앰블을 전송하는 시점은 단말기(2)가 랜덤 액세스 프리앰블을 전송하는 시점과 서로 다를 수 있다. 이 실시예에서, 단말기(1) 및 단말기(2)가 전송하는 랜덤 액세스 프리앰블(RAP1, RAP2)들은, 각각 업링크 서브프레임 번호 sf_F_N=1 및 sf_F_N=2에 대응되는 시각에서 전송된다. 단말기(1)와 단말기(2)는 각각 랜덤 액세스 프리앰블을 단계 S1430 및 단계 S1430'에서 전송한다.

<66> 만일 기지국(3)이 임의의 랜덤 액세스 프리앰블(예컨대, RAP1, RAP2)을 수신하게 되면, 기지국(3)은 수신된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답(RAR1)을 전송한다. 이때, 도 7과 관련하여 상술한 바와 같이, 기지국이 모든 자원을 다른 처리에 사용하고 있어, 랜덤 액세스 요청에 대한 자원을 할당할 수 없는 경우에는 랜덤 액세스 응답을 송신할 때에 처리 지연이 발생할 수 있다. 이러한 처리 지연이 발생할 경우에, 기지국(3)은 처리 지연 시간에 관한 정보(timing offset)를 랜덤 액세스 응답에 포함시킬 수 있다(S1440). 그 후, 기지국(3)은 랜덤 액세스 응답(RAR1)을 전송한다(S1450). 전송되는 랜덤 액세스 응답은 단말기(1)과 단말기(2)에 모두 도달할 수 있다. 이 실시예에서, 기지국(3)은, 단말기(2)에 의해 전송된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 전송하기에

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앞서, 단말기(1)에 의해 전송된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답(RAR1)을 먼저 전송한다. 단말기(1)와 단말기(2)는, 각각 단계 S1460, S1460'에서 전송된 랜덤 액세스 응답을 수신한다. 단말기(1)와 단말기(2)는, 각각, 단계 S1460 및 S1460'에서, 수신된 랜덤 액세스 응답이 자신이 단계 S1420, S1420'에서 설정한 디폴트 시간에 수신된 것인지를 확인한다. 이하, 단말기(1)의 단계 S1460을 중심으로 설명한다.

<67> 수신된 랜덤 액세스 응답이, 단말기(1)가 설정한 디폴트 시간에 수신된 것으로 가정한다. 이때, 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답일 수도 있고, 그렇지 않을 수도 있다. 만일 수신된 랜덤 액세스 응답에 포함된 오프셋이 0(zero)인 경우, 기지국(3)에서의 처리 지연이 발생하지 않았다는 것을 나타내며, 따라서 단말기(1)가 설정한 디폴트 시간에 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답이라고 결정할 수 있다. 그러나, 만일 수신된 랜덤 액세스 응답에 포함된 오프셋이 0(zero)이 아닌 경우, 기지국(3)에서의 처리 지연이 발생한 것을 나타내며, 따라서 단말기(1)가 설정한 디폴트 시간에 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답이 아니라고 결정할 수 있다.

<68> 계속하여 단말기(1)의 단계 S1460을 중심으로 설명한다. 수신된 랜덤 액세스 응답이, 단말기(1)가 설정한 디폴트 시간에 수신되지 않은 것으로 가정한다. 이때, 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답일 수도 있고, 그렇지 않을 수도 있다. 만일 수신된 랜덤 액세스 응답에

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포함된 오프셋이 0(zero)인 경우, 기지국(3)에서의 처리 지연이 발생하지 않았다는 것을 나타낸다. 따라서, 단말기(1)는, 단말기(1)가 설정한 디폴트 시간에 랜덤 액세스 응답을 수신하였어야 한다. 따라서, 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답이 아니라고 결정할 수 있다. 반대로, 만일 수신된 랜덤 액세스 응답에 포함된 오프셋이 0(zero)이 아닌 경우, 기지국(3)에서의 처리 지연이 발생한 것을 나타내며, 따라서 단말기(1)가 설정한 디폴트 시간에 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답일 가능성이 있다고 판단할 수 있다. 단말기(1)가, 단계 S1420에 의해 예정되어 있던 시간보다 j 구간(또는, 서브프레임 개수 또는 시간) 후에 랜덤 액세스 응답을 수신하였다고 가정하자. 이때, 만일 수신된 랜덤 액세스 응답에 포함된 오프셋이 j 구간에 대응하는 것이라면, 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답인 것으로 결정된다. 반대로, 수신된 랜덤 액세스 응답에 포함된 오프셋이 j 구간에 대응하는 것이 아니라면, 수신된 랜덤 액세스 응답은 단말기(1)가 전송한 랜덤 액세스 프리앰블에 대한 응답이 아닌 것으로 결정된다.

<69> 이상에서 설명된 실시예들은 본 발명의 구성요소들과 특징들이 소정 형태로 결합된 것들이다. 각 구성요소 또는 특징은 별도의 명시적 언급이 없는 한 선택적인 것으로 고려되어야 한다. 각 구성요소 또는 특징은 다른 구성요소나 특징과 결합되지 않은 형태로 실시될 수 있다. 또한, 일부 구성요소들 및/또는 특징들을 결합하여 본 발명의 실시예를 구성하는 것도 가능하다. 본 발명의 실시예들에서 설

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명되는 동작들의 순서는 변경될 수 있다. 어느 실시예의 일부 구성이나 특징은 다른 실시예에 포함될 수 있고, 또는 다른 실시예의 대응하는 구성 또는 특징과 교체될 수 있다. 특허청구범위에서 명시적인 인용 관계가 있지 않은 청구항들을 결합하여 실시예를 구성하거나 출원 후의 보정에 의해 새로운 청구항으로 포함시킬 수 있음은 자명하다.

<70> 본 문서에서 본 발명의 실시예들은 기지국과 단말 간의 데이터 송수신 관계를 중심으로 설명되었다. 여기서, 기지국은 단말과 직접적으로 통신을 수행하는 네트워크의 종단 노드(terminal node)로서의 의미를 갖는다. 본 문서에서 기지국에 의해 수행되는 것으로 설명된 특정 동작은 경우에 따라서는 기지국의 상위 노드(upper node)에 의해 수행될 수도 있다. 즉, 기지국을 포함하는 다수의 네트워크 노드들(network nodes)로 이루어지는 네트워크에서 단말과의 통신을 위해 수행되는 다양한 동작들은 기지국 또는 기지국 이외의 다른 네트워크 노드들에 의해 수행될 수 있음은 자명하다. '기지국'은 고정국(fixed station), Node B, eNode B(eNB), 액세스 포인트(access point) 등의 용어에 의해 대체될 수 있다. 또한, '단말'은 UE(User Equipment), MS(Mobile Station), MSS(Mobile Subscriber Station) 등의 용어로 대체될 수 있다.

<71> 본 발명에 따른 실시예는 다양한 수단, 예를 들어, 하드웨어, 펌웨어(firmware), 소프트웨어 또는 그것들의 결합 등에 의해 구현될 수 있다. 하드웨어에 의한 구현의 경우, 본 발명의 일 실시예는 하나 또는 그 이상의 ASICs(application specific integrated circuits), DSPs(digital signal

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processors), DSPDs(digital signal processing devices), PLDs(programmable logic devices), FPGAs(field programmable gate arrays), 프로세서, 콘트롤러, 마이크로 콘트롤러, 마이크로 프로세서 등에 의해 구현될 수 있다.

<72> 펌웨어나 소프트웨어에 의한 구현의 경우, 본 발명의 일 실시예는 이상에서 설명된 기능 또는 동작들을 수행하는 모듈, 절차, 함수 등의 형태로 구현될 수 있다. 소프트웨어 코드는 메모리 유닛에 저장되어 프로세서에 의해 구동될 수 있다. 상기 메모리 유닛은 상기 프로세서 내부 또는 외부에 위치하여, 이미 공지된 다양한 수단에 의해 상기 프로세서와 데이터를 주고 받을 수 있다.

<73> 본 발명은 본 발명의 정신 및 필수적 특징을 벗어나지 않는 범위에서 다른 특정한 형태로 구체화될 수 있음은 당업자에게 자명하다. 따라서, 상기의 상세한 설명은 모든 면에서 제한적으로 해석되어서는 아니 되고 예시적인 것으로 고려되어야 한다. 본 발명의 범위는 첨부된 청구항의 합리적 해석에 의해 결정되어야 하고, 본 발명의 등가적 범위 내에서의 모든 변경은 본 발명의 범위에 포함된다.

【특허청구범위】

【청구항 1】

단말기가 랜덤 액세스 프리앰블을 전송하는 단계; 및

상기 단말기가 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 수신하는 단계

를 포함하며,

상기 단말기가 수신하는 상기 랜덤 액세스 응답에는, 상기 수신하는 랜덤 액세스 응답에 대응되는 랜덤 액세스 프리앰블이 전송된 시점에 관한 시간 관련 정보가 포함되어 있는,

랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【청구항 2】

제1항에 있어서,

상기 시간 관련 정보는, 상기 단말기가 상기 랜덤 액세스 프리앰블을 전송하는 시점의 서브프레임에 관련된 번호인,

랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【청구항 3】

제2항에 있어서,

상기 서브프레임에 관련된 번호는, 서브프레임 중 RACH(Random Access Channel) 슬롯이 존재하는 서브프레임에 대하여만 할당된 번호인,

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랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【청구항 4】

제3항에 있어서,

상기 할당은, 서브프레임 중 RACH 슬롯이 존재하는 서브프레임의 번호에 대한 모듈로(modulo) 연산에 의해 이루어지는,

랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【청구항 5】

제4항에 있어서,

상기 모듈로 연산은, 모듈로 4 연산인,

랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【청구항 6】

제1항에 있어서,

상기 시간 관련 정보는 셀 크기를 기초로 하여 추정된 것인

랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【청구항 7】

기지국이 랜덤 액세스 프리앰블을 수신하는 단계; 및

상기 기지국이 상기 수신된 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답을 전송하는 단계

를 포함하고,

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상기 전송하는 상기 랜덤 액세스 응답에는, 상기 수신된 랜덤 액세스 프리앰블이 전송된 시점에 관한 시간 관련 정보, 또는 상기 기지국이 상기 랜덤 액세스 프리앰블을 수신한 때로부터 상기 랜덤 액세스 응답을 전송하는데 소요되는 처리 지연 시간에 관련된 지연 오프셋 정보가 포함되어 있는,

랜덤 액세스 프리앰블의 수신 및 랜덤 액세스 응답의 전송 방법.

【청구항 8】

제7항에 있어서,

상기 전송된 시점은 셀 크기를 기초로 하여 상기 기지국이 추정한 것인,

랜덤 액세스 프리앰블의 수신 및 랜덤 액세스 응답의 전송 방법.

【청구항 9】

제7항에 있어서,

상기 수신된 랜덤 액세스 프리앰블에는, 상기 수신된 랜덤 액세스 프리앰블이 전송된 시점에 관한 시간 관련 정보가 포함되어 있고,

상기 전송하는 상기 랜덤 액세스 응답에 포함되어 있는 시간 관련 정보는, 상기 수신된 랜덤 액세스 요청에 포함되어 있는 시간 관련 정보와 연관된 것인,

랜덤 액세스 프리앰블의 수신 및 랜덤 액세스 응답의 전송 방법.

【청구항 10】

단말기가 랜덤 액세스 프리앰블을 전송하는 단계; 및

상기 단말기가 랜덤 액세스 응답을 수신하는 단계

를 포함하며,

상기 단말기가 상기 랜덤 액세스 응답을 수신하는 단계는, 상기 랜덤 액세스 프리앰블이 전송되는 시점 이후의 미리 결정된 시각을 포함하는 미리 결정된 시구간에서 수행되며,

상기 미리 결정된 시각은, 상기 랜덤 액세스 프리앰블이 전송되는 시점 이후로부터, HARQ(Hybrid Automatic Repeat Request) 프로세스 왕복 시간의 절반에 대응하는 시간에 미리 결정된 오프셋(offset) 시간을 가산한 시간이 경과한 시각인,

랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【청구항 11】

제10항에 있어서,

상기 랜덤 액세스 응답에는 지연 오프셋 정보가 포함되어 있고,

상기 지연 오프셋 정보는, 상기 미리 결정된 시구간을 변경하는데 사용되는,

랜덤 액세스 프리앰블의 전송 및 랜덤 액세스 응답의 수신 방법.

【도면의 간단한 설명】

<74> 도 1a 및 도 1b는, 랜덤 액세스 응답 방법의 일 예를 나타낸 것이다.

<75> 도 2a는, 광대역 무선 접속 시스템에서 사용되는 프레임 구조의 일 예를 나타낸 것이다.

<76> 도 2b는, 랜덤 액세스 프리앰블의 포맷의 일 예를 나타낸 것이다.

<77> 도 3a 및 도 3b는, 본 발명의 일 실시예에 의한, 시간 정보를 포함하는 랜덤

액세스 응답 방법을 설명하기 위한 도면이다.

<78> 도 4는, 본 발명의 다른 실시예에 의한, 랜덤 액세스 요청 및 랜덤 액세스 응답의 송수신 방법에 관한 순서도이다.

<79> 도 5a 및 도 5b는, 본 발명의 다른 실시예에 의한, RACH 슬롯이 2ms 주기를 가지는 경우에 대한, 시간 정보를 포함하는 랜덤 액세스 응답에 관한 도면이다.

<80> 도 6a 및 도 6b는, 본 발명의 실시예 중, RACH 슬롯이 2ms의 주기를 가지는 경우에, 지연된 랜덤 액세스 응답에 관한 도면이다.

<81> 도 7a 및 도 7b는, 본 발명의 다른 실시예에 의한, 번호 재정의(renumbering) 및 그룹화(grouping)을 설명하는 도면이다.

<82> 도 8은, 본 발명의 다른 실시예에 의한, 도 4의 단계 S420의 내부 처리 과정을 더 자세히 도시한 순서도이다.

<83> 도 9는, 본 발명의 다른 실시예에 의한, 랜덤 액세스 요청 및 랜덤 액세스 응답의 송수신 방법에 관한 순서도이다.

<84> 도 10은, 도 9의 단계 S920(S920')의 내부 처리과정을 더 자세히 설명한 도면이다.

<85> 도 11은, ARQ의 원리를 설명하기 위한 도면이다.

<86> 도 12는, HARQ의 원리를 설명하기 위한 도면이다.

<87> 도 13은, 본 발명의 다른 실시예에 관련된, HARQ 처리의 구체적인 예를 나타낸 도면이다.

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<88> 도 14는, 본 발명의 다른 실시예에 의한, 랜덤 액세스 요청 및 랜덤 액세스 응답의 송수신 방법에 관한 순서도이다.

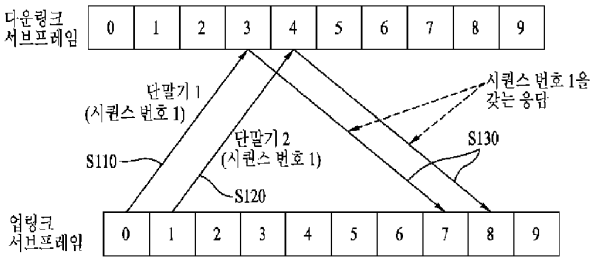
<89> 도 15는, 광대역 무선 접속 시스템에 있어서, 채널의 계층별 구분을 설명하기 위한 도면이다.

<90> 도 16은, 광대역 무선 접속 시스템에 있어서, 채널의 계층별 구간별 구분을 설명하기 위한 도면이다.

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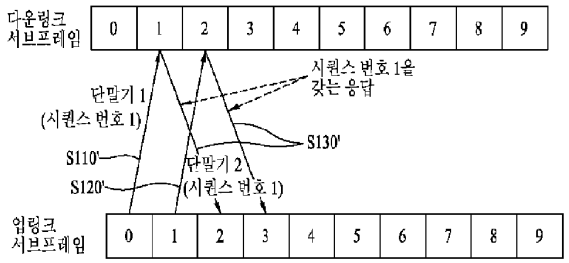
【도면】

【도 1a】



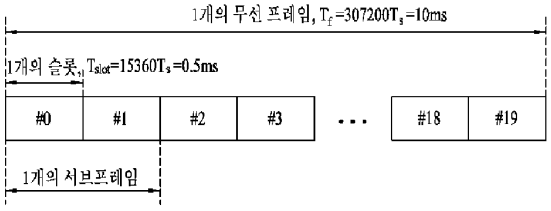
<랜덤 액세스 응답의 예>

【도 1b】



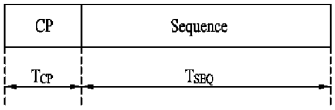
<랜덤 액세스 응답의 예>

【도 2a】



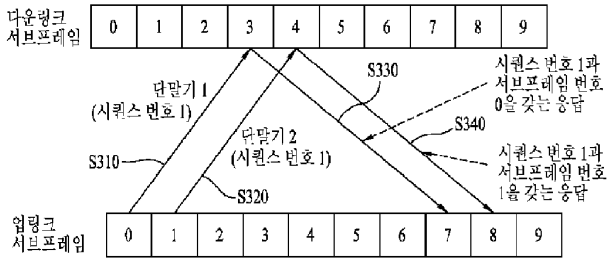
<프레임 구조 타입 1>

【도 2b】



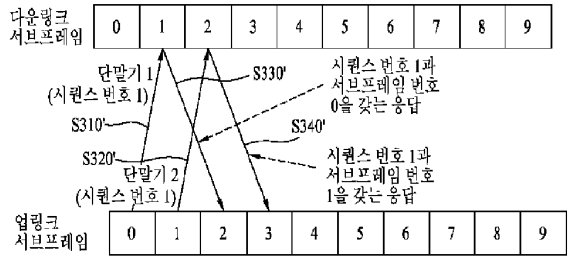
<랜덤 엑세스 프리앰블 포맷>

【도 3a】



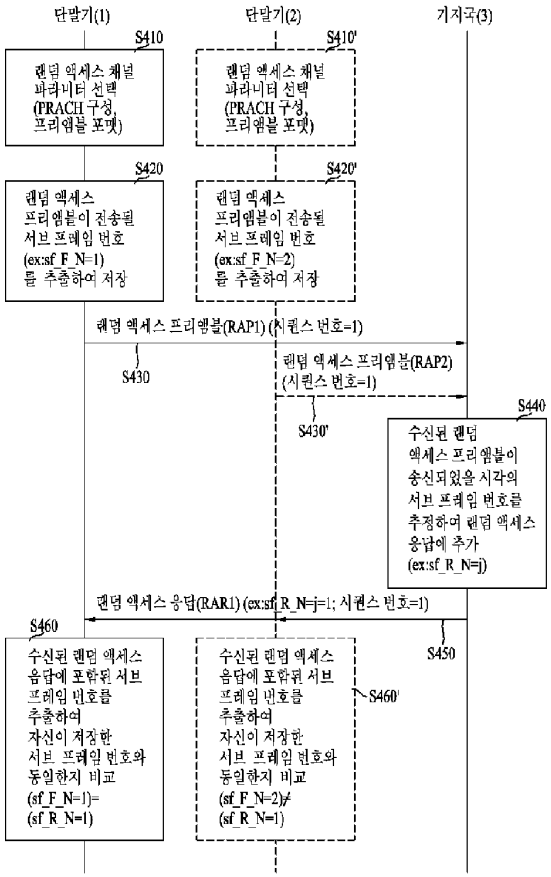
<시간 정보를 포함하는 응답의 예>

【도 3b】

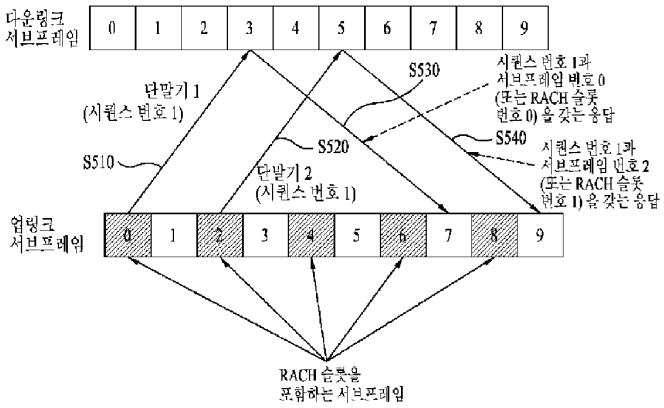


<시간 정보를 포함하는 응답의 예>

【도 4】

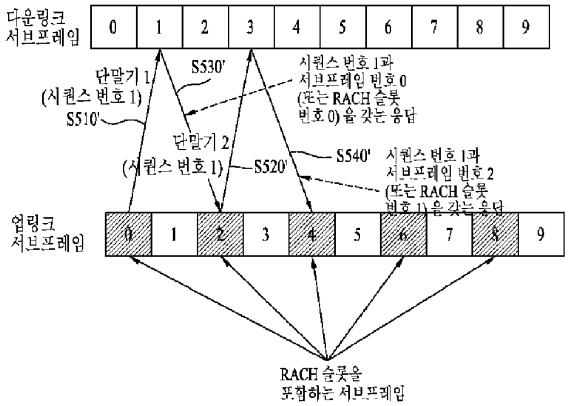

단말기(1)
단말기(2)
기지국(3)
S410
랜덤 액세스 채널 파라미터 선택 (PRACH 구성, 프리앰블 포맷)
S410'
랜덤 액세스 채널 파라미터 선택 (PRACH 구성, 프리앰블 포맷)
S420
랜덤 액세스 프리앰블이 전송될 서브 프레임 번호 (ex:sf_F_N=1) 를 추출하여 저장
S420'
랜덤 액세스 프리앰블이 전송될 서브 프레임 번호 (ex:sf_F_N=2) 를 추출하여 저장
랜덤 액세스 프리앰블(RAP1) (시퀀스 번호=1)
S430
랜덤 액세스 프리앰블(RAP2) (시퀀스 번호=1)
S430'
S440
수신된 랜덤 액세스 프리앰블이 송신되었을 시각의 서브 프레임 번호를 추정하여 랜덤 액세스 응답에 추가 (ex:sf_R_N=j)
랜덤 액세스 응답(RAR1) (ex:sf_R_N=j=1; 시퀀스 번호=1)
S450
S460
수신된 랜덤 액세스 응답에 포함된 서브 프레임 번호를 추출하여 자신이 저장한 서브 프레임 번호와 동일한지 비교 (sf_F_N=1)= (sf_R_N=1)
S460'
수신된 랜덤 액세스 응답에 포함된 서브 프레임 번호를 추출하여 자신이 저장한 서브 프레임 번호와 동일한지 비교 (sf_F_N=2)≠ (sf_R_N=1)

【도 5a】



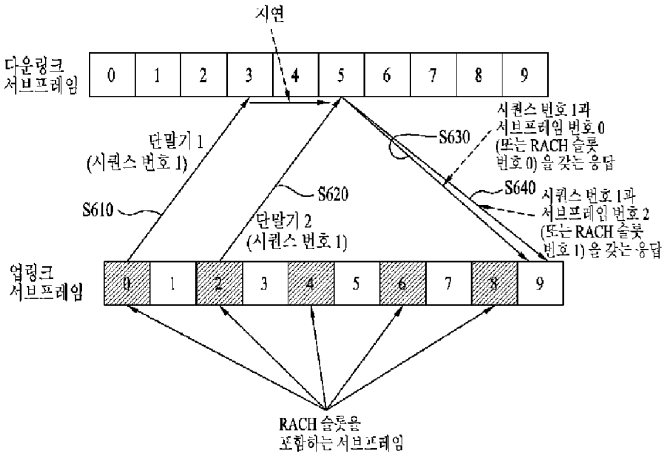
<RACH 슬롯이 2ms 주기를 가지는 경우에 대한, 시간 정보를 포함하는 응답의 예>

【도 5b】



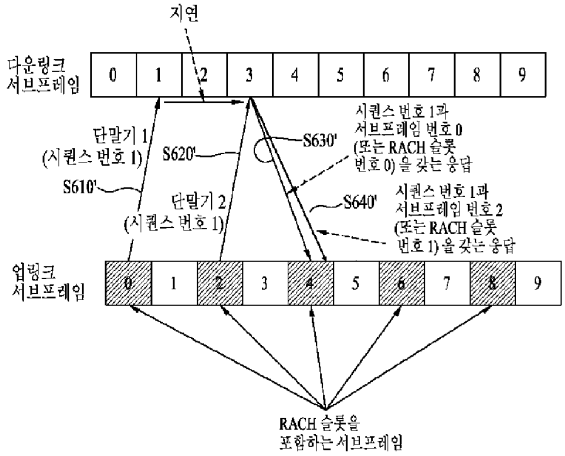
<RACH 슬롯이 2ms 주기를 가지는 경우에 대한, 시간 정보를 포함하는 응답의 예>

【도 6a】



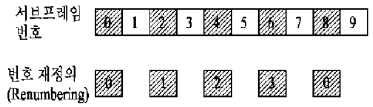
<RACH 슬롯이 2ms 주기를 가지는 경우에 대한, 지연된 응답의 예>

【도 6b】



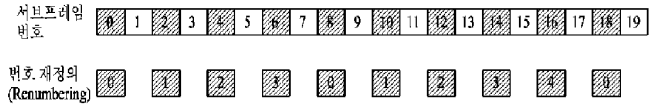
<RACH 슬롯이 2ms 주기를 가지는 경우에 대한, 지연된 응답의 예>

【도 7a】



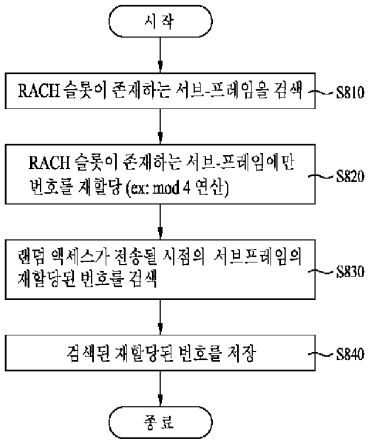
<번호 재정의(Renumbering) 및 그룹화(Grouping)
(또는 모듈러 연산(Modular Operation)>

【도 7b】

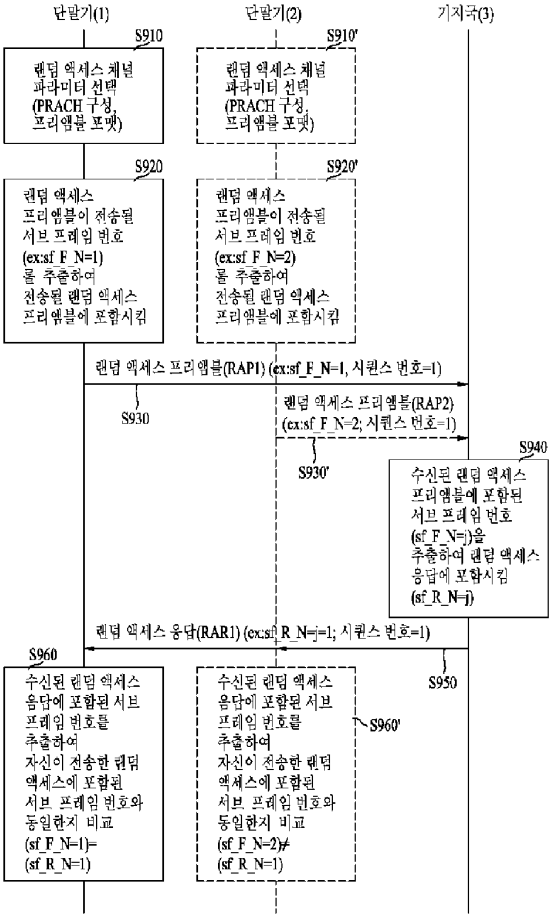


<번호 재정의(Renumbering) 및 그룹화(Grouping)
(또는 모듈러 연산(Modular Operation)>

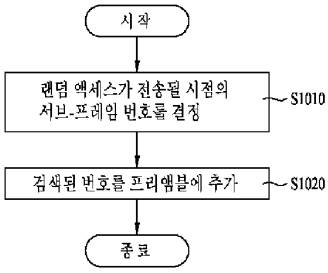
【도 8】



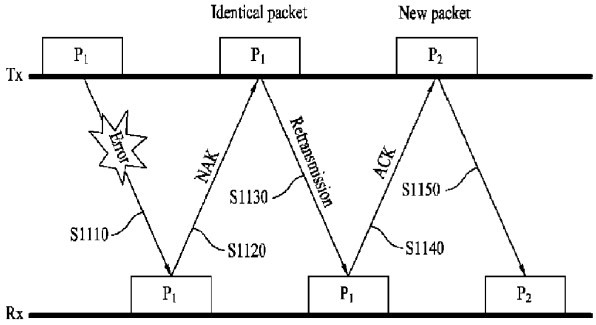
【도 9】


단말기(1)
단말기(2)
기지국(3)
S910
랜덤 액세스 채널 파라미터 선택 (PRACH 구성, 프리앰블 포맷)
S910'
랜덤 액세스 채널 파라미터 선택 (PRACH 구성, 프리앰블 포맷)
S920
랜덤 액세스 프리앰블이 전송될 서브 프레임 번호 (ex:sf_F_N=1) 를 추출하여 전송될 랜덤 액세스 프리앰블에 포함시킴
S920'
랜덤 액세스 프리앰블이 전송될 서브 프레임 번호 (ex:sf_F_N=2) 를 추출하여 전송될 랜덤 액세스 프리앰블에 포함시킴
랜덤 액세스 프리앰블(RAP1) (ex:sf_F_N=1, 시퀀스 번호=1)
S930
랜덤 액세스 프리앰블(RAP2) (ex:sf_F_N=2; 시퀀스 번호=1)
S930'
S940
수신된 랜덤 액세스 프리앰블에 포함된 서브 프레임 번호 (sf_F_N=j)을 추출하여 랜덤 액세스 응답에 포함시킴 (sf_R_N=j)
랜덤 액세스 응답(RAR1) (ex:sf_R_N=j=1; 시퀀스 번호=1)
S960
수신된 랜덤 액세스 응답에 포함된 서브 프레임 번호를 추출하여 자신이 전송한 랜덤 액세스에 포함된 서브 프레임 번호와 동일한지 비교 (sf_F_N=1)= (sf_R_N=1)
수신된 랜덤 액세스 응답에 포함된 서브 프레임 번호를 추출하여 자신이 전송한 랜덤 액세스에 포함된 서브 프레임 번호와 동일한지 비교 (sf_F_N=2)≠ (sf_R_N=1)
S960'
S950

【도 10】

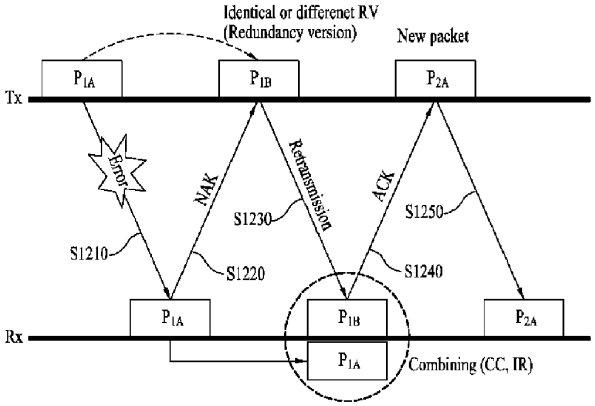


【도 11】



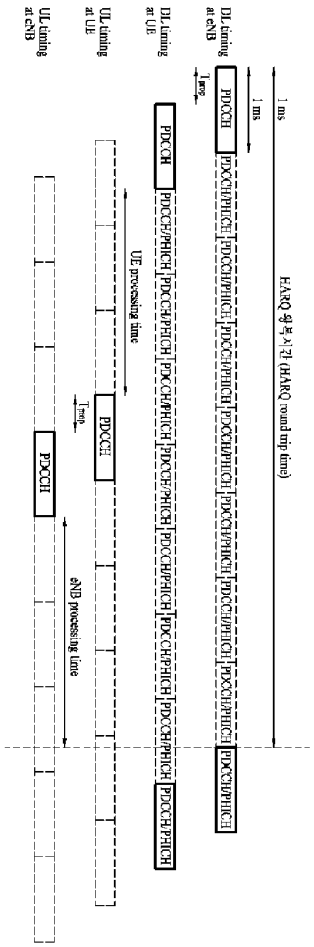
<ARQ의 원리>

【도 12】


Identical or differenet RV
(Redundancy version)
New packet
Tx
Rx
P_{1A}
P_{1B}
P_{2A}
Error
NAK
Retransmission
ACK
S1210
S1220
S1230
S1240
S1250
Combining (CC, IR)

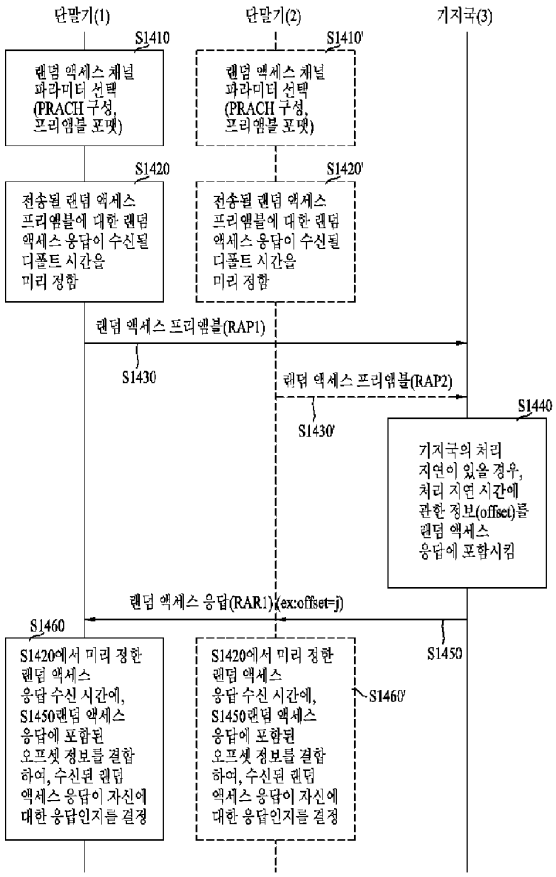
<HARQ의 원리>

【도 13】

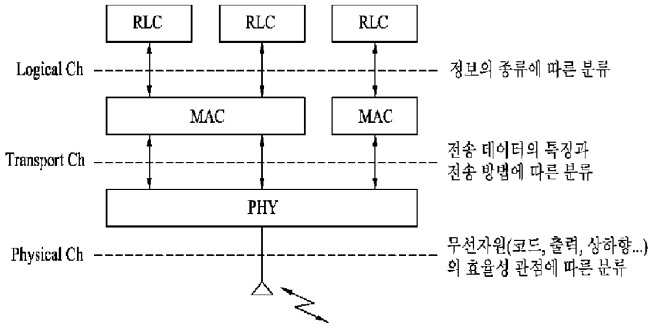

DL timing at eNB
DL timing at UE
UL timing at UE
UL timing at eNB
1 ms
1 ms
1 ms
PDCCH
PDCCH/PHICH
HARQ 송신 시간 (HARQ round trip time)
UE processing time
eNB processing time

<HARQ 처리 예 >

【도 14】

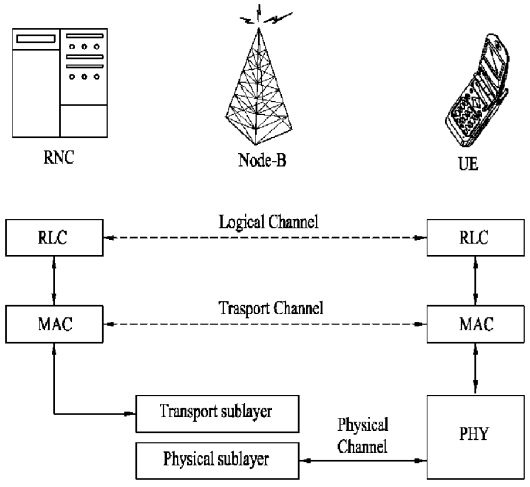

단말기(1)
단말기(2)
기지국(3)
S1410
랜덤 액세스 채널 파라미터 선택 (PRACH 구성, 프리앰블 포맷)
S1410'
랜덤 액세스 채널 파라미터 선택 (PRACH 구성, 프리앰블 포맷)
S1420
전송될 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답이 수신될 디폴트 시간을 미리 정함
S1420'
전송될 랜덤 액세스 프리앰블에 대한 랜덤 액세스 응답이 수신될 디폴트 시간을 미리 정함
랜덤 액세스 프리앰블(RAP1)
S1430
랜덤 액세스 프리앰블(RAP2)
S1430'
S1440
기지국의 처리 지연이 있을 경우, 처리 지연 시간에 관한 정보(offset)를 랜덤 액세스 응답에 포함시킴
랜덤 액세스 응답(RAR1){ex:offset=j}
S1460
S1420에서 미리 정한 랜덤 액세스 응답 수신 시간에, S1450랜덤 액세스 응답에 포함된 오프셋 정보를 결합하여, 수신된 랜덤 액세스 응답이 자신에 대한 응답인지를 결정
S1450
S1420에서 미리 정한 랜덤 액세스 응답 수신 시간에, S1450랜덤 액세스 응답에 포함된 오프셋 정보를 결합하여, 수신된 랜덤 액세스 응답이 자신에 대한 응답인지를 결정
S1460'

【도 15】



<채널의 계층별 구분>

【도 16】



<채널의 계층별 구간별 구분>

PTO/SB/08a (01-10)
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Application Number	13340447
Filing Date	2011-12-29
First Named Inventor	Min Seok Noh
Art Unit	2473
Examiner Name	
Attorney Docket Number	2101-3617C1

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	1	7301921		2007-11-27	Heo	
	2	6014562		2000-01-11	Weiss	

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	1	20100323736		2010-12-23	Fischer et al.	
	2	20080232317		2008-09-25	Jen	
	3	20080139214		2008-06-12	SUN et al.	
	4	20080273610		2008-11-06	Malladi et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Art Unit	2473
	Examiner Name	
	Attorney Docket Number	2101-3617C1

	5	20100093386		2010-04-15	Damnjanovic et al.	
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	1	10-2007-0080552	KR		2007-08-10	LG Electronics Inc.		☐
	2	10-2007-0065101	KR		2007-06-22	Samsung Electronics Co., Ltd.		☐
	3	2007078165	WO		2007-07-12	LG Electronics Inc.		☐

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	Application Number	13340447
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	First Named Inventor	Min Seok Noh
	Art Unit	2473
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	Attorney Docket Number	2101-3617C1

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13340447
	Filing Date	2011-12-29
	First Named Inventor	Min Seok Noh
	Art Unit	2473
	Examiner Name	
	Attorney Docket Number	2101-3617C1

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Name/Print	David Majdali	Registration Number	53,257

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(19) KOREAN INTELLECTUAL PROPERTY OFFICE

KOREAN PATENT ABSTRACTS

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(21)Application number: 1020050125804
(22)Date of filing: 19.12.2005
(30)Priority: ..

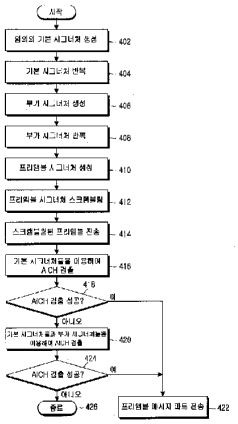
(51)Int. Cl H04B 1/69

(71)Applicant: SAMSUNG ELECTRONICS CO., LTD.

(72)Inventor: LEE, HYUN BAE
LIM, JONG HAN
MOON, HI CHAN

(54) METHOD AND AN APPARATUS FOR TRANSMITTING AND RECEIVING RACH PREAMBLES IN A UMTS, ESPECIALLY CONCERNED WITH TRANSMITTING AND RECEIVING A NEW RACH OR AICH PREAMBLE SIGNATURE IN ORDER TO IMPROVE RACH OR AICH PREAMBLE SIGNATURE DETECTION CAPABILITY

(57) Abstract:



PURPOSE: A method and an apparatus for transmitting and receiving RACH(Random Access CHannel) preambles in a UMTS(Universal Mobile Telecommunication System) are provided to increase an existing RACH preamble detection success rate and shorten RACH procedure delay time by enhancing and expanding the structure of an RACH preamble. CONSTITUTION: A mobile terminal selects an arbitrary access slot, and creates an 16-symbol arbitrary basic signature(402). The created basic signature is spread through 256 iterations(404). The mobile terminal creates a 4-symbol supplemental signature(406). The supplemental signature is also iterated 256 times (408). The mobile terminal concatenates the spread basic signatures with the spread supplemental signatures, creates preamble signatures, scrambles the created preamble signatures, and transmits the scrambled preamble signatures through the access slot(410-414). Then the mobile terminal attempts the detection of an AICH(Acquisition Indication CHannel) signature corresponding to the preamble signatures using the basic signatures(416). If the AICH signature is successfully detected, the mobile terminal transmits a preamble message part through an RACH(422).

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Legal Status
Date of request for an examination (00000000)
Notification date of refusal decision ( )
Final disposal of an application (application)
Date of final disposal of an application (00000000)
Patent registration number ( )
Date of registration ( )
Number of opposition against the grant of a patent ( )
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Number of trial against decision to refuse ( )
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(19)대한민국특허청(KR)
(12) 공개특허공보(A)

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H04B 1/69 (2006.01)

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(74) 대리인 이건주

전체 청구항 수 : 총 22 항

(54) UMTS에서 RACH 프리앰블의 송수신 방법 및 장치

(57) 요약

본 발명은 유엠티에스에서 이동국이 기지국에 접속하는 방법 및 장치에 관한 것으로, 특히 상기 접속 시에 소요되는 접속 시간을 감소시키기 위한 방법 및 장치에 관한 것이다. 본 발명에 따른 방법은 이동 단말로부터 RACH 프리앰블 시그너처를 수신하여 미리 정해지는 기본 시그너처 정보들을 이용하여 상기 수신된 프리앰블 시그너처의 검출을 시도하여 검출여부를 판단하는 과정과, 상기 판단 결과 상기 프리앰블 시그너처의 검출에 실패하였을 경우에는 상기 기본 시그너처 정보들과 미리 정해지는 부가 시그너처 정보들을 이용하여 상기 수신된 프리앰블 시그너처의 검출을 다시 시도하여 검출여부를 판단하는 과정과, 상기 판단결과 상기 프리앰블 시그너처의 검출에 성공을 하게 되면 상기 검출된 기본 시그너처와 상기 검출된 기본 시그너처에 대응하는 부가 시그너처를 포함하는 AICH 프리앰블을 생성하여 이동 단말로 전송하는 과정을 포함한다. 이와 같은 본 발명은 RACH 또는 AICH의 수신 성공률을 향상시켜주어 호 접속 시간의 단축 및 이동 단말의 소비 전력을 감소시켜주는 효과가 있다.

대표도

도 4

특허청구의 범위

청구항 1.

이동 단말이 기지국으로 RACH 프리앰블을 전송 하는 방법에 있어서,

ONEPLUS EXHIBIT 1019
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사용 가능한 시그너처들 중 임의의 제 1 시그너처를 생성하는 단계;

상기 제 1 시그너처의 인덱스를 나타내는 제 2 시그너처를 생성하는 단계;

상기 제 1 시그너처와 상기 제 2 시그너처를 결합하여 프리앰블 시그너처를 생성하는 단계;

상기 생성된 프리앰블 시그너처를 전송하는 단계를 포함하는 RACH 프리앰블 전송방법.

청구항 2.

제 1 항에 있어서, 제 1 시그너처들을 이용하여 AICH를 검출하는 단계;

상기 AICH가 검출이 되었을 경우, RACH 메시지 파트를 전송하는 단계;

상기 AICH가 검출이 되지 않았을 경우, 제 1 시그너처들과 제 2 시그너처들을 이용하여 AICH를 검출하는 단계;

상기 제 2 시그너처를 추가적으로 이용하여 AICH가 검출되었을 경우, RACH 메시지 파트를 전송하는 것을 특징으로 하는 RACH 프리앰블 전송방법.

청구항 3.

제 1 항에 있어서, 상기 제 2 시그너처는 상기 제 1 시그너처의 인덱스를 이진수로 변환하여 변환된 이진수에서 각각의 비트들을 심볼로 변환하여 구성되는 것을 특징으로 하는 방법.

청구항 4.

제 1 항에 있어서, 상기 제 1 시그너처는 16 심볼로 구성되는 것을 특징으로 하는 방법.

청구항 5.

제 1 항에 있어서, 상기 제 2 시그너처는 4 심볼로 구성되는 것을 특징으로 하는 방법.

청구항 6.

제 1 항에 있어서, 상기 이용 가능한 시그너처들은 16 종류로 구성되는 것을 특징으로 하는 방법.

청구항 7.

기지국에서 RACH 프리앰블을 수신하는 방법에 있어서,

미리 저장하고 있는 제 1 시그너처들을 이용하여 RACH 프리앰블 시그너처를 검출하는 단계;

상기 검출결과 RACH 프리앰블 시그너처가 검출되었을 경우, 상기 검출된 프리앰블 시그너처를 이용하여 AICH을 생성하여 전송하는 단계;

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상기 검출결과 RACH 프리앰블 시그너처가 검출되지 않았을 경우, 상기 제 1 시그너처들과 미리 저장하고 있는 제 2 시그너처들을 이용하여 상기 수신된 프리앰블의 시그너처를 검출하는 단계;

상기 제 1 시그너처들과 상기 제 2 시그너처들을 이용하여 시그너처가 검출되었을 경우, 상기 검출된 시그너처를 이용하여 AICH를 생성하여 전송하는 단계를 포함하는 RACH 프리앰블 수신 방법.

청구항 8.

제 7 항에 있어서, 상기 프리앰블 시그너처는 16 심볼의 제 1 시그너처와 4 심볼의 제 2 시그너처로 구성되는 것을 특징으로 하는 방법.

청구항 9.

제 8 항에 있어서, 상기 제 2 시그너처는 상기 제 1 시그너처의 인덱스를 이진수로 변환하여 변환된 이진수에서 각각의 비트들을 심볼로 변환하여 구성되는 것을 특징으로 하는 방법.

청구항 10.

제 7 항에 있어서, 상기 제 1 시그너처들은 16 종류로 구성되는 것을 특징으로 하는 방법.

청구항 11.

제 7 항에 있어서, 상기 제 2 시그너처들은 16 종류로 구성되는 것을 특징으로 하는 방법.

청구항 12.

이동 단말이 기지국으로 RACH 프리앰블을 전송 하는 장치에 있어서,

이용 가능한 시그너처들 중 임의의 제 1 시그너처를 생성하고 상기 제 1 시그너처의 인덱스를 이용하여 제 2 시그너처를 생성하는 생성부와;

상기 생성된 제 1 시그너처를 반복하는 제 1 반복부와;

상기 생성된 제 2 시그너처를 반복하는 제 2 반복부와;

반복된 제 1 시그너처와 제 2 시그너처를 결합하여 프리앰블 시그너처를 생성하는 결합부와;

상기 생성된 프리앰블 시그너처를 스크램블링하는 스크램블러와;

스크램블링된 상기 프리앰블 시그너처를 전송하는 송수신부를 포함하는 RACH 프리앰블 전송 장치.

청구항 13.

제 12 항에 있어서, 상기 제 2 시그너처는 상기 제 1 시그너처의 인덱스를 이진수로 변환하여 변환된 이진수에서 각각의 비트들을 심볼로 변환하여 구성되는 것을 특징으로 하는 장치.

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청구항 14.

제 12 항에 있어서, 상기 제 1 시그너처는 16 심볼로 구성되는 것을 특징으로 하는 장치.

청구항 15.

제 12 항에 있어서, 상기 제 2 시그너처는 4 심볼로 구성되는 것을 특징으로 하는 장치.

청구항 16.

제 12 항에 있어서, 상기 이용 가능한 시그너처들은 16 종류로 구성되는 것을 특징으로 하는 장치.

청구항 17.

기지국에서 RACH 프리앰블을 수신하는 장치에 있어서,

상기 기지국으로부터 RACH 프리앰블을 수신하는 수신부와;

상기 수신된 RACH 프리앰블을 디스크램블링하는 디스크램블러와;

상기 디스크램블링된 RACH 프리앰블을 결합하여 RACH 프리앰블 시그너처를 얻는 결합부와;

상기 프리앰블 시그너처를 제 1 시그너처와 제 2 시그너처로 분할하는 분할부와;

제 1 시그너처들을 이용하여 상기 프리앰블 시그너처를 검출하거나 제 1 시그너처들과 제 2 시그너처들을 이용하여 상기 프리앰블 시그너처를 검출하는 검출부와;

상기 검출된 프리앰블 시그너처를 이용하여 AICH를 생성하여 전송하는 단계를 포함하는 RACH 프리앰블 수신 장치.

청구항 18.

제 17 항에 있어서, 상기 제 2 시그너처는 상기 제 1 시그너처의 인덱스를 이진수로 변환하여 변환된 이진수에서 각각의 비트들을 심볼로 변환하여 구성되는 것을 특징으로 하는 장치.

청구항 19.

제 17 항에 있어서, 상기 제 1 시그너처는 16 심볼로 구성되는 것을 특징으로 하는 장치.

청구항 20.

제 17 항에 있어서, 상기 제 2 시그너처는 4 심볼로 구성되는 것을 특징으로 하는 장치.

청구항 21.

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제 17 항에 있어서, 상기 제 1 시그너처들은 16 종류로 구성되는 것을 특징으로 하는 장치.

청구항 22.

제 17 항에 있어서, 상기 제 2 시그너처들은 16 종류로 구성되는 것을 특징으로 하는 장치.

명세서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 UMTS(Universal Mobile Telecommunication system) 시스템에 관한 것으로서, 특히 이동 단말이 기지국을 접속하는 방법 및 장치에 관한 것이다.

WCDMA(Wideband Code Division Multiple Access) 혹은 CDMA2000(Code Division Multiple Access 2000) 과 같은 무선 이동통신 시스템에서는 단말이 호 연결을 요구하거나, 짧은 사용자 패킷 전송 등 컨트롤 정보를 전송하기 위한 목적으로 업링크로 랜덤 액세스 채널을 사용한다. 이때 전송되는 랜덤 액세스 채널은 크게 두 부분, 즉 실제 정보전송을 위한 메시지 부분(RACH message part)과 기지국이 메시지를 받을 수 있도록 하기위해 메시지 이전에 보내지는 프리앰블(RACH Preamble)로 구성된다.

이동 단말은 랜덤 액세스 채널을 통해 데이터를 전송하기에 앞서서 특별한 용도로 활용되는 프리앰블을 전송한다. 이 프리앰블은 길이가 256인 확산코드를 사용하고 16개의 심볼들을 포함하는 시그너처로 구성된다. 따라서, 확산된 프리앰블은 모두 4096개의 칩으로 구성된다. 상기 프리앰블에 대한 기지국으로부터의 응답이 AICH를 통해 수신된 이후 단말은 10ms 또는 20ms 의 길이에 해당하는 메시지 부분을 전송한다. 메시지 부분은 요구되는 데이터 량에 따라 256~32까지의 확산코드를 사용한다. 승인인지채널 (Acquisition Indication Channel)은 단말로부터 보내 온 프리앰블을 검출 성공하여, 액세스 채널 시그너처(signature)를 받았음을 알려주는 채널이다. AICH에 사용되는 확산코드의 길이는 256이며, 16개의 심볼로 이루어져 있다. AICH에서 전송되는 시그너처는 단말로부터 수신한 랜덤 액세스 프리앰블과 동일한 시그너처를 사용하며, 역시 4096칩으로 확산된다.

현재 WCDMA 시스템에서 사용되는 랜덤 액세스 방식은 slotted-ALOHA 방식으로 미리 규정된 액세스 슬롯들 중에서 랜덤하게 액세스 슬롯을 결정하고, 결정된 액세스 슬롯에서는 미리 규정된 여러개의 시그너처 중 슬롯에 랜덤한 시그너처를 선택하여 전송한다. 이렇게 전송되어진 프리앰블을 기지국이 일정 에너지 이상으로 검출하면 액세스를 허용한다는 의미로 AICH 프리앰블을 전송하게 된다. CDMA 시스템에서의 랜덤 액세스 프로시져는 초기 전송시 전송파워에 대한 정확한 정보가 없기 때문에, 근원(near-far) 문제에 직면하게 된다. 이 문제에 대처하기 위해 개루프 전력제어(Open-loop power control)이 적용되는데, 이는 초기 파워로 RACH 프리앰블을 전송한 이후 하향링크로 AICH 프리앰블을 받기 전까지 일정 횟수 동안 RACH의 파워를 높여가는 방식이다.

도 1은 종래의 RACH 전송 과정을 나타낸 구성도이다.

이동 단말은 선택된 RACH 프리앰블 시그너처를 반복 및 스크램블링 과정을 거쳐 생성된 4096칩의 RACH 프리앰블(102)을 RACH를 통해 기지국으로 전송하게 된다. RACH 프리앰블(102)을 전송한 뒤 일정 시간내에 AICH를 통해 상기 RACH 프리앰블(102)에 대응하는 응답 시그너처를 수신하지 못할 경우, 단말은 RACH의 전송 파워를 높여가며 RACH 프리앰블(106)을 재전송하여 준다. 상기 RACH 프리앰블(106)을 기지국이 수신에 성공을 하게 되면 기지국은 상기 RACH 프리앰블(106)의 시그너처를 포함하는 AICH 프리앰블(108)을 이동단말로 전송하게 된다. 상기 이동 단말은 AICH 프리앰블(108)의 수신에 성공하면, RACH 메시지 파트(110)를 전송하게 된다.

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상기된 바와 같이 동작하는 종래 기술에 의한 RACH에 의한 기지국 접속에 있어서는, RACH 프리앰블의 초기 파워 설정에 따라 전체 랜덤 액세스 프로시져에 걸리는 시간이 많이 좌우된다. 단말의 입장에서 볼때 RACH 프로시져 지연은 최소화 할수록 유리하고 성공률은 높일수록 좋다. 이를 위해서는 단말에서 전송하는 RACH 프리앰블의 초기 파워를 크게 하면 되나, 이는 곧바로 상향링크의 간섭을 증가시켜 전체 시스템의 용량을 감소시키는 문제점이 있었다.

발명이 이루고자 하는 기술적 과제

따라서 상기한 바와 같이 동작되는 종래 기술의 문제점을 해결하기 위하여 창안된 본 발명은, RACH 또는 AICH 프리앰블 시그너처 검출 능력을 향상시키기 위하여 새로운 RACH 또는 AICH 프리앰블 시그너처를 송수신하는 방법 및 장치를 제공한다.

본 발명은, RACH 또는 AICH를 검출하는 시간을 단축하도록 하기 위하여 새로운 RACH 또는 AICH 프리앰블 시그너처를 송수신하는 방법 및 장치를 제공한다.

본 발명은, 이동 단말의 소비 전력을 감소하기 위하여 새로운 RACH 또는 AICH 프리앰블 시그너처를 송수신하는 방법 및 장치를 제공한다.

본 발명의 실시예는, 이동 단말이 기지국으로 RACH 프리앰블을 전송 하는 방법에 있어서,

사용 가능한 시그너처들 중 임의의 제 1 시그너처를 생성하는 단계;

상기 제 1 시그너처의 인덱스를 나타내는 제 2 시그너처를 생성하는 단계;

상기 제 1 시그너처와 상기 제 2 시그너처를 결합하여 프리앰블 시그너처를 생성하는 단계;

상기 생성된 프리앰블 시그너처를 전송하는 단계를 포함하는 RACH 프리앰블 전송방법;

본 발명의 다른 실시예는, 기지국에서 RACH 프리앰블을 수신하는 방법에 있어서,

미리 저장하고 있는 제 1 시그너처들을 이용하여 RACH 프리앰블 시그너처를 검출하는 단계;

상기 검출결과 RACH 프리앰블 시그너처가 검출되었을 경우, 상기 검출된 프리앰블 시그너처를 이용하여 AICH을 생성하여 전송하는 단계;

상기 검출결과 RACH 프리앰블 시그너처가 검출되지 않았을 경우, 상기 제 1 시그너처들과 미리 저장하고 있는 제 2 시그너처들을 이용하여 상기 수신된 프리앰블의 시그너처를 검출하는 단계;

상기 제 1 시그너처들과 상기 제 2 시그너처들을 이용하여 시그너처가 검출되었을 경우, 상기 검출된 시그너처를 이용하여 AICH를 생성하여 전송하는 단계를 포함하는 RACH 프리앰블 수신 방법.

발명의 구성

이하 첨부된 도면을 참조하여 본 발명의 바람직한 실시예에 대한 동작 원리를 상세히 설명한다. 하기에서 본 발명을 설명함에 있어 관련된 공지 기능 또는 구성에 대한 구체적인 설명이 본 발명의 요지를 불필요하게 흐릴 수 있다고 판단되는 경우에는 그 상세한 설명을 생략할 것이다. 그리고 후술되는 용어들은 본 발명에서의 기능을 고려하여 정의된 용어들로서 이는 사용자, 운용자의 의도 또는 관례 등에 따라 달라질 수 있다. 그러므로 그 정의는 본 명세서 전반에 걸친 내용을 토대로 내려져야 할 것이다.

이하 본 발명을 구체적으로 설명하는데 있어, 비동기식 WCDMA(Wideband Code Division Multiple Access) 시스템을 이용할 것이다. 하지만, 본 발명의 기본 목적인 기지국 접속 시간 단축 방법은 유사한 기술적 배경 및 채널형태를 가지는 여타의 이동통신시스템에도 본 발명의 범위를 크게 벗어나지 아니하는 범위에서 약간의 변형으로 적용 가능하며, 이는 본 발명의 분야에서 숙련된 기술적 지식을 가진 자의 판단으로 가능할 것이다.

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후술되는 본 발명의 주요한 요지는 RACH 또는 AICH 프리앰블 전송시 16심볼의 시그너처에 시그너처 인덱스와 같은 부가 정보를 부가하여 전송하는 것이다.

기존의 RACH 프리앰블은 16 심볼의 길이를 가지는시그너처를 길이 256짜리 확산코드를 사용함으로써 전체 4096칩에 해당하는 길이로 확산된 것이다. WCDMA에서 한 슬롯의 길이가 2560 칩이므로 RACH 프리앰블의 전체 길이는 2슬롯에 못미치는 1.6슬롯 길이에 해당한다. 2슬롯에 해당하는 총 심볼 수는 256 길이의 확산코드가 사용되므로 20심볼에 해당하며, 16 심볼 길이의 시그너처를 제외한 나머지 4개의 심볼구간 동안은 실제로 어떠한 신호도 전송하지 않는다. 본 발명의 바람직한 실시예에서는 이처럼 사용하지 않는 4 심볼 구간에 부가적인 정보를 실어 보낸다. 이때 이전 16 심볼 구간에는 기존에 사용하는 프리앰블 시그너처를 변경없이 사용한다.

도 2는 본 발명의 실시예에 따른 이동 단말의 RACH 프리앰블 시그너처 구성의 일 실시예이다. 도시된 바와 같이 16 심볼의 기본 시그너처에 부가적으로 4 심볼의 부가 시그너처를 추가하여 RACH 프리앰블의 시그너처를 생성한다.

도 3은 본 발명의 실시예에 따라 구성된 프리앰블 시그너처 심볼 시퀀스들을 도시하였다.

16개의 프리앰블 시그너처들 각각은, 미리정해지는 16심볼 길이의 기본 시그너처와 상기 기본 시그너처의 인덱스를 나타내는 4심볼의 부가 시그너처로 구성된다. 상기 프리앰블 시그너처들을 생성하는 동작을 설명하면 하기와 같다.

단말은 기지국에 의해 허용된 기본 시그너처들 중에서 랜덤하게 선택된 하나의 기본 시그너처의 인덱스를 이진수로 표현하여 4 심볼의 부가 정보를 얻는다. 예를 들어, 모든 기본 시그너처는 0~15번까지 인덱싱되어 있으며, 이중 선택된 기본 시그너처의 인덱스가 5번이라고 하면 이 값을 이진수로 변환하여 0x0101 로 표시할 수 있고, 각각의 비트들을 심볼로 변환하여 1, -1, 1, -1 로 심볼을 할당하게 된다. WCDMA 시스템에서 규정된 기본 시그너처의 갯수가 모두 16개이므로 상기 기본 시그너처의 인덱스는 4비트로 모두 표현이 가능하며, 상기 4 bit 중 '비트 0'은 '1'값으로, '비트 1'은 '-1' 값으로 대체하여 부가 시그너처로 삼는다. 이와 같이 부가 시그너처를 기본 시그너처에 더하여 최종 프리앰블 시그너처가 생성된다. 기본 시그너처의 부가정보인 부가 시그너처로는 여러 가지 정보가 사용될수 있으며, 위의 예제에서는 시그너처 인덱스를 바이너리 코딩한 것을 사용하였다. 셀 내에서 허용된 기본 시그너처가 16개이하인 경우 프리앰블 시그너처는 상기 기본 시그너처를 반복하여 구성될 수 있다.

도 4는 본 발명의 실시예에 따른 이동 단말의 RACH 프리앰블 송신 흐름도이다.

이동 단말은 (402)단계에서 현재 이용 가능한 억세스 슬롯들 중 임의의 억세스 슬롯을 선택한 후, 전송 가능한 모든 16 심볼의 기본 시그너처들 중 임의의 기본 시그너처를 생성한다. (404)단계에서 상기 생성된 기본 시그너처는 256번의 반복을 통하여 확산된다. (406)단계에서 단말은 프리엠블 시그너처의 검출에 추가 적용될 수 있는 부가정보인 4 심볼의 부가 시그너처를 생성한다. 일예로서상기 부가 시그너처는 상기 생성된 기본 시그너처의 인덱스를 나타낸다. (408)단계에서 상기 부가 시그너처는 상기 기본 시그너처와 같이 256번 반복된다. (410)단계에서 이동 단말은 상기 확산된 기본 시그너처와 확산된 부가 시그너처를 연접하여 프리앰블 시그너처를 생성한다. (412)단계에서는 상기 프리앰블 시그너처가 스크램블링된다. (414)단계에서 상기 스크램블링된 프리앰블 시그너처는 RACH의 상기 억세스 슬롯을 통해 전송된다.

이동 단말은 상기 스크램블링된 프리앰블 시그너처를 전송 한 후 미리 정해진 시간이후 상기 생성한 기본 시그너처만을 이용하여 (416)단계에서 상기 프리앰블 시그너처에 해당하는 AICH 시그너처의 검출을 시도하게 된다. (418)단계에서 이동 단말은 상기 기본 시그너처를 이용한 AICH 검출이 성공하였는지를 판단한다. 상기 판단결과 AICH 검출이 성공하였을 경우, (422)단계에서 RACH를 통해 프리앰블 메시지 파트를 전송한다. (418)단계에서 AICH 검출이 실패하였을 경우에는, (420)단계에서 상기 기본 시그너처와 상기 부가 시그너처를 이용하여 AICH의 검출을 다시 시도한다. (424)단계에서 AICH 검출 성공 여부를 다시 판단하여 검출에 성공을 하였을 경우에는 (422)단계에서 프리앰블 메시지 파트를 전송한다.

도 5는 본 발명의 실시예에 따른 기지국의 RACH 프리앰블 수신 흐름도이다.

기지국은 (502)단계에서 이동 단말로부터 RACH 프리앰블을 수신한다. (504)단계에서 상기 수신된 프리앰블은 디스크램블링 및 결합되어 프리앰블 시그너처로서 수신된다. (506)단계에서는 미리 저장되어 있는 기본 시그너처들을 이용하여 상기 수신된 프리앰블 시그너처를 검출한다. (508)단계에서는 미리 저장되어 있는 기본 시그너처들과 상기 수신된 프리앰블 시그너처를 비교하여 수신된 프리앰블 시그너처와 상기 기본 시그너처들과 일치하는 시그너처가 있는지 여부를 판단하여 상기 프리앰블 시그너처의 검출 성공여부를 판단한다. (508)단계에서 상기 프리앰블 시그너처의 검출에 실패하였을 경우, (510)단계에서 상기 기본 시그너처들과 상기 기본 시그너처들에 대응하는 부가 시그너처들을 이용하여 RACH 프리앰블

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시그너처 검출을 다시 시도한다. (512)단계에서는 (510)단계에서의 검출이 성공하였는지를 판단한다. (508)단계 또는 (512)단계에서 검출 성공여부 판단결과 RACH 프리앰블 검출에 성공을 하게 되면, (514)단계에서 상기 검출된 기본 시그너처와 해당 부가 시그너처를 포함하는 AICH 프리앰블을 생성한다. (516)단계에서는 생성된 AICH 프리앰블을 AICH를 통해 이동 단말로 전송을 한다.

도 6은 본 발명의 실시예에 따른 이동 단말의 RACH 프리앰블 전송부의 블록구성도이다.

상기 도 6에서 생성부(602)는 미리 저장하고 있는 유효한 모든 시그너처들 중 임의의 기본 시그너처를 선택한 뒤, 상기 선택된 기본 시그너처의 인덱스를 나타내는 부가 시그너처를 생성하여 RACH 프리앰블로서 전송하고자 하는 최종 프리앰블 시그너처를 생성하는 부분이다. 상기 생성부(602)에서 선택된 상기 기본 시그너처는 제 1 반복부(604)에서 일정한 반복률에 따라 반복이 되고, 상기 생성부(602)에서 생성된 부가 시그너처는 제 2 반복부(606)에서 일정한 반복률에 따라 반복이 된다. 제 1 및 제 2 반복부(604)(606)에서 각각 반복된 시그너처들은 결합부(608)에서 결합하여 프리앰블 시그너처를 생성하며, 스크램블러(610)는 상기 프리앰블 시그너처를 스크램블링하여 송수신부(612)에 의해 RACH를 통해 기지국으로 전송한다.

도 7은 본 발명의 실시예에 따른 기지국의 RACH 프리앰블수신부의 블록구성도이다.

기지국 수신부(702)는 이동 단말로부터 RACH 프리앰블을 수신하며 디스크램블러(704)에 의해서 상기 RACH 프리앰블을 디스크램블링 하여준다. 상기 디스크램블링된 신호는 결합부(706)에서 이동단말에서 반복된 횟수만큼 결합된 후 프리앰블 시그너처의 시퀀스로서 출력된다. 상기 프리앰블 시그너처는 분할부(708)에서 상위 16 심볼인 기본 시그너처와 하위 4 심볼인 부가 시그너처로 분할된다. 검출부(710)에서는 미리 저장하고 있는 기본 시그너처들을 이용하여 상기 수신된 프리앰블 시그너처의 검출을 시도한다. 상기 기본 시그너처 정보들을 이용하여 검출이 실패할 경우, 상기 기본 시그너처들과 부가 시그너처들을 이용하여 다시 프리앰블 시그너처 검출을 시도 하게 된다. 상기 검출결과 RACH 프리앰블 검출이 성공하게 되면, 검출된 RACH 프리앰블의 시그너처를 포함하는 AICH 프리앰블을 이동 단말로 전송하게 된다.

한편 본 발명의 상세한 설명에서는 구체적인 실시예에 관해 설명하였으나, 본 발명의 범위에서 벗어나지 않는 한도 내에서 여러 가지 변형이 가능함은 물론이다. 그러므로 본 발명의 범위는 설명된 실시예에 국한되지 않으며, 후술되는 특허청구의 범위뿐만 아니라 이 특허청구의 범위와 균등한 것들에 의해 정해져야 한다.

발명의 효과

이상에서 상세히 설명한 바와 같이 동작하는 본 발명에 있어서, 개시되는 발명중 대표적인 것에 의하여 얻어지는 효과를 간단히 설명하면 다음과 같다.

본 발명은,WCDMA 시스템에서 RACH 프리앰블의 구조를 개선 확장함으로써, 기존의 RACH 프리앰블 검출 성공률을 높이고 RACH 프로시져 지연 시간을 단축시킬 수 있는 것이다. 더구나 기존의 RACH 프로시져 구조에 전혀 변경이 가해지지 않으면서도, 간단한 확장을 통하여 호 성공률을 높일 수 있고, 궁극적으로는 시스템 용량증대에 도움을 줄 수 있다. 기존 구조의 확장임으로 인해 얻을 수 있는 또다른 효과는 본 발명이 적용되지 않은 현재의 WCDMA 시스템에도 무리없이 적용될 수 있다는 것이다. 즉, 본 발명의 구조를 적용한 단말이나 시스템이라면 기존의 단말이나 시스템에 비해 RACH 프로시져에 이득을 볼 수 있고, 따라서 전체적인 시스템 용량을 증대 할 수 있는 효과가 있다.

도면의 간단한 설명

도 1은 종래의 RACH 전송 과정을 나타낸 구성도이다.

도 2는 본 발명의 실시예에 따른 이동 단말의 RACH 프리앰블 시그너처 구성의 일 실시예이다.

도 3은 본 발명의 실시예에 따라 구성된 프리앰블 시그너처 심볼 시퀀스들의 표이다.

도 4는 본 발명의 실시예에 따른 이동 단말의 RACH 프리앰블 송신 흐름도이다.

도 5는 본 발명의 실시예에 따른 기지국의 RACH 프리앰블 수신 흐름도이다.

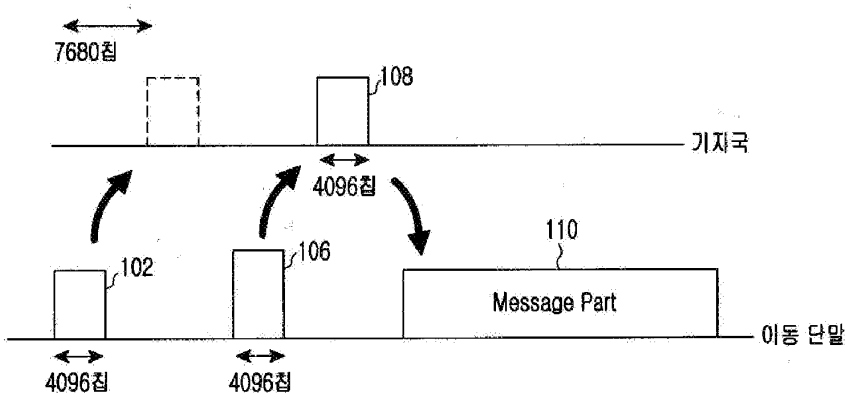
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도 6은 본 발명의 실시예에 따른 이동 단말의 RACH 프리앰블 전송부의 블록구성도이다.

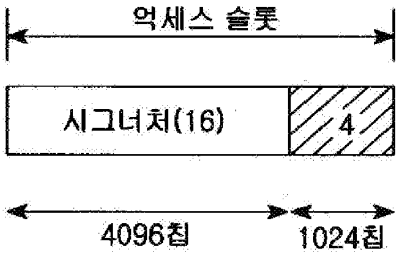
도 7은 본 발명의 실시예에 따른 기지국의 RACH 프리앰블 수신부의 블록구성도이다.

도면

도면1



도면2



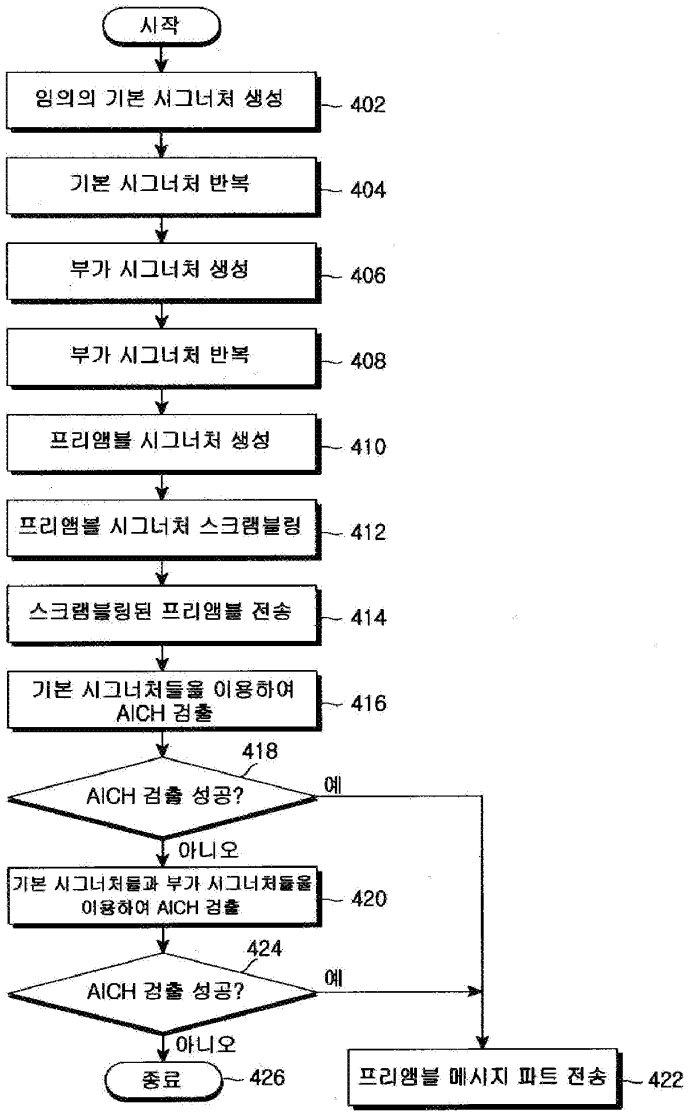
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도면3

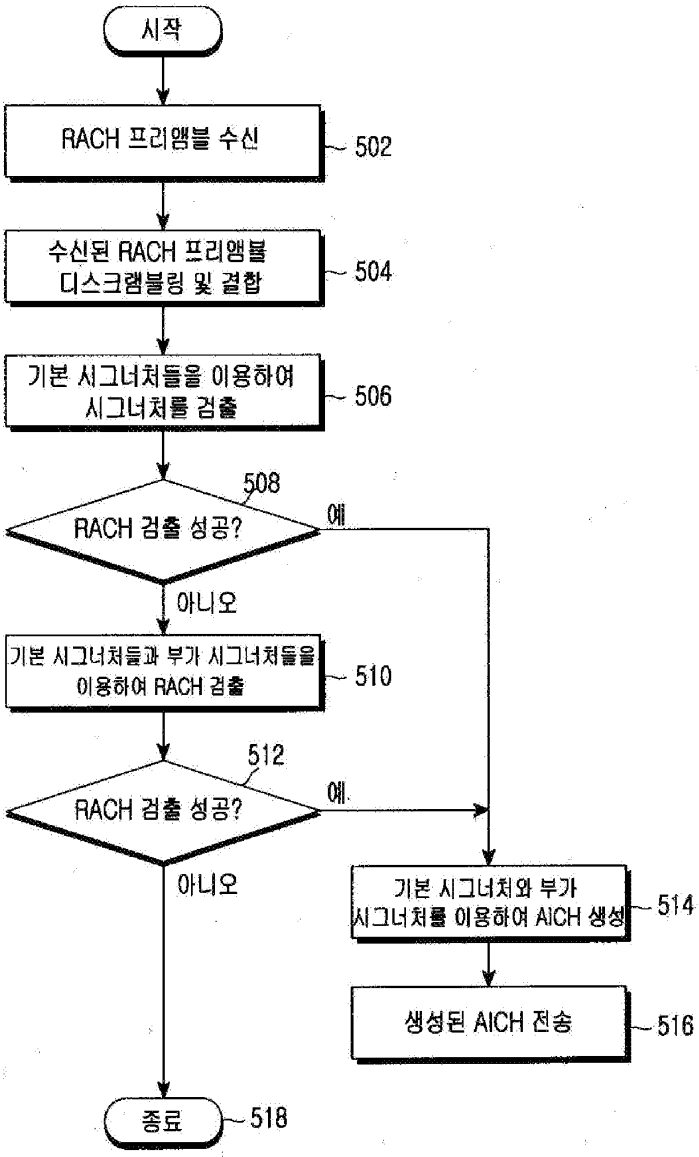
Preamble signature	value of n																			
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P0(n)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P1(n)	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	1	1	-1
P2(n)	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	1
P3(n)	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	1	-1	-1
P4(n)	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	-1	1	1
P5(n)	1	-1	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1	1	-1	1	-1
P6(n)	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	-1	-1	1
P7(n)	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1	1	-1	1	-1	-1	-1
P8(n)	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1
P9(n)	1	-1	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1	-1	1	1	-1
P10(n)	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	1	-1	1
P11(n)	1	-1	-1	1	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1	-1	1	-1	-1
P12(n)	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	1	1
P13(n)	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1	1	-1	1	-1	-1	-1	1	-1
P14(n)	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1	-1	1
P15(n)	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1	1	-1	-1	1	-1	-1	-1	-1

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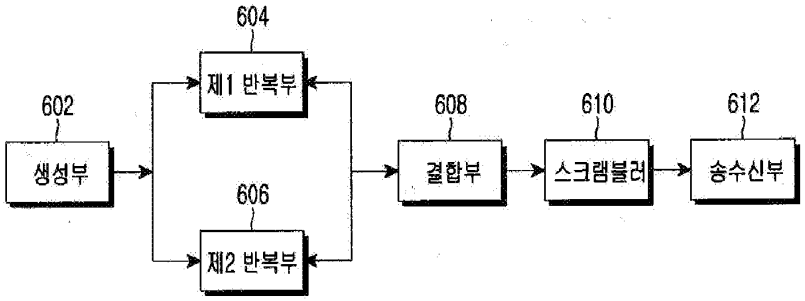
도면4


시작
임의의 기본 시그너처 생성
402
기본 시그너처 반복
404
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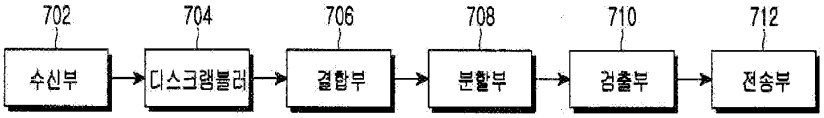
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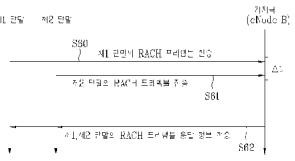
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(54) RESPONSE INFORMATION TRANSMISSION METHOD IN A MOBILE COMMUNICATION SYSTEM, PARTICULARLY CONCERNED IN BEING CAPABLE OF INCREASING EFFICIENCY OF RADIO RESOURCES BY REDUCING WASTED RADIO RESOURCES

(57) Abstract:



PURPOSE: A response information transmission method in a mobile communication system is provided to be capable of configuring response information on terminals which transmit RACH(Random Access Channel) preambles into one data unit through a common channel without individually sending the information, in order to deliver the configured information, thereby reducing a waste of radio resources. CONSTITUTION: RACH preambles are received from at least more than one terminal(S60,S61). A base station transmits response information on the received preambles through a common channel with which the at least more than one terminal is able to receive data by accessing(S62). The response information on the preambles consists of one data unit. The one data unit includes a header having length information of the response information and identifiers of the at least one terminal.

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(54) 이동 통신 시스템에서의 응답 정보 전송 방법

(57) 요약

본 발명에서는 기지국이 RACH 프리앰블의 응답정보를 단말로 전송할 때, 같거나 비슷한 시간에 RACH 프리앰블을 전송한 단말들에 대한 응답정보를 개별적으로 전송하지 않고, 공통의 채널을 통해서 하나의 데이터 단위로 구성하여 전달하는 것을 특징으로 하는 이동 통신 시스템을 제안한다. 그리고, 단말이 RACH를 통해 할당받은 상향링크의 무선자원으로 데이터를 기지국으로 전송할 때 HARQ 동작 방식이 사용된다면, 재전송을 위한 상향링크의 무선자원을 미리 단말로 할당해 주는 것이 아니라 HARQ의 첫 전송을 위한 무선자원을 할당하고, 재전송이 필요할 때는 NACK 신호와 함께 재전송에 필요한 무선자원을 다시 할당해주는 방법을 제안한다.

대표도

도 6

특허청구의 범위

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청구항 1.

적어도 하나 이상의 단말을 포함하는 이동 통신 시스템에서의 응답 정보 전송 방법에 있어서,

상기 적어도 하나 이상의 단말로부터 RACH(Random Access Channel) 프리앰블을 수신하는 단계;

수신된 프리앰블에 대한 응답 정보를 상기 적어도 하나 이상의 단말들이 모두 접근하여 데이터를 수신할 수 있는 공통 채널을 통해 전송하는 단계

를 포함하는 것을 특징으로 하는 응답 정보 전송 방법.

청구항 2.

제 1 항에 있어서,

상기 프리앰블에 대한 응답 정보는, 하나의 데이터 유닛(data unit)으로 구성되는 것을 특징으로 하는 응답 정보 전송 방법.

청구항 3.

제 1 항에 있어서,

상기 하나의 데이터 유닛은 적어도 하나의 단말의 식별자 및 응답정보의 길이 정보를 가지는 헤더를 포함하는 것을 특징으로 하는 응답 정보 전송 방법.

청구항 4.

제 1 항에 있어서,

상기 각 응답 정보는 해당 단말에 할당된 무선 자원에 대한 정보, 셀 내에서의 식별자 정보, 해당 단말에 대한 임시 식별자 정보 및 상기 기지국과의 시간 동기를 맞추기 위한 정보 중에서 적어도 하나를 포함하는 것을 특징으로 하는 응답 정보 전송 방법.

청구항 5.

제 1 항에 있어서,

상기 공통 채널은 하향링크의 공유 채널(Down Link Shared CHannel: DL-SCH)인 것을 특징으로 하는 응답 정보 전송 방법.

청구항 6.

제 1 항에 있어서,

상기 이동 통신 시스템에서 HARQ 방식을 사용하는 경우,

상기 적어도 하나 이상의 단말 중 제1 단말로부터 데이터를 수신하고 복조하는 단계;

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상기 수신 및 복조 중 적어도 하나에 실패한 경우 재전송을 위한 무선 자원을 할당한 정보를 포함한 상기 데이터에 대한 NACK 신호를 상기 제1 단말로 전송하는 단계;

상기 제1 단말에 할당된 무선 자원을 통해서 재전송된 데이터를 수신하는 단계

를 더 포함하는 것을 특징으로 하는 응답 정보 전송 방법.

명세서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 이동 통신 시스템에 관한 것으로 보다 구체적으로는 이동 통신 시스템에서 응답 정보를 전송하는 방법에 관한 것이다.

도 1은 이동 통신 시스템인 LTE(Long Term Evolution) 시스템의 망 구조를 설명하기 위한 도면이다. LTE시스템은 기존 UMTS시스템에서 진화한 시스템으로 현재 3GPP에서 기초적인 표준화 작업을 진행하고 있다.

LTE망은 크게 E-UTRAN과 CN(Core Network)으로 구분할 수 있다. E-UTRAN은 적어도 하나의 기지국(eNode B)을 포함하여 구성된다. 그리고, 망의 종단에 위치하여 외부망과 연결되는 접속 게이트웨이(Access Gateway: 이하 AG로 약칭)를 포함한다. AG는 사용자 트래픽을 처리하는 부분과 제어용 트래픽을 처리하는 부분을 포함하여 이루어진다. 이때는 새로운 사용자 트래픽을 처리하는 AG 부분과 제어용 트래픽을 처리하는 AG 부분 사이에 새로운 인터페이스를 사용하여 서로 통신을 할 수 있다. 하나의 기지국에는 하나 이상의 셀(Cell)을 포함하여 이루어질 수 있다. 기지국 간에는 사용자 트래픽 혹은 제어 트래픽 전송을 위한 인터페이스가 사용된다. CN은 AG와 기타 UE의 사용자 등록 등을 위한 노드 등을 포함한다. 또한, E-UTRAN과 CN을 구분하기 위해 인터페이스가 사용될 수 있다.

도 2 및 도 3은 3GPP 무선접속망 규격을 기반으로 한 단말과 UTRAN (UMTS Terrestrial Radio Access Network) 사이의 무선 인터페이스 프로토콜 (Radio Interface Protocol)의 구조를 나타낸다.

무선 인터페이스 프로토콜은 수평적으로 물리 계층(Physical Layer), 데이터링크 계층(Data Link Layer) 및 네트워크 계층(Network Layer)으로 이루어지며, 수직적으로는 데이터정보 전송을 위한 사용자 평면(User Plane)과 제어신호(Signaling) 전송을 위한 제어 평면(Control Plane)으로 구분된다. 프로토콜 계층들은 통신시스템에서 널리 알려진 개방형 시스템 간 상호접속 (Open System Interconnection; OSI)기준모델의 하위 3개 계층을 바탕으로 L1 (제1계층), L2 (제2계층), L3(제3계층)로 구분될 수 있다. 이 중에서 제1계층에 속하는 물리계층은 물리채널(Physical Channel)을 이용한 정보 전송 서비스(Information Transfer Service)를 제공하며, 제3계층에 위치하는 무선 자원 제어(Radio Resource Control; 이하 RRC라 약칭함)계층은 단말과 망간에 무선 자원을 제어하는 역할을 수행한다. 이를 위해 RRC계층은 단말과 망간에 RRC메시지를 서로 교환한다. RRC계층은 기지국과 AG 등 망 노드들에 분산되어 위치할 수 있고, 기지국 또는 AG에만 위치할 수도 있다.

이하 도 2를 참조하여 무선 프로토콜 제어 평면을 설명한다. 무선 프로토콜 제어 평면은 물리계층, 매체접속제어(Medium Access Control; 이하 MAC로 약칭)계층, 무선링크제어(Radio Link Control; 이하 RLC로 약칭)계층 및 무선 자원제어(Radio Resource Control; 이하 RRC라 약칭함)계층을 포함하여 이루어진다.

제1계층인 물리계층은 물리 채널(Physical Channel)을 이용하여 상위 계층에게 정보 전송 서비스(Information Transfer Service)를 제공한다. 물리 계층은 상위에 있는 매체접속제어(Medium Access Control)계층과는 전송 채널(Transport Channel)을 통해 연결되어 있으며, 이 전송채널을 통해 매체접속제어계층과 물리계층 사이의 데이터가 이동한다. 그리고, 서로 다른 물리계층 사이, 즉 송신측과 수신측의 물리계층 사이는 물리채널을 통해 데이터가 이동한다.

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제2계층의 MAC 계층은 논리 채널(Logical Channel)을 통해 상위계층인 무선링크제어(Radio Link Control)계층에게 서비스를 제공한다. 제2계층의 RLC 계층은 신뢰성 있는 데이터의 전송을 지원한다. RLC 계층의 기능이 MAC내부의 기능 블록으로 구현될 수도 있다. 이러한 경우에는 RLC계층은 존재하지 않을 수도 있다.

제3계층의 가장 상부에 위치한 RRC 계층은 제어 평면에서만 정의되며, 무선베어러 (Radio Bearer; RB라 약칭함)들의 설정(Configuration), 재설정(Re-configuration) 및 해제(Release)와 관련되어 논리 채널, 전송 채널 및 물리 채널들의 제어를 담당한다. 이때, RB는 단말과 UTRAN간의 데이터 전달을 위해 제2계층에 의해 제공되는 서비스를 의미한다.

이하 도 3을 참조하여 무선 프로토콜 사용자 평면의 각 계층을 설명한다. 무선 프로토콜 사용자 평면은 물리계층, MAC 계층, RLC 계층 및 PDCP 계층을 포함하여 이루어진다.

제1계층의 물리계층과 제2계층의 MAC 계층, RLC 계층에 대한 설명은 도 2에서의 설명과 동일하므로 생략한다. 제2계층의 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.

이하 망과 단말 사이의 데이터 전송하기 위한 상향 및 하향 전송 채널에 대해 설명한다. 망에서 단말로 데이터를 전송하는 하향 전송 채널로는 시스템 정보를 전송하는 BCH(Broadcast Channel)과 그 이외에 사용자 트래픽이나 제어 메시지를 전송하는 하향 SCH(Shared Channel)와 SCCH(Shared Control Channel)이 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 상향 전송 채널로는 초기 제어메시지를 전송하는 RACH (Random Access Channel)와 그 이외에 사용자 트래픽이나 제어 메시지를 전송하는 상향 SCH(Shared Channel)와 SCCH(Shared Control Channel)가 있다.

도 4는 HARQ (hybrid ARQ) 방식에 대해 설명하기 위한 도면이다. 이하 무선 패킷 통신 시스템의 하향 링크 물리 계층에 적용되는 HARQ(hybrid ARQ)의 구체적인 구현 방식에 대해 설명한다.

도 4를 참조하면, 기지국은 패킷을 수신할 단말과 그 단말에 전송할 패킷의 형식(부호화율, 변조방식, 데이터량 등)을 결정하여 이 정보를 먼저 하향 링크 제어 채널(HS-SCCH) 전송을 통하여 그 단말에 알려주고, 이와 연관된 시점에서 해당 데이터 패킷(HS-DSCH)을 전송한다. 해당 단말은 하향 링크 제어 채널을 수신하여 자신에게 전송될 패킷의 형식과 전송 시점을 알게 되고, 해당 패킷을 수신할 수 있다. 만일, 단말이 패킷(data1) 복호화에 실패했을 경우 단말은 NACK 신호를 기지국으로 전송하고, NACK 신호를 수신한 기지국은 해당 단말로의 패킷 전송이 실패했음을 감지하고 적절한 시점에서 동일 데이터를 동일한 패킷 형식, 또는 새로운 패킷 형식으로 재전송할 수 있다. 이때에 단말은 재전송된 패킷(data1)과 이전에 수신했지만 복호화에 실패한 패킷을 다양한 방식으로 결합하여 다시 복호화를 시도하게 된다.

패킷 수신 후에 그 패킷 데이터의 복호화를 거쳐서 만일 복호화에 성공했을 경우 단말은 ACK 신호를 기지국으로 전송하고, ACK 신호를 수신한 기지국은 해당 단말로의 패킷 전송이 성공했음을 감지하고 다음 패킷(data2) 전송 작업을 수행할 수 있다.

이하 단말이 망으로 초기 제어메시지를 전송하는 RACH(Random Access Channel)에 대해서 자세히 설명한다. 일반적으로 RACH를 이용하는 목적으로는 단말이 망과 시간 동기를 맞추기 위한 것과 단말이 상향링크로 데이터 전송하고자 할 때 상기 데이터를 전송할 상향링크의 무선자원이 없는 경우에 무선자원을 획득하는 것이다. 예를 들면, 단말이 전원을 켜서 새로운 셀로 처음 접근하려고 한다. 이 경우에 단말은 다운링크의 동기를 맞추고, 접속하려는 셀에서의 시스템 정보를 수신한다. 그리고, 상기 시스템 정보를 수신한 후에는 상기 단말은 RRC 접속을 위해서 접속요청 메시지를 전송해야 할 것이다. 하지만, 상기 단말은 현재 망과의 시간 동기도 맞지 않은 상태이고 또한 상향링크의 무선자원도 확보되지 않은 상태이기 때문에 RACH를 이용한다. 즉, RACH를 이용하여 상기 단말은 망에게 접속요청 메시지 전송을 위한 무선자원을 요청한다. 그리고 해당 무선자원 요청을 받은 기지국은 상기 단말로 RRC 접속메시지(RRC Connection Request Message)를 전송할 수 있도록 적당한 무선자원을 할당해 준다. 그러면 상기 단말은 상기 무선자원을 통해서 RRC 접속메시지를 망으로 전송할 수 있다. 또 다른 예를 들면, 단말이 망과의 RRC 접속이 설정되어 있다고 가정한다. 이 경우에, 망의 무선자원 스케줄링에 따라서 단말은 무선자원을 할당받게 되고, 이 무선자원을 통해서 단말의 데이터를 망으로 전송하게 된다. 하지만, 단말의 버퍼에 더 이상 전송할 데이터가 남아 있지 않다면, 망은 상기 단말로 더 이상의 상향링크의 무선자원을 할당하지 않는다. 왜냐하면 전송할 데이터를 가지고 있지 않은 단말로 상향링크의 무선자원을 할당하는 것은 비효율적이기 때문이

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다. 여기서 단말의 버퍼 상태는 주기적 혹은 사건 발생적으로 망으로 보고된다. 상기 상황처럼 무선 자원이 없는 단말의 버퍼에 새로운 데이터가 생기게 되면, 상기 단말로 할당된 상향링크의 무선자원이 없기 때문에, 상기 단말은 RACH를 이용한다. 즉, RACH를 이용해서 단말은 데이터의 전송에 필요한 무선자원을 망에게 요청한다.

이하에서는 WCDMA의 RACH에 대해 더욱 구체적으로 설명한다. RACH는 상향으로 짧은 길이의 데이터를 전송하기 위해 사용된다. RRC 연결요청 메시지(RRC Connection Request Message)와 셀 갱신 메시지(Cell Update Message), URA 갱신 메시지(URA Update Message) 등의 일부 RRC 메시지가 RACH를 통해 전송된다. CCCH(Common Control Channel), DCCH(Dedicated Control Channel), DTCH(Dedicated Traffic Channel), DTCH(Dedicated Traffic Channel) 등의 논리채널들이 전송채널인 RACH에 매핑될 수 있으며, RACH는 다시 물리채널의 하나인 PRACH(Physical Random Access Channel)에 매핑된다.

도 5는 PRACH(Physical Random Access Channel) 전송 방법의 일례를 설명하기 위한 도면이다. 도 5을 참조하면, 상향 물리채널 PRACH는 프리앰블 부분(Preamble Part)과 메시지 부분(Message Part)으로 나누어진다. 프리앰블 부분은 메시지 전송에 사용되는 적절한 전송전력을 조절하는 전력 램핑(Power Ramping) 기능과 여러 단말 간의 충돌(Collision)을 방지하는 기능을 수행한다. 메시지 부분은 MAC에서 물리채널에 전달한 MAC PDU(Protocol Data Unit)를 전송하는 기능을 수행한다.

단말 MAC이 단말 물리계층에 PRACH 전송을 지시하면, 단말 물리계층은 먼저 하나의 액세스 슬롯(Access Slot)과 하나의 시그너처(Signature)를 선택하여 PRACH 프리앰블을 상향으로 전송한다. 상기 프리앰블은 1.33ms 길이의 액세스 슬롯 구간 동안 전송될 수 있으며, 액세스 슬롯의 처음 일정 길이 동안에 16가지 시그너처 중 하나의 시그너처를 선택하여 전송할 수 있다.

단말이 프리앰블을 전송하면 기지국은 하향 물리채널 AICH(Acquisition Indicator Channel)을 통해 응답 신호를 전송할 수 있다. 기지국은 상기 AICH가 전송하는 응답 신호를 통해 긍정적인 응답(ACK) 또는 부정적인 응답(NACK)을 단말로 전송한다. 만일 단말이 ACK을 수신하면, 단말은 메시지 부분을 전송한다. 만일 단말이 NACK을 수신하면, 단말 MAC은 적당한 시간 이후에 단말 물리계층에게 다시 PRACH 전송을 지시한다.

한편, 만일 단말이 전송한 프리앰블에 대응되는 응답을 수신하지 못하였을 경우, 단말은 정해진 액세스 슬롯 이후에 이전 프리앰블보다 한 단계 높은 전력으로 새로운 프리앰블을 전송한다.

상기에서는 RACH 프리앰블에 대한 응답에 대하여 설명하고 있으나, 이외에 기지국에서 단말로 데이터 전송 혹은 제어 신호를 전송할 수 있다. 기지국으로부터 단말로 전송되는 제어 신호는 하향링크 스케줄링 정보(Downlink Scheduling Information), 상향링크 스케줄링 할당(Uplink Scheduling Grant) 그리고 단말의 RACH 프리앰블 전송에 대한 응답정보 등 있다.

종래의 기술에서는 단말이 RACH를 통해 데이터를 전송할 때, 기지국으로 RACH 프리앰블을 전송하고, 이에 따라 기지국은 상기 단말로 RACH 프리앰블에 대한 응답 정보를 전송하게 된다.

하지만, 둘 이상의 단말이 같거나 비슷한 시간에 RACH를 이용하기 위해서 각각의 RACH 프리앰블을 전송하는 경우, 기지국은 각각의 단말들에게 상기 프리앰블에 대한 응답 정보를 각각 따로 알려줘야 하므로, 상기 응답 정보를 전송하기 위한 무선자원 또한 각각의 단말들을 위해서 할당되어야 하는 문제점이 발생한다.

그리고, 만약 단말이 RACH를 통해 할당받은 무선자원을 통하여 기지국으로 데이터를 전송하려고 할 때 HARQ 동작 방식을 사용하는 경우, 첫 전송 데이터에 대한 무선 자원뿐만 아니라, 미리 재전송 데이터에 대한 무선 자원을 상기 단말에 미리 할당하여 단말이 첫 전송에서 데이터의 전송에 성공한다면 재전송을 위해서 할당된 무선자원이 낭비되는 문제점이 발생한다.

발명이 이루고자 하는 기술적 과제

본 발명은 상술한 바와 같은 종래 기술의 문제점을 해결하기 위해서 안출된 것으로서, 본 발명의 목적은, 이동 통신 시스템에서 낭비되는 무선자원을 줄여 무선 자원의 효율을 높여 무선자원을 효율적으로 사용할 수 있는 효과가 있다. 효과가 있다.

발명의 구성

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본 발명에서는 기지국이 RACH 프리앰블의 응답정보를 단말로 전송할 때, 같거나 비슷한 시간에 RACH 프리앰블을 전송한 단말들에 대한 응답정보를 개별적으로 전송하지 않고, 공통의 채널을 통해서 하나의 데이터 단위로 구성하여 전달하는 것을 특징으로 하는 이동 통신 시스템을 제안한다.

그리고, 단말이 RACH를 통해 할당받은 상향링크의 무선자원으로 데이터를 기지국으로 전송할 때 HARQ 동작 방식이 사용된다면, 재전송을 위한 상향링크의 무선자원을 미리 단말로 할당해 주는 것이 아니라 HARQ의 첫 전송을 위한 무선자원을 할당하고, 재전송이 필요할 때는 NACK 신호와 함께 재전송에 필요한 무선자원을 다시 할당해주는 방법을 제안한다. 따라서, 단말이 첫 전송에서 데이터가 성공적으로 전송되어 재전송이 필요 없는 경우에, 낭비되는 무선자원을 줄이는 효과가 있다.

본 발명의 일 실시 형태에 따른, 적어도 하나 이상의 단말을 포함하는 이동 통신 시스템에서의 응답 정보 전송 방법은, 상기 적어도 하나 이상의 단말로부터 RACH(Random Access Channel) 프리앰블을 수신하는 단계와, 수신된 프리앰블에 대한 응답 정보를 상기 적어도 하나 이상의 단말들이 모두 접근하여 데이터를 수신할 수 있는 공통 채널을 통해 전송하는 단계를 포함하여 이루어진다.

상술한 본 발명의 목적, 구성 및 다른 특징들과 관련한 바람직한 실시 형태의 예들을 첨부된 도면을 참조하여 다음의 상세한 설명을 통해서 상세히 설명한다. 첨부된 도면과 함께 이하에 개시될 상세한 설명은 본 발명의 예시적인 실시 형태를 설명하고자 하는 것이며, 본 발명이 실시될 수 있는 유일한 실시 형태를 나타내고자 하는 것이 아니다. 또한, 이하의 설명에서 상향링크 신호를 송신하는 주체로서 "단말"을, 수신 주체로서 "기지국"을 중심으로 설명하나, 이들 용어에 한정될 필요는 없으며 상향링크 송신 주체로서 "사용자 기기(UE)", 수신 주체로서 "노드 B(eNode B)" 등 임의의 용어로서 지칭되는 경우 역시 동일한 의미를 나타낸다. 또한, 본 명세서 전체에서 동일한 구성요소에 대해서는 동일한 도면 부호를 사용하여 설명한다.

도 6은 본 발명의 일 실시 형태에 따른 절차 흐름도이다. 이하 도 6을 참조하여 적어도 하나 이상의 단말들의 프리앰블 전송에 대한 응답 정보를 한 번에 전송하는 방법을 설명한다.

단말은 기지국과의 RRC 접속요청, 셀 갱신, 핸드오버, 상향링크의 무선자원 요청 그리고 기지국과의 시간 동기 유지를 목적으로 RACH를 이용한다. 상기 단말은 RACH 전송을 할 때 데이터 전송에 앞서서 프리앰블을 먼저 전송한다. 상기 프리앰블은 데이터 전송에 대한 적절한 전송 전력을 조절하거나 여러 단말 간의 충돌을 방지하기 위한 정보 등이 포함되어 전송된다. 단말은 RACH를 이용하기 위해서, RACH 프리앰블을 기지국으로 전송하고, 기지국은 이에 따라 응답 정보를 상기 단말로 전송한다.

기지국이 RACH 프리앰블의 응답 정보를 단말로 전달할 때, 같거나 비슷한 시간에 RACH 프리앰블을 전송한 단말들에 대한 응답을 개별적으로 전송하지 않고, 공통의 채널을 통해서 한꺼번에 전달한다. 예를 들면, 일정 시간 내에 제1 단말, 제2 단말 및 제3 단말의 3개의 단말들이 기지국으로 RACH 프리앰블을 전송한 경우, 이에 대한 응답으로 상기 기지국은 상기 3개의 단말들에 대한 응답 정보들을 하나로 데이터 단위로 묶어서 상기 공통 채널을 통해 전송한다.

도 6을 참조하면, 제1 단말이 기지국으로 RACH 프리앰블을 전송한다(S60). 상기 제1 단말이 RACH 프리앰블을 전송한 시각과 동일한 시각 또는 비슷한 시각에 제2 단말이 상기 기지국으로 RACH 프리앰블을 전송한다(S61). 즉, 제1 단말과 제2 단말은 각각 RACH 프리앰블을 같거나 비슷한 시간에 기지국으로 전송한다. 위와 같은 방법으로 상기 기지국은 일정 시간(Δ_t) 동안에 하나 이상의 단말로부터 하나 이상의 RACH 프리앰블들을 수신한다. 도 6에서는 제1 단말과 제2 단말만을 도시하였지만, N개의 단말에 대해 이루어질 수 있음은 자명하다.

기지국은 제1 단말과 제2 단말의 RACH 프리앰블들을 수신하고, 이에 대한 응답 정보를 전송한다(S62). 이때 상기 기지국은 제1 단말과 제2 단말로 각각에 대해 무선 채널을 할당하여 응답 정보를 전송하는 것이 아니라 공통 채널을 통해서 전송한다. 상기의 공통 채널은 셀 내의 모든 단말들이 기지국으로부터의 데이터를 수신하고, 읽을 수 있는 채널이다.

도 7은 본 발명의 일 실시 형태에 따라 기지국이 공통 채널의 일례인 DL-SCH(Down Link Shared CHannel)를 통해서 응답정보를 단말로 전달하는 방법을 설명하기 위한 도면이다.

일반적으로 DL-SCH는 기지국에서 지정된 단말들에게 데이터를 전송할 때 사용되거나, 셀 내에 모든 단말들에게 데이터 전송을 위해 사용된다. 따라서, 서로 다른 다수의 단말들이 상기 DL-SCH을 통해 전송되는 데이터를 수신할 수 있으므로,

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상기 DL-SCH에 다수의 단말에 대한 응답 정보를 한꺼번에 전송하더라도 각 단말은 자기의 응답 정보를 수신할 수 있다. 기지국은 단말의 RACH 프리앰블에 대한 응답 정보를 DL-SCH를 통해서 단말에게 전달한다. 상기 하나의 응답 정보에 다수의 단말들에 대한 응답 정보들이 포함된다.

도 7을 참조하면, 상기 DL-SCH를 읽기 위해서 단말은 먼저 DL-SCCH을 읽어야 한다. 상기 DL-SCH의 위치 정보는 DL-SCCH를 통해서 전송된다. 즉, RACH 프리앰블을 전송한 단말은 기지국으로부터 응답 정보를 수신하기 위하여 DL-SCCH를 먼저 읽고, 관련된 DL-SCH의 위치를 판단한다. 일반적인 물리계층이나 제2계층과 관련된 제어신호는 DL-SCCH을 통해서 기지국에서 단말로 전송된다. 또한, 상기 DL-SCCH에는 어떤 단말로 전달되는 정보인지를 나타내는 단말 식별자, 상기 단말들이 어느 DL-SCH를 읽을 것인지 대한 위치정보(주파수와 시간), 그리고 상기 단말이 상기 DL-SCH를 읽기 위해 필요한 정보, 디코딩하기 위해 정보 등이 포함된다. 즉, 상기 DL-SCCH의 식별자를 통하여 어떤 단말들이 특정 DL-SCH를 읽을 것인지 알 수 있다.

도 6의 실시 형태의 경우 상기 DL-SCH에는 제1 단말과 제2 단말 모두의 응답 정보가 포함된다. 즉, 제1 단말과 제2 단말은 같은 DL-SCCH를 읽고, 같은 DL-SCH의 위치를 판단한다. 그리고, 같은 DL-SCH에서 자신의 응답정보를 읽는다. 상기의 응답정보는 기지국의 제 2계층에서 같거나 비슷한 시간에 RACH 프리앰블을 전송한 단말들의 응답 정보들을 다중화(Multiplexing)해서 상기 단말들에게 전송한다.

기지국은 같거나 비슷한 시간에 전송된 단말들의 RACH 프리앰블에 대한 응답 정보를 구성한다. 또한, 상기 구성된 응답 정보들을 하나의 MAC PDU(Protocol Data Unit)로 구성한다. 즉, 기지국은 상기 구성된 MAC PDU을 통해 상기 DL-SCH 전송을 한다. 이하 다수의 단말들에 대한 응답 정보를 하나의 응답 정보 즉, 하나의 MAC PDU로 다중화(Multiplexing)해서 전송하는 방법을 설명한다. 하기 표 1은 여러 개의 응답 정보를 다중화(Multiplexing)한 하나의 PDU 구성의 일례를 나타낸다.

[표 1]

제N단말의 응답정보	제1단말의 응답정보	제2단말의 헤더	제2단말의 응답정보	...	제N단말의 응답정보	제N 단말의 응답정보

표 1을 참조하면, 제1 단말의 응답정보 앞에 제1 단말에 대한 헤더(Header)를 전송한다. 상기 헤더는 어떤 단말이 상기 응답 정보를 읽어야 하는지에 대한 단말의 식별자와 상기 응답 정보의 길이를 나타내는 정보를 포함한다. 상기 헤더를 전송한 후에 제1 단말의 응답 정보를 전송한다. 상기 응답 정보에는 상기 단말에 할당된 상향링크의 무선자원, 셀 내에서의 식별자, 단말의 임시 식별자 그리고 기지국과의 시간 동기와 관련된 보정 값 등이 포함된다. 그리고 다음에는 제2 단말의 응답 정보를 위한 제2 단말의 헤더를 전송하고, 그 후에 제2 단말의 응답 정보를 전송한다. 이런 방법으로 기지국이 하나의 응답 정보에 다수의 단말들에 대한 응답정보들을 포함하는 PDU를 구성한다.

하기 표 2는 여러 개의 응답 정보를 다중화(Multiplexing)한 하나의 PDU 구성의 다른 일례를 나타낸다.

[표 2]

제1단말의 헤더	제2단말의 헤더	...	제N단말의 헤더	헤더의 끝을 알리는 지시자	제1단말의 응답정보	제2단말의 응답정보	...	제N단말의 응답정보

표 2를 참조하면, 먼저, MAC PDU에 제2 단말의 식별자와 응답정보의 길이가 포함된 헤더를 붙인다. 상기 헤더는 표 1을 통해 설명한 헤더와 동일한 기능을 한다. 그 후에 제2 단말의 헤더를 붙인다. 이런 식으로 하나의 응답정보에 포함될 단말의 응답정보 수(N)만큼의 헤더를 붙이고, 그 후에 헤더 부분이 끝나는 것을 알리는 지시자를 붙인다. 상기 지시자를 통해 이후에 응답 정보들이 수신됨을 알 수 있다. 그 후에 각 단말의 응답정보를 차례대로 붙여서 MAC PDU를 생성한다. 상기 응답 정보 역시 상기 단말에 할당된 상향링크의 무선자원, 셀 내에서의 식별자, 단말의 임시 식별자 그리고 기지국과의 시간 동기와 관련된 보정 값 등이 포함된다.

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각 단말은 상기 하나의 응답 정보로 구성되어 공통 채널을 통해서 전송된 응답 정보 중에서 각자 자신의 응답 정보를 확인한다. 단말은 RACH 프리앰블에 대한 응답정보에 포함된 상향링크의 무선자원 정보를 이용하여 데이터를 기지국으로 전송한다.

도 8은 본 발명의 다른 실시 형태에 따른 절차 흐름도이다. 도 8을 참조하여, 데이터를 기지국으로 전송할 때 HARQ (Hybrid ARQ)동작 방식이 사용되는 경우 적용할 수 있는 스케줄링 방법을 설명한다.

제1 단말 및 제2 단말은 도 6을 통해 설명했던 바와 동일한 방법으로 각 단말의 RACH 프리앰블을 기지국으로 전송하고(S79, S71), 공통 채널(예를 들어, DL-SCH)을 통해 하나의 데이터 단위로 구성된 응답 정보를 수신한다. 각 단말은 RACH 프리앰블에 대한 응답정보에 포함된 상향링크의 무선자원 정보를 이용하여 데이터를 기지국으로 전송한다. 도 8에서는 응답 정보 수신 이후 절차는 제2 단말과 기지국 간의 데이터 송수신 과정만을 도시한다. 하지만, 제1 단말의 경우도 동일한 방법이 적용될 수 있음은 자명하다. 각 단말이 RACH를 이용해서 할당받은 상향링크의 무선자원으로 데이터를 기지국으로 전송할 때 HARQ동작 방식이 사용된다면, 재전송을 위한 상향링크의 무선자원을 미리 할당하는 것이 아니고, 기지국에서 디코딩 실패로 상기 단말의 데이터 재전송이 요구될 때, NACK신호와 함께 재전송에 필요한 무선 자원 할당 정보가 포함된 특정 제어신호를 단말로 전송한다.

도 8을 참조하면, 기지국으로부터 응답 정보를 수신한 제2 단말은 기지국으로 데이터를 전송한다(S73). 상기 제2 단말은 상기 데이터를 기지국으로 전송할 때 HARQ 방식을 사용한다. 이 과정에서 사용하는 HARQ 방식에 대한 설정은 시스템 정보를 통해서 기지국이 단말들에게 알린다.

기지국은 제2 단말로부터 상기 데이터를 수신하고, 디코딩을 수행한다. 만약 기지국이 정상적으로 상기 데이터를 디코딩하지 못한다면, 제2 단말로 디코딩 에러를 알리기 위해서 NACK신호를 전송한다(S74). 또한 기지국은 제2 단말에 상기 데이터의 재전송에 필요한 무선 자원을 할당하고 상기 할당된 무선 자원에 대한 정보를 상기 NACK 신호 전송시 함께 전송한다.

즉, 기지국이 단말의 RACH 프리앰블에 대한 응답 정보를 전송할 때 상기 응답 정보에 포함된 상향링크의 무선 자원 할당 정보는 HARQ의 첫 전송만을 고려된다. 예를 들면, 단말이 RACH 프리앰블 이후에 전송하려는 데이터를 위해 필요한 무선 자원이 100이라는 값을 가진다고 가정한다. 상기 데이터가 HARQ 동작에 의해 재전송이 요구된다면, 단말은 다시 100의 무선 자원이 필요하다. 즉, 만약 기지국이 단말의 RACH 프리앰블에 따라 상향링크의 무선 자원을 할당할 때, 재전송을 고려해서 할당한다면 단말로 200의 무선자원을 할당할 것이다. 하지만 본 발명에 따르면, 단말의 RACH 프리앰블에 대한 응답 정보로 무선 자원을 할당할 때 첫 전송에 대한 100의 무선 자원만을 할당한다. 그 후에 단말의 데이터 전송이 실패해서 재전송이 필요하다면 기지국은 NACK신호와 함께 100의 무선 자원을 추가적으로 할당한다.

상기의 재전송에 필요한 무선 자원 할당 정보가 포함된 특성 제어신호는 RACH 프리앰블에 대한 응답정보와 같은 형식으로 전달할 수 있다. 또는 기지국이 단말로 무선자원을 할당할 때 사용하는 채널을 사용할 수도 있다.

상기 제2 단말은 상기 NACK 신호와 함께 전송된 상향링크 무선 자원 할당 정보에 따라 상기 데이터를 기지국으로 재전송한다(S75).

이상에서 설명한 본 발명이 속하는 기술분야의 당업자는 본 발명이 그 기술적 사상이나 필수적 특징을 변경하지 않고서 다른 구체적인 형태로 실시될 수 있다는 것을 이해할 수 있을 것이다. 그러므로 이상에서 기술한 실시 형태는 모든 면에서 예시적인 것이며 한정적인 것이 아닌 것으로서 이해할 것이다. 본 발명의 범위는 상기 상세한 설명보다는 후술하는 특허청구범위에 의하여 나타내어지며, 특허청구범위의 의미 및 범위 그리고 그 동일한 개념으로부터 도출되는 모든 변경 또는 변형된 형태가 본 발명의 범위에 포함되는 것으로 해석될 것이다.

발명의 효과

본 발명에 따르면, 무선자원을 효율적으로 사용할 수 있는 효과가 있다. 또한, 무선 자원에 대한 낭비를 줄일 수 있는 효과가 있다.

도면의 간단한 설명

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도 1은 이동 통신 시스템인 LTE(Long Term Evolution) 시스템의 망 구조를 설명하기 위한 도면이다.

도 2는 3GPP 무선접속망 규격을 기반으로 한 단말과 UTRAN (UMTS Terrestrial Radio Access Network) 사이의 무선 인터페이스 프로토콜 (Radio Interface Protocol) 제어 평면의 구조를 설명하기 위한 도면이다.

도 3은 3GPP 무선접속망 규격을 기반으로 한 단말과 UTRAN (UMTS Terrestrial Radio Access Network) 사이의 무선 인터페이스 프로토콜 (Radio Interface Protocol) 사용자 평면의 구조를 설명하기 위한 도면이다.

도 4는 HARQ (hybrid ARQ) 방식에 대해 설명하기 위한 도면이다.

도 5는 PRACH(Physical Random Access Channel) 전송 방법의 일례를 설명하기 위한 도면이다.

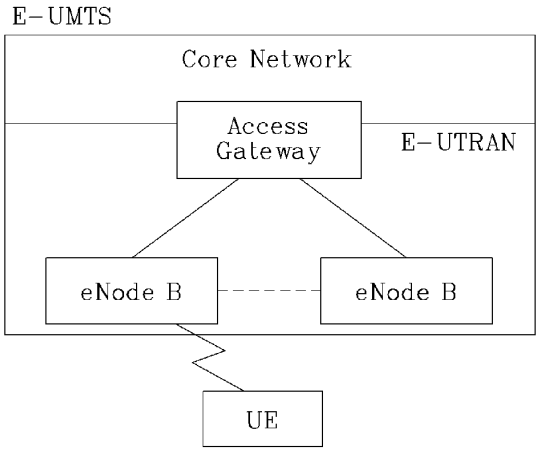
도 6은 본 발명의 일 실시 형태에 따른 절차 흐름도이다.

도 7은 본 발명의 일 실시 형태에 따라 기지국이 공통 채널을 통해서 응답정보를 단말로 전달하는 방법을 설명하기 위한 도면이다.

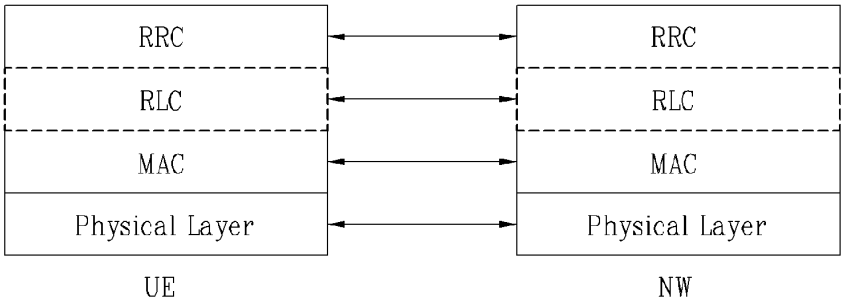
도 8은 본 발명의 다른 실시 형태에 따른 절차 흐름도이다.

도면

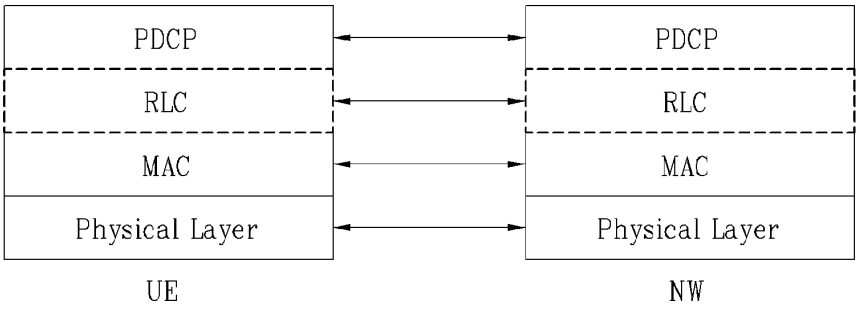
도면1



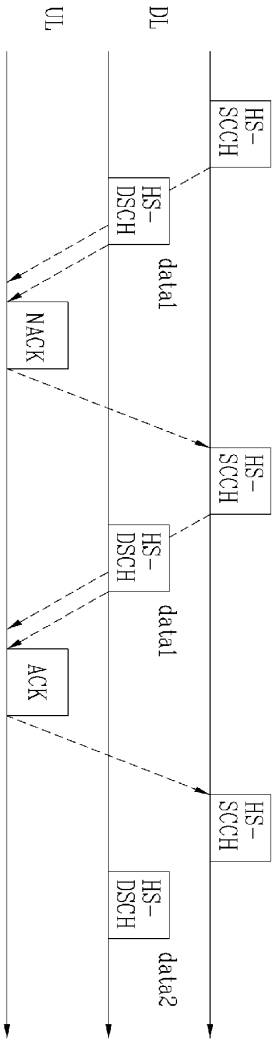
도면2



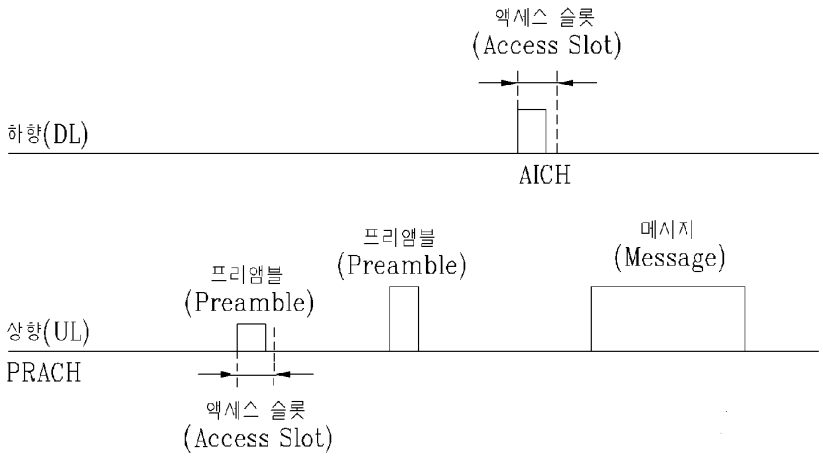
도면3


PDCP
RLC
MAC
Physical Layer
UE
PDCP
RLC
MAC
Physical Layer
NW

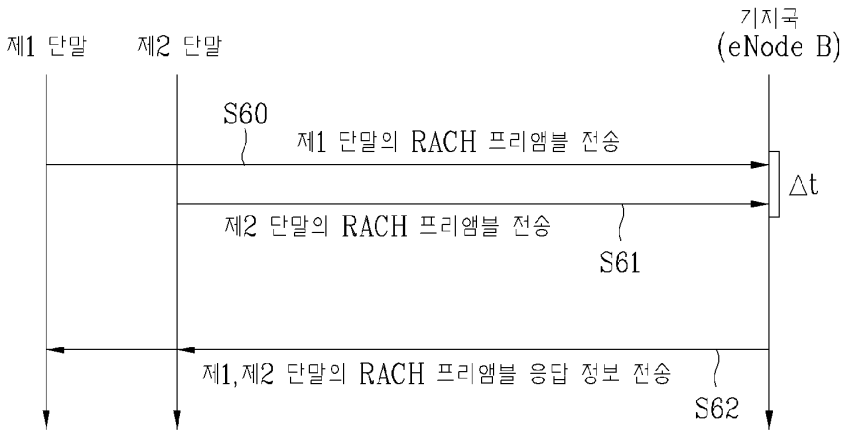
도면4


UL
DL
HS-SCCH
HS-DSCH
data1
NACK
HS-SCCH
HS-DSCH
data1
ACK
HS-SCCH
HS-DSCH
data2

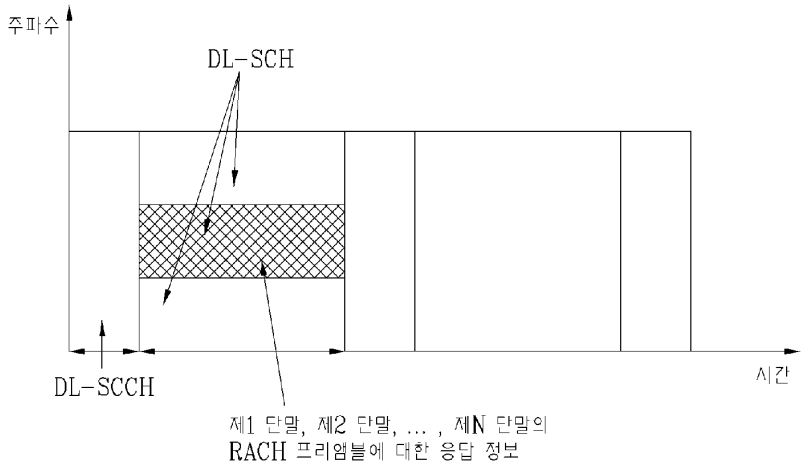
도면5


액세스 슬롯
(Access Slot)
하향(DL)
AICH
프리앰블
(Preamble)
메시지
(Message)
프리앰블
(Preamble)
상향(UL)
PRACH
액세스 슬롯
(Access Slot)

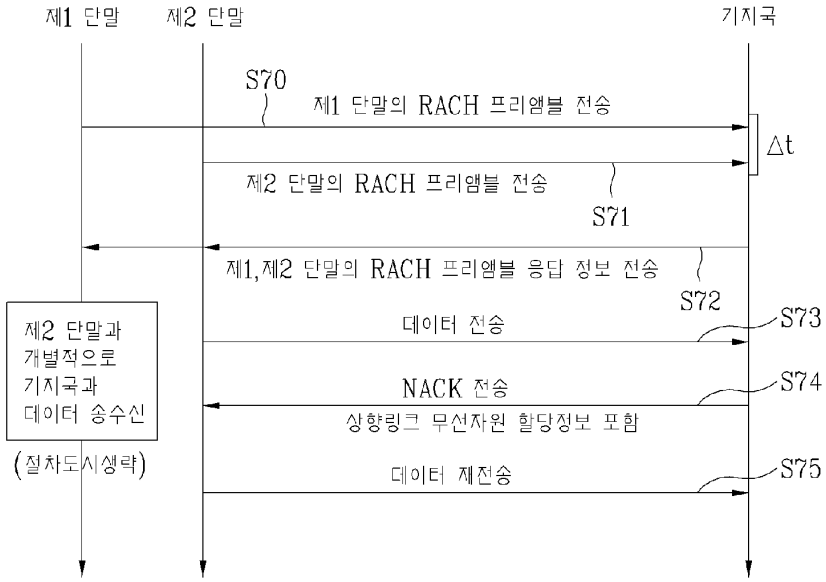
도면6


제1 단말
제2 단말
기지국
(eNode B)
S60
제1 단말의 RACH 프리앰블 전송
Δt
제2 단말의 RACH 프리앰블 전송
S61
제1,제2 단말의 RACH 프리앰블 응답 정보 전송
S62

도면7


주파수
DL-SCH
DL-SCCH
시간
제1 단말, 제2 단말, … , 제N 단말의
RACH 프리앰블에 대한 응답 정보

도면8


제1 단말
제2 단말
기지국
S70
제1 단말의 RACH 프리앰블 전송
Δt
제2 단말의 RACH 프리앰블 전송
S71
제1,제2 단말의 RACH 프리앰블 응답 정보 전송
S72
데이터 전송
S73
NACK 전송
S74
상향링크 무선자원 할당정보 포함
데이터 재전송
S75
제2 단말과
개별적으로
기지국과
데이터 송수신
(절차도시생략)

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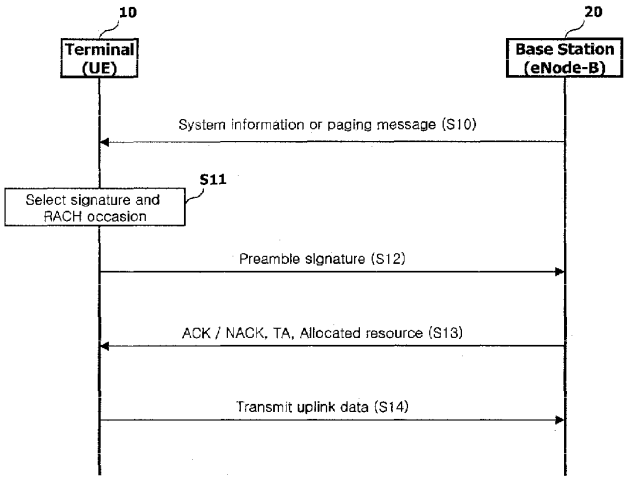
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[Continued on next page]

(54) Title: TRANSMITTING INFORMATION IN MOBILE COMMUNICATIONS SYSTEM



(57) Abstract: Transmitting information using a preamble of a Random Access Channel (RACH) in an Evolved Universal mobile Telecommunications System (E-UMTS) is provided. A preamble transmission is used to inform a base station of specific information when a terminal uses a RACH and the base station efficiently allocates radio resources for data transmission to the terminal according to the specific information. Delay time before the terminal transmits data is reduced and unnecessary consumption of radio resources is minimized.

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Description

TRANSMITTING INFORMATION IN MOBILE COMMUNICATIONS SYSTEM

Disclosure of Invention

Technical Solution

[1] This disclosure relates to transmitting information in a mobile communications system.

[2] Fig. 1 illustrates an exemplary network structure of an E-UMTS. The E-UMTS system is a system that has evolved from an existing UMTS system.

[3] Basic standardization for the E-UMTS system is currently being developed by the Third Generation Partnership Project (3GPP). The E-UMTS system may be referred to as a Long Term Evolution (LTE) system.

[4] As illustrated in FIG. 1, an E-UMTS network may consist of an E-UTRAN and a Core Network (CN). The E-UTRAN may include User Equipment (UE), a base station, referred to as eNode B or eNB, and an Access Gateway (AG) located at the end of the network and connected to an external network.

[5] The AG may be divided into a portion for processing user traffic and a portion for processing control traffic. The AG portion for processing user traffic and the AG portion for processing control traffic may be connected to each other via a new interface for communication.

[6] One or more cells may exist in an eNode B (eNB). The eNode Bs may be connected by an interface for the transmission of user traffic and/or control traffic.

[7] The CN may also include the AG and a node adapted for user registration of a UE. An interface may also be provided in the E-UMTS in order to divide the E-UTRAN and the CN.

[8] Radio interface protocol layers between a mobile terminal and network may be classified into a first layer (L1), a second layer (L2) and a third layer (L3) based upon the lower three layers of an Open System Interconnection (OSI) model which is well known in communications systems. A physical layer of the first layer provides an information transfer service using a physical channel. A Radio Resource Control (RRC) layer positioned in the third layer controls radio resources between the mobile terminal and the network.

[9] The RRC layer allows an RRC message exchange between the mobile terminal and the network. The RRC layer may be positioned in each network node, such as the eNode B and the AG, or positioned in either the eNode B or the AG.

[10] Fig. 2 illustrates an architecture of radio interface protocols between a terminal and

a UMTS Terrestrial Radio Access Network (UTRAN) based upon a 3GPP radio access network specification. The radio interface protocols of Fig. 2 are horizontally formed of a physical layer, a data link layer and a network layer and vertically formed of a user plane for transmitting data information and a control plane for transmitting control signals.

[11] The protocol layers of Fig. 2 may be divided into a first layer (L1), a second layer (L2) and a third layer (L3) based upon the lower three layers of an Open System Interconnection (OSI) model which is well known in communications systems. Each radio protocol layer in the control plane illustrated in Fig. 2 and each radio protocol layer in the user plane illustrated in Fig. 3 will now be explained.

[12] A physical layer, which is a first layer, provides an information transfer service to an upper layer using a physical channel. The physical layer is connected to a Medium Access Control (MAC) layer (located at a higher level) via a transport channel.

[13] Data is transferred between the MAC layer and the physical layer via a transport channel. Data also is transferred between different physical layers, specifically, between a physical layer of a transmitting side and a physical layer of a receiving side.

[14] A MAC layer of the second layer provides a service via a logical channel to a Radio Link Control (RLC) layer, which is its upper layer. The RLC layer of the second layer supports reliable data transmission.

[15] The functions performed by the RLC layer may be implemented as a functional block within the MAC. However, the RLC layer may not exist.

[16] A Packet Data Convergence Protocol (PDCP) layer of the second layer is used to effectively transmit data using an IP packet, such as IPv4 or IPv6, on a radio interface with a relatively small bandwidth. The PDCP layer reduces unnecessary control information using a function called a header compression for this purpose.

[17] A Radio Resource Control (RRC) layer located at the lowest portion of the third layer is only defined in the control plane. The RRC layer handles the transport and physical channels for the configuration, re-configuration and release of radio bearers. A Radio Bearer (RB) denotes a service provided by the second layer for data transfer between the mobile terminal and the UTRAN.

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

control message.

[19] Hereinafter, a random access channel (RACH) will be explained in detail. In general, an RACH is used to obtain a radio resource if there is no uplink radio resource to transmit data when a terminal matches a time synchronization with a network or the terminal transmits the corresponding data over the uplink.

[20] For example, a terminal generally matches a downlink synchronization to enable reception of system information from a cell it desires to access when the terminal is turned on. The terminal should transmit an access request message to the network or base station for an RRC connection after receiving the system information. However, the terminal uses the RACH if it does not currently match the time synchronization with the network and does not acquire an uplink radio resource.

[21] In other words, the terminal requests a radio resource for transmitting an access request message from the network using the RACH. The base station then allocates an appropriate radio resource to the terminal in order to allow the terminal to transmit an RRC connection message. The terminal can then transmit the RRC connection message to the network using the allocated radio resource.

[22] In another example, the terminal acquires a radio resource from the network according to radio resource scheduling and transmits data to the network using the allocated radio resource when the terminal forms an RRC connection with the network. However, the network may not allocate the uplink radio resource if there is no data left in the terminal buffer because it is inefficient to allocate an uplink radio resource to a terminal that has no data to transmit. The state of the terminal buffer is reported to the network periodically or according to an event generation. If new data that does not require a radio resource is generated in the buffer, the terminal uses the RACH because it does not currently have the uplink radio resource allocated. In other words, the terminal requests a radio resource required for data transmission from the network using the RACH.

[23] Hereinafter, a RACH in a Wideband Code Division Multiple Access (WCDMA) will be explained. The RACH channel is used to transmit data with a short length over an uplink.

[24] A portion of RRC messages, such as an RRC connection request message, a cell update message or a URA update message, may be transmitted on the RACH. A logical channel CCCH (Common Control Channel), DCCH (Dedicated Control Channel) and DTCH (Dedicated Traffic Channel) are mapped to the RACH and the RACH is mapped to a physical channel PRACH (Physical Random Access Channel).

[25] The physical layer of a terminal selects one access slot and one signature to transmit a PRACH preamble via an uplink when the terminal MAC indicates a PRACH transmission to a physical layer of the terminal. The preamble is transmitted for an

access slot interval having a length of 1.33 ms. One of 16 signatures is selected and transmitted for a certain length of an initial portion of the access slot.

[26] The base station transmits a response signal using a downlink physical channel AICH (Acquisition Indicator Channel) after the terminal transmits the preamble. The AICH transmitted in response to the preamble transmits the signature selected by the preamble for a certain length of the initial portion of the access slot corresponding to the transmitted access slot.

[27] The base station transmits a positive response (ACK) or negative response (NACK) to the terminal using the signature transmitted from the AICH. The terminal transmits a message portion with a length of 10 ms or 20 ms using an OVSF code corresponding to the transmitted signature upon receiving the ACK. The terminal MAC indicates the PRACH transmission again to the physical layer of the terminal after an appropriate time period upon receiving the NACK. The terminal transmits a new preamble using power one level higher than that of the previous preamble after a designated access slot if the terminal has not received the AICH corresponding to a previously transmitted preamble.

[28] Channel Quality Indicator (CQI) information is information that enables a terminal to measure a downlink channel state in a current cell and provide the measured state to the base station. The base station then performs radio resource scheduling using the provided CQI information. For example, if the value of CQI may be between 1 to 10, whereby 1 indicates that a channel is not in a good state and 10 indicates that the channel is in a good state.

[29] The base station may determine that the current downlink channel is in a good state and transmit data to the terminal according to a higher bit rate when the terminal transmits CQI information of 10 to the base station. Conversely, the base station may determine that the downlink channel is not in a good state and transmit data to the terminal according to a lower bit rate when the terminal transmits CQI information of 1 to the base station. The base station previously informs the terminal that the terminal should perform reporting periodically or according to an event generation in order to transmit the CQI information.

[30] The present inventors recognized at least the following problems in currently existing RACH procedures. As previously indicated, the terminal first selects one signature and one access slot and then transmits a preamble over an uplink when using the RACH. Thereafter, the terminal transmits a message portion to the base station upon receiving an ACK from the base station in response to the preamble. Therefore, the terminal must perform the preamble transmission, the ACK reception and the message portion transmission in order to inform the base station of specific information using the RACH in related art methods. As a result, delay time is increased

and radio resources are wasted. Based upon such problem recognition, various features and aspects described herein have been conceived by the present inventors.

[31]

[32] An aspect of this disclosure is to provide a method of transmitting information in a mobile communications system that prevents unnecessary consumption of radio resources and reduces delay time for information transfer.

[33] In one aspect, a method for allocating radio resources in a mobile communication system is provided. The method includes receiving grouping information related to signatures and occasions for accessing a Random Access Channel (RACH), selecting one signature and one Random Access Channel (RACH) occasion according to the grouping information, transmitting a preamble according to the selected signature and RACH occasion, receiving a message including a radio resource allocated according to the selected signature and RACH occasion and transmitting data using the allocated radio resource.

[34] It is contemplated that RACH signatures and occasions are grouped according to predetermined criteria. It is further contemplated that the predetermined criteria include at least one of a purpose for using RACH, CQI information, a requested amount of radio resources and an establishment cause.

[35] It is contemplated that the purpose for using RACH includes one of an initial access, handover, maintaining synchronization, an access release and a radio resource request. It is further contemplated that the establishment cause includes one of an emergency call, transition from an idle state to an active state and transition from a dis-connected state to an active state. The grouping information may be received in one of system information and a paging message.

[36] In another aspect of this disclosure, a method for allocating radio resources in a mobile communication system is provided. The method includes transmitting grouping information related to signatures and occasions for accessing a Random Access Channel (RACH), receiving a preamble transmitted according to a signature and RACH occasion selected according to the grouping information, transmitting a message including a radio resource allocated according to the selected signature and RACH occasion and receiving data transmitted using the allocated radio resource.

[37] It is contemplated that the method further includes grouping the RACH signatures and occasions according to predetermined criteria. It is further contemplated that the predetermined criteria include at least one of a purpose for using RACH, CQI in-formation, a requested amount of radio resources and an establishment cause.

[38] It is contemplated that the purpose for using RACH includes one of an initial access, handover, maintaining synchronization, an access release and a radio resource request. It is further contemplated that the establishment cause includes one of an

emergency call, transition from an idle state to an active state and transition from a disconnected state to an active state.

[39] It is contemplated that the grouping information is transmitted in one of system information and a paging message. It is further contemplated that the grouping information is transmitted in one of system information and a paging message. The method may further include changing and retransmitting the grouping information.

[40] In another aspect of this disclosure, a method for allocating radio resources in a mobile communication system is provided. The method includes a network transmitting grouping information related to signatures and occasions for accessing a Random Access Channel (RACH), a mobile communication terminal selecting one signature and one Random Access Channel (RACH) occasion according to the grouping information, the mobile communication terminal transmitting a preamble according to the selected signature and RACH occasion, the network transmitting a message including a radio resource allocated according to the selected signature and RACH occasion and the mobile communication terminal transmitting data using the allocated radio resource.

[41] It is contemplated that RACH signatures and occasions are grouped according to predetermined criteria. It is further contemplated that the predetermined criteria include at least one of a purpose for using RACH, CQI information, a requested amount of radio resources and an establishment cause.

[42] It is contemplated that the purpose for using RACH includes one of an initial access, handover, maintaining synchronization, an access release and a radio resource request. It is further contemplated that the establishment cause includes one of an emergency call, transition from an idle state to an active state and transition from a disconnected state to an active state.

[43] It is contemplated that the network transmits the grouping information in one of system information and a paging message. It is further contemplated that the method further includes the network changing and retransmitting the grouping information.

[44] The foregoing and other features and aspects of this disclosure will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

[45] Additional features and aspects will be set forth in the description that follows, and in part will be apparent from the description, or may be learned by practice of the features in this disclosure. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the claims.

[46] These and other exemplary embodiments will also become readily apparent to those skilled in the art from the following detailed description of the embodiments having

reference to the attached figures, the features herein not being limited to any particular embodiments disclosed.

[47]

[48] The accompanying drawings, which are included to provide further understanding and are incorporated in and constitute a part of this specification, illustrate various exemplary embodiments and together with the description serve to explain the principles of this disclosure. Features, elements, and aspects that are referenced by the same numerals in different figures represent the same, equivalent, or similar features, elements, or aspects in accordance with one or more embodiments.

[49] Fig. 1 illustrates an exemplary network structure of an E-UMTS that is a mobile communications system.

[50] Fig. 2 illustrates each layer on a control plane of radio protocols.

[51] Fig. 3 illustrates each layer on a user plane of radio protocols.

[52] Fig. 4 illustrates a grouping of all RACH occasions by a base station according to a particular purpose according to certain embodiment(s).

[53] Fig. 5 illustrates how a base station combines signatures and RACH occasions for their grouping according to certain embodiment(s).

[54] Fig. 6 illustrates a grouping according to the combination of an establishment cause and CQI information described in Fig. 5.

[55] Fig. 7 illustrates signal flow of a method for transmitting information in a mobile communications system in accordance with certain embodiment(s).

[56]

[57] Description will now be given in detail with reference to the accompanying drawings. The features herein may be implemented in a mobile communications system, such as a UMTS. However, such features may be applied to other communications systems that are operated according to other specifications.

[58] This disclosure proposes a method by which a terminal informs a base station of certain information using a preamble signature and transmission timing, or transmission occasion, of a RACH in order to decrease delay time before transmitting data and make efficient use of uplink radio resources. In order to accomplish this, the features described herein classify signatures and transmission occasions according to specific information for use.

[59] In one embodiment, the features are implemented such that a preamble can be transmitted by selecting one signature and one resource from signatures grouped according to first information and transmission occasions grouped according to second information in a signature group and a RACH resource group classified according to several specific information. The specific information may include usage purpose of RACH, CQI information, information related to a requested amount of radio resource

and information on an establishment cause.

[60] For example, the usage purpose of RACH may include an initial access of a terminal, handover, synchronization maintenance, an access release, and a radio resource request. The CQI information is a value indicating a downlink channel state. The requested amount of radio resource indicates a buffer state of the terminal, which may be indicated with 50 bits, 100 bits, or 200 bits. The establishment cause may denote an emergency call, change of the terminal from an idle state to an active state, or change of the terminal from a disconnected, or detached state, to an active state.

[61] The RACH resource may indicate a RACH occasion. Specifically, the RACH resource indicates informing terminals within a cell of resource information related to use of the RACH by the base station.

[62] The resource information is configured with a specific frequency and a specific time. The resource information may also include a duration of the RACH occasion.

[63] In another embodiment, the features are implemented such that a preamble can be transmitted by selecting one signature from the combination of signatures and RACH occasions and a group configured with the combination as well as by using signatures grouped according to first information and transmission occasions grouped according to second information. In one exemplary embodiment, one signature always has the same meaning, such as information. However, one signature may have another meaning according to a transmission occasion with which it is combined in this embodiment.

[64] Explanation will now be given of a method for selecting one signature and one resource from signatures grouped according to first information and transmission occasions grouped according to second information in order to transmit a preamble.

[65] Signature selection

[66] A base station groups all the signatures according to a specific purpose. Information related to the grouped signatures is transmitted to a terminal using system information or a paging message. Therefore, the terminal selects one signature group from signature groups classified according to specific information related to a state of the terminal when using RACH. The terminal randomly selects one signature from the corresponding signature group once the one signature group has been selected.

[67] For example, if there are 64 signatures, numerals 0 to 63 are set to the signatures. The base station uses a usage purpose of RACH as specific information that is a criterion for the grouping. A group 1 may be configured for the purpose of an initial access, a group 2 may be configured for the purpose of handover, a group 3 may be configured for the purpose of a synchronization maintenance, a group 4 may be configured for the purpose of an access release, and a group 5 may be configured for the purpose of a radio resource request. The base station appropriately maps the whole

signatures onto each group.

[68] In other words, the group 1 has signatures from 0 to 11, group 2 has signatures from 12 to 23, group 3 has signatures from 24 to 35, group 4 has signatures from 36 to 47, and group 5 has signatures from 48 to 63. Information (or grouping information) regarding the signatures grouped according to the usage purpose of RACH is transmitted to the terminal using system information or a paging message. Therefore, the terminal selects group 2 according to the set grouping information and thereafter randomly selects one of the signatures having numerals from 12 to 23 mapped onto the group 2 if the purpose of RACH is for handover.

[69] Furthermore, the base station can dynamically change the grouping information. In other words, the base station can map more signatures onto the corresponding group if terminals within a cell frequently use a certain group among the signature groups.

[70] For example, if group 4 has 12 signatures and group 5 has 16 signatures, the base station may decrease the number of signatures in group 4 and increase the number of signatures in group 5 if a frequency of use of the terminal within the cell is low in the group 4 and high in the group 5. The changed information related to the signature grouping is transmitted from the base station to the terminal using system information or a paging message.

[71] RACH occasion selection

[72] As illustrated in Fig. 4, the base station groups entire RACH occasions according to a specific purpose. The specific purpose may be the same as the previously disclosed specific information used as the criterion for the grouping of signatures or may be different.

[73] For example, signatures may be grouped according to the usage purpose of RACH and RACH occasions may be grouped according to CQI information or both signatures and RACH occasions may be grouped according to the usage purpose of RACH. Grouping information related to the grouped RACH occasions is transmitted to the terminal using system information or a paging message.

[74] Accordingly, one group is selected from the groups of the RACH occasions according to the state of the terminal when the terminal uses a RACH. If the selected group includes two or more RACH occasions, the terminal randomly selects one RACH occasion from the selected group.

[75] The base station uses CQI information as specific information for grouping RACH occasions. For example, the base station groups a group A with a bad channel state, a group B with a good channel state, and a group C with a best channel state. The base station appropriately maps the RACH occasions onto each group.

[76] Information related to the grouping according to the CQI information is transmitted to the terminal using system information or a paging message. The terminal selects

group A according to the set grouping information if the terminal is in a bad channel state. The terminal randomly selects one RACH occasion if group A includes two or more RACH occasions.

[77] The base station can also dynamically change the grouping information. The grouping information that is changed by the base station every period of the RACH occasion or every multiple of the period is transmitted to the terminal using system information or a paging message.

[78] A method of selecting one of groups configured by the combination of signatures and RACH occasions in order to transmit a preamble will now be explained. In this method, a particular signature may not always have the same information. For example, the same signature can deliver different information depending on an RACH occasion with which it is combined.

[79] Fig. 5 illustrates how a base station combines signatures and RACH occasions for their grouping. Fig. 6 illustrates an actual grouping according to the combination of an establishment cause and CQI information described in Fig. 5.

[80] As illustrated in Fig. 5, within one period, four RACH occasions A, B, C and D exist. The four RACH occasions may exist at the same time as shown in Fig. 5 or exist separately at different times. For example, the four RACH occasions A, B, C and D may all exist at Time 2 or exist separately at times 4, 5 and 6. The total number of signatures is assumed to be 16.

[81] Establishment cause and CQI information are used as criteria for a grouping. The establishment cause and CQI information are used, respectively, in two cases. Four groups are generated using the establishment cause and CQI information as illustrated in Fig. 6. The terminal randomly selects one value from a third group which includes C5~C9 and D0~D8 if the establishment cause of the terminal is A and CQI value is 1. C5 indicates a RACH occasion of C and a signature of 5.

[82] As previously indicated, one signature and one RACH occasion may not always indicate the same information. For example, a signature 10 may deliver different information depending on the RACH occasion with which it is combined. A RACH occasion A may also deliver different information depending on the signature with which it is combined. The grouping information according to the combination of signatures and RACH occasions are also transmitted to the terminal using system information or a paging message.

[83] Fig. 7 illustrates an exemplary signal flow of a method of transmitting information in a mobile communications system in accordance with a certain embodiment(s). As illustrated in Fig. 7, a base station 20 groups entire signatures and RACH occasions according to specific purposes and informs a terminal 10 of information related to the grouping using system information or a paging message (S10).

[84] According to a setup of the base station 20, the terminal 10 selects one signature and one RACH occasion from the groups of signatures and RACH occasions or selects one group from groups configured by the combination of signatures and RACH occasions (S11). Using the previous example, the terminal 10 selects one value from the third group including C5-C9 and D0-D8.

[85] The terminal 10 then transmits a preamble to the base station 20 using the selected signature and RACH occasion (S12). The base station 20 then determines to which group the corresponding signature and RACH occasion belong and schedules a radio resource according to the determination in order to allocate an appropriate radio resource to the terminal 10 (S13).

[86] For example, when the terminal 10 has used a signature group for an initial access and RACH occasions have been grouped according to a requested amount of radio resources of 100 bits, the base station 20 allocates an appropriate radio resource to the terminal based upon the information. The terminal uses the corresponding radio resource to transmit uplink data to the base station 20 after receiving the appropriate radio resource allocated from the base station (S14).

[87] The features described herein may be implemented such that a preamble transmission is used to inform the base station of specific information when the terminal uses a RACH and the base station can efficiently allocate a radio resource for data transmission to the terminal according to the specific information. Delay time before the terminal transmits data is reduced and consumption of radio resources is prevented or at least minimized.

[88] As the features in this disclosure may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its scope as defined in the appended claims. Therefore, all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are intended to be embraced by the appended claims.

[89] The foregoing embodiments and features are merely exemplary and are not to be construed as limiting. The present teachings can be readily applied to other types of apparatuses.

[90] This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. In the claims, means-plus-function clauses are intended to cover the structure described herein as performing the recited function and not only structural equivalents but also equivalent structures.

Claims

[1] A method for allocating radio resources in a mobile communication system, the method comprising:
receiving grouping information related to signatures and occasions for accessing a Random Access Channel (RACH);
selecting one signature and one Random Access Channel (RACH) occasion according to the grouping information;
transmitting a preamble according to the selected signature and RACH occasion;
receiving a message comprising a radio resource allocated according to the selected signature and RACH occasion; and
transmitting data using the allocated radio resource.

[2] The method of claim 1, wherein RACH signatures and occasions are grouped according to predetermined criteria.

[3] The method of claim 2, wherein the predetermined criteria comprise at least one of a purpose for using RACH, Channel Quality Indicator (CQI) information, a requested amount of radio resources and an establishment cause.

[4] The method of claim 3, wherein the purpose for using RACH comprises one of an initial access, handover, maintaining synchronization, an access release and a radio resource request.

[5] The method of claim 3, wherein the establishment cause comprises one of an emergency call, transition from an idle state to an active state and transition from a disconnected state to an active state.

[6] The method of claim 1, wherein the grouping information is received in one of system information and a paging message.

[7] A method for allocating radio resources in a mobile communication system, the method comprising:
transmitting grouping information related to signatures and occasions for accessing a Random Access Channel (RACH);
receiving a preamble transmitted according to a signature and RACH occasion selected according to the grouping information;
transmitting a message comprising a radio resource allocated according to the selected signature and RACH occasion; and
receiving data transmitted using the allocated radio resource.

[8] The method of claim 7, further comprising grouping the RACH signatures and occasions according to predetermined criteria.

[9] The method of claim 8, wherein the predetermined criteria comprise at least one of a purpose for using RACH, Channel Quality Indicator (CQI) information, a

requested amount of radio resources and an establishment cause.

[10] The method of claim 9, wherein the purpose for using RACH comprises one of an initial access, handover, maintaining synchronization, an access release and a radio resource request.

[11] The method of claim 9, wherein the establishment cause comprises one of an emergency call, transition from an idle state to an active state and transition from a disconnected state to an active state.

[12] The method of claim 7, wherein the grouping information is transmitted in one of system information and a paging message.

[13] The method of claim 7, further comprising:
changing and retransmitting the grouping information.

[14] A method for allocating radio resources in a mobile communication system, the method comprising:
a network transmitting grouping information related to signatures and occasions for accessing a Random Access Channel (RACH);
a mobile communication terminal selecting one signature and one Random Access Channel (RACH) occasion according to the grouping information;
the mobile communication terminal transmitting a preamble according to the selected signature and RACH occasion;
the network transmitting a message comprising a radio resource allocated according to the selected signature and RACH occasion; and
the mobile communication terminal transmitting data using the allocated radio resource.

[15] The method of claim 14, wherein RACH signatures and occasions are grouped according to predetermined criteria.

[16] The method of claim 15, wherein the predetermined criteria comprise at least one of a purpose for using RACH, Channel Quality Indicator (CQI) information, a requested amount of radio resources and an establishment cause.

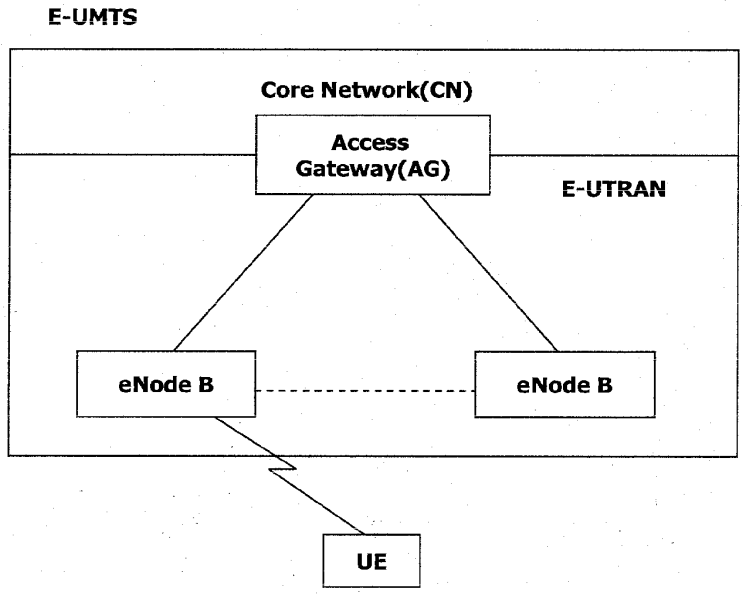
[17] The method of claim 16, wherein the purpose for using RACH comprises one of an initial access, handover, maintaining synchronization, an access release and a radio resource request.

[18] The method of claim 16, wherein the establishment cause comprises one of an emergency call, transition from an idle state to an active state and transition from a disconnected state to an active state.

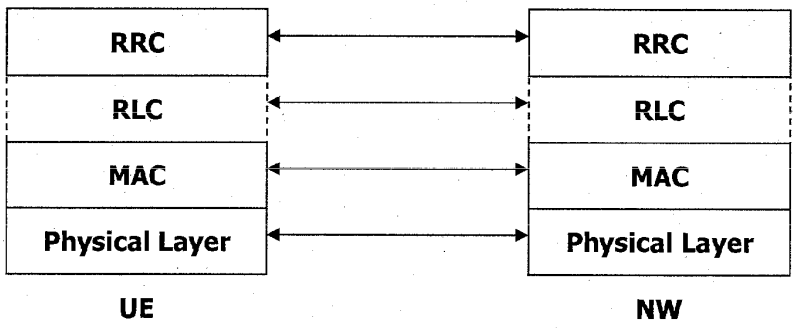
[19] The method of claim 14, wherein the network transmits the grouping information in one of system information and a paging message.

[20] The method of claim 14, further comprising the network changing and re-transmitting the grouping information.

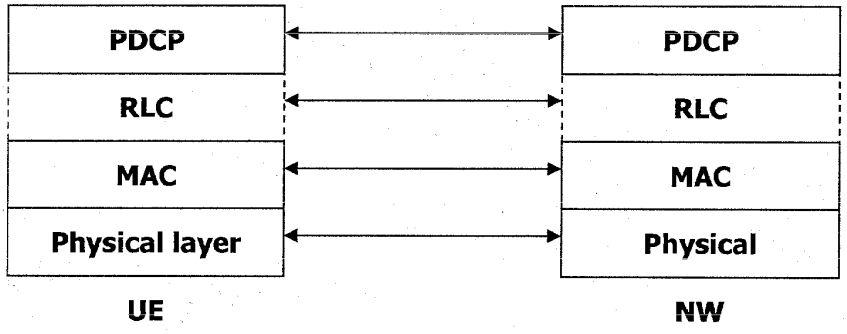
[Fig. 1]



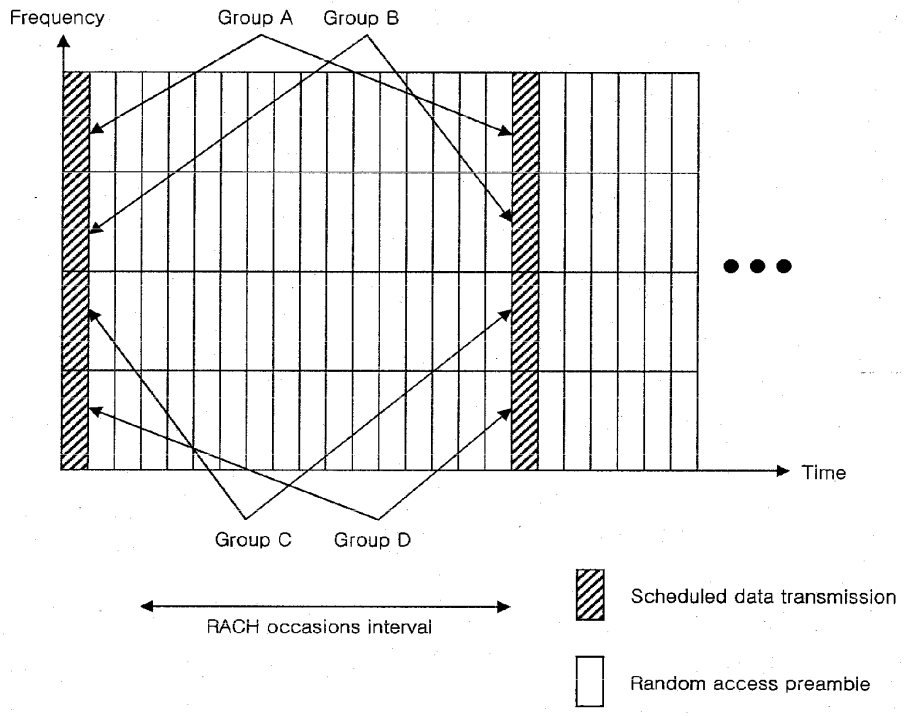
[Fig. 2]



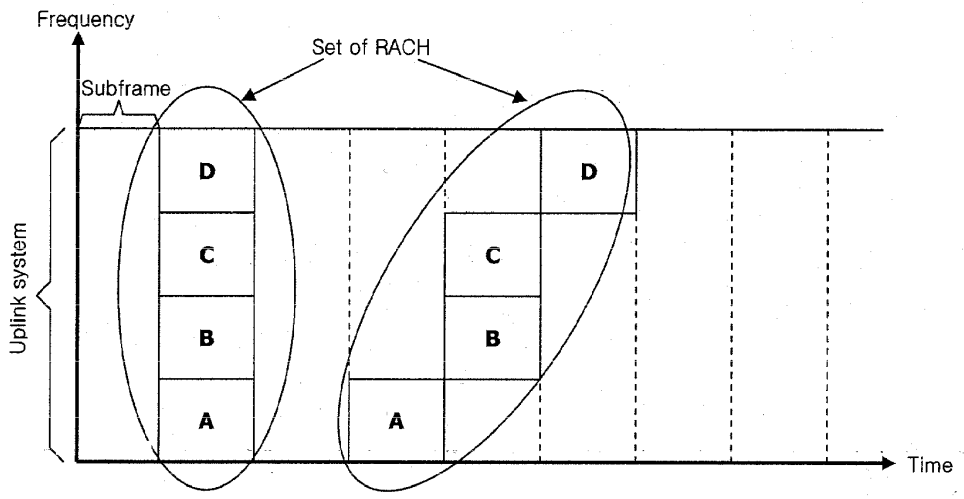
[Fig. 3]



[Fig. 4]


Frequency
Group A
Group B
Time
Group C
Group D
RACH occasions interval
Scheduled data transmission
Random access preamble

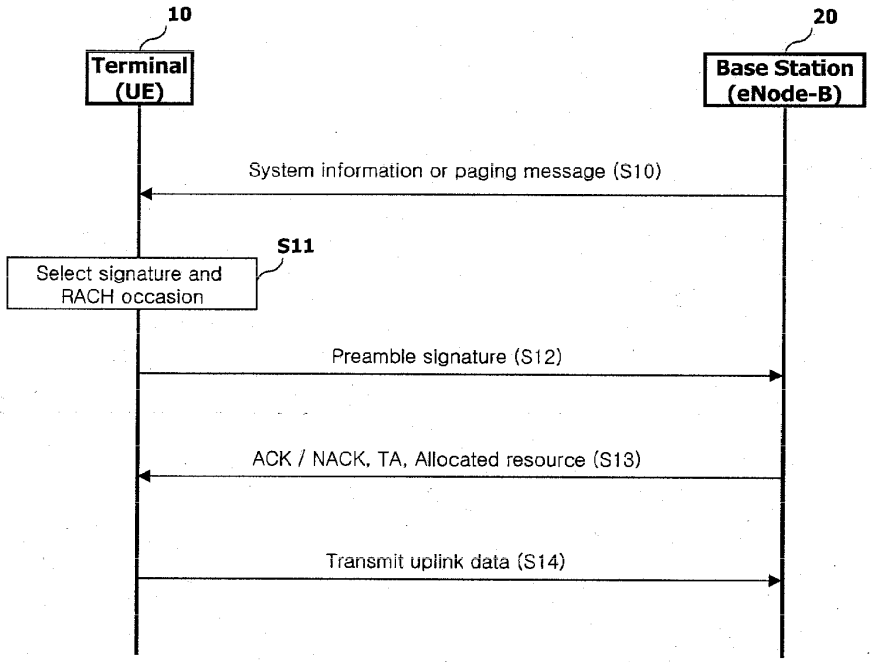
[Fig. 5]


Frequency
Set of RACH
Subframe
Uplink system
D
C
B
A
D
C
B
A
Time

[Fig. 6]

Establishment Cause(A,B)	CQI (0,1)	Available resources(A~G) and signatures(0~15)	Number of random ids/ signatures
A	0	A0,.., A10, B0,.., B7, C0,..,C1	21
B	0	B8,..,B15, C2,..,C4	11
A	1	C5,..,C9, D0,..,D8	14
B	1	A11,..,A15, C10,..,C15, D9,..,D15	18

[Fig. 7]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2007/000067

A. CLASSIFICATION OF SUBJECT MATTER

H04B 7/26(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC8 H04B 7/26, H04Q 7/20, 7/38, H04J 3/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
KOREAN PATENTS AND APPLICATIONS FOR INVENTIONS SINCE 1975
KOREAN UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
eKIPASS, DELPHION, ESPACENET & Keywords : E-UMTS, LTE, random access, RACH, signature, occasion, preamble and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2004-157602 A1 (KHAWAND) 12 August 2004 * abstract, paragraph [0022], figure 7 *	1-20
A	US2003-76812 A1 (BENEDITTIS) 24 April 2003 * abstract, paragraph [0122], figures 7-8 *	1-20
A	US2001-24956 A1 (YOU et al.) 27 September 2001 * abstract, paragraph [0148], figure 11 *	1-20

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 FEBRUARY 2007 (27.02.2007)	**27 FEBRUARY 2007 (27.02.2007)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer KIM, Sang Woo Telephone No. 82-42-481-8324

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2007/000067

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US2004-157602 A1	12.08.2004	US2004157602AA	12.08.2004
US2003-76812 A1	24.04.2003	CA2400883AA	30.08.2001
		CA2400883A1	30.08.2001
		CN1209942C	06.07.2005
		CN1401197A	05.03.2003
		DE10008653A1	06.09.2001
		EP1258087A2	20.11.2002
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		US20030076812AA	24.04.2003
		WO0163775A2	30.08.2001
		WO0163775A3	27.12.2001
US2001-24956 A1	27.09.2001	DE60111299C0	14.07.2005
		DE60111299T2	18.05.2006
		EP1146762A2	17.10.2001
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		JP2001298770A2	26.10.2001
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		KR2001093515A	29.10.2001
		KR2001093516A	29.10.2001
		US2001024956AA	27.09.2001
		US6778835BB	17.08.2004

Electronic Acknowledgement Receipt

EFS ID:	11912201
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	35884
Filer:	David Gerard Majdali/Neeti Rajput
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3617C1
Receipt Date:	24-JAN-2012
Filing Date:	29-DEC-2011
Time Stamp:	19:57:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3617C1_122911_IDSform.pdf	612490 e793c5376dccdf087a5acf9438e5aacf6d407434	no	5

Warnings:	
Information:	

2	Foreign Reference	KR10-2007-0065101.pdf	1402809 a06eea6ca595112b9e72d9be0ffcf0c5d401636b	no	14
Warnings:					
Information:					
3	Foreign Reference	KR10-2007-0080552.pdf	475873 c71fd53babe72e01833ac50d52cb2593defee3fe	no	13
Warnings:					
Information:					
4	Foreign Reference	WO2007-078165.pdf	2200653 dd87f1eac26b0bb5196587c4f4a792739991af83	no	20
Warnings:					
Information:					
			Total Files Size (in bytes):	4691825	

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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.

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

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/340,447

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE($)	FEE($)		RATE($)	FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	1 minus 20 =	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1250

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/340,447	12/29/2011	2473	1250	2101-3617C1	1	1

CONFIRMATION NO. 1869

35884
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660 S. FIGUEROA STREET
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FILING RECEIPT

OC000000051953388

Date Mailed: 01/13/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

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Dragan Vujcic, Limours, FRANCE;

Power of Attorney: The patent practitioners associated with Customer Number 035884

Domestic Priority data as claimed by applicant

This application is a CON of 12/347,352 12/31/2008 PAT 8102804
which claims benefit of 61/018,492 01/01/2008

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2008-0047656 05/22/2008

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

If Required, Foreign Filing License Granted: 01/11/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/340,447**

Projected Publication Date: 04/19/2012

Non-Publication Request: No

Early Publication Request: No
Title

METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

Preliminary Class

370

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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

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

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

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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

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

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

NOT GRANTED

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

SelectUSA

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

PTO/SB/05 (08-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

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

Attorney Docket No.	2101-3617C1
First Inventor	Min Seok NOH
Title	METHOD FOR TRANSMITTING...
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☑ **Fee Transmittal Form** (e.g., PTO/SB/17)
2. ☐ **Applicant claims small entity status.** See 37 CFR 1.27.
3. ☑ **Specification** [*Total Pages* 39]
   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* 17]
5. **Oath or Declaration** [*Total Sheets* 6]
   a. ☐ Newly executed (original or copy)
   b. ☑ A copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 18 completed)
   i. ☐ DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☑ **Application Data Sheet.** See 37 CFR 1.76
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_____
10. ☐ **37 CFR 3.73(b) Statement** *(when there is an assignee)* ☑ **Power of Attorney**
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:_____

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

☑ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: 12/347,352

Prior application information: *Examiner* Chan, Sai Ming *Art Unit:* 2462

19. CORRESPONDENCE ADDRESS

☑ The address associated with Customer Number: 35884 ***OR*** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/Norman T. Lee/	Date	12/29/2011	
Name (Print/Type)	Norman T. Lee	Registration No. (Attorney/Agent)	58,941	

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

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT (U.S.A.)

ATTORNEY'S DOCKET NO. 2101-3617

DECLARATION
and POWER OF ATTORNEY

☒ ORIGINAL
☐ CONTINUATION-IN-PART
☐ DIVISIONAL

As a below named inventor, I declare that the information given herein is true, that I believe that I am the original, first and sole inventor (if only one name is listed as 1 below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

the specification of which is attached hereto unless the following box is checked:

☒ was filed on December 31, 2008 as United States Application Number 12/347,352 .

My residence, post office address and citizenship are as stated below next to my name. I acknowledge my duty to disclose information, which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations § 1.56(a). I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I hereby claim foreign priority benefits under Title 35, United States Code, § 119 OR 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APPLICATION NUMBER	DATE OF FILING Month Day Year	PRIORITY CLAIMED UNDER 35 U.S.C. 119
KOREA	10-2008-0047656	May 22, 2008	YES

I hereby claim the benefit under Title 35, United States Code, §119 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

61/018,492	January 1, 2008	Provisional
(Application Serial No.)	(Filing Date)	(Status)

POWER OF ATTORNEY: As a named Inventor, I hereby appoint the following attorney(s) and/or Agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

THE ATTORNEYS ASSOCIATED WITH CUSTOMER NO. 035884

SEND CORRESPONDENCE TO:	Jonathan Y. Kang, Esq. **LEE, HONG, DEGERMAN, KANG & WAIMEY** At the address associated with **Customer No. 35884**	TELEPHONE NO.: FAX NO.:	(213) 623-2221 (213) 623-2211/8601

1	Name of Inventor	Residence: CITY	STATE or COUNTRY
	Min Seok NOH	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea
2	Name of Inventor	Residence: CITY	STATE or COUNTRY
	Yeong Hyeon KWON	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
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3	Name of Inventor	Residence: CITY	STATE or COUNTRY
	Jin Sam KWAK	Gyeonggi-do	Republic of Korea
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	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea
4	Name of Inventor	Residence: CITY	STATE or COUNTRY
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	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea
5	Name of Inventor	Residence: CITY	STATE or COUNTRY
	Sung Ho MOON	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea
6	Name of Inventor	Residence: CITY	STATE or COUNTRY
	Seung Hee HAN	Gyeonggi-do	Republic of Korea
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	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea

	Name of Inventor	Residence: CITY	STATE or COUNTRY
7	Hyun Woo LEE	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea
	Name of Inventor	Residence: CITY	STATE or COUNTRY
8	Dragan VUJCIC	Limours	France
	Mailing Address		CITIZENSHIP
	8ter, Rue des Cendrieres 91470 Limours, France		France

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 1	SIGNATURE OF INVENTOR 2
DATE	DATE
SIGNATURE OF INVENTOR 3	SIGNATURE OF INVENTOR 4
DATE Mar. 16. 2009	DATE
SIGNATURE OF INVENTOR 5	SIGNATURE OF INVENTOR 6
DATE	DATE
SIGNATURE OF INVENTOR 7	SIGNATURE OF INVENTOR 8
DATE	DATE

PATENT (U.S.A.)

ATTORNEY'S DOCKET NO. 2101-3617

DECLARATION
and POWER OF ATTORNEY

☒ ORIGINAL
☐ CONTINUATION-IN-PART
☐ DIVISIONAL

As a below named inventor, I declare that the information given herein is true, that I believe that I am the original, first and sole inventor (if only one name is listed as 1 below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

the specification of which is attached hereto unless the following box is checked:

☒ was filed on December 31, 2008 as United States Application Number 12/347,352 .

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PRIOR FOREIGN APPLICATION(S)

COUNTRY	APPLICATION NUMBER	DATE OF FILING Month Day Year	PRIORITY CLAIMED UNDER 35 U.S.C. 119
KOREA	10-2008-0047656	May 22, 2008	YES

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61/018,492	January 1, 2008	Provisional
(Application Serial No.)	(Filing Date)	(Status)

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SEND CORRESPONDENCE TO:	Jonathan Y. Kang, Esq. **LEE, HONG, DEGERMAN, KANG & WAIMEY** At the address associated with **Customer No. 35884**	TELEPHONE NO.: FAX NO.:	(213) 623-2221 (213) 623-2211/8601

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	Mailing Address		CITIZENSHIP
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	Jin Sam KWAK	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea
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	Dong Cheol KIM	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
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	Mailing Address		CITIZENSHIP
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	Seung Hee HAN	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea

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7	Hyun Woo LEE	Gyeonggi-do	Republic of Korea
	Mailing Address		CITIZENSHIP
	LG Institute, Hogye 1(il)-dong, Dongan-gu, Anyang-si Gyeonggi-do, 431-749, Korea		Republic of Korea
	Name of Inventor	Residence: CITY	STATE or COUNTRY
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	Mailing Address		CITIZENSHIP
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SIGNATURE OF INVENTOR 1	SIGNATURE OF INVENTOR 2
DATE 03/06/2009	DATE Mar-06-2009
SIGNATURE OF INVENTOR 3	SIGNATURE OF INVENTOR 4
DATE	DATE Mar-06-2009
SIGNATURE OF INVENTOR 5	SIGNATURE OF INVENTOR 6
DATE APR-06-2009	DATE Mar-06-2009
SIGNATURE OF INVENTOR 7	SIGNATURE OF INVENTOR 8 : DRAGAN VUJCIC
DATE Mar/04/2009	DATE: Mar/04/2009

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	A METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Filer:	Norman Thomas Lee/Maggie Wen
Attorney Docket Number:	2101-3617C1

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	380	380
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1250**

Electronic Acknowledgement Receipt	
EFS ID:	11732368
Application Number:	13340447
International Application Number:	
Confirmation Number:	1869
Title of Invention:	A METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE
First Named Inventor/Applicant Name:	Min Seok Noh
Customer Number:	35884
Filer:	Norman Thomas Lee/Maggie Wen
Filer Authorized By:	Norman Thomas Lee
Attorney Docket Number:	2101-3617C1
Receipt Date:	29-DEC-2011
Filing Date:	
Time Stamp:	18:51:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1250
RAM confirmation Number	4924
Deposit Account	502290
Authorized User	KANG,JONATHAN Y.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	2_FeeXM_2101-3617C1.pdf	330895 531ad57557e2ba4edafb77f4d5b0c69dd74661cd	no	2
Warnings:					
Information:					
2		2101-3617C1_PA_filed_12292011.pdf	20035 1c561a49246e63889cd77543ecee5f48fd2ed2af	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Specification	2	2
	Claims	3	3
	Applicant Arguments/Remarks Made in an Amendment	4	4

Warnings:					
Information:					
3		2101-3617_Application.pdf	1410208 c908777e6a56bbe8cd2cae4f77f933b77f93956c	yes	40

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	36
	Claims	37	39
	Abstract	40	40

Warnings:					
Information:					
4	Drawings-only black and white line drawings	2101-3617C1_Drawings_toPTO.pdf	1331531 e371d494a78451ca9c2d27c648985bb009cabaa6	no	17
Warnings:					
Information:					

5	Transmittal of New Application	1_sb0017_XM_2101-3617C1.pdf	321542 999fdafa17753ff6d8e6603957680c4e1f278fb6	no	2
Warnings:					
Information:					
6	Oath or Declaration filed	2101-3617C1_POA.pdf	442290 8e02cb1089297da44c64967d0c8f4352ab5d31bc	no	6
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	33028 8347a7a2d78b66eac1f611aed1e903d318cea85a	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	3889529	

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FEE TRANSMITTAL

Complete if Known	
Application Number	
Filing Date	December 29, 2011
First Named Inventor	Min Seok NOH
Examiner Name	
Art Unit	
Attorney Docket No.	2101-3617C1

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 1,250

METHOD OF PAYMENT (check all that apply)

☐ Check ☑ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☑ Deposit Account Deposit Account Number: 502290 Deposit Account Name: Lee, Hong, Degerman, Kang

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**

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee ($)	FILING FEES Small Entity Fee ($)	SEARCH FEES Fee ($)	SEARCH FEES Small Entity Fee ($)	EXAMINATION FEES Fee ($)	EXAMINATION FEES Small Entity Fee ($)	Fees Paid ($)
Utility	380	190	620	310	250	125	1,250
Design	250	125	120	60	160	80	
Plant	250	125	380	190	200	100	
Reissue	380	190	620	310	750	375	
Provisional	250	125	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	60	30
Each independent claim over 3 (including Reissues)	250	125
Multiple dependent claims	450	225

Total Claims		Extra Claims		Fee ($)		Fee Paid ($)
1	- 20 or HP =	0	x	0	=	0

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

Indep. Claims		Extra Claims		Fee ($)		Fee Paid ($)
1	- 3 or HP =	0	x	0	=	0

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

Multiple Dependent Claims Fee ($)	Multiple Dependent Claims Fee Paid ($)

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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 $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof		Fee ($)		Fee Paid ($)
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SUBMITTED BY

Signature	/Norman T. Lee/	Registration No. (Attorney/Agent) 58,941	Telephone 213-623-2221
Name (Print/Type)	Norman T. Lee		Date 12/29/2011

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

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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Customer No. 035884 Attorney Docket No. 2101-3617C1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re continuation application of: Min Seok Noh et al. Serial No: N/A Filed: Herewith For: A METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE Parent Serial No: 12/347,352 Parent Filed: December 31, 2008	Parent Art Unit: 2462 Parent Examiner: Chan, Sai Ming

PRELIMINARY AMENDMENT

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

Dear Sir:

Prior to examining the above-referenced continuation application, please enter the following amendments:

IN THE SPECIFICATION:

Please amend paragraphs [0001] and [0002] on page 2 of the specification as follows:

[0001] This application is a continuation of U.S. Application No. 12/347,352, filed on December 31, 2008, which claims the benefit of and right of priority to the Korean Patent Application No. 10-2008-0047656, filed on May 22, 2008, ~~which is hereby incorporated by reference as if fully set forth herein~~ and U.S. Provisional Application No. 61/018,492, filed on January 1, 2008, the contents of all of which are incorporated by reference herein in their entireties.

~~[0002] This application also claims the benefit of U. S. Provisional Application Serial No. 61/018,492, filed on January 1, 2008, the contents of which are hereby incorporated by reference herein in their entirety.~~

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IN THE CLAIMS:

Please cancel claims 2-11 without prejudice or disclaimer as follows:

1. (Original) A method of receiving a random access response, the method comprising:

transmitting a random access preamble; and

receiving the random access response corresponding to the random access preamble,

wherein the received random access response includes information of a transmission time when the random access preamble is transmitted.

2 – 11. (Canceled)

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REMARKS

Claim 1 is pending in this continuation application. This preliminary amendment is submitted with an associated patent application filed concurrently herewith. The foregoing amendments contain no new matter. Applicants respectfully request entry of this amendment prior to examination of the application, and early favorable action thereon.

In accordance with MPEP § 201.14(b), Applicants are not submitting an additional certified copy of the foreign priority document since it was made of record in priority U.S Application No. 12/347,352.

The Commissioner is hereby authorized to charge any fees that arise in connection with this application, or credit any overpayment, to Deposit Account No. 502290.

If for any reason the Examiner believes a telephone conference can advance the prosecution of this application, the Examiner is requested to call the undersigned attorney at the Los Angeles, California, telephone number 213-623-2221.

Respectfully submitted,
Lee, Hong, Degerman, Kang & Waimey

Date: December 29, 2011

By: /Norman T. Lee/
Norman T. Lee
Registration No. 58,941
Attorney for Applicant(s)

Customer No. 035884

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UNITED STATES PATENT APPLICATION

OF

[Hyun Woo Lee, Minseok Noh, Yeong Hyeon Kwon, Dragan Vujcic, Jin Sam Kwak, Dong Cheol Kim, Sungho Moon, Seung Hee Han]

FOR

A METHOD FOR TRANSMITTING AND RECEIVING RANDOM ACCESS REQUEST AND TRANSMITTING AND RECEIVING RANDOM ACCESS RESPONSE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of the Korean Patent Application No. 10-2008-0047656, filed on May 22, 2008, which is hereby incorporated by reference as if fully set forth herein.

[0002] This application also claims the benefit of U.S. Provisional Application Serial No. 61/018,492, filed on January 1, 2008, the contents of which are hereby incorporated by reference herein in their entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

[0003] The present invention relates to a wideband radio access system, and more particularly, to a method of transmitting and receiving a random access request (random access preamble) and transmitting and receiving a random access response in a wideband radio access system.

Discussion of the Related Art

[0004] In a technology related to a wideband radio access system, each user equipment may attempt to access the system with a randomly selected sequence or opportunity in each random access channel (RACH) slot. A base station detects a random access sequence (or an RACH sequence) and then transmits a random access response (or an RACH response). Each user equipment receives the random access response from the base station, considers a response including its sequence as its response, and performs a timing advance operation.

[0005] In the technology of this field, each user equipment may attempt to access the system with a randomly selected sequence or opportunity in each RACH slot. A base station detects the RACH sequence and then transmits a response thereof. Each user equipment receives the RACH response from the base station, considers a response including its sequence as its response and performs a timing advance operation. At this time, if an accurate time interval is not present when each user equipment waits for the response, each user equipment may erroneously receive a response of another user equipment as its response. This state is shown in FIG. 1A. FIG. 1A is a view showing an example of an RACH response (random access response). This state may appear in all RACH periods. Referring to "3GPP TS 36.211 v.8.1.0, 'Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation', 2007-12-20" regarding to random access in a wideband radio access system, a table for a random access preamble format, a random access preamble parameter and random access preamble timing for preamble formats 0 to 3 is described. FIG. 1A shows an RACH slot having a period of 1 ms and a preamble format of 0.

[0006] In FIG. 1A, a first user equipment 1 attempts access with a randomly selected sequence 1 in an uplink (UL) subframe 0 (S110). In an uplink subframe 1, a second user equipment 2 attempts access with a randomly selected sequence 1 (S120). If a base station detects the sequences of the two user equipments, the base station transmits responses of the detected sequences (S130). At this time, the two user equipments 1 and 2 which attempt access wait for their responses. When the response of the sequence 1 is reached in an uplink subframe 7, both the user equipment 1 (UE1) and the user equipment 2 (UE2) may determine that the response reached in the uplink subframe 7 is the response for their

sequence. In this case, one of the two user equipments erroneously determines that the response reached in the uplink subframe 7 is its response. Since the two user equipments perform time synchronization by the response received in the uplink subframe 7, one user equipment performs erroneous time synchronization. In addition, since data or a control signal is transmitted again in uplink using the same resource indicated by the response, a problem that the two user equipments use the same resource occurs.

[0007] In FIG. 1 and the description related to FIG. 1, a cell radius is not considered in order to facilitate the understanding of the problems of the technology related to the present invention. However, if the cell radius is actually about 50 km and the propagation speed of an electromagnetic wave is considered, a random access preamble transmitted by the user equipment 1 in the uplink subframe 0 may reach the base station in a downlink subframe 0 or a downlink subframe 1, and a random access preamble transmitted by the user equipment 2 in the uplink subframe 1 may reach the base station in a downlink subframe 1 or a downlink subframe 2. In addition, a random access response transmitted by the base station in the downlink subframe 1 may reach the user equipment 1 and/or the user equipment 2 in the uplink subframe 1 or an uplink subframe 2 and a random access response transmitted by the base station in the downlink subframe 2 may reach the user equipment 1 and/or the user equipment 2 in the uplink subframe 2 or an uplink subframe 3 (see Fig. 1B).

[0008] Unlike the above example, if a resource available in a time domain in which the base station transmits the response is not present, a problem that the response cannot be transmitted on time occurs. In this case, the response of the RACH slot is not transmitted or

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is delayed. At this time, there is a need for a method of distinguishing between a delayed response and a response which is transmitted on time or between delayed responses.

[0009] In addition, if responses of several RACH slots are collected and are simultaneously transmitted, there is a need for a method of distinguishing between RACH slots.

SUMMARY OF THE INVENTION

[0010] An object of the present invention devised to solve the problem lies on a method of transmitting and receiving a random access response, which is capable of preventing a user equipment which attempts to access using a randomly selected sequence from erroneously receiving a response for the access of another user equipment, which attempts access with the same sequence, as a response for its access.

[0011] The object of the present invention can be achieved by providing a method of transmitting a random access preamble and receiving a random access response, the method including: at an user equipment, transmitting the random access preamble; and at the user equipment, receiving the random access response of the random access preamble, wherein the random access response received by the user equipment includes time related information of a time point when the random access preamble corresponding to the received random access response is transmitted. The time related information may include a subframe related number at the time point when the user equipment transmits the random access preamble. The subframe related number may be a number allocated to a subframe, in which a random access channel (RACH) slot is present, of subframes. The allocation

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may be performed by a modulo operation of the subframe number, in which the RACH slot is present, of the subframes. The modulo operation may be a modulo-4 operation. The time related information may be estimated on the basis of a cell size.

[0012] In another aspect of the present invention, provided herein is a method of receiving a random access preamble and transmitting a random access response, the method including: at a base station, receiving the random access preamble; and at the base station, transmitting the random access response of the received random access preamble, wherein the transmitted random access response includes time related information of a time point when the received random access preamble is transmitted or delay offset information related to a processing delay time consumed for transmitting the random access response from when the base station receives the random access preamble. The transmitted time point may be estimated by the base station on the basis of a cell size. The received random access preamble may include time related information of the time point when the received random access preamble is transmitted, and the time related information included in the transmitted random access response may be associated with time related information included in the received random access request.

[0013] In another aspect of the present invention, provided herein is method of transmitting a random access preamble and receiving a random access response, the method including: at a user equipment, transmitting the random access preamble; and at the user equipment, receiving the random access response, wherein the receiving of the random access response at the user equipment is performed in a predetermined time period including a predetermined time after a time point when the random access preamble is

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transmitted, and the predetermined time is a time when a time obtained by adding a predetermined offset time to a time corresponding to a half of a hybrid automatic repeat request (HARQ) process round trip time elapses after the time point when the random access preamble is transmitted. The random access response may include delay offset information, and the delay offset information may be used to change the predetermined time period.

[0014] According to the present invention, it is possible to solve a problem that a user equipment recognizes a random access response for a random access request transmitted by another user equipment as a response for its random access request.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The accompanying drawings, which are included to provide a further understanding of the invention, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention.

[0016] In the drawings:

[0017] FIGs. 1A and 1B are views showing an example of a random access response.

[0018] FIG. 2A is a view showing an example of a frame structure used in a wideband radio access system.

[0019] FIG. 2B is a view showing an example of a random access preamble format.

[0020] FIGs. 3A and 3B are views showing a random access response including time information according to an embodiment of the present invention.

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[0021] FIG. 4 is a flowchart illustrating a method of transmitting and receiving a random access request and a random access response according to another embodiment of the present invention.

[0022] FIGs. 5A and 5B are views showing a random access response including time information if an RACH slot has a period of 2 ms, according to another embodiment of the present invention.

[0023] FIGs. 6A and 6B are views showing a delayed random access response if an RACH slot has a period of 2 ms, according to the embodiment of the present invention.

[0024] FIGs. 7A and 7B are views explaining renumbering and grouping according to another embodiment of the present invention.

[0025] FIG. 8 is a flowchart in detail illustrating an internal process of a step S420 of FIG. 4 according to another embodiment of the present invention.

[0026] FIG. 9 is a flowchart illustrating a method of transmitting and receiving a random access request and a random access response according to another embodiment of the present invention.

[0027] FIG. 10 is a view in detail showing an internal process of a step S920 (S920') of FIG. 9.

[0028] FIG. 11 is a view explaining the principle of an automatic repeat request (ARQ).

[0029] FIG. 12 is a view explaining the principle of a hybrid automatic repeat request (HARQ).

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[0030] FIG. 13 is a view showing a detailed example of a HARQ process according to another embodiment of the present invention.

[0031] FIG. 14 is a flowchart illustrating a method of transmitting and receiving a random access request and a random access response according to another embodiment of the present invention.

[0032] FIG. 15 is a view explaining the classification of channels according to layers in a wideband radio access system.

[0033] FIG. 16 is a view explaining the classification of channels according to layers and areas.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. The following embodiments are examples applied to a wideband radio access system, which may refer to "3GPP TS 36.211 v.8.1.0, 'Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation', 2007-12-20" regarding to random access in a wideband radio access system.

[0035] In the wideband radio access system, a "channel" refers to a passage allocated to transmitter and receiver and indicates a logical signal passage rather than a physical transmission path. Accordingly, several channels may exist in one transmission path.

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[0036] In an asynchronous wideband code division multiplexing access (WCDMA), three channels are defined according to layers. A first channel is a logical channel between a radio link control (RLC) layer and a medium access control (MAC) layer, and is classified depending on which type of information is included, that is, the "type of information". A second transport channel is a channel between the MAC layer and a physical layer, is classified according to the "characteristics of delivery information", and is largely classified into a dedicated transport channel and a common transport channel. A third physical channel is a channel transmitted via an actual antenna and is classified according to the "radio resource and, more particularly, efficiency of a code and RF output" (see FIGs. 15 and 16). In the RLC layer for providing transport reliability, retransmission is performed in the unit of logical channels. That is, when an error occurs in a receiver side, logical channel retransmission is performed in the information units (transmission time intervals (TTIs)), instead of the frame units configured in the physical layer.

[0037] The transport channel is the delivery channel between the physical layer and an upper layer and is defined according to the characteristics of transport data and transmitting methods. The transport channel transmits data received from the logical channel, but the logical channel and the transport channel do not one-to-one correspond to each other. Several logical channels may be transmitted using one transport channel. Accordingly, the MAC layer between the logical channel and the transport channel perform mapping between the logical channel and the transport channel.

[0038] Similar to the logical channel, the transport channel is considered as the flow of data rather than the physical channel. In particular, since all protocols are located at the

same location in the user equipment, the transport channel of the user equipment is internally defined between the MAC layer and the physical layer. Since the physical layer is located at a node B in a universal mobile telecommunication system (UMTS) terrestrial radio access network (UTRAN), an appropriate interface should be defined for data exchange with the MAC layer located at a radio network controller (RNC).

[0039] The transport channel is classified into the dedicated transport channel and the common transport channel according to the characteristics of the delivery information. A dedicated channel (DCH) belongs to the dedicated transport channel, and a broadcasting channel (BCH), a forward access channel (FACH), a paging channel (PCH), a random access channel (RACH), a downlink shared channel (DSCH), a common packet channel (CPCH), and a high speed-downlink shared channel (HS-DSCH) belong to the common transport channel.

[0040] The RACH transmits control information such as short packet data such as a short messaging service (SMS) and call set-up in uplink, and operates by a process similar to a synchronous random access channel on the basis of a slotted ALOHA random access scheme. Accordingly, collision risk with the signal of another user equipment may occur, and an open-loop power control is used. While a transmission rate of 9.6 kbps is defined in the synchronous CDMA system, a transmission rate of up to 120 kbps is defined in an asynchronous system. However, the transmission rate is actually restricted to about 15 kbps.

[0041] The physical channel is transmitted via the actual antenna and various types of information are transmitted via one physical channel or several physical channels. Since some overhead physical channels are used for aiding the transmission and reception of the

physical channels regardless of the upper layer, they are generated by a base station without a direct mapping relation with the transport channel. Among the transport channels, the RACH is mapped to a physical random access channel (PRACH) of the physical channel.

[0042] In uplink random access, a user equipment which does not access a base station uses a slotted ALOHA random access scheme in order to access the base station, and gradually increases and repeatedly transmits a probe output until access becomes successful when a probe (an action for checking and finding something) transmission fails. In the WCDMA system, an Acquisition Indication sense multiple access (AiSMA) scheme of transmitting only a preamble part in each probe, receiving information that synchronization acquisition of an access preamble is performed from the base station via an acquisition indication channel (AICH) and transmitting a message part is employed. Accordingly, since the transmission time of the random access probe in the WCDMA system is extremely shorter than that of the synchronous system, a base station reception noise phenomenon due to the probes which fail in the access to the base station is remarkably improved. Information about subgroups and codes available for a random access preamble part is specified according to access service rating via a system information block (SIB) 5 message from a radio resource management layer which is an upper layer, and information about a transmission format of a message part and a system frame number is received from the MAC layer. A random access channel is used to perform an operation related to a request for the set-up of the call to the base station and to transmit short one-way packet data of one or two frames in uplink.

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[0043] The message part transmitted after an ACK signal for a preamble signal is received has a length of 10 msec or 20 msec, and a substantial data part and a control part are multiplexed to an I/Q channel, are BPSK-modulated and are simultaneously transmitted.

[0044] In order to minimize a probability that RACH signals of several user equipments collide, the transmission of the RACH signals is started in respective access slots specified to the user equipments. The access slot number is uniquely specified in an upper layer. Parameters related to the RACH are broadcasted to all the reception-standby user equipments via the SIB 5 of the BCH.

[0045] FIG. 2A is a view showing an example of a frame structure used in a wideband radio access system.

[0046] In "3GPP TS 36.211 v.8.1.0, 'Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation', 2007-12-20", a physical channel for an evolved UTRA is described. Two frame structures may be used. A first frame structure (see FIG. 2A) is applicable to a full duplex frequency division duplex (FDD) and a half duplex FDD. Each radio frame has a length of 10 ms and is configured by 20 slots each having a length of 0.5 ms. The slots have numbers of 0 to 19. One subframe is configured by two continuous slots. In the FDD, 10 subframes are used for an uplink transmission and a downlink transmission during 10 ms.

[0047] FIG. 2B is a view showing an example of a random access preamble format.

[0048] As shown in FIG. 2B, a physical layer random access preamble includes a cyclic prefix (CP) having a length of T_{CP} and a sequence part having a length of T_{SEQ}.

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Parameters are shown in Table 1 and are decided by the frame structure and the random access configuration. The preamble format is controlled by the upper layer.

[Table 1]

Preamble format	T_{CP}	T_{SEQ}
0	$3618 \cdot T_S$	$24576 \cdot T_S$
1	$21024 \cdot T_S$	$24576 \cdot T_S$
2	$6240 \cdot T_S$	$2 \cdot 24576 \cdot T_S$
3	$21024 \cdot T_S$	$2 \cdot 24576 \cdot T_S$
4 (Corresponding to only frame structure type 2.)	$448 \cdot T_S$	$4096 \cdot T_S$

[0049] With respect to the preamble formats 0 to 3, a maximum of one random access resource exists per subframe. Table 2 shows subframes for allowing a random access preamble transmission in the given configuration. If it is assumed that a timing advance is zero, the start of the random access preamble will be aligned in parallel to the start of an uplink subframe corresponding to a user equipment (terminal). In Table 2, the random access channel has a period of 1 ms to 20 ms.

[Table 2]

PRACH configuration	System frame number	Subframe number
0	Even	1
1	Even	4
2	Even	7
3	Any	1
4	Any	4
5	Any	7
6	Any	1, 6
7	Any	2, 7
8	Any	3, 8
9	Any	1, 4, 7
10	Any	2, 5, 8
11	Any	3, 6, 9
12	Any	0, 2, 4, 6, 8

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13	Any	1, 3, 5, 7, 9
14	Any	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
15	Even	9

[0050] In the following description, the RACH configuration having the period of 1 ms will be described. However, the present invention is not limited to such an RACH period. In addition, since the effect of the present invention is further increased when the period is short, the present invention may be used only in a specific RACH configuration having a short period. In addition, although the 3GPP LTE system is used for convenience of description, the present invention is not limited to this. For example, the present invention is applicable to a ranging channel of the IEEE 802.16 (hereinafter, referred to as 802.16). In other words, an RACH response of the LTE described in the present invention may be analyzed as a ranging response of the 802.16.

[0051] FIG. 3A is a view showing a random access response including time information according to an embodiment of the present invention.

[0052] In the embodiment of the present invention described in FIG. 3A, since a method of transmitting a random access response including time information is used, it is possible to prevent the random access response from being erroneously received. In this case, since additional information is further transmitted, signaling overhead may slightly occur. For example, as shown in FIG. 3A, when the base station transmits the random access response, it is possible to transmit the uplink subframe number of the time point when the user equipment transmits a random access request (random access preamble) (hereinafter, the uplink subframe number of an uplink subframe 0 is denoted by "0"). Like the embodiment described in FIG. 3A, it is assumed that each subframe has a length of 1 ms in a

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time domain. In addition, it is assumed that an RACH slot for transmitting the random access preamble has a period of 1 ms. A user equipment 1 may transmit a random access preamble having a randomly selected sequence number 1 in an uplink subframe 0 (S310). A user equipment 2 may transmit a random access preamble having a sequence number 1, which is randomly selected but is identical to the sequence transmitted by the user equipment 1, in an uplink subframe 1 (S320). A base station may receive the random access sequence transmitted by the user equipment 1 in a downlink subframe 3 and then transmit a random access response thereof (S330). This random access response may include information about the sequence number 1 and the uplink subframe 0. Thereafter, the base station may receive the random access sequence transmitted by the user equipment 2 in a downlink subframe 4 and then transmit a random access response thereof (S340). This random access response may include information about the sequence number 1 and the uplink subframe 1. The user equipment 1 and the user equipment 2 may receive the random access response of the random access preamble transmitted by the user equipment 1 in an uplink subframe 7. Thereafter, the user equipment 1 and the user equipment 2 may check whether the uplink subframe number included in the received random access response is identical to any one of the uplink subframe numbers of the random access preambles transmitted by the user equipment 1 and the user equipment 2. If the uplink subframe number included in the random access response received by the user equipment 1 is identical to the uplink subframe number of the random access preamble transmitted by the user equipment 1, it may be determined that the random access response received by the user equipment 1 is the response of the random access transmitted by the user equipment 1. However, if the uplink subframe

number included in the random access response received by the user equipment 1 is not identical to the uplink subframe number of the random access preamble transmitted by the user equipment 1, it may be determined that the random access response received by the user equipment 1 is not the response of the random access transmitted by the user equipment 1. Similarly, if the uplink subframe number included in the random access response received by the user equipment 2 is identical to the uplink subframe number of the random access preamble transmitted by the user equipment 2, it may be determined that the random access response received by the user equipment 2 is the response of the random access transmitted by the user equipment 2. However, if the uplink subframe number included in the random access response received by the user equipment 2 is not identical to the uplink subframe number of the random access preamble transmitted by the user equipment 2, it may be determined that the random access response received by the user equipment 2 is not the response of the random access transmitted by the user equipment 2.

[0053] In FIG. 3A and the description related to FIG. 3A, a cell radius is not considered in order to facilitate the understanding of the problems of the technology related to the present invention. However, if the cell radius is actually about 50 km and the propagation speed of an electromagnetic wave is considered, the random access preamble transmitted by the user equipment 1 in the uplink subframe 0 may reach the base station in a downlink subframe 0 or a downlink subframe 1, and the random access preamble transmitted by the user equipment 2 in the uplink subframe 1 may reach the base station in a downlink subframe 1 or a downlink subframe 2. Similarly, a random access response transmitted by the base station in the downlink subframe 1 may reach the user equipment 1 and/or the user

equipment 2 in the uplink subframe 1 or an uplink subframe 2 and a random access response transmitted by the base station in the downlink subframe 2 may reach the user equipment 1 and/or the user equipment 2 in the uplink subframe 2 or an uplink subframe 3 (see Fig. 3B).

[0054] FIG. 4 is a flowchart illustrating a method of transmitting and receiving a random access between a user equipment 1, a user equipment 2 and a base station, according to another embodiment of the present invention.

[0055] The user equipment 1 and the user equipment 2 select random access channel parameters, such as a PRACH configuration and a preamble format, in steps S410 and S410', respectively. As the PRACH configuration and the preamble format, one of the configurations shown in Table 1 and Table 2 may be selected. The user equipment 1 and the user equipment 2 may decide the sequence number of the random access preamble to be transmitted and apply it to the preamble, respectively. The random access preamble sequence numbers transmitted by the user equipment 1 and the user equipment 2 may be identical or different. In this embodiment, it is assumed that the sequence numbers transmitted by the user equipment 1 and the user equipment 2 are identical to "1". The user equipment 1 and the user equipment 2 extract and store the uplink subframe numbers at time points when the random access preambles are transmitted, in steps S420 and S420', respectively. The time point when the random access preamble is transmitted by the user equipment 1 may be different from the time point when the random access preamble is transmitted by the user equipment 2. Hereinafter, the respective uplink subframe numbers stored by the user equipment 1 and the user equipment 2 are denoted by sf_F_N. In this embodiment, the random access preambles RAP1 and RAP2 transmitted by the user

equipment 1 and the user equipment 2 are transmitted at time points corresponding to the uplink subframe numbers sf_F_N=1 and sf_F_N=2, respectively. The user equipment 1 and the user equipment 2 transmit the random access preambles in steps S430 and S430', respectively.

[0056] If the base station 3 receives the random access preambles (e.g., RAP1 and RAP2), the base station 3 extracts the sequence numbers of the received random access preambles and estimates the uplink subframe numbers sf_F_N=j, which might be transmitted by the received random access preambles, in consideration of the cell radius (cell size). The base station 3 includes the estimated information in the random access responses of the received random access preambles (S440). Thereafter, the base station 3 transmits the random access responses (S450). The transmitted random access responses may reach the user equipment 1 and the user equipment 2. In this embodiment, the base station 3 transmits the random access response of the random access preamble transmitted by the user equipment 1 before transmitting the random access response of the random access preamble transmitted by the user equipment 2. The user equipment 1 and the user equipment 2 receive the respective random access responses transmitted in the step S450. The user equipment 1 and the user equipment 2 extract the uplink subframe numbers included in the received random access responses and compare the extracted subframe numbers with the uplink subframe numbers stored in the step S420 (step S420'), in the steps S460 and S460'. In the user equipment 1, since the uplink subframe number sf_R_N=1 included in the received random access response is identical to the stored uplink subframe number sf_F_N=1 of the random access preamble transmitted by the user equipment 1, it may be determined that the received

random access response is the response of the random access preamble transmitted by the user equipment 1. In the user equipment 2, since the uplink subframe number sf_R_N=1 included in the received random access response is different from the stored uplink subframe number sf_F_N=2 of the random access preamble transmitted by the user equipment 2, it may be determined that the received random access response is not the response of the random access preamble transmitted by the user equipment 2. Each user equipment may further use sequence information included in the received random access response as well as the uplink subframe number included in the received random access response, in order to check whether the random access response received by each user equipment is the response of the random access preamble transmitted by each user equipment. If both the sequence information and the uplink subframe number included in the random access response received by any user equipment are identical to the sequence information included in the random access preamble transmitted by the user equipment and the uplink subframe number at the time point when the user equipment transmits the random access preamble, it may be determined that the received random access response is the response of the random access preamble transmitted by the user equipment.

[0057] FIG. 5A shows the case where each subframe has a length of 1 ms in a time domain and an RACH slot for transmitting a random access preamble has a period of 2 ms.

[0058] A user equipment 1 transmits a random access preamble having a randomly selected sequence number 1 in an uplink subframe 0 (S510). A user equipment 2 transmits a random access preamble having a sequence number 1, which is randomly selected but is identical to the sequence transmitted by the user equipment 1, in an uplink subframe 2 (S520).

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A base station receives the random access sequence transmitted by the user equipment 1 in a downlink subframe 3 and then transmits a random access response thereof (S530). This random access response (S530) includes the sequence number 1 and the uplink subframe number sf_F_N=0 included in the random access preamble received in the downlink subframe 3, which is estimated by the base station in consideration of a cell radius (cell size). Thereafter, the base station receives the random access sequence transmitted by the user equipment 2 in a downlink subframe 5 and then transmits a random access response thereof (S540). This random access response (S540) may include the sequence number 1 and the uplink subframe number sf_F_N=2 included in the random access preamble received in the downlink subframe 5, which is estimated by the base station in consideration of a cell radius (cell size).

[0059] The embodiment of FIG. 5A is different from the embodiment of FIG. 3A in that the random access sequence is transmitted only in the uplink subframe having an even number. That is, the random access sequence is transmitted only in the uplink subframes 0, 2, 4, 6 and 8 which is hatched in FIG. 5A. Accordingly, in order to enable the base station to estimate the uplink subframe numbers so as to represent the numbers by binary numbers, four signaling bits are necessary. If the original uplink subframe numbers Original={0, 2, 4, 6, 8} are renumbered to Renumbered={0, 1, 2, 3, 4}, the numbers can be represented using only three signaling bits. Thus, it is possible to reduce the number of signaling bits. This concept is applicable to the embodiment of FIG. 4.

[0060] Although one RACH channel is present per subframe in the present invention, this is exemplary for convenience of description and the present invention is

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applicable to the case where several RACH channels are present per subframe. For example, the RACH channel number and the subframe number can be signaled on a frequency within a subframe. Alternatively, the numbers may be two-dimensionally allocated and signaled in frequency and time domains. An RACH channel may be numbered on a frequency within a subframe and an RACH channel of a next subframe may be then numbered subsequent to that number. In contrast, an RACH channel is first numbered on a subframe and an RACH channel may be then numbered on another frequency domain subsequent to that number.

[0061] In the invention, the RACH subframe number may be defined in the unit of frames or superframes.

[0062] In FIG. 5A and the description related to FIG. 5A, a cell radius is not considered in order to facilitate the understanding of the problems of the technology related to the present invention. However, if the cell radius is actually about 50 km and the propagation speed of an electromagnetic wave is considered, the random access preamble transmitted by the user equipment 1 in the uplink subframe 0 may reach the base station in a downlink subframe 0 or a downlink subframe 1, and the random access preamble transmitted by the user equipment 2 in the uplink subframe 2 may reach the base station in a downlink subframe 2 or a downlink subframe 3. Similarly, a random access response transmitted by the base station in the downlink subframe 1 may reach the user equipment 1 and/or the user equipment 2 in the uplink subframe 1 or an uplink subframe 2, and a random access response transmitted by the base station in the downlink subframe 3 may reach the user equipment 1 and/or the user equipment 2 in the uplink subframe 3 or an uplink subframe 4 (see Fig. 5B).

[0063] FIG. 6A is a view showing a delayed random access response if an RACH slot has a period of 2 ms, in the embodiment of FIG. 5A.

[0064] That is, the random access response of the uplink subframe 0 is delayed. When a base station receives a random access preamble in a downlink subframe 3 (S610), the base station may not have a resource which will be transmitted in downlink. This may occur in various cases. For example, if a resource is used for a dedicated multicast broadcast single frequency network (MBSFN), a unicast downlink resource cannot be allocated. In contrast, although a resource is not used for a special purpose, all resources may be used for other control signals and data signals at a specific time. In this case, the transmission of the random access response may be delayed. In addition, several random access responses may be simultaneously transmitted by one resource. Accordingly, time information (that is, delay offset information) related to the delayed time is preferably included in the random access response. As the time information (or the time related information), other information related to the time and/or the subframe number may be used.

[0065] In FIG. 6A and the description related to FIG. 6A, a cell radius is not considered in order to facilitate the understanding of the problems of the technology related to the present invention. However, if the cell radius is actually about 50 km and the propagation speed of an electromagnetic wave is considered, the random access preamble transmitted by the user equipment 1 in the uplink subframe 0 may reach the base station in a downlink subframe 0 or a downlink subframe 1, and the random access preamble transmitted by the user equipment 2 in the uplink subframe 2 may reach the base station in a downlink subframe 2 or a downlink subframe 3. Similarly, a random access response transmitted by

the base station in the downlink subframe 3 may reach the user equipment 1 and/or the user equipment 2 in the uplink subframe 3 or an uplink subframe 4 (see FIG. 6B).

[0066] FIGs. 7A and 7B are views explaining renumbering and grouping according to another embodiment of the present invention.

[0067] Up to now, the uplink subframe number or the renumbered uplink subframe number was used as the time information included in the random access response. However, a grouping method may be used when the uplink subframe number is renumbered. As the grouping method, a modulo operation and/or various known methods may be used (the modulo operation indicates an operation for obtaining a remainder when a number is divided by another number). For example, a modulo-4 operation indicates an operation for obtaining a remainder when any number is divided by 4 as a result value. For example, the subframe number may be renumbered so as to be repeated in a period of 10 ms or less. For example, while 4-bit signaling is necessary if a fifteenth PRACH configuration of Table 2 is used, 2-bit signaling is necessary if the uplink subframe number is subjected to the modulo-4 operation. Application examples may be made using various PRACH configurations of Table 2. FIGs. 7A and 7B show one of these examples. In FIGs. 7A and 7B, in a configuration in which the length of an uplink subframe is 1 ms and RACH slots are repeated in a period of 2 ms, the uplink subframe numbers in which the RACH slots are present are renumbered. The uplink subframe numbers are grouped and repeated by the modulo-4 operation.

[0068] FIG. 8 is a flowchart in detail illustrating an internal process of a step S420 of FIG. 4, in which the embodiment of FIG. 7 is applied to the embodiment of FIG. 4.

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[0069] In a step S810, subframes in which an RACH slot is present are detected. In a step S820, numbers are reallocated to only the uplink subframes in which the RACH slot is present. In a step S830, the reallocated number of an uplink subframe at a time point when a random access will be transmitted is decided. In a step S840, the decided reallocated number is stored. Although, in this embodiment, the RACH slots are present only in even-numbered frames, the RACH slots may be present in any numbered frames. That is, the reallocation of the numbers in the step S830 may use the grouping method. In more detail, the modulo operation may be used.

[0070] FIG. 9 is a flowchart illustrating a method of transmitting and receiving a random access request and a random access response according to another embodiment of the present invention, that is, a method of transmitting and receiving a random access between a user equipment 1, a user equipment 2 and a base station.

[0071] The user equipment 1 and the user equipment 2 may select random access channel parameters such as a PRACH configuration and a preamble format in steps S910 and S910', respectively. As the PRACH configuration and the preamble format, one of the configurations shown in Table 1 and Table 2 may be selected. The user equipment 1 and the user equipment 2 decide the sequence numbers of the random access preambles to be transmitted and apply to the random access preambles, respectively. In this embodiment, the random access preamble sequence numbers transmitted by the user equipment 1 and the user equipment 2 may be identical or different. The user equipment 1 and the user equipment 2 extract the uplink subframe numbers at time points when the random access preambles are transmitted and include the extracted uplink subframe numbers in the random

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access preambles to be transmitted, in steps S920 and S920', respectively. The time point when the random access preamble is transmitted by the user equipment 1 may be different from the time point when the random access preamble is transmitted by the user equipment 2. Hereinafter, the respective uplink subframe numbers included in the random access preambles transmitted by the user equipment 1 and the user equipment 2 are denoted by sf_F_N. In this embodiment, the random access preambles RAP1 and RAP2 transmitted by the user equipment 1 and the user equipment 2 are transmitted at time points corresponding to the uplink subframe numbers sf_F_N=1 and sf_F_N=2, respectively. The user equipment 1 and the user equipment 2 transmit the random access preambles in steps S930 and S930', respectively. In this embodiment, it is assumed that both the random access preambles transmitted by the user equipment 1 and the user equipment 2 have a sequence number 1.

[0072] If the base station 3 receives the random access preambles (e.g., RAP1 and RAP2), the base station 3 may extract the sequence numbers and the uplink subframe number sf_F_N=j included in the received random access preambles and include the extracted information in the random access responses of the received random access preambles (S940). Hereinafter, the uplink subframe number included in the random access response is denoted by sf_R_N. Thereafter, the base station 3 transmits the random access response RAR1 (S950). The transmitted random access response RAR1 may reach the user equipment 1 and the user equipment 2. In this embodiment, the base station 3 may transmit the random access response RAR1 of the random access preamble transmitted by the user equipment 1 before transmitting the random access response RAR2 of the random access preamble transmitted by the user equipment 2. The user equipment 1 and the user equipment 2

receive the respective random access responses RAR1 transmitted in the step S950. The user equipment 1 and the user equipment 2 extract the uplink subframe number included in the received random access responses RAR1 and compare the extracted uplink subframe number with the uplink subframe numbers included in the respective random accesses transmitted by the user equipments, in the steps S960 and S960'. In the user equipment 1, since the uplink subframe number sf_R_N=1 included in the received random access response RAR1 is identical to the uplink subframe number sf_F_N=1 of the random access preamble RAP1 transmitted by the user equipment 1, it may be determined that the received random access response RAR1 is the response of the random access preamble RAP1 transmitted by the user equipment 1. In the user equipment 2, since the uplink subframe number sf_R_N=1 included in the received random access response RAR1 is different from the uplink subframe number sf_F_N=2 of the random access preamble RAP2 transmitted by the user equipment 2, it may be determined that the received random access response RAR1 is not the response of the random access preamble RAP2 transmitted by the user equipment 2. Each user equipment may further use sequence information included in the received random access response as well as the uplink subframe number included in the received random access response, in order to check whether the random access response received by each user equipment is the response of the random access preamble transmitted by each user equipment. If both the sequence information and the uplink subframe number included in the random access response received by any user equipment are identical to the sequence information and the uplink subframe number included in the random access preamble transmitted by the user

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equipment, it may be determined that the received random access response is the response of the random access preamble transmitted by the user equipment.

[0073] FIG. 10 is a view in detail showing an internal process of the step S920 (S920') of FIG. 9.

[0074] The user equipments 1 and 2 decide the uplink subframe numbers at the time point when the random access preambles are transmitted. Thereafter, the user equipments 1 and 2 add the uplink subframes numbers decided in the step S1010 to the preambles to be transmitted, in a step S1020. FIGs. 11, 12 and 13 are views facilitating the understanding of the other embodiments of the present invention, which show the principle of an ARQ, the principle of a HARQ and a detailed example of a HARQ process, respectively.

[0075] In the other embodiments of the present invention, a user equipment waits for a response at a predetermined time period. The user equipment which transmits a random access preamble can previously know a time point when a response of the random access preamble transmitted by the user equipment is transmitted, on the basis of the predetermined time period.

[0076] For example, the predetermined time period may be decided in association with HARQ timing. The HARQ is a hybrid technology of an ARQ technology of an MAC layer and a channel coding technology of a physical layer. The ARQ is a closed-loop error correction method based on feedback. If an error occurs in the physical layer in spite of making an effort to suppress the occurrence of the error in a transmission by forward error correction (FEC), a packet in which the error occurs is retransmitted by the ARQ in an RLC

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layer. As a result, when data is transmitted to the RLC layer in uplink, information may be restored by only packets without an error.

[0077] FIG. 11 is a view explaining the principle of the ARQ. If an error occurs when a packet P_1 transmitted by a transmitter Tx is received by a receiver Rx (S1110), the receiver Rx transmits a negative acknowledgement (NAK) signal (S1120). The transmitter Tx which receives the NAK signal retransmits the same packet P_1 as the packet P_1 in which the error occurs upon transmission (S1130). If the receiver Rx confirms that an error does not occur in the retransmitted packet, the receiver Rx transmits an ACK signal to the transmitter Tx (S1140). The transmitter Tx which receives the ACK signal transmits a new packet P_2 (S1150).

[0078] FIG. 12 is a view explaining the principle of the HARQ. The HARQ is different from the ARQ in that the channel coding of the physical layer is combined to the ARQ. If an error occurs when a receiver Rx receives a packet P_{1A} transmitted by a transmitter Tx (S1210), the receiver Rx transmits an NAK signal (S1220). The transmitter Tx which receives the NAK signal transmits a packet P_{1B} (S1230). In FIG. 12, the packet P_{1A} and the packet P_{1B} are made of the same information bits, that is, the same channel encoder input packet P_{1A} and are identical or slightly different. In the HARQ, although an error occurs in the packet P_{1A} which is first transmitted, since the packet P_{1A} has any information amount, the packet P_{1A} is stored without being discarded until the retransmitted signal is received and is soft-combined with the retransmitted signal P_{1B} or is demodulated using another method. A method of utilizing packets in which errors occur and newly

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retransmitted packets includes a chase combining (CC) method and an incremental redundancy (IR) method.

[0079] Each user equipment can estimate a random access response location on the basis of HARQ timing at a time location of the RACH slot transmitted by the user equipment and receive only a downlink signal in a specific time location section. For example, like FIG. 13 showing the example of the HARQ process, if it is assumed that a time consumed for performing the HARQ process is 1 ms and the number of HARQ processes is 8, a time consumed for, at the user equipment, processing a signal transmitted from a base station in downlink and, at the base station, processing the signal transmitted by the user equipment in uplink is 8 ms. In FIG. 13, T_{prop} denotes a propagation delay time. A half of a HARQ round trip time or a half of the total number of HARQ processes is consumed for receiving a response of a transmitted signal excluding the processing time of the received signal.

[0080] The user equipment which attempts random access may wait for a half of the HARQ round trip time or a half of the total number of HARQ processes from a time point when a random access preamble is transmitted, and wait for a response within a predetermined time period from a time point when a half of the HARQ round trip time or a half of the total number of HARQ processes elapses. Alternatively, a method of applying an offset (delay offset) in consideration of a difference between a data processing time and a random access processing time may be used. For example, a method of receiving a downlink signal by the user equipment at a location separated from a time determined by the HARQ round trip time or the total number of HARQ processes by one subframe. This

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offset may be represented by adding or subtracting a predetermined number and may be represented by a multiple of the number of HARQ processes.

[0081] If the RACH having a length of 2 ms or 3 ms is transmitted in the above method, a method of estimating a time for waiting for a response from a time location for a start time location of an RACH slot is possible. Alternatively, a method of estimating a time for waiting for a response from a time location for an end time location of an RACH slot is possible.

[0082] It is possible to prevent each user equipment to erroneously receive a response for another user equipment as its response using a predetermined response reception time location. If this method is used, signaling overhead is no longer included in random data in which overhead is transmitted and received.

[0083] FIG. 14 is a flowchart illustrating a method of transmitting and receiving a random access between a user equipment 1, a user equipment 2 and a base station, according to an embodiment of the present invention.

[0084] The user equipment 1 and the user equipment 2 select random access channel parameters, such as a PRACH configuration and a preamble format, in steps S1410 and S1410', respectively. As the PRACH configuration and the preamble format, one of the configurations shown in Table 1 and Table 2 may be selected. The user equipment 1 and the user equipment 2 may decide the sequence numbers of the random access preambles to be transmitted and apply it to the random access preambles, respectively. In this embodiment, the random access preamble sequence numbers transmitted by the user equipment 1 and the user equipment 2 may be identical or different. The user equipment 1 and the user

equipment 2 decide default times, in which the random access responses of the random access preambles to be transmitted will be received, and default uplink subframe sections in advance. The default times or the default uplink subframe sections may be changed when processing delay occurs in the base station. This change may be, although described below, performed by, at the base station, transmitting a random access response in a state of including information about a processing delay time when processing delay occurs in the base station. The time point when the random access preamble is transmitted by the user equipment 1 may be different from the time point when the random access preamble is transmitted by the user equipment 2. In this embodiment, the random access preambles RAP1 and RAP2 transmitted by the user equipment 1 and the user equipment 2 are transmitted at time points corresponding to the uplink subframe numbers sf_F_N=1 and sf_F_N=2, respectively. The user equipment 1 and the user equipment 2 transmit the random access preambles in steps S1430 and S1430', respectively.

[0085] If the base station 3 receives the random access preambles (e.g., RAP1 and RAP2), the base station 3 transmits a random access response RAR1 of the received random access preambles. At this time, as described above in association with FIG. 7, if the base station uses all resources for other processes and thus cannot allocate the resources with respect to the random access request, processing delay may occur when the random access response is transmitted. If such processing delay occurs, the base station 3 may include information about the processing delay time (timing offset) in the random access response (S1440). Thereafter, the base station transmits a random access response RAR1 (S1450). The transmitted random access response may reach both the user equipment 1 and the user

equipment 2. In this embodiment, the base station 3 transmits the random access response RAR1 of the random access preamble transmitted by the user equipment 1 before transmitting the random access response RAR2 of the random access preamble transmitted by the user equipment 2. The user equipment 1 and the user equipment 2 receive the respective random access responses transmitted in the steps S1460 and S1460'. The user equipment 1 and the user equipment 2 check whether the received random access responses are received at the default times set in the steps S1460 and S1460', respectively. Hereinafter, the step S1460 of the user equipment 1 will be described.

[0086] It is assumed that the received random access response is received at the default time set by the user equipment 1. At this time, the received random access response may be or may not be the response of the random access preamble transmitted by the user equipment 1. If the offset included in the received random access response is 0 (zero), it is indicated that the processing delay does not occur in the base station 3. Accordingly, it may be determined that the random access response received at the default time set by the user equipment 1 is the response of the random access preamble transmitted by the user equipment 1. In contrast, if the offset included in the received random access response is not 0 (zero), it is indicated that the processing delay occurs in the base station. Accordingly, it may be determined that the random access response received at the default time set by the user equipment 1 is not the response of the random access preamble transmitted by the user equipment 1.

[0087] Subsequently, the step S1460 of the user equipment 1 will be described. It is assumed that the received random access response is not received at the default time set by

the user equipment 1. At this time, the received random access response may be or may not be the response of the random access preamble transmitted by the user equipment 1. If the offset included in the received random access response is 0 (zero), it is indicated that the processing delay does not occur in the base station 3. Accordingly, the user equipment 1 should receive the random access response at the default time set by the user equipment 1. Thus, it may be determined that the received random access response is not the response of the random access preamble transmitted by the user equipment 1. In contrast, if the offset included in the received random access response is not 0 (zero), it is indicated that the processing delay occurs in the base station. Accordingly, it may be determined that the random access response received at the default time set by the user equipment 1 is the response of the random access preamble transmitted by the user equipment 1. It is assumed that the user equipment 1 receives the random access response after j sections (or the number of subframes or the time) from a time decided in the step S1420. At this time, the offset included in the received random access response corresponds to the j sections, it is determined that the received random access response is the response of the random access preamble transmitted by the user equipment 1. In contrast, if the offset included in the received random access response does not correspond to the j sections, it is determined that the received random access response is not the response of the random access preamble transmitted by the user equipment 1.

[0088] The above-described embodiments are proposed by combining constituent components and characteristics of the present invention according to a predetermined format. The individual constituent components or characteristics should be considered to be optional

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factors on the condition that there is no additional remark. If required, the individual constituent components or characteristics may not be combined with other components or characteristics. Also, some constituent components and/or characteristics may be combined to implement the embodiments of the present invention. The order of operations to be disclosed in the embodiments of the present invention may be changed to another. Some components or characteristics of any embodiment may also be included in other embodiments, or may be replaced with those of the other embodiments as necessary. It will be apparent to those skilled in the art that unrelated claims are combined so as to configure embodiments or are included in new claims by amendments after an application.

[0089] The above-mentioned embodiments of the present invention are disclosed on the basis of a data communication relationship between a base station and a mobile station. In this case, the base station is used as a terminal node of a network via which the base station can directly communicate with the mobile station. Specific operations to be conducted by the base station in the present invention may also be conducted by an upper node of the base station as necessary. In other words, it will be obvious to those skilled in the art that various operations for enabling the base station to communicate with the mobile station in a network composed of several network nodes including the base station will be conducted by the base station or other network nodes other than the base station. The term "Base Station" may be replaced with a fixed station, Node-B, eNode-B (eNB), or an access point as necessary. The term "mobile station" may also be replaced with a user equipment (UE), a mobile station (MS) or a mobile subscriber station (MSS) as necessary.

[0090] The embodiments of the present invention can be implemented by a variety of means, for example, hardware, firmware, software, or a combination of them. In the case of implementing the present invention by hardware, the present invention can be implemented with application specific integrated circuits (ASICs), Digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), a processor, a controller, a microcontroller, a microprocessor, etc.

[0091] If operations or functions of the present invention are implemented by firmware or software, the present invention can be implemented in the form of a variety of formats, for example, modules, procedures, functions, etc. The software codes may be stored in a memory unit so that it can be driven by a processor. The memory unit is located inside or outside of the processor, so that it can communicate with the aforementioned processor via a variety of well-known parts.

[0092] 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 cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

[0093] The present invention is applicable to a wireless mobile communication apparatuses.

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WHAT IS CLAIMED IS:

1. A method of receiving a random access response, the method comprising:

transmitting a random access preamble; and

receiving the random access response corresponding to the random access preamble,

wherein the received random access response includes information of a transmission time when the random access preamble is transmitted.

2. The method according to claim 1, wherein the information includes a number indicating the transmission time of the random access preamble.

3. The method according to claim 2, wherein the number is allocated only to subframes in which a random access channel (RACH) slot is allocated.

4. The method according to claim 3, wherein the number is obtained by a modulo operation of a subframe number, in which the RACH slot is present, of the subframes.

5. The method according to claim 4, wherein the modulo operation is a modulo-4 operation.

6. The method according to claim 1, wherein the transmission time is estimated on the basis of a cell size.

7. A method of transmitting a random access response, the method comprising:

receiving the random access preamble; and

transmitting a random access response of the received random access preamble,

wherein the transmitted random access response includes information of a transmission time when the received random access preamble is transmitted or delay offset information related to a processing delay time consumed for transmitting the random access response from when the random access preamble is received.

8. The method according to claim 7, wherein the transmission time is estimated by the base station on the basis of a cell size.

9. The method according to claim 7, wherein:

the received random access preamble includes information of a transmission time the random access preamble is transmitted, and

the information included in the transmitted random access response is associated with the information related to the transmission time of the random access preamble.

10. A method of receiving a random access response, the method comprising:

transmitting a random access preamble; and

receiving the random access response,

wherein the receiving of the random access response is performed within a predetermined time span including a predetermined time point after a transmission time when the random access preamble is transmitted, and

the predetermined time point is obtained by adding half of the round trip time for a hybrid automatic repeat request (HARQ) process to the random access preamble transmission time.

11. The method according to claim 10, wherein:

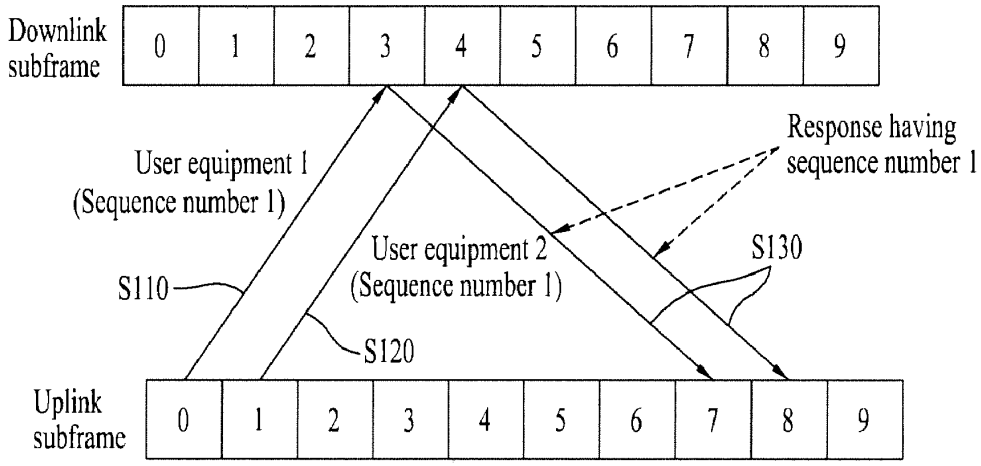
the random access response includes delay offset information, and

the delay offset information is used to change the predetermined time span.

ABSTRACT OF THE DISCLOSURE

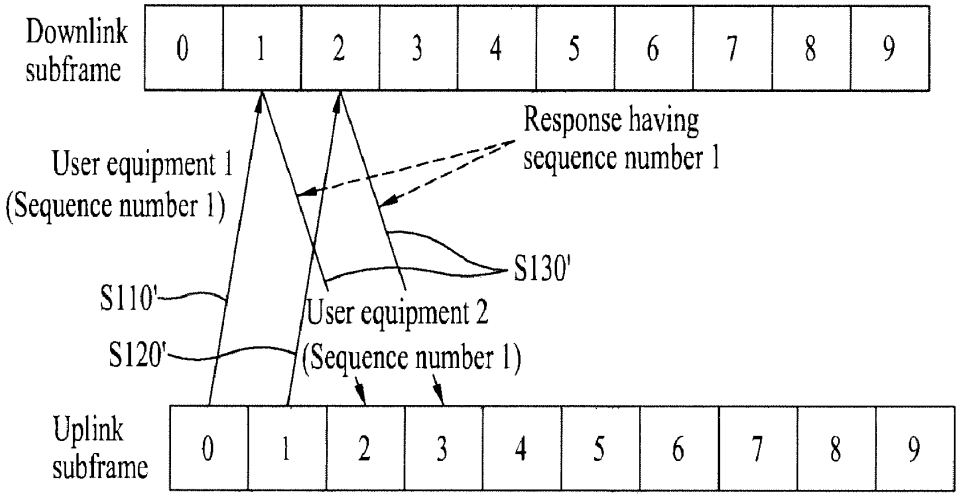
A base station transmits a random access response in response to a random access request (random access preamble) of a user equipment. The random access response includes information about a time when the random access request is transmitted and sequence number information of the random access request (random access preamble). The user equipment checks whether the received random access response is the response of the random access request transmitted by the user equipment, using the information about the time when the random access request is transmitted and the sequence number information included in the received random access response.

FIGURE 1a



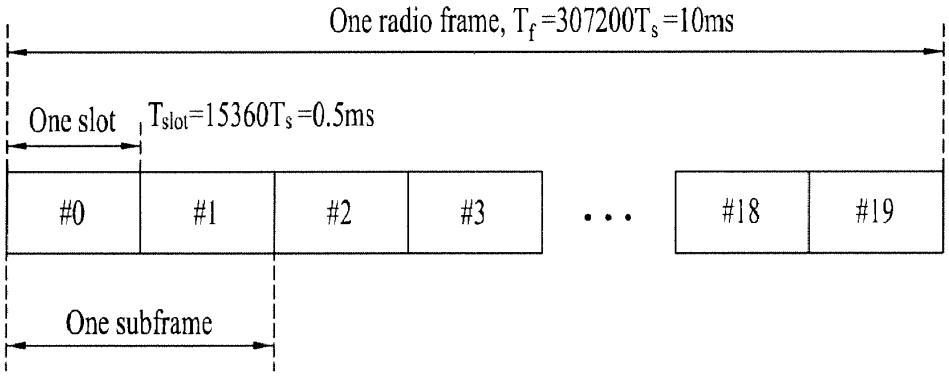
< Example of random access response >

FIGURE 1b



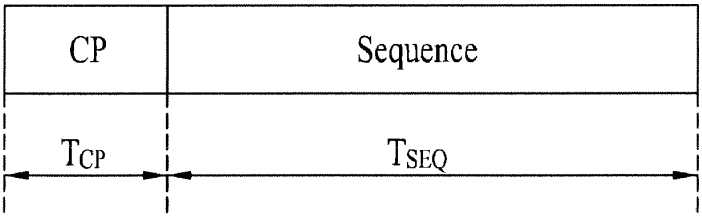
< Example of random access response >

FIGURE 2a



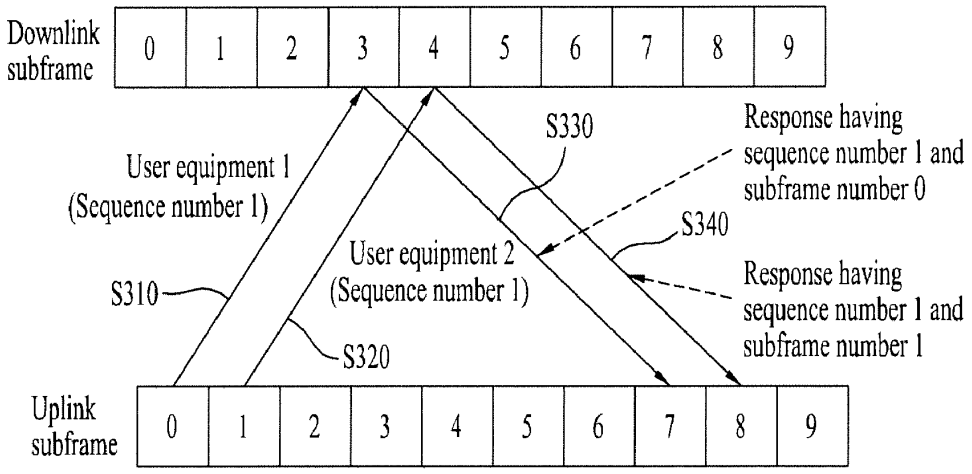
<Frame structure type 1>

FIGURE 2b



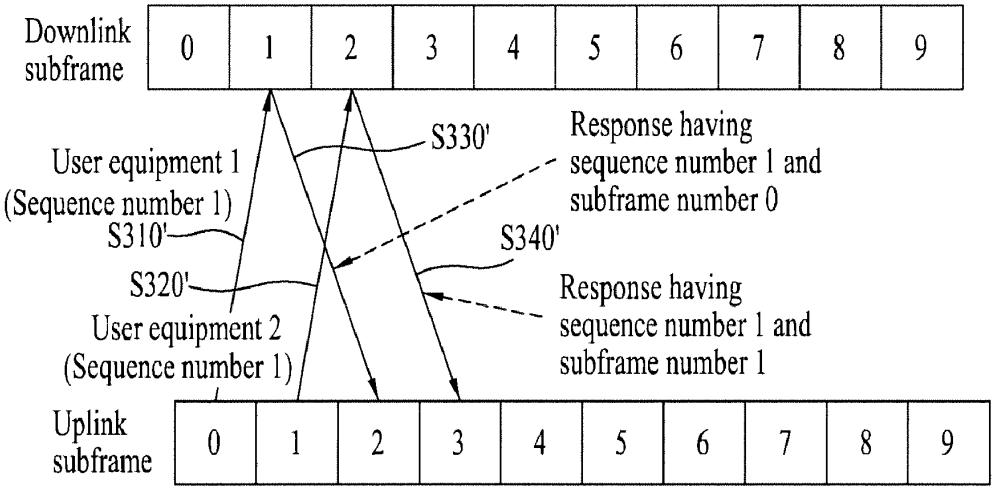
< Random access preamble format >

FIGURE 3a



< Example of response including time information >

FIGURE 3b



< Example of response including time information >

FIGURE 4

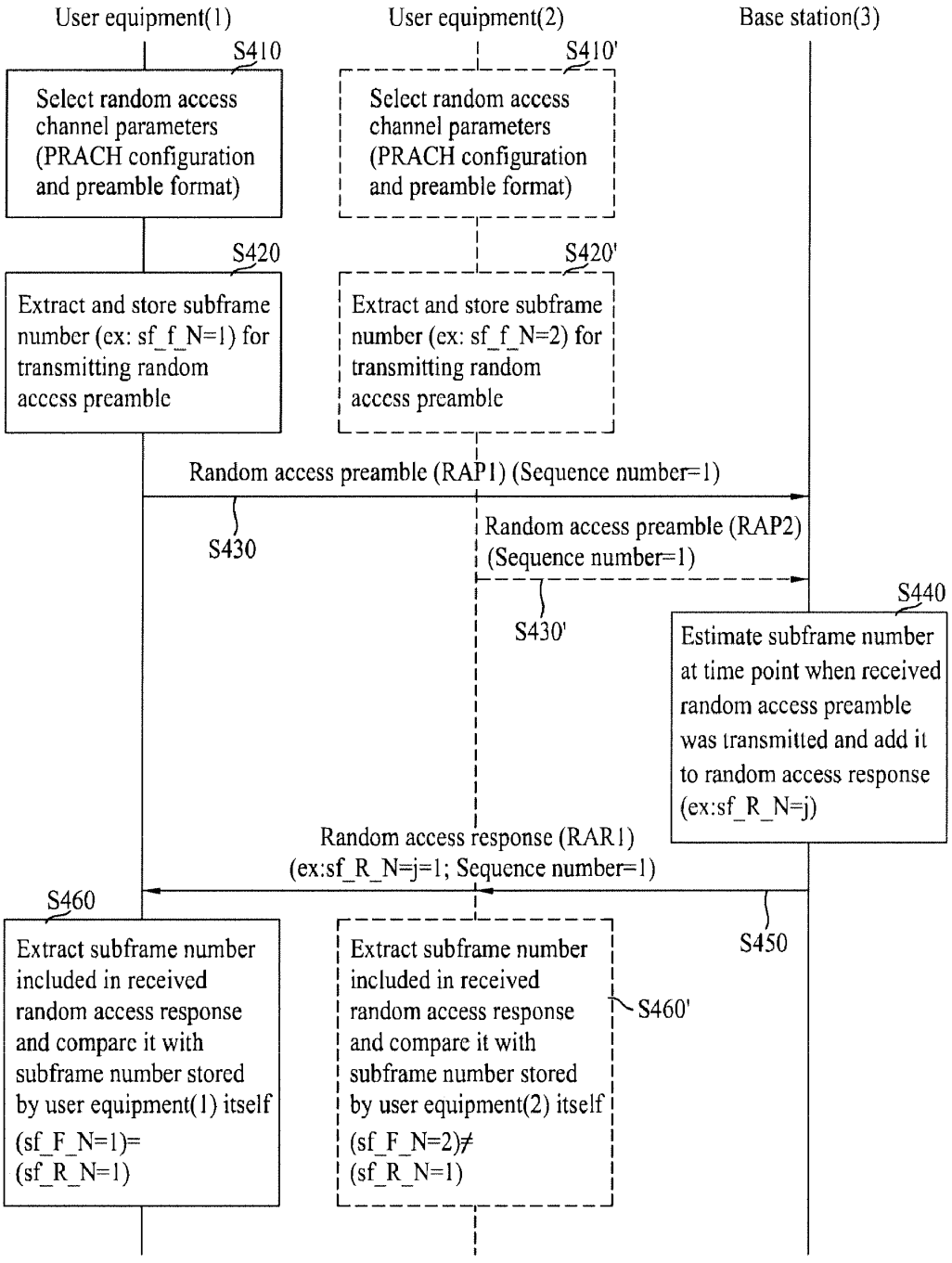
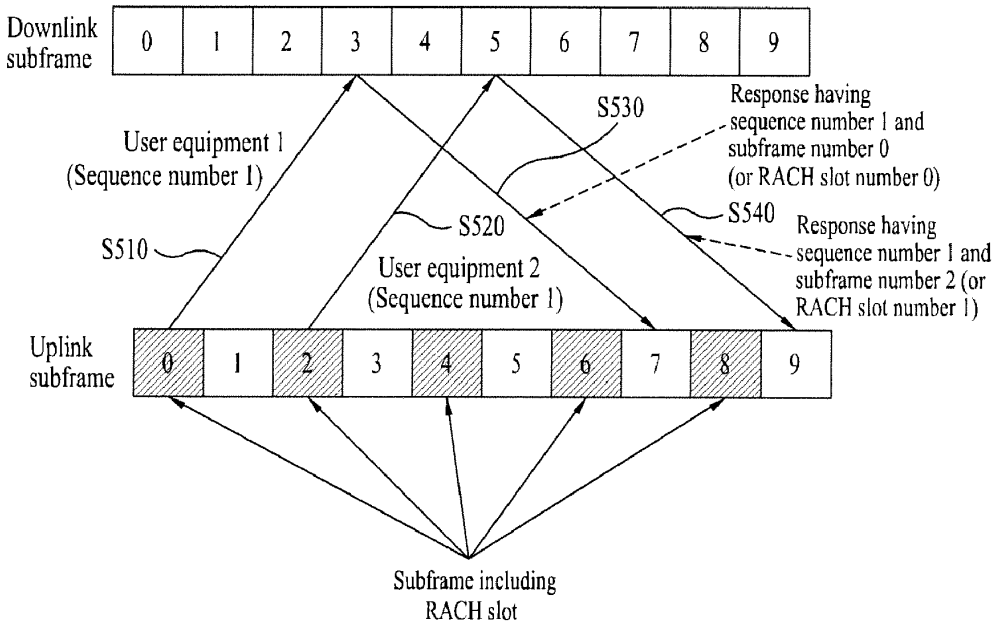
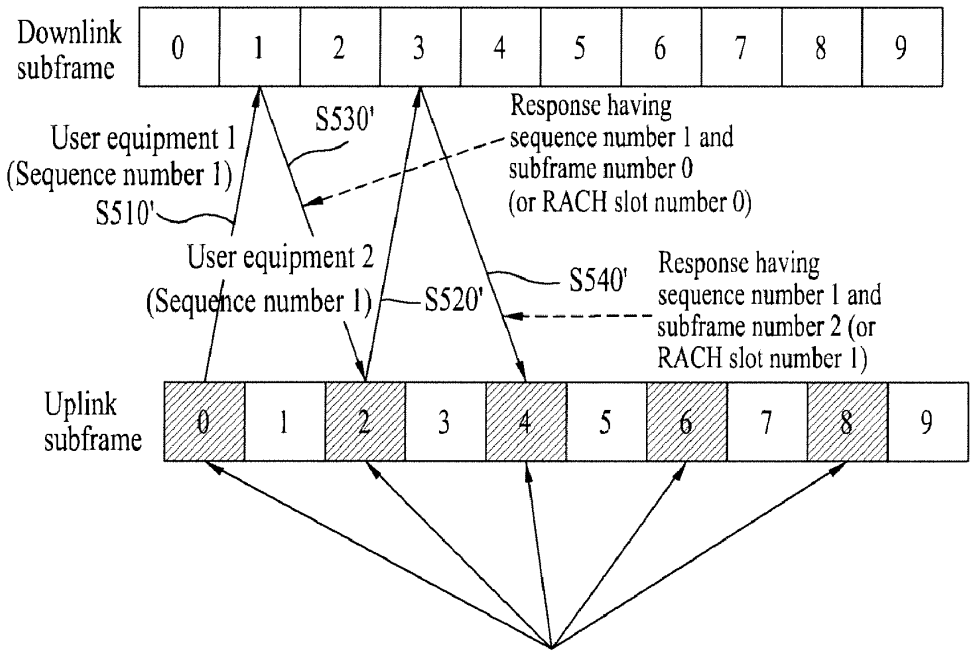

User equipment(1)
User equipment(2)
Base station(3)
S410
Select random access channel parameters (PRACH configuration and preamble format)
S410'
Select random access channel parameters (PRACH configuration and preamble format)
S420
Extract and store subframe number (ex: sf_f_N=1) for transmitting random access preamble
S420'
Extract and store subframe number (ex: sf_f_N=2) for transmitting random access preamble
Random access preamble (RAP1) (Sequence number=1)
S430
Random access preamble (RAP2) (Sequence number=1)
S430'
S440
Estimate subframe number at time point when received random access preamble was transmitted and add it to random access response (ex:sf_R_N=j)
Random access response (RAR1) (ex:sf_R_N=j=1; Sequence number=1)
S450
S460
Extract subframe number included in received random access response and compare it with subframe number stored by user equipment(1) itself (sf_F_N=1)= (sf_R_N=1)
Extract subframe number included in received random access response and compare it with subframe number stored by user equipment(2) itself (sf_F_N=2)≠ (sf_R_N=1)
S460'

FIGURE 5a



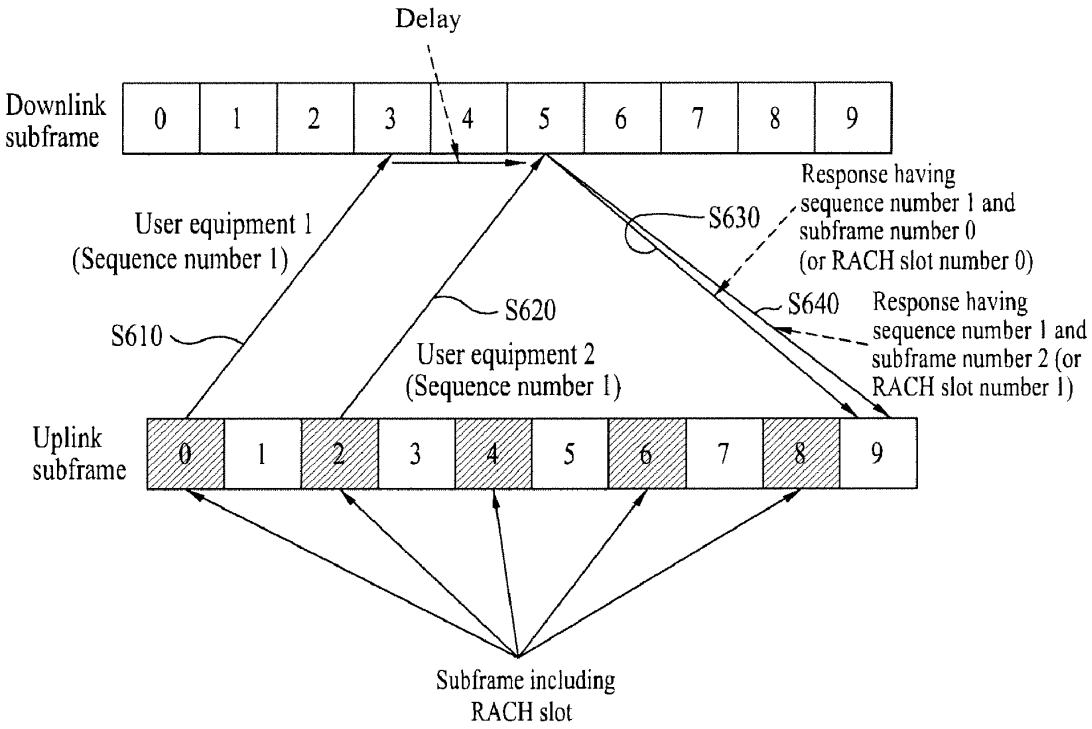
< Example of response including time information if RACH slot has period of 2 ms >

FIGURE 5b



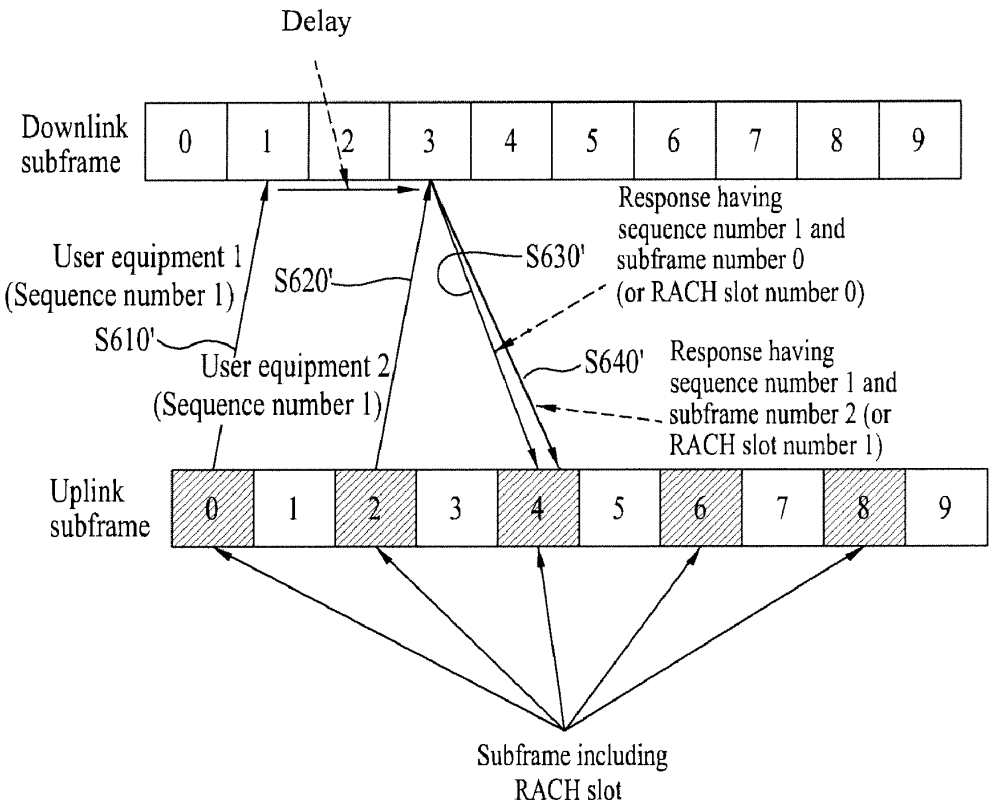
< Example of response including time information if RACH slot has period of 2 ms >

FIGURE 6a



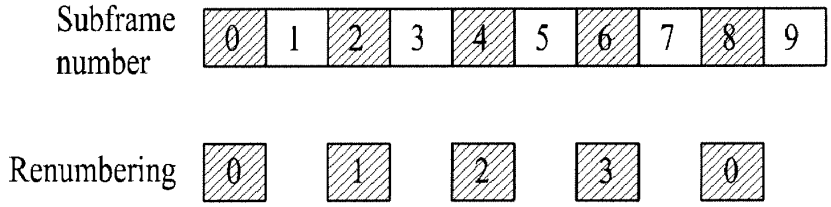
< Example of delayed response if RACH slot has period of 2 ms >

FIGURE 6b



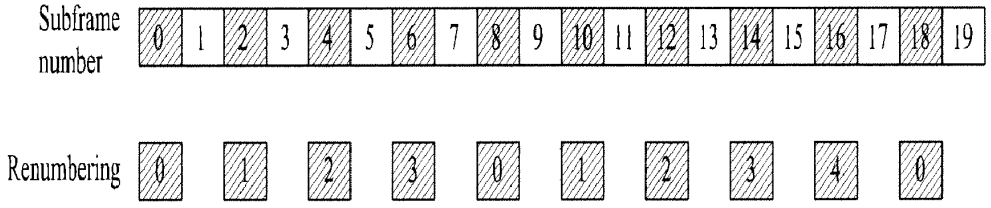
< Example of delayed response if RACH slot has period of 2 ms >

FIGURE 7a



< Renumbering and grouping (or modulo operation) >

FIGURE 7b



< Renumbering and grouping (or modulo operation) >

FIGURE 8

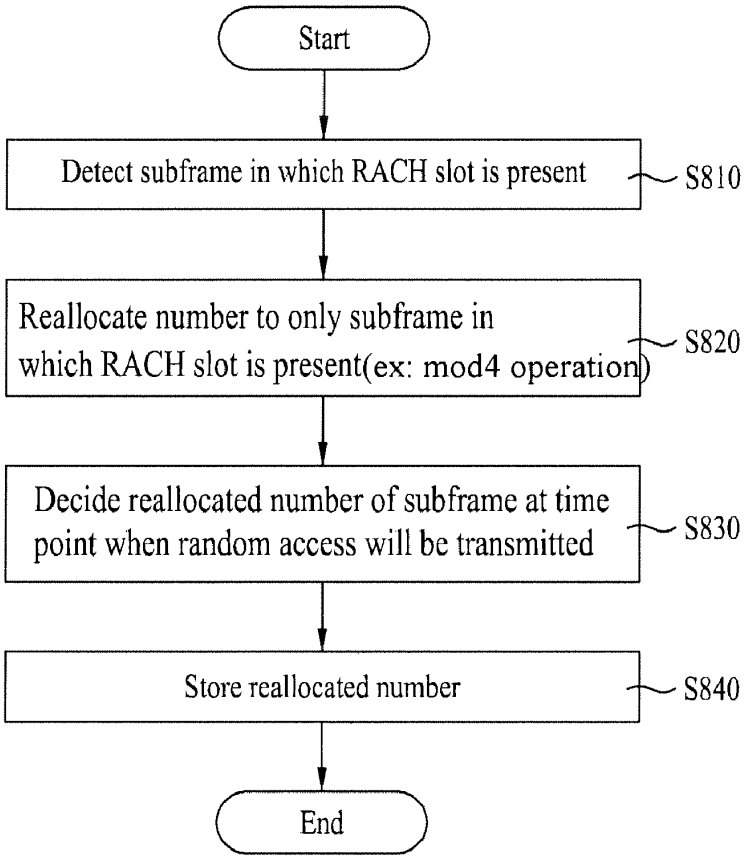

Start
Detect subframe in which RACH slot is present
S810
Reallocate number to only subframe in which RACH slot is present(ex: mod4 operation)
S820
Decide reallocated number of subframe at time point when random access will be transmitted
S830
Store reallocated number
S840
End

FIGURE 9

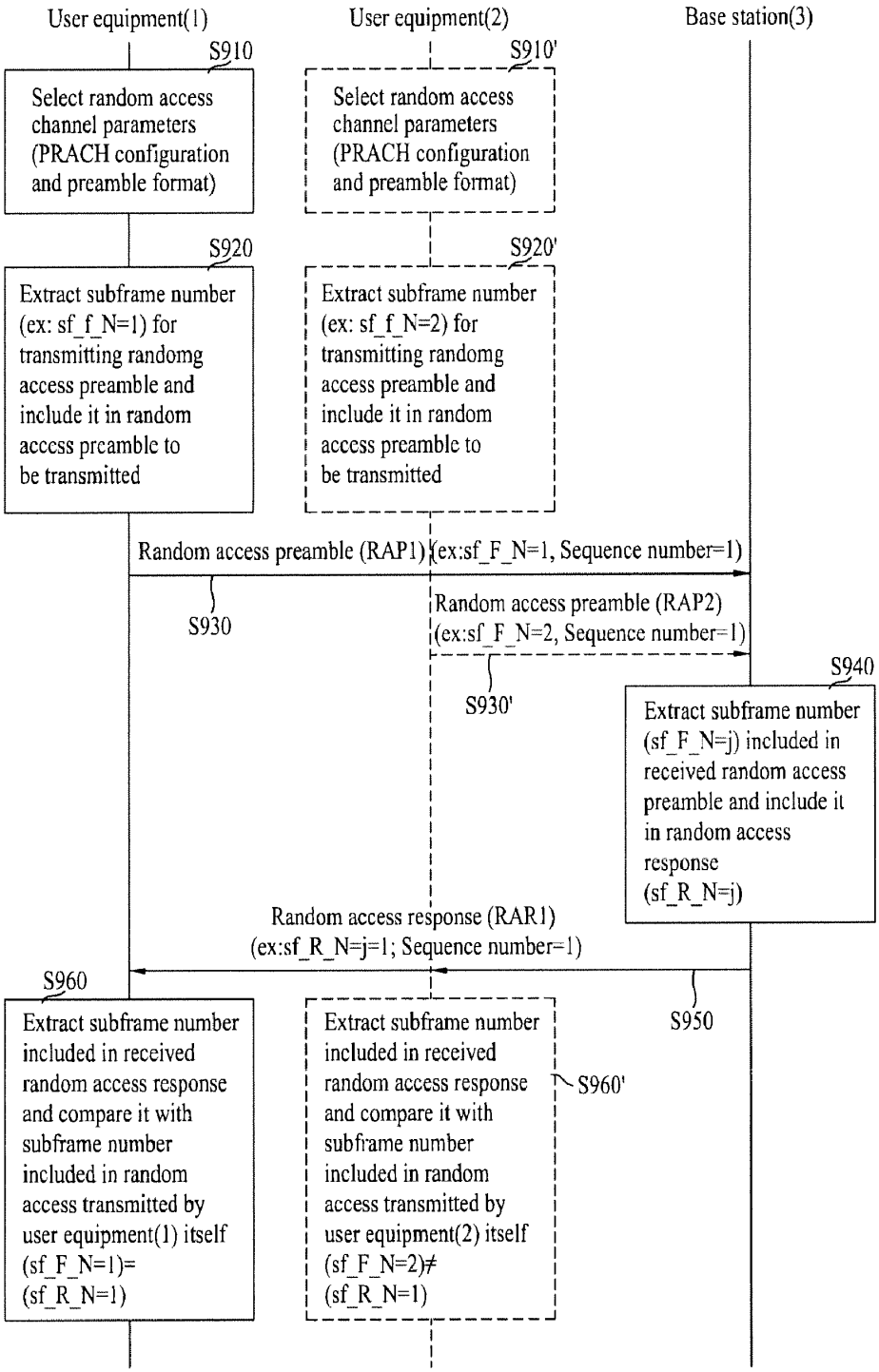

User equipment(1)
User equipment(2)
Base station(3)
S910
Select random access channel parameters (PRACH configuration and preamble format)
S910'
Select random access channel parameters (PRACH configuration and preamble format)
S920
Extract subframe number (ex: sf_f_N=1) for transmitting randomg access preamble and include it in random acccss preamble to be transmitted
S920'
Extract subframe number (ex: sf_f_N=2) for transmitting randomg access preamble and include it in random access preamble to be transmitted
Random access preamble (RAP1)
(ex:sf_F_N=1, Sequence number=1)
S930
Random access preamble (RAP2)
(ex:sf_F_N=2, Sequence number=1)
S930'
S940
Extract subframe number (sf_F_N=j) included in received random access preamble and include it in random access response (sf_R_N=j)
Random access response (RAR1)
(ex:sf_R_N=j=1; Sequence number=1)
S950
S960
Extract subframe number included in received random access response and compare it with subframe number included in random access transmitted by user equipment(1) itself (sf_F_N=1)= (sf_R_N=1)
Extract subframe number included in received random access response and compare it with subframe number included in random access transmitted by user equipment(2) itself (sf_F_N=2)≠ (sf_R_N=1)
S960'

FIGURE 10

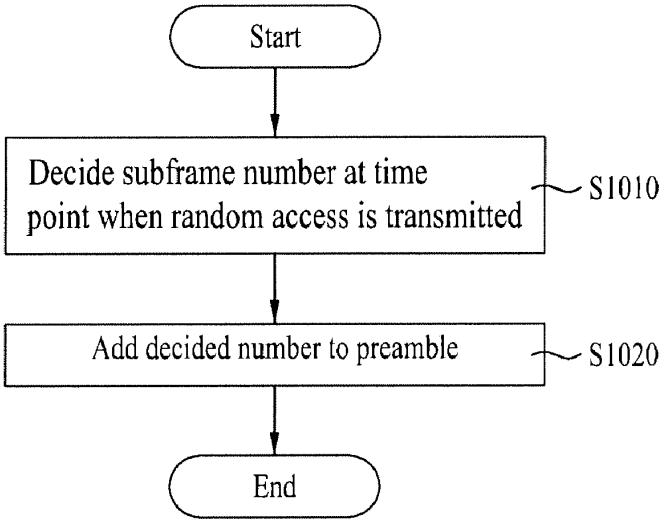
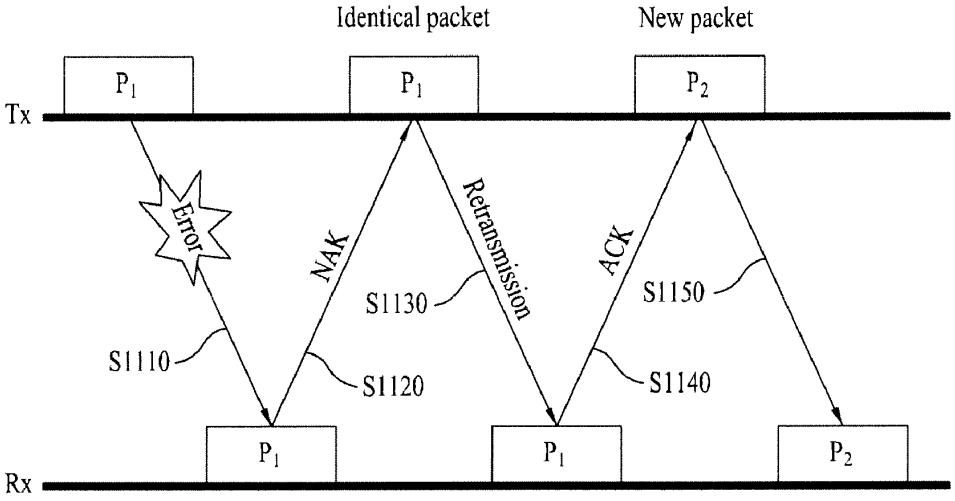
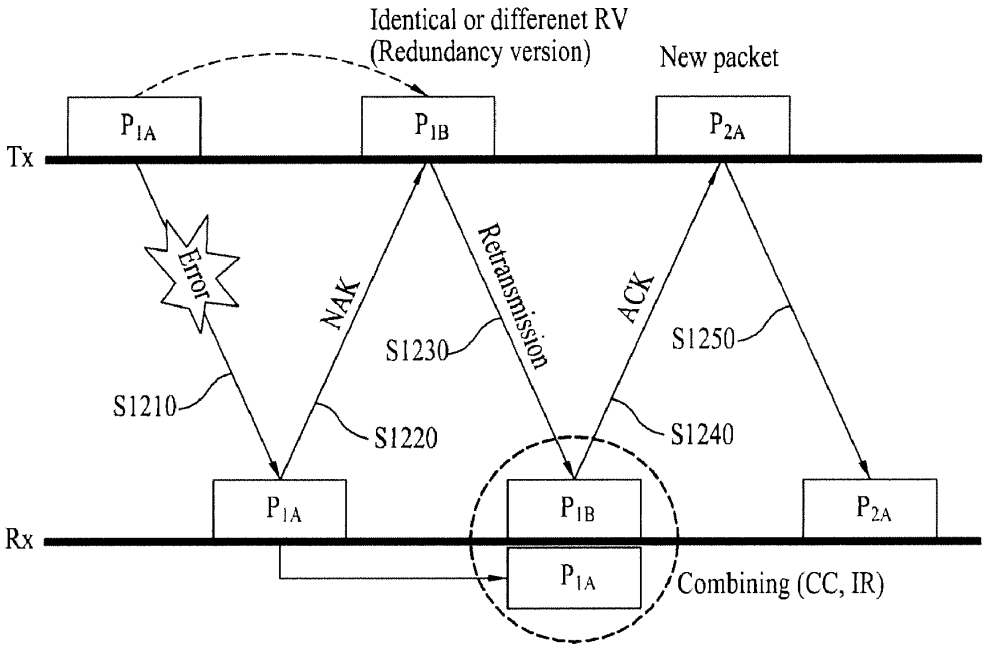


FIGURE 11



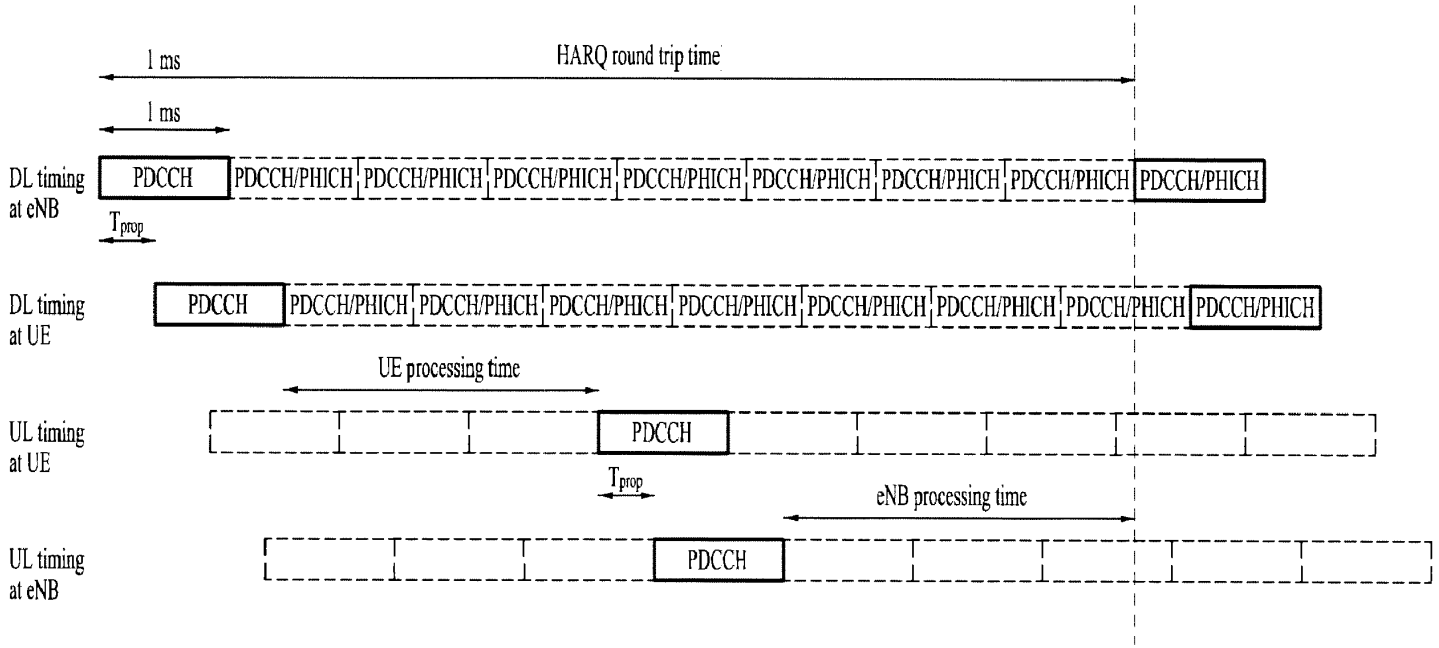
< Principle of ARQ >

FIGURE 12



<Principle of HARQ>

FIGURE 13



< Example of HARQ process >

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FIGURE 14

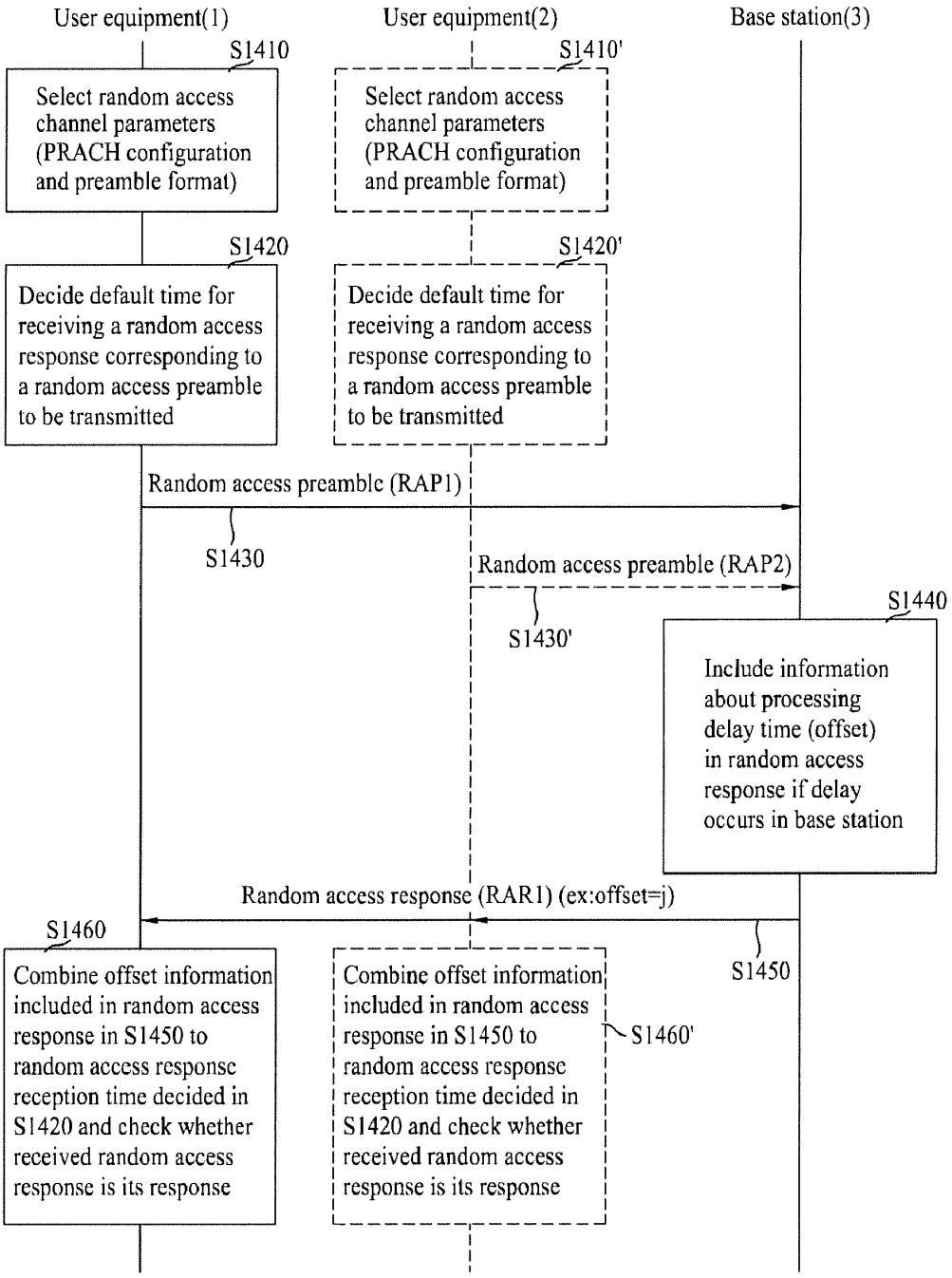
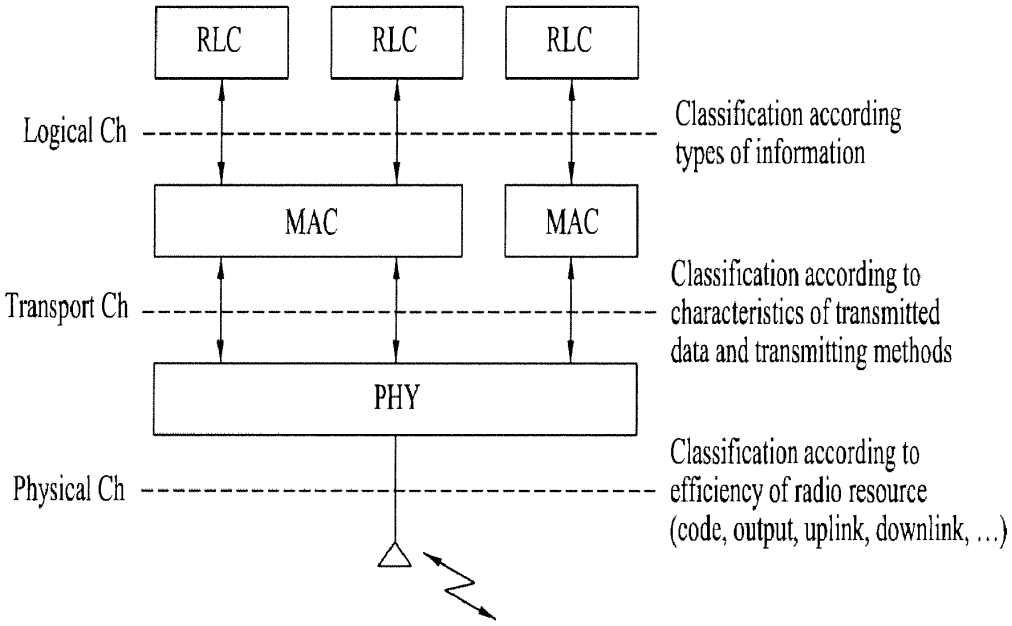
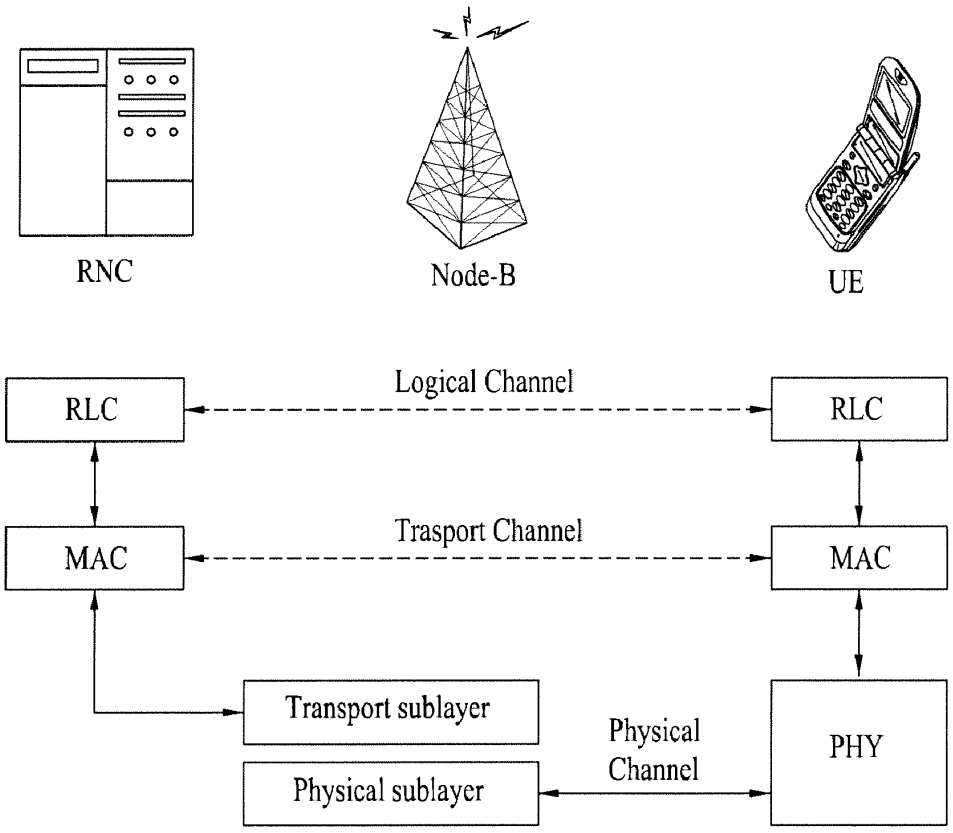

User equipment(1)
User equipment(2)
Base station(3)
S1410
Select random access channel parameters (PRACH configuration and preamble format)
S1410'
Select random access channel parameters (PRACH configuration and preamble format)
S1420
Decide default time for receiving a random access response corresponding to a random access preamble to be transmitted
S1420'
Decide default time for receiving a random access response corresponding to a random access preamble to be transmitted
Random access preamble (RAP1)
S1430
Random access preamble (RAP2)
S1430'
S1440
Include information about processing delay time (offset) in random access response if delay occurs in base station
Random access response (RAR1) (ex:offset=j)
S1450
S1460
Combine offset information included in random access response in S1450 to random access response reception time decided in S1420 and check whether received random access response is its response
Combine offset information included in random access response in S1450 to random access response reception time decided in S1420 and check whether received random access response is its response
S1460'

FIGURE 15



< Classification of channel according to layers >

FIGURE 16



< Classification of channel according to layers and areas >

REMARKS

Claim 1 is pending in this continuation application. This preliminary amendment is submitted with an associated patent application filed concurrently herewith. The foregoing amendments contain no new matter. Applicants respectfully request entry of this amendment prior to examination of the application, and early favorable action thereon.

In accordance with MPEP § 201.14(b), Applicants are not submitting an additional certified copy of the foreign priority document since it was made of record in priority U.S Application No. 12/347,352.

The Commissioner is hereby authorized to charge any fees that arise in connection with this application, or credit any overpayment, to Deposit Account No. 502290.

If for any reason the Examiner believes a telephone conference can advance the prosecution of this application, the Examiner is requested to call the undersigned attorney at the Los Angeles, California, telephone number 213-623-2221.

Respectfully submitted,
Lee, Hong, Degerman, Kang & Waimey

Date: December 29, 2011

By: /Norman T. Lee/
Norman T. Lee
Registration No. 58,941
Attorney for Applicant(s)

Customer No. 035884

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PTO/SB/06 (07-06)
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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
13/340,447	12/29/2011	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	12/29/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 1	Minus	** 20	= 0	X $ =		OR	X $60=	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X $ =		OR	X $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/CAROLYN THOMAS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.