Electronic Acknowledgement Receipt	
EFS ID:	13974808
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	15800
Filer:	Stuart A. Schanbacher/Marissa Antonelli
Filer Authorized By:	Stuart A. Schanbacher
Attorney Docket Number:	IHSP_2-1853.01.US
Receipt Date:	12-OCT-2012
Filing Date:	26-SEP-2008
Time Stamp:	15:53:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$124
RAM confirmation Number	2687
Deposit Account	090435
Authorized User	
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		IHSP_2_185301US_supplemental_Responsedocx.pdf	126836 3b4e2271d308ae2e47603ab04738914745f4a039	yes	10

Multipart Description/PDF files in .zip description

Document Description	Start	End
Supplemental Response or Supplemental Amendment	1	1
Claims	2	6
Applicant Arguments/Remarks Made in an Amendment	7	10

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30527 79522e5d32c6b717814704e4103f1492e59aef56	no	2

Warnings:

Information:

Total Files Size (in bytes):	157363

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/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
12/238,910	09/26/2008	

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	10/11/2012	(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))	* 32	Minus	** 32	= 0	X $ =		OR	X $62=	0
	Independent (37 CFR 1.16(h))	* 8	Minus	***8	= 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	10/12/2012	(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))	* 34	Minus	** 32	= 2	X $ =		OR	X $62 =	124
	Independent (37 CFR 1.16(h))	* 7	Minus	*** 8	= 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	**124**

* 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:
/TONYA MCBRIDE/

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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	IHSP_2-1853.01.US	2438

15800 7590 10/15/2012

Condo Roccia LLP
One Liberty Place
Suite 2200
Philadelphia, PA 19103

EXAMINER	
YUEN, KAN	
ART UNIT	**PAPER NUMBER**
2464	

MAIL DATE	DELIVERY MODE
10/15/2012	PAPER

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.

Applicant-Initiated Interview Summary	**Application No.** 12/238,910	**Applicant(s)** PELLETIER ET AL.	
	Examiner KAN YUEN	**Art Unit** 2464	

All participants (applicant, applicant's representative, PTO personnel):

(1) *KAN YUEN*. (3)_____.

(2) *Stuart A. Schanbacher*. (4)_____.

Date of Interview: *09 October 2012*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: *n/a*.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: _____.

Identification of prior art discussed: *Wager et al.*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Attorney Schanbacher called to discuss priority arguments in the present office action. In particularly, the attorney stated that the feature "on a condition that the buffer is empty, the WRTU releasing a E-DCH resource allocation" is supported by the paragraphs 0016-0018, 0025-0028 and 0036-0039 of application 60/975985. The Examiner did not agree with the attorney, and suggested the attorney to submit a written argument.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/KAN YUEN/ Examiner, Art Unit 2464	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

DOCKET NO.: IHSP_2-1853.01.US **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Pelletier, Benoit **Confirmation No.: 2438**

Application No.: 12/238,910 **Group Art Unit: 2464**

Filing Date: September 26, 2008 **Examiner: Yuen, Kan**

For: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

Filed Via EFS

INFORMATION DISCLOSURE STATEMENT

Pursuant to 37 CFR § 1.56 and in accordance with 37 CFR §§ 1.97-1.98, information relating to the above-identified application is hereby disclosed. Inclusion of information in this statement is not to be construed as an admission that this information is material as that term is defined in 37 CFR § 1.56(b).

☐ **IDS Filed Under 37 CFR 1.97(b)**

In accordance with § 1.97(b), since this Information Disclosure Statement is being filed either within three months of the filing date of the above-identified application, within three months of the date of entry into the national stage of the above identified application as set forth in § 1.491, before the mailing date of a first Office Action on the merits of the above-identified application, or before the mailing date of a first Office Action after the filing of request for continued examination under § 1.114, no additional fee is required.

☒ **IDS filed Under 37 CFR 1.97(c)**

In accordance with § 1.97(c), this Information Disclosure Statement is being filed after the period set forth in § 1.97(b) above but before the mailing date of either a Final Action under § 1.116 or a Notice of Allowance under § 1.311, or before an action that otherwise closes prosecution in the application, therefore:

☐ Certification in Accordance with § 1.97(e) is attached; or

☒ The fee of **$180.00** as set forth in § 1.17(p) is attached.

☐ **IDS filed Under 37 CFR 1.97(d)**

In accordance with § 1.97(d), this Information Disclosure Statement is being filed after the mailing date of either a Final Action under § 1.113 or a Notice of Allowance under § 1.311 but before, or simultaneously with, the payment of the Issue Fee, therefore included are: Certification in Accordance with § 1.97(e); and the submission fee of **$180.00** as set forth in § 1.17(p).

CONTENT OF IDS PURSUANT TO 37 CFR 1.98

☐ Copies of reference numbers listed on the attached Form PTO-1449 are not required to be submitted pursuant to 37 CFR § 1.98(a)(2)(ii).

☒ Copies of reference numbers 54-56 listed on the attached Form PTO-1449 are enclosed herewith.

☐ Copies of reference numbers are not being submitted because they were previously cited by or submitted to the U.S. Patent and Trademark Office in patent application number , filed for which a claim for priority under 35 U.S.C. § 120 has been made in the instant application.

☐ The month of publication for reference numbers is not available. However, the year of publication for these references is sufficiently earlier than the effective US filing date and any foreign priority date so that the particular month of publication is not in issue pursuant to 37 CFR § 1.98(b).

REFERENCES IN A LANGUAGE OTHER THAN ENGLISH

☒ The following documents are not in the English language. Accordingly, a concise explanation of the relevance of the document was incorporated in the specification passages identified below, the document was identified in a foreign communication as identified below or an English language counterpart application has been provided as indicated below.

Foreign Language Document	Cite No.	Pages of Reference in Specification or Relevance of Document
KR 10-2006-0054117 A	54	Cited in a Decision of Grant dated June 19, 2012, issued

		in related Korean Patent Application No. 10-2010-7009403

Foreign Language Document	Cite No.	English Language Counterpart	Cite No.
KR 10-2006-0054117 A	54	WO 2006/043782 A1	55

☐ **CERTIFICATION IN ACCORDANCE WITH § 1.97(e)**

I hereby certify that:

☐ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement.

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

Please charge any deficiency or credit any overpayment to Deposit Account No. 09-0435.

Date: December 17, 2012

/Stuart A. Schanbacher/
Stuart A. Schanbacher
Registration No. 61,895

CONDO ROCCIA LLP
One Liberty Place, Suite 2200
1650 Market Street
Philadelphia, PA 19103
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Substitute for 1449/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(use as many sheets as necessary)*				***Complete if Known***	
				Application Number	12/238,910
				Filing Date	September 26, 2008
				First Named Inventor	Pelletier, Benoit
				Art Unit	2464
				Examiner Name	Yuen, Kan
Sheet	1	of	1	**Attorney Docket Number**	IHSP_2-1853.01.US

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Foreign Patent Document Country Code- Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T
	54	KR 10-2006-0054117 A	05-22-2006	Samsung Electronics Co., Ltd.	
	55	WO 2006/043782 A1	04-27-2006	Samsung Electronics Co., Ltd.	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials	Cite No.	Include name of the author, 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
	56	3rd Generation Partnership Project (3GPP), R2-073567, "Issues regarding persistent scheduling", NTT DoCoMo, Inc., 3GPP TSG RAN WG2 #59, Athens, Greece, August 20-24, 2007, 4 pages	

Examiner Signature		**Date Considered**	

Espacenet

Bibliographic data: KR20060054117 (A) — 2006-05-22

METHOD AND APPARATUS FOR SIGNALING OF UESTATUS INFORMATION FOR UPLINK DATA TRANSMISSION IN A MOBILE COMMUNICATION SYSTEM

Inventor(s): KWAK YONG JUN [KR]; HEO YOUN HYOUNG [KR]; VAN LIESHOUT GERT JAN [NL]; LEE KOOK HEUI [KR]; LEE JU HO [KR]; CHO JOON YOUNG [KR]; KIM YOUNG BUM [KR] ± (KWAK, YONG JUN, ; HEO, YOUN HYOUNG, ; VAN LIESHOUT GERT JAN, ; LEE, KOOK HEUI, ; LEE, JU HO, ; CHO, JOON YOUNG, ; KIM, YOUNG BUM)

Applicant(s): SAMSUNG ELECTRONICS CO LTD [KR] ± (SAMSUNG ELECTRONICS CO., LTD)

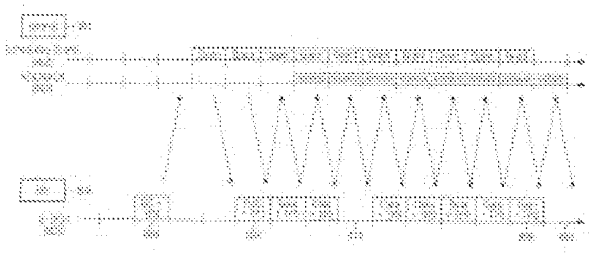
Classification: - **international:** ***H04B7/26; H04W52/14; H04W52/56;*** *H04W28/18*
- **European:** H04W52/14U; H04W52/56

Application number: KR20050098687 20051019

Priority number(s): KR20040083775 20041019; KR20040092153 20041111

Also published as: KR100663463 (B1) WO2006043782 (A1) US2006140154 (A1) JP2008517551 (A) CN101044698 (A)

Abstract not available for KR20060054117 (A)
Abstract of corresponding document: WO2006043782 (A1)



A method and apparatus for increasing the scheduling performance of a system supporting an uplink data service and total system stability by effectively UE status information to a Node B in a mobile communication system supporting the uplink data service are provided. UE status information including buffer occupancy information and transmit power status information is transmitted to a Node B periodically or upon generation of an event, irrespective of the presence or absence of uplink data to be transmitted. Since the buffer occupancy information and the transmit power status information are transmitted to the Node B by MAC-e signaling, physical channel resources are saved and E-DCH performance is improved.

Last updated: 04.12.2012 Worldwide Database 5.7.44.8; 92p

IPR2023-01267 Page 594

(19)대한민국특허청(KR)
(12) 등록특허공보(B1)

(51) 。Int. Cl.
H04B 7/26 (2006.01)

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(74) 대리인 이건주

(56) 선행기술조사문헌
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심사관 : 하은주

전체 청구항 수 : 총 28 항

(54) 이동통신 시스템에서 역방향 데이터 전송을 위한 단말상태 정보의 시그널링 방법 및 장치

(57) 요약

본 발명은 역방향 패킷 데이터 서비스를 지원하는 이동통신 시스템에서 단말 상태 정보를 기지국으로 효과적으로 전송함으로써 역방향 데이터 서비스를 지원하는 시스템의 스케쥴링 성능을 높이고, 전체적인 시스템의 안정성을 높일 수 있는 방법 및 장치에 관한 것이다. 구체적으로 본 발명은 주기적 혹은 이벤트 발생적으로 버퍼 정보와 역방향 채널 상태 정보를 포함하는 단말 상태 정보를, 전송할 데이터의 존재 여부와 관계없이 기지국으로 전송한다. 이러한 본 발명은 버퍼 정보와 역방향 채널 상태 정보를 MAC-e 시그널링을 이용하여 기지국으로 전송함으로써, 물리 채널 리소스를 절약하고 E-DCH의 성능을 개선시킨다.

대표도

도 8

특허청구의 범위

청구항 1.

이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 방법에 있어서,

역방향으로 전송할 데이터의 양을 감시하여 버퍼 정보를 생성하는 과정과,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 과정과,

상기 버퍼 정보를 전송할 구간에 도달하였는지를 판단하는 과정과,

상기 버퍼 정보를 전송할 구간에 도달하였으면, 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하는 과정과,

상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정과,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 과정을 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 2.

제 1 항에 있어서, 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하지 않았으면 상기 역방향 채널 상태 정보의 전송 이벤트가 발생하였는지를 판단하는 과정과,

상기 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하여 전송하는 과정을 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 3.

제 1 항에 있어서, 상기 생성하는 과정은,

상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였으면 상기 역방향 채널 상태 정보의 전송 이벤트가 발생하였는지를 판단하는 과정과,

상기 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정을 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 4.

제 1 항에 있어서, 상기 패킷 데이터 유닛은,

역방향 패킷 데이터를 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 5.

제 4 항에 있어서, 상기 패킷 데이터 유닛은,

향상된 역방향 전용 채널(E-DCH)을 통해 전송되는 매체 액세스 제어 패킷 데이터 유닛(MAC-e PDU)임을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 6.

이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 장치에 있어서,

역방향으로 전송할 데이터를 저장하며 상기 데이터의 양을 감시하여 버퍼 정보를 생성하는 버퍼와,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 역방향 채널 상태 정보 관리부와,

상기 버퍼 정보를 전송할 구간에 도달하였는지를 판단하고, 상기 버퍼 정보를 전송할 구간에 도달하였으면, 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하며, 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 단말 상태 정보를 생성하는 단말 상태 정보 생성부와,

상기 단말 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 패킷 데이터 유닛 생성부와,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 송신부를 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 7.

제 6 항에 있어서, 상기 단말 상태 정보 생성부는,

상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하지 않았으면 상기 역방향 채널 상태 정보의 전송 이벤트가 발생하였는지를 판단하고, 상기 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 상기 단말 상태 정보를 생성하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 8.

제 6 항에 있어서, 상기 단말 상태 정보 생성부는,

상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였으면 상기 역방향 채널 상태 정보의 전송 이벤트가 발생하였는지를 판단하고, 상기 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 상기 단말 상태 정보를 생성하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 9.

제 6 항에 있어서, 상기 패킷 데이터 유닛은,

상기 역방향으로 전송될 데이터를 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 10.

제 9 항에 있어서, 상기 패킷 데이터 유닛은,

향상된 역방향 전용 채널(E-DCH)을 통해 전송되는 매체 액세스 제어 패킷 데이터 유닛(MAC-e PDU)임을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 11.

이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 방법에 있어서,

역방향으로 전송할 데이터의 양을 감시하여 버퍼 정보를 생성하는 과정과,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였는지를 판단하는 과정과,

상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정과,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 과정을 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 12.

제 11 항에 있어서, 상기 역방향 채널 상태 정보의 전송 이벤트가 발생하지 않았으면 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하는 과정과,

상기 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하여 전송하는 과정을 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 13.

제 11 항에 있어서, 상기 생성하는 과정은,

상기 역방향 채널 상태 정보의 전송 이벤트가 발생하였으면 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하는 과정과,

상기 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정을 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 14.

제 11 항에 있어서, 상기 패킷 데이터 유닛은,

역방향 패킷 데이터를 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 15.

제 14 항에 있어서, 상기 패킷 데이터 유닛은,

향상된 역방향 전용 채널(E-DCH)을 통해 전송되는 매체 액세스 제어 패킷 데이터 유닛(MAC-e PDU)임을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 16.

이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 장치에 있어서,

역방향으로 전송할 데이터를 저장하며 상기 데이터의 양을 감시하여 버퍼 정보를 생성하는 버퍼와,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 역방향 채널 상태 정보 관리부와,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하고, 상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였는지를 판단하며, 상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 단말 상태 정보를 생성하는 단말 상태 정보 생성부와,

상기 단말 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 패킷 데이터 유닛 생성부와,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 송신부를 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 17.

제 16 항에 있어서, 상기 단말 상태 정보 생성부는,

상기 역방향 채널 상태 정보의 전송 이벤트가 발생하지 않았으면 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하고, 상기 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 상기 단말 상태 정보를 생성하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

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청구항 18.

제 16 항에 있어서, 상기 단말 상태 정보 생성부는,

상기 역방향 채널 상태 정보의 전송 이벤트가 발생하였으면 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하고, 상기 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 상기 단말 상태 정보를 생성하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 19.

제 16 항에 있어서, 상기 패킷 데이터 유닛은,

상기 역방향으로 전송할 데이터를 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 20.

제 19 항에 있어서, 상기 패킷 데이터 유닛은,

향상된 역방향 전용 채널(E-DCH)을 통해 전송되는 매체 액세스 제어 패킷 데이터 유닛(MAC-e PDU)임을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 21.

이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 방법에 있어서,

역방향으로 전송할 데이터의 양을 감시하여 버퍼 정보를 생성하는 과정과,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정과,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 과정을 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 22.

제 21 항에 있어서, 상기 버퍼 정보를 전송할 시간 구간은,

주기적과 이벤트 발생적 중 적어도 하나에 의해 정해지는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 23.

제 21 항에 있어서, 상기 패킷 데이터 유닛은,

역방향 패킷 데이터를 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 24.

제 23 항에 있어서, 상기 패킷 데이터 유닛은,

향상된 역방향 전용 채널(E-DCH)을 통해 전송되는 매체 액세스 제어 패킷 데이터 유닛(MAC-e PDU)임을 특징으로 하는, 단말 상태 정보의 송신 방법.

청구항 25.

이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 장치에 있어서,

역방향으로 전송할 데이터를 저장하고 상기 데이터의 양을 감시하여 버퍼 정보를 생성하는 버퍼와,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 역방향 채널 상태 정보 관리부와,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하고, 상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 단말 상태 정보를 생성하는 단말 상태 정보 생성부와,

상기 단말 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 패킷 데이터 유닛 생성부와,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 송신부를 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 26.

제 25 항에 있어서, 상기 버퍼 정보를 전송할 시간 구간은,

주기적과 이벤트 발생적 중 적어도 하나에 의해 정해지는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 27.

제 25 항에 있어서, 상기 패킷 데이터 유닛은,

역방향 패킷 데이터를 더 포함하는 것을 특징으로 하는, 단말 상태 정보의 송신 장치.

청구항 28.

제 27 항에 있어서, 상기 패킷 데이터 유닛은,

향상된 역방향 전용 채널(E-DCH)을 통해 전송되는 매체 액세스 제어 패킷 데이터 유닛(MAC-e PDU)임을 특징으로 하는, 단말 상태 정보의 송신 장치.

명세서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 비동기 광대역 부호분할다중접속(Wideband Code Division Multiple Access: 이하 "WCDMA"라 칭함.) 통신에 관한 것으로서, 특히 역방향 패킷 전송의 스케쥴링을 위한 단말의 역방향 채널 상태 정보를 시그널링하는 방법 및 장치에 관한 것이다.

유럽식 이동통신 시스템인 GSM(Global System for Mobile Communications)을 기반으로 하고 WCDMA를 사용하는 제 3 세대 이동통신 시스템인 UMTS(Universal Mobile Telecommunication Service) 시스템은, 이동 전화나 컴퓨터 사용자들이 전 세계 어디에 있든지 간에 패킷 기반의 텍스트, 디지털화된 음성이나 비디오 및 멀티미디어 데이터를 2 Mbps 이상의 고속으로 전송할 수 있는 일관된 서비스를 제공한다. UMTS는 인터넷 프로토콜(Internet Protocol: IP)과 같은 패킷 프로토콜을 사용하는 패킷교환 방식의 접속이란 가상접속이라는 개념을 사용하며, 네트워크 내의 다른 어떠한 종단에라도 항상 접속이 가능하다.

도 1은 종래의 UMTS 시스템의 무선접속 네트워크(UMTS Terrestrial Radio Access Network: 이하 "UTRAN"이라 칭함)를 나타낸 구성도이다.

도 1을 참조하면, UTRAN(12)은 무선망 제어기들(Radio Network Controller: 이하 "RNC"라 칭함)(16a,16b)과 기지국들(Node B)(18a,18b,18c,18d)로 구성되어, 사용자 단말(User Equipment: 이하 "UE"라 칭함)(20)을 핵심 네트워크(Core Network)(10)로 연결한다. 기지국들(18a,18b,18c,18d)의 하위에는 복수의 셀들이 존재할 수 있으며, 각각의 RNC(16a,16b)는 해당하는 하위의 기지국들(18a 내지 8d)을 제어하고, 각각의 기지국(18a,18b,18c,18d)은 해당하는 하위의 셀들을 제어한다. 하나의 RNC에 의해 제어를 받는 기지국들과 셀들을 합쳐서 무선망 서브시스템(Radio Network Subsystem: 이하 "RNS"라 칭함)(14a,14b)이라고 한다.

RNC(16a,16b)는 자신이 제어하는 기지국들(18a 내지 18d)의 무선자원을 할당하거나 관리하며, 기지국들(18a 내지 18d)은 실제 무선자원을 제공하는 역할을 한다. 무선 자원은 셀별로 구성되어 있으며, 기지국들(18a 내지 18d)이 제공하는 무선자원은 자신이 관리하는 셀들의 무선 자원들을 의미한다. 단말(20)은 특정 기지국의 특정 셀이 제공하는 무선 자원을 이용해서 무선 채널을 구성하고 통신을 수행할 수 있다. 단말(20)의 입장에서는 기지국들(18a 내지 18d)과 셀들 간의 구별은 무의미하며, 오직 셀별로 구성되는 물리계층만을 인식하므로, 이하 기지국들(18a 내지 18d)과 셀은 동일한 의미로서 언급될 것이다.

단말과 RNC 사이의 인터페이스는 Uu 인터페이스라 불리며, 도 2에 자세한 계층적 구조를 도시하였다. 상기 도 2는 단말기와 무선망 제어기(RNC) 사이의 인터페이스를 나타낸 도면이다. Uu 인터페이스는 단말기와 RNC 사이에 제어 신호를 교환하기 위하여 사용되는 제어 평면(Control Plane: C-plane)과 실제 데이터를 전송하기 위하여 사용되는 사용자 평면(User Plane: U-plane)으로 구분된다.

제어 평면(30)에는 RRC(Radio Resource Control)계층(32), RLC(Radio Link Control)계층(40), MAC(Media Access Control)계층(42)과 물리(Physical: 이하 "PHY"라 칭함)계층(44)이 존재하고, 사용자 평면(32)에는 PDCP(Packet Data Control Protocol) 계층(36), BMC(Broadcast/Multicast Control) 계층(38), RLC 계층(40), MAC 계층(42), 물리계층(44)이 존재한다. 여기에 도시한 계층들 중 물리계층(44)은 각 셀들에 위치하게 되며 MAC 계층(42)부터 RRC 계층(34)까지는 통상 RNC에 위치한다.

물리계층(44)은 무선 전송(Radio Transfer) 기술을 이용한 정보 전송 서비스를 제공하는 계층이며, OSI(Open Systems Interconnection) 모델의 제1 계층에 해당한다. 물리 계층(44)과 MAC 계층(42) 사이는 전송 채널들(Transport Channels)로 연결되어 있으며, 전송 채널들은 특정 데이터가 물리계층에서 처리되는 방식에 의해서 정의된다.

MAC 계층(42)과 RLC 계층(40)은 논리 채널들을 통해 연결되어 있다. MAC 계층(42)은 논리 채널을 통해 RLC 계층(40)이 전달한 데이터를 적절한 전송 채널을 통해 물리계층에 전달하고, 물리계층(44)이 전송 채널을 통해 전달한 데이터를 적절한 논리 채널을 통해 RLC 계층(40)에 전달하는 역할을 한다. 또한 논리 채널이나 전송 채널을 통해 전달받은 데이터에 부가 정보를 삽입하거나 삽입된 부가정보를 해석해서 적절한 동작을 취하고, 랜덤 액세스 동작을 제어한다. 이러한 MAC 계층(42)에서 사용자 평면(30)에 관련된 부분은 MAC-d(MAC-data)라 칭해지며, 제어 평면(32)에 관련된 부분은 MAC-c(MAC-control)라 칭해진다.

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RLC 계층(40)은 논리 채널들의 설정 및 해제를 담당한다. RLC 계층(40)은 AM(Acknowledged Mode), UM (Unacknowledged Mode), TM (Transparent Mode)이라는 3가지 동작 모드 중 하나로 동작할 수 있으며, 각 동작 모드마다 서로 다른 기능을 제공한다. 일반적으로 RLC 계층(40)은 상위계층으로부터 내려온 서비스 데이터 유닛(Service Data Unit: 이하 "SDU"라 칭함)을 적절한 크기로 분할하거나 조립하는 기능 및 오류 정정 기능 등을 담당한다.

PDCP 계층(36)은 사용자 평면(32)에서 RLC 계층(40)의 상위에 위치하며, IP 패킷 형태로 전송된 데이터의 헤더를 압축하고 복원하는 기능과, 특정 단말에게 서비스를 제공하는 RNC가 단말의 이동성으로 인하여 변경되는 상황하에서 데이터의 무손실 전달 기능 등을 담당한다.

물리계층(44)과 상위 계층들 간을 연결하는 전송채널의 특성은 길쌈채널 부호화(convolutional channel encoding), 인터리빙(Interleaving) 및 서비스 고유 전송률 정합(service-specific rate matching)과 같은 물리계층 처리과정을 규정하고 있는 전송형식(TF:Transport Format)에 의해 정해진다.

특히 UMTS 시스템에서는 단말로부터 기지국으로의 역방향(UL:Uplink) 통신에 있어서 패킷 전송의 성능을 좀더 향상시킬 수 있도록 향상된 역방향 전용채널(Enchanced Uplink Dedicated Channel: 이하 "E-DCH" 혹은 "EUDCH"라 칭함)을 사용한다. E-DCH는 보다 안정된 고속의 데이터 전송을 지원하기 위하여 복합 자동 재전송 요구(HARQ:Hybrid Automatic Retransmission Request) 및 기지국 제어 스케쥴링 (Node B controlled scheduling) 등의 기술을 지원한다.

도 3은 전형적인 무선링크에서 E-DCH를 통한 데이터의 전송을 도시한 도면이다. 참조번호 100은 E-DCH(111 내지 114)를 지원하는 기지국을 나타내며 101 내지 104는 E-DCH(111 내지 114)를 송신하는 단말들을 나타낸다.

도 3을 참조하면, 기지국(100)는 E-DCH를 사용하는 단말들(101 내지 104)의 상황을 파악하여 각 단말들의 데이터 전송을 스케쥴링 한다. 상기 스케쥴링은 시스템 전체의 성능을 높이기 위해 기지국(100)의 측정 잡음 증가(Noise Rise) 값이 목표 잡음 증가 값을 넘지 않도록 하면서, 기지국(100)에서 멀리 있는 단말(101)에게는 낮은 데이터 전송율을 할당하고, 가까이 있는 단말(104)에게는 높은 데이터 전송율를 할당하는 방식으로 수행한다.

도 4는 전형적인 E-DCH를 통한 메시지의 송수신 절차를 나타낸 도면이다.

도 4를 참조하면, 202단계에서 기지국과 단말은 E-DCH를 설정한다. 상기 202단계는 전용 전송 채널(Dedicated Transport Channel)을 통한 메시지들의 전달 과정을 포함한다. E-DCH의 설정이 이루어지면, 204단계와 같이 상기 단말은 상기 기지국에게 단말 상태 정보를 알려준다. 상기 단말 상태 정보로는 단말 송신 전력 정보와 단말이 송신할 수 있는 여분의 전력 정보 및 단말의 버퍼에 쌓여 있는 송신되어야 할 데이터의 양 등이 있다.

기지국은 206단계에서 각 단말들의 데이터 전송을 스케쥴링하기 위하여 상기 복수의 단말들로부터의 단말 상태 정보를 모니터링한다. 208단계에서 기지국은 단말에게 역방향 패킷 전송을 허용할 것으로 결정하고, 단말에게 스케쥴링 할당(Scheduling Assignment) 정보를 전송한다. 상기 스케쥴링 할당 정보에는 허용된 데이터 전송율과 허용 타이밍 등이 포함된다.

단말은 210단계에서 상기 스케쥴링 할당 정보를 이용하여 역방향으로 전송할 E-DCH의 전송 형식(TF)을 결정하고, 214단계에서 E-DCH를 통해 역방향(UL) 패킷 데이터를 전송하는 동시에 212단계에서 상기 TF 정보 즉, TFRI(Transport Format Resource Indicator)를 기지국으로 전송한다. 216단계에서 기지국은 상기 TF 정보와 상기 패킷 데이터에 오류가 있는지 판단한다. 218단계에서 기지국은 상기 판단 결과 어느 하나라도 오류가 나타난 경우 부정응답(NACK: Non-Acknowledge)을, 모두 오류가 없을 경우는 긍정응답(ACK: Acknowledge)을 ACK/NACK 채널을 통해 단말에게 전송한다.

ACK 정보가 전송되는 경우 패킷 데이터의 전송이 완료되어 단말은 새로운 사용자 데이터를 E-DCH를 통해 보내지만, NACK 정보가 전송되는 경우 상기 단말은 같은 내용의 패킷 데이터를 E-DCH를 통해 다시 재전송한다.

상기에서 설명한 바와 같이 E-DCH의 스케쥴링을 위해서 단말은 단말 상태 정보를 기지국으로 전송할 필요가 있다. 단말 상태 정보 중에서 특히 역방향 송신 전력을 나타내는 정보는 스케쥴링에 필요한 중요한 요소로 작용한다. 따라서 상기 역방향 송신 전력을 나타내는 정보를 전송하는 방법을 구체화하여 E-DCH의 동작을 효율적으로 수행하기 위한 기술을 필요로 하게 되었다.

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발명이 이루고자 하는 기술적 과제

따라서 상기한 바와 같은 종래 기술의 문제점을 해결하기 위하여 창안된 본 발명은, 기지국이 역방향 데이터 전송을 스케쥴링을 하는데 필요한 단말의 역방향 송신 전력을 나타내는 정보를 단말로부터 기지국으로 전송하는 방법 및 장치를 제공한다.

본 발명은, 단말의 역방향 송신 전력을 나타내는 정보를 E-DCH를 통해 전송되는 전송채널 데이터에 포함하여 기지국으로 전송하는 방법 및 장치를 제공한다. 본 발명의 바람직한 실시예에 따른 방법은, 이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 방법에 있어서,

역방향으로 전송할 데이터의 양을 감시하여 버퍼 정보를 생성하는 과정과,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 과정과,

상기 버퍼 정보를 전송할 구간에 도달하였는지를 판단하는 과정과,

상기 버퍼 정보를 전송할 구간에 도달하였으면, 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하는 과정과,

상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정과,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 과정을 포함하는 것을 특징으로 한다.

본 발명의 바람직한 실시예에 따른 장치는, 이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 장치에 있어서,

역방향으로 전송할 데이터를 저장하며 상기 데이터의 양을 감시하여 버퍼 정보를 생성하는 버퍼와,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 역방향 채널 상태 정보 관리부와,

상기 버퍼 정보를 전송할 구간에 도달하였는지를 판단하고, 상기 버퍼 정보를 전송할 구간에 도달하였으면, 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였는지를 판단하며, 상기 역방향 채널 상태 정보의 전송 주기에 따른 전송 구간에 도달하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 단말 상태 정보를 생성하는 단말 상태 정보 생성부와,

상기 단말 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 패킷 데이터 유닛 생성부와,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 송신부를 포함하는 것을 특징으로 한다.

본 발명의 다른 실시예에 따른 방법은, 이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 방법에 있어서,

역방향으로 전송할 데이터의 양을 감시하여 버퍼 정보를 생성하는 과정과,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였는지를 판단하는 과정과,

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상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정과,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 과정을 포함하는 것을 특징으로 한다.

본 발명의 다른 실시예에 따른 장치는, 이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 장치에 있어서,

역방향으로 전송할 데이터를 저장하며 상기 데이터의 양을 감시하여 버퍼 정보를 생성하는 버퍼와,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 역방향 채널 상태 정보 관리부와,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하고, 상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였는지를 판단하며, 상기 역방향 채널 상태 정보에 대한 전송 이벤트가 발생하였으면 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 단말 상태 정보를 생성하는 단말 상태 정보 생성부와,

상기 단말 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 패킷 데이터 유닛 생성부와,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 송신부를 포함하는 것을 특징으로 한다.

본 발명의 또 다른 실시예에 따른 방법은, 이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 방법에 있어서,

역방향으로 전송할 데이터의 양을 감시하여 버퍼 정보를 생성하는 과정과,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하는 과정과,

상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 과정과,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 과정을 포함하는 것을 특징으로 한다.

본 발명의 또 다른 실시예에 따른 장치는,

이동통신 시스템에서 역방향 데이터 전송을 위한 단말 상태 정보의 송신 장치에 있어서,

역방향으로 전송할 데이터를 저장하고 상기 데이터의 양을 감시하여 버퍼 정보를 생성하는 버퍼와,

역방향 송신 전력 상태를 감시하여 역방향 채널 상태 정보를 생성하는 역방향 채널 상태 정보 관리부와,

상기 버퍼 정보를 전송할 시간 구간에 도달하였는지를 판단하고, 상기 버퍼 정보를 전송할 시간 구간에 도달하였으면, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 포함하는 단말 상태 정보를 생성하는 단말 상태 정보 생성부와,

상기 단말 상태 정보를 포함하는 패킷 데이터 유닛을 생성하는 패킷 데이터 유닛 생성부와,

상기 패킷 데이터 유닛을 부호화 및 변조하여 송신하는 송신부를 포함하는 것을 특징으로 한다.

발명의 구성

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이하 첨부된 도면을 참조하여 본 발명의 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.

후술되는 본 발명의 주요한 요지는 단말의 역방향 송신 전력을 나타내는 역방향 채널 상태 정보를 기지국으로 전송하는 것이다. 여기서 상기 역방향 채널 상태 정보는, 단말의 역방향 최대 송신 전력, 또는 제어 채널만의 송신 전력 등으로 표현되거나, 다른 경우 단말이 송신할 수 있는 최대의 전송율 또는 전송 형식 등으로 표현된다. 또 다른 경우 상기 역방향 채널 상태 정보는 제어 채널의 송신 전력에 대한 최대 송신 전력의 비율이 될 수 있다. 이와 같이 상기 역방향 채널 상태 정보는 단말이 송신할 수 있는 여분의 전력 정보 등을 포함하여, 역방향 채널의 특성을 나타내는 정보들을 의미한다.

본 명세서에서는 단말의 역방향 송신 전력 정보를 기지국으로 전송할 때, MAC 정보를 이용하는 실시예들을 설명한다. MAC 계층은RLC 계층과 물리 계층 사이에서 중간 접속 제어(medium access control)을 담당한다. E-DCH가 도입됨으로서 도 2에서 도시한 MAC 구조가 변화되면서, 기존 DCH를 위하여 존재하던 MAC-d 개체와 함께 E-DCH의 기능을 담당하기 위한 MAC-e 개체가 새로이 정의되었다. MAC-e 개체는 MAC-d 개체와 물리 계층 사이에 존재하게 된다. 상기 MAC 구조를 통과하면서 데이터 포맷이 변화되는 모습을 도 5에서 보여주고 있다.

도 5를 참조하면, RLC PDU(501)는 RLC 계층에서 MAC 계층으로 전송되는 데이터이며, 상기 MAC 계층에서는 상기 RLC PDU(501)에 MAC 헤더를 추가하여 MAC PDU를 생성한 후, 상기 MAC PDU를 물리 계층으로 전송한다. E-DCH가 사용되는 경우, 상기 MAC 계층은 MAC-d 개체와 MAC-e 개체로 구분되며, MAC 헤더는 다음의 두 가지 단계를 거쳐 추가된다.

우선 MAC-d 개체는 상기 RLC계층에서 전송된 한 개 또는 여러 개의 RLC PDU(501)를 가지고 MAC-d SDU(502)를 구성하고, 상기 MAC-d SDU(502)에 MAC-d 헤더(503)을 첨가하여 MAC-d PDU(505)를 만들게 된다. 상기 MAC-d 헤더(503)는 상기 MAC-d PDU(505)에 포함되는 하나 혹은 여러 개의 RLC PDU(501)가 발생된 소스, 즉 RLC 개체를 지칭하는 다중화 정보를 포함한다.

상기 MAC-d PDU(505)는 MAC-e 개체에게 전달된다. MAC-e 개체는 한 개 또는 여러 개의 MAC-d PDU(505)를 가지고 MAC-e SDU(504)를 구성하고, 상기 MAC-e SDU(504)에 MAC-e 헤더(506)를 첨가하여 MAC-e PDU(507)를 만들게 된다. 상기 MAC-e 헤더는 상기 MAC-e PDU(507)에 포함되는 하나 혹은 여러 개의 MAC-e SDU(504)에 관련된 정보를 포함한다. 도 5에서는 MAC-e 헤더(506)가 MAC-e SDU(504)의 앞에 배치되는 것으로 도시하였으나, 실제로 MAC-e 헤더(506)라 함은, MAC-d PDU(505)(들)을 제외한, MAC-e 개체에 의해 추가되는 정보를 포괄하는 것으로 이해되어야 한다. 상기 MAC-e PDU(507)는 전송 블록(508)에 실려 물리 계층으로 전달되어, CRC 첨가, 채널 코딩, 레이트 매칭 등의 전송 채널 프로세싱을 통해 수신측으로 전송된다.

상기 도 5를 통하여 설명한 데이터 구조화에 필요한 단말기 동작을 도 6을 이용하여 설명한다.

도 6에서 RLC PDU(601)는 MAC-d 개체(602)에 입력되며, MAC-d 개체(602)는 상기 RLC PDU(601)에 MAC-d 헤더를 첨가한 후 MAC-d PDU를 출력한다. 상기 MAC-d PDU는 MAC-e 개체(603)에 입력되며, MAC-e 개체(603)는 상기 MAC-d PDU에 MAC-e 헤더를 첨가한 후 MAC-e PDU를 출력한다. 상기 MAC-e PDU는 물리 계층(604)으로 전달되어 HARQ 등을 포함하는 전송 채널 프로세싱 과정을 거친 후 물리 채널에 사상되어 전송(605)된다. 도 6에서 기술된 모든 과정은 모두 하나의 단말(610) 내부에서 일어나는 과정들이다.

이하 도 7을 이용하여 상기 E-DCH 데이터를 수신하는 동작을 설명한다. 도시한 바와 같이, 기지국은 물리계층(703)과 MAC-e 개체(704)를 포함하며, RNC(709)는 MAC-es 개체(706)와 MAC-d 개체(707) 및 상위 계층들(도시하지 않음)을 포함한다. 여기서 MAC-es 개체(706)란, E-DCH에 관련된 시그널링을 수행하는 부분이다.

도 7을 참조하면, 기지국(701)은 E-DCH가 매핑되는 물리 채널인 E-DPCH(Enhanced Dedicated Physical channel)의 신호(702)를 수신하여, 상기 수신 신호에 대해 물리 계층(703)에서 HARQ를 포함하는 전송 채널 프로세싱 과정을 수행한다. 상기 물리 계층 (703)의 출력은 전송 블록이 된다. 상기 전송 블록이 기지국(701)의 MAC-e 개체(704)에 입력되면, 상기 MAC-e 개체(704)는 기지국(701)에 필요한 정보를 포함하는 MAC-e 헤더를 상기 전송 블록으로부터 추출하고 상기 MAC-e 헤더를 해석한다. MAC-e 개체(704)의 출력은 Iub 접속(705)을 통하여 RNC(709)로 전달되고 RNC(709)에 포함된 MAC-es 개체(706)로 입력된다.

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도시한 바와 같이 MAC-e는 기지국(701)과 RNC(709)에 나누어져서 존재하게 되는데, 그 이유는 MAC-e 헤더에 포함된 정보가, 기지국(701)에서 필요한 정보와 RNC(709)에서 필요한 정보로 나누어질 수 있기 때문이다. 따라서 상기 기지국(701)에 포함된 MAC-e 개체(704)가 추출하여 Iub 접속(705)을 통해 RNC(709)에 포함된 MAC-es 개체(706)로 입력되는 데이터는, 전체 MAC-e 헤더를 포함한 MAC-e PDU가 되거나, 혹은 상기 MAC-e 헤더 중에서 기지국(701)에서는 필요하지만 RNC(709)에서는 불필요한 정보들이 제거된, 즉 RNC(709)에서 필요로 하는 정보들만을 포함하는 MAC-e PDU가 될 수도 있다.

상기 MAC-es 개체(706) 는 상기 MAC-e 개체(704)로부터 제공된 MAC-e PDU에서 MAC-e 헤더를 추출, 해석한 후에, 상기 MAC-e 헤더를 제거한 MAC-d PDU를 출력한다. 상기 MAC-d PDU는 MAC-d 개체(707)에 입력되며, MAC-d 개체(707)는 상기 MAC-d PDU에서 MAC-d 헤더를 추출, 해석한 후 상기 MAC-d 헤더를 제거하고 RLC PDU(708)을 출력한다. 상기 RLC PDU(708)는 도시하지 않은 상위 계층들, 즉 RLC 계층 등에 의해 적절하게 처리된다.

상기 도 7에서 수신 동작을 설명하면서, MAC 헤더에 포함된, 기지국이 필요로 하는 정보에 대하여 기술하였다. 상기 기지국이 필요로 하는 정보에는 단말 상태 정보가 포함된다. 이미 언급한 바와 같이 단말 상태 정보에는, 단말이 전송하고자 하는 역방향 데이터의 양을 나타내는 버퍼 정보(Buffer Occupancy: BO)과, 역방향 채널 상태를 나타내는 역방향 채널 상태 정보(Transmission Power Status: 이하 TPS라 칭함)가 있다. 여기서 상기 버퍼 정보는 주기에 따라(Periodic) 혹은 이벤트 발생적으로(Event-Triggered) 전송될 수 있다. 상기 버퍼 정보의 전송을 야기(Trigger)하는 이벤트로는, 새로운 데이터가 E-DCH 전송을 위한 버퍼에 입력된 경우, 혹은 버퍼의 데이터 량이 임계치를 초과한 경우 등이 있다. 본 명세서에서 버퍼 정보의 전송 방식은 미리 정해지는 것으로 한다.

하기에서는 단말이 기지국으로 역방향 채널 상태 정보를 전송함에 있어서 상기 MAC-e PDU를 이용한다. 즉, 단말은 도 5의 MAC-e 헤더(506)에 역방향 채널 상태 정보를 포함시켜서 E-DCH를 통해 전송한다.

상기 도 7에서 기술한 바와 같이 상기 역방향 채널 상태 정보는, 버퍼 정보와 함께 기지국 제어 스케쥴링(Node B controlled scheduling)을 위해 필요한 정보이다. 기지국에서는 MAC-e 헤더에 포함된 상기 역방향 채널 상태 정보를 해석하고, RNC의 MAC-es 개체로는 상기 역방향 채널 상태 정보를 포함한 MAC-e PDU를 전달하거나, 혹은 상기 역방향 채널 상태 정보를 제거한 MAC-e PDU (즉 MAC-es PDU)를 전달할 수 있다. 상기와 같이 버퍼 정보나 역방향 채널 상태 정보와 같은 제어 정보를 MAC-e 헤더에 포함시켜서 전송하는 방법을, 본 명세서에서는 MAC-e 시그널링이라 명명한다.

또한 하기에서는, 단말이 기지국으로 단말 상태 정보 중 하나인 역방향 채널 상태 정보를 전송함에 있어서, 역방향 채널 상태 정보를 포함하는 MAC-e 제어 PDU를 따로이 만들어서 전송하는 방법을 제시한다. 즉 상기 도 5에서 MAC-e SDU(504)에 역방향 채널 상태 정보를 삽입하는 것이다. 이와 같이, MAC-e 헤더(506)가 아닌 페이로드(504)에 상기 역방향 채널 상태 정보를 삽입하여 MAC-e PDU(507)를 만들고 전송하는 방법을, 본 명세서에서는 MAC-e 제어 PDU 시그널링이라 명명한다. 상기에서 단말은 MAC-e 제어 PDU 시그널링의 사용 여부를 E-DCH의 전송 형식 지시자(Enhanced TF Index: E-TFI) 등을 이용하여 기지국에 알려준다. 기지국은 MAC-e 제어 PDU 시그널링에 따른 MAC-e PDU(즉 MAC-e 제어 PDU)를 수신하면, 상기 MAC-e 제어 PDU를 기지국에서만 사용하고 RNC로 전송하지 않을 수도 있다.

하기에서 구체적인 실시예들을 통하여 단말이 MAC-e 시그널링을 이용하여 역방향 채널 상태 정보를 기지국으로 전송하는 방법에 대하여 기술한다. 이때, MAC-e 제어 PDU 시그널링을 통한 역방향 채널 상태 정보의 전송은 MAC-e 시그널링을 준용하여 구현할 수 있으므로 하기에서는 구체적으로 언급하지 않는다.

<<제1 실시예>>

도 8은 본 발명의 제1 실시예에 따라, 단말이 E-DCH의 스케쥴링에 필요한 역방향 채널 상태 정보를 항상 MAC-e 헤더에 포함시켜서 전송하는 방법을 보여주고 있다.

이하 도 8을 이용하여 제1 실시예를 자세히 설명한다.

도 8에서 단말(804)은 버퍼에 데이터가 새로이 생기게 되면, 버퍼 정보(BO)와 역방향 채널 상태 정보(TPS)(806)를 우선 기지국으로 E-DCH(805)를 통해 전송하게 된다. 버퍼 정보/TPS(806)는 초기 MAC-e PDU에 포함되어 전송되며, 초기 MAC-e PDU는 데이터 없이 버퍼 정보만을 포함하거나, 데이터 없이 버퍼 정보와 역방향 채널 상태 정보만을 MAC-e 헤더에 포함하여 MAC-e 시그널링의 방법으로 전송된다. 상기 초기 MAC-e PDU는 E-DCH를 통한 데이터의 전송 시작을 기지국에게 알리는 의미로 사용된다.

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E-DCH(905)를 통해 버퍼 정보, 또는 버퍼 정보/역방향 채널 상태 정보를 수신한 기지국(801)은 상기 버퍼 정보로부터 E-DCH 데이터의 존재 여부를 판단하게 되고, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 바탕으로 스케쥴링을 수행한다. 상기 스케쥴링의 결과로 기지국(801)은 스케쥴링 그랜트 채널(802)을 통해 스케쥴링 그랜트 정보를 단말(804)에게 내려준다. 상기 스케쥴링 방식에는 여러 가지 방법이 가능하다. 대표적으로 단말(804)이 사용 가능한 리소스의 절대치를 알려주는 절대 그랜트(Absolute grant)와, 단말(804)이 사용 가능한 리소스를 기존 리소스와 비교하여 그 상대치를 알려주는 상대 그랜트(Relative grant) 등이 있다. 기지국(801)은 상기 MAC-e PDU를 수신하여서 HARQ에 따른 처리를 수행하고, 상기 HARQ의 수행 결과로서 ACK/NACK 신호를ACK/NACK 채널(803)을 통하여 단말(804)에게 알려주게 된다.

단말(804)은 상기 스케쥴링 그랜트 정보와 상기 ACK/NACK 신호를 바탕으로 E-DCH 데이터를 송신하게 되는데, 제1 실시예에서 단말(804)은 E-DCH 데이터가 존재하는 경우만 역방향 채널 상태 정보를 MAC-e 헤더를 이용하여 전송하게 된다. 즉, 도 8의 참조번호 807 및 808까지 모든 E-DCH 데이터가 전송되는 모든 시간 구간들에서, 모든 MAC-e PDU는 항상 MAC-e 헤더에 역방향 채널 상태 정보를 포함한다.

반면 E-DCH 데이터가 존재하지 않을 경우, 즉 참조번호 807의 이전 구간들에서 역방향 채널 상태 정보는 전송되지 않는다. 다만, 버퍼 정보가 전송되는 구간에서는 역방향 채널 상태 정보가 함께 전송될 수 있다. 그리고, 단말의 버퍼에는 데이터가 있지만, 스케쥴링에 의해서나 다른 상황에 의해서 단말이 데이터를 송신하지 않는 구간들(810)에서, 역방향 채널 상태 정보는 전송되지 않는다. 또한 E-DCH 데이터를 더 이상 전송할 필요가 없게 되면, 즉 단말의 버퍼가 비게 되면, 참조번호 809와 같이 역방향 채널 상태 정보의 전송도 멈추게 된다.

기지국은 매 MAC-e PDU가 수신될 때마다 상기 각 MAC-e PDU에서 버퍼 정보 및/또는 역방향 채널 상태 정보를 추출하고, 상기 버퍼 정보 및/또는 역방향 채널 상태 정보를 이용하여 스케쥴링을 수행한다.

<<제2 실시예>>

도 9는 본 발명의 제2 실시예에 따라, 단말이 E-DCH의 스케쥴링에 필요한 역방향 채널 상태 정보를 주기적으로 전송하는 방법을 보여주고 있다.

제2 실시예에서 단말은 역방향 채널 상태 정보를 일정 TPS 주기를 가지고 전송한다. 구체적으로 상기 TPS 주기에 따른 구간들에서 전송할 E-DCH 데이터가 있는 경우에, 상기 역방향 채널 상태 정보는 상기 E-DCH 데이터와 함께 MAC-e PDU에 포함되어 전송되며, 전송할 E-DCH 데이터가 없는 경우에는 역방향 채널 상태 정보만을 포함하는 MAC-e PDU가 전송된다.

도 9를 이용하여 자세히 기술하면, 단말(904)은 버퍼에 데이터가 새로이 생기게 되면 버퍼 정보(BO)와 역방향 채널 상태 정보(TPS)(906)를 우선 기지국으로 E-DCH(905)를 통해 전송하게 된다. BO/TPS(906)는 초기 MAC-e PDU에 포함되어 전송되며, 초기 MAC-e PDU는 데이터 없이 버퍼 정보만을 포함하거나, 데이터 없이 버퍼 정보와 역방향 채널 상태 정보만을 MAC-e 헤더에 포함하여 MAC-e 시그널링의 방법으로 전송된다.

E-DCH(905)를 통해 버퍼 정보, 또는 버퍼 정보/역방향 채널 상태 정보를 함께 수신한 기지국(901)은 상기 버퍼 정보로부터 E-DCH 데이터의 존재 여부를 판단하게 되고, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 바탕으로 스케쥴링을 수행한다. 상기 스케쥴링의 결과로 기지국(901)은 스케쥴링 그랜트 채널(902)을 통해 스케쥴링 그랜트 정보를 단말(904)에게 내려준다. 상기 스케쥴링 방식에는, 사용 가능한 리소스의 절대치를 알려주는 절대 그랜트와, 사용 가능한 리소스를 기존 리소스와 비교하여 그 상대치를 알려주는 상대 그랜트 등이 있다. 기지국(901)은 상기 MAC-e PDU를 수신하여 HARQ에 따른 처리를 수행하고, 상기 HARQ의 수행 결과로서 ACK/NACK 신호를 ACK/NACK 채널(803)을 통하여 단말(904)에게 알려준다.

단말(904)은 상기 스케쥴링 그랜트 정보와 상기 ACK/NACK 신호를 바탕으로 E-DCH 데이터를 전송하게 되는데, 제2 실시예에서 단말(904)은 역방향 채널 상태 정보를 일정 TPS 주기(910)를 가지고 전송한다. 구체적으로 단말(904)은 데이터가 존재하는 경우는 상기 데이터를 포함하는 MAC-e PDU의 MAC-e 헤더를 이용하여 역방향 채널 상태 정보를 전송하고, 데이터가 존재하지 않는 경우는 상기 역방향 채널 상태 정보만을 포함하는 MAC-e PDU를 전송한다. 즉, 역방향 채널 상태 정보를 포함하는 MAC-e PDU는, TPS 주기(910)의 간격을 가지는 구간들(907, 908, 909)에서 전송된다.

이때, 상기 구간들(907, 908, 909)은 HARQ 프로세스에 있어서 이전 전송된 MAC-e PDU가 ACK으로 판단되었거나, 이전 전송된 MAC-e PDU의 전송 회수가 최대 전송회수에 다다른 경우로 한정될 수 있다. 즉 초기 전송이 가능한 구간에만

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채널 상태 정보가 전송될 수 있다. 따라서 모든 조건을 고려했을 경우 역방향 채널 상태 정보를 전송할 수 있는 구간은, 상기 TPS 주기(910)가 도래한 이후에 채널 상태 정보의 전송이 가능한 가장 빠른 구간, 즉 상기 TPS 주기(910)가 도래한 이후 초기전송 MAC-e PDU가 발생한 때에, 단말은 상기 역방향 상태 정보를 상기 초기전송 MAC-e PDU의 MAC-e 헤더에 첨가하여 전송하게 된다. 상기 TPS 주기(910)는 미리 정해진 고정값이 사용되거나, 혹은 상위 시그널링을 통해 RNC가 단말과 기지국에게 RRC와 NBAP(Node B Application Part) 프로토콜을 이용하여 각각 전달해 줄 수 있다.

상기 TPS 주기(910)로 정해진 구간이 아니더라도, 버퍼 정보가 전송되는 구간(911)에서는, 버퍼정보와 함께 역방향 채널 상태 정보 역시 MAC-e 헤더에 포함되어 전송될 수 있다.

도 9의 구간(907) 이전, 즉 E-DCH 데이터가 전송되기 이전에는, TPS 주기(910)에 관계없이 역방향 채널 상태 정보는 전송되지 않는다. 다만, E-DCH 데이터의 전송 시작을 알리기 위해 첫번째 버퍼 정보가 전송되는 구간(906)에서는, 상기 버퍼정보와 함께 역방향 채널 상태 정보가 전송된다. 또한 E-DCH 데이터를 더 이상 전송할 필요가 없게 되면, 즉 단말(904)의 버퍼가 비게(empty) 되면 참조번호 912와 같이 역방향 채널 상태 정보의 전송도 멈추게 된다.

기지국은 버퍼 정보와 역방향 채널 상태 정보 만을 포함하는 초기 MAC-e PDU를 수신한 이후, 데이터를 포함하는 첫번째 MAC-e PDU에서 역방향 채널 상태 정보를 추출한다. 그리고 나면, 기지국은 매 TPS 주기에 따른 구간에서 수신되는 MAC-e PDU에서 역방향 채널 상태 정보를 추출한다.

<<제3 실시예>>

도 10은 본 발명의 제3 실시예에 따라, 단말이 E-DCH의 스케쥴링에 필요한 역방향 채널 상태 정보를 이벤트 발생적으로(Event-triggered)전송하는 방법을 보여주고 있다.

제3 실시예에서 단말은 미리 정의되는 이벤트를 만족시키는 경우에 역방향 채널 상태 정보를 전송한다. 구체적으로 상기 이벤트를 만족하는 구간들에서 전송할 E-DCH 데이터가 있는 경우에, 단말은 상기 E-DCH 데이터와 함께 MAC-e PDU에 역방향 채널 상태 정보를 포함시켜 전송하며, 전송할 E-DCH 데이터가 없는 경우는 역방향 채널 상태 정보만을 포함하는 MAC-e PDU가 전송된다.

도 10을 이용하여 자세히 기술하면, 단말(1004)은 버퍼에 데이터가 새로이 생기게 되면, 버퍼 정보(BO)와 역방향 채널 상태 정보(TPS)(1006)를 우선 기지국으로 E-DCH(1005)를 통해 전송하게 된다. BO/TPS(1006)는 초기 MAC-e PDU에 포함되어 전송되며, 초기 MAC-e PDU는 데이터 없이 버퍼 정보만을 포함하거나, 데이터 없이 버퍼 정보와 역방향 채널 상태 정보만을 MAC-e 헤더에 포함하여 MAC-e 시그널링의 방법으로 전송된다.

E-DCH(1005)를 통해 버퍼 정보, 또는 버퍼 정보와 역방향 채널 상태 정보를 함께 수신한 기지국(1001)은 상기 버퍼 정보로부터 E-DCH 데이터의 존재 여부를 판단하게 되고, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 바탕으로 스케쥴링을 수행한다. 상기 스케쥴링의 결과로 기지국(1001)은 스케쥴링 그랜트 채널(1002)을 통해 스케쥴링 그랜트 정보를 단말(1004)에게 내려준다. 상기 스케쥴링 방식에는, 사용 가능한 리소스의 절대치를 알려주는 절대 그랜트와, 사용 가능한 리소스를 기존 리소스와 비교하여 그 상대치를 알려주는 상대 그랜트 등이 있다. 기지국(1001)은 상기 MAC-e PDU를 수신하여 HARQ에 따른 처리를 수행하고, 상기 HARQ의 수행결과로서 ACK/NACK 신호를 ACK/NACK 채널(1003)을 통하여 단말(1004)에게 알려주게 된다.

단말(1004)은 상기 스케쥴링 그랜트 정보와 상기 ACK/NACK 신호를 바탕으로 E-DCH 데이터를 전송하게 된다. 제3 실시예에서 단말(1004)은 미리 정의된 이벤트의 발생 여부를 판단하고, 상기 이벤트가 발생한 경우 역방향 채널 상태 정보를 MAC-e PDU에 실어 전송하게 된다. 구체적으로 단말(1004)는 데이터가 존재하는 경우에는 상기 데이터를 포함하는 MAC-e PDU의 MAC-e 헤더에 상기 역방향 채널 상태 정보를 첨가하여 전송하고, 데이터가 존재하지 않는 경우에는 상기 역방향 채널 상태 정보만을 포함하는 MAC-e PDU를 전송한다.

이때, 상기 이벤트의 일 예는 아래와 같다. 즉, 이전에 MAC-e 헤더를 이용하여 전송한 역방향 채널 상태 정보와 현재의 역방향 채널 상태 정보와의 차이가 일정 문턱치 값을 넘는 경우, , 이벤트가 발생한다. 단말(1004)은 상기 이벤트가 발생한 직후의 데이터 전송 구간에서 MAC-e 헤더를 이용하여 역방향 채널 상태 정보를 전송한다. 상기 문턱치 값은 미리 결정된 고정값을 사용하거나, RRC와 NBAP을 통한 상위 시그널링으로 단말과 기지국에게 각각 전송될 수 있다. 물론 상기 역방향 채널 상태 정보를 전송하기 위한 여러 가지의 이벤트가 다른 여러 가지의 기준으로 정의될 수 있다.

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도 10의 구간(1009)에서 단말(1004)은 미리 정해진 이벤트의 발생을 감지하면 이어지는 구간(1010)에서 역방향 채널 상태 정보를 MAC-e 헤더에 실어 전송한다. 여기에 상기 구간(1010)은 HARQ 프로세스에 있어서 이전 전송된 MAC-e PDU가ACK으로 판단되었거나, 이전 전송된 MAC-e PDU의 전송회수가 최대 전송회수에 다다른 경우로 한정될 수 있다. 즉 초기 전송이 가능한 때에만 채널 상태 정보가 전송될 수 있다. 따라서 모든 조건을 고려했을 경우 역방향 채널 상태 정보를 전송할 수 있는 구간은, 상기 이벤트가 발생한 이후에 역방향 채널 상태 정보의 전송이 가능한 가장 빠른 구간, 즉 상기이벤트가 발생한 이후 초기전송 MAC-e PDU가 발생한 때에 단말은 상기 역방향 채널 상태 정보를 상기 초기전송 MAC-e PDU의 MAC-e 헤더에 첨가하여 전송하게 된다.

상기 이벤트의 발생에 의해 역방향 채널 상태 정보를 전송해야 하는 구간이 아니더라도, 버퍼 정보가 전송되는 구간(1008)에서는, 상기 버퍼정보와 함께 역방향 채널 상태 정보 역시 함께 MAC-e 헤더에 포함되어 전송될 수 있다.

도 10의 구간(1007) 이전, 즉 E-DCH 데이터가 전송되기 이전에는, 상기 이벤트가 발생되더라도 역방향 채널 상태 정보는 전송되지 않는다. 다만, E-DCH 데이터의 전송 시작을 알리기 위한 첫번째 버퍼 정보가 전송되는 구간(1006)에서는, 상기 버퍼정보와 함께 역방향 채널 상태 정보가 전송된다. 또한 E-DCH 데이터를 더 이상 전송할 필요가 없게 되면, 즉 단말(1004)의 버퍼가 비게 되면 참조번호 1011와 같이 역방향 채널 상태 정보도 더 이상 전송되지 않는다.

기지국은 매 MAC-e PDU를 수신할 때마다 상기 각 MAC-e PDU에 포함된 MAC-e 시그널링 지시 비트에 따라 상기 MAC-e PDU가 역방향 채널 상태 정보를 포함하는지를 판단한다. 만일 역방향 채널 상태 정보가 포함되는 경우 기지국은 상기 MAC-e PDU에서 역방향 채널 상태 정보를 추출하여 스케쥴링에 이용한다.

<<제4 실시예>>

도 11은 본 발명의 제4 실시예에 따라, 단말이 E-DCH의 스케쥴링에 필요한 역방향 채널 상태 정보를 주기적 또는 이벤트 발생적으로 전송하는 방법을 보여주고 있다.

제4 실시예에서 단말은 미리 정의되는 이벤트를 만족시키는 경우 역방향 채널 상태 정보를 전송하고 또한 미리 정해지는 TPS 주기에 따라 정해진 구간에서도 역방향 채널 상태 정보를 전송한다. 즉 단말은 상기 이벤트를 만족한 때에 역방향 채널 상태 정보를 전송하고 또한 이와 병행하여 TPS 주기를 가지고 역방향 채널 상태 정보를 전송하여, 상기 이벤트에 따른 전송이 실패한 경우 상기 주기적인 전송을 통해 상기 역방향 채널 상태 정보의 안정적인 전송을 보장한다. 구체적으로 상기 이벤트를 만족하거나 상기 TPS 주기가 도래한 때에 전송할 E-DCH 데이터가 존재하면, 단말은 상기 E-DCH 데이터를 포함하는 MAC-e PDU의 MAC-e 헤더에 역방향 채널 상태 정보를 포함시켜 전송한다. 전송할 E-DCH 데이터가 없는 경우는 역방향 채널 상태 정보만을 포함하는 MAC-e PDU가 전송된다.

도 11을 이용하여 자세히 기술하면, 단말(1104)은 버퍼에 데이터가 새로이 생기게 되면, 버퍼 정보(BO)와 역방향 채널 상태 정보(TPS)(1106)를 우선 기지국으로 E-DCH(1105)를 통해 전송하게 된다. BO/TPS(1106)는 초기 MAC-e PDU에 포함되어 전송되며, 상기 초기 MAC-e PDU는 데이터 없이 버퍼 정보만을 포함하거나, 데이터 없이 버퍼 정보와 역방향 채널 상태 정보만을 MAC-e 헤더에 포함하여 MAC-e 시그널링의 방법으로 전송된다.

E-DCH(1105)를 통해 버퍼 정보, 또는 버퍼 정보와 역방향 채널 상태 정보를 함께 수신한 기지국(1101)은, 상기 버퍼 정보로부터 E-DCH 데이터의 존재 여부를 판단하게 되고, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 바탕으로 스케쥴링을 수행한다. 상기 스케쥴링의 결과로 기지국(1101)은 스케쥴링 그랜트 채널(1102)을 통해 스케쥴링 그랜트 정보를 단말(1104)에게 내려준다. 상기 스케쥴링 방식에는, 사용 가능한 리소스의 절대치를 알려주는 절대 그랜트와, 사용 가능한 리소스를 기존 리소스와 비교하여 그 상대치를 알려주는 상대 그랜트 등이 있다. 기지국(1101)은 상기 MAC-e PDU를 수신하여 HARQ에 따른 처리를 수행하고, 상기 HARQ의 수행결과로서 ACK/NACK 신호를 ACK/NACK 채널(1103)을 통하여 단말(1104)에게 알려주게 된다.

단말(1104)은 상기 스케쥴링 그랜트 정보와 상기 ACK/NACK 신호를 바탕으로 E-DCH 데이터를 전송하게 된다. 제4 실시예에서 단말(1104)은 미리 정해지는 TPS 주기(1111)에 따라 역방향 채널 상태 정보를 전송하며, 이와 병행하여 이벤트가 발생한 경우 역방향 채널 상태 정보를 전송하게 된다. 이때 단말(1104)는, 데이터가 존재하는 경우에는 상기 데이터를 포함하는 MAC-e PDU의 MAC-e 헤더에 상기 역방향 채널 상태 정보를 첨가하여 전송하고, 데이터가 존재하지 않는 경우에는 상기 역방향 채널 상태 정보만을 포함하는 MAC-e PDU를 전송하게 된다.

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상기 이벤트의 일 예는 아래와 같다. 즉, 이전에 MAC-e 헤더를 이용하여 전송한 역방향 채널 상태 정보와 현재의 역방향 채널 상태 정보와의 차이가 일정 문턱치 값을 넘는 경우, 이벤트가 발생한다. 단말(1104)은 상기 이벤트가 발생한 직후의 데이터 전송 구간에서 MAC-e 헤더를 이용하여 역방향 채널 상태 정보를 전송한다. 상기 문턱치 값은 미리 결정된 고정값을 사용하거나, RRC와 NBAP을 통한 상위 시그널링으로 단말과 기지국에게 각각 전송될 수 있다. 상기 역방향 채널 상태 정보를 전송하기 위한 여러 가지 이벤트가 다른 여러 가지의 기준으로 정의될 수 있다. 또한 제4 실시예에서 상기 TPS 주기(1111)는 미리 결정된 고정값이 사용되거나 혹은, 상위 시그널링을 통해 RNC가 단말과 기지국에게 RRC와 NBAP을 이용하여 각각 전달해 줄 수 있다.

도 11의 구간들(1107, 1109, 1110)에서 단말(1104)은 TPS 주기(1111)에 따라 역방향 채널 상태 정보를 전송한다. 또한 구간(1112)에서 단말(1104)이 미리 정해진 이벤트의 발생을 감지한 경우, 이어지는 구간(1113)에서 역방향 채널 상태 정보가 전송된다. 여기에 상기 역방향 채널 상태 정보를 전송하는 구간들(1107, 1109, 1110, 1113)은 HARQ 프로세스에 있어서 이전 전송된 MAC-e PDU가 ACK으로 판단되었거나, 이전 전송된 MAC-e PDU의 전송회수가 최대 전송회수에 다다른 경우로 한정된다, 즉 초기 전송이 가능한 때에만 역방향 채널 상태 정보가 전송될 수 있다.

따라서 모든 조건을 고려했을 경우 역방향 채널 상태 정보를 전송할 수 있는 구간은, TPS 주기가 도래한 이후에 채널 상태 정보의 전송이 가능한 가장 빠른 구간, 즉 상기 TPS 주기가 도래한 이후 초기전송 MAC-e PDU가 발생한 때, 또는 상기 이벤트가 발생한 이후에 역방향 채널 상태 정보의 전송이 가능한 가장 빠른 시점, 즉 상기 이벤트가 발생한 이후 초기전송 MAC-e PDU가 최초로 발생한 때에 단말은 상기 역방향 채널 상태 정보를 상기 초기전송 MAC-e PDU의 MAC-e 헤더에 첨가하여 전송하게 된다.

상기 주기적, 또는 이벤트 발생적으로 역방향 채널 상태 정보를 전송해야 하는 구간이 아니더라도, 버퍼 정보가 전송되는 구간(1108)에서는, 상기 버퍼정보와 함께 역방향 채널 상태 정보 역시 함께 MAC-e 헤더에 포함되어 전송될 수 있다.

도 11의 구간(1107) 이전, 즉 E-DCH 데이터가 전송되기 이전에는, 상기 이벤트 또는 상기 TPS 주기와 관계없이 역방향 채널 상태 정보는 전송되지 않는다. 다만, E-DCH 데이터의 전송 시작을 알리기 위한 첫번째 버퍼 정보가 전송되는 구간(1006)에서는, 상기 버퍼정보와 함께 역방향 채널 상태 정보가 전송된다. 또한 E-DCH데이터를 더 이상 전송할 필요가 없게 되면, 즉 단말(1104)의 버퍼가 비게 되면 참조번호 1114와 같이 역방향 채널 상태 정보도 더 이상 전송되지 않는다.

기지국은 버퍼 정보와 역방향 채널 상태 정보 만을 포함하는 초기 MAC-e PDU를 수신한 이후, 데이터를 포함하는 첫번째 MAC-e PDU에서 역방향 채널 상태 정보를 추출한다. 그리고 나면, 기지국은 매 TPS 주기에 따른 구간에서 수신되는 MAC-e PDU에서 역방향 채널 상태 정보를 추출한다. 또한 기지국은 매 MAC-e PDU를 수신할 때마다 상기 MAC-e PDU에 포함된 MAC-e 시그널링 지시 비트를 확인하여 상기 MAC-e PDU가 역방향 채널 상태 정보를 포함하는지를 판단한다. 만일 역방향 채널 상태 정보가 포함되는 경우라면 기지국은 상기 MAC-e PDU에서 역방향 채널 상태 정보를 추출하여 스케쥴링을 수행한다.

<<제5 실시예>>

도 12는 본 발명의 제5 실시예에 따라, 단말이 E-DCH의 스케쥴링에 필요한 역방향 채널 상태 정보를 주기적 및 이벤트 발생적으로 전송하는 방법을 보여주고 있다.

제5 실시예에서 단말은 미리 정해진 TPS 주기를 감시하고, 상기 TPS 주기가 도래한 시점에서 미리 정해진 이벤트를 만족시키는 경우 역방향 채널 상태 정보를 전송한다. 구체적으로 상기 TPS 주기가 도래하고 상기 이벤트가 발생했을 때에, 전송할 E-DCH 데이터가 있으면, 단말은 상기 E-DCH 데이터를 포함하는 MAC-e PDU의 MAC-e 헤더에 역방향 채널 상태 정보를 포함시켜 전송한다. 전송할 E-DCH 데이터가 없는 경우는 역방향 채널 상태 정보만을 포함하는 MAC-e PDU가 전송된다.

도 12를 이용하여 자세히 기술하면, 단말(1204)은 버퍼에 데이터가 새로이 생기게 되면, 버퍼 정보(BO)와 역방향 채널 상태 정보(TPS)(1206)를 우선 기지국으로 E-DCH(1205)를 통해 전송하게 된다. BO/TPS(1206)는 초기 MAC-e PDU에 포함되어 전송되며, 상기 초기 MAC-e PDU는 데이터 없이 버퍼 정보만을 포함하거나, 데이터 없이 버퍼 정보와 역방향 채널 상태 정보만을 MAC-e 헤더에 포함하여 MAC-e 시그널링의 방법으로 전송된다.

E-DCH(1205)를 통해 버퍼 정보, 또는 버퍼 정보와 역방향 채널 상태 정보를 함께 수신한 기지국(1201)은, 상기 버퍼 정보로부터 E-DCH의 존재 여부를 판단하게 되고, 상기 버퍼 정보와 상기 역방향 채널 상태 정보를 바탕으로 스케쥴링을 수

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행한다. 상기 스케쥴링의 결과로 기지국(1201)은 스케쥴링 그랜트 채널(1202)을 통해 스케쥴링 그랜트 정보를 단말(1204)에게 내려준다. 상기 스케쥴링 방식에는, 사용 가능한 리소스의 절대치를 알려주는 절대 그랜트와, 사용 가능한 리소스를 기존 리소스와 비교하여 그 상대치를 알려주는 상대 그랜트 등이 있다. 기지국(1201)은 상기 MAC-e PDU를 수신하여 HARQ에 따른 처리를 수행하고, 상기 HARQ의 수행결과로서 ACK/NACK 신호를 ACK/NACK 채널(1203)을 통하여 단말(1204)에게 알려주게 된다.

단말(1204)은 상기 스케쥴링 그랜트 정보와 상기 ACK/NACK 신호를 바탕으로 E-DCH 데이터를 전송하게 된다. 제5 실시예에서 단말(1204)은 미리 정해지는 TPS 주기(1210)에 따른 구간들(1207, 1209, 1211)에서 미리 정의된 이벤트의 발생 여부를 판단하며, 상기 이벤트가 발생한 것으로 판단되는 구간(1211)에서 역방향 채널 상태 정보를 전송하게 된다. 이때 단말(1204)는, 데이터가 존재하는 경우에는 상기 데이터를 포함하는 MAC-e PDU의 MAC-e 헤더에 상기 역방향 채널 상태 정보를 첨가하여 전송하고, 데이터가 존재하지 않는 경우에는 상기 역방향 채널 상태 정보만을 포함하는 MAC-e PDU를 전송하게 된다.

상기 이벤트의 일 예는 아래와 같다. 즉, 이전에 MAC-e 헤더를 이용하여 전송한 역방향 채널 상태 정보와 현재의 역방향 채널 상태 정보와의 차이가 일정 문턱치 값을 넘는 경우, 이벤트가 발생한다. 단말(1204)은 상기 이벤트가 발생한 직후의 데이터 전송 구간에서 MAC-e 헤더를 이용하여 역방향 채널 상태 정보를 전송한다. 상기 문턱치 값은 미리 결정된 고정값을 사용하거나, RRC와 NBAP을 통한 상위 시그널링으로 단말과 기지국에게 각각 전송될 수 있다.

상기 역방향 채널 상태 정보를 전송하기 위한 여러 가지 이벤트가 다른 여러 가지의 기준으로 정의될 수 있다. 또한 제5 실시예에서 상기 TPS 주기(1210)는 정해진 고정값이 사용되거나 혹은, 상위 시그널링을 통해 RNC가 단말과 기지국에게 RRC와 NBAP을 이용하여 각각 전달해 줄 수 있다.

도 12에서 TPS 주기(1210)의 간격을 가지는 구간들(1207, 1209, 1211)에서 단말(1204)은 이전 한 TPS 주기 동안 미리 정해지는 이벤트가 발생하였는지를 판단한다. 구간(1212)에서 상기 이벤트가 발생한 경우, 이어지는 구간(1211)에서 단말은 역방향 채널 상태 정보를 전송한다. 즉, TPS주기(1210)가 도래 했지만 이벤트가 발생하지 않은 구간들(1207, 1209)에서는 역방향 채널 상태 정보가 전송되지 않는다. 여기에서 상기 역방향 채널 상태 정보를 전송하는 구간(1211)은, HARQ 프로세스에 있어서 이전 전송된 MAC-e PDU가 ACK으로 판단되었거나, 이전 전송된 MAC-e PDU의 전송회수가 최대 전송회수에 다다른 경우로 한정된다. 즉 초기 전송이 가능한 때에만 역방향 채널 상태 정보가 전송될 수 있다.

따라서 모든 조건을 고려했을 경우 역방향 채널 상태 정보를 전송할 수 있는 구간은, 이벤트가 발생한 후에 TPS 주기가 최초로 도래한 구간이다. 상기 TPS 주기의 간격을 가지는 주기적인 구간들 중에서 이벤트의 발생이 일어난 구간이 아니더라도, 버퍼 정보가 전송되는 구간(1208)에서는, 상기 버퍼정보와 함께 역방향 채널 상태 정보 역시 함께 MAC-e 헤더에 포함되어 전송될 수 있다.

도 12의 구간(1207) 이전, 즉 E-DCH 데이터가 전송되기 이전에는 상기 이벤트 또는 상기 TPS 주기와 관계없이 역방향 채널 상태 정보는 전송되지 않는다. 다만, E-DCH 데이터의 전송 시작을 알리기 위한 첫번째 버퍼 정보가 전송되는 구간(1206)에서는, 상기 버퍼정보와 함께 역방향 채널 상태 정보가 전송된다. 또한 E-DCH 데이터를 더 이상 전송할 필요가 없어지면, 즉 단말(1204)의 버퍼가 비게 되면 참조번호 1213과 같이 역방향 채널 상태 정보도 더 이상 전송되지 않는다.

기지국은 매 MAC-e PDU를 수신할 때마다 상기 MAC-e PDU에 포함된 MAC-e 시그널링 지시 비트를 확인하여 상기 MAC-e PDU가 역방향 채널 상태 정보를 포함하는지를 판단한다. 만일 역방향 채널 상태 정보가 포함되는 경우라면 기지국은 상기 MAC-e PDU에서 역방향 채널 상태 정보를 추출하여 스케쥴링을 수행한다.

<<제6 실시예>>

제6 실시예는 단말이 MAC-e 시그널링을 이용하여 버퍼 정보와 역방향 채널 상태 정보를 함께 전송하는 방법을 제시한다. 상기 제6 실시예에서는 버퍼 정보의 전송 시점 또는 역방향 채널 상태 정보의 전송 시점에, 상기 두 가지의 정보를 항상 함께 보낸다.

이와 같이 MAC-e 시그널링을 통하여 버퍼 정보를 전송해야 하는 시점에는 버퍼 정보를 전송하고, 역방향 채널 상태 정보를 전송해야 하는 시점에는 역방향 채널 상태 정보를 전송해야 한다면, MAC-e PDU 크기의 종류가 매우 다양해지기 때문에, 상기 MAC-e PDU 크기 정보를 E-DCH 제어 채널인 E-DPCCH(Enhanced - Dedicated Physical Control Channel)로 전송하기 위한 물리 계층의 시그널링할 정보 량이, 좀 더 많이 필요해질 수 있다. 따라서 단말은, 일정 크기의 버퍼 정보

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필드를 할당하고 또한 일정 크기의 역방향 채널 상태 정보 필드를 할당하며, 상기 두 가지 정보 중에서 하나라도 전송이 필요한 경우 상기 두 가지 정보를 항상 함께 전송하여 MAC-e PDU 크기의 종류를 최대한 줄인다. 따라서 E-DPCCH 상에서 MAC-e PDU의 크기를 나타내는 정보의 크기를 줄일 수 있다.

이전 실시예들과 같이 버퍼 정보와 역방향 채널 상태 정보가 서로 독립적으로 전송되게 된다면, 각각의 MAC-e PDU에 대해 4가지의 MAC-e 시그널링 종류, 즉 버퍼 정보만 전송되는 경우, 역방향 채널 상태 정보만 전송되는 경우, 두 정보가 함께 전송되는 경우, 두 정보가 모두 전송되지 않는 경우를 각각 나타내기 위해, 물리적으로 2비트의 정보필드가 필요하다. 하지만 제6 실시예와 같이 버퍼 정보와 역방향 상태 정보가 항상 함께 전송된다면 2가지 MAC-e 시그널링 종류, 즉 두 정보가 전송되는 경우와 두 정보가 모두 전송되지 않는 경우를 나타내기 위해 물리적으로 단지 1비트의 정보필드만을 필요로 하게 되어, MAC-e 시그널링을 지시하기 위해 필요한 비트 수를 줄일 수 있게 된다.

제6 실시예의 구체적인 동작을 하기에서 설명한다.

앞서 언급한 여러 실시예들을 통해서, 정해진 주기 또는 정해진 이벤트에 따라서, 또한 상기 주기와 이벤트의 조합을 통하여 MAC-e 시그널링을 통해한 역방향 채널 상태 정보를 전송하는 방법들을 설명하였다. 버퍼 정보 역시 미리 정해진 주기에 따라서 또는 정해진 이벤트를 만족시키는 경우에 따라서, 또한 상기 두 가지의 조합을 통하여 MAC-e 시그널링을 통해 전송된다. 따라서 역방향 채널 상태 정보를 전송하는 조건과 버퍼 정보를 전송하는 조건이 각각 정해지면, 상기 두 가지의 조건들 중 어느 하나라도 만족시키는 경우에, MAC-e 시그널링을 이용하여 버퍼 정보와 역방향 채널 상태 정보가 모두 전송된다.

일 예로서 버퍼 정보의 전송을 위한 BO 주기는 역방향 채널 상태 정보의 전송을 위한 TPS 주기와 동일하거나 또는 다르게 설정될 수 있으며, 버퍼 정보와 역방향 채널 상태 정보의 전송 구간들은 개별적으로 정해진다. 예를 들어 버퍼 정보는 단말의 버퍼에 데이터가 처음으로 저장되었을 시 최초 전송된다. 또한 버퍼 정보의 전송을 위한 이벤트는, 예를 들어 단말의 버퍼에 새로운 데이터가 저장되거나 또는 단말의 버퍼에 저장된 데이터 양이 임계치에 도달하는 경우로 정해질 수 있다. 그리고 역방향 채널 상태 정보의 전송 이벤트는 채널 상태의 변화가 크거나 채널 상태가 열악하여지는 경우로 정해질 수 있다.

버퍼 정보의 크기와 역방향 채널 상태 정보의 크기는 일정하며, 상기 두 가지를 합한 크기의 정보가 E-DCH 데이터에 합해져서 MAC-e 시그널링을 위한 MAC-e PDU를 만들게 된다. 즉 MAC-e 시그널링에 사용되는 MAC-e PDU에 있어서는 버퍼정보를 위한 필드와 역방향 채널 상태 정보를 위한 필드를 각각 두고, MAC-e 시그널링에 있어서는 상기 필드들에 해당 전송 구간에서의 버퍼 정보와 역방향 상태 정보를 포함시킨다.

단말은 매 구간마다 버퍼 정보의 전송을 위한 BO 주기 또는 역방향 채널 상태 정보의 전송을 위한 TPS 주기에 도달하였는지를 판단한다. 만일 어느 주기에도 도달하지 않았으면, 버퍼 정보의 전송을 위한 이벤트 또는 역방향 채널 상태 정보의 전송을 위한 이벤트가 발생하였는지를 판단한다. 상기 주기들 중 어느 하나에 도달하였거나 또는 상기 이벤트들 중 어느 하나가 발생하였으면, 단말은 데이터를 포함하는 MAC-e PDU에 버퍼 정보와 채널 상태 정보를 삽입하여 함께 전송한다.

제6 실시예의 또 다른 가능한 동작을 설명하면 하기와 같다.

단말은 버퍼 정보와 역방향 채널 상태 정보를 위한 MAC-e 시그널링 필드를 정하여, 버퍼정보의 전송 조건이 만족되는 경우는 상기 MAC-e 시그널링 필드 중에서 버퍼 정보 필드에 버퍼 정보를 넣고, 역방향 채널 상태 정보 필드에는 의미 없는 값을 삽입하여 전송한다. 또한 역방향 채널 상태 정보의 전송 조건이 만족되는 경우는 상기 MAC-e 시그널링 필드 중에서 역방향 채널 상태 정보 필드에는 역방향 채널 상태 정보를 넣고, 버퍼 정보 필드에는 의미 없는 값을 삽입하여 전송한다. 상기 의미 없는 값을 삽입하는 경우는, 4종류의 MAC-e 시그널링을 지시하기 위해 물리적으로 2비트의 정보비트가 필요하다.

기지국은 매 MAC-e PDU를 수신할 때마다 상기 MAC-e PDU에 포함된 MAC-e 시그널링 지시 비트를 확인하여 상기 MAC-e PDU가 단말 상태 정보를 포함하는지를 판단한다. 만일 단말 상태 정보가 포함되는 경우라면 기지국은 상기 MAC-e PDU에서 버퍼 정보와 역방향 채널 상태 정보를 추출하여 스케쥴링을 수행한다.

하기에서 본 발명의 대표적인 실시예들에 대한 흐름도 및 블록도를 설명한다.

도 13은 본 발명의 제4 실시예에 따른 단말 동작을 나타낸 흐름도이다. 도시한 단계들은 E-DCH의 매 전송 구간마다 실행된다.

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도 13을 참조하면, 1302단계에서 단말은 E-DCH 데이터의 전송이 처음으로 시작되는지를 판단한다. E-DCH 데이터의 전송이 처음으로 시작되는 구간으로 판단되었다면 1306단계로 진행하여, 역방향 채널 상태 정보를 버퍼 정보와 함께 MAC-e PDU에 포함시킨 후 1308단계로 진행한다. 반면 E-DCH 데이터의 전송이 처음으로 시작되는 구간이 아니라면, 1303단계로 진행하여 단말은 버퍼 정보가 전송되는 구간인지를 판단한다. 버퍼 정보가 전송되는 구간이라면 1306 단계로 진행하여 역방향 채널 상태 정보를 버퍼 정보와 함께 MAC-e PDU에 포함시킨 후 1308단계로 진행한다. 한편 변형된 실시예로서 역방향 채널 상태 정보가 버퍼 상태와 관계없이 전송된다면, 상기 1303단계는 생략될 것이다.

반면 버퍼 정보가 전송되는 구간이 아니라면 1304단계로 진행하여 TPS 주기에 해당되는 구간인지를 판단한다. 여기에서 단말은 이전 역방향 채널 상태 정보를 전송한 이후 혹은 E-DCH 데이터의 전송이 처음으로 시작된 이후 TPS 주기만큼의 시간이 경과되었는지를 판단한다. 만일 TPS 주기에 해당하는 구간이라면, 1306단계로 진행하여 역방향 채널 상태 정보를 MAC-e PDU에 포함시킨 후 1308단계로 진행한다. TPS 주기에 해당하는 구간이 아니라면 1305단계로 진행하여 단말은 이전 구간에서 역방향 채널 상태 정보의 전송 이벤트가 발생하였는지를 판단한다. 만일 상기 전송 이벤트가 발생하였다면 1306단계로 진행하여 역방향 채널 상태 정보를 MAC-e PDU에 포함시킨 후 1308단계로 진행한다.

상기 1305단계에서 만일 상기 전송 이벤트가 발생하지 않았다면, 1307단계에서 단말은 전송할 E-DCH 데이터가 존재하는지를 판단한다. 만일 전송할 E-DCH 데이터가 존재하면, 1308단계에서 단말은 상기 MAC-e PDU의 페이로드에 상기 E-DCH 데이터를 실어 E-DCH를 통해 전송한다. 여기서 상기 MAC-e PDU는 상기 1306단계에서 삽입된 버퍼 정보 및/또는 역방향 채널 상태 정보를 포함할 수 있다. 반면 전송할 E-DCH 데이터가 존재하지 않는다면 현재 구간에서 어떠한 MAC-e PDU도 전송되지 않으며 단말은 다음 전송 구간까지 대기한 후 1302단계로 복귀한다. 한편 변형된 실시예로서, 전송할 E-DCH 데이터가 존재하지 않는 경우에 버퍼 정보 및/또는 역방향 채널 상태 정보만을 포함하는 MAC-e PDU가 전송될 수 있다.

도 13의 흐름도를 제1 실시예에 적용한다면, 단말은 상기 1302단계(혹은 1303단계)에서 No인 경우 1307단계로 바로 진행한다. 또한 제2 실시예에 적용한다면, 단말은 상기 1304단계에서 No인 경우 1307단계로 바로 진행한다. 마지막으로 제3 실시예에 적용한다면, 단말은 상기 1302단계(혹은 1303단계)에서 No인 경우 1305단계로 바로 진행한다.

도 14는 본 발명의 제5 실시예에 따른 단말 동작을 나타낸 흐름도이다. 마찬가지로 도시한 단계들은 E-DCH의 매 전송 구간마다 실행된다.

도 14를 참조하면, 1402단계에서 단말은 E-DCH 데이터의 전송이 처음으로 시작되는지를 판단한다. E-DCH 데이터의 전송이 처음으로 시작되는 구간으로 판단되었다면 1406단계로 진행하여, 역방향 채널 상태 정보를 버퍼 정보와 함께 MAC-e PDU에 포함시킨 후 1408단계로 진행한다. 반면 E-DCH 데이터의 전송이 처음으로 시작되는 구간이 아니라면, 1403단계로 진행하여 단말은 버퍼 정보가 전송되는 구간인지를 판단한다. 버퍼 정보가 전송되는 구간이라면 1406단계로 진행하여, 역방향 채널 상태 정보를 버퍼 정보와 함께 MAC-e PDU에 포함시킨 후 1408단계로 진행한다. 한편 변형된 실시예로서 역방향 채널 상태 정보가 버퍼 상태와 관계없이 전송된다면, 상기 1403단계는 생략될 것이다.

반면 버퍼 정보가 전송되는 구간이 아니라면 1404단계로 진행하여 단말은 TPS 주기에 해당하는 구간인지를 판단한다. 즉 단말은 이전 역방향 채널 상태 정보를 전송한 이후 혹은 E-DCH 데이터의 전송이 처음으로 시작된 이후 TPS 주기만큼의 시간이 경과되었는지를 판단한다. 만일 TPS 주기에 해당하는 구간이 아니라면, 단말은 1407단계로 진행한다. 반면 TPS 주기에 해당하는 구간이라면 1405단계로 진행하여 단말은 이전 한 TPS 주기 동안에 역방향 채널 상태 정보의 전송 이벤트가 발생하였는지를 판단한다. 만일 상기 전송 이벤트가 발생하였다면, 1406단계로 진행하여 단말은 역방향 채널 상태 정보를 MAC-e PDU에 포함시킨 후 1408단계로 진행한다. 반면 상기 전송 이벤트가 발생하지 않았다면 단말은 1407단계로 진행한다.

상기 1407단계에서 단말은 전송할 E-DCH 데이터가 존재하는지를 판단한다. 만일 전송할 E-DCH 데이터가 존재한다면 1408단계에서 단말은 상기 MAC-e PDU의 페이로드에 상기 E-DCH 데이터를 실어 E-DCH를 통해 전송한다. 여기서 상기 MAC-e PDU는 상기 1406단계에서 삽입된 버퍼 정보 및/또는 역방향 채널 상태 정보를 포함할 수 있다. 반면 전송할 E-DCH 데이터가 존재하지 않는다면 현재 구간에서 어떠한 MAC-e PDU도 전송되지 않으며 단말은 다음 전송 구간까지 대기한 후 1402단계로 복귀한다. 한편 변형된 실시예로서, 전송할 E-DCH 데이터가 존재하지 않는 경우에 버퍼 정보 및/또는 역방향 채널 상태 정보만을 포함하는 MAC-e PDU가 전송될 수 있다.

도 15는 본 발명의 바람직한 실시예에 따른 단말의 구조를 나타낸 블록도이다. 여기에서는 본 발명의 주요한 요지와는 관련이 없는 다른 구성요소의 도시를 생략하였다.

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도 15를 참조하면, 단말은 E-DCH 데이터를 저장하는 E-DCH 버퍼(1501)과, 역방향 채널 상태 정보를 관리하는 TPS 관리부(1502)를 구비한다. 상기 E-DCH 버퍼(1501)에서는 역방향으로 전송하고자 하는 데이터 양을 감시하여 버퍼 정보(1504)를 생성하고 버퍼 정보(1504)를 단말 상태 정보 생성부(1507)로 입력한다. 상기 TPS 관리부(1502)는 단말의 송신 가능한 최대 송신 전력을 알고 있으며, 기지국의 전력 제어 및 역방향 채널들의 송신 여부 등에 따라 각 채널들의 송신 전력을 감시(monitoring)하여 역방향 채널 상태 정보(1503)를 생성하고, 상기 역방향 채널 상태 정보(1503)을 상기 단말 상태 정보 생성부(1507)로 입력한다.

상기 단말 상태 정보 생성부(1507)는 상기 버퍼 정보(1504) 혹은 상기 역방향 채널 상태 정보(1503)를 전송할 시간 구간에 도달하였는지를 판별하고, 상기 버퍼 정보(1504) 및/또는 상기 역방향 채널 상태 정보(1503)를 포함하는 단말 상태 정보를 생성한다. 상기 단말 상태 정보에 상기 버퍼 정보(1504)를 포함하는 조건은 주기적 또는 이벤트 발생적, 또는 초기 E-DCH 전송의 경우 등 여러 가지로 정해질 수 있다. 또한 상기 단말 상태 정보에 상기 역방향 채널 상태 정보(1503)를 포함는 조건 역시 주기적 또는 이벤트 발생적, 또는 초기 E-DCH 전송의 경우 등, 앞서 설명한 여러 가지 실시예들 중 하나에 따라 정해질 수 있다. 상기 TPS 관리부(1502)는 E-DCH 버퍼(1501)로부터 제공되는 제어정보(1506), 즉 버퍼 정보(1504)가 전송되는지의 여부를 나타내는 정보에 따라서 역방향 채널 상태 정보(1503)를 상기 단말 상태 정보 생성부(1507)로 입력할 수 있다.

E-DCH 버퍼(1501)는 또한 매 전송 구간마다 허용된 데이터 전송율에 따라 E-DCH 데이터(1505)를 출력한다. 상기 E-DCH 데이터(1505)는 MAC-e PDU생성부(1508)로 입력되고, 또한 MAC-e 시그널링이 필요한 경우 단말 상태 정보 생성부(1507)는 상기 버퍼 정보 및/또는 상기 역방향 채널 상태 정보를 포함하는 단말 상태 정보를 MAC-e PDU생성부(1508)로 입력한다. MAC-e PDU 생성부(1508)는 상기 E-DCH 데이터와 상기 단말 상태 정보 중 적어도 하나를 포함하는 MAC-e PDU를 생성하며, 상기 MAC-e PDU는 E-DCH 송신부(1509)에서 부호화와 변조를 통하여 기지국으로 전송되게 된다.

상기에서 본 발명이 제시하는 방법은 어느 정도 구체적일 수 있으나 상기 기술에 한정적이지 않고, 본 발명의 범위에서 벗어나지 않는 한도 내에서 여러 가지 변형이 가능함은 물론이다. 그러므로 본 발명의 범위는 상기 설명된 방법에 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 발명 중 대표적인 것에 의하여 얻어지는 효과를 간단히 설명하면 다음과 같다.

본 발명은, E-DCH를 사용하는 WCDMA 통신 시스템에 있어서 역방향 패킷 전송을 위한 전송율 스케쥴링을 수행함에 있어서 필요한 역방향 채널 상태 정보의 정확하고 효율적인 전송을 제공한다. 단말은 역방향 채널 상태 정보를 MAC-e 시그널링과 같이 MAC-e 헤더에 포함시켜서 E-DCH 전송과 함께 기지국으로 전송함으로써, 물리 채널 리소스를 절약하고, 효율적으로 역방향 채널 상태 정보를 기지국으로 전송해 줌으로써 E-DCH의 성능을 개선시킬 수 있게 된다.

도면의 간단한 설명

도 1은 전형적인 UMTS 시스템의 무선접속 네트워크(UTRAN)를 나타낸 구성도.

도 2는 단말과 무선망 제어기(RNC) 사이의 인터페이스를 나타낸 계층을 도시한 도면.

도 3은 전형적인 무선링크에서 E-DCH를 통한 데이터의 전송을 도시한 도면.

도 4는 종래의 E-DCH를 통한 메시지의 송수신 절차를 나타낸 도면.

도 5는 MAC-e 패킷 데이터 단위(PDU)의 구성을 도시한 도면.

도 6는 단말의 E-DCH 송신 관련 MAC/PHY 계층의 구조도.

도 7은 기지국의 E-DCH 수신 관련 MAC/PHY 계층의 구조도.

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도 8은 본 발명의 바람직한 제1 실시예에 따른 역방향 채널 상태 정보의 전송을 설명하는 도면.

도 9는 본 발명의 바람직한 제2 실시예에 따른 역방향 채널 상태 정보의 전송을 설명하는 도면.

도 10은 본 발명의 바람직한 제3 실시예에 따른 역방향 채널 상태 정보의 전송을 설명하는 도면.

도 11은 본 발명의 바람직한 제4 실시예에 따른 역방향 채널 상태 정보의 전송을 설명하는 도면

도 12는 본 발명의 바람직한 제5 실시예에 따른 역방향 채널 상태 정보의 전송을 설명하는 도면

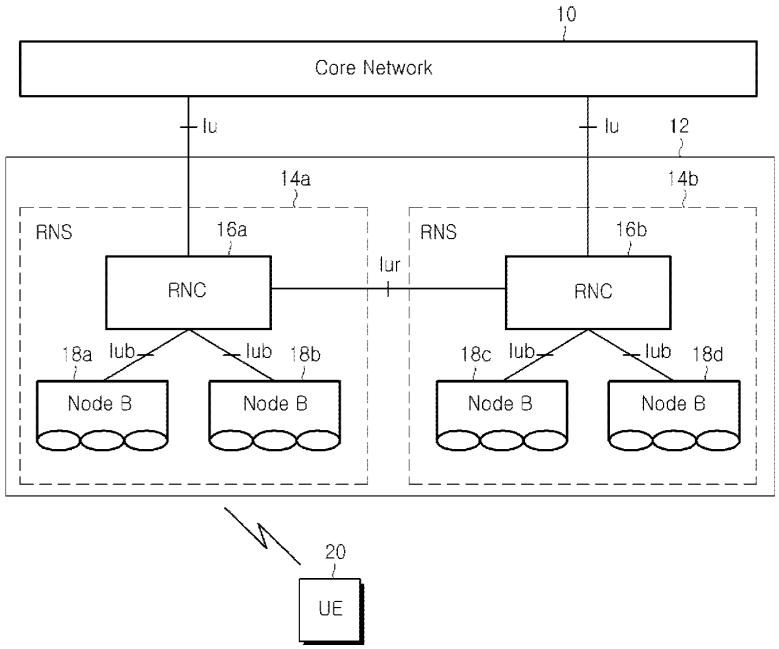
도 13은 본 발명의 바람직한 제4 실시예에 따라 단말이 역방향 채널 상태 정보를 전송하는 동작을 나타낸 흐름도.

도 14는 본 발명의 바람직한 제5 실시예에 따라 단말이 역방향 채널 상태 정보를 전송하는 동작을 나타낸 흐름도.

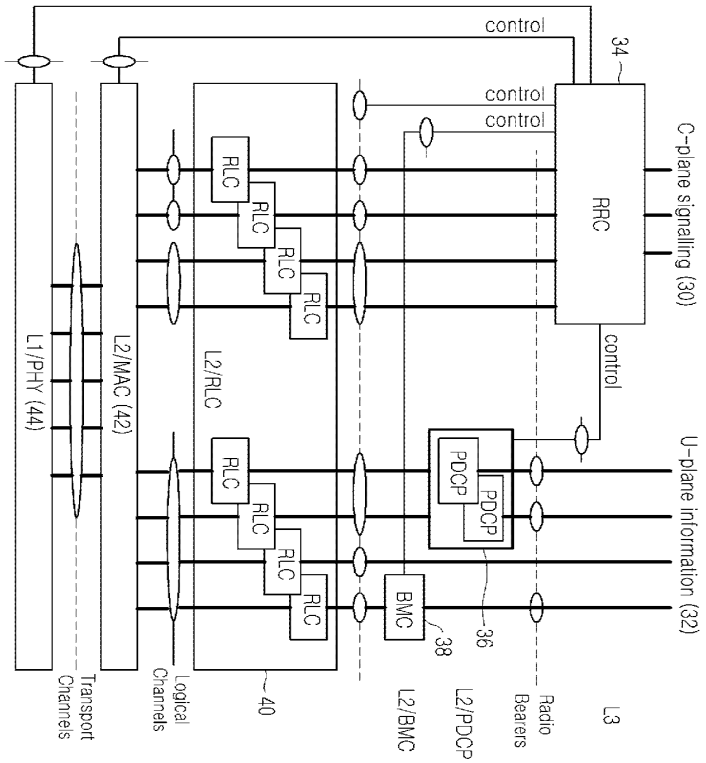
도 15는 본 발명의 바람직한 실시예에 따라 역방향 채널 상태 정보를 전송하는 단말의 구조를 나타낸 블록도.

도면

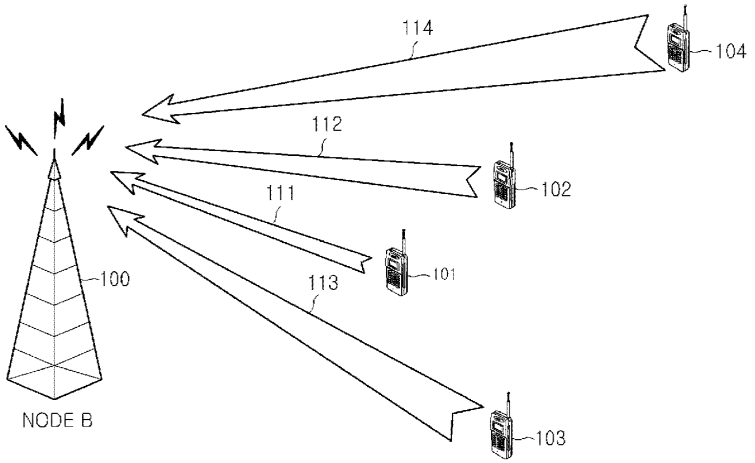
도면1



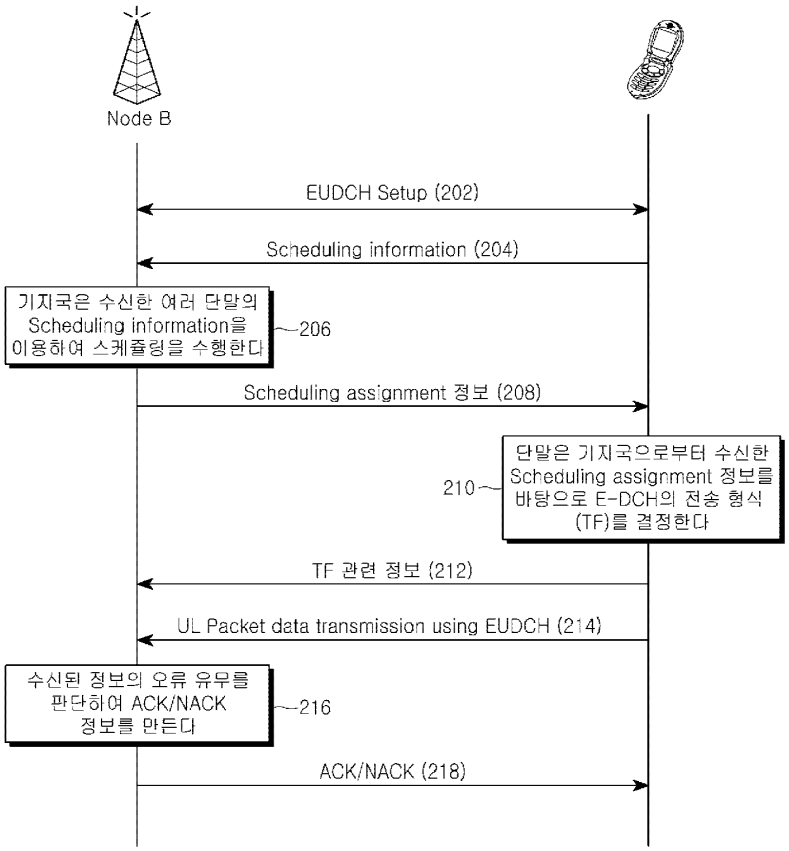
도면2


control
34
control
control
C-plane signalling (30)
RRC
RLC
RLC
RLC
RLC
control
L1/PHY (44)
L2/MAC (42)
L2/RLC
RLC
RLC
RLC
RLC
PDCP
PDCP
U-plane information (32)
BMC
38
36
Transport Channels
Logical Channels
40
L2/BMC
L2/PDCP
Radio Bearers
L3

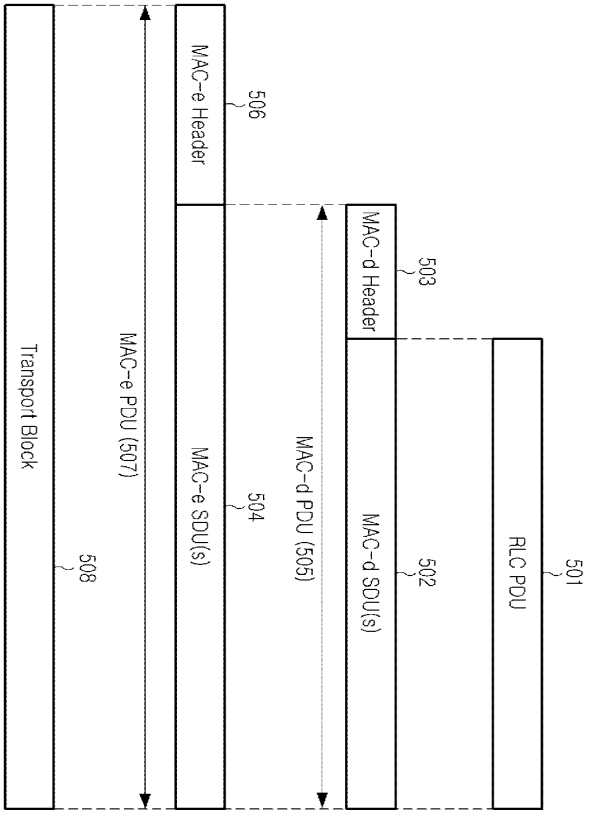
도면3


114
104
112
102
111
101
100
113
103
NODE B

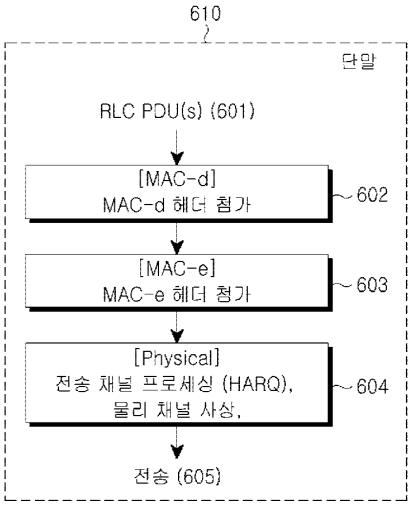
도면4


Node B
EUDCH Setup (202)
Scheduling information (204)
기지국은 수신한 여러 단말의 Scheduling information을 이용하여 스케쥴링을 수행한다
206
Scheduling assignment 정보 (208)
210
단말은 기지국으로부터 수신한 Scheduling assignment 정보를 바탕으로 E-DCH의 전송 형식 (TF)를 결정한다
TF 관련 정보 (212)
UL Packet data transmission using EUDCH (214)
수신된 정보의 오류 유무를 판단하여 ACK/NACK 정보를 만든다
216
ACK/NACK (218)

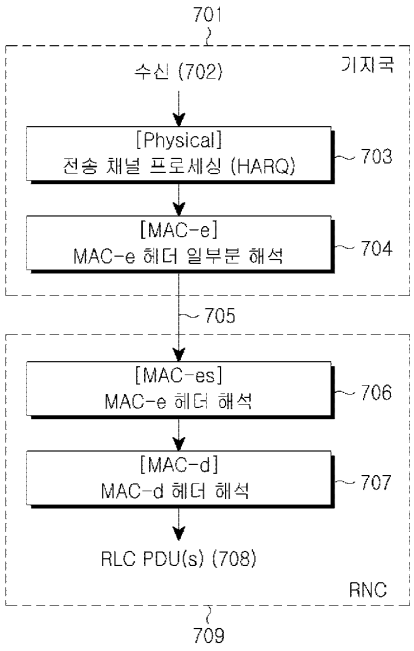
도면5


Transport Block
508
MAC-e PDU (507)
MAC-e Header
506
MAC-e SDU(s)
504
MAC-d PDU (505)
MAC-d Header
503
MAC-d SDU(s)
502
RLC PDU
501

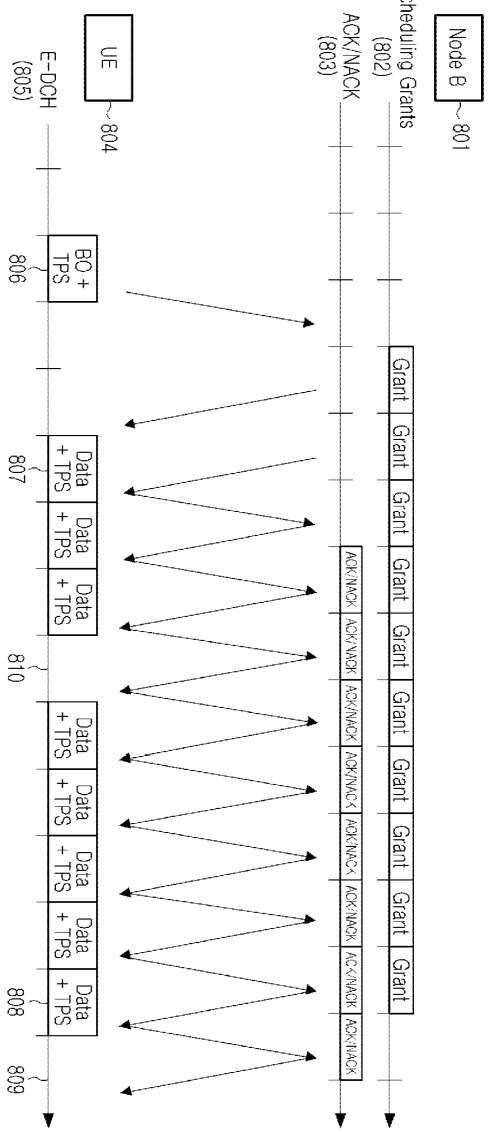
도면6


610
단말
RLC PDU(s) (601)
[MAC-d]
MAC-d 헤더 첨가
602
[MAC-e]
MAC-e 헤더 첨가
603
[Physical]
전송 채널 프로세싱 (HARQ),
물리 채널 사상,
604
전송 (605)

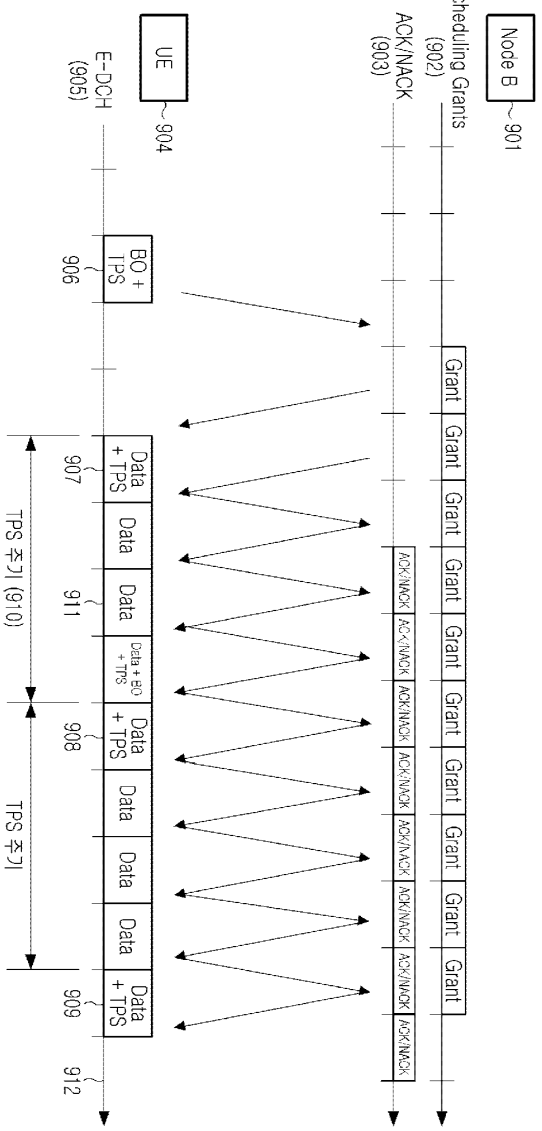
도면7


701
수신 (702)
기지국
[Physical]
전송 채널 프로세싱 (HARQ)
703
[MAC-e]
MAC-e 헤더 일부분 해석
704
705
[MAC-es]
MAC-e 헤더 해석
706
[MAC-d]
MAC-d 헤더 해석
707
RLC PDU(s) (708)
RNC
709

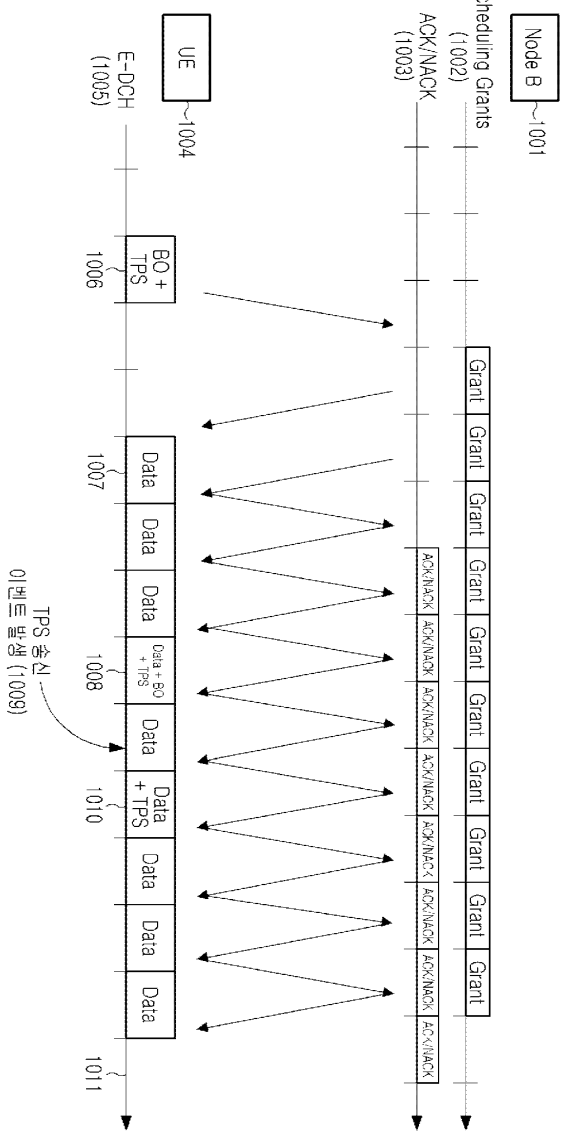
도면8


Node B
801
Scheduling Grants
(802)
ACK/NACK
(803)
UE
804
E-DCH
(805)
BO + TPS
806
Data + TPS
807
810
808
809
Grant
ACK/NACK

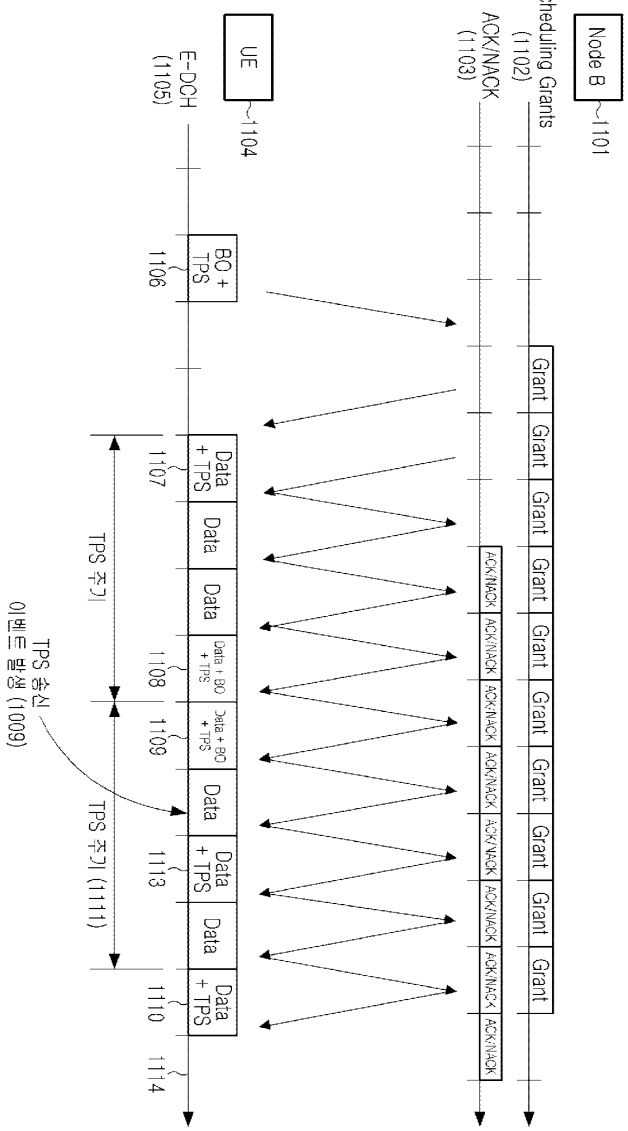
도면9


Node B
901
Scheduling Grants
(902)
ACK/NACK
(903)
UE
904
E-DCH
(905)
BO + TPS
906
Grant
ACK/NACK
Data + TPS
907
Data
911
Data + BO + TPS
908
909
912
TPS 주기 (910)
TPS 주기

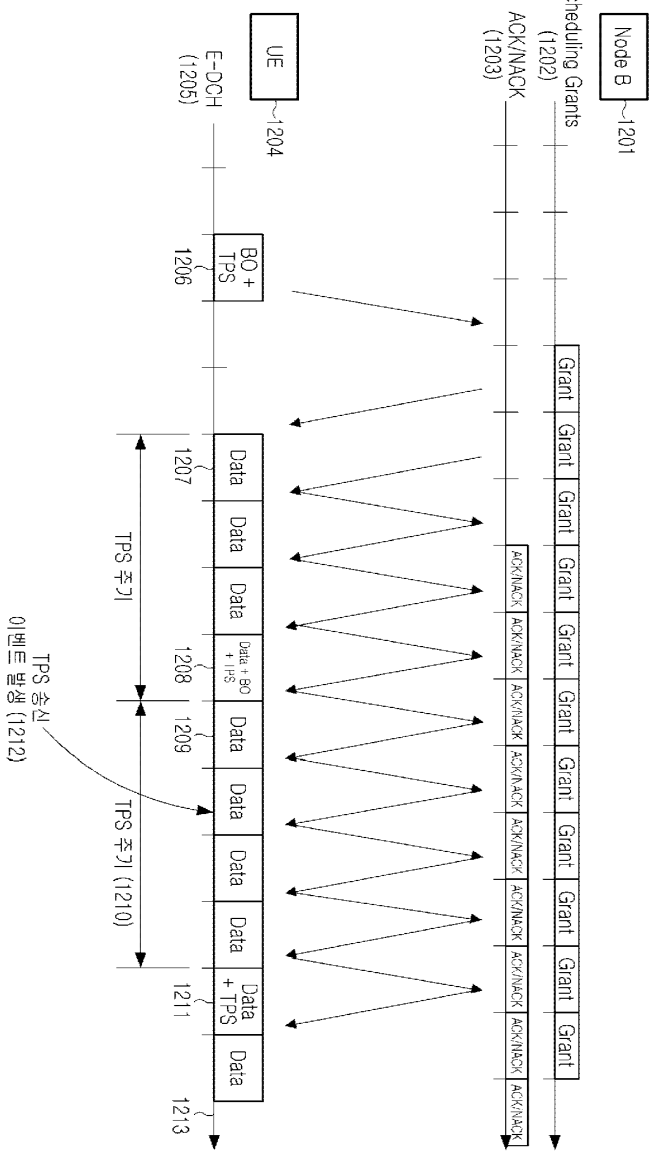
도면10


Node B
~1001
Scheduling Grants
(1002)
ACK/NACK
(1003)
UE
~1004
E-DCH
(1005)
BO + TPS
1006
Data
Data + BO + TPS
Data + TPS
1007
1008
1010
1011
TPS 송신 이벤트 발생 (1009)
Grant
ACK/NACK

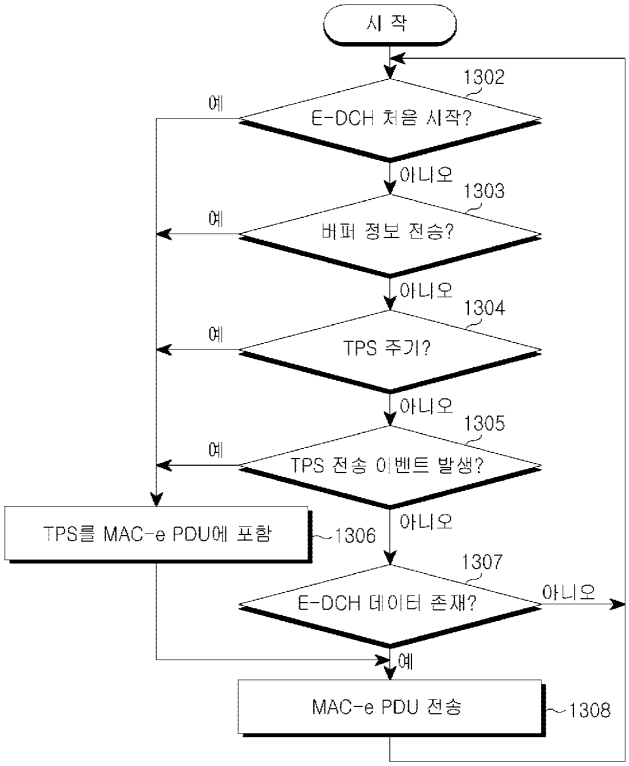
도면11


Node B
~1101
Scheduling Grants
(1102)
ACK/NACK
(1103)
UE
~1104
E-DCH
(1105)
BO + TPS
1106
Data + TPS
Data
Data + BO + TPS
1107
1108
1109
1113
1110
1114
Grant
ACK/NACK
TPS 주기
TPS 주기 (1111)
TPS 송신
이벤트 발생 (1009)

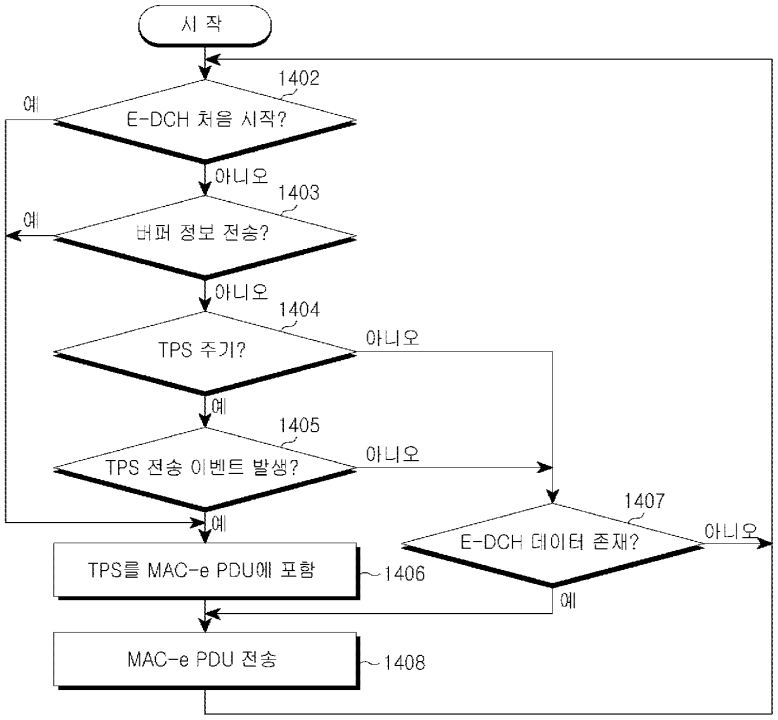
도면12


Node B
1201
Scheduling Grants
(1202)
ACK/NACK
(1203)
UE
1204
E-DCH
(1205)
BO + TPS
1206
Grant
ACK/NACK
Data
Data + BO + TPS
Data + TPS
1207
1208
1209
1211
1213
TPS 주기
TPS 주기 (1210)
TPS 송신
이벤트 발생 (1212)

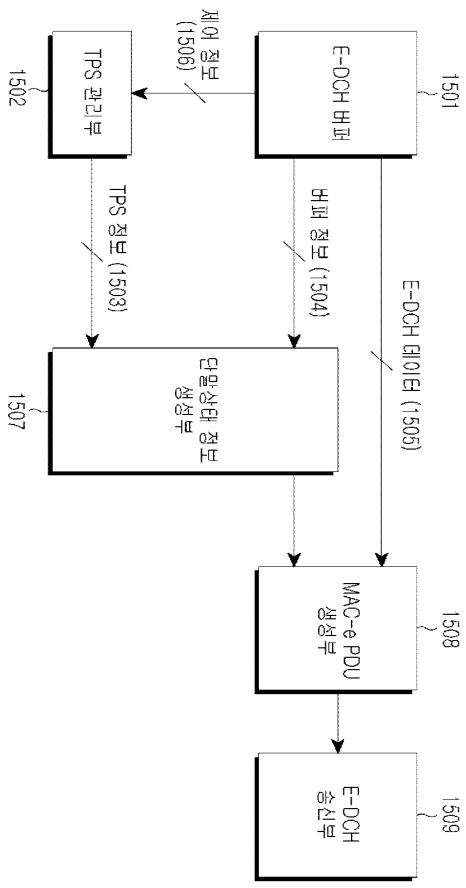
도면13


시 작
1302
E-DCH 처음 시작?
예
아니오
1303
버퍼 정보 전송?
예
아니오
1304
TPS 주기?
예
아니오
1305
TPS 전송 이벤트 발생?
예
아니오
TPS를 MAC-e PDU에 포함
1306
1307
E-DCH 데이터 존재?
아니오
예
MAC-e PDU 전송
1308

도면14


시 작
1402
E-DCH 처음 시작?
예
아니오
1403
버퍼 정보 전송?
예
아니오
1404
TPS 주기?
아니오
예
1405
TPS 전송 이벤트 발생?
아니오
예
1407
E-DCH 데이터 존재?
아니오
예
TPS를 MAC-e PDU에 포함
1406
MAC-e PDU 전송
1408

도면15


E-DCH 버퍼
1501
제어 정보 (1506)
TPS 관리부
1502
버퍼 정보 (1504)
TPS 정보 (1503)
E-DCH 데이터 (1505)
단말상태 정보 생성부
1507
MAC-e PDU 생성부
1508
E-DCH 송신부
1509

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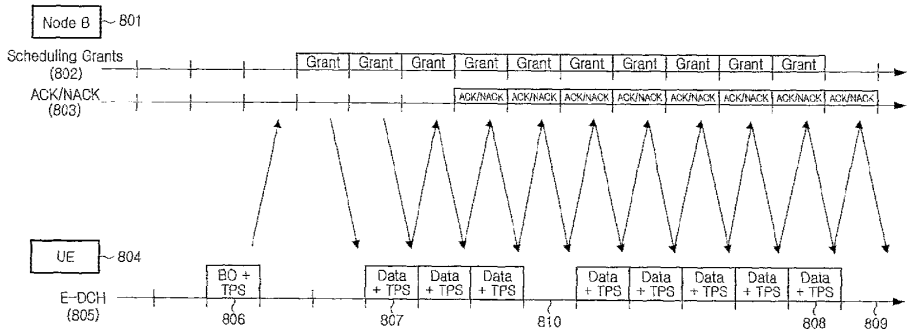
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(54) Title: METHOD AND APPARATUS FOR SIGNALING USER EQUIPMENT STATUS INFORMATION FOR UPLINK DATA TRANSMISSION IN A MOBILE COMMUNICATION SYSTEM



(57) Abstract: A method and apparatus for increasing the scheduling performance of a system supporting an uplink data service and total system stability by effectively UE status information to a Node B in a mobile communication system supporting the uplink data service are provided. UE status information including buffer occupancy information and transmit power status information is transmitted to a Node B periodically or upon generation of an event, irrespective of the presence or absence of uplink data to be transmitted. Since the buffer occupancy information and the transmit power status information are transmitted to the Node B by MAC-e signaling, physical channel resources are saved and E-DCH performance is improved.

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METHOD AND APPARATUS FOR SIGNALING USER EQUIPMENT STATUS INFORMATION FOR UPLINK DATA TRANSMISSION IN A MOBILE COMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to asynchronous Wideband Code Division Multiple Access (WCDMA) communications. In particular, the present invention relates to a method and apparatus for signaling the transmit power status (TPS), that is, uplink channel status of a User Equipment (UE) for use in uplink packet transmission scheduling.

Description of the Related Art

A 3rd generation mobile communication system using WCDMA based on the European Global System for Mobile communications (GSM) system, Universal Mobile Telecommunication Service (UMTS) provides mobile subscribers or computer users with a uniform service of transmitting packet-based text, digitized voice, and video and multimedia data at or above 2Mbps irrespective of their locations around the world. With the introduction of the concept of virtual access, the UMTS system allows access to any end point within a network at all times. The virtual access refers to packet-switched access using a packet protocol like Internet Protocol (IP).

FIG. 1 illustrates the configuration of the UMTS Terrestrial Radio Access Network (UTRAN) of a conventional UMTS system.

Referring to FIG. 1, a UTRAN 12 includes Radio Network Controllers (RNCs) 16a and 16b and Node Bs 18a to 18d and connects a UE 20 to a Core Network (CN) 10. A plurality of cells may underlie the Node Bs 18a to 18d. Each RNC 16a or 16b controls its underlying Node Bs and each Node B controls its underlying cells. An RNC, and Node Bs and cells under the control of the RNC collectively form a Radio Network Subsystem (RNS) 14a or 14b.

The RNCs 16a and 16b each allocate or manage radio resources to the Node Bs 18a to 18d under their control and the Node Bs 18a to 18d function to actually provide

the radio resources. The radio resources are configured on a cell basis and the radio resources provided by the Node Bs 18a to 18d refer to radio resources of the cells that they manage. The UE establishes a radio channel using radio resources provided by a particular cell under a particular Node B, for communications. From the UE's point of view, a distinction between the Node Bs 18a to 18d and their controlled cells is meaningless and the UE 20 deals only with a physical layer configured on a cell basis. Therefore, the terms "Node B" and "cell" are interchangeably used herein.

A Uu interface is defined between a UE and an RNC. The hierarchical protocol architecture of the Uu interface is illustrated in detail in FIG. 2. This interface is divided into a control plane (C-plane) 30 for exchanging control signals between the UE and the RNC and a user plane (U-plane) 32 for transmitting actual data.

Referring to FIG. 2, a Radio Resource Control (RRC) layer 32, a Radio Link Control (RLC) layer 40, a Medium Access Control (MAC) layer 42, and a physical (PHY) layer 44 are defined on the C-plane 30. A Packet Data Control Protocol (PDCP) layer 36, a Broadcast/Multicast Control (BMC) layer 38, the RLC layer 40, the MAC layer 42, and the PHY layer 44 are defined on the U-plane 32. The PHY layer 44 resides in each cell and the MAC layer 42 through the RRC layer 34 are configured usually in each RNC.

The PHY layer 44 provides an information delivery service by a radio transfer technology, corresponding to Layer 1 (L1) in an Open System Interconnection (OSI) model. The PHY layer 44 is connected to the MAC layer 42 via transport channels. The mapping relationship between the transport channels and physical channels is determined according to how data is processed in the PHY layer 44.

The MAC layer 42 is connected to the RLC layer 40 via logical channels. The MAC layer 42 delivers data received from the RLC layer 40 on the logical channels to the PHY layer 44 on appropriate transport channels, and delivers data received from the PHY layer 44 on the transport channels to the RLC layer 40 on appropriate logical channels. The MAC layer 42 inserts additional information or interprets inserted data in data received on the logical channels and controls random access. A U-plane-related part is called MAC-data (MAC-d) and a C-plane-related part is called MAC-control (MAC-c) in the MAC layer 42.

The RLC layer 40 controls the establishment and release of the logical channels.

The RLC layer 40 operates in one of an Acknowledged Mode (AM), an Unacknowledged Mode (UM) and a Transparent Mode (TM) and provides different functionalities in those modes. Typically, the RLC layer 40 segments or concatenates Service Data Units (SDUs) received form an upper layer to an appropriate size and correct errors.

The PDCP layer 36 resides above the RLC layer 40 in the U-plane 32. The PDCP layer 36 is responsible for compression and decompression of the header of data carried in the form of an IP packet and data delivery with integrity in the case where a serving RNC is changed due to the UE's mobility.

The characteristics of the transport channels that connect the PHY layer 44 to the upper layers depend on Transport Format (TF) that defines PHY layer processes including convolutional channel encoding, interleaving, and service-specific rate matching.

Particularly, the UMTS system uses an Enhanced Uplink Dedicated CHannel (E-DCH) with the aim to further improve packet transmission performance on the uplink from UEs to a Node B. To support more stable high-speed data transmission, the E-DCH utilizes Hybrid Automatic Retransmission request (HARQ) and Node B-controlled scheduling.

FIG. 3 illustrates data transmission on the E-DCH via typical radio links. Reference numeral 100 denotes a Node B supporting the E-DCH 111 to 114 and reference numerals 101 to 104 denote UEs that transmit the E-DCH 111 to 114.

Referring to FIG. 3, the Node B 100 evaluates the channel statuses of the UEs 101 to 104 and schedules their uplink data transmissions based on the channel statues. The scheduling is performed such that a noise rise measurement does not exceed a target noise rise in the Node B 100 in order to increase total system performance. Therefore, the Node B 100 allocates a low data rate to a remote UE 104 and a high data rate to a nearby UE 101.

FIG. 4 is a diagram illustrating a typical signal flow for message transmission on the E-DCH.

Referring to FIG. 4, a Node B and a UE establish an E-DCH in step 202. Step 202 involves message transmission on dedicated transport channels. The UE transmits its UE status information to the Node B in step 204. The UE status information may

contain information about the transmit power and power margin of the UE and the amount of buffered data to be transmitted to the Node B.

In step 206, the Node B monitors UE status information from a plurality of UEs to schedule uplink data transmissions for the individual UEs. The Node B decides to approve an uplink packet transmission from the UE and transmits scheduling assignment information to the UE in step 208. The scheduling assignment information includes an allowed data rate and an allowed timing.

In step 210, the UE determines the TF of the E-DCH based on the scheduling assignment information. The UE then transmits to the Node B TF information, that is, a Transport Format Resource Indicator (TFRI) and uplink packet data on the E-DCH at the same time in steps 212 and 214. The Node B determines whether the TFRI and the uplink packet data have errors in step 216. In the presence of errors in either of the TFRI and the uplink packet data, the Node B transmits an ACKnowledgement (ACK) signal to the UE, whereas in the absence of errors in both, the Node B transmits Non-ACKnowledgement (NACK) signal to the UE in step 218.

In the former case, the packet data transmission is completed and the UE transmits new packet data to the Node B on the E-DCH. On the other hand, in the latter case, the UE retransmits the same packet data to the Node B on the E-DCH.

As described above, the UE needs to transmit its UE status information to the Node B, to assist E-DCH scheduling. Particularly, the uplink transmit power information included in the UE status information is a significant factor in scheduling. Accordingly, a need exists for specifying how the uplink transmit power information is to be transmitted for efficient E-DCH transmission.

SUMMARY OF THE INVENTION

An object of the present invention is to address at least the above problems and/or disadvantages. Accordingly, an object of the present invention is to provide a method and apparatus for transmitting information about the uplink transmit power of a UE to a Node B for use in uplink data transmission scheduling in the Node B.

Another object of the present invention is to provide a method and apparatus for transmitting information about the uplink transmit power of a UE to a Node B by

transport channel data of an E-DCH.

The above exemplary objects of the present invention are achieved by providing an apparatus and method of transmitting UE status information for uplink data transmission in a mobile communication system.

According to one exemplary aspect of the present invention, in a method of transmitting UE status information for uplink data transmission in a mobile communication system, buffer occupancy (BO) information is generated by monitoring the amount of uplink data to be transmitted and transit power status (TPS) information is generated by monitoring uplink transmit power status. It is determined whether the BO information is to be transmitted in a current time interval. If the BO information is to be transmitted in the current time interval, it is determined whether the TPS information is to be transmitted in the current time interval according to a TPS period. If the TPS information is to be transmitted in the current time interval, a PDU including the BO information and the TPS information is generated and transmitted after coding and modulation.

According to another exemplary aspect of the present invention, in an apparatus for transmitting UE status information for uplink data transmission in a mobile communication system, a buffer buffers uplink data and generates BO information by monitoring the amount of the uplink data. A TPS information manager generates TPS information by monitoring uplink transmit power status. A UE status information generator determines whether the BO information is to be transmitted in a current time interval, determines whether the TPS information is to be transmitted in the current time interval, if the BO information is to be transmitted in the current time interval according to a TPS period, and generates UE status information including the BO information and the TPS information if the TPS information is to be transmitted in the current time interval. A PDU generator generates a PDU including the UE status information and a transmitter transmits the PDU after coding and modulation.

According to a further exemplary aspect of the present invention, in a method of transmitting UE status information for uplink data transmission in a mobile communication system, BO information is generated by monitoring the amount of uplink data to be transmitted, and TPS information is generated by monitoring uplink transmit power status. It is determined whether the BO information is to be transmitted

in a current time interval. If the BO information is to be transmitted in the current time interval, it is determined whether a TPS information transmission event has occurred. If the TPS information transmission event has occurred, a PDU including the BO information and the TPS information is generated and transmitted after coding and modulation.

According to still another exemplary aspect of the present invention, in an apparatus for transmitting UE status information for uplink data transmission in a mobile communication system, a buffer buffers uplink data to be transmitted and generates BO information by monitoring the amount of the uplink data. A TPS information manager generates TPS information by monitoring uplink transmit power status. A UE status information generator determines whether the BO information is to be transmitted in a current time interval, determines whether a TPS information transmission event has occurred, if the BO information is to be transmitted in the current time interval, and generates UE status information including the BO information and the TPS information if the TPS information transmission event has occurred. A PDU generator generates a PDU including the UE status information, and a transmitter transmits the PDU after coding and modulation.

According to yet another exemplary aspect of the present invention, in a method of transmitting UE status information for uplink data transmission in a mobile communication system, BO information is generated by monitoring the amount of uplink data to be transmitted and TPS information is generated by monitoring uplink transmit power status. It is determined whether a current time interval is a BO transmission interval in which the BO information is to be transmitted. If the current time interval is the BO transmission interval, a PDU including the BO information and the TPS information is generated and transmitted after coding and modulation.

According to yet further exemplary aspect of the present invention, in an apparatus for transmitting UE status information for uplink data transmission in a mobile communication system, a buffer buffers uplink data to be transmitted and generates BO information by monitoring the amount of the uplink data. A TPS information manager generates TPS information by monitoring uplink transmit power status. A UE status information generator determines whether a current time interval is a BO transmission interval in which the BO information is to be transmitted, and generates UE status

information including the BO information and the TPS information, if the current time interval is the BO transmission interval. A PDU generator generates a PDU including the UE status information, and a transmitter transmits the PDU after coding and modulation.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which like reference symbols indicate the same or similar components, wherein:

FIG. 1 illustrates the configuration of a UTRAN in a typical UMTS system;

FIG. 2 illustrates the hierarchical architecture of an interface defined between a UE and an RNC;

FIG. 3 illustrates a conventional E-DCH transmission via a radio link;

FIG. 4 is a diagram illustrating a conventional signal flow for message transmission/reception on an E-DCH;

FIG. 5 illustrates the structure of a MAC-e Packet Data Unit (PDU);

FIG. 6 illustrates the configuration of MAC and PHY layers in relation to E-DCH transmission in a UE;

FIG. 7 illustrates the configuration of MAC and PHY layers in relation to E-DCH reception in a Node B;

FIG. 8 illustrates TPS transmission according to an exemplary embodiment of the present invention;

FIG. 9 illustrates TPS transmission according to another exemplary embodiment of the present invention;

FIG. 10 illustrates TPS transmission according to a third exemplary embodiment of the present invention;

FIG. 11 illustrates TPS transmission according to a fourth exemplary embodiment of the present invention;

FIG. 12 illustrates TPS transmission according to a fifth exemplary embodiment of the present invention;

FIG. 13 is a flowchart illustrating TPS transmission from a UE according to the

fourth exemplary embodiment of the present invention;

FIG. 14 is a flowchart illustrating TPS transmission from a UE according to the fifth exemplary embodiment of the present invention; and

FIG. 15 is a block diagram of a UE for TPS transmission according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Exemplary embodiments of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail for conciseness.

An exemplary object of the present invention is to transmit the TPS of a UE to a Node B. The TPS is expressed as the maximum transmit power of the UE or the transmit power of a control channel alone from the UE. Alternatively, TPS is expressed as a maximum data rate available to the UE or a TF. Alternatively, the uplink transmit power information can be the ratio of the maximum transmit power to the transmit power of the control channel, that is, the power margin of the UE. In this context, the TPS represents the uplink channel status of the UE.

The TPS is transmitted to the Node B by MAC information in the exemplary embodiments of the present invention. As implied from its appellation, the MAC layer is responsible for medium access control between the RLC layer and the PHY layer. With the introduction of the E-DCH, the MAC layer configuration illustrated in FIG. 2 has been modified so that for the E-DCH functionality, a MAC-e entity is newly defined to work in conjunction with the existing MAC-d entity configured for a Dedicated CHannel (DCH). The MAC-e entity exists between the MAC-d entity and the PHY layer. As data is processed in the MAC layer, its format is changed as illustrated in FIG. 5.

Referring to FIG. 5, an RLC PDU 501 is data delivered from the RLC layer to the MAC layer. The MAC layer creates a MAC PDU by adding a MAC header to the RLC PDU 501 and provides the MAC PDU to the PHY layer. In the case of using the E-DCH, the MAC layer is divided into a MAC-d entity and a MAC-e entity and the MAC header attachment is carried out in the following two stages.

First, the MAC-d entity creates a MAC-d SDU 502 with one or more RLC

PDUs 501 received from the RLC layer and adds a MAC-d header 503 to the MAC-d SDU 502, thus creating a MAC-d PDU 505. The MAC-d header 503 includes multiplexing information indicating a source (that is, RLC entity) from which the one or more RLC PDUs 501 were generated.

The MAC-d PDU 505 is delivered to the MAC-e entity. The MAC-e entity forms a MAC-e SDU 504 with one or more MAC-d PDUs 505 and adds a MAC-e header 506 to the MAC-e SDU 504, thus creating a MAC-e PDU 507. The MAC-e header 506 contains information about the one or more MAC-e SDUs 504 included in the MAC-e PDU 507. While the MAC-e header 506 is placed before the MAC-e SDU 504 in FIG. 5, it is to be understood that the MAC-e header 506 actually covers all information added by the MAC-e entity, other than the MAC-d PDU. The MAC-e PDU 507 is carried in the form of a transport block to the PHY layer and subject to transport channel processing including Cyclic Redundancy Check (CRC) attachment, channel coding, and rate matching, prior to transmission to a receiver.

With reference to FIG. 6, a UE operation for generating data in the procedure illustrated in FIG. 5 will be described below.

Referring to FIG. 6, upon receipt of an RLC PDU 601, a MAC-d entity 602 generates a MAC-d PDU by adding a MAC-d header to the RLC PDU 601. A MAC-e entity 603 creates a MAC-e PDU by adding a MAC-e header to the MAC-d PDU. The MAC-e PDU is delivered to a PHY layer 604, is subject to transport channel processing including an HARQ operation, and is mapped to a PHY channel. The PHY channel is then transmitted as indicated by reference numeral 605. All this procedure illustrated in FIG. 6 is carried out in one UE 610.

Now a description will be made of exemplary E-DCH data reception with reference to FIG. 7. Referring to FIG. 7, a Node B 701 includes a PHY layer 703 and a MAC-e entity 704. An RNC 709 includes a MAC-es entity 706, a MAC-d entity 707, and upper layers (not shown). The MAC-es entity 706 performs E-DCH-related signaling.

The Node B 701 receives a PHY channel to which the E-DCH is mapped, an Enhanced Dedicated Physical CHannel (E-DPCH) 702, and performs transport channel processing including an HARQ operation on the received signal in the PHY layer 703. The resulting transport block is provided to the MAC-e entity 704. The MAC-e entity

704 extracts a MAC-e header, including necessary information for the Node B 701, from the transport block and interprets the MAC-e header. The output of the MAC-e entity 704 is provided to the MAC-es entity 706 of the RNC 709 via an Iub interface 705.

As illustrated in FIG. 7, the MAC-e exists separately in the Node B 701 and the RNC 709 because the information of the MAC-e header can be divided into information needed for the Node B 701 and information needed for the RNC 709. Therefore, the data fed to the MAC-es entity 706 via the Iub interface 705 is a MAC-e PDU with the entire MAC-e header or a MAC-e PDU with only the information needed for the RNC 709 except for the information needed for the Node B 701.

The MAC-es entity 706 extracts the MAC-e header from the received MAC-e PDU and outputs the resulting MAC-d PDU. The MAC-d entity 707 extracts a MAC-d header from the MAC-d PDU, interprets the MAC-d header, and outputs the resulting RLC PDU 708. The RLC PDU 708 is appropriately processed in the upper layers (not shown) including the RLC layer.

The information needed for the Node B 701 set in the MAC-e header contains UE status information. The UE status information has buffer information indicating the amount of uplink data to be transmitted (hereinafter, referred to as BO short for Buffer Occupancy), and uplink channel status information (hereinafter, referred to as TPS short for Transmit Power Status). Transmission of the BO is periodic or event-triggered. Events that trigger the BO transmission include input of new data in an E-DCH buffer and the amount of buffered data exceeding a threshold. It is assumed herein that a BO transmission method is predetermined.

The UE uses a MAC-e PDU to transmit the TPS. Specifically, the UE transmits the TPS in the MAC-e header 506 on the E-DCH.

Besides the BO, the TPS is required for Node B-controlled scheduling, as stated before. The Node B interprets a TPS set in the MAC-e header of a received MAC-e PDU and transmits a MAC-e PDU with the TPS or a MAC-e PDU free of the TPS (i.e. a MAC-es PDU) to the MAC-es entity of the RNC. Transmission of control information like the BO or the TPS by a MAC-e header is called MAC-e signaling in the present invention.

Alternatively, the UE can transmit a TPS by a MAC-e control PDU, specifically in the MAC-e SDU 504 illustrated in FIG. 5. The process of inserting the TPS in the

payload 504 instead of the MAC-e header 506 and transmitting the TPS is called MAC-e control PDU signaling in the present invention. The UE notifies the Node B of whether the MAC-e control PDU signaling is used by an Enhanced TF Index (E-TFI). Upon receipt of a MAC-e control PDU by the MAC-e control PDU signaling, the Node B may not transmit the MAC-e control PDU to the RNC.

Hereinbelow a description will be made of a method of transmitting a TPS to a Node B by MAC-e signaling in exemplary embodiments of the present invention. Since MAC-e control PDU signaling can be contemplated from the MAC-e signaling, TPS transmission by the MAC-e control PDU signaling will not be described in detail.

First Exemplary Embodiment

FIG. 8 illustrates TPS transmission using a MAC-e header from a UE for E-DCH scheduling according to an exemplary embodiment of the present invention.

Referring to FIG. 8, when new data is buffered, a UE 804 first transmits a BO & TPS 806 to a Node B 801 on an E-DCH 805. The BO & TPS 806 is included in an initial MAC-e PDU. The initial MAC-e PDU includes the BO or/and TPS in a MAC-e header with no data in payload and is transmitted by MAC-e signaling. The initial MAC-e PDU is used to indicate the start of data transmission on the E-DCH to the Node B 801.

Upon receipt of the BO or/and TPS on the E-DCH 805, the Node B 801 determines from the BO whether E-DCH data exists in the UE and schedules E-DCH data transmission based on the BO and TPS. The Node B 801 then transmits scheduling grant information to the UE 804 on a scheduling grant channel 802 as a result of the scheduling. The scheduling grant information can be the absolute value of available resources or the relative value of available resources to the previous resources. The former is called an absolute grant and the latter is called a relative grant. The Node B 801 receives a MAC-e PDU, performs an HARQ operation, and transmits an ACK/NACK signal to the UE 804 on an ACK/NACK channel 803.

The UE 804 transmits the E-DCH based on the scheduling grant information and the ACK/NACK signal. In accordance with the exemplary embodiment of the present invention, the UE transmits a TPS by a MAC-e header only in the presence of E-DCH data. In all E-DCH transmission time intervals 807 and 808, MAC-e PDUs have TPSs in their MAC-e headers.

On the other hand, in the absence of E-DCH data as before a time interval 807, no TPSs are transmitted. Yet, exceptionally a TPS can also be transmitted along with a BO in a BO transmission time interval. In a time interval 810 in which the buffer has data but the UE 804 is not allowed to transmit the data by scheduling or for any other reason, a TPS is not transmitted. When the buffer becomes empty, the UE 804 discontinues the TPS transmission as indicated by reference numeral 809.

Every time it receives a MAC-e PDU, the Node B 801 extracts a BO or/and TPS from the MAC-e PDU and performs scheduling based on the BO or/and TPS.

Second Exemplary Embodiment

FIG. 9 illustrates periodic TPS transmission from a UE for E-DCH scheduling according to another exemplary embodiment of the present invention.

The UE transmits a TPS every predetermined TPS period. In the presence of E-DCH data in time intervals defined by the TPS period, a TPS is transmitted along with the E-DCH data in a MAC-e PDU. In the absence of E-DCH data, the MAC-e PDU contains only the TPS.

Referring to FIG. 9, when new data is buffered, a UE 904 first transmits a BO & TPS 906 in an initial MAC-e PDU to a Node B 901 on an E-DCH 905. The initial MAC-e PDU includes only the BO or/and TPS in a MAC-e header with no data in payload and is transmitted by MAC-e signaling.

Upon receipt of the BO or/and TPS, the Node B 901 determines from the BO whether the UE 904 has E-DCH data and schedules based on the BO and the TPS. The Node B 901 then transmits scheduling grant information to the UE 904 on a scheduling grant channel 902 as a result of the scheduling. The scheduling grant information can be an absolute grant or a relative grant. The Node B 901 receives the MAC-e PDU, performs an HARQ operation, and transmits an ACK/NACK signal to the UE 904 on an ACK/NACK channel 903.

The UE 904 transmits the E-DCH data based on the scheduling grant information and the ACK/NACK signal. In accordance with the second exemplary embodiment of the present invention, the UE 904 transmits a TPS every predetermined TPS period 910. For example, in the presence of E-DCH data, the UE 904 transmits a TPS in the MAC-e header of a MAC-e PDU with the E-DCH data. In the absence of E-

DCH data, the UE 904 transmits a MAC-e PDU containing the TPS only. Thus, MAC-e PDUs with TPSs are transmitted in time intervals 907, 908 and 909 each apart from the following time interval by the TPS period 910.

The time intervals 907, 908 and 909 are limited to the case where an ACK signal is received for the previous MAC-e PDU or the number of transmissions of the previous MAC-e PDU has reached a maximum allowed number in an HARQ process. In other words, a TPS can be transmitted only in a time interval in which an initial transmission is possible. All conditions considered, the UE 904 transmits a TPS in the MAC-e header of an initial transmission MAC-e PDU in the earliest time interval in which TPS transmission is possible after expiration of the TPS period 910, that is, when the TPS period 910 has expired and the initial transmission MAC-e PDU has been created. The TPS period 910 is a predetermined fixed value or notified to the UE and the Node B from the RNC by upper layer signaling using Radio Resource Control (RRC) and Node B Application Part (NBAP) protocols.

In a BO transmission time interval 911, a TPS can also be transmitted in a MAC-e header even though the BO transmission time interval 911 is not a time interval in which TPS transmission is allowed according to the TPS period 910.

Before a time interval 907, that is, before the E-DCH data transmission, no TPSs are transmitted irrespective of the TPS period 910, except for a first BO transmission period 906 indicating the start of the E-DCH data transmission. In the time interval 906, the TPS and the BO are transmitted together. When there is no need for transmitting E-DCH data any longer, that is, when the buffer is empty in the UE 904, the UE 904 discontinues the E-DCH data transmission as indicated by reference numeral 912.

After receiving an initial MAC-e PDU containing a BO and a TPS only, the Node B 901 extracts the TPS from the first MAC-e PDU including data. Then, the Node B 904 extracts a TPS from a MAC-e PDU received every TPS period 910.

Third Exemplary Embodiment

FIG. 10 illustrates event-triggered TPS transmission from a UE for E-DCH scheduling according to a third exemplary embodiment of the present invention.

The UE transmits a TPS when a predetermined event is fulfilled. When the

event has occurred and E-DCH data exists, the UE transmits the E-DCH data and a TPS in a MAC-e PDU. In the absence of E-DCH data, the UE transmits a MAC-e PDU including only the TPS.

Referring to FIG. 10, when new data is buffered, a UE 1004 first transmits a BO & TPS 1006 in an initial MAC-e PDU to a Node B 1001 on an E-DCH 1005. The initial MAC-e PDU includes only the BO or/and TPS in a MAC-e header with no data in payload and is transmitted by MAC-e signaling.

Upon receipt of the BO or/and TPS, the Node B 1001 determines from the BO whether the UE 1004 has E-DCH data and schedules based on the BO and the TPS. The Node B 1001 then transmits scheduling grant information to the UE 1004 on a scheduling grant channel 1002 as a result of the scheduling. The scheduling grant information can be an absolute grant or a relative grant. The Node B 1001 receives the MAC-e PDU, performs an HARQ operation, and transmits an ACK/NACK signal to the UE 1004 on an ACK/NACK channel 1003.

The UE 1004 transmits the E-DCH data based on the scheduling grant information and the ACK/NACK signal. In accordance with the third exemplary embodiment of the present invention, the UE determines whether a predetermined event has occurred. Upon generation of the event, the UE 1004 transmits a TPS in a MAC-e PDU. To describe in more detail, in the presence of E-DCH data, the UE 1004 transmits a TPS in the MAC-e header of a MAC-e PDU with the E-DCH data. In the absence of E-DCH data, the UE 904 transmits a MAC-e PDU containing the TPS only.

For instance, when the difference between a TPS transmitted in the previous MAC-e PDU and the current TPS exceeds a predetermined threshold, this is an event that triggers TPS transmission. The UE 1004 transmits the TPS in a MAC-e header in a transmission time interval following the event. The threshold is a predetermined fixed value or notified to the UE and the Node B from the RNC by RRC and NBAP upper signaling. Many other events that trigger TPS transmission can be defined.

When the UE 1004 detects occurrence of a predetermined event in a time interval 1009, it transmits a TPS in a MAC-e header in the following time interval 1010. The time interval 1010 can be limited to the case where an ACK signal is received for the previous MAC-e PDU or the number of transmissions of the previous MAC-e PDU has reached a maximum allowed number in an HARQ process. That is, the TPS can be

transmitted only when an initial transmission is possible. All conditions considered, the UE 1004 transmits a TPS in the MAC-e header of an initial transmission MAC-e PDU in the earliest time interval in which TPS transmission is possible after the event, that is, when the event has occurred and then the initial transmission MAC-e PDU has been created.

In a BO transmission time interval 1008, a TPS can also be transmitted in a MAC-e header even though the event has not occurred in the previous time interval to the BO transmission time interval 1008.

Before a time interval 1007, that is, before the E-DCH data transmission, no TPSs are transmitted irrespective of event occurrence, except for a first BO transmission period 1006 indicating the start of the E-DCH data transmission. In the time interval 1006, the TPS and the BO are transmitted together. When there is no need for transmitting E-DCH data any longer, that is, when the buffer is empty in the UE 1004, the UE 1004 discontinues the E-DCH data transmission as indicated by reference numeral 1011.

Every time the Node B 1001 receives a MAC-e PDU, it determines whether the MAC-e PDU includes a TPS based on a MAC-e signaling indicator bit set in the MAC-e PDU. If the MAC-e signaling indicator bit indicates the presence of the TPS, the Node B 1001 extracts the TPS from the MAC-e PDU and uses the TPS in scheduling.

Fourth Exemplary Embodiment

FIG. 11 illustrates periodic or event-triggered TPS transmission from a UE for E-DCH scheduling according to a fourth exemplary embodiment of the present invention.

The UE transmits a TPS not only when a predetermined event is fulfilled but also every predetermined TPS period. As the UE transmits a TPS in an event-triggered manner and in addition, periodically, the periodic TPS transmission ensures stable TPS transmission despite failure of the event-triggered TPS transmission. When either the event has occurred or the TPS period has expired, in the presence of E-DCH data, the TPS is transmitted along with the E-DCH data in a MAC-e PDU. In the absence of E-DCH data, the MAC-e PDU contains only the TPS.

Referring to FIG. 11, when new data is buffered, a UE 1104 first transmits a BO

& TPS 1106 in an initial MAC-e PDU to a Node B 1101 on an E-DCH 1105. The initial MAC-e PDU includes only the BO or/and TPS in a MAC-e header with no data in payload and is transmitted by MAC-e signaling.

Upon receipt of the BO or/and TPS, the Node B 1101 determines from the BO whether the UE 1104 has E-DCH data and schedules based on the BO and the TPS. The Node B 1101 then transmits scheduling grant information to the UE 1104 on a scheduling grant channel 1102 as a result of the scheduling. The scheduling grant information can be an absolute grant or a relative grant. The Node B 1101 receives the MAC-e PDU, performs an HARQ operation, and transmits an ACK/NACK signal to the UE 1104 on an ACK/NACK channel 1103.

The UE 1104 transmits the E-DCH data based on the scheduling grant information and the ACK/NACK signal. In accordance with the fourth exemplary embodiment of the present invention, the UE 1104 transmits a TPS every predetermined TPS period 1111. Besides the periodic TPS transmission, the UE 1104 additionally transmits a TPS when the event occurs. In the presence of E-DCH data, the UE 1104 transmits a TPS in the MAC-e header of a MAC-e PDU with the E-DCH data. In the absence of E-DCH data, the UE 1104 transmits a MAC-e PDU containing the TPS only.

For instance, when the difference between a TPS transmitted in the previous MAC-e PDU and the current TPS exceeds a predetermined threshold, this is an event that triggers TPS transmission. The UE 1104 transmits the TPS in a MAC-e header in a transmission time interval following the event. The threshold is a predetermined fixed value or notified to the UE and the Node B from the RNC by RRC and NBAP upper signaling. Many other events that trigger TPS transmission can be defined. The TPS period 1111 is also a predetermined fixed value or notified to the UE and the Node B by RRC and NBAP upper signaling.

In time intervals 1107, 1109 and 1110, the UE 1104 transmits TPSs according to the TPS period 1111. Also, when the UE 1104 detects occurrence of the event in a time interval 1112, it transmits a TPS in the following time interval 1113. The time intervals 1107, 1109, 1110 and 1113 carrying the TPSs are limited to the case where an ACK signal is received for the previous MAC-e PDU or the number of transmissions of the previous MAC-e PDU has reached a maximum allowed number in an HARQ process. In other words, a TPS can be transmitted only in a time interval in which an initial

transmission is possible.

Therefore, all conditions considered, the UE 1104 transmits a TPS in the MAC-e header of an initial transmission MAC-e PDU in the earliest time interval in which TPS transmission is possible after expiration of the TPS period 1111 or occurrence of the event, that is, when the TPS period 1111 has expired or the event has occurred, and the initial transmission MAC-e PDU has been created.

In a BO transmission time interval 1108, a TPS can also be transmitted in a MAC-e header even though the BO transmission time interval 1108 is neither a time interval in which TPS transmission is allowed according to the TPS period 1111 nor a time interval following occurrence of the event.

Before a time interval 1107, that is, before the E-DCH data transmission, no TPSs are transmitted irrespective of the TPS period 1111 and the event, except for a first BO transmission period 1106 indicating the start of the E-DCH data transmission. In the time interval 1106, the TPS and the BO are transmitted together. When there is no need for transmitting E-DCH data any longer, that is, when the buffer is empty in the UE 1104, the UE 1104 discontinues the E-DCH data transmission as indicated by reference numeral 1114.

After receiving an initial MAC-e PDU containing a BO and a TPS only, the Node B 1101 extracts the TPS from the first MAC-e PDU including data. Then, the Node B 1104 extracts a TPS from a MAC-e PDU received every TPS period 1111. Also, every time the Node B 1101 receives a MAC-e PDU, it determines whether the MAC-e PDU includes a TPS based on a MAC-e signaling indicator bit set in the MAC-e PDU. In the presence of the TPS, the Node B 1101 extracts the TPS from the MAC-e PDU and uses the TPS in scheduling.

Fifth Exemplary Embodiment

FIG. 12 illustrates periodic event-triggered TPS transmission from a UE for E-DCH scheduling according to a fifth exemplary embodiment of the present invention.

The UE monitors a predetermined TPS period. Only when a predetermined event is fulfilled upon expiration of the TPS period, the UE transmits a TPS. When the TPS period has expired and the event has occurred, in the presence of E-DCH data, the TPS is transmitted along with the E-DCH data in a MAC-e PDU. In the absence of E-

DCH data, the MAC-e PDU contains only the TPS.

Referring to FIG. 12, when new data is buffered, a UE 1204 first transmits a BO & TPS 1206 in an initial MAC-e PDU to a Node B 1201 on an E-DCH 1205. The initial MAC-e PDU includes only the BO or/and TPS in a MAC-e header with no data in payload and is transmitted by MAC-e signaling.

Upon receipt of the BO or/and TPS, the Node B 1201 determines from the BO whether the UE 1104 has E-DCH data and schedules based on the BO and the TPS. The Node B 1201 then transmits scheduling grant information to the UE 1204 on a scheduling grant channel 1202 as a result of the scheduling. The scheduling grant information can be an absolute grant or a relative grant. The Node B 1201 receives the MAC-e PDU, performs an HARQ operation, and transmits an ACK/NACK signal to the UE 1204 on an ACK/NACK channel 1203.

The UE 1204 transmits the E-DCH data based on the scheduling grant information and the ACK/NACK signal. In accordance with the fifth exemplary embodiment of the present invention, the UE 1204 determines whether the event has occurred in time intervals 1207, 1209 and 1211 defined by the TPS period 1210 and transmits a TPS in the time interval 1211 for which the event is fulfilled. In the presence of E-DCH data, the UE 1204 transmits a TPS in the MAC-e header of a MAC-e PDU with the E-DCH data. In the absence of E-DCH data, the UE 1204 transmits a MAC-e PDU containing the TPS only.

For instance, when the difference between the previous TPS and the current TPS exceeds a predetermined threshold, this is an event that triggers TPS transmission. The UE 1204 transmits the TPS in a MAC-e header in a transmission time interval following the event. The threshold is a predetermined fixed value or notified to the UE and the Node B from the RNC by RRC and NBAP upper signaling.

Many other events that trigger TPS transmission can be defined. The TPS period 1210 is also a predetermined fixed value or notified to the UE and the Node B by RRC and NBAP upper signaling.

In time intervals 1207, 1209 and 1211 each apart from the following time interval by the TPS period 1210, the UE 1204 determines whether the event has occurred in the previous time interval. Upon occurrence of the event in a time interval 1212, the UE 1204 transmits a TPS in the following time interval 1211. In the time intervals 1207

and 1209, no TPSs are transmitted because the TPS period 1210 has expired but the event has not occurred. The time interval 1211 carrying the TPS is limited to the case where an ACK signal is received for the previous MAC-e PDU or the number of transmissions of the previous MAC-e PDU has reached a maximum allowed number in an HARQ process. In other words, a TPS can be transmitted only in a time interval in which an initial transmission is possible.

Therefore, all conditions considered, the UE 1104 transmits a TPS in the MAC-e header of an initial transmission MAC-e PDU in the earliest time interval when the TPS period 1210 has expired after occurrence of the event.

In a BO transmission time interval 1208, a TPS can also be transmitted in a MAC-e header even though the TPS period 1210 has expired in the BO transmission time interval 1208 after the event occurred.

Before a time interval 1207, that is, before E-DCH data transmission, no TPSs are transmitted irrespective of the TPS period 1210 and the event, except a first BO transmission period 1206 indicating the start of the E-DCH data transmission. In the time interval 1206, the TPS and the BO are transmitted together. When there is no need for transmitting E-DCH data any longer, that is, when the buffer is empty in the UE 1204, the UE 1204 discontinues the E-DCH data transmission as indicated by reference numeral 1213.

Every time the Node B 1201 receives a MAC-e PDU, it determines whether the MAC-e PDU includes a TPS based on a MAC-e signaling indicator bit set in the MAC-e PDU. In the presence of the TPS, the Node B 1101 extracts the TPS from the MAC-e PDU and uses the TPS in scheduling.

Sixth Exemplary Embodiment

In this exemplary embodiment of the present invention, the UE transmits a BO and a TPS together at both a BO transmission time and a TPS transmission time by MAC-e signaling.

In the case where BO transmission is confined to a BO transmission time and TPS transmission to a TPS transmission time, the MAC-e PDU has very different sizes. As a result, the amount of PHY layer signaling information to deliver information about a MAC-e PDU size on an E-DCH control channel, Enhanced-Dedicated Physical

Control CHannel (E-DPCCH) can be increased. Therefore, the UE allocates a BO field of a predetermined size and a TPS field of a predetermined size and when it needs to transmit either the BO or the TPS, the UE fills both the BO and the TPS in the two fields all the time. Thus, the number of the MAC-e PDU sizes is reduced and as a result, the amount of the MAC-e PDU size information is decreased.

Separate BO and TPS transmission as in the previous exemplary embodiments of the present invention physically requires a 2-bit information field to represent four MAC-e signaling types for each MAC-e PDU: BO only, TPS only, both BO and TPS, and none. However, concurrent BO and TPS transmission physically needs only a 1-bit information field to represent two MAC-e signaling types: both BO and TPS and none. Therefore, the number of bits required to indicate MAC-e signaling is reduced.

TPS transmission is carried out by MAC-e signaling every predetermined TPS period, or in an event-triggered manner, or in both in the above-described exemplary embodiments. BO transmission is carried out by MAC-e signaling in the same manner. Therefore once the conditions for transmitting the BO and the TPS are set, separately, if either of the conditions is satisfied, both the BO and TPS are transmitted by MAC-e signaling.

A BO period may be equal to or different from a TPS period and BO and TPS transmission time intervals are set separately. For example, the BO is initially transmitted when data is first buffered in the E-DCH buffer of the UE. An event that triggers BO transmission can be defined as buffering of new data in the E-DCH buffer or buffered data filled to a threshold. An event that triggers TPS transmission can be defined as a great channel status change or a band channel status.

The sizes of the BO and TPS are predetermined and the BO and TPS size information and E-DCH data form a MAC-e PDU or MAC-e signaling. That is, a MAC-e PDU for MAC-e signaling is configured to include a BO field and a TPS field and these fields are filled with a BO and a TPS when MAC-e signaling is performed.

The UE determines every time interval whether the BO period or the TPS period has expired. If neither of the BO and TPS periods has expired, the UE determines whether a BO event or a TPS event has occurred. If either of the BO and TPS periods has expired or either of the BO and TPS events has occurred, the UE inserts a BO and a TPS in a MAC-e PDU and transmits the MAC-e PDU.

In accordance with the sixth exemplary embodiment of the present invention, the following operation can be further contemplated.

The UE sets a MAC-e signaling field to contain a BO and a TPS. If a BO transmission condition is satisfied, the BO is written in a BO field and null data is filled in a TPS field within the MAC-e signaling field. On the other hand, if a TPS transmission condition is satisfied, the TPS is written in the TPS field and null data is filled in the BO field within the MAC-e signaling field. In this case, two information bits are physically required to represent four MAC-e signaling types.

Every time it receives a MAC-e PDU, the Node B checks a MAC-e signaling indicator bit in the MAC-e PDU. If the MAC-e signaling indicator bit indicates the presence of UE status information, the Node B extracts a BO and a TPS from the MAC-e PDU and schedules based on the BO and the TPS.

Exemplary implementations of certain embodiments of the present invention and a related block diagram will be described below.

FIG. 13 is a flowchart illustrating TPS transmission from a UE according to the fourth exemplary embodiment of the present invention. Step 1302 through step 1308 are performed in every E-DCH transmission interval.

Referring to FIG. 13, the UE determines whether E-DCH data transmission is to start in step 1302. If the UE determines that the E-DCH data transmission will start in the current time interval, it includes a BO and a TPS in a MAC-e PDU in step 1306 and proceeds to step 1308. If the E-DCH data transmission will not start in the current time interval, the UE determines whether a BO is to be transmitted in the current time interval in step 1303. If the current time interval is a BO transmission interval, the UE includes the BO and the TPS in a MAC-e PDU in step 1306 and proceeds to step 1308. If the TPS is transmitted irrespective of the BO in another embodiment, step 1303 will not be performed.

If the current time interval is not a BO transmission interval, the UE determines whether a TPS period has expired in step 1304. That is, the UE determines whether the TPS period has elapsed after transmission of the previous TPS or the start of the E-DCH data transmission. If the current time interval is a TPS transmission interval, the UE includes the TPS in the MAC-e PDU in step 1306 and proceeds to step 1308. If the current time interval is not a TPS transmission interval, the UE determines whether a

TPS event has occurred in the previous time interval in step 1305. If the TPS event has occurred in the previous time interval, the UE includes the TPS in the MAC-e PDU in step 1306 and proceeds to step 1308.

If the TPS event has not occurred in step 1305, the UE determines whether E-DCH data exists for transmission in step 1307. In the presence of E-DCH data, the UE fills the E-DCH data in the payload of the MAC-e PDU and transmits the MAC-e PDU in step 1308. The MAC-e PDU may include the BO or/and TPS inserted in step 1306. In the absence of E-DCH data, the UE waits till the next time interval and returns to step 1302. It can be further contemplated as another exemplary embodiment that in the absence of E-DCH data to be transmitted, a MAC-e PDU including only a BO or/and TPS is transmitted.

When applying the flowchart of FIG. 13 to the first exemplary embodiment, the UE proceeds to step 1307 directly if the E-DCH data transmission is not to start in the current time interval in step 1302. In the second embodiment, the UE directly jumps to step 1307 if the TPS period has not expired in step 1304. In the third embodiment, the UE directly jumps to step 1305 if the E-DCH data transmission is not to start in the current time interval in step 1302 or if the current time interval is not a BO transmission interval in step 1303.

FIG. 14 is a flowchart illustrating TPS transmission from a UE according to the fifth exemplary embodiment of the present invention. Step 1402 through step 1408 are performed in every E-DCH transmission interval.

Referring to FIG. 14, the UE determines whether E-DCH data transmission is to start in step 1402. If the UE determines that the E-DCH data transmission will start in the current time interval, it includes a BO and a TPS in a MAC-e PDU in step 1406 and proceeds to step 1408. If the E-DCH data transmission will not start in the current time interval, the UE determines whether a BO is to be transmitted in the current time interval in step 1403. If the current time interval is a BO transmission interval, the UE includes the BO and the TPS in a MAC-e PDU in step 1406 and proceeds to step 1408. If the TPS is transmitted irrespective of the BO in another exemplary embodiment, step 1403 will not be performed.

If the current time interval is not a BO transmission interval, the UE determines whether a TPS period has expired in step 1404. That is, the UE determines whether the

TPS period has elapsed after transmission of the previous TPS or the start of the E-DCH data transmission. If the current time interval is not a TPS transmission interval, the UE goes to step 1407. On the other hand, if the current time interval is a TPS transmission interval, the UE determines whether a TPS event has occurred for the previous TPS period in step 1405. If the TPS event has occurred in the previous TPS period, the UE includes the TPS in the MAC-e PDU in step 1406 and proceeds to step 1408. If the TPS event has not occurred in step 1405, the UE proceeds to step 1407.

In step 1407, the UE determines whether E-DCH data exists for transmission. In the presence of E-DCH data, the UE fills the E-DCH data in the payload of the MAC-e PDU and transmits the MAC-e PDU in step 1408. The MAC-e PDU may include the BO or/and TPS inserted in step 1406. In the absence of E-DCH data, the UE waits till the next time interval and returns to step 1402. It can be further contemplated as another embodiment that in the absence of E-DCH data to be transmitted, a MAC-e PDU including only a BO or/and TPS is transmitted.

FIG. 15 is a block diagram of a UE according to an exemplary embodiment of the present invention. It is to be appreciated that components of the receiver not related to the subject matter of the present invention are not shown in FIG. 15.

Referring to FIG. 15, the UE includes an E-DCH buffer 1501 for buffering E-DCH data and a TPS manager 1502 for managing a TPS. The E-DCH buffer 1501 monitors the amount of uplink data, correspondingly generates a BO 1504, and provides the BO 1504 to a UE status information generator 1507. The TPS manager 1502 has knowledge of a maximum transmit power available to the UE, monitors the transmit power of each channel according to Node B power control and according to whether uplink channels are in use or not, correspondingly generates a TPS 1503, and provides the TPS 1503 to the UE status information generator 1507.

The UE status information generator 1507 determines whether it is time to transmit the BO 1504 or the TPS 1503 and generates UE status information with the BO 1504 or/and the TPS 1503. The criterion for including the BO 1504 in the UE status information can be periodic transmission, event-triggered transmission, or initial E-DCH transmission. Similarly, the criterion for including the TPS 1503 in the UE status information can be periodic transmission, event-triggered transmission, or initial E-DCH transmission, as in the embodiments of the present invention. The TPS manager 1502

may provides the TPS 1503 to the UE status information generator 1507 according to control information 1506 indicating whether the BO 1504 is to be transmitted, received from the E-DCH buffer 1501.

The E-DCH buffer 1501 outputs E-DCH data 1505 at an allowed data rate in each transmission interval. The E-DCH data 1505 is provided to a MAC-e PDU generator 1508, and when MAC-e signaling is needed, the UE status information generator 1507 provides the UE status information including the BO 1504 and the TPS 1503 to the MAC-e PDU generator 1508. The MAC-e PDU generator 1508 generates a MAC-e PDU containing at least one of the E-DCH data and the UE status information. The MAC-e PDU is transmitted to a Node B, after coding and modulation in an E-DCH transmitter 1509.

As described above, the present invention can enable accurate, efficient TPS transmission to assist rate scheduling for uplink packet transmission in a WCDMA communication system supporting the E-DCH. A UE transmits a TPS in a MAC-e header by MAC-e signaling along with E-DCH data to a Node B. Therefore, PHY channel resources are saved and the efficient TPS transmission improves E-DCH performance.

While the invention has been shown and described with reference to certain exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method of transmitting user equipment (UE) status information for uplink data transmission in a mobile communication system, the method comprising the steps of:

generating buffer occupancy (BO) information by monitoring an amount of uplink data to be transmitted;

generating transmit power status (TPS) information by monitoring uplink transmit power status;

determining whether the BO information is to be transmitted in a current time interval;

determining whether the TPS information is to be transmitted in the current time interval, if the BO information is to be transmitted in the current time interval according to a TPS period;

generating a packet data unit (PDU) comprising the BO information and the TPS information if the TPS information is to be transmitted in the current time; and

transmitting the PDU after coding and modulation.

2. The method of claim 1, further comprising the steps of:

determining whether a TPS information transmission event has occurred if the TPS information is not to be transmitted in the current time interval according to the TPS period; and

generating a PDU comprising the BO information and the TPS information if the TPS information transmission event has occurred and transmitting the PDU.

3. The method of claim 1, wherein the PDU generating step comprises the steps of:

determining whether the TPS information transmission event has occurred if the TPS period has expired and the TPS information is to be transmitted in the current time interval; and

generating a PDU comprising the BO information and the TPS information if the TPS information transmission event has occurred.

4. The method of claim 1, wherein the PDU further comprises uplink packet data.

5. The method of claim 4, wherein the PDU comprises a medium access control PDU (MAC-e PDU) transmitted on an enhanced uplink dedicated channel (E-DCH).

6. An apparatus for transmitting user equipment (UE) status information for uplink data transmission in a mobile communication system, the apparatus comprising:

a buffer for buffering uplink data and generating buffer occupancy (BO) information by monitoring an amount of the uplink data;

a transmit power status (TPS) information manager for generating TPS information by monitoring uplink transmit power status;

a UE status information generator for determining whether the BO information is to be transmitted in a current time interval, determining whether the TPS information is to be transmitted in the current time interval, if the BO information is to be transmitted in the current time interval according to a TPS period, and generating UE status information comprising the BO information and the TPS information if the TPS information is to be transmitted in the current time interval;

a packet data unit (PDU) generator for generating a PDU comprising the UE status information; and

a transmitter for transmitting the PDU after coding and modulation.

7. The apparatus of claim 6, wherein the UE status information generator determines whether a TPS information transmission event has occurred if the TPS information is not to be transmitted in the current time interval according to the TPS period, and generates the UE status information comprising the BO information and the TPS information if the TPS information transmission event has occurred.

8. The apparatus of claim 6, wherein the UE status information generator

determines whether the TPS information transmission event has occurred if the TPS period has expired and the TPS information is to be transmitted in the current time interval, and generates the UE status information comprising the BO information and the TPS information if the TPS information transmission event has occurred.

9. The apparatus of claim 6, wherein the PDU further comprises uplink data.

10. The apparatus of claim 9, wherein the PDU comprises a medium access control PDU (MAC-e PDU) transmitted on an enhanced uplink dedicated channel (E-DCH).

11. A method of transmitting user equipment (UE) status information for uplink data transmission in a mobile communication system, the method comprising the steps of:

generating buffer occupancy (BO) information by monitoring an amount of uplink data to be transmitted;

generating transmit power status (TPS) information by monitoring uplink transmit power status;

determining whether the BO information is to be transmitted in a current time interval;

determining whether a TPS information transmission event has occurred, if the BO information is to be transmitted in the current time interval;

generating a packet data unit (PDU) comprising the BO information and the TPS information if the TPS information transmission event has occurred; and

transmitting the PDU after coding and modulation.

12. The method of claim 11, further comprising the steps of:

determining whether the TPS information is to be transmitted in the current time interval according to a TPS period, if the TPS information transmission event has not occurred; and

generating a PDU comprising the BO information and the TPS information if

the TPS information is to be transmitted in the current time interval according to the TPS period, and transmitting the PDU.

13. The method of claim 11, wherein the PDU generating step comprises the steps of:

determining whether the TPS information is to be transmitted in the current time interval according to the TPS period, if the TPS information transmission event has occurred; and

generating a PDU comprising the BO information and the TPS information if the TPS information is to be transmitted in the current time interval according to the TPS period.

14. The method of claim 11, wherein the PDU further comprises uplink packet data.

15. The method of claim 14, wherein the PDU comprises a medium access control PDU (MAC-e PDU) transmitted on an enhanced uplink dedicated channel (E-DCH).

16. An apparatus for transmitting user equipment (UE) status information for uplink data transmission in a mobile communication system, the apparatus comprising:

a buffer for buffering uplink data to be transmitted and generating buffer occupancy (BO) information by monitoring an amount of the uplink data;

a transmit power status (TPS) information manager for generating TPS information by monitoring uplink transmit power status;

a UE status information generator for determining whether the BO information is to be transmitted in a current time interval, determining whether a TPS information transmission event has occurred, if the BO information is to be transmitted in the current time interval, and generating UE status information comprising the BO information and the TPS information if the TPS information transmission event has occurred;

a packet data unit (PDU) generator for generating a PDU comprising the UE

status information; and

a transmitter for transmitting the PDU after coding and modulation.

17. The apparatus of claim 16, wherein the UE status information generator determines whether the TPS information is to be transmitted in the current time interval according to a TPS period, if the TPS information transmission event has not occurred, and generates the UE status information comprising the BO information and the TPS information if the TPS information is to be transmitted in the current time interval according to the TPS period.

18. The apparatus of claim 16, wherein the UE status information generator determines whether the TPS information is to be transmitted in the current time interval according to the TPS period, if the TPS information transmission event has occurred, and generates the UE status information comprising the BO information and the TPS information if the TPS information is to be transmitted in the current time interval according to the TPS period.

19. The apparatus of claim 16, wherein the PDU further comprises uplink packet data.

20. The apparatus of claim 19, wherein the PDU comprises a medium access control PDU (MAC-e PDU) transmitted on an enhanced uplink dedicated channel (E-DCH).

21. A method of transmitting user equipment (UE) status information for uplink data transmission in a mobile communication system, the method comprising the steps of:

generating buffer occupancy (BO) information by monitoring an amount of uplink data to be transmitted;

generating transmit power status (TPS) information by monitoring uplink transmit power status;

determining whether a current time interval is a BO transmission interval in

which the BO information is to be transmitted;

generating a packet data unit (PDU) comprising the BO information and the TPS information, if the current time interval is the BO transmission interval; and

transmitting the PDU after coding and modulation.

22. The method of claim 21, wherein the BO transmission interval is at least one of periodic and event-triggered.

23. The method of claim 21, wherein the PDU further comprises uplink packet data.

24. The method of claim 21, wherein the PDU comprises a medium access control PDU (MAC-e PDU) transmitted on an enhanced uplink dedicated channel (E-DCH).

25. An apparatus for transmitting user equipment (UE) status information for uplink data transmission in a mobile communication system, the apparatus comprising:

a buffer for buffering uplink data to be transmitted and generating buffer occupancy (BO) information by monitoring an amount of the uplink data;

a transmit power status (TPS) information manager for generating TPS information by monitoring uplink transmit power status;

a UE status information generator for determining whether a current time interval is a BO transmission interval in which the BO information is to be transmitted, and generating UE status information comprising the BO information and the TPS information, if the current time interval is the BO transmission interval;

a packet data unit (PDU) generator for generating a PDU comprising the UE status information; and

a transmitter for transmitting the PDU after coding and modulation.

26. The apparatus of claim 25, wherein the BO transmission interval is at least one of periodic and event-triggered.

27. The apparatus of claim 25, wherein the PDU further comprises uplink packet data.

28. The apparatus of claim 27, wherein the PDU comprises a medium access control PDU (MAC-e PDU) transmitted on an enhanced uplink dedicated channel (E-DCH).

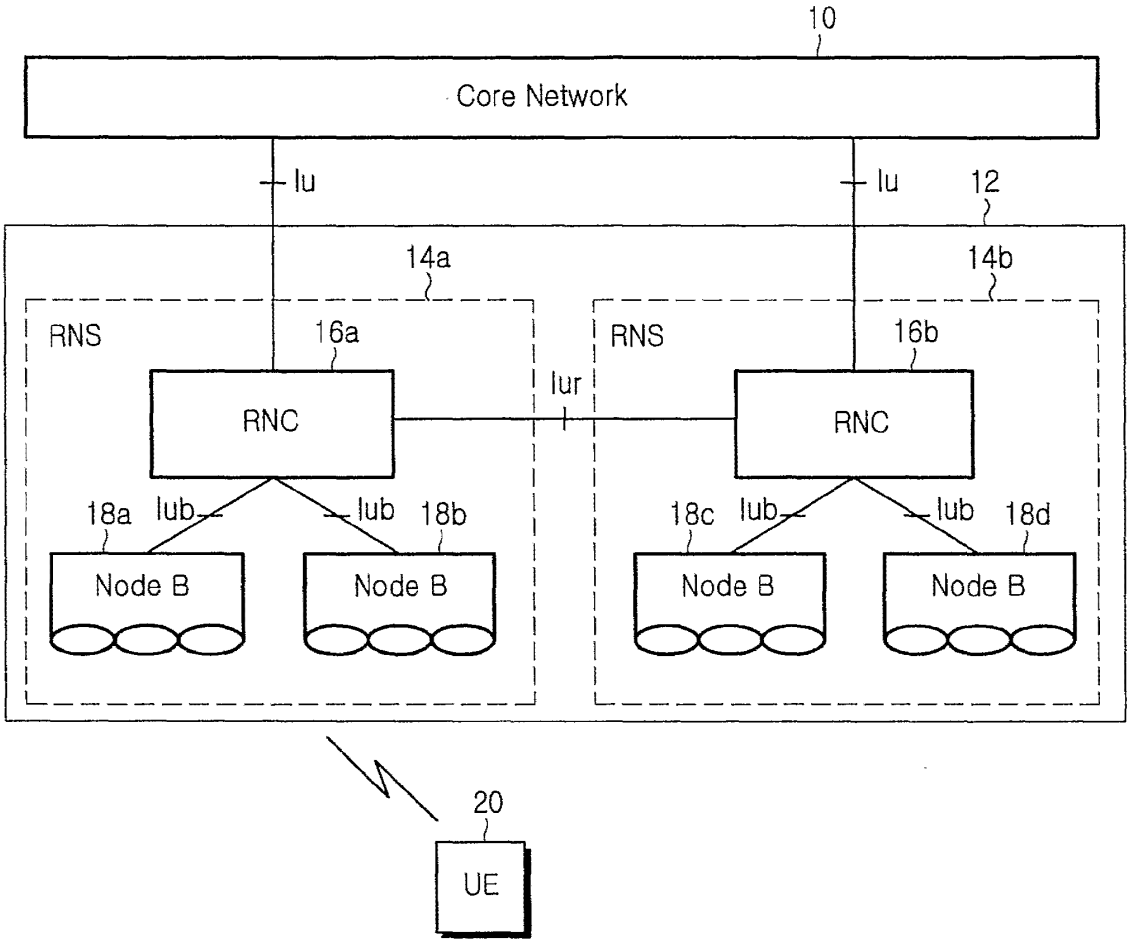

10
Core Network
Iu
Iu
12
14a
14b
RNS
16a
RNS
16b
Iur
RNC
RNC
18a
Iub
Iub
18b
18c
Iub
Iub
18d
Node B
Node B
Node B
Node B
20
UE

FIG.1

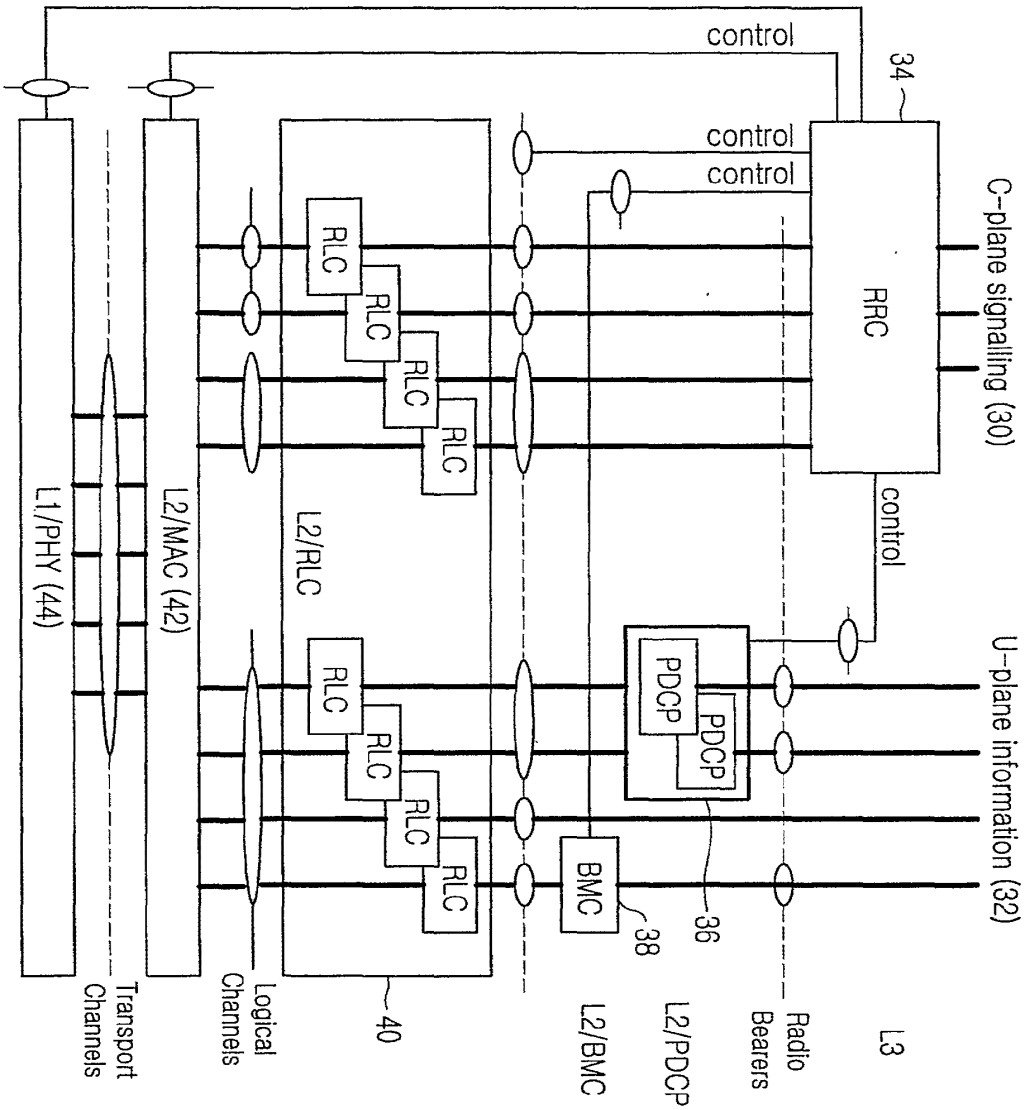

control
34
control
control
C-plane signalling (30)
RRC
RLC
RLC
RLC
RLC
control
L2/RLC
L1/PHY (44)
L2/MAC (42)
PDCP
PDCP
U-plane information (32)
RLC
RLC
RLC
RLC
BMC
38
36
40
Transport Channels
Logical Channels
L2/BMC
L2/PDCP
Radio Bearers
L3

FIG.2

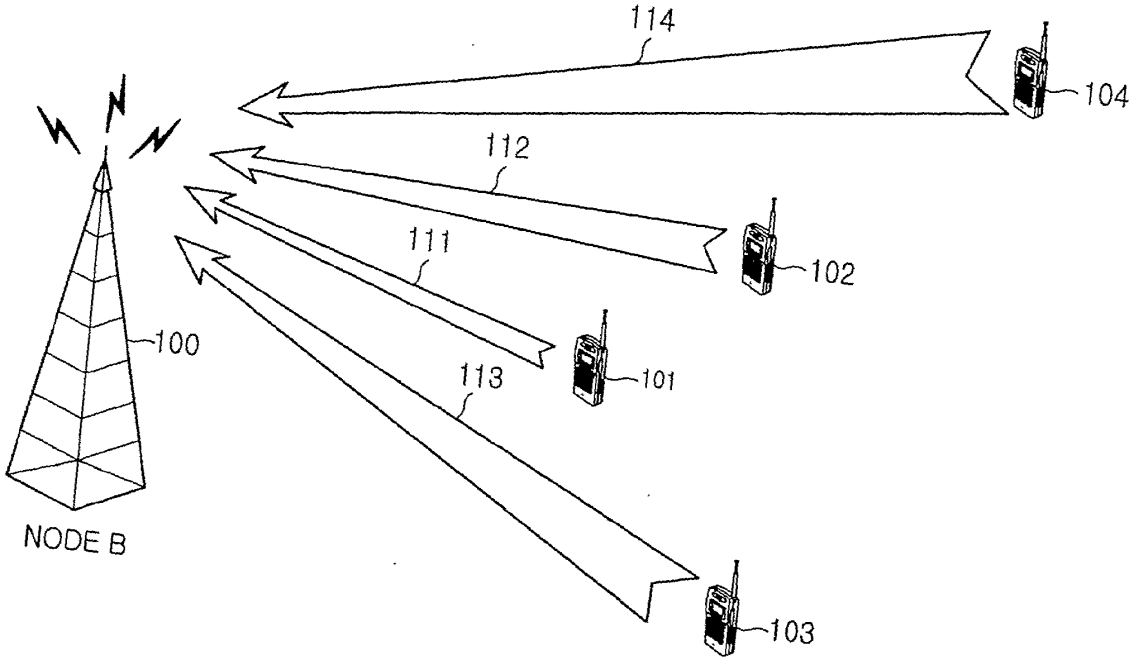


FIG.3

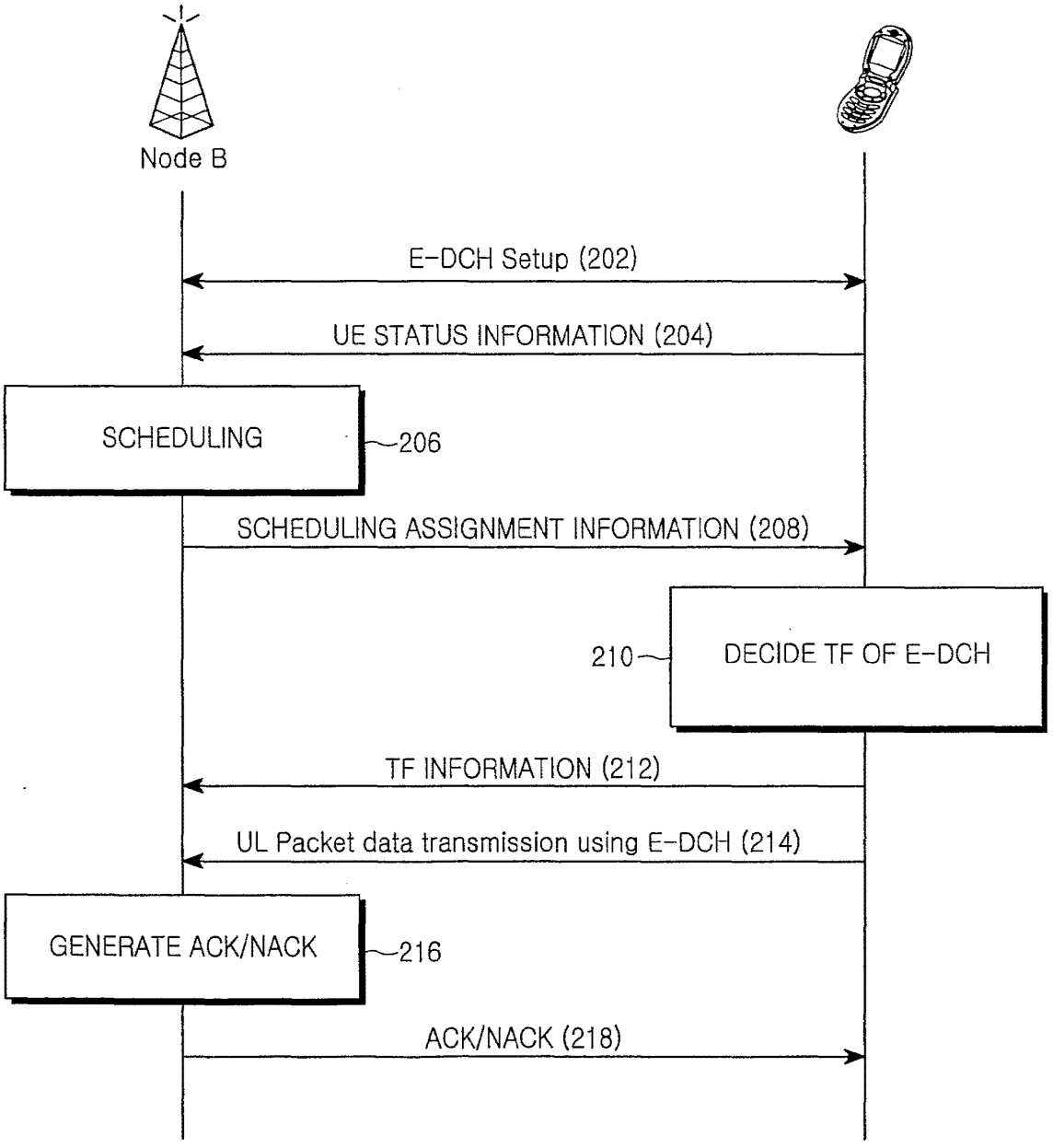

Node B
E-DCH Setup (202)
UE STATUS INFORMATION (204)
SCHEDULING
206
SCHEDULING ASSIGNMENT INFORMATION (208)
210
DECIDE TF OF E-DCH
TF INFORMATION (212)
UL Packet data transmission using E-DCH (214)
GENERATE ACK/NACK
216
ACK/NACK (218)

FIG.4

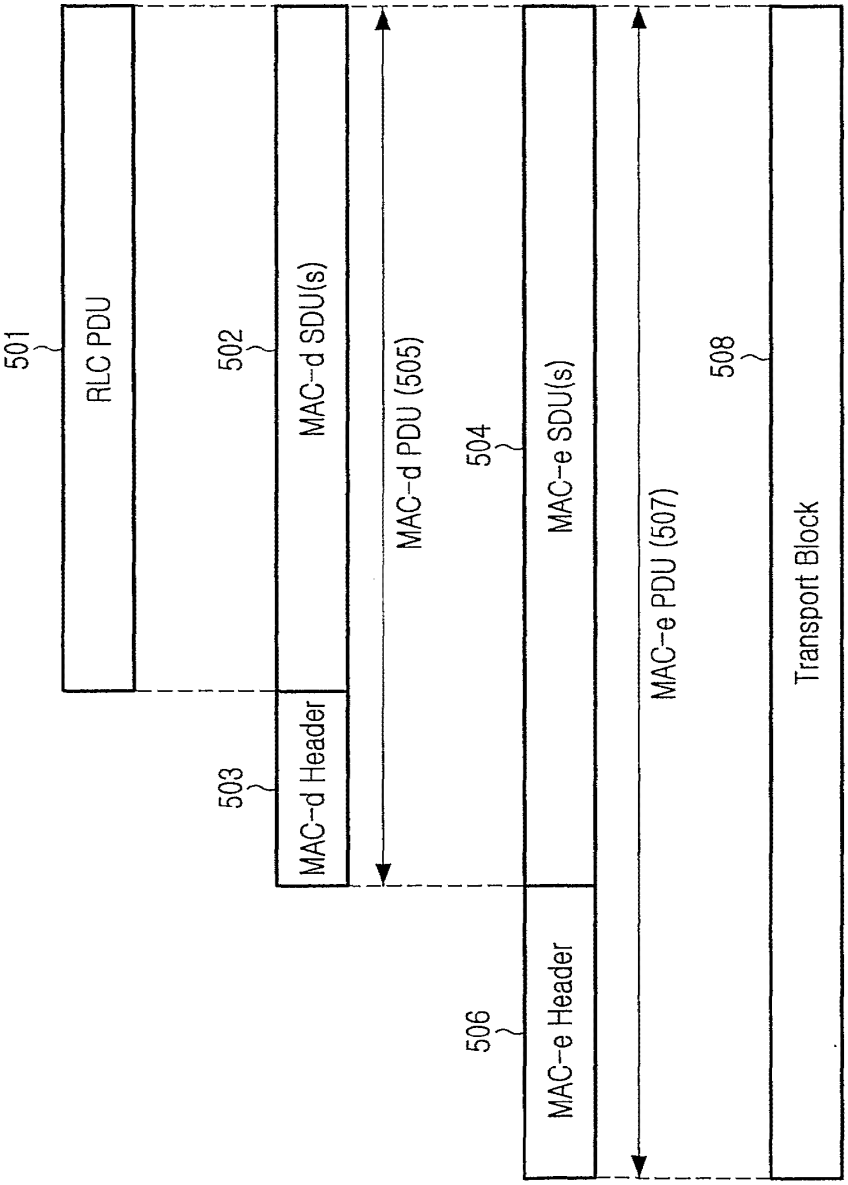

501
RLC PDU
502
MAC-d SDU(s)
503
MAC-d Header
MAC-d PDU (505)
504
MAC-e SDU(s)
506
MAC-e Header
MAC-e PDU (507)
508
Transport Block

FIG.5

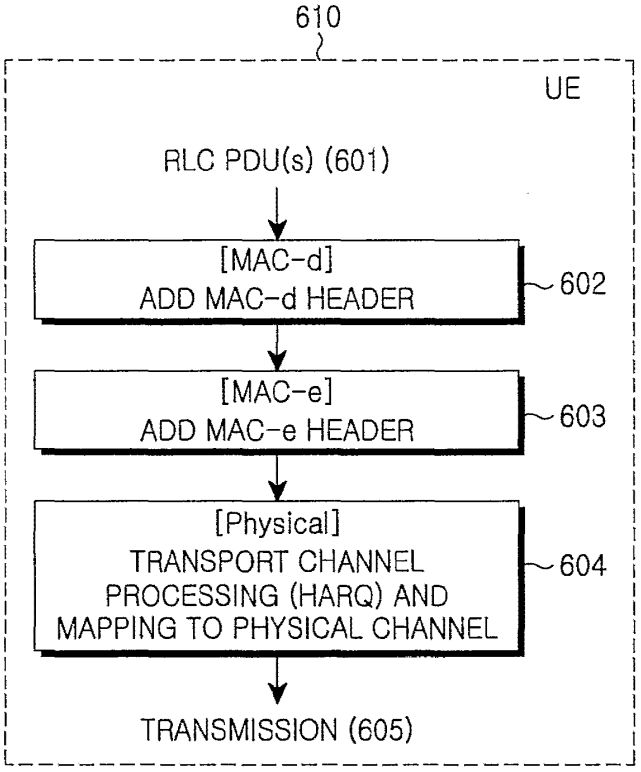

610
UE
RLC PDU(s) (601)
[MAC-d]
ADD MAC-d HEADER
602
[MAC-e]
ADD MAC-e HEADER
603
[Physical]
TRANSPORT CHANNEL
PROCESSING (HARQ) AND
MAPPING TO PHYSICAL CHANNEL
604
TRANSMISSION (605)

FIG.6

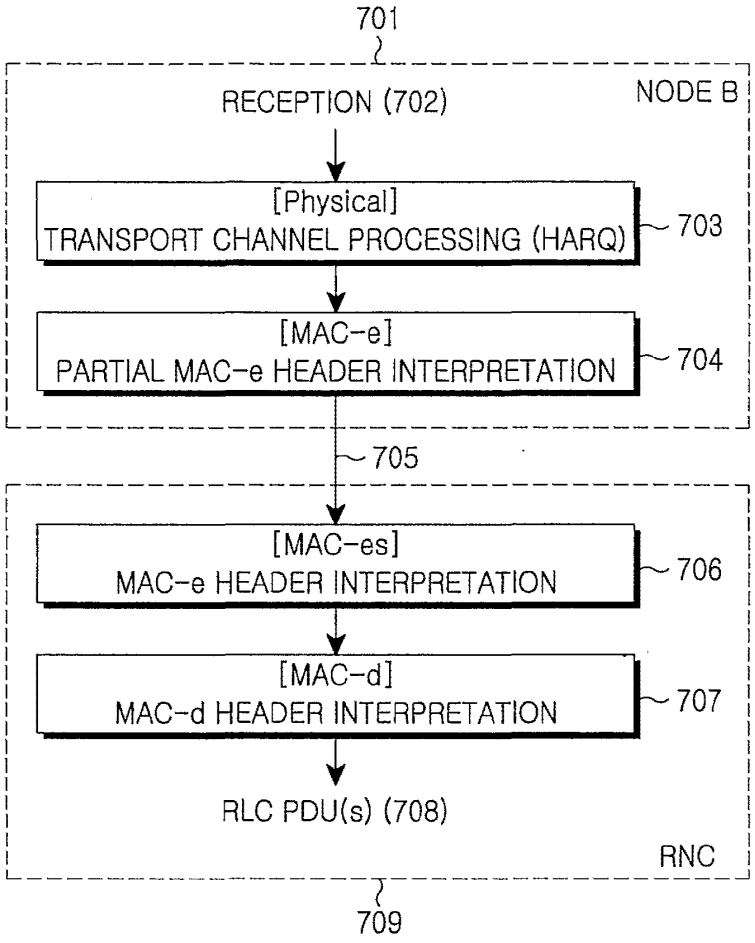

701
NODE B
RECEPTION (702)
[Physical]
TRANSPORT CHANNEL PROCESSING (HARQ)
703
[MAC-e]
PARTIAL MAC-e HEADER INTERPRETATION
704
705
[MAC-es]
MAC-e HEADER INTERPRETATION
706
[MAC-d]
MAC-d HEADER INTERPRETATION
707
RLC PDU(s) (708)
RNC
709

FIG.7

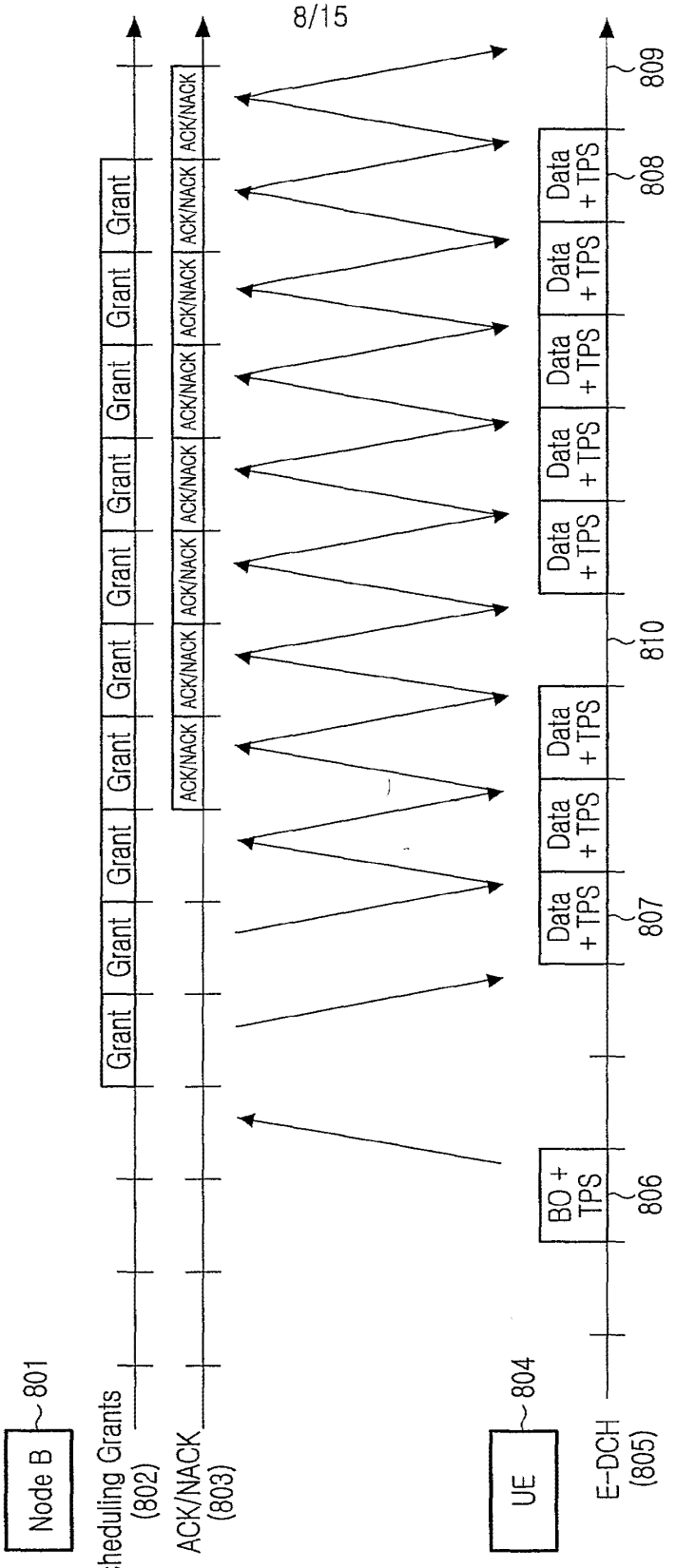

Node B
801
Scheduling Grants
(802)
ACK/NACK
(803)
UE
804
E-DCH
(805)
Grant
ACK/NACK
BO + TPS
806
Data + TPS
807
810
808
809

FIG.8

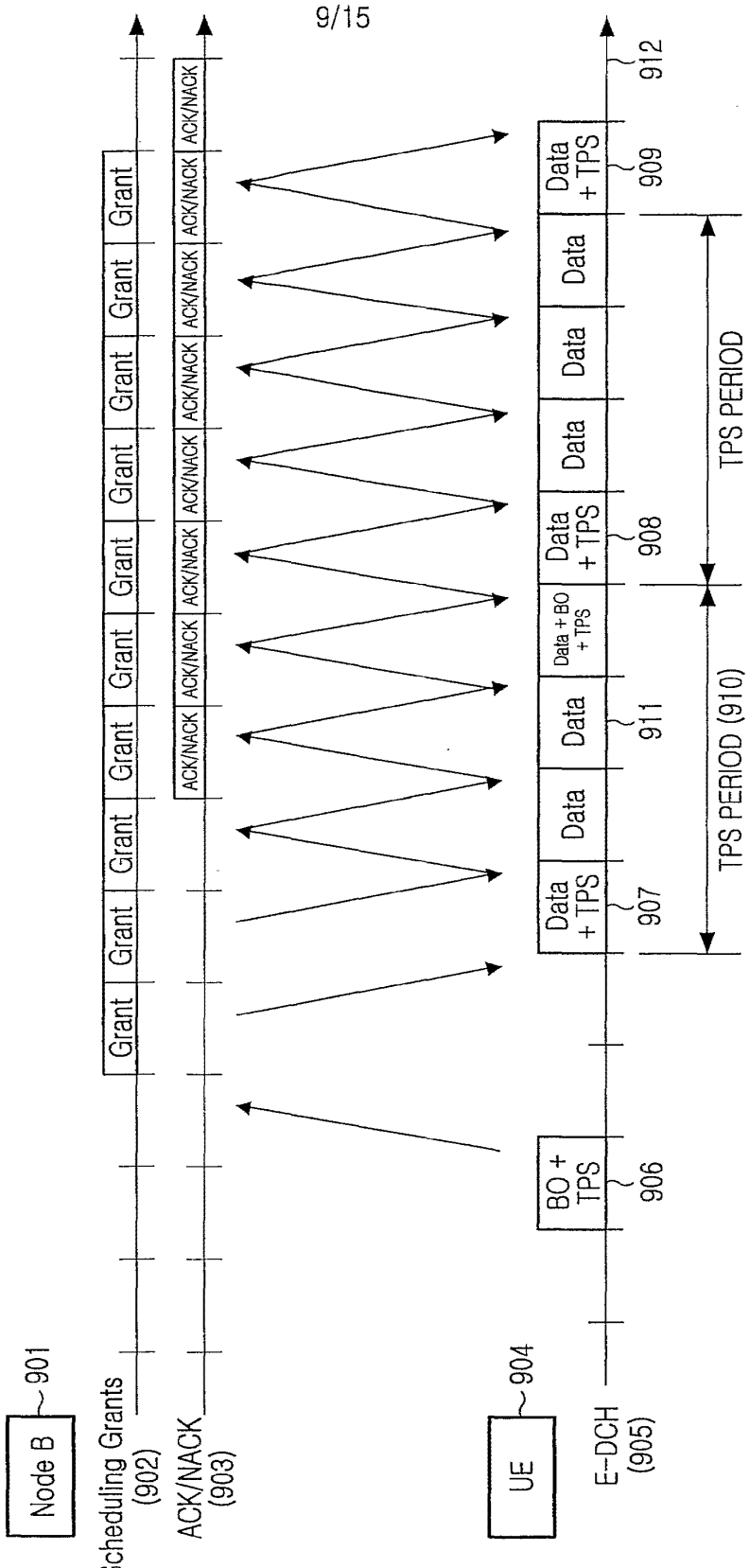

Node B
901
Scheduling Grants
(902)
ACK/NACK
(903)
UE
904
E-DCH
(905)
Grant
ACK/NACK
BO + TPS
906
Data + TPS
907
Data
911
Data + BO + TPS
Data + TPS
908
Data
909
912
TPS PERIOD
TPS PERIOD (910)

FIG.9

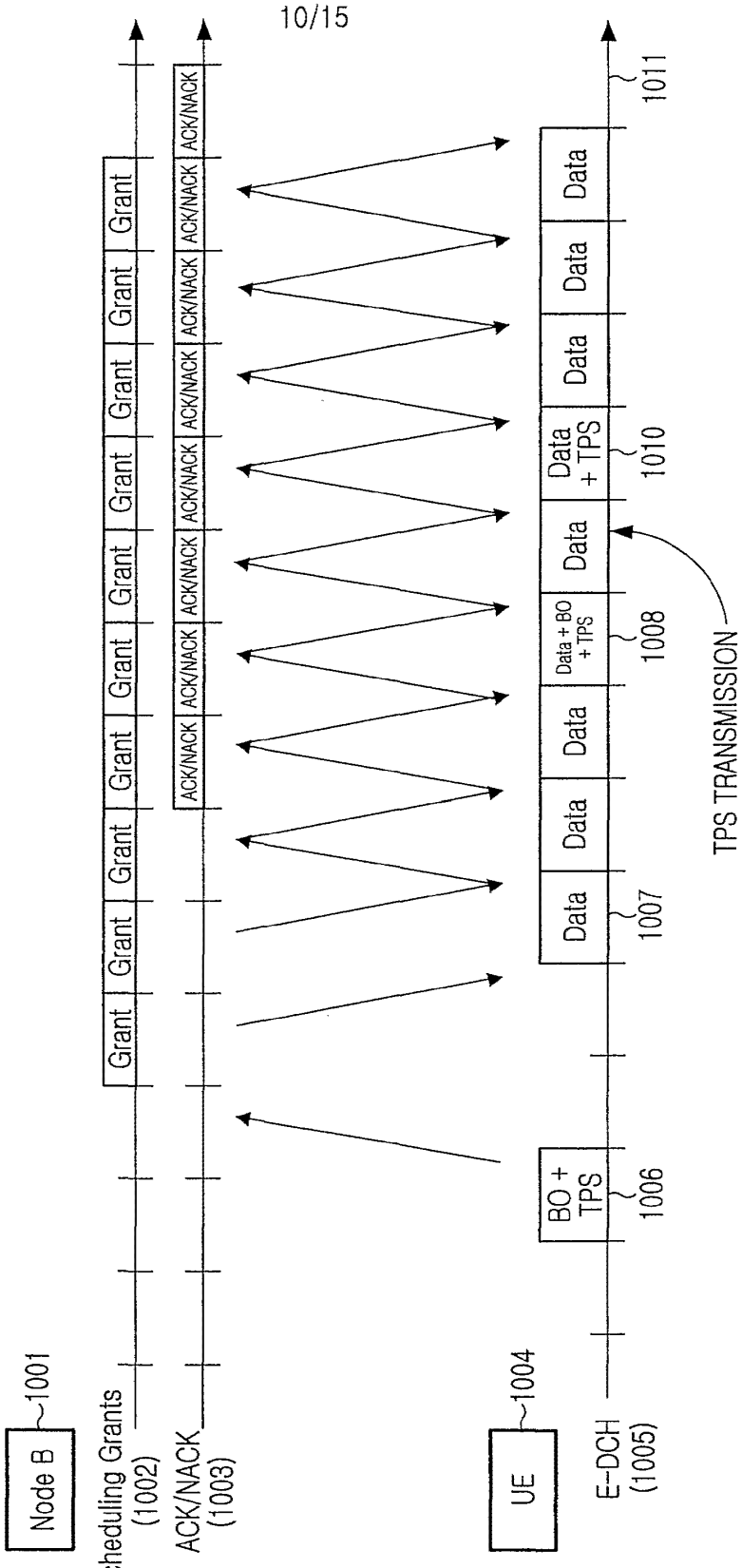

Node B
1001
Scheduling Grants
(1002)
ACK/NACK
(1003)
UE
1004
E-DCH
(1005)
Grant
ACK/NACK
BO + TPS
1006
Data
Data + BO + TPS
Data + TPS
1007
1008
1010
1011
TPS TRANSMISSION EVENT (1009)

FIG. 10

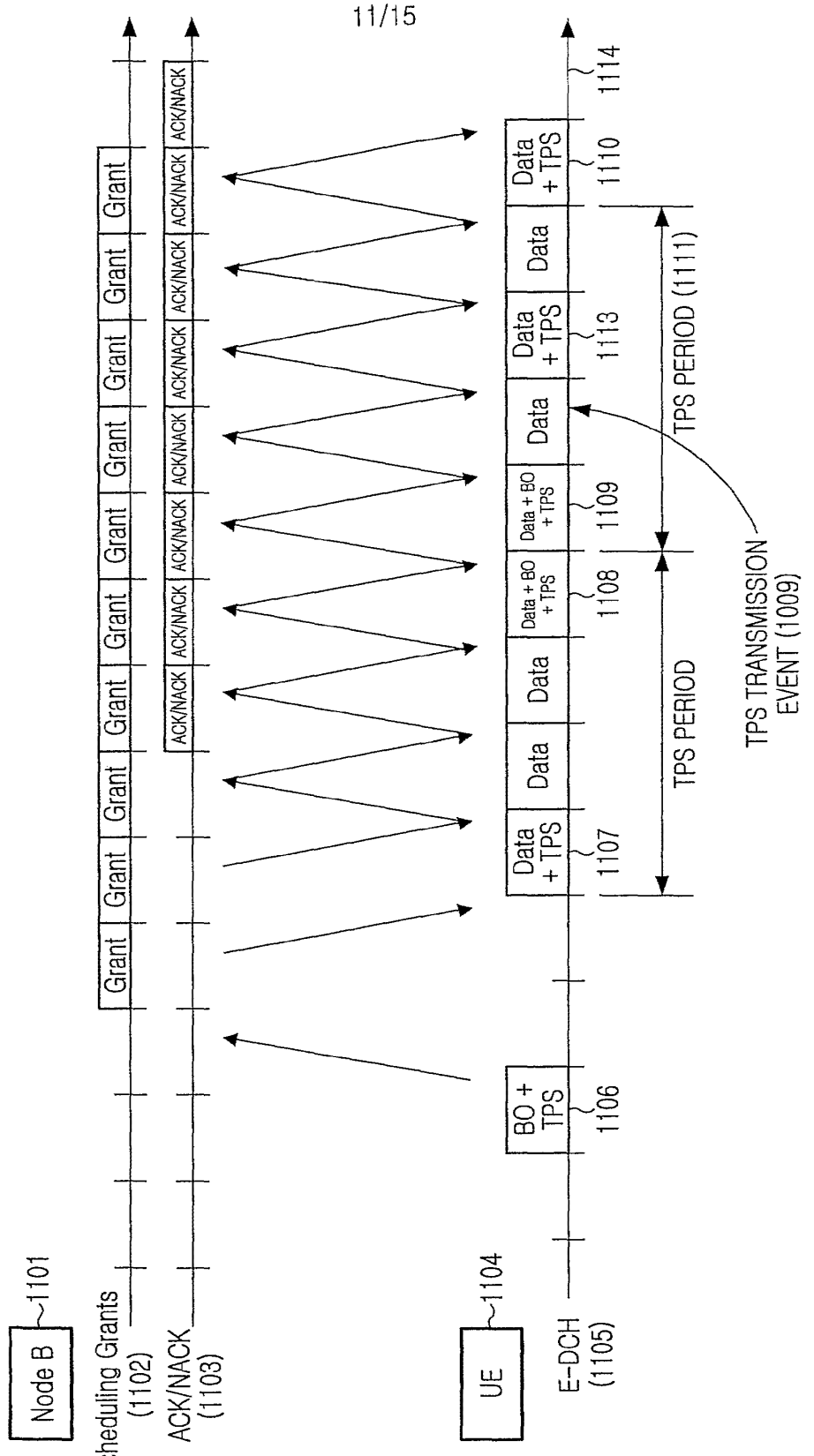

Node B
1101
Scheduling Grants
(1102)
ACK/NACK
(1103)
UE
1104
E-DCH
(1105)
Grant
ACK/NACK
BO + TPS
1106
Data + TPS
1107
Data
Data + BO + TPS
1108
1109
Data
Data + TPS
1113
Data
Data + TPS
1110
1114
TPS PERIOD
TPS PERIOD (1111)
TPS TRANSMISSION EVENT (1009)

FIG.11

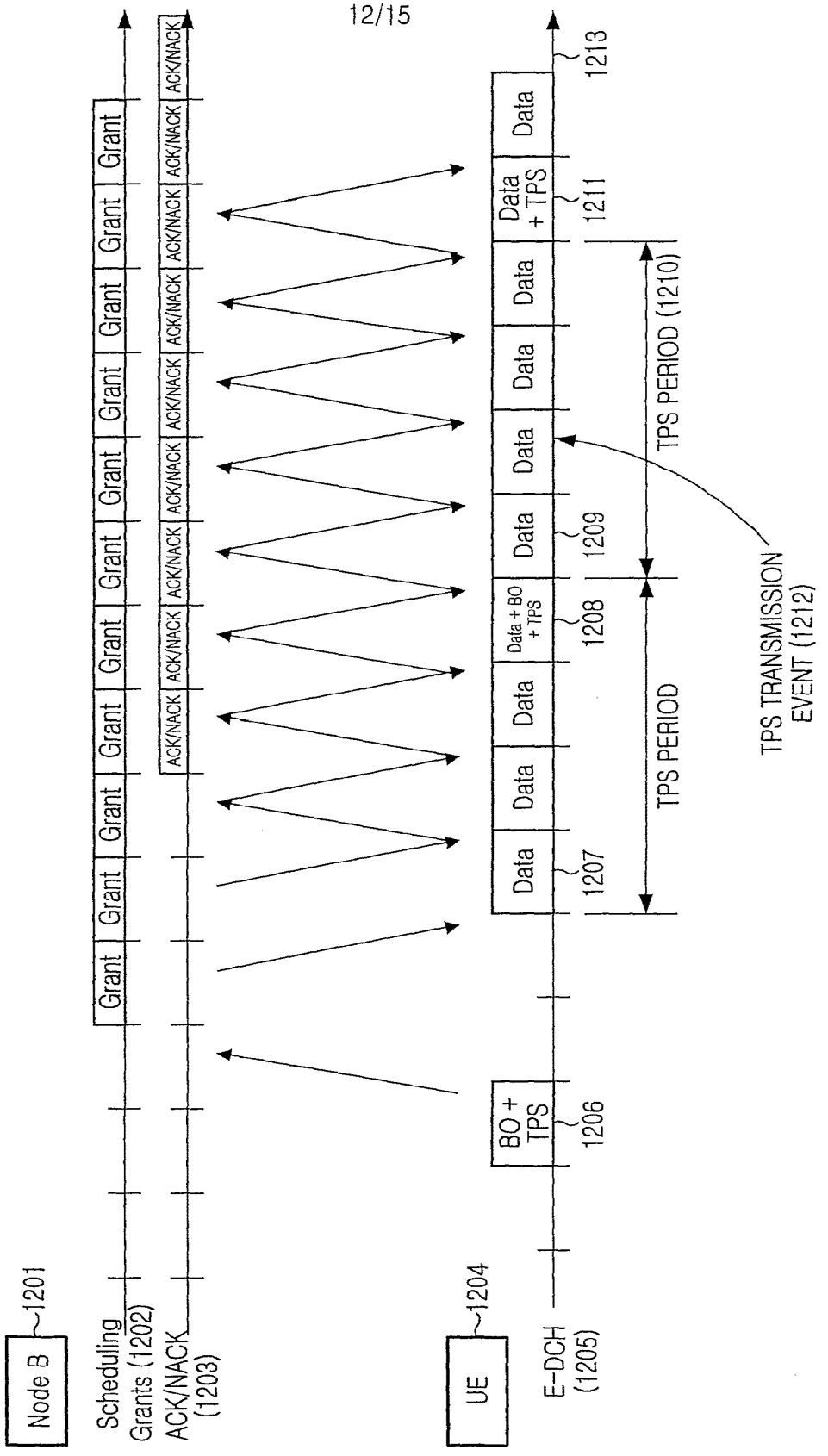

Node B
1201
Scheduling Grants (1202)
ACK/NACK (1203)
UE
1204
E-DCH (1205)
Grant
ACK/NACK
BO + TPS
1206
Data
1207
Data + BO + TPS
1208
Data + TPS
1211
1213
1209
TPS PERIOD
TPS PERIOD (1210)
TPS TRANSMISSION EVENT (1212)

FIG.12

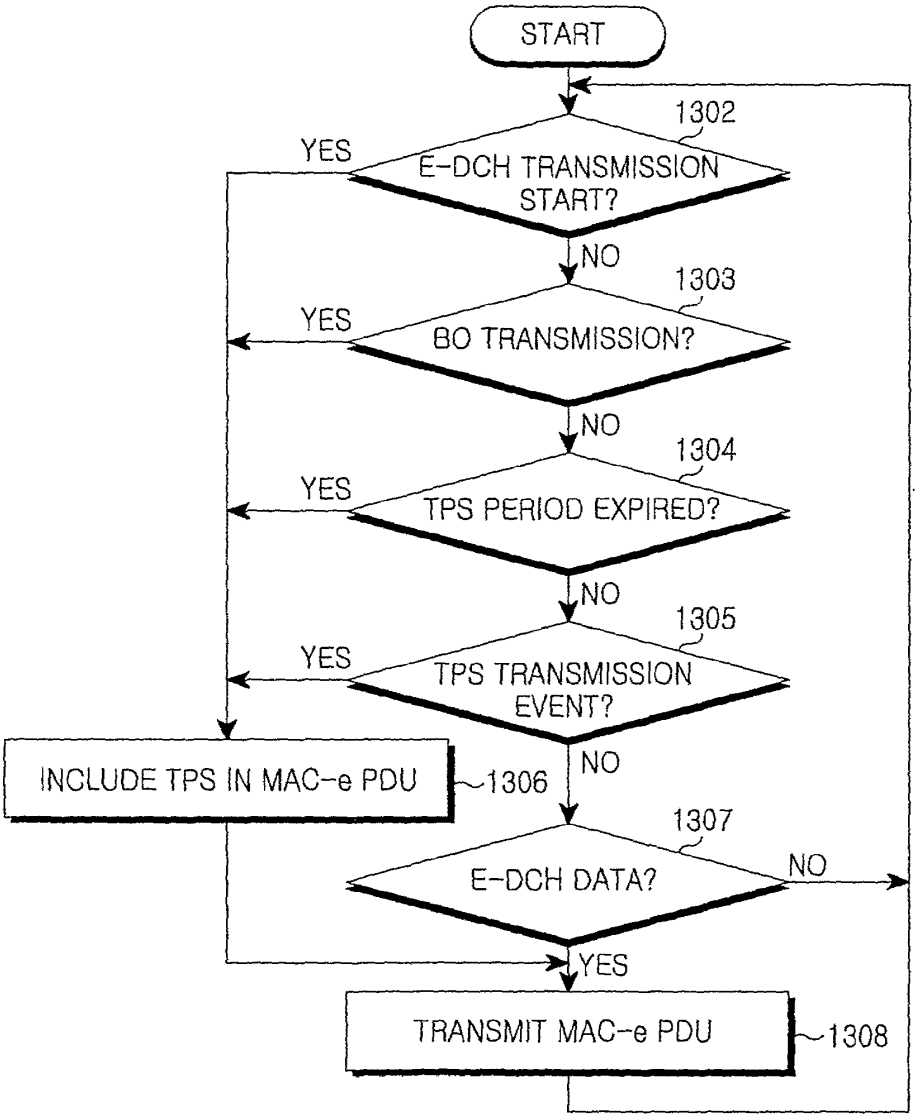

START
1302
E-DCH TRANSMISSION START?
YES
NO
1303
BO TRANSMISSION?
YES
NO
1304
TPS PERIOD EXPIRED?
YES
NO
1305
TPS TRANSMISSION EVENT?
YES
NO
INCLUDE TPS IN MAC-e PDU
1306
1307
E-DCH DATA?
NO
YES
TRANSMIT MAC-e PDU
1308

FIG.13

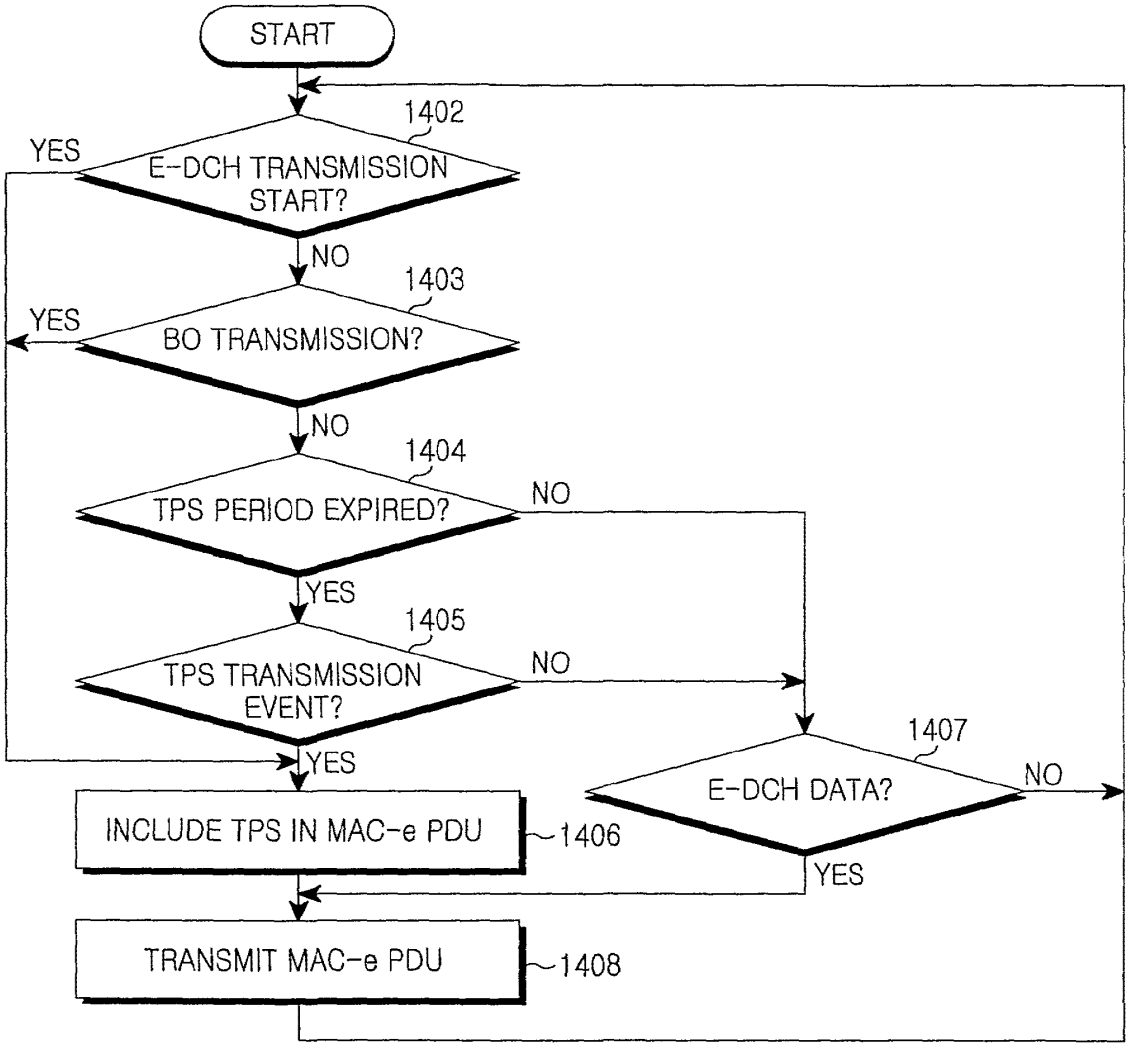

START
1402
E-DCH TRANSMISSION START?
YES
NO
1403
BO TRANSMISSION?
YES
NO
1404
TPS PERIOD EXPIRED?
NO
YES
1405
TPS TRANSMISSION EVENT?
NO
YES
1407
E-DCH DATA?
NO
YES
INCLUDE TPS IN MAC-e PDU
1406
TRANSMIT MAC-e PDU
1408

FIG.14

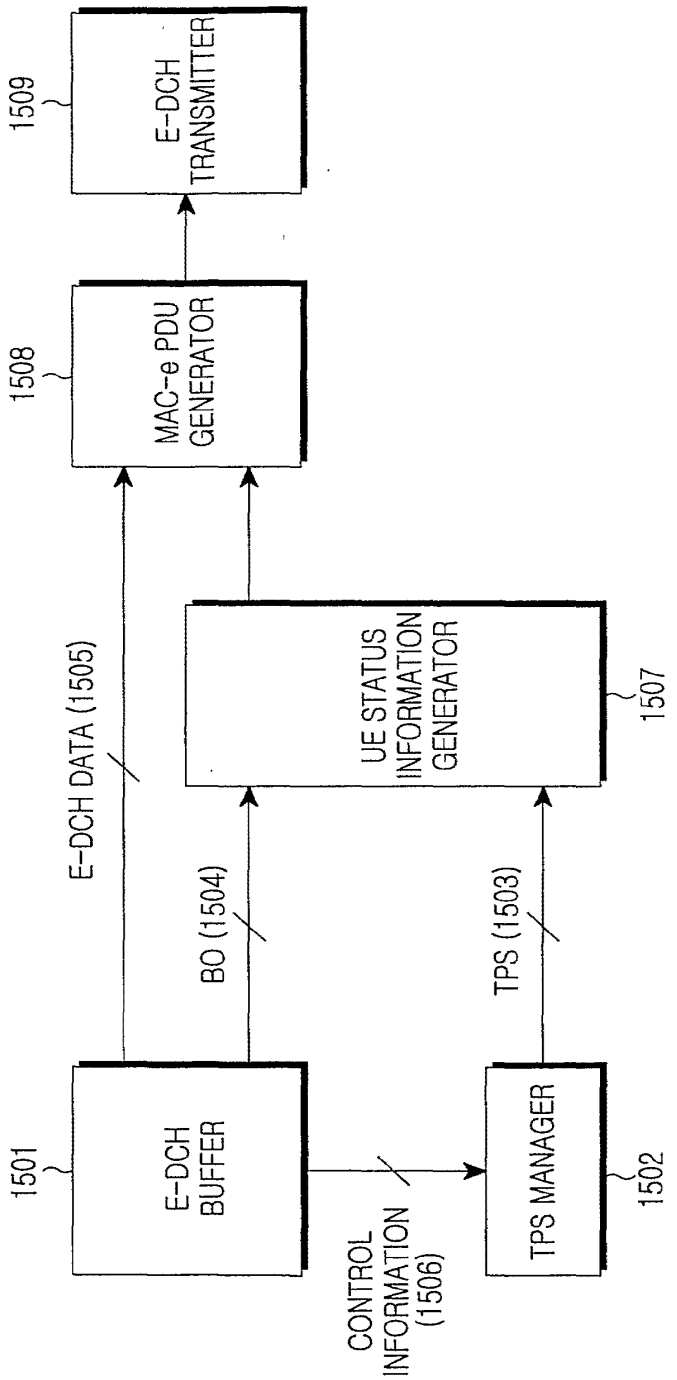

1509
E-DCH TRANSMITTER
1508
MAC-e PDU GENERATOR
E-DCH DATA (1505)
UE STATUS INFORMATION GENERATOR
1507
BO (1504)
TPS (1503)
1501
E-DCH BUFFER
CONTROL INFORMATION (1506)
TPS MANAGER
1502

FIG.15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/003491

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, H04L 12/56, H04L 12/28

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
KIPASS, DELPHION, ESPACENET & Keywords : scheduling, uplink, UE, MAC-e, E-DCH, status, information, transmit, power, buffer, PDU 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.
PA	US2005-83943 A (SAMSUNG ELECTRONICS CO., LTD.) 21 April 2005 * abstract, paragraphs[0100]-[0103], figure 10 *	1-28
PA	US2005-78651 A (SAMSUNG ELECTRONICS CO., LTD.) 14 April 2005 * abstract, paragraphs[0096]-[0099], figure 13 *	1-28
PA	US2005-47416 A (SAMSUNG ELECTRONICS CO., LTD.) 3 March 2005 * abstract, paragraphs[0068]-[0072], figure 9 *	1-28
A	US2004-160919 A (Balachandran et al.) 19 August 2004 * abstract, paragraphs[0024]-[0029], figure 1 *	1-28

☐ 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 JANUARY 2006 (27.01.2006)	**31 JANUARY 2006 (31.01.2006)**
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/KR2005/003491

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US2005-83943 A	21.04.2005	NONE	
US2005-78651 A	14.04.2005	CN1604687A	06.04.2005
		EP01509011A2	23.02.2005
		JP2005065298A2	10.03.2005
		KR1020050018540	23.02.2005
US2005-47416 A	03.03.2005	NONE	
US2004-160919 A	19.08.2004	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

Electronic Patent Application Fee Transmittal

Application Number:	12238910
Filing Date:	26-Sep-2008
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Filer:	Stuart A. Schanbacher/Marissa Antonelli
Attorney Docket Number:	IHSP_2-1853.01.US

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($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	14487835
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	15800
Filer:	Stuart A. Schanbacher/Marissa Antonelli
Filer Authorized By:	Stuart A. Schanbacher
Attorney Docket Number:	IHSP_2-1853.01.US
Receipt Date:	17-DEC-2012
Filing Date:	26-SEP-2008
Time Stamp:	15:34:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	2606
Deposit Account	090435
Authorized User	
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	Information Disclosure Statement (IDS) Form (SB08)	IHSP_2_1853_01_US_SIDS_Trans_IDCC.pdf	103740 a35f90a287a512292e86424bb4e16e0c4d256e5d	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
2	Transmittal Letter	IHSP_2_1853_01_US_SIDS_1449.pdf	121442 a6801b3e55ae50506ab6143a3617ee53cde9cfa5	no	1
Warnings:					
Information:					
3	Foreign Reference	KR_10-2006-0054117.pdf	710753 b8e1c52c85e1e67f021a09e53e60513d8303b12a	no	36
Warnings:					
Information:					
4	Foreign Reference	WO_2006043782.pdf	2125358 ce6cccaf4cb7b2b07649a475d8be964d90ecf36c	no	50
Warnings:					
Information:					
5	Non Patent Literature	Final_3GPP_R2-073567_TSG-RANWG2_August2007_4pp.pdf	169779 c73f642009b41af4d2edece50d1d1c9c71298a2b	no	4
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	30462 88d6d9b0acb8442bda0a4112722072ae88dd5345	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3261534		

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.

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	IHSP_2-1853.01.US	2438

15800 7590 01/31/2013

Condo Roccia LLP
One Liberty Place
Suite 2200
Philadelphia, PA 19103

EXAMINER	
YUEN, KAN	
ART UNIT	**PAPER NUMBER**
2464	

MAIL DATE	DELIVERY MODE
01/31/2013	PAPER

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.

Office Action Summary	Application No.	Applicant(s)	
	12/238,910	PELLETIER ET AL.	
	Examiner	Art Unit	
	KAN YUEN	2464	

-- 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 *12 October 2012*.

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

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

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

Disposition of Claims

5)☒ Claim(s) *1-7 and 30-34* is/are pending in the application.

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

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-7 and 30-34* is/are rejected.

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

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

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

Application Papers

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

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

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

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

Priority under 35 U.S.C. § 119

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

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) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

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

4) ☐ Other: _____.

Detailed Action

Response to Arguments

1. Applicant's arguments, see remarks, filed 10/12/2012, with respect to the rejection(s) of claim(s) 1-7 and 30-32 under 103 Rejection have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Kwak et al. (Pub No.: 2006/0140154) in view of Yeo et al. (Pub No.: 2009/0225739).

Claim Rejections - 35 USC § 103

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

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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

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

4. Claims 1 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwak et al. (Pub No.: 2006/0140154) in view of Yeo et al. (Pub No.: 2009/0225739).

Regarding claim 6, Kwak et al. discloses a WTRU comprising: a processor configured to:

determine that a buffer is empty; on a condition that the buffer is empty, release a E-DCH resource (Kwak et al. see paragraph 0090; when there is no need for transmitting E-DCH data any longer, that is, when the buffer is empty in the UE 1004, the UE 1004 discontinues the E-DCH data transmission as indicated by reference numeral 1011). In other words, by determining the buffer is empty, the UE discontinues the E-DCH data transmission. In other words, when the E-DCH resource is unoccupied the E-DCH resource is released.

However, Kwak et al. does not explicitly disclose the feature wherein on a condition that the buffer is empty, trigger a transmission of scheduling information (SI) with a total E-DCH buffer status (TEBS) equal to zero.

Yeo et al. from the same or similar fields of endeavor discloses the feature wherein on a condition that the buffer is empty, trigger a transmission of scheduling information (SI) with a buffer status equal to zero (Yeo et al. see fig. 1; paragraphs 0034 and 0035; when the service data unit does not in the buffer (empty buffer), the terminal transmits scheduling information including buffer empty information to the base station).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Kwak et al. and to implement the feature as taught by Yeo et al. to provide TEBS buffer empty information when the buffer is empty.

The motivation would be to reduce power consumption by going waiting mode or standby mode when the buffer is empty.

Claim 1 is rejected similarly to claim 6.

5. Claims 2 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwak et al. (Pub No.: 2006/0140154) in view of Yeo et al. (Pub No.: 2009/0225739) as applied to claim 1 above, and further in view of Lin (Pub No.: 2010/0091652).

Regarding claims 2 and 30, Kawk et al. in view of Yeo et al. failed to disclose the feature wherein an inactivity timer is started when the buffer is empty.

Lin from the same or similar fields of endeavor disclosed the feature wherein an inactivity timer is started when the buffer is empty (Lin see paragraph 0038; when a queue becomes empty, the timer corresponding to the queue starts counting).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Kawk et al. in view of Yeo et al. and to implement the feature as disclosed by Lin to provide the feature wherein an inactivity timer is started when the buffer is empty.

The motivation would be to increase the transmission efficiency by providing indication on how long the queue is empty.

6. Claims 3 and 31 rejected under 35 U.S.C. 103(a) as being unpatentable over Kwak et al. (Pub No.: 2006/0140154) in view of Yeo et al. (Pub No.: 2009/0225739) and

Lin (Pub No.: 2010/0091652) as applied to claim 2 above, and further in view of Lee et al. (Pub No.: 2009/0168704).

Regarding claims 3 and 31, Kawk et al., in view of Yeo et al. and Lin failed to disclose the feature wherein the transmission of the SI is triggered when the inactivity timer expires.

Lee et al. from the same or similar fields of endeavor disclosed the feature wherein the transmission of the SI is triggered when the inactivity timer expires (Lee et al. see paragraphs 0077 and 0078; the SI is sent each time the timer expires).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Kawk et al., in view of Yeo et al. and Lin and to implement the feature as disclosed by Lee et al. to provide the feature wherein the transmission of the SI is triggered when the inactivity timer expires.

The motivation would be to improve transmission reliability by sending scheduling information from a UE to control an uplink radio resource.

7. Claims 4 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwak et al. (Pub No.: 2006/0140154) in view of Yeo et al. (Pub No.: 2009/0225739) as applied to claim 1 above, and further in view of Ranta-Aho et al. (Pub No.: 2008/0192766).

Regarding claims 4 and 32, Kwak et al. in view of Yeo et al. does not explicitly disclose the feature wherein an E-DCH transmission occurs on a condition that a

response is received on an E-DCH acquisition indication channel (E- AICH) to a preamble transmitted by the WTRU.

Ranta-Aho et al. from the same or similar fields of endeavor discloses the feature wherein an E-DCH transmission occurs on a condition that a response is received on an E-DCH acquisition indication channel (E- AICH) to a preamble transmitted by the WTRU (Ranta-Aho et al. see paragraph 0023).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Kwak et al. in view of Yeo et al. and to implement the feature as taught by Ranta-Aho et al.

The motivation would be to improve transmission efficiency.

8. Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwak et al. (Pub No.: 2006/0140154) in view of Yeo et al. (Pub No.: 2009/0225739) as applied to claim 1 above, and further in view of Fisher (Pub No.: 2005/0026623).

Regarding claims 5 and 7, Kwak et al. in view of Yeo et al. failed to disclose the feature for terminating the E-DCH transmission in case of cell reselection or radio link failure.

Fisher from the same or similar fields of endeavor disclosed the feature for terminating the E-DCH transmission in case of cell reselection or radio link failure (Fisher see paragraph 0027; a determination is whether all of the dedicated channels are NRT. If all the DCHs are not NRT, then this indicates a failure, and the procedure is terminated).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Kwak et al. in view of Yeo et al. and to implement the feature as disclosed by Fisher et al. to provide the feature for terminating E-DCH when failure is detected.

The motivation would be to reduce transmission error.

9. Claims 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwak et al. (Pub No.: 2006/0140154) in view of Yeo et al. (Pub No.: 2009/0225739) as applied to claim 1 above, and further in view of Kim et al. (Pub No.: 2012/0327833).

Regarding claims 33 and 34, Kwak et al. in view of Yeo et al. does not explicitly disclose the feature wherein the processor is further configured to determine a condition of a last hybrid automatic repeat request (HARQ) data transmission.

Kim et al. from the same or similar fields of endeavor discloses the feature wherein the processor is further configured to determine a condition of a last hybrid automatic repeat request (HARQ) data transmission (Kim et al. see paragraph 0060; the UE maintains the active period until packets stored in an HARQ processor at the time when the UE detects that the packet is the last one are completely processed and when the processing is completed, the UE enters into the sleep mode).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Kwak et al. in view of Yeo et al. and to implement the feature as taught by Kim et al.

The motivation would be to reduce power consumption.

Examiner's Note

10. Examiner has cited particular paragraphs and/or columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

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

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KAN YUEN whose telephone number is (571)270-1413. The examiner can normally be reached on Monday-Friday 11:00a.m-6:00p.m EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky O. Ngo can be reached on 571-272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/KAN YUEN/
Primary Examiner, Art Unit 2464

Notice of References Cited	Application/Control No. 12/238,910	Applicant(s)/Patent Under Reexamination PELLETIER ET AL.	
	Examiner KAN YUEN	Art Unit 2464	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0140154 A1	06-2006	Kwak et al.	370/335
*	B	US-2008/0192766 A1	08-2008	Ranta-Aho et al.	370/445
*	C	US-2009/0225739 A1	09-2009	Yeo et al.	370/345
*	D	US-2012/0327833 A1	12-2012	Kim et al.	370/311
	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.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	Art Unit
	KAN YUEN	2464

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	05/01/2012								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	N								
	9	N								
	10	N								
	11	N								
	12	N								
	13	N								
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	21	N								
	22	N								
	23	N								
	24	N								
	25	N								
	26	N								
	27	N								
	28	N								
	29	N								
	30	✓								
	31	✓								
	32	✓								
	33	✓								
	34	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	Art Unit
	KAN YUEN	2464

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	328,329,338,341,348	1/25/2013	KY
455	450,464	1/25/2013	KY
709	226,229	1/25/2013	KY

SEARCH NOTES		
Search Notes	Date	Examiner
EAST SEARCH CONSULTED WITH SPE	1/25/2013	KY
MANUAL SEARCH CLASS 370 SUBCLASS 329	1/25/2013	KY
INVENTORSHIP SEARCH	1/25/2013	KY

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	12	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) same (buffer or tebs) near8 (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 14:58
L2	334	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:21
L3	4153	(tebs or ((buffer$4 or database or stor$4 or memory or queue) near3 status)) near7 (empt$4 or zero or "0" or vacant$4 or deplet$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:24
L4	18	2 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:25
L10	18	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) with (buffer$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:32
L11	3	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-rach or (random$4 near2 access$4 near2 channel)) with (buffer$4 or queue)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:38
L12	87	(tebs same (buffer$4 near2 status))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:44
L13	1579	(tebs or (buffer$4 near2 status)) with (zero or "0" or empt$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:45
L14	34	12 13	US-PGPUB; USPAT;	AND	ON	2013/01/25 15:45

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L15	34366	(e-dch or (dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
L16	34	14 15	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
L17	4	("2009051502").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/01/25 15:50
L18	2	("20090086671").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/01/25 15:53
L21	286	(releas$4 near9 (e-dch or (enhanc$4 near4 dedicat$4 near4 channel)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:00
L22	7329	interdigital$.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
L23	21593	interdigital$	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
L24	49	21 23	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
L25	4	24 12	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
L26	2	12/346631	US-PGPUB; USPAT;	AND	ON	2013/01/25 16:03

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L27	396	(terminat$4 or releas$4 or disconnect$4 or teardown or tear-down or cancel$4) with (e-dch or (enhanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:09
L28	27105389	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:10
L29	210	27 28	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:11
L32	438	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer$4 or queu$4 or database or memory or stor$4 or register)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:13
L33	59	29 32	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:14
L34	37	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer or queue) with (zero or empt$4 or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:40
L35	55	(schedul$4 near2 information) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:10
L36	132678	(tebs or buffer or queue) with (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:12
L37	32	35 36	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:13
L38	13222	((schedul$4 near2 information) or SI) with (tebs or buffer)	US-PGPUB; USPAT;	AND	ON	2013/01/25 17:19

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L39	2208	36 38	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
L40	238	((schedul$4 near2 information) or SI) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
L41	86	39 40	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
L42	9	41 28	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
L43	1219	28 39	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:38
L44	451	(schedul$4 near2 information) with si	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
L45	14	43 44	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
L46	64	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (e-aich or aich or (acquisition near2 indication near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:52
L47	4	46 28	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:52
L48	59	(determin$7 or detect$6 or monitor$6) with (last near8	US-PGPUB; USPAT;	AND	ON	2013/01/25 18:00

		(harq))	USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L49	17	28 48	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 18:00

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	12	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:26
L6	1498	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
L7	4	5 6	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
L8	1549	(buffer near2 empt$4).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
L9	2	7 8	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
L19	3	11/117579	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:58

1/ 25/ 2013 6:08:17 PM

Substitute for 1449/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(use as many sheets as necessary)*				***Complete if Known***	
				Application Number	12/238,910
				Filing Date	September 26, 2008
				First Named Inventor	Pelletier, Benoit
				Art Unit	2464
				Examiner Name	Yuen, Kan
Sheet	1	of	1	**Attorney Docket Number**	IHSP_2-1853.01.US

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Foreign Patent Document Country Code- Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T
	54	KR 10-2006-0054117 A	05-22-2006	Samsung Electronics Co., Ltd.	
	55	WO 2006/043782 A1	04-27-2006	Samsung Electronics Co., Ltd.	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials	Cite No.	Include name of the author, 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
	56	3rd Generation Partnership Project (3GPP), R2-073567, "Issues regarding persistent scheduling", NTT DoCoMo, Inc., 3GPP TSG RAN WG2 #59, Athens, Greece, August 20-24, 2007, 4 pages	

Examiner Signature	/Kan Yuen/	**Date Considered**	01/25/2013

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: **Benoit Pelletier, et al.**	**Confirmation No.: 2438**
Application No.: 12/238,910	**Group Art Unit: 2464**
Filing Date: September 26, 2008	**Examiner: Kan Yuen**

For: Method And Apparatus For Terminating Transmission Of A Message In An Enhanced Random Access Channel

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

Sir:

REPLY PURSUANT TO 37 CFR § 1.111

In response to the Official Action dated January 31, 2013, reconsideration is respectfully requested in view of the amendments and/or remarks as indicated below:

☐ **Amendments to the Specification** begin on page of this paper.

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

☐ **Amendments to the Drawings** begin on page of this paper and include an attached replacement sheet.

☒ **Remarks** begin on page 7 of this paper.

☒ The Commissioner is hereby authorized to charge any fee deficiency, charge any additional fees, or credit any overpayment of fees, associated with this application in connection with this filing, or any future filing, submitted to the U.S. Patent and Trademark Office during the pendency of this application, to Deposit Account No. 09-0435.

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

Listing of Claims:

1. (Currently Amended) A method for completing an enhanced dedicated channel (E-DCH) transmission in a cell forward access channel (CELL_FACH) state by a wireless transmit/receive unit (WTRU), the method comprising:

determining that a buffer is empty;

on a condition that the buffer is empty, triggering a transmission by the WTRU of scheduling information (SI) with a total enhanced dedicated channel (E-DCH) buffer status (TEBS) equal to zero;

determining a last hybrid automatic repeat request (HARQ) data transmission; and

on a condition that the buffer is empty and the last hybrid automatic repeat request (HARQ) data transmission has been determined, releasing an E-DCH resource.

2. (Original) The method as in claim 1, wherein an inactivity timer is started when the buffer is empty.

3. (Original) The method as in claim 2, wherein the transmission of the SI is triggered when the inactivity timer expires.

4. (Previously Presented) The method as in claim 1, wherein an E-DCH transmission occurs on a condition that a response is received on an E-DCH acquisition indication channel (E-AICH) to a preamble transmitted by the WTRU.

5. (Previously Presented) The method as in claim 1, further comprising completing the E-DCH transmission in case of cell reselection or radio link failure.

6. (Currently Amended) A wireless transmit/receive unit (WTRU) comprising:

a processor configured to:

determine that a buffer is empty;

on a condition that the buffer is empty, trigger a transmission of scheduling information (SI) with a total E-DCH buffer status (TEBS) equal to zero;

determine a last hybrid automatic repeat request (HARQ) data transmission; and

on a condition that the buffer is empty and the last hybrid automatic repeat request (HARQ) data transmission has been determined, release an E-DCH resource.

7. (Previously Presented) The WTRU as in claim 6, the processor further configured to complete the E-DCH transmission on a condition cell reselection or radio link failure.

8. (Withdrawn) A method for terminating an enhanced random access channel (E-RACH) message in an E-RACH transmission, the method comprising:

releasing the E-RACH message during transition from cell forward access channel (CELL_FACH) state to cell dedicated channel (CELL_DCH) state.

9. (Withdrawn) The method as in claim 8, further comprising terminating the E-RACH message in case of cell reselection or radio link failure.

10. (Withdrawn) A wireless transmit receive unit (WTRU), comprising:

a receiver configured to receive enhanced dedicated channel (E-DCH) resources on an acquisition indication channel (AICH) and an E-DCH AICH (E-AICH); and

a processor configured to access the E-DCH resources in cell forward access channel (CELL_FACH) state, to receive a reconfiguration message indicating to switch to a cell dedicated channel (CELL_DCH) state, and to release the E-DCH resources based on switching to CELL_DCH state.

11. (Withdrawn) A method for terminating an enhanced random access channel (E-RACH) message in an E-RACH transmission, the method comprising:

receiving an explicit E-DCH termination signal; and

releasing a E-DCH resource.

12. (Withdrawn) The method as in claim 11, further comprising terminating the E-RACH message in case of cell reselection or radio link failure.

13. (Withdrawn) The method as in claim 11, wherein the explicit E-DCH termination signal comprises a special value signaled on an E-DCH absolute grant channel (E-AGCH).

14. (Withdrawn) A method for terminating an enhanced random access channel (E-RACH) message in an E-RACH transmission, the method comprising:

initiating a timer in response to a trigger; and

releasing resource allocation for common control channel (CCCH) when a maximum allowable transmission time for the CCCH has been reached.

15. (Withdrawn) The method as in claim 14, further comprising terminating the E-RACH message in case of cell reselection or radio link failure.

16. (Withdrawn) The method as in claim 14, wherein a maximum enhanced dedicated channel (E-DCH) allocation time is allocated to the CCCH transmission when an E-DCH radio network temporary identifier (E-RNTI) is not present.

17. (Withdrawn) The method as in claim 14, wherein the timer starts when a positive acknowledgement (ACK) associated with a transmitted preamble signature is received on an acquisition indication channel (AICH) or an enhanced dedicated channel (E-DCH) AICH (E-AICH).

18. (Withdrawn) The method as in claim 14, wherein the timer starts when radio resource control (RRC) provides timer values to medium access control (MAC), and after receiving resource index of an enhanced dedicated channel (E-DCH).

19. (Withdrawn) The method as in claim 14, wherein the timer starts when a wireless transmit receive unit (WTRU) starts first dedicated physical control channel (DPCCH) preamble transmission.

20. (Withdrawn) The method as in claim 19, wherein the timer starts when the first DPCCH transmission is completed after an enhanced dedicated channel (E-DCH) transmission backoff transmission time intervals (TTIs) or a first medium access control (MAC) protocol data unit (PDU) is passed to a physical layer.

21. (Withdrawn) The method as in claim 14, wherein the timer starts when a wireless transmit receive unit (WTRU) starts an enhanced dedicated channel (E-DCH) transmission.

22. (Withdrawn) The method as in claim 14, wherein a wireless transmit receive unit (WTRU) may initiate the timer when a collision resolution an enhanced dedicated channel (E-DCH) absolute grant channel (E-AGCH) carrying the WTRU E-DCH radio network temporary identifier (E-RNTI) is received.

23. (Withdrawn) A Node-B comprising:

a processor configured to determine an end of enhanced random access channel (E-RACH) message transmission; and

a transmitter connected to the processor, the transmitter configured to transmit a special value over an enhanced dedicated channel (E-DCH) absolute grant channel (E-AGCH) indicating the end of transmission.

24. (Withdrawn) A method for releasing enhanced dedicated channel (E-DCH) resources while in cell forward access channel (CELL_FACH) state, the method comprising:

terminating reception procedures for an enhanced dedicated channel (E-DCH) absolute grant channel (E-AGCH), an E-DCH relative grant channel (E-RGCH), and an E-DCH hybrid automatic repeat request (HARQ) indicator channel (E-HICH); and

terminating transmission procedures for an E-DCH dedicated physical control channel (E-DPCCH) and an enhanced dedicated physical data channel (E-DPDCH); and

resetting the medium access control (MAC) entity.

25. (Withdrawn) The method as in claim 24, wherein the channels are terminated when an enhanced random access channel (E-RACH) transmission signal has been received.

26. (Withdrawn) The method as in claim 24, wherein the channels are terminated when a common control channel (CCCH) timer has expired.

27. (Withdrawn) The method as in claim 24, wherein the channels are terminated when the scheduling information (SI) is equal to zero.

28. (Withdrawn) The method as in claim 24, wherein the MAC reset procedures include flushing the hybrid automatic repeat request (HARQ) processes, discarding remaining segments in segmentation entity of the MAC entity, and resetting a transmission sequence number (TSN) value to zero.

29. (Withdrawn) The method as in claim 24, wherein the resources are released when an inactivity timer expires.

30. (Previously Presented) The WTRU as in claim 6, wherein the processor is further configured to start an inactivity timer when the buffer is empty.

31. (Previously Presented) The WTRU as in claim 30, wherein the transmission of the SI is triggered when the inactivity timer expires.

32. (Previously Presented) The WTRU as in claim 6, wherein an E-DCH transmission occurs on a condition that a response is received on an E-DCH acquisition indication channel (E-AICH) to a preamble transmitted by the WTRU.

33. (Cancelled).

34. (Cancelled).

IPR2023-01267 Page 708

REMARKS

Claims 1-7 and 30-34 are pending in the present application. Claims 1and 6 have been amended. Claims 33 and 34 have been cancelled. Claims 8-29 were previously withdrawn. No claims have been cancelled. No new matter has been added. Support for the claim amendments can be found throughout the application, including cancelled claims 33 and 34, as well as paragraphs 0023, 0029, and 0037-0050, as found in the as-filed application. Applicants request reconsideration and withdrawal of the rejections in view of the foregoing amendments and following remarks.

Rejections under 35 U.S.C. §103

Claims 1-7 and 30-32 stand rejected under Section 103 as allegedly being obvious over one or more of U.S. Pat. Pub. No. 2006/0140154 ("Kwak"), U.S. Pat. Pub. No. 2009/0225739 ("Yeo"), U.S. Pat. Pub. No. 2010/0091652 ("Lin"), U.S. Pat. Pub. No. 2009/0168704 ("Lee"), U.S. Pat. Pub. No. 2008/0192766 ("Ranta-Aho"), U.S. Pat. Pub. No. 2005/0026623 ("Fisher"), and U.S. Pat. Pub. No. 2012/0327833 ("Kim"). The rejections are moot in view of the present claim amendments.

As amended, independent claim 1 recites "determining a last hybrid automatic repeat request (HARQ) data transmission" and "on a condition that the buffer is empty and the last hybrid automatic repeat request (HARQ) data transmission has been determined, releasing an E-DCH resource." Independent claim 6 recites similar features.

By contrast, Kim discloses an LTE method "for setting a DRX cycle that varies according to the amount of packet data in the UE" (Kim at para. 0050). In particular, Kim discloses that a UE alternates between an active period and a sleep period (Kim at FIG. 3 and paras. 0060-0062). After transmitting its data, the UE switches from the active mode to the sleep mode (*Id.*). As noted in Kim, the disclosed method is "for a connected UE in the LTE system" (Kim at para. 0025). Although Kim may disclose an LTE method for a connected UE to perform DRX operation, it nowhere teaches or suggests "on a condition that the buffer is empty and the last hybrid automatic repeat request (HARQ) data transmission has been determined, releasing

an E-DCH resource," as recited in claim 1 and similarly in claim 6. Furthermore, none of the other cited references are asserted to teach or suggest the above features.

Accordingly, Applicants submit that independent claims 1 and 6 patentably define over the asserted art for at least the reasons stated above. Inasmuch as claims 2-5, 7, and 30-32 all depend directly or indirectly on claim 1 or 6, Applicants submit that that these claims are likewise patentable. Therefore, Applicants respectfully request withdrawal of the rejection of claims 1-7 and 30-32.

CONCLUSION

In view of the foregoing, Applicants submit that the claims are allowable and that the present application is in condition for allowance. Reconsideration of the application and an early Notice of Allowance are requested. In the event that the Examiner cannot allow the present application for any reason, the Examiner is encouraged to contact the undersigned attorney to discuss resolution of any remaining issues.

Date: July 1, 2013

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PTO/AIA/22 (03-13)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): IHSP_2-1853.01.US

Application Number: 12/238,910

Filed: September 26, 2008

For: Method And Apparatus For Terminating Transmission Of A Message In An Enhanced Random Access Channel

Art Unit: 2464

Examiner: Kan Yuen

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☑	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$ 600.00
☐	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

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

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 09-0435.

☑ Payment made via EFS-Web.

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.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 61,895.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Stuart A. Schanbacher/ — Signature

July 1, 2013 — Date

Stuart A. Schanbacher — Typed or printed name

215-558-5740 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 6 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 PCT, 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.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	12238910
Filing Date:	26-Sep-2008
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Filer:	Stuart A. Schanbacher/melissa overline
Attorney Docket Number:	IHSP_2-1853.01.US

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 - 2 months with $0 paid	1252	1	600	600

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**600**

Electronic Acknowledgement Receipt	
EFS ID:	16211487
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	15800
Filer:	Stuart A. Schanbacher/melissa overline
Filer Authorized By:	Stuart A. Schanbacher
Attorney Docket Number:	IHSP_2-1853.01.US
Receipt Date:	01-JUL-2013
Filing Date:	26-SEP-2008
Time Stamp:	21:38:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$600
RAM confirmation Number	8195
Deposit Account	090435
Authorized User	
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)	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IHSP_2_185301US_Response_to_Non_Final_OA_dated_1_31_13.pdf	135184 15cb94e35b8267ef1e71ad37718829242c5f290e	yes	9
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	6	
	Applicant Arguments/Remarks Made in an Amendment		7	9	
Warnings:					
Information:					
2	Extension of Time	IHSP_2_185301US_EOT.pdf	121532 9643503fba602da2f01d957fddf33fa9097c74ce	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30734 04b7179890f284afe8d42f4bac0d756445904c4e	no	2
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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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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/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/238,910	Filing Date 09/26/2008	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 = *		X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 = *		X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	07/01/2013	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 32	Minus	** 34	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 8	Minus	***8	= 0	X $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/ROSS W. BROWN/

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.**

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DOCKET NO.: IHSP_2-1853.01.US **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
Benoit Pelletier	**Confirmation No.: 2438**
Application No.: 12/238,910	**Group Art Unit: 2464**
Filing Date: September 26, 2008	**Examiner: YUEN, KAN**

For: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

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

Applicant-Initiated Interview Summary

Date of Interview:

Interview Type: ☐Personal ☒Telephonic ☐Electronic Mail ☐Video Conference ☐ Other:

Participants:

From PTO: (Include Name and Title)

1.

For Applicant:

1.

☐An exhibit or demonstration was included and is described below:

The claims discussed included:

The ☐art ☐prior art discussed included:

An agreement ☐was ☐was not reached.

☐It was agreed that the attached claims are allowable.

☐It was agreed that the attached amendment would be entered.

☒The interview is summarized below.

Summary of Telephonic Interview

Applicants thank Examiner Yuen for taking the time to conduct telephonic interviews on July 9, 2013 and July 24, 2013. During the interviews, the undersigned and Examiner Yuen discussed the pending claims in light of asserted reference U.S. Pat. Pub. No. 2006/0140154 ("Kwak"). No agreement was reached during the interviews. Shown below is a summary of the arguments presented in relation to the Kwak reference.

Independent claims 1 and 6 stand rejected, at least in part, by Kwak. However, Kwak nowhere teaches or suggests "on a condition that the buffer is empty and the last hybrid automatic repeat request (HARQ) data transmission has been determined, releasing an E-DCH resource" as recited in claim 1 and similarly in claim 6.

In contrast to the claimed features, Kwak simply recites discontinuing an E-DCH transmission. The Office Action notes that paragraph 0090 of Kwak recites that "the UE discontinues the E-DCH data transmission," and alleges that such disclosure means that the UE also releases its E-DCH resources (Office Action dtd 1/31/13 at p. 3). However, paragraph 0090 of Kwak is silent regarding E-DCH resources. In addition, the rest of the Kwak reference indicates that E-DCH transmissions may be discontinued without releasing E-DCH resources. For example, as shown with reference to Figs. 13 and 14 and their corresponding descriptions, an E-DCH transmission may be discontinued, but may start again if the UE has E-DCH data (e.g., see Fig. 13 at 1307/1302 and Fig. 14 at 1407/1402). Because the UE may again start E-DCH transmissions, the UE does not release its resources. That is, Kwak nowhere teaches or suggests "on a condition that the buffer is empty and the last hybrid automatic repeat request (HARQ) data transmission has been determined, releasing an E-DCH resource" as recited in claim 1 and similarly in claim 6.

Accordingly, Applicants submit that independent claims 1 and 6 patentably define over Kwak for at least the reasons stated above. Inasmuch as claims 2-5, 7, and 30-32 all depend directly or indirectly on claim 1 or 6, Applicants submit that that these claims likewise patentably define over Kwak. Therefore, Applicants respectfully request withdrawal of the rejection of claims 1-7 and 30-32.

Date: August 5, 2013

/Stuart A. Schanbacher/
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Electronic Acknowledgement Receipt

EFS ID:	16497106
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	15800
Filer:	Stuart A. Schanbacher/melissa overline
Filer Authorized By:	Stuart A. Schanbacher
Attorney Docket Number:	IHSP_2-1853.01.US
Receipt Date:	05-AUG-2013
Filing Date:	26-SEP-2008
Time Stamp:	11:50:11
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	Applicant summary of interview with examiner	IHSP_2_1853_01US_as_filed_applicant_initiated_interview_summary.pdf	91231 d4a6a1aa137c6160097516425e50b18a83156ae0	no	4
Warnings:					
Information:					

Total Files Size (in bytes):	91231

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.

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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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	IHSP_2-1853.01.US	2438

15800 7590 08/19/2013

Condo Roccia LLP
One Liberty Place
Suite 2200
Philadelphia, PA 19103

EXAMINER	
YUEN, KAN	
ART UNIT	**PAPER NUMBER**
2464	

MAIL DATE	DELIVERY MODE
08/19/2013	PAPER

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.

Office Action Summary	Application No. 12/238,910	Applicant(s) PELLETIER ET AL.	
	Examiner KAN YUEN	Art Unit 2464	AIA (First Inventor to File) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* 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 *5 August 2013*.

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

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

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

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

Disposition of Claims

5)☒ Claim(s) *1-7 and 30-32* is/are pending in the application.

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

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-7 and 30-32* is/are rejected.

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

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

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

Application Papers

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

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

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some * c)☐ None of the:

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

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

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

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

Attachment(s)

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

2) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

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

4) ☐ Other: _____.

Detailed Action

Response to Arguments

1. Applicant's arguments with respect to claims 1-7 and 30-32 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

Claim Rejections - 35 USC § 102

2. 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 (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 4, 6 and 32 are rejected under 35 U.S.C. 102(e) as being anticipated by Wager et al. (Pub No.: 2009/025709).

Regarding claim 6, Wager et al. disclosed a wireless transmit/receive unit (WTRU) (fig. 5A; UE 10) comprising:

a processor (fig. 5A; UE 10) **configured to:**

determining that a buffer (fig. 5a; buffer 14) **is empty** (Wager et al. see fig. 6; a decision is made in step S16 whether there is any more data in the RLC buffer 14);

on a condition that the buffer is empty, trigger a transmission of scheduling information (SI) with a total enhanced dedicated channel (E-DCH)

buffer status (TEBS) equal to zero (Wager et al. see fig. 6; paragraph 0046; if there is no more data in the buffer 14, the controller 18 creates a MAC-PDU that includes an indicator indicating that the mobile's buffer is empty). The indicator is the scheduling information (SI) which indicates the buffer status equals zero;

determining a last hybrid automatic repeat request (HARQ) data transmission (Wager et al. see paragraph 0046; a decision is made in the UE in step S26 whether all of the HARQ processes for this UE uplink transmission have been completed); and

on a condition that the buffer is empty and the last HARQ data transmission has been determined, releasing an E-DCH resource allocation (Wager et al. see paragraph 0046; if they are, the UE releases the common E-DCH resource as step S28). Thus, the E-DCH resource is released based on the WTRU buffer status 14 and the HARQ processes as shown in fig. 6.

Claim 1 is rejected similar to claim 6.

Regarding claims 4 and 32, Wager et al. disclosed the feature wherein an E-DCH transmission occurs on a condition that a response is received on an E-DCH acquisition indication channel (E- AICH) to a preamble transmitted by the WTRU (Wager et al. see paragraph 0025; the AICH echoes/response back an identical signature sequence as received on the RACH. In the AICH acknowledgement, the base station echoed back the same second preamble signature sequence and informed the UE which common E-DCH resource it has assigned to the UE).

4. Claims 2 and 30 rejected under 35 U.S.C. 103(a) as being unpatentable over Wager et al. (Pub No.: 2009/025709) in view of Lin (Pub No.: 2010/0091652).

Regarding claims 2 and 30, Wager et al. failed to disclose the feature wherein an inactivity timer is started when the buffer is empty.

Lin from the same or similar fields of endeavor disclosed the feature wherein an inactivity timer is started when the buffer is empty (Lin see paragraph 0038; when a queue becomes empty, the timer corresponding to the queue starts counting).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Wager et al. and to implement the feature as disclosed by Lin to provide the feature wherein an inactivity timer is started when the buffer is empty.

The motivation would be to increase the transmission efficiency by providing indication on how long the queue is empty.

5. Claims 3 and 31 rejected under 35 U.S.C. 103(a) as being unpatentable over Wager et al. (Pub No.: 2009/025709) in view of Lin (Pub No.: 2010/0091652) as applied to claim 2 above, and further in view of Lee et al. (Pub No.: 2009/0168704).

Regarding claims 3 and 31, Wager et al. in view of Lin failed to disclose the feature wherein the transmission of the SI is triggered when the inactivity timer expires.

Lee et al. from the same or similar fields of endeavor disclosed the feature wherein the transmission of the SI is triggered when the inactivity timer expires (Lee et al. see paragraphs 0077 and 0078; the SI is sent each time the timer expires).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Wager et al. in view of Lin and to implement the feature as disclosed by Lee et al. to provide the feature wherein the transmission of the SI is triggered when the inactivity timer expires.

The motivation would be to improve transmission reliability by sending scheduling information from a UE to control an uplink radio resource.

6. Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wager et al. (Pub No.: 2009/025709) in view of Fisher (Pub No.: 2005/0026623).

Regarding claims 5 and 7, Wager et al. failed to disclose the feature for terminating the E-DCH transmission in case of cell reselection or radio link failure.

Fisher from the same or similar fields of endeavor disclosed the feature for terminating the E-DCH transmission in case of cell reselection or radio link failure (Fisher see paragraph 0027; a determination is whether all of the dedicated channels are NRT. If all the DCHs are not NRT, then this indicates a failure, and the procedure is terminated).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the disclosure of Wager et al. and to implement the feature as disclosed by Fisher et al. to provide the feature for terminating E-DCH when failure is detected.

The motivation would be to reduce transmission error.

Examiner's Note:

7. Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

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

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KAN YUEN whose telephone number is (571)270-1413. The examiner can normally be reached on Monday-Friday 11:00a.m-6:00p.m EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky O. Ngo can be reached on 571-272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/KAN YUEN/
Primary Examiner, Art Unit 2464

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	05/01/2012								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	N								
	9	N								
	10	N								
	11	N								
	12	N								
	13	N								
	14	N								
	15	N								
	16	N								
	17	N								
	18	N								
	19	N								
	20	N								
	21	N								
	22	N								
	23	N								
	24	N								
	25	N								
	26	N								
	27	N								
	28	N								
	29	N								
	30	✓								
	31	✓								
	32	✓								
	33	-								
	34	-								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	Art Unit
	KAN YUEN	2464

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	328,329,338,341,348	8/13/2013	KY
455	450,464	8/13/2013	KY
709	226,229	8/13/2013	KY

SEARCH NOTES		
Search Notes	Date	Examiner
EAST SEARCH CONSULTED WITH SPE	8/13/2013	KY
MANUAL SEARCH CLASS 370 SUBCLASS 329	8/13/2013	KY
INVENTORSHIP SEARCH	8/13/2013	KY

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	15	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) same (buffer or tebs) near8 (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L2	390	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L3	4356	(tebs or ((buffer$4 or database or stor$4 or memory or queue) near3 status)) near7 (empt$4 or zero or "0" or vacant$4 or deplet$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L4	23	L2 L3	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L5	21	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) with (buffer$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L6	3	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-rach or (random$4 near2 access$4 near2 channel)) with (buffer$4 or queue)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L7	102	(tebs same (buffer$4 near2 status))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L8	1650	(tebs or (buffer$4 near2 status)) with (zero or "0" or empt$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L9	41	L7 L8	US-PGPUB; USPAT;	AND	ON	2013/08/13 16:09

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L10	36633	(e-dch or (dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L11	41	L9 L10	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L12	4	("2009051502").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/08/13 16:09
L13	2	("20090086671").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/08/13 16:09
L14	330	(releas$4 near9 (e-dch or (enhanc$4 near4 dedicat$4 near4 channel)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L15	7690	interdigital$.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L16	22367	interdigital$	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L17	62	L14 L16	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L18	6	L17 L7	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L19	3	12/346631	US-PGPUB; USPAT;	AND	ON	2013/08/13 16:09

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L20	456	(terminat$4 or releas$4 or disconnect$4 or teardown or tear-down or cancel$4) with (e-dch or (enhanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L21	27282371	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L22	217	L20 L21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L23	501	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer$4 or queu$4 or database or memory or stor$4 or register)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L24	60	L22 L23	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L25	45	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer or queue) with (zero or empt$4 or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L26	65	(schedul$4 near2 information) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L27	138240	(tebs or buffer or queue) with (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L28	38	L26 L27	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L29	13820	((schedul$4 near2 information) or SI) with (tebs or buffer)	US-PGPUB; USPAT;	AND	ON	2013/08/13 16:09

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L30	2277	L27 L29	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L31	251	((schedul$4 near2 information) or SI) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L32	93	L30 L31	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L33	10	L32 L21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L34	1239	L21 L30	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L35	523	(schedul$4 near2 information) with si	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L36	15	L34 L35	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L37	82	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (e-aich or aich or (acquisition near2 indication near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L38	4	L37 L21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
L39	68	(determin$7 or detect$6 or monitor$6) with (last near8	US-PGPUB; USPAT;	AND	ON	2013/08/13 16:09

		(harq))	USOCR; FPRS; EPO; DERWENT; IBM_TDB			
L40	19	L21 L39	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/08/13 16:09
S1	12	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) same (buffer or tebs) near8 (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 14:58
S2	334	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:21
S3	4153	(tebs or ((buffer$4 or database or stor$4 or memory or queue) near3 status)) near7 (empt$4 or zero or "0" or vacant$4 or deplet$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:24
S4	18	S2 S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:25
S5	18	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) with (buffer$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:32
S6	3	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-rach or (random$4 near2 access$4 near2 channel)) with (buffer$4 or queue)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:38
S7	87	(tebs same (buffer$4 near2 status))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:44
S8	1579	(tebs or (buffer$4 near2 status)) with (zero or "0" or empt$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:45
S9	34	S7 S8	US-PGPUB; USPAT;	AND	ON	2013/01/25 15:45

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S10	34366	(e-dch or (dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
S11	34	S9 S10	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
S12	4	("2009051502").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/01/25 15:50
S13	2	("20090086671").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/01/25 15:53
S14	286	(releas$4 near9 (e-dch or (enhanc$4 near4 dedicat$4 near4 channel)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:00
S15	7329	interdigital$.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S16	21593	interdigital$	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S17	49	S14 S16	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S18	4	S17 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S19	2	12/346631	US-PGPUB; USPAT;	AND	ON	2013/01/25 16:03

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S20	396	(terminat$4 or releas$4 or disconnect$4 or teardown or tear-down or cancel$4) with (e-dch or (enhanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:09
S21	27105389	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:10
S22	210	S20 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:11
S25	438	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer$4 or queu$4 or database or memory or stor$4 or register)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:13
S26	59	S22 S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:14
S27	37	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer or queue) with (zero or empt$4 or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:40
S28	55	(schedul$4 near2 information) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:10
S29	132678	(tebs or buffer or queue) with (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:12
S30	32	S28 S29	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:13
S31	13222	((schedul$4 near2 information) or SI) with (tebs or buffer)	US-PGPUB; USPAT;	AND	ON	2013/01/25 17:19

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S32	2208	S29 S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S33	238	((schedul$4 near2 information) or SI) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S34	86	S32 S33	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S35	9	S34 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S36	1219	S21 S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:38
S37	451	(schedul$4 near2 information) with si	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
S38	14	S36 S37	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
S39	64	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (e-aich or aich or (acquisition near2 indication near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:52
S40	4	S39 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:52
S41	59	(determin$7 or detect$6 or monitor$6) with (last near8	US-PGPUB; USPAT;	AND	ON	2013/01/25 18:00

		(harq))	USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S42	17	S21 S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 18:00

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L41	15	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:09
L42	1623	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:09
L43	4	L41 L42	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:09
L44	1618	(buffer near2 empt$4).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:09
L45	2	L43 L44	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:09
L46	3	11/117579	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:09
L47	12415	(schedul$4 near5 information).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:14
L48	2010	(buffer near3 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:14
L49	150	47 48	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:14
L50	21	(releas$5 near4 dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:15
L51	4	49 50	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:15
L52	1748	(buffer$5 near4 empty).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:17
L53	2	51 52	US-PGPUB; USPAT; UPAD	AND	ON	2013/08/13 16:18
S43	12	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:26
S44	1498	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
S45	4	S43 S44	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
S46	1549	(buffer near2 empt$4).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
S47	2	S45 S46	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
S48	3	11/117579	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:58

8/ 13/ 2013 4:19:12 PM
C:\ Users\ kyuen\ Documents\ EAST\ Workspaces\ 12238910.wsp

PTO/SB/80 (11-08)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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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:

☑ Practitioners associated with the Customer Number: 24374

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:

☑ The address associated with Customer Number: 24374

OR

☐ Firm or Individual Name	Volpe and Koenig, P.C.		
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

INTERDIGITAL PATENT HOLDINGS, INC.
200 Bellevue Parkway
Suite 300, Wilmington, Delaware 19809

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	[signature]	Date	8 October 2013
Name	Christos A. Ioannidi	Telephone	(302) 281-3665
Title	Patent Executive, InterDigital Patent Holdings, Inc.		

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

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

IPH-2-1853.01.US

PTO/SB/96 (07-09)
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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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: INTERDIGITAL PATENT HOLDINGS, INC.

Application No./Patent No.: 12/238,910 Filed/Issue Date: September 26, 2008

Titled: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

INTERDIGITAL PATENT HOLDINGS, INC. , 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 021966, Frame 0202, 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: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

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

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.

C Ioannidi — Signature

Oct. 2013 — Date

Christos A. Ioannidi — Printed or Typed Name

Patent Executive, InterDigital Patent Holdings, Inc. — 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:	17084427
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	15800
Filer:	Robert D. Leonard
Filer Authorized By:	
Attorney Docket Number:	IHSP_2-1853.01.US
Receipt Date:	10-OCT-2013
Filing Date:	26-SEP-2008
Time Stamp:	16:52:33
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	IPH-GeneralPOA-Pre-AIA-EXECUTED.pdf	900801 3c95d10c7f29439c73be7eb99492e376e4339460	no	1

Warnings:	
Information:	

2	Assignee showing of ownership per 37 CFR 3.73.	IPH-2-1853-01-US_Executed373b.pdf	755891 191f7e0f57951e40a67429ba35450a2076d45497	no	1

Warnings:	
Information:	
Total Files Size (in bytes):	1656692

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

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

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

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/238,910	09/26/2008	Benoit Pelletier	IHSP_2-1853.01.US

CONFIRMATION NO. 2438

POA ACCEPTANCE LETTER

24374
VOLPE AND KOENIG, P.C.
DEPT. ICC
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

OC000000064383518

Date Mailed: 10/21/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/10/2013.

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.

/ddinh/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/238,910	09/26/2008	Benoit Pelletier	IHSP_2-1853.01.US

CONFIRMATION NO. 2438

15800
Condo Roccia LLP
One Liberty Place
Suite 2200
Philadelphia, PA 19103

POWER OF ATTORNEY NOTICE

OC000000064383475

Date Mailed: 10/21/2013

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/10/2013.

- 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).

/ddinh/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of: Pelletier et al.	
Application No.: 12/238,910	
Confirmation No.: 2438	Our File: IPH-2-1853.01.US
Filed: September 26, 2008	Date: October 21, 2013
For: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL	
Group: 2464	
Examiner: Kan YUEN	

REPLY PURSUANT TO 37 C.F.R. §1.116

Mail Stop After Final
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Madam:

This Reply is being filed within two months of the August 19, 2013 Final Rejection. Since October 19, 2013 was a Saturday, this Reply is being filed within two months from the August 19, 2013 Final Rejection. Expedited Handling pursuant to MPEP 714.13 is respectfully requested.

2719729-1

REMARKS/ARGUMENTS

Claims 1-7, and 30-32 are currently pending in this application. Claims 33-34 were previously canceled without prejudice. Claims 8-29 were previously withdrawn.

Claim Rejections - 35 USC § 102

Claims 1, 4, 6, and 32 are rejected under 35 USC 102(e) as being anticipated by Wager et al. (US Publication No. 2009/0225709).

Applicants submit that Wager is not proper 35 USC 102(e) art against the pending claims. For reasons already developed in the record (see, for example, page 2 of January 31, 2013 Office Action, October 12, 2012 Supplemental Response, and April 20, 2012 Response), Applicants submit that the provisional application of Wager does not support all of the subject matter disclosed in the cited Wager publication. Accordingly, Wager is not a proper prior art reference under 35 USC 102(e). For at least this reason, Applicants respectfully request withdrawal of this 35 USC 102(e) rejection.

Claim Rejection – 35 USC § 103

Claims 2 and 30 are rejected under 35 USC 103(a) as being unpatentable over Wager in view of Lin (US Publication No. 2010/0091652).

As argued above, Wager is not a proper prior art reference. Accordingly, Wager in view of Lin does not render claims 2 and 30 obvious. Withdrawal of this 35 USC 103(a) rejection is respectfully requested.

Claims 3 and 31 are rejected under 35 USC 103(a) as being unpatentable over Wager in view of Lin and further in view of Lee et al. (US Publication No. 2009/0168704).

As argued above, Wager is not a proper prior art reference. Accordingly, Wager in view of Lin and Lee et al. does not render claims 3 and 31 obvious. Withdrawal of this 35 USC 103(a) rejection is respectfully requested.

Claims 5 and 7 are rejected under 35 USC 103(a) as being unpatentable over Wager in view of Fisher (US Publication No. 2005/0026623).

As argued above, Wager is not a proper prior art reference. Accordingly, Wager in view of Fisher does not render claims 5 and 7 obvious. Withdrawal of this 35 USC 103(a) rejection is respectfully requested.

Conclusion

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

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

Respectfully submitted,

Pelletier et al.

By /Robert D. Leonard/
Robert D. Leonard
Registration No. 57,204

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

RDL/kmm
Enclosure

Electronic Acknowledgement Receipt	
EFS ID:	17185264
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	24374
Filer:	Robert D. Leonard/Kathryn Monaco
Filer Authorized By:	Robert D. Leonard
Attorney Docket Number:	IHSP_2-1853.01.US
Receipt Date:	21-OCT-2013
Filing Date:	26-SEP-2008
Time Stamp:	18:20:15
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		IPH-2-1853-01-US_ReplyAfterFinal.PDF	92456 46f75ac1adeb59719785ad85636e26891694322c	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Applicant Arguments/Remarks Made in an Amendment	2	4
Warnings:			
Information:			
	Total Files Size (in bytes):	92456	

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New Applications Under 35 U.S.C. 111
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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
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

24374 7590 11/08/2013
VOLPE AND KOENIG, P.C.
DEPT. ICC
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER	
YUEN, KAN	
ART UNIT	**PAPER NUMBER**
2464	

DATE MAILED: 11/08/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	IPH-2-1853.01.US	2438

TITLE OF INVENTION: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

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	02/10/2014

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)

24374 7590 11/08/2013
VOLPE AND KOENIG, P.C.
DEPT. ICC
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

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.
12/238,910	09/26/2008	Benoit Pelletier	IPH-2-1853.01.US	2438

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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	02/10/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
YUEN, KAN	2464	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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	IPH-2-1853.01.US	2438

24374 7590 11/08/2013

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

EXAMINER	
YUEN, KAN	

ART UNIT	PAPER NUMBER
2464	

DATE MAILED: 11/08/2013

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 349 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 349 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.

Notices of Allowance and Fee(s) Due mailed between October 1, 2013 and December 31, 2013

(Addendum to PTOL-85)

If the "Notice of Allowance and Fee(s) Due" has a mailing date on or after October 1, 2013 and before January 1, 2014, the following information is applicable to this application.

If the issue fee is being timely paid on or after January 1, 2014, the amount due is the issue fee and publication fee in effect January 1, 2014. On January 1, 2014, the issue fees set forth in 37 CFR 1.18 decrease significantly and the publication fee set forth in 37 CFR 1.18(d)(1) decreases to $0.

If an issue fee or publication fee has been previously paid in this application, applicant is not entitled to a refund of the difference between the amount paid and the amount in effect on January 1, 2014.

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	12/238,910	PELLETIER ET AL.	
	Examiner	Art Unit	
	KAN YUEN	2464	

All participants (applicant, applicant's representative, PTO personnel):

(1) *KAN YUEN*. (3)_____.

(2) *Robert Leonard*. (4)_____.

Date of Interview: *01 November 2013*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *n/a*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Discussed about the Examiner's Amendment and to cancel withdrawn claims 8-29 .

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/KAN YUEN/ Primary Examiner, Art Unit 2464	

Notice of Allowability	Application No. 12/238,910	Applicant(s) PELLETIER ET AL.	
	Examiner KAN YUEN	Art Unit 2464	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 *10/21/2013*.
   ☐ 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 *1-7,30-32 (Renumbered 1-10 Respectively)*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   Certified copies:
   a) ☐ All b) ☐ Some *c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

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

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

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

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20131101* .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/KAN YUEN/
Primary Examiner, Art Unit 2464

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Robert Leonard on 11/1/2013.

The application has been amended as follows:

Claims 8-29 are now cancelled.

Allowable Subject Matter

2. Claims 1-7 and 30-32 are allowed. The prior art of record fails to disclose the features on a condition that the buffer is empty, triggering a transmission by the WTRU of scheduling information (SI) with a total enhanced dedicated channel (E-DCH) buffer status (TEBS) equal to zero; determining a last hybrid automatic repeat request (HARQ) data transmission; and on a condition that the buffer is empty and the last hybrid automatic repeat request (HARQ) data transmission has been determined, releasing an E-DCH resource, as recited in claims 1 and 6.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KAN YUEN whose telephone number is (571)270-1413. The examiner can normally be reached on Monday-Friday 11:00a.m-6:00p.m EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky O. Ngo can be reached on 571-272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/KAN YUEN/
Primary Examiner, Art Unit 2464

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	12/238,910	PELLETIER ET AL.	
	Examiner	Art Unit	
	KAN YUEN	2464	

All participants (applicant, applicant's representative, PTO personnel):

(1) *KAN YUEN*. (3)_____.

(2) *Robert Leonard*. (4)_____.

Date of Interview: *01 November 2013*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *n/a*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

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☐ Attachment

/KAN YUEN/ Primary Examiner, Art Unit 2464	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	12	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) same (buffer or tebs) near8 (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 14:58
S2	334	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:21
S3	4153	(tebs or ((buffer$4 or database or stor$4 or memory or queue) near3 status)) near7 (empt$4 or zero or "0" or vacant$4 or deplet$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:24
S4	18	S2 S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:25
S5	18	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) with (buffer$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:32
S6	3	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-rach or (random$4 near2 access$4 near2 channel)) with (buffer$4 or queue)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:38
S7	87	(tebs same (buffer$4 near2 status))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:44
S8	1579	(tebs or (buffer$4 near2 status)) with (zero or "0" or empt$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:45
S9	34	S7 S8	US-PGPUB; USPAT;	AND	ON	2013/01/25 15:45

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S10	34366	(e-dch or (dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
S11	34	S9 S10	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
S12	4	("2009051502").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/01/25 15:50
S13	2	("20090086671").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/01/25 15:53
S14	286	(releas$4 near9 (e-dch or (enhanc$4 near4 dedicat$4 near4 channel)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:00
S15	7329	interdigital$.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S16	21593	interdigital$	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S17	49	S14 S16	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S18	4	S17 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S19	2	12/346631	US-PGPUB; USPAT;	AND	ON	2013/01/25 16:03

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S20	396	(terminat$4 or releas$4 or disconnect$4 or teardown or tear-down or cancel$4) with (e-dch or (enhanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:09
S21	27105389	(@rlad<"20070928" or @ad<"20070928" or @ptad<"20070928")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:10
S22	210	S20 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:11
S25	438	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer$4 or queu$4 or database or memory or stor$4 or register)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:13
S26	59	S22 S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:14
S27	37	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer or queue) with (zero or empt$4 or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:40
S28	55	(schedul$4 near2 information) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:10
S29	132678	(tebs or buffer or queue) with (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:12
S30	32	S28 S29	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:13
S31	13222	((schedul$4 near2 information) or SI) with (tebs or buffer)	US-PGPUB; USPAT;	AND	ON	2013/01/25 17:19

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S32	2208	S29 S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S33	238	((schedul$4 near2 information) or SI) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S34	86	S32 S33	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S35	9	S34 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S36	1219	S21 S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:38
S37	451	(schedul$4 near2 information) with si	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
S38	14	S36 S37	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
S39	64	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (e-aich or aich or (acquisition near2 indication near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:52
S40	4	S39 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:52
S41	59	(determin$7 or detect$6 or monitor$6) with (last near8 (harq))	US-PGPUB; USPAT;	AND	ON	2013/01/25 18:00

			USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S42	17	S21 S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 18:00
S51	2	("20090225709").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/10/28 15:59
S52	7	(releas$4 or cancel$5 or cancellation or clos$4 or disconnect$5 or terminat$5 or teardown or tear-down) with (e-dch or edch or dch or (dedicat$4 near2 channel)) with (harq) same (buffer$4 or stor$3 or memory) near4 (empty or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/10/28 16:04

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L6	16	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/11/01 12:56
L7	1663	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/11/01 12:56
L8	4	L6 L7	US-PGPUB; USPAT; UPAD	AND	ON	2013/11/01 12:56
L9	1650	(buffer near2 empt$4).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/11/01 12:56
L10	2	L8 L9	US-PGPUB; USPAT; UPAD	AND	ON	2013/11/01 12:56
L11	73	(trigger$4 near5 transmission near7 schedul$6).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/11/01 13:00
L12	1	10 11	US-PGPUB; USPAT; UPAD	AND	ON	2013/11/01 13:00
S43	12	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:26
S44	1498	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
S45	4	S43 S44	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
S46	1549	(buffer near2 empt$4).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
S47	2	S45 S46	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
S48	3	11/117579	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:58

11/ 1/ 2013 1:00:45 PM
C:\ Users\ kyuen\ Documents\ EAST\ Workspaces\ 12238910.wsp

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

CPC						
Symbol					**Type**	**Version**
H04W		28	/	04	F	20130101
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CPC Combination Sets						
Symbol				**Type**	**Set**	**Ranking**	**Version**
			/				
			/				

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	10	
/KAN YUEN/ Primary Examiner.Art Unit 2464	11/01/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

U.S. Patent and Trademark Office — Part of Paper No. 20131028

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

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	338				
455	450				

NONE	Total Claims Allowed:	
(Assistant Examiner) (Date)	10	
/KAN YUEN/ Primary Examiner.Art Unit 2464 11/01/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner) (Date)	1	6

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		17												
2	2		18												
3	3		19												
4	4		20												
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	11		27												
	12		28												
	13		29												
	14	8	30												
	15	9	31												
	16	10	32												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	10	
/KAN YUEN/ Primary Examiner.Art Unit 2464	11/01/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

U.S. Patent and Trademark Office Part of Paper No. 20131028

OK TO ENTER: /K.Y./

11/01/2013

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of: Pelletier et al.	
Application No.: 12/238,910	
Confirmation No.: 2438	Our File: IPH-2-1853.01.US
Filed: September 26, 2008	Date: October 21, 2013
For: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL	
Group: 2464	
Examiner: Kan YUEN	

REPLY PURSUANT TO 37 C.F.R. §1.116

Mail Stop After Final
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Madam:

This Reply is being filed within two months of the August 19, 2013 Final Rejection. Since October 19, 2013 was a Saturday, this Reply is being filed within two months from the August 19, 2013 Final Rejection. Expedited Handling pursuant to MPEP 714.13 is respectfully requested.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	Art Unit
	KAN YUEN	2464

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	328,329,338,341,348	11/1/2013	KY
455	450,464	11/1/2013	KY
709	226,229	11/1/2013	KY

SEARCH NOTES		
Search Notes	Date	Examiner
EAST SEARCH CONSULTED WITH SPE	11/1/2013	KY
MANUAL SEARCH CLASS 370 SUBCLASS 329	11/1/2013	KY
INVENTORSHIP SEARCH	11/1/2013	KY

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	INTERFERENCE SEARCH PRINTOUT	11/1/2013	KY

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	11/01/2013								
1	1	=								
2	2	=								
3	3	=								
4	4	=								
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10	32	=								
	33	-								
	34	-								

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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	IPH-2-1853.01.US	2438

24374 7590 12/17/2013

VOLPE AND KOENIG, P.C.
DEPT. ICC
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER	
YUEN, KAN	
ART UNIT	**PAPER NUMBER**
2464	

NOTIFICATION DATE	DELIVERY MODE
12/17/2013	ELECTRONIC

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

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

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

eoffice@volpe-koenig.com

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/238,910	26 September, 2008	PELLETIER ET AL.	IPH-2-1853.01.US

VOLPE AND KOENIG, P.C.
DEPT. ICC
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER	
KAN YUEN	
ART UNIT	PAPER
2464	20131212

DATE MAILED:

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Commissioner for Patents

The information disclosure statement (IDS) submitted on 11/4/2011 was filed after the mailing date of the Non-Final Rejection on 7/8/2011. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

/KAN YUEN/
Primary Examiner, Art Unit 2464

PTO-90C (Rev.04-03)

Substitute for 1449/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(use as many sheets as necessary)*				***Complete if Known***	
				Application Number	12/238,910
				Filing Date	September 26, 2008
				First Named Inventor	Pelletier, Benoit
				Art Unit	2464
				Examiner Name	Yuen, Kan
Sheet	1	of	1	**Attorney Docket Number**	IHSP_2-1853.01.US

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Foreign Patent Document Country Code- Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T
	40	EP 1796416 A1	06-13-2007	Evolium Sas	

NON PATENT LITERATURE DOCUMENTS

Examiner Initials	Cite No.	Include name of the author, 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
	41	International Patent Application No. PCT/US2008/077904: Written Opinion dated October 6, 2009, 10 pages	
	42	International Patent Application No. PCT/US2008/077904: International Search Report dated October 6, 2009, 7 pages	
	43	International Patent Application No. PCT/US2008/077904: Notification of Transmittal of International Preliminary Report on Patentability, March 15, 2010, 9 pages	

Examiner Signature	/Kan Yuen/	**Date Considered**	12/12/2013

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

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

■ Practitioners associated with Customer Number: 03624

OR

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

Name	Registration Number	Name	Registration Number

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

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

■ The address associated with Customer Number: 03624

OR

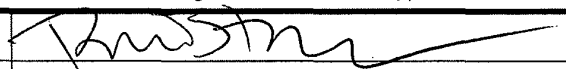
☐	Firm or Individual Name	Volpe and Koenig, P.C.		
	Address			
	City		State	Zip
	Country			
	Telephone		Email	

Assignee Name and Address: Signal Trust For Wireless Innovation
1011 Centre Road, Suite 327
Wilmington, Delaware 19805

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

SIGNATURE of Assignee of Record

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

Signature		Date	November 25, 2013
Name	HCJ Advisors LLC, as Trustee, by Bruce Bernstein	Telephone	302-573-3819
Title	President		

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

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

Privacy Act Statement

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

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

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

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 of1995, no persons arerequired to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Signal Trust for Wireless Innovation

Application No./Patent No.: 12/238,910 Filed/Issue Date: September 26, 2008

Titled: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

Signal Trust for Wireless Innovation, a corporation

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

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

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

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

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

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

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

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

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

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

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

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

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

1. From: _____ To: INTERDIGITAL PATENT HOLDINGS, INC.

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

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

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

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

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

/Abhik A. Huq/	January 23, 2014
Signature	Date
Abhik A. Huq	40,656
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

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5. A record related to an InternationalApplication 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.
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Electronic Acknowledgement Receipt

EFS ID:	18005200
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	24374
Filer:	Abhik A. Huq/Sandy Yi
Filer Authorized By:	Abhik A. Huq
Attorney Docket Number:	SIG-2-1853.01.US
Receipt Date:	23-JAN-2014
Filing Date:	26-SEP-2008
Time Stamp:	16:58:06
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	SIG_Trust_POA.PDF	165839 2a002e9c7289f27f2d31af413491301f13334d9b	no	2
Warnings:					
Information:					

2	Assignee showing of ownership per 37 CFR 3.73.	SIG_2_1853_01_US_373c.PDF	123555 86c5e30ad6f49e7b32ebbce66ba791542f7207a4	no	3

Warnings:	
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Total Files Size (in bytes):	289394

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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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New International Application Filed with the USPTO as a Receiving Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/238,910	09/26/2008	Benoit Pelletier	

CONFIRMATION NO. 2438

POA ACCEPTANCE LETTER

3624
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

OC00000066291154

Date Mailed: 01/28/2014

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/23/2014.

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.

/mbekele nedy/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/238,910	09/26/2008	Benoit Pelletier	SIG-2-1853.01.US

CONFIRMATION NO. 2438

POWER OF ATTORNEY NOTICE

24374
VOLPE AND KOENIG, P.C.
DEPT. ICC
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

OC00000066291153

Date Mailed: 01/28/2014

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/23/2014.

- 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).

/mbekele nedy/

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PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	12238910
Filing Date	2008-09-26
First Named Inventor	Pelletier et al.
Art Unit	2464
Examiner Name	Kan Yuen
Attorney Docket Number	SIG-2-1853.01.US

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	6167248	B1	2000-12-26	Hamalainen et al.	
	2	6246692	B1	2001-06-12	Dai et al.	
	3	6721566	B2	2004-04-13	Longoni et al.	
	4	6845238	B1	2005-01-18	Muller	* Corresponds to JP 2003-509982
	5	7079489	B2	2006-07-18	Massie et al.	
	6	7406314	B2	2008-07-29	Sharma	
	7	7477609	B2	2009-01-13	Agin	
	8	7480269	B2	2009-01-20	Heo et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	9	7890094	B2	2011-02-15	Iwamure	* Corresponds to JP 2009-147920
	10	7894390	B2	2011-02-22	Nakamata	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040052229	A1	2004-03-18	Terry et al.	
	2	20040068505	A1	2004-04-08	Lee et al.	
	3	20040117860	A1	2004-06-17	Yi et al.	
	4	20050026623	A1	2005-02-03	Fisher	
	5	20050053035	A1	2005-03-10	Kwak et al.	
	6	20050180371	A1	2005-08-18	Malkamaki et al.	
	7	20060039326	A1	2006-02-23	Jeong et al.	

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	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	8	20060251027	A1	2006-11-09	Chun et al.	
	9	20070115871	A1	2007-05-24	Zhang et al.	
	10	20080008152	A1	2008-01-10	Lohr et al.	
	11	20080049669	A1	2008-02-28	Lundby et al.	
	12	20080125043	A1	2008-05-29	Karmanenko et al.	
	13	20080192766	A1	2008-08-14	Ranta-Aho et al.	
	14	20080268852	A1	2008-10-30	Petrovic et al.	
	15	20090086671	A1	2009-04-02	Pelletier et al.	
	16	20090143074	A1	2009-06-04	Pelletier et al.	
	17	20090168704	A1	2009-07-02	Lee et al.	
	18	20090225709	A1	2009-09-10	Wager et al.	

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	Examiner Name	Kan Yuen
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	19	20090225739	A1	2009-09-10	Yeo et al.	
	20	20100091652	A1	2010-04-15	Lin	
	21	20100215005	A1	2010-08-26	Pradas et al.	
	22	20100278143	A1	2010-11-04	Chun et al.	
	23	20110164540	A1	2011-07-07	Lee et al.	
	24	20120327833	A1	2012-12-27	Kim et al.	

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	1	04100598	WO	A1	2004-11-18	GRANZOW WOLFGANG		☐
	2	05006829	WO	A2	2005-01-27	SHARMA SANJEEV		☐
	3	05089050	WO	A2	2005-09-29	HWANG WOONHEE		☐

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	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	4	07048470	WO	A1	2007-05-03	SEIDEL EIKO		☐
	5	07077250	WO	A2	2007-07-12	ANDERSON NICHOLAS WILLIAM		☐
	6	08097489	WO	A2	2008-08-14	MARINIER PAUL		☐
	7	08137421	WO	A2	2008-11-13	MARINIER PAUL		☐

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	1	INFINEON TECHNOLOGIES, "Multiplexing option selection in case of E_DCH_TRANSMISSION equal FALSE," 3GPP TSG- RAN WG2 Meeting #58, R2-072054, Kobe, Japan, (May 7 – 11, 2007).	☐
	2	QUALCOMM EUROPE, "Layer 1/2 aspects for enhanced UL for CELL_FACH," 3GPP TSG-RAN WG2 #59bis, R2-074390 (Oct 8-12, 2007).	☐
	3	THIRD GENERATION PARTNERSHIP PROJECT WORK AREA, "Enhanced Uplink for CELL_FACH State In FDD", TSG-RAN #37 Meeting, RP-070677, (Riga, Latvia, September 11-14, 2007).	☐
	4	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 1999)," 3GPP TS 25.425 V3.8.0 (December 2003).	☐
	5	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 4)," 3GPP TS 25.425 V4.4.0 (December 2003).	☐

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	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	6	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 5)," 3GPP TS 25.425 V5.8.0 (June 2005).	☐
	7	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 1999)," 3GPP TS 25.321 V3.17.0 (June 2004).	☐
	8	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 4)," 3GPP TS 25.321 V4.10.0 (June 2004).	☐
	9	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 5)," 3GPP TS 25.321 V5.13.0 (March 2007).	☐
	10	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 5)," 3GPP TS 25.321 V5.14.0 (September 2008).	☐
	11	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 6)," 3GPP TS 25.321 V6.13.0 (June 2007).	☐
	12	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 6)," 3GPP TS 25.321 V6.16.0 (September 2008).	☐
	13	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification(Release 7)," 3GPP TS 25.321 V7.10.0 (September 2008).	☐
	14	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 1999)," 3GPP TS 25.211 V3.12.0 (September 2002).	☐
	15	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 4)," 3GPP TS 25.211 V4.6.0 (September 2002).	☐
	16	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 5)," 3GPP TS 25.211 V5.8.0 (December 2005).	☐

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	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	17	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 6)," 3GPP TS 25.211 V6.8.0 (September 2007).	☐
	18	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 6)," 3GPP TS 25.211 V6.9.0 (November 2007).	☐
	19	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 7)," 3GPP TS 25.211 V7.6.0 (May 2008).	☐
	20	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Enhanced uplink; Overall description; Stage 2 (Release 7)," 3GPP TS 25.319 V7.6.0 (May 2008).	☐
	21	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 1999)," 3GPP TS 25.427 V3.11.0 (December 2003).	☐
	22	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 4)," 3GPP TS 25.427 V4.5.0 (December 2003).	☐
	23	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 5)," 3GPP TS 25.427 V5.5.0 (June 2005).	☐
	24	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 6)," 3GPP TS 25.427 V6.8.0 (December 2006).	☐
	25	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 7)," 3GPP TS 25.427 V7.5.0 (September 2007).	☐
	26		☐
	27		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

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

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12238910
	Filing Date	2008-09-26
	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

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	/Abhik A. Huq/	Date (YYYY-MM-DD)	2014-02-07
Name/Print	Abhik A. Huq	Registration Number	40656

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

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The 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.

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	12238910	Filing Date	2008-09-26	Docket Number (if applicable)	SIG-2.1853.01.US	Art Unit	2464
First Named Inventor	Benoit Pelletier			Examiner Name	Kan Yuen		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

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

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

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

☐ Other _____

☒ Enclosed

☐ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☒ Other
Form PTO/SB/08a (10 pages); 32 References

MISCELLANEOUS

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

☐ Other _____

FEES

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

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 220493

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

Signature of Registered U.S. Patent Practitioner			
Signature	/Abhik A. Huq/	Date (YYYY-MM-DD)	2014-02-07
Name	Abhik A. Huq	Registration Number	40656

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

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

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

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

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

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

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

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

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

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

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

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:	
Pelletier et al.	
Application No.: 12/238,910	
Confirmation No.: 2438	Our File: SIG-2-1853.01.US
Filed: September 26, 2008	Date: February 7, 2014
For: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL	
Group: 2464	
Examiner: Kan Yuen	

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

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

Madam:

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

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

This Application claims the benefit of Provisional Application No. 61/083,409, which was filed on July 24, 2008, Provisional Application No. 61/074,288, which was filed on June 20, 2008, Provisional Application No. 61/038,576, which was filed on March 21, 2008, Provisional Application No. 61/025,441, which was filed on February 1, 2008, Provisional Application No. 61/018,999, which was filed on January 4, 2008, Provisional Application No. 60/982,528, which was filed on October 25, 2007, and Provisional Application No. 60/975,985, which was filed on September 28, 2007.

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

Respectfully submitted,

Pelletier et al.

By /Abhik A. Huq/
Abhik A. Huq
Registration No. 40,656
(215) 568-6400

Volpe and Koenig, P.C.
United Plaza
30 South 17th Street
Philadelphia, PA 19103

AAH/PCK
Enclosures (33)

Electronic Patent Application Fee Transmittal

Application Number:	12238910
Filing Date:	26-Sep-2008
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Filer:	Abhik A. Huq/Sandy Yi
Attorney Docket Number:	

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($)
Miscellaneous:				
RCE - 2nd and Subsequent Request	1820	1	1700	1700
		Total in USD ($)		**1700**

Electronic Acknowledgement Receipt	
EFS ID:	18141958
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Abhik A. Huq/Sandy Yi
Filer Authorized By:	Abhik A. Huq
Attorney Docket Number:	
Receipt Date:	07-FEB-2014
Filing Date:	26-SEP-2008
Time Stamp:	13:11:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1700
RAM confirmation Number	13098
Deposit Account	220493
Authorized User	HUQ, ABHIK A.
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 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Foreign Reference	wo04100598.pdf	1151673 9c016d967eec152e1b2e069f5ae376f250354d7f	no	26
Warnings:					
Information:					
2	Foreign Reference	WOpat.PDF	4284107 0a1c7da4fb50f110b1f1a3237b11f790685e5c9e	no	36
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Information:					
3	Foreign Reference	wo07048470.pdf	2814121 b27c030ca125ebdde5a59df9f8651d5e220b0e0d	no	63
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4	Foreign Reference	wo08097489.pdf	1711405 0c22fdb5b30930e8f892600a5bad6e800d5ac311	no	43
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28	Foreign Reference	wo05089050.pdf	1498573 27ced3cd8d8988fc8d858bda14ab4678bf0c955f	no	38
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Information:					
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Information:					
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Warnings:					
Information:					

36	Fee Worksheet (SB06)	fee-info.pdf	30127 0e53f909f64689366c0929824912e19c28230164	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	31769280	

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.

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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 November 2004 (18.11.2004)

PCT

(10) International Publication Number
WO 2004/100598 A1

(51) International Patent Classification[7]: H04Q 7/38, H04B 7/26

(21) International Application Number: PCT/SE2004/000721

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0301400-8 12 May 2003 (12.05.2003) SE

(71) Applicant *(for all designated States except US)*: **TELEFONAKTIEBOLAGET LM ERICSSON (publ)** [SE/SE]; S-164 83 Stockholm (SE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **GRANZOW, Wolfgang** [DE/DE]; Seelachweg 6, 90562 Heroldsberg (DE). **FRANK, Georg** [DE/DE]; Kieler Strasse 26A, 90425 Nürnberg (DE).

(74) Agent: **MAGNUSSON, Monica**; Ericsson AB, Patent Unit Radio Networks, S-164 80 Stockholm (SE).

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

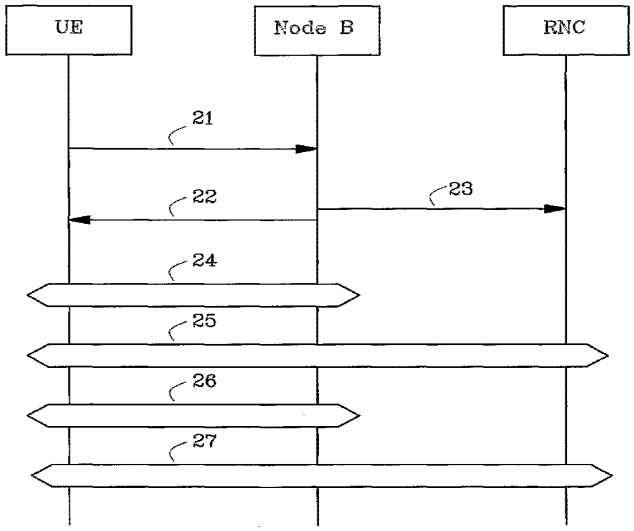
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ,*

[Continued on next page]

(54) Title: FAST SETUP OF PHYSICAL COMMUNICATION CHANNELS



(57) Abstract: The present invention relates to improvements for a fast setup of physical communication channels in a CDMA-based communication system. A Node B of a telecommunication network is permitted to manage and assign a certain share of the downlink transmission resources of a radio network controller without inquiry of said radio network controller. On reception of a resource request message from a user equipment, the node B derives and specifies a certain amount of said resources that can be allocated to the user equipment. In a preferred embodiment of the present invention said resources are only assigned temporarily until the ordinary RL setup procedure, which involves the RNC, has been successfully finished.

WO 2004/100598 A1

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Fast Setup of Physical Communication Channels

FIELD OF THE INVENTION

The present invention relates to a fast setup of physical communication channels, e.g., in a CDMA-based radio communication system.

BACKGROUND OF THE INVENTION

In a Universal Mobile Telecommunications System (UMTS), by means of an example including a universal terrestrial radio access for a frequency division duplex (UTRA-FDD) system, the setup of dedicated channels is implemented as illustrated in figure 1: A mobile user equipment (UE) sends periodically short access preambles at an increasing power level on an uplink Physical Random Access Channel (PRACH), step 11. When the user equipment receives an acquisition acknowledgement on the downlink Acquisition Indicator Channel (AICH), step 12, it sends the actual PRACH message, step 13. This message is in the following referred to as a "Resource Request", since it is assumed that the network, in reaction to this message, allocates dedicated resources for communication between the considered user and the network. The Resource Request is forwarded on a Common Channel (CCH) over the Iub-interface from the Node B to the RNC, step 14, where a decision is taken whether or not the requested resources are granted. In case of a positive decision, the RNC selects the parameters of the dedicated resources and initiates the RL Setup procedure of the NBAP protocol, step 15. Upon reception of an RL setup response from the Node B, step 16, the RNC sends a Physical Channel Reconfiguration (or Radio Bearer Setup, or Transport Channel

Reconfiguration) message on a downlink common channel, i.e. a FACH that is mapped onto a SCCPCH, to the user equipment, step 17. When this Setup or Reconfiguration message has arrived and has been processed by the user equipment, the downlink DPCCH synchronization procedure is started by the user equipment and subsequently the uplink DPCCH transmit power control (TPC) preamble is transmitted which enables the Node B to obtain synchronization on the uplink DPCCH, step 18. After expiry of the time interval employed for uplink DPCCH TPC preamble transmission, the user equipment transmits a Setup or Reconfiguration Complete message on the now established uplink DCH, step 19. The arrival of the Setup or Reconfiguration Complete message in the RNC confirms that the dedicated connection has been established successfully. The network may wait until reception of this Complete message before user data is sent in the downlink direction. The established dedicated channel can now be used for data transmission in both uplink and downlink direction, step 20.

For efficient support of packet data services, frequent switching between data transmissions on common channels, i.e. RACH/FACH, and dedicated channels, i.e. DCH on both uplink and downlink, is needed. The involved concept is referred to as channel type switching. Channel type switching consists of two different procedures: switching from common to dedicated channels (DCH setup) or switching from dedicated to common channels (DCH release).

SUMMARY OF THE INVENTION

The main problem of existing technology according to the state of the art is the rather large latency involved with the transition from common to dedicated channel state, i.e.

DCH setup time. The presently standardized scheme typically requires several hundreds of milliseconds to establish dedicated channels from common channel state Cell_FACH. It is therefore the objective of the present invention to reduce DCH setup times.

Generally, two different situations can be distinguished: In the one situation the mobile has not yet received any dedicated channel parameters and the network is not aware of a potential attempt by the mobile to establish a dedicated channel. In the other situation the mobile has assigned dedicated channel parameters and the network is aware that this mobile will attempt to setup a DCH within a given period of time.

The first situation occurs when the DCH setup is initiated by the mobile unit, e.g. due to large uplink traffic volume. The second situation occurs, for instance, when the DCH setup is initiated by the network, e.g. due to large downlink traffic volume. The second situation also occurs in case of periodic DCH setup (controlled by timers in the mobile equipment and the network). However, when the mobile unit is inactive for a rather large time, i.e. when it has been moved into a paging state, Cell_PCH or URA_PCH, in order to save power, it is advantageous when the mobile station reacts to paging by the network with an ordinary DCH setup procedure as in the first situation. The present invention addresses the first of the two situations described above.

The basic idea of the present invention is a fast DCH setup scheme that can be summarized as follows:

A Node B of a telecommunication network is permitted to manage and assign a certain share of the downlink transmission resources of a radio network controller without

inquiry of said radio network controller. On reception of a resource request message from a user equipment, the node B derives and specifies a certain amount of said resources that can be allocated to the user equipment. In a preferred embodiment of the present invention said resources are only assigned temporarily until the ordinary RL setup procedure, which involves the RNC, has been successfully finished.

The main benefit of the scheme according to the present invention is the high speed of setting up dedicated channels, i.e. 20 – 30 ms. With the proposed method even short data packets, e.g. of around 100 ms duration, would be transmitted efficiently on dedicated channels, thus avoiding inefficient common channels for user data transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 describes a mobile initiated DCH establishment with existing technology in UTRA FDD mode by means of an example.

Figure 2 describes the proposed fast DCH establishment according to the present invention.

DETAILED DESCRIPTION

Figure 2 illustrates the signalling procedure of the proposed fast DCH setup scheme according to the present invention. As a prerequisite for the application of the proposed scheme, it is assumed that a context between the user equipment and the network has been created. This context is stored in both the user equipment and the Node B. As part of this context, a user identification (UE-ID) is assigned to the user equipment. Other information included in the context might be physical channel parameters needed when setting up the DPCH such as, e.g., spreading factor and

slot format. It is further assumed that the context is created with separate procedures in a previous state.

The user equipment sends a short access preamble on an uplink Physical Random Access Channel (PRACH), step 21. In contrast to the preambles of an ordinary PRACH, the preambles of the proposed scheme include a UE-ID information. This UE-ID information enables the Node B to recognise, within the preamble acquisition phase, which particular user is accessing the system. This access preamble shall be interpreted as a "Resource Request" by the network. From the corresponding context, which is stored in the Node B, it is possible to derive a subset of resources, i.e. indicating both the amount and the expressively specified resources, that should be assigned to the requesting user equipment, e.g. based on knowledge of the Radio Bearer configuration of that particular user. The transmit power level of the access preamble shall be derived by means of the open-loop power control scheme as used for ordinary PRACH transmissions. The system should adjust SIR margins such that the likelihood for acquisition of the preamble by the Node B is rather high and such that a repetition of preamble transmission is not required normally. However, in case that the first transmitted preamble is not acknowledged, it shall be repeated by the terminal a short time interval later.

Upon acquisition of the access preamble, the Node B responds with a "Resource Assignment" message on the downlink, step 22. For this purpose a new downlink control channel can be introduced, which, within the context of the present invention, is referred to as High-Speed Shared Control Channel #2, HS-SCCH-2. This channel shall have a similar format as the HS-SCCH, which has been introduced for release-5 of UMTS for support of HS-DSCH transmissions, and comprise a short transmission time interval of only 2 ms.

The resource assignment shall include all parameters needed to establish a dedicated channel. According to one embodiment this includes especially the assignment of the downlink spreading code to be applied. Correspondingly, it would be possible to assign downlink time slots. It could also include information on the initial power level of the subsequently transmitted DPCH power control (TPC) preamble. The echoed UE-ID can be included implicitly as on the HS-SCCH. In contrast to the present DCH setup scheme according to the state of the art, where the RNC assigns resources, the present invention assumes that the Node B is capable to assign the DCH resources. For this purpose the Node B must be enabled to manage a part of the downlink code resources without inquiring the RNC. This can be done, for instance, by sharing code resources that are employed for HS-DSCH transmissions by the Node B. In case that the resources that have been assigned by the Node B shall only be assigned temporarily, the Node B will forward a resource request including at least the UE-ID to the responsible radio network controller, step 23. Another conceivable alternative could be to forward the resource request for information purposes to the radio network controller.

Upon reception of the Resource Assignment on control channel, the user equipment shall start transmitting the TPC preamble on the uplink DPCCH. In this step an appropriate synchronization procedure shall be applied such that uplink synchronization can be obtained within a short time interval, e.g. within 10 ms. After the power control preamble transmission phase is completed, both user equipment and Node B shall assume that the DCH connection is synchronized. Uplink and downlink transmission of user data can be started using the temporarily assigned resources, step 24.

If the established dedicated channel shall be used for more than just a few radio frames it is recommended to reconfigure the DPCH such that channelization codes are used which are managed by the RNC, step 25. This is to free those code resources which are autonomously managed by the Node B. Furthermore it should be noted that it is not possible to support inter-Node B macro-diversity with codes that are assigned by Node B. Accordingly, in order to enable full support of macro-diversity, a reallocation of the channelization code will be necessary, too, step 26. The reallocation can be done "on the fly", i.e. without interruption of user data transmission. Also in this step it is likely that it is necessary to reconfigure the user plane transport bearer on the Iub/Iur-interfaces from a common transport bearer, which should be employed initially, to a dedicated transport bearer.

After reconfiguration of the (downlink) DPCH channelization codes and transport bearers, transmission is performed as usual in Cell_DCH state, step 27. The sequences shown in figure 2 show the case that a HS-DSCH is assigned to the UE. HS-DSCH transmission may already start in parallel with the "temporary" DPCH code assignment, i.e. before reconfiguration of the DPCH code.

The following sections now describe several further improvements to achieve enhancements of the DCH setup procedure for reducing the delay of DCH setup.

A first improvement refers to fast UL/DL synchronization. The intention of this scheme is a reduction of the time intervals T_6 and T_7 required for uplink and downlink synchronization as shown in figure 1. For the proposed synchronization scheme it is assumed that the user equipment obtains initial downlink synchronization on common channels (CPICH and/or P-CCPCH) such that no specific in-sync verification period on downlink DPCH is required. Uplink and

downlink DPCH transmission shall start simultaneously (within the limits of the usual timing offsets) at an activation time indicated in the switching message. The time intervals T_6 and T_7 shall now fall together. The uplink DPCH is started sending power-ramped time-slots (power control preamble). The user equipment evaluates the downlink DPCH power control commands. As soon as the user equipment receives power down commands, this is interpreted as an acquisition indication of its uplink channel. Both user equipment and Node B then resume with ordinary power control on uplink and downlink DPCH. Performance evaluations have shown that this scheme can provide uplink-downlink synchronization within $T_6 = T_7 = 10$ ms with very high reliability even in the presence of 10% error rate for the downlink power control commands.

The information whether or not this synchronization scheme is used must be exchanged in some way between UE and network, for instance, as additional UE capability parameter or by making it a mandatory feature for certain UMTS release.

The following will now discuss an improvement for reduction of the DCH setup time, which addresses other time intervals than DPCH synchronization time. These ideas can be combined with the fast synchronization scheme presented above. A straightforward way to reduce the time intervals $T_{1.1}$ and $T_{1.2}$ in figure 1 is allowing the UE to employ a specific PRACH to be used exclusively for DCH setup, or an ordinary PRACH with special parameters. This could be done as follows:

When providing special PRACH(s) in a cell to be used only for fast DCH setup such a channel could be assigned explicitly, e.g., at RRC connection setup. The assignment would be saved as part of the "communication contexts" in both the Node B and the user equipment. A separate PRACH scrambling code could be assigned to avoid collisions with

"ordinary" PRACHs and a special set of access parameters could be assigned as will be discussed below.

The persistence value that governs the backoff delay could be set to a value P = 1 such that $T_{1.1}$ = 0 at least for the first ramping cycle. Backoff delay may or may not be introduced when the first ramping cycle fails, i.e. none or negative acknowledgement on AICH received.

A special setting of initial preamble transmit power could be applied such that a high success rate for the first preamble transmission is achieved. This, however, results in a trade off between delay reduction and increased interference. The interference increase is more critical with respect to the message that follows the preamble, especially if the message would be transmitted at high data rate (small spreading factor). The possibility that the tx-power value of the preamble is set somewhat too high is, on the other hand, less critical.

By means of the embodiment described above the RACH access delay and the access delay variations could be reduced from presently several radio frames to its minimum of three access slots, i.e. $T_{min} = 6*T_{slot}$ = 4 ms.

Still a further elaboration of the present invention relates to fast random access scheme with immediate UE identification and addresses potential delay reductions concerning the time intervals from $T_{1.3}$ to T_5 as shown in figure 1. This interval starts with sending a "Resource Request" and ends with the initiation of the synchronization procedure on the granted dedicated resources.

From figure 1 it is obvious that a significant amount of the time that is needed for setup is due to the fact that the resource request must be forwarded to the RNC where the decision is taken, the reconfiguration of the Node B(s) is

controlled, and the resource assignment message is generated. Consequently, the following schemes consider a case where resource control responsibility is moved from the RNC into the Node B for DCH setup in RRC connected mode. This means that any necessary pre-agreements between the user equipment and the network, which may help to simplify the resource setup procedure, could be arranged in advance.

The minimum amount of information, which must be included into a resource request message, is a user equipment identifier (UE-ID). In addition, some information on the resource request "cause" may be included, which may help the receiver to select a suitable amount of resources to be assigned. However, in the following it is assumes that dedicated resources shall be assigned for which all relevant parameters, except for the downlink channelization code, have been pre-agreed and stored in the communication context. In this case reception of an RACH message, which simply consists of a UE-ID, would be sufficient to trigger the further resource assignment procedure.

Assuming that the Node B handles resource requests received from the user equipment and assigns resources, the following modification of the present random access scheme can be considered: The present connection setup can be seen as a "five-way handshake": preamble (UE) - Acquisition Indicator (Node B) - resource request message (UE) - resource assignment (RNC) - assignment confirm (UE). This can be simplified into an ordinary "3-way handshake": preamble = resource request (UE) - resource assignment (Node B) - assignment confirm (UE).

The physical implications resulting from the inclusion of the UE-ID information into the PRACH preamble will be discussed later in more detail. It should be noted here that this has a very important impact on the access principle, namely it makes the RACH collision-free. If the UE-ID is

extracted by the Node B, it can be directly included into the resource assignment message replied to the user equipment. The resource assignment message replaces the acquisition indication. Of course since the amount of information increases, it cannot be transmitted on the present AICH. The resource assignment must include a DL DPCH channelization code and the echoed UE-ID. In addition for instance the initial UL DPCH power level could be included to make the DPCH synchronization procedure more efficient. An important requirement of the approach is that the Node B can autonomously assign channelization codes without inquiry of the RNC. However, this could be handled according to the principles of "shared channels". A shared physical channel, i.e. PDSCH and HS-PDSCH, can be interpreted as a part of the downlink code resource, which is controlled autonomously by the Node B. The DL DPCH channelization code could be taken initially from this shared resource as a temporary assignment. If necessary, for instance if the connection shall be maintained for a time interval longer than some given limit, the DL channelization code could be reconfigured with ordinary RRC and NBAP procedures using an assignment selected by the RNC.

The basic principle of the proposed scheme is illustrated by help of figure 2. It is assumed that the resource assignment is provided over a control channel, e.g. a high-speed shared control channel (HS-SCCH-2), step 22. Upon reception of said resource assignment, the user equipment could start a DCH setup procedure. The radio frame following the 10 ms-synchronization phase could then include the resource setup confirm message, which would complete the three-way handshake in the successful case. It would be desired that this confirm message is evaluated directly in the Node B without passing through RNC. In the setup failure case, when the confirm message is not received, this should trigger the release of the temporary allocated resources in the Node B.

The confirm message could be forwarded to the RNC and used as a trigger to initiate a reconfiguration of the radio link, i.e. a change from the temporary to a permanent RNC assigned code. This approach is indicated in the example signaling sequence in figure 2. The time for sending the resource request (preamble), step 21, until start of the synchronization procedure seems feasible within 10 ms. In combination with the fast DCH setup scheme, the total DCH setup time amounts to just 20 ms.

The present PRACH includes a 4-bit information, which is referred to as signature. This information is presently not used as explicit UE-ID but instead to enable multiple simultaneous access attempts at low collision probability when the overall PRACH load is not too high. It would be straightforward to redefine the signature as an explicit UE-ID by mandating that a specific UE must use a specific preamble signature. In this case only a group of 16 users could be distinguished on one common PRACH scrambling code. The number of available PRACH UE-IDs, i.e. the UE-ID included into the PRACH preamble, limits the number of users that can take advantage of the proposed fast DCH setup procedure. It should be sufficiently large to handle those users that typically run a packet data service, e.g. web a browsing session, with frequent reason to switch between activity states, e.g. due to periods of inactivity for power saving reasons and to free downlink DPCH code resources. A number of 256 or 1024 should be sufficient, i.e. 8 or 10 bits code space. If the support of 10 bits would be technically feasible, the already defined "H-RNTI" could be employed simply on the preambles. The assignment of UE-ID can be handled the same way as for H-RNTI. A mapping between PRACH UE-ID and the 16-bit C-RNTI employed in MAC c/hs needs to be defined.

The Resource Assignment message sent on HS-SCCH-2 preferably includes the following information elements:

- PRACH UE-ID (8 or 10 bits);
- DL DPCH channelization code (8 bits);
- Initial power offset for UL DPCH (4 or 5 bits);
- CRC code (16 bits);
- Protocol information, e.g. explicit resource assignment reject, etc. (1 - 3 bits).

It is assumed that a user-specific timing offset of the DPCH relative to CPICH can also be pre-configured. If this is not feasible this information would need to be included into the Resource Assignment message in addition. The size of the Resource Assignment message amounts to around 40 bits. A channel similar to HS-SCCH would be well suitable to carry the Resource Assignment messages. However, it should be noted that a single HS-SCCH-2 can carry only a Resource Assignment message for a single UE per subframe. Therefore several parallel HS-SCCH-2 channels might be needed to serve multiple resource request simultaneously.

The following section gives attention to the case where the request for DCH setup originates at the network side. It considers the case where the UE initially is in paging channel state. The present procedure has been described in figure 4. In this case, the decision to set up dedicated channels is taken at the network side. In the next step the network sends a page indicator to the respective UE, which essentially triggers the UE-side part of the DCH setup procedure. The paging procedure can be simplified, by allowing the UE to tune directly to a channel where the resource assignment is provided. This could be, e.g., the

HS-SCCH-2 channel discussed above. Note that an improvement would also be achieved if the resource allocation were sent on FACH/S-CCPCH since at least the intermediate step of reading PCH is saved.

Regarding the preamble design, according to present specifications a PRACH preamble consists of 4096 chips, which is a sequence of 256 repetitions of Walsh-Hadamard codes of length 16. The preamble is scrambled with a PRACH specific scrambling code. The Walsh-Hadamard codes are referred to as signature of the preamble. The present preamble structure has been designed with main focus on providing a low false alarm rate and high detection probability under fast fading and frequency offset conditions. However the hardware complexity is slightly increased compared with other useful preamble schemes (for fading at moderate velocities). In a possible implementation for discriminating one set of PRACH preambles the preamble receiver comprises of a code matched filter for descrambling (buffer for 256 chips); a fast WH transform of length 16; 16 integrate and dump blocks covering a time window equal to of the expected delay spread.

There are further options when including UE-ID information into the preamble that can be considered:

Multiple scrambling codes: The presently defined PRACH has capability to distinguish between 16 different UE-IDs. The most straightforward way to increase the number of UE-IDs would be to configure several parallel PRACH channels, each one employing a different scrambling code. However, with this approach receiver complexity increases proportional with the number of signatures. The ratio of hardware increase relative to the increased number of UE-IDs is extremely unfavourable, because nevertheless only a few UE-IDs will be used at a given time, whereas receiver hardware

is provided which is capable to detect all UE-IDs simultaneously.

Increased set of signatures: A second method for increasing the number of usable UE-IDs is to increase the set of signatures, e.g. from presently 16 to N = 256 (or 1024). In this case each preamble is composed of 16 symbols, each spread with a Walsh-Hadamard symbol of length 256. This requires N x N WHT, one integrate and dump block for each of the N signatures. Only a single scrambling code used and only a single code matched filter is required. The resulting Hardware complexity is almost the same as for the scheme described above.

Mixed concept with modulation: A compromise between hardware demand and flexibility is a combination of the present Walsh-Hadamard signature with an additional modulation on the preamble. This scheme comprises a first level signature as in the original scheme with Walsh-Hadamard spreading of length N_1 = 16 or higher. This parameter limits the number of accesses, which could be handled simultaneously. A sequence of several successive Walsh-Hadamard symbols could then represent a modulation interval and would be modulated with a symbol of a second level signature. Both signatures together define the number $2^{(N_1+N_2)}$ of UE-IDs. The second level 'signature' could be a symbol out of a set of orthogonal symbols, or a conventionally coded binary (or quaternary) number and could even include CRC protection. This mixed concept allows handling a large set of UE-IDs. The receiver could be simplified by increasing the access slot size and dividing the preamble into two parts, where the first part carries the ordinary signature and only the second part is modulated. This scheme allows using an ordinary preamble receiver in a first detection step, where the signature and the channel propagation paths should be detected. In a second detection step the UE-ID would be demodulated from

the second part of the preamble, employing the channel paths determined in the first step. The additional information about the increased set of UE-IDs is encoded in the second part, which can be de-spreaded by the same hardware as the first preamble part. Only the integrate and dump operation has to be performed in separate hardware including the necessary demodulation, e.g. by re-modulation, on the already known propagation paths.

Time division: The number of independent UE-IDs can also be increased by assignment of different access slots to different users. This results in a quite simple preamble receiver structure. However, this implies also a somewhat increased delay. In order to reduce the delay increase, the present access slots could also be divided into a number of sub-access-slots. The length of a sub-access-slot must be larger than the searcher window of the receiver, i.e. larger than twice the propagation delay.

Techniques to improve preamble detection performance: When designing the preamble receiver advanced techniques such as interference-suppressing multi-user detectors should be considered to improve the overall detection performance. When time-division for the preambles as described above is employed, the CTDMA approach could be considered, where inverse filters instead of code matched filters are employed for ease of receiver complexity. It should be noted that a very low false alarm rate is an important requirement of the proposed scheme. False alarms will cause unnecessary resource reservations in the Node B and transmissions of resource assignments on the downlink. A false alarm would be detected only by the Node B when no confirm message is received within the defined waiting time. The introduction of a CRC on the UE-ID would be a means for adjustment of false alarm probability.

This application has described procedures, which allow a fast setup of dedicated channels. If the request for DCH setup is initiated by the network, the DCH setup time is essentially just increased by the duration of the DRX interval employed in paging channel state. Being able to setup dedicated channel in this fast way, it will be possible to perform state switching rather frequently, i.e. at a speed of several times per seconds, and provide optimum adaptation to the characteristics of packet data. Frequent data transfer in Cell_FACH state could then be avoided. Even short data packets would be transmitted efficiently on dedicated channels. This makes any further optimizations of data transport in common channel state unnecessary, e.g. concepts like CPCH, tight power control on FACH, etc..

CLAIMS

1. A method in a network node of a telecommunication network for fast setup of a physical communication channel,

c h a r a c t e r i z e d b y

managing and assigning a share of the downlink transmission resources of a radio network controller without inquiry of said radio network controller;

maintaining a user equipment communication context;

deriving and specifying by help of said user equipment communication context, on reception of a resource request message from a user equipment on a random access channel including at least an identifier of said user equipment, a subset of resources that can be assigned to said user equipment;

assigning over a control channel the specified subset of resources to the user equipment by help of a resource assignment message including the parameters that are necessary for establishing the dedicated channel.

2. The method according to claim 1, whereby said subset of resources is temporarily assigned until the radio link setup procedure towards the radio network controller has been successfully performed.

3. The method according to claim 1 or 2, whereby the downlink transmission resources consist of a share of downlink codes.

4. The method according to claim 1 or 2, whereby the downlink transmission resources consist of a share of downlink time slots.

5. The method according to claim 3, whereby the communication context includes pre-agreed information about the user equipment.

6. The method according to claim 3, whereby the resource assignment message includes an identifier of the user equipment.

7. The method according to claim 3, whereby the resource assignment message includes a downlink DPCH channelisation code.

8. A method in a user equipment unit of a telecommunication network for fast setup of a physical communication channel,

c h a r a c t e r i z e d b y

sending a short access preamble on a random access channel as a resource request message including at least an identifier of the user equipment for requesting network resources from a Node B;

obtaining a synchronization of the uplink and downlink by means of retrieving initial downlink synchronization information on a common channel, starting uplink transmission and downlink reception simultaneously, and sending power-ramped control preambles until a power down command has been received.

9. The method according to claim 8, whereby the user equipment employs a random access channel that is exclusively assigned for DCH setup.

10. The method according to claim 9, whereby the random access channel is assigned at RRC connection setup.

11. The method according to claim 8, whereby the resource request message at 1east includes an identifier of the user equipment.

12. The method according to claim 11, whereby the signature field of the random access channel is used to include an identifier of the user equipment.

13. The method according to claim 8, whereby the resource request message includes a cause indicator for the resource request.

14. The method according to claim 8, whereby the necessary pre-agreements between user equipment and network are arranged in advance.

1/2

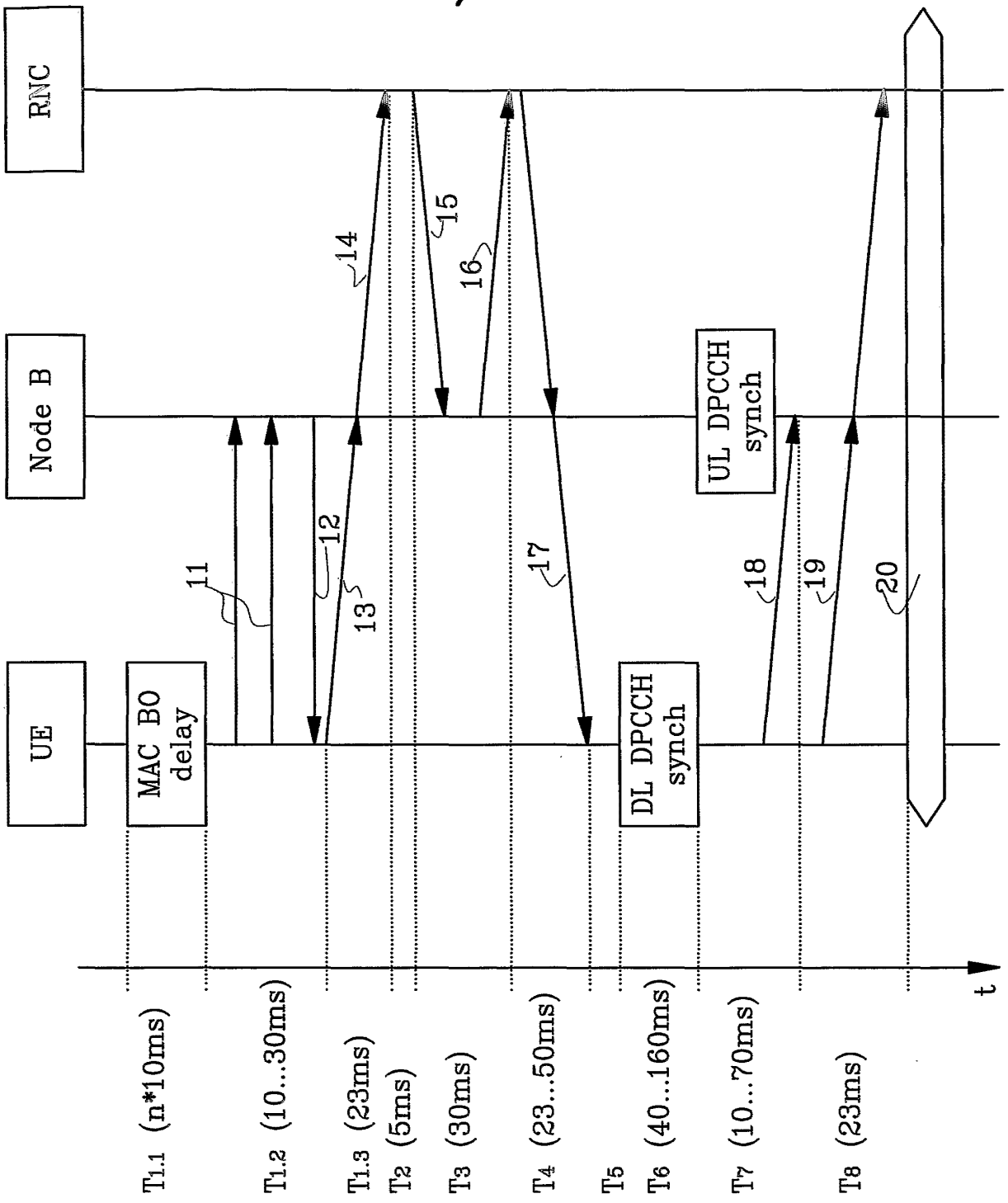

RNC
Node B
UE
MAC BO delay
DL DPCCH synch
UL DPCCH synch
11
12
13
14
15
16
17
18
19
20
t
T1.1 (n*10ms)
T1.2 (10...30ms)
T1.3 (23ms)
T2 (5ms)
T3 (30ms)
T4 (23...50ms)
T5
T6 (40...160ms)
T7 (10...70ms)
T8 (23ms)

Fig. 1

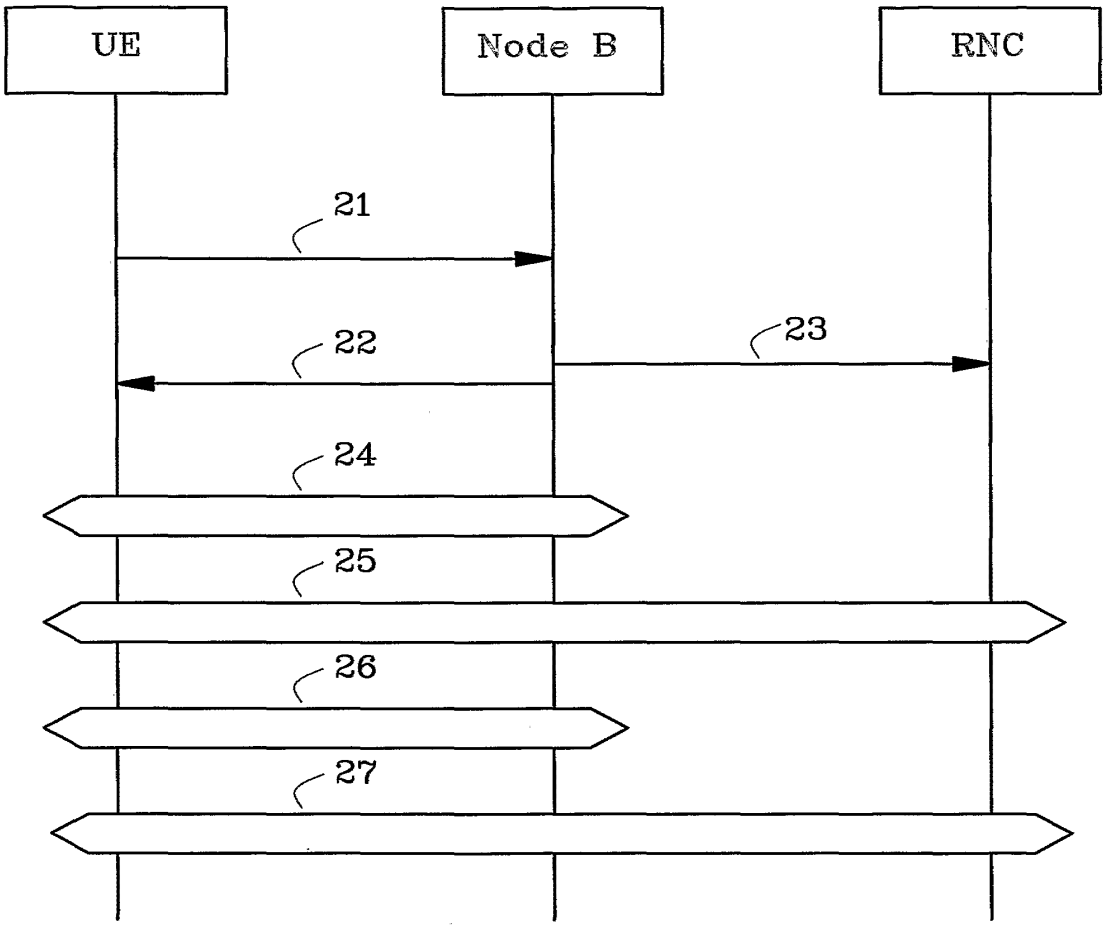


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 2004/000721

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38, H04B 7/26
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)

IPC7: H04B, H04Q, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 0230134 A2 (TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)), 11 April 2002 (11.04.2002), page 2, line 24 - page 3, line 21; page 9, line 15 - line 21 --	1-14
A	US 2002119784 A1 (AGIN, P), 29 August 2002 (29.08.2002), [0052]-[0131] --	1-14

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

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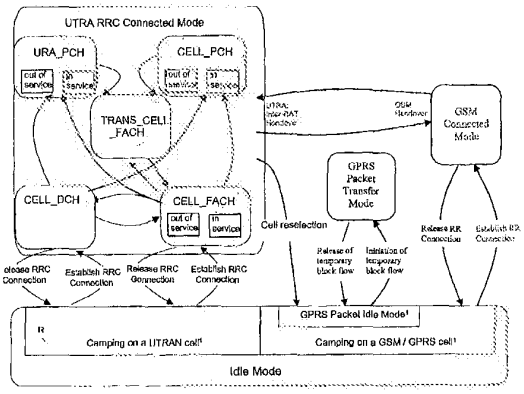
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(54) **Title:** WIRELESS TRANSMIT RECEIVE UNIT HAVING A TRANSITION STATE FOR TRANSITIONING FROM MONITORING TO DUPLEX CONNECTED STATES AND METHOD



(57) **Abstract:** A wireless transmit/receive unit (WTRU) and method for wireless uplink communication to and downlink communication from a wireless network are provided. The WTRU has a selectively configurable transceiver that has a network connected mode defined by a plurality of functional states including at least one monitoring state and a duplex state. The transceiver is configured to transition from a monitoring state upon occurrence of predefined WTRU events that are each associated with a respective uplink procedure initiation communication where at least one of procedures results in a network response that includes a temporary identifier. The transceiver is configurable into a transition state wherein the transceiver is configured to send only the uplink initiation communications and is otherwise configured only for downlink communications.

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[0001] WIRELESS TRANSMIT RECEIVE UNIT HAVING A TRANSITION STATE FOR TRANSITIONING FROM MONITORING TO DUPLEX CONNECTED STATES AND METHOD

[0002] FIELD OF INVENTION

[0003] The present invention relates to methods and components for wireless communication equipment and, in particular, methods and components for facilitating efficient maintenance of wireless communications.

[0004] BACKGROUND

[0005] Wireless telecommunication systems are well known in the art. In order to provide global connectivity for wireless systems, standards have been developed and are being implemented. One current standard in widespread use is known as Global System for Mobile Telecommunications (GSM). This is considered as a so-called Second Generation mobile radio system standard (2G) and was followed by its revision (2.5G). GPRS and EDGE are examples of 2.5G technologies that offer relatively high speed data service on top of (2G) GSM networks. Each one of these standards sought to improve upon the prior standard with additional features and enhancements. In January 1998, the European Telecommunications Standard Institute – Special Mobile Group (ETSI SMG) agreed on a radio access scheme for Third Generation Radio Systems called Universal Mobile Telecommunications Systems (UMTS). To further implement the UMTS standard, the Third Generation Partnership Project (3GPP) was formed in December 1998. 3GPP continues to work on a common third generational mobile radio standard.

[0006] A typical UMTS system architecture in accordance with current 3GPP specifications is depicted in Figure 1a. The UMTS network architecture includes a Core Network (CN) interconnected with a UMTS Terrestrial Radio Access Network (UTRAN) via an interface known as Iu which is defined in detail in the current publicly available 3GPP specification documents. The UTRAN is configured to provide wireless telecommunication services to users through

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wireless transmit receive units (WTRUs), known as User Equipments (UEs) in 3GPP, via a radio interface known as Uu. The UTRAN has one or more Radio Network Controllers (RNCs) and base stations, known as Node Bs in 3GPP, which collectively provide for the geographic coverage for wireless communications with UEs. One or more Node Bs is connected to each RNC via an interface known as Iub in 3GPP. The UTRAN may have several groups of Node Bs connected to different RNCs; two are shown in the example depicted in Figure 1. Where more than one RNC is provided in a UTRAN, inter-RNC communication is performed via an Iur interface.

[0007] Communications external to the network components are performed by the Node Bs on a user level via the Uu interface and the CN on a network level via various CN connections to external systems.

[0008] In general, the primary function of base stations, such as Node Bs, is to provide a radio connection between the base stations' network and the WTRUs. Typically a base station emits common channel signals allowing non-connected WTRUs to become synchronized with the base station's timing. In 3GPP, a Node B performs the physical radio connection with the UEs. The Node B receives signals over the Iub interface from the RNC that control the radio signals transmitted by the Node B over the Uu interface.

[0009] A CN is responsible for routing information to its correct destination. For example, the CN may route voice traffic from a UE that is received by the UMTS via one of the Node Bs to a public switched telephone network (PSTN) or packet data destined for the Internet. In 3GPP, the CN has six major components: 1) a serving General Packet Radio Service (GPRS) support node; 2) a gateway GPRS support node; 3) a border gateway; 4) a visitor location register; 5) a mobile services switching center; and 6) a gateway mobile services switching center. The serving GPRS support node provides access to packet switched domains, such as the Internet. The gateway GPRS support node is a gateway node for connections to other networks. All data traffic going to other operator's networks or the internet goes through the gateway GPRS support node. The border gateway acts as a firewall to prevent attacks by intruders outside the network on subscribers

within the network realm. The visitor location register is a current serving networks 'copy' of subscriber data needed to provide services. This information initially comes from a database which administers mobile subscribers. The mobile services switching center is in charge of 'circuit switched' connections from UMTS terminals to the network. The gateway mobile services switching center implements routing functions required based on current location of subscribers. The gateway mobile services also receives and administers connection requests from subscribers from external networks.

[0010] The RNCs generally control internal functions of the UTRAN. The RNCs also provides intermediary services for communications having a local component via an Iub interface connection with a Node B and an external service component via a connection between the CN and an external system, for example overseas calls made from a cell phone in a domestic UMTS.

[0011] Typically a RNC oversees multiple base stations, manages radio resources within the geographic area of wireless radio service coverage serviced by the Node Bs and controls the physical radio resources for the Uu interface. In 3GPP, the Iu interface of an RNC provides two connections to the CN: one to a packet switched domain and the other to a circuit switched domain. Other important functions of the RNCs include confidentiality and integrity protection. Background specification data for such systems are publicly available and continue to be developed.

[0012] In general, commercial wireless systems utilize a well defined system time frame format for the transmission of wireless communication signals. In communication systems such as Third Generation Partnership Project (3GPP) Time Division Duplex (TDD) and Frequency Division Duplex (FDD) systems, multiple shared and dedicated channels of variable rate data are combined for transmission.

[0013] There are four defined states in the Universal terrestrial radio access (UTRA) RRC Connected mode currently specified in 3GPP TS 25.331: Radio Resource Control (RRC) Protocol Specification as illustrated in Figure 1b. These states include two duplex states, CELL_DCH and CELL_FACH, and two

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monitoring states CELL_PCH and URA_PCH. These states allow the UTRAN to allocate resources to the User Equipment (UE) on a demand basis.

[0014] The CELL_DCH state is a duplex state characterized by:

- A dedicated physical channel is allocated to the UE in uplink and downlink.
- The UE is known on cell level according to its current active set.
- Dedicated transport channels, downlink and uplink (TDD) shared transport channels, and a combination of these transport channels can be used by the UE.

[0015] The CELL_DCH state is entered from an Idle Mode through the setup of an RRC connection, or by establishing a dedicated physical channel from the CELL_FACH state. A PDSCH may be assigned to the UE in this state, to be used for a DSCH. In TDD a PUSCH may also be assigned to the UE in this state, to be used for a USCH. If PDSCH or PUSCH are used for TDD, a FACH transport channel may be assigned to the UE for reception of physical shared channel allocation messages.

[0016] Transition from CELL_DCH to Idle Mode is realized through the release of the RRC connection. Transition from CELL_DCH to CELL_FACH state occurs when all dedicated channels have been released, which may be via explicit signaling (e.g. physical channel reconfiguration, radio bearer reconfiguration, radio bearer release, radio bearer setup, transport channel reconfiguration, etc.) or at the end of a time period for which the dedicated channel was allocated. Transition from CELL_DCH to CELL_PCH state occurs via explicit signaling (e.g. physical channel reconfiguration, radio bearer reconfiguration, radio bearer release, radio bearer setup, transport channel reconfiguration, etc.). Transition from CELL_DCH to URA_PCH state occurs via explicit signaling (e.g. physical channel reconfiguration, radio bearer reconfiguration, radio bearer release, radio bearer setup, transport channel reconfiguration, etc.).

[0017] Radio Resource Allocation tasks for the CELL_DCH state are specified. For the DCH, several physical channel allocation strategies may be applied. The allocations can be either permanent (needing a DCH release message) or based on time or amount-of-data. Resource allocation can be done separately for

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each packet burst with fast signaling on the DCH. For each radio frame the UE and the network indicate the current data rate (in uplink and downlink respectively) using the transport format combination indicator (TFCI). However, in TDD, DCH and DSCH or USCH may be mapped on different CCTrCHs, their TFCI are totally independent. DCH transmission is not modified by the simultaneous existence of DSCH/USCH. If the configured set of combinations (i.e. transport format set for one transport channel) are found to be insufficient to retain the QoS requirements for a transport channel, the network initiates a reconfiguration of the transport format set (TFS) for that transport channel. This reconfiguration can be done during or in between data transmission. Further, the network can reconfigure the physical channel allowing an increase or decrease of the peak data rate. For the uplink data transmission, the UE reports the observed traffic volume to the network in order for the network to re-evaluate the current allocation of resources. This report contains e.g. the amount of data to be transmitted or the buffer status in the UE.

[0018] RRC Connection mobility tasks for the CELL_DCH state are specified. Depending on the amount and frequency of data macrodiversity (soft handover) may or may not be applied. The RRC Connection mobility is handled by measurement reporting, soft handover and Timing re-initialized or Timing maintained hard handover procedures.

[0019] UE Measurements for the CELL_DCH state are specified. The UE performs measurements and transmit measurement reports according to the measurement control information. The UE uses the connected mode measurement control information received in other states until new measurement control information has been assigned to the UE.

[0020] Acquisition of system information in the CELL_DCH state is specified. FDD UEs with certain capabilities reads system information broadcast on FACH. TDD UEs reads the BCH to acquire valid system information. For each acquisition, the UE may need different combinations of system information broadcast on BCH. The scheduling on the broadcast channel is done in such way that the UE knows when the requested information can be found.

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[0021] The CELL_FACH state is a duplex state characterized by:

- No dedicated physical channel is allocated to the UE.
- The UE continuously monitors a FACH in the downlink.
- The UE is assigned a default common or shared transport channel in the uplink (e.g. RACH) that it can use anytime according to the access procedure for that transport channel.
- The position of the UE is known by UTRAN on cell level according to the cell where the UE last made a cell update.
- In TDD mode, one or several USCH or DSCH transport channels may have been established.

[0022] Transition from CELL_FACH to CELL_DCH state occurs, when a dedicated physical channel is established via explicit signaling (e.g. physical channel reconfiguration, radio bearer reconfiguration, radio bearer release, radio bearer setup, transport channel reconfiguration, etc.). Transition from CELL_FACH to CELL_PCH state occurs when UTRAN orders the UE to move to CELL_PCH state, which is done via explicit signaling (e.g. cell update confirm, radio bearer reconfiguration, etc.). Transition from CELL_FACH to Idle Mode occurs upon release of the RRC connection. Transition from CELL_FACH to URA_PCH State occurs when UTRAN orders the UE to move to URA_PCH state, which is done via explicit signaling (e.g. ura update confirm, radio bearer reconfiguration, etc.).

[0023] Radio Resource Allocation Tasks for the CELL_FACH state are specified. In the CELL_ FACH state the UE monitors a FACH. It is enabled to transmit uplink control signals and it may be able to transmit small data packets on the RACH. The network can assign the UE transport channel parameters (e.g. transport format sets) in advance, to be used when a DCH is used. Upon assignment of the physical channel for DCH, the UE moves to CELL_DCH state and uses the preassigned TFS for the DCH. If no UE dedicated physical channel or transport channel configuration has been assigned, the UE uses the common physical channel and transport channel configuration according to the system information. For the uplink data transmission, the UE reports the observed traffic

volume to the network in order for the network to re-evaluate the current allocation of resources. This report contains e.g. the amount of data to be transmitted or the buffer status in the UE. When there is either user or control data to transmit, a selection procedure determines whether the data should be transmitted on a common transport channel, or if a transition to CELL_DCH should be executed. The selection is dynamic and depends on e.g. traffic parameters (amount of data, packet burst frequency).

[0024] In FDD mode, the UTRAN can assign CPCH resources to the UE in CELL_FACH state. When CPCH resources are assigned, the UE will continue to monitor FACHs. When CPCH resources are assigned, the UE will use CPCH for all uplink traffic in accordance with RB mapping. In FDD mode, UTRAN may configure the UE to provide CPCH measurement reports of traffic volume on each CPCH channel used. With these measures, the UTRAN can reallocate network resources on a periodic basis. The UTRAN allocates CPCH Sets to each cell and assigns UEs to one of the cell's CPCH Sets. The UEs can dynamically access the CPCH resources without further UTRAN control.

[0025] In the TDD mode, the UTRAN can assign USCH / DSCH resources to the UE in CELL_FACH state. When USCH / DSCH resources are assigned, the UE will continue to monitor FACHs, depending on the UE capability. The UE may use the USCH / DSCH to transmit signaling messages or user data in the uplink and / or the downlink using USCH and / or DSCH when resources are allocated to cell and UE is assigned use of those USCH / DSCH. For the uplink data transmission on USCH the UE reports to the network the traffic volume (current size of RLC data buffers), The UTRAN can use these measurement reports to re-evaluate the current allocation of the USCH / DSCH resources.

[0026] RRC Connection mobility tasks for the CELL_FACH state are specified. In this state the location of the UE is known on cell level. A cell update procedure is used to report to the UTRAN, when the UE selects a new cell to observe the common downlink channels of a new cell. Downlink data transmission on the FACH can be started without prior paging. The UE monitors the broadcast channel and system information on BCCH of its own and neighbor cells and from

this the need for the updating of cell location is identified. The UE performs cell reselection and upon selecting a new UTRA cell, it initiates a cell update procedure. Upon selecting a new cell belonging to another radio access system than UTRA, the UE enters idle mode and makes an access to that system according to its specifications.

[0027] UE Measurements for the CELL_FACH state are specified. The UE performs measurements and transmit measurement reports according to the measurement control information. By default, the UE uses the measurement control information broadcast within the system information. However, for measurements for which the network also provides measurement control information within a MEASUREMENT CONTROL message, the latter information takes precedence.

[0028] Transfer and update of system information for the CELL_FACH state is specified. The UE reads the BCH to acquire valid system information. For each acquisition, the UE may need different combinations of system information broadcast on BCH. The scheduling on the broadcast channel is done in such way that the UE knows when the requested information can be found. When the system information is modified, the scheduling information is updated to reflect the changes in system information transmitted on BCH. The new scheduling information is broadcast on FACH in order to inform UEs about the changes. If the changes are applicable for the UE, the modified system information is read on BCH.

[0029] The CELL_PCH state is a monitoring (i.e. non-duplex) state characterized by:

- No dedicated physical channel is allocated to the UE.
- The UE selects a PCH with a specified algorithm and uses DRX for monitoring the selected PCH via an associated PICH.
- No uplink activity is possible.
- The position of the UE is known by UTRAN on cell level according to the cell where the UE last made a cell update in CELL_FACH state.

- The DCCH logical channel cannot be used in this state. If the network wants to initiate any activity, it needs to make a paging request on the PCCH logical channel in the known cell to initiate any downlink activity.

[0030] Transition from CELL_PCH to CELL_FACH state occurs

a) by paging from UTRAN (PAGING TYPE1 message) or

b) through any uplink access.

The release of an RRC connection is not possible in the CELL_PCH state. The UE will first move to CELL_FACH state to perform a release signaling.

[0031] Radio Resource Allocation Tasks for the CELL_PCH state are specified. In CELL_PCH state no resources have been granted for data transmission. For this purpose, a transition to another state has to be executed. The UE may use Discontinuous Reception (DRX) in order to reduce power consumption. When DRX is used the UE needs only to receive at one paging occasion per DRX cycle. The UE may be instructed to use a specific DRX cycle length by the network. The UE determines its paging occasions in the same way as for Idle Mode, although is this connected mode state, UTRAN DRX cycle length coefficient is also taken into consideration.

[0032] RRC Connection mobility tasks for the CELL_PCH state are specified. In the CELL_PCH state, the UE mobility is performed through cell reselection procedures. The UE performs cell reselection and upon selecting a new UTRA cell, it moves to CELL_FACH state and initiates a cell update procedure in the new cell. After the cell update procedure has been performed, the network may direct the UE to change its state back to CELL_PCH state if neither the UE nor the network has any more data to transmit. Upon selecting a new cell belonging to another radio access system than UTRA, the UE enters idle mode and make an access to that system according to its specifications. In case of low UE activity, UTRAN may want to reduce the cell-updating overhead by ordering the UE to move to the URA_PCH State. This transition is made via the CELL_FACH state. UTRAN may apply an inactivity timer, and optionally, a counter, which counts the number of cell updates e.g. UTRAN orders the UE to move to URA_PCH when the number of cell updates has exceeded certain limits (network parameter).

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[0033] UE Measurements for the CELL_PCH state are specified. The UE performs measurements and transmit measurement reports according to the measurement control information. The UE uses the measurement control information according to the system information when no UE dedicated measurement control information has been assigned.

[0034] Transfer and update of system information for the CELL_PCH state is specified. The UE reads the BCH to acquire valid system information. For each acquisition, the UE may need different combinations of system information broadcast on BCH. The scheduling on the broadcast channel is done in such way that the UE knows when the requested information can be found.

[0035] The URA_PCH state is a monitoring state characterized by:

- No dedicated channel is allocated to the UE.
- The UE selects a PCH with a specified algorithm and uses DRX for monitoring the selected PCH via an associated PICH.
- No uplink activity is possible.
- The location of the UE is known on UTRAN Registration area level according to the URA assigned to the UE during the last URA update in CELL_FACH state.
- The DCCH logical channel cannot be used in this state.

If the network wants to initiate any activity, it needs to make a paging request on the PCCH logical channel within the URA where the location of the UE is known. If the UE needs to transmit anything to the network, it goes to the CELL_FACH state. The transition to URA_PCH State can be controlled with an inactivity timer, and optionally, with a counter that counts the number of cell updates. When the number of cell updates has exceeded certain limits (a network parameter), then the UE changes to the URA_PCH State. URA updating is initiated by the UE, which, upon the detection of the Registration area, sends the network the Registration area update information on the RACH of the new cell.

[0036] Transition from URA_PCH State to CELL_FACH State occurs:

a) when uplink access is performed by RACH.

b) by paging from UTRAN (PAGING TYPE1 message).

The release of an RRC connection is not possible in the URA_PCH State. The UE will first move to CELL_FACH State to perform the release signaling.

[0037] Radio Resource Allocation Tasks for the URA_PCH state are specified. In URA_PCH State no resources have been granted for data transmission. For this purpose, a transition to CELL_FACH State has to be executed. The UE may use Discontinuous Reception (DRX) in order to reduce power consumption. When DRX is used the UE needs only to receive at one paging occasion per DRX cycle. The UE may be instructed to use a specific DRX cycle length by the network. The UE determines its paging occasions in the same way as for Idle Mode, although is this connected mode state, UTRAN DRX cycle length coefficient is also taken into consideration.

[0038] RRC Connection mobility tasks for the URA_PCH state are specified. In URA_PCH State the location of a UE is known on UTRAN Registration area level. In this state, the UE mobility is performed through URA reselection procedures. The UE performs cell reselection and upon selecting a new UTRA cell belonging to a URA that does not match the URA used by the UE, the UE moves to CELL_FACH state and initiates a URA update towards the network. After the URA update procedure has been performed, the network may direct the UE to change its state back to URA_PCH state if neither the UE nor the network has any more data to transmit. Upon selecting a new cell belonging to another radio access system than UTRA, the UE enters idle mode and makes an access to that system according to its specifications.

[0039] UE Measurements for the URA_PCH state are specified. The UE performs measurements and transmit measurement reports according to the measurement control information. The UE uses the measurement control information according to the system information when no UE dedicated measurement control information has been assigned.

[0040] Transfer and update of system information for the URA_PCH state is specified. The same mechanisms to transfer and update system information as for state CELL_PCH are applicable for UEs in URA_PCH state. The UE is put into

the CELL_PCH or URA_PCH state by the UTRAN depending on the traffic activity originating from the UE.

[0041] At the access stratum level, the UE is identified either by

a) U-RNTI

b) C-RNTI

While using the common transport channels (e.g., RACH, FACH, PCH), UTRAN recognizes the UE using one of the above identifiers. C-RNTI gets deleted when entering the CELL_PCH or URA_PCH state. It also gets deleted when UE reselects a cell for communication via a different base station, even while in a CELL_FACH state.

[0042] Whenever the UE transitions from CELL_PCH or URA_PCH state to CELL_FACH state, it performs a respective Cell Update or URA Update procedure. Also, if the UE does not have a valid C-RNTI in the CELL_FACH state, such as when reselecting a cell, it needs to get one from the UTRAN via the Cell Update procedure. The UE transmits a CELL_UPDATE or URA_UPDATE message on the common control channel (CCCH). A CELL_UPDATE_CONFIRM response message is built and sent by the UTRAN on either on a CCCH or DCCH.

[0043] Figures 2a and 2b illustrate successful Cell Update scenarios. Figure 2a shows the basic flow without a response from the UE; Figure 2b shows the basic flow with a response from the UE in accordance with 3GPP TS 25.331: Radio Resource Control (RRC) Protocol Specification. The URA Update procedure is similar.

[0044] As noted above, all of the existing connected mode UE state transitions, except coming out of CELL_PCH or URA_PCH, are UTRAN directed (i.e. UTRAN orders UE to be come into the indicated state). In comparison, the UE is configured to transition out of the CELL_PCH or URA_PCH monitoring states depending on events occurring at the UE. As stated above, these transitions take place in connection with either a Cell Update or URA Update procedure which procedures are initiated by the UE entering the CELL_FACH duplex state.

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[0045] The applicable standard specifications (including 3GPP TS 25.331: Radio Resource Control (RRC) Protocol Specification, and 3GPP 25.321: Medium Access Control (MAC) Protocol Specification) state that the UE enters CELL_FACH state when a Cell Update or URA Update procedure starts. This is intended because a CELL_UPDATE_CONFIRM or URA_UPDATE_CONFIRM message can be received on a DCCH, which is unavailable in the CELL_PCH or URA_PCH state. However, the inventors have recognized a problem with this transition, since the UE is without a temporary identifier, such as a C-RNTI, until a response to the update procedure is received by the UE. Also, the inventors have recognized a problem due to the UE losing its C-RNTI when it reselects a cell in the CELL_FACH state.

[0046] For mapping the DCCH or DTCH logical channels over RACH (transport channel for uplink), UE MAC uses the C-RNTI in MAC data PDU header (see standard 3GPP 25.321: Medium Access Control (MAC) Protocol Specification). As a result, the DCCH or DTCH transmission over RACH is not feasible unless the UE has a C-RNTI. On the other hand, the UTRAN can send downlink DCCH or DTCH messages over FACH, by using the U-RNTI in the MAC data PDU header. Hence the inventors have recognized that the UE can only have a half duplex downlink link for DCCH or DTCH until it has a C-RNTI.

[0047] Two manifestations of the problem identified by the inventors with the state configurations currently specified in 3GPP TS 25.331: Radio Resource Control (RRC) Protocol Specification are set forth below in connection with Figures 3 and 4.

[0048] Figure 3 illustrates problematic UE behavior where the UE is placed in the CELL_FACH state without a C-RNTI to initiate a Cell Update procedure. As shown in Figure 3, the UE starts in a monitoring state, in this case the CELL_PCH state. An event occurs requiring the Cell Update procedure. Under current specifications, the UE is transitioned into the duplex CELL_FACH state in order to perform the Cell Update procedure which requires an uplink initiation by the UE. In the CELL_FACH state, the UE then send the appropriate request via a CELL_UPDATE message which is received by the UTRAN. The UTRAN

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processes the CELL_UPDATE message and responds with a CELL_UPDATE_CONFIRM message that includes a temporary identifier such as a C-RNTI.

[0049] This is problematic where another event occurs that require uplink messaging before the UE receives the CELL_UPDATE_CONFIRM message, i.e. before it receives the C-RNTI. Upon entering the duplex CELL_FACH state, the UE supports all the RRC procedures applicable to CELL_FACH state. For example, it is then specified as being configured to perform 'Initial Direct Transfer' or 'Uplink Direct Transfer' such as set forth in 3GPP TS 25.331 that require DCCH or DTCH uplink transmissions. However, when the UE is in the CELL_FACH state but without a C-RNTI, the UE has only a half duplex (downlink) DCCH. As a result, the UE is not able to transmit 'Initial Direct Transfer' or 'Uplink Direct Transfer' messaging resulting in a failure to properly transmit such uplink messaging which it should be capable of when in the CELL_FACH state. A number of such scenarios are possible because the UE non-access stratum has two independent state machines for circuit-switched (CS) and packet-switched (PS) services. Both of these utilize the common RRC connection or in other words the common RRC state.

[0050] A variation of the problem that has been recognized by the inventors occurs where Periodic Cell or URA Updates are processed. A high priority Cell or URA Update can be delayed due to UE's operation in the CELL_FACH state while it is without a C-RNTI. For example, as illustrated in Figure 4, the UE in the CELL_PCH state initiates a periodical cell update procedure by transitioning to the CELL_FACH state and transmitting a CELL_UPDATE message that indicates that it is a periodic cell update request. The UTRAN upon receiving such a period request treats it as a request for information, not resources, so that the UTRAN responds with a CELL_UPDATE_CONFIRM message with the requested information and a command for the UE to return to the CELL_PCH state. However, if in the interim the UE detects uplink data to transmit, the UE may not be able to send a cell update request with this high priority cause (uplink data transmission), until it has possibly returned to the CELL_PCH state again. This

scenario is illustrated in Figure 4, showing the high priority cell update getting delayed.

[0051] In view of the problem recognized by the inventors, it is desirable, to provide a WTRU such as a UE that has a connection mode configuration that includes a transition state to implement transitioning to a duplex state where a temporary identifier is supplied to facilitate duplex communications in the duplex state.

[0052] SUMMARY

[0053] A wireless transmit/receive unit (WTRU) and method for wireless uplink communication to and downlink communication from a wireless network are provided. The WTRU has a selectively configurable transceiver that has various modes of operation. The WTRU transceiver has a network connected mode defined by a plurality of functional states including at least one monitoring state wherein the transceiver is configured for only downlink communications and a duplex state wherein the transceiver is configured for both uplink and downlink communications in which the WTRU has a received temporary identifier. The transceiver is configured to transition from a monitoring state upon occurrence of predefined WTRU events that are each associated with a respective uplink procedure initiation communication of a predefined procedure. At least one of the predefined procedures is intended to result in a network response that includes a temporary identifier. The transceiver is configurable into a transition state wherein the transceiver is configured to send only the uplink initiation communications and is otherwise configured only for downlink communications. The transceiver is configured to transition into the transition state upon occurrence of one of the predefined WTRU events such that after receiving a downlink response with a requested temporary identifier, the transceiver is configured into the duplex state.

[0054] The WTRU can be configured to communicate with the network via network base stations. In such case, the WTRU is preferably configured such that when the WTRU is communicating via a first base station in the duplex state, the

WTRU becomes configured to the transition state when it is desired to switch routing of the wireless communication to be via a different base station.

[0055] In a preferred embodiment, the WTRU is configured as a User Equipment (UE) for wireless uplink communication to and downlink communication from a UMTS Terrestrial Radio Access Network (UTRAN). In such case, the UE's transceiver has a UTRAN connected mode defined by the plurality of functional states. Preferably, the UE transceiver is configurable into two monitoring states and is configured to transition to the duplex state from either of the two monitoring states by first entering the transition state and awaiting completion of all procedures initiated by the UE sending uplink initiation communications while in the transition state.

[0056] The two monitoring states into which the UE transceiver is configurable are preferably:

a URA_PCH state wherein no dedicated channel is allocated to the UE, the UE monitors a selected paging channel (PCH) via an associated paging indicator channel (PICH), no uplink activity is performed, a location of the UE is known on a UTRAN Registration area level according to a URA assigned to the UE during a prior URA update in CELL_FACH state; and

a CELL_PCH state wherein no dedicated physical channel is allocated to the UE, the UE monitors a selected PCH via an associated PICH, no uplink activity is performed and a position of the UE is known by UTRAN on cell level according to the cell where the UE last made a cell update in CELL_FACH state.

[0057] The duplex state into which the UE transceiver is configurable is preferably a CELL_FACH state wherein no dedicated physical channel is allocated to the UE, the UE continuously monitors a FACH in the downlink, the UE is assigned a default common or shared transport channel in the uplink that it can use anytime according to the access procedure for that transport channel and the position of the UE is known by UTRAN on cell level according to the cell where the UE last made a cell update.

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[0058] Where the WTRU is configured as a UE, the UE communicates with the UTRAN via UTRAN base stations. Accordingly, the UE's transceiver can be configured such that when the UE is communicating via a first base station in the duplex state, the UE becomes configured to the transition state when it is desired to switch routing of the wireless communication to be via a different base station.

[0059] A method of wireless communication for the WTRU is provided. The method includes transitioning the WTRU from the monitoring state to the duplex state via a transition state wherein at least one uplink procedure initiation communication is transmitted while otherwise maintaining the WTRU configured only for downlink communications. After receiving a downlink response with a requested temporary identifier, the WTRU is configured into the duplex state. Preferably, the transitioning into the duplex state from the monitoring state is implemented by first entering the transition state and awaiting completion of all procedures initiated by the sending of uplink initiation communications while in the transition state. Where the WTRU communicates with the wireless network via network base stations, the method can include configuring the WTRU into the transition state from the duplex state when the WTRU is communicating via a first base station in the duplex state and it is desired to switch routing of the wireless communication to be via a different base station.

[0060] Preferably the method is used for communication by a User Equipment (UE) with a UMTS Terrestrial Radio Access Network (UTRAN). In such case, the UE has a connected mode for wireless uplink communication to and downlink communication from a UTRAN defined by the plurality of functional states that preferably include two monitoring states, namely the URA_PCH state and the CELL_PCH state and the duplex state into which the UE transceiver is configurable is the CELL_FACH state. In such case, the transitioning into the duplex state from either of the two monitoring states is preferably implemented by first entering the transition state and awaiting completion of all procedures initiated by the UE sending uplink initiation communications while in the transition state.

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[0061] Another aspect of the invention is to provide an application specific integrated circuit (ASIC) for the selectively configurable transceiver of the WTRU. The ASIC preferably has circuitry configured to define a network connected mode having a plurality of functional states including at least one monitoring state wherein the transceiver is configured for only downlink communications and a duplex state wherein the transceiver is configured for both uplink and downlink communications in which the WTRU has a received temporary identifier. The ASIC is preferably configured to transition the transceiver from a monitoring state upon occurrence of predefined WTRU events that are each associated with a respective uplink procedure initiation communication of a predefined procedure where at least one procedure is intended to result in a network response that includes a temporary identifier. The ASIC preferably has circuitry to configure the transceiver into a transition state wherein the transceiver is configured to send only the uplink initiation communications and is otherwise configured only for downlink communications. Preferably, the ASIC is configured to transition the transceiver into the transition state upon occurrence of one of the predefined WTRU events such that after receiving a downlink response with a requested temporary identifier, the transceiver is configured into the duplex state. In a preferred embodiment, the ASIC is configured for a User Equipment (UE) that is intended for wireless communication with a UMTS Terrestrial Radio Access Network (UTRAN).

[0062] Other objects and advantages of the invention will be apparent to those skilled in the art from the following description of a preferred embodiment, given by way of example and to be understood in conjunction with the accompanying drawings.

[0063] BRIEF DESCRIPTION OF THE DRAWING(S)

[0064] Figure 1a shows an overview of a system architecture of a conventional UMTS network.

[0065] Figure 1b is an illustration of RRC states and state transitions including GSM for a UE of a conventional 3GPP system;

[0066] Figures 2a and 2b are time line illustrations of conventional cell update procedures of two types, without and with a response from a UE, respectively.

[0067] Figure 3 is a timeline illustration of a first communication scenario illustrating a potential communication problem when utilizing the conventional duplex CELL_FACH state.

[0068] Figure 4 is a timeline illustration of a second communication scenario illustrating a potential communication problem when utilizing the conventional duplex CELL_FACH state.

[0069] Figure 5 is an illustration of a preferred embodiment of a modified UE state machine in accordance with the teachings of the present invention.

[0070] Figures 6a and 6b are time line illustrations of a UE utilizing a TRANS_CELL_FACH state in accordance with the teachings of the present invention.

[0071] TABLE OF ACRONYMS

2G	Second Generation Mobile Radio System Standard
3GPP	Third Generation Partnership Project
ARIB	Association Of Radio Industries Businesses
ASIC	Application Specific Integrated Circuit
BLER	Block Error Rate
CCCH	Common Control Channel
CELL_DCH	UE Connected Mode Duplex State (dedicated resources)
CELL_FACH	UE Connected Mode Duplex State (common resources)
URA_PCH	UE Connected Mode Monitoring State
CN	Core Network
CS	Circuit Switched
C-RNTI	Cell Radio Network Temporary Identifier
DCCH	Dedicated Control Channel
DCH	Dedicated Channel
DL	Downlink
DTCH	Dedicated Traffic Channel
ETSI SMG	European Telecommunications Standard Institute – Special Mobile Group
FACH	Forward Access Channel
FDD	Frequency Division Duplex
GPRS	General Packet Radio Service
GSM	Global System For Mobile Telecommunications

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HS	High Speed
HSDPA	High Speed Down Link Packet Access
HS-DSCH	High Speed Downlink Shared Channel
HS-SICH	High Speed Shared Information Channel
L1	Layer 1
MAC	Medium Access Control
PCH	Paging Channel
PS	Packet Switched
PSTN	Public Switched Telephone Network
RACH	Random Access Channel
RNC	Radio Network Controller
RRC	Radio Resource Control
SIR	Signal To Interference Ratio
TDD	Time-Division Duplex
TDSCDMA	Time-Division Synchronous Code-Division Multiple Access
TS	Time Slot
TRANS_CELL_FACH	UE Connected Mode Transition State
TTI	Transmission Time Interval
Tx	Transmission
UE	User Equipment
UL	Uplink
UL DCH	Uplink Dedicated Channel
UL SCH	Uplink Shared Channel
UMTS	Universal Mobile Telecommunication System
URA	UTRAN registration area
URA_PCH	UE Connected Mode Monitoring State
U-RNTI	UTRAN Radio Network Temporary Identifier
UTRA	Universal Terrestrial Radio Access
UTRA TDD	UMTS Terrestrial Radio Access Time Division Duplex
UTRAN	UMTS Terrestrial Radio Access Network
WTRU	Wireless Transmit Receive Unit

[0072] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0073] The present invention is described with reference to the drawing figures wherein like numerals represent like elements throughout. The terms base station, wireless transmit/receive unit (WTRU) and mobile unit are used in their general sense.

[0074] The term base station as used herein includes, but is not limited to, a base station, Node-B, site controller, access point, or other interfacing device in a

wireless environment that provides WTRUs with wireless access to a network with which the base station is associated.

[0075] The term WTRU as used herein includes, but is not limited to, user equipment (UE), mobile station, fixed or mobile subscriber unit, pager, or any other type of device capable of operating in a wireless environment. WTRUs include personal communication devices, such as phones, video phones, and Internet ready phones that have network connections. In addition, WTRUs include portable personal computing devices, such as PDAs and notebook computers with wireless modems that have similar network capabilities. WTRUs that are portable or can otherwise change location are referred to as mobile units.

[0076] The present invention is particularly useful when used in conjunction with mobile units, i.e., mobile WTRUs. For example, the invention can be implemented in a UE of the conventional UTMS system illustrated in Figure 1a.

[0077] The description that follows is directed to a preferred embodiment as implemented for a WTRU in the form of a UE that has a transceiver configured for wireless communication with a UTRAN. In particular, the UE preferably includes a configurable transceiver having a UTRAN connected mode defined by a plurality of functional states. The functional states preferably include CELL_PCH and URA_PCH monitoring states wherein the transceiver is configured for only downlink communications. The functional states also preferably include CELL_FACH and CELL_DCH duplex state wherein the transceiver is configured for both uplink and downlink communications in which the UE has a received temporary identifier.

[0078] These monitoring and duplex states preferably have the functionality as described above for a conventional UE's RRC connected mode, except the transceiver also is configurable into a transition state, herein referred to as TRANS_CELL_FACH as illustrated in Figure 5. The transceiver is configured to enter TRANS_CELL_FACH transition state in advance of entering the CELL_FACH duplex state to provide for the reception of a temporary identifier, so that the UE can properly conduct all of the duplex communications required in the conventional CELL_FACH duplex state.

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[0079] Preferably, the transceiver when configured in the TRANS_CELL_FACH transition state permits the uplink procedure initiation communications of cell update procedures and has only half duplex DCCH or DTCH capability in the downlink direction. The UE is preferably configured to transition from the CELL_PCH or URA_PCH state to CELL_FACH state only via TRANS_CELL_FACH state. When in the CELL_PCH or URA_PCH state, the UE is without C-RNTI and an event calling for a cell or URA update (such as uplink data transmission or periodic update) preferably triggers entry to the TRANS_CELL_FACH state to enable the UE to perform the uplink procedure initiation communication of the called for cell update procedure.

[0080] Preferably, the UE remains in the TRANS_CELL_FACH state as long as a Cell Update or URA Update procedure is active whereupon the transceiver enters the CELL_FACH state if a temporary identifier is received. Accordingly, the UE will receive a temporary identifier before it enters the CELL_FACH state where the UE has the full duplex DCCH/DTCH capability.

[0081] Optionally, the transceiver can be configured to return to a CELL_PCH or URA_PCH state if no temporary identifier is received during the transition state after all cell update procedures initiated while in the TRANS_CELL_FACH state are completed. For example, as illustrated in Figure 6a, where in response to a periodic update request from the UE, the UTRAN decides that the UE should return to the prior CELL_PCH monitoring state, the UE will make that state change where there is no intervening update procedure.

[0082] Figure 6b illustrates a preferred scenario where there is an intervening procedure initiated while the UE is in the TRANS_CELL_FACH state. In that case the UE preferably does not return to the CELL_PCH state when receiving the command from the UTRAN, but awaits completion of the pending CELL_UPDATE that it initiated which results in the generation of a C-RNTI which is received by the UE and the cause the UE to assume the CELL_FACH state.

[0083] The UE preferably also enters the TRANS_CELL_FACH state from the CELL_FACH state in case of cell reselection. In such case, the UE remains in

the TRANS_CELL_FACH state which switching the conduct of a wireless communication via a first base station to a second base station until a temporary identifier is received from the second base station whereupon the transceiver resumes the CELL_FACH state.

[0084] All RRC procedures requiring uplink DCCH or DTCH transmission are preferably defined or redefined to delay the procedure until a cell or URA update procedure is completed. Where such definitions are employed, a virtual TRANS_CELL_FACH state can be implemented even if the UE transceiver is not specifically configurable into a separate TRANS_CELL_FACH transition state that differs from the CELL_FACH duplex state. Also, the Cell Update and URA Update procedures are preferably enhanced to make it possible for UE to send an update request with a high priority cause (e.g. uplink data transmission), if the UE is without a C-RNTI.

[0085] By implementing the invention in a UE, the UE behavior is more clearly defined in terms of its transmission/ reception capabilities when in different states in order to avoid unnecessary signaling between UE and UTRAN. Also, Cell Update and URA Update procedures are made more efficient because of the correct recognition of events in terms of UE transmission capabilities.

[0086] Preferably, the components of the UE transceiver that are configurable into the connected states illustrated in Figure 5 are implemented on an single integrated circuit, such as an application specific integrated circuit (ASIC). However, the components may also be readily implemented on multiple separate integrated circuits.

[0087] The foregoing description makes references to a UE configured for wireless communication with a UTRAN as an example only and not as a limitation. The invention is applicable to WTRUs of other systems of wireless communication where monitoring states and duplex state are defined. Other variations and modifications consistent with the invention will be recognized by those of ordinary skill in the art without departing from the scope of the invention as described hereinabove.

* * *

CLAIMS

What is claimed is:

1. A wireless transmit/receive unit (WTRU) for wireless uplink communication to and downlink communication from a wireless network comprising a selectively configurable transceiver having a network connected mode defined by a plurality of functional states including at least one monitoring state wherein the transceiver is configured for only downlink communications and a duplex state wherein the transceiver is configured for both uplink and downlink communications in which the WTRU has a received temporary identifier, the transceiver configured to transition from a monitoring state upon occurrence of predefined WTRU events that are each associated with a respective uplink procedure initiation communication of a predefined procedure where at least one procedure is intended to result in a network response that includes a temporary identifier, the transceiver configurable into a transition state wherein the transceiver is configured to send only the uplink initiation communications and is otherwise configured only for downlink communications, and the transceiver configured to transition into the transition state upon occurrence of one of the predefined WTRU events such that after receiving a downlink response with a requested temporary identifier, the transceiver is configured into the duplex state.

2. The invention according to claim 1 wherein the WTRU communicates with the network via network base stations wherein the WTRU is configured such that when the WTRU is communicating via a first base station in the duplex state, the WTRU becomes configured to the transition state when it is desired to switch routing of the wireless communication to be via a different base station.

3. A User Equipment (UE) for wireless uplink communication to and downlink communication from a UMTS Terrestrial Radio Access Network (UTRAN) comprising a selectively configurable transceiver having a UTRAN connected mode defined by a plurality of functional states including at least one monitoring state wherein the transceiver is configured for only downlink

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communications and a duplex state wherein the transceiver is configured for both uplink and downlink communications in which the UE has a received temporary identifier, the transceiver configured to transition from a monitoring state upon occurrence of predefined UE events that are each associated with a respective uplink procedure initiation communication of a predefined procedure where at least one procedure is intended to result in a network response that includes a temporary identifier, the transceiver configurable into a transition state wherein the transceiver is configured to send only the uplink initiation communications and is otherwise configured only for downlink communications, and the transceiver configured to transition into the transition state upon occurrence of one of the predefined UE events such that after receiving a downlink response with a requested temporary identifier, the transceiver is configured into the duplex state.

4. The invention according to claim 3 wherein the UE transceiver is configurable into two monitoring states and is configured to transition to the duplex state from either of the two monitoring states by first entering the transition state and awaiting completion of all procedures initiated by the UE sending uplink initiation communications while in the transition state.

5. The invention according to claim 4 wherein

the two monitoring states into which the UE transceiver is configurable are:

a URA_PCH state wherein no dedicated channel is allocated to the UE, the UE monitors a selected paging channel (PCH) via an associated paging indicator channel (PICH), no uplink activity is performed, a location of the UE is known on a UTRAN Registration area level according to a URA assigned to the UE during a prior URA update in CELL_FACH state; and

a CELL_PCH state wherein no dedicated physical channel is allocated to the UE, the UE monitors a selected PCH via an associated PICH, no uplink activity is performed and a position of the UE is known by

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UTRAN on cell level according to the cell where the UE last made a cell update in CELL_FACH state; and

the duplex state into which the UE transceiver is configurable is a CELL_FACH state wherein no dedicated physical channel is allocated to the UE, the UE continuously monitors a FACH in the downlink, the UE is assigned a default common or shared transport channel in the uplink that it can use anytime according to the access procedure for that transport channel and the position of the UE is known by UTRAN on cell level according to the cell where the UE last made a cell update.

6. The invention according to claim 5 wherein the UE communicates with the UTRAN via UTRAN base stations wherein the UE is configured such that when the UE is communicating via a first base station in the duplex state, the UE becomes configured to the transition state when it is desired to switch routing of the wireless communication to be via a different base station.

7. The invention according to claim 3 wherein the UE communicates with the UTRAN via UTRAN base stations wherein the UE is configured such that when the UE is communicating via a first base station in the duplex state, the UE becomes configured to the transition state when it is desired to switch routing of the wireless communication to be via a different base station.

8. A method of wireless communication for a wireless transmit/receive unit (WTRU) with a wireless network wherein the WTRU has a connected mode for wireless uplink communication to and downlink communication from the wireless network defined by a plurality of functional states including a monitoring state wherein the WTRU is configured for only downlink communications and a duplex state wherein the WTRU is configured for both uplink and downlink communications in which the WTRU has a received temporary identifier, the method comprising transitioning the WTRU from the monitoring state to the duplex state via a transition state wherein at least one uplink procedure initiation

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communication is transmitted while otherwise maintaining the WTRU configured only for downlink communications and, after receiving a downlink response with a requested temporary identifier, configuring the WTRU into the duplex state.

9. The method according to claim 8 wherein the transitioning into the duplex state from the monitoring state is implemented by first entering the transition state and awaiting completion of all procedures initiated by the sending of uplink initiation communications while in the transition state.

10. The method according to claim 8 wherein the WTRU communicates with the wireless network via network base stations further comprising configuring the WTRU into the transition state from the duplex state when the WTRU is communicating via a first base station in the duplex state and it is desired to switch routing of the wireless communication to be via a different base station.

11. A method of wireless communication for a User Equipment (UE) with a UMTS Terrestrial Radio Access Network (UTRAN) wherein the UE has a connected mode for wireless uplink communication to and downlink communication from a UTRAN defined by a plurality of functional states including a monitoring state wherein the UE is configured for only downlink communications and a duplex state wherein the UE is configured for both uplink and downlink communications in which the UE has a received temporary identifier, the method comprising transitioning the UE from the monitoring state to the duplex state via a transition state wherein at least one uplink procedure initiation communication is transmitted while otherwise maintaining the UE configured only for downlink communications and, after receiving a downlink response with a requested temporary identifier, configuring the UE into the duplex state.

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12. The method according to claim 11 where the UE transceiver is configurable into two monitoring states, namely:

a URA_PCH state wherein no dedicated channel is allocated to the UE, the UE monitors a selected paging channel (PCH) via an associated paging indicator channel (PICH), no uplink activity is performed, a location of the UE is known on a UTRAN Registration area level according to a URA assigned to the UE during a prior URA update in CELL_FACH state, and

a CELL_PCH state wherein no dedicated physical channel is allocated to the UE, the UE monitors a selected PCH via an associated PICH, no uplink activity is performed and a position of the UE is known by UTRAN on cell level according to the cell where the UE last made a cell update in CELL_FACH state, and

where the duplex state into which the UE transceiver is configurable is a CELL_FACH state wherein no dedicated physical channel is allocated to the UE, the UE continuously monitors a FACH in the downlink, the UE is assigned a default common or shared transport channel in the uplink that it can use anytime according to the access procedure for that transport channel and the position of the UE is known by UTRAN on cell level according to the cell where the UE last made a cell update, the method wherein:

the transitioning into the duplex state from either of the two monitoring states is implemented by first entering the transition state and awaiting completion of all procedures initiated by the UE sending uplink initiation communications while in the transition state.

13. The method according to claim 12 wherein the UE communicates with the wireless network via network base stations further comprising configuring the UE into the transition state from the duplex state when the UE is communicating via a first base station in the duplex state and it is desired to switch routing of the wireless communication to be via a different base station.

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14. The method according to claim 11 wherein the UE communicates with the wireless network via network base stations further comprising configuring the UE into the transition state from the duplex state when the UE is communicating via a first base station in the duplex state and it is desired to switch routing of the wireless communication to be via a different base station.

15. An application specific integrated circuit (ASIC) for a selectively configurable transceiver of a wireless transmit/receive unit (WTRU) for wireless uplink communication to and downlink communication from a wireless network, the ASIC having circuitry configured to define a network connected mode having a plurality of functional states including at least one monitoring state wherein the transceiver is configured for only downlink communications and a duplex state wherein the transceiver is configured for both uplink and downlink communications in which the WTRU has a received temporary identifier, the ASIC configured to transition the transceiver from a monitoring state upon occurrence of predefined WTRU events that are each associated with a respective uplink procedure initiation communication of a predefined procedure where at least one procedure is intended to result in a network response that includes a temporary identifier, the ASIC having circuitry to configure the transceiver into a transition state wherein the transceiver is configured to send only the uplink initiation communications and is otherwise configured only for downlink communications, and the ASIC configured to transition the transceiver into the transition state upon occurrence of one of the predefined WTRU events such that after receiving a downlink response with a requested temporary identifier, the transceiver is configured into the duplex state.

16. The invention according to claim 15 wherein the ASIC is configured for a User Equipment (UE) that is intended for wireless communication with a UMTS Terrestrial Radio Access Network (UTRAN).

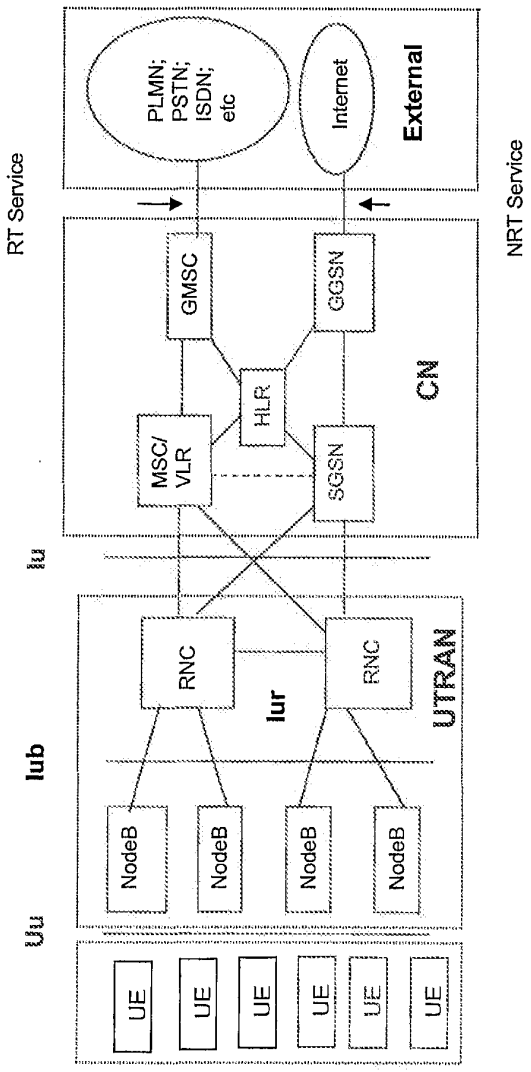


Figure 1a
(Prior Art)

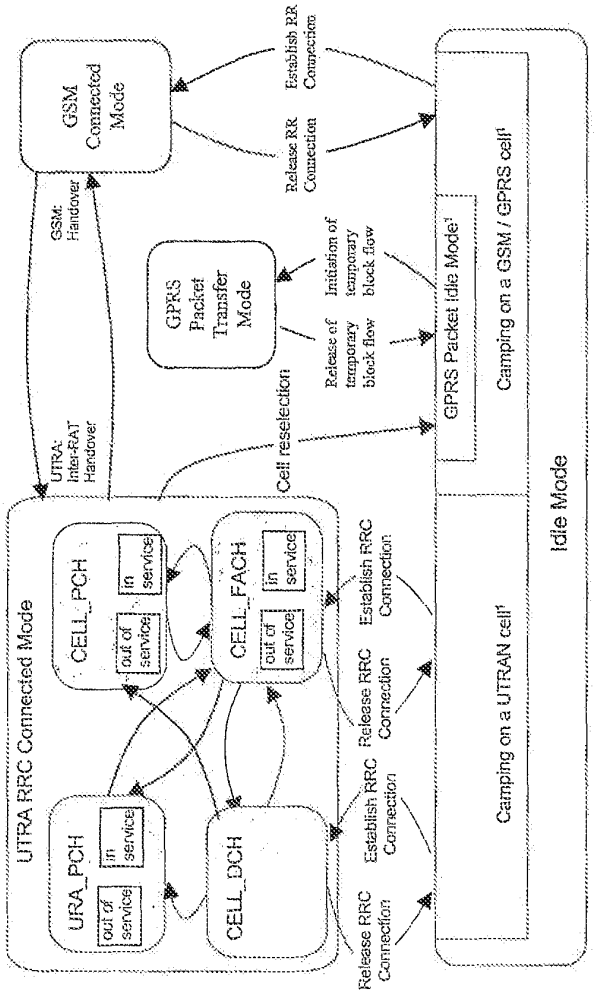


Figure 1b
(Prior Art)

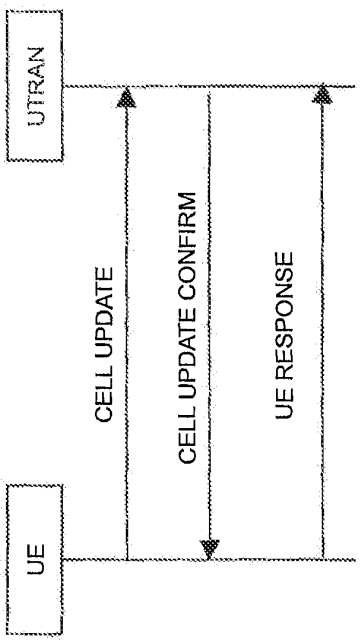


Figure 2b
(Prior Art)

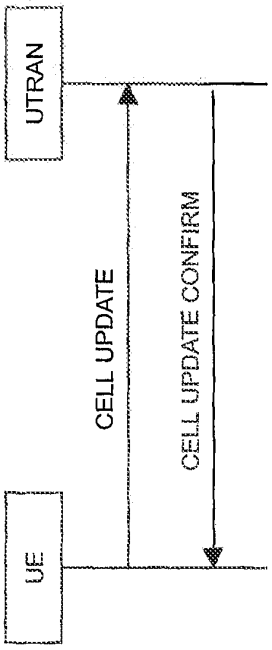


Figure 2a
(Prior Art)

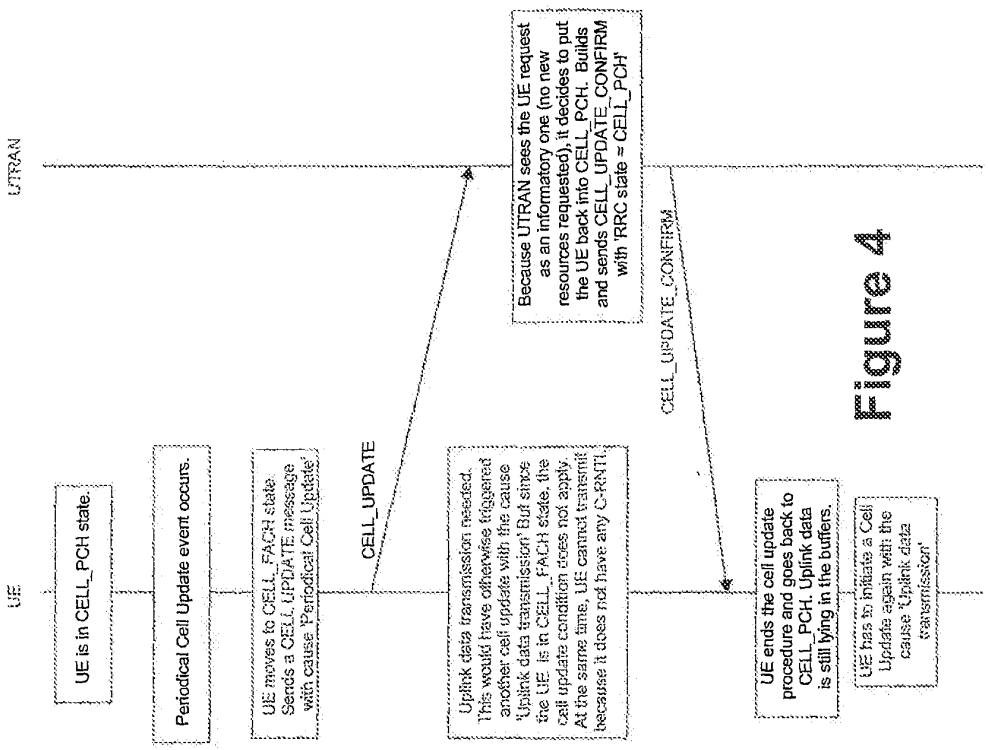


Figure 4

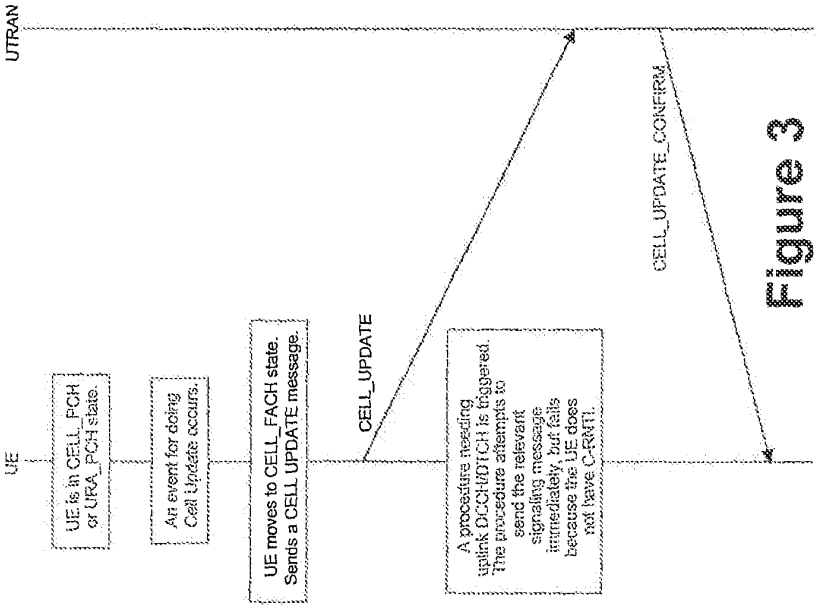


Figure 3

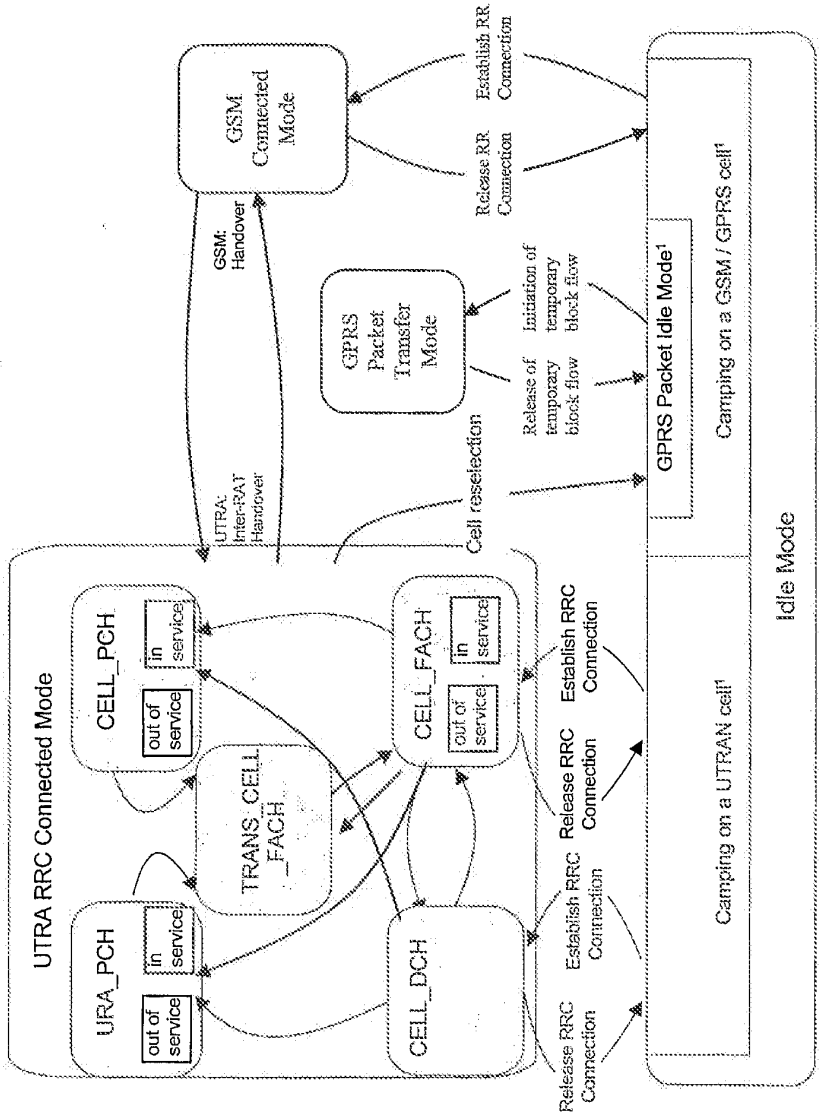
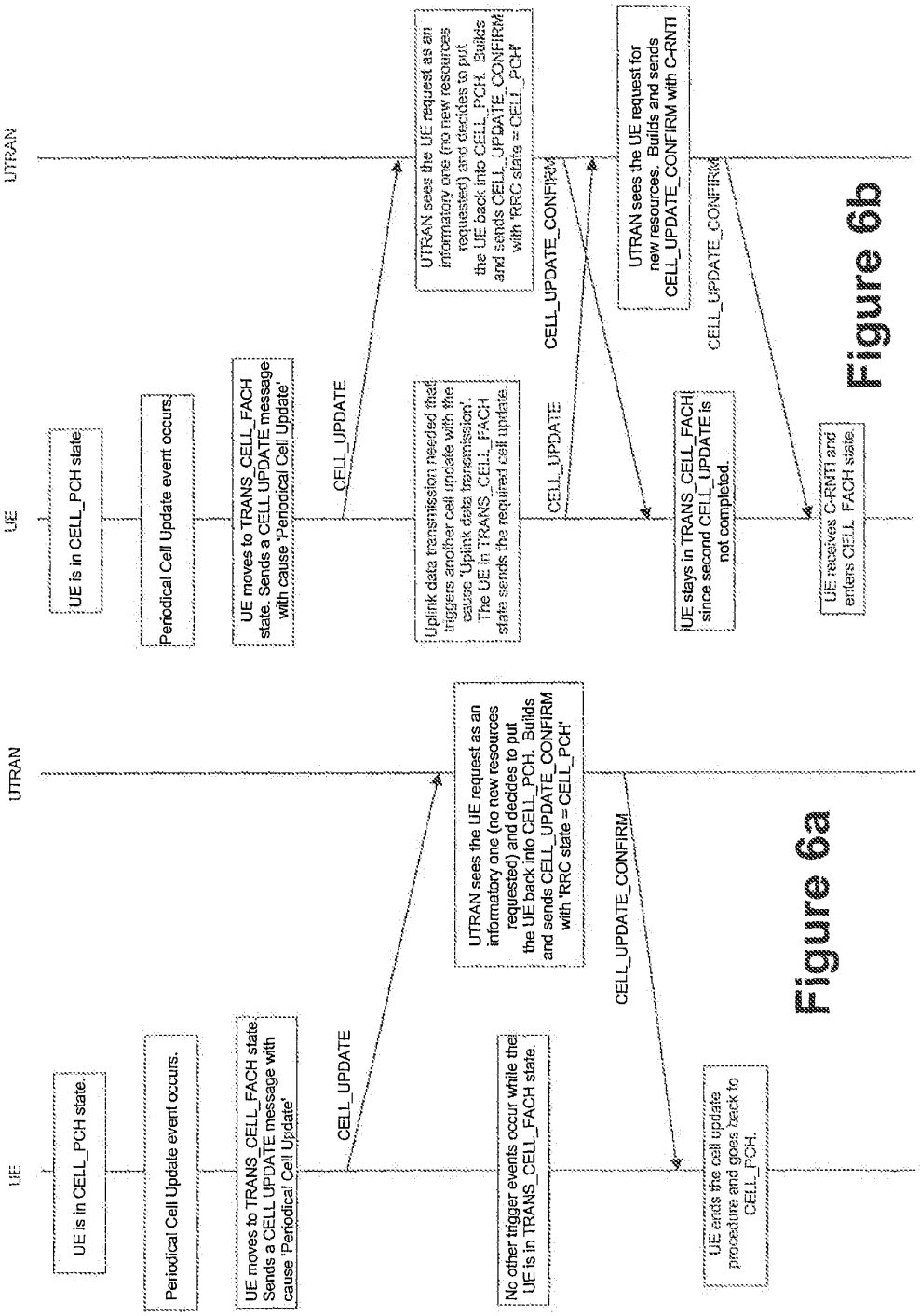

UTRA RRC Connected Mode
URA_PCH
out of service
in service
CELL_PCH
out of service
in service
TRANS_CELL_FACH
CELL_DCH
CELL_FACH
out of service
in service
Release RRC Connection
Establish RRC Connection
Release RRC Connection
Establish RRC Connection
UTRA: Inter-RAT Handover
GSM: Handover
GSM Connected Mode
GPRS Packet Transfer Mode
Cell reselection
Release of temporary block flow
Initiation of temporary block flow
Release RR Connection
Establish RR Connection
GPRS Packet Idle Mode[1]
Camping on a UTRAN cell[1]
Camping on a GSM / GPRS cell[1]
Idle Mode

Figure 5


UE
UTRAN
UE is in CELL_PCH state.
Periodical Cell Update event occurs.
UE moves to TRANS_CELL_FACH state. Sends a CELL UPDATE message with cause 'Periodical Cell Update'
CELL_UPDATE
No other trigger events occur while the UE is in TRANS_CELL_FACH state.
UTRAN sees the UE request as an informatory one (no new resources requested) and decides to put the UE back into CELL_PCH. Builds and sends CELL_UPDATE_CONFIRM with 'RRC state = CELL_PCH'
CELL_UPDATE_CONFIRM
UE ends the cell update procedure and goes back to CELL_PCH.
Figure 6a
UE
UTRAN
UE is in CELL_PCH state
Periodical Cell Update event occurs.
UE moves to TRANS_CELL_FACH state. Sends a CELL UPDATE message with cause 'Periodical Cell Update'
CELL_UPDATE
Uplink data transmission needed that triggers another cell update with the cause 'Uplink data transmission'. The UE in TRANS_CELL_FACH state sends the required cell update.
UTRAN sees the UE request as an informatory one (no new resources requested) and decides to put the UE back into CELL_PCH. Builds and sends CELL_UPDATE_CONFIRM with 'RRC state = CELL_PCH'
CELL_UPDATE_CONFIRM
UE stays in TRANS_CELL_FACH since second CELL_UPDATE is not completed.
UTRAN sees the UE request for new resources. Builds and sends CELL_UPDATE_CONFIRM with C-RNTI
CELL_UPDATE_CONFIRM
UE receives C-RNTI and enters CELL_FACH state.
Figure 6b

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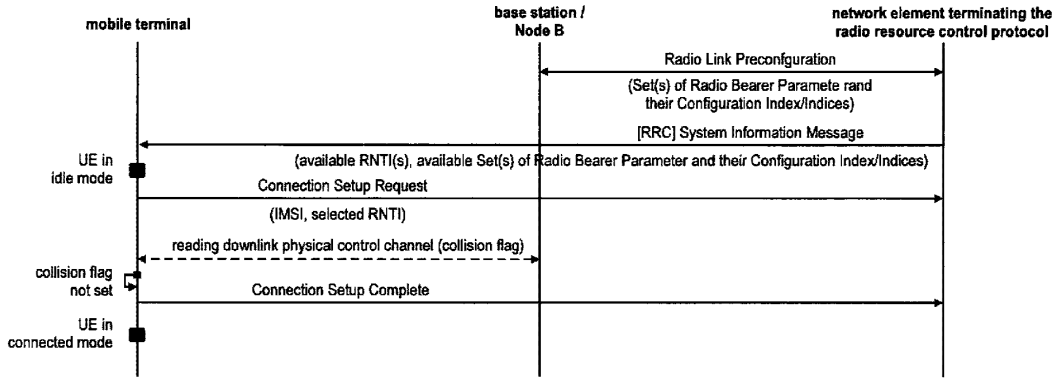
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(54) **Title:** FAST RADIO BEARER ESTABLISHMENT IN A MOBILE COMMUNICATION SYSTEM



(57) **Abstract:** The invention relates to methods for establishing a radio bearer between a network element terminating radio resource control protocol and a mobile terminal. The invention provides RNC for establishing a radio bearer between the RNC and a mobile terminal, especially adapted mobile terminals and a system comprising the network element and at least one mobile terminal. In order to reduce the delays implied by the signaling in the procedure the invention proposes two mechanisms. The first mechanism aims at reducing the delay implied by setting up the radio link for the radio bearer by preconfiguring a pool of resources comprising a set of at least radio bearer configuration and making the available radio bearer configurations known to the mobile terminals. The second mechanism aims at avoiding the delay implied by the explicit assignment of a radio network temporary identifier by signaling a set of available identifiers from which the mobile terminal may choose an identifier.

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FAST RADIO BEARER ESTABLISHMENT IN A MOBILE COMMUNICATION SYSTEM

FIELD OF THE INVENTION

The present invention relates to methods for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal. The invention further provides network elements in a radio access network terminating radio resource control protocol, especially adapted mobile terminals and a system comprising at least one of the network elements and at least one of the mobile terminals.

TECHNICAL BACKGROUND

W-CDMA (Wideband Code Division Multiple Access) is a radio interface for IMT-2000 system (International Mobile Telecommunication system), which was standardized for use as the 3rd generation wireless mobile telecommunication system. It provides a variety of services such as voice services and multimedia mobile communication services in a flexible and efficient way. The standardization bodies in Japan, Europe, USA, and other countries have jointly organized a project called the 3rd Generation Partnership Project (3GPP) to produce common radio interface specifications for W-CDMA.

The standardized European version of IMT-2000 is commonly called UMTS (Universal Mobile Telecommunication System). The first release of the specification of UMTS has been published in 1999 (Release 99). In the mean time several improvements to the standard have been standardized by the 3GPP in Release 4, Release 5 and Release 6. A discussion on further improvements is ongoing under the scope of Release 7 and Study Item on Evolved UTRA and UTRAN.

UMTS Architecture

The high level Release 99/4/5 architecture of Universal Mobile Telecommunication System (UMTS) is shown in Fig. 1 (see 3GPP TR 25.401: "UTRAN Overall Description", available from http://www.3gpp.org). The UMTS system consists of a number of network

elements each having a defined function. Though the network elements are defined by their respective function, a similar physical implementation of the network elements is common but not mandatory.

The network elements are functionally grouped into the Core Network (CN) 101, the UMTS Terrestrial Radio Access Network (UTRAN) 102 and the User Equipment (UE) 103. The UTRAN 102 is responsible for handling all radio-related functionality, while the CN 101 is responsible for routing calls and data connections to external networks. The interconnections of these network elements are defined by open interfaces (Iu, Uu). It should be noted that UMTS system is modular and it is therefore possible to have several network elements of the same type.

In the sequel two different architectures will be discussed. They are defined with respect to logical distribution of functions across network elements. In actual network deployment, each architecture may have different physical realizations meaning that two or more network elements may be combined into a single physical node.

Fig. 2 illustrates the current architecture of UTRAN. A number of Radio Network Controllers (RNCs) 201, 202 are connected to the CN 101. Functionally, the RNC 201, 202 owns and controls the radio resources in its domain and typically terminates the Radio Resource Control protocol on the access network side. Each RNC 201, 202 controls one or several base stations (Node Bs) 203, 204, 205, 206, which in turn communicate with the user equipments. An RNC controlling several base stations is called Controlling RNC (C-RNC) for these base stations. A set of controlled base stations accompanied by their C-RNC is referred to as Radio Network Subsystem (RNS) 207, 208. For each connection between User Equipment and the UTRAN, one RNS is the Serving RNS (S-RNS). It maintains the so-called Iu connection with the Core Network (CN) 101. When required, the Drift RNS 302 (D-RNS) 302 supports the Serving RNS (S-RNS) 301 by providing radio resources as shown in Fig. 3. Respective RNCs are called Serving RNC (S-RNC) and Drift RNC (D-RNC). It is also possible and often the case that C-RNC and D-RNC are identical and therefore abbreviations S-RNC or RNC are used. Commonly, a Drift RNS 302 is used for soft handovers of UEs between different RNS.

General Description of the Protocol Model of the UTRAN Terrestrial Interfaces

Fig. 4 shows an overview of the protocol model of the UTRAN in an UMTS network. For a better understanding, only a brief description is provided herein; further details may be

found in Holma et al., "WCDMA for UMTS", Third Edition, Wiley & Sons, Inc., October 2004, Chapter 5.

On the horizontal plane, the protocol model can be split into the radio network layer and the transport network layer. All UTRAN-related issues are visible and handled on the radio network layer, while transport network layer typically represents standard transport technology that is selected to be used for data transport for the UTRAN without any UTRAN-specific changes.

On the vertical plane, the protocol model can be split into control plane and user plane. The control plane is used for UMTS-specific control signaling (i.e. radio network layer related control signaling) and includes the Application Protocol (AP), e.g. RANAP on the Iu interfaces, RNSAP on the Iur interfaces, NBAP on the Iub and RRC on Uu interfaces. The control plane functions and Application Protocol allows setting up traffic radio bearers to the UEs via so-called signaling radio bearers.

While the control plane protocols are responsible for the UMTS-specific control signaling, the user plane transports the data streams sent by and sent to the users, such as voice calls, streaming data, packets of packet-switched services, etc. For transport, the user plane contains the so-called traffic radio bearers (also sometimes referred to as Data Bearers).

The transport network control plane is used for control signaling within the transport network layer and does not include any radio network layer related information. The transport network control plane includes the ALCAP protocol, which is used to set up the traffic radio bearers for exchanging user plane information and the signaling radio bearers required for communicating ALCAP protocol messages. Due to the presence of the transport network control plane, it is possible that the Application Protocol within the control plane may operate completely independent from the technology selected for data transport on the traffic radio bearers in the user plane. The transport network control plane controls the operation of the transport network user plane.

UTRA Radio Interface Protocol architecture

An overview of the radio interface protocol architecture of the UTRAN is shown in Fig. 5. Generally, the radio interface protocol architecture of the UTRAN implements Layers 1 to 3 of the OSI protocol stack. The protocols terminated in the UTRAN are also referred to as the access stratum (protocols). In contrast to the access stratum, all protocols not

terminated in the UTRAN are typically also referred to as the non-access stratum protocols.

As has been discussed with respect to Fig. 4, the vertical split of the protocols into user plane and control plane is illustrated. The Radio Resource Control (RRC) protocol is a Layer 3 protocol of the control plane which controls the protocols in the lower layers of the UTRA Radio Interface (Uu).

The RRC protocol is typically terminated in the RNC of the UTRAN, however other network elements have also been considered for terminating the RRC protocol in the UTRAN, e.g. the Node Bs. The RRC protocol is used for signaling of control information to control access to radio resources of the radio interface to the UEs. Further, there is also the possibility that the RRC protocol encapsulates and transports non-access stratum protocol messages, which are usually related to control within the non-access stratum protocol.

In the control plane, the RRC protocol relays the control information to Layer 2, i.e. the Radio Link Control (RLC) protocol, via signaling radio bearers through Service Access Points (SAPs). In the user plane the non-access stratum protocol entities may use traffic radio bearers to directly access Layer 2 via SAPs. The access may be made to the RLC directly or to the Packed Data Convergence Protocol which in turn provides its PDUs to the RLC protocol entity.

The RLC offers the SAPs to the higher layers. The SAPs define how RLC will handle the packets, e.g. whether RLC is operating in transparent, acknowledged or unacknowledged mode. The services provided to the higher layers in the control plane and user plane by the RRC or PDCP are also referred to as signaling radio bearer and traffic radio bearer, respectively.

The MAC/RLC layer in turn offers its services to the RLC layer by means of so-called logical channels. The logical channels essentially define what kind of data is transported. The physical layer offers its services to the MAC/RLC layer, the so-called transport channels. The transport channels define how and with which characteristics the data received from the MAC layer are transmitted via the physical channels.

Logical and Transport Channels in UTRAN

In this section the mapping between relevant logical channels and transport channels will be outlined. The mapping of logical channels to transport channels may be utilized for some of the signaling messages within a RRC connection establishment procedure.

The characteristics and mapping of relevant logical and transport channels for UTRA and E-UTRA are summarized in the following tables. Logical channels are mainly described by data type to be transmitted whereas transport channels are mainly described by respective transmission types and identification method.

The table below contains a description of logical and transport channels for UTRA and E-UTRA, respectively.

Logical (LCH) or Transport Channel (TrCH) type vs. channel characteristic and mapping		*Channel characteristic*				*Mapping (LCH -> TrCH)*
		Data Type	*Transmission* Type	*Direction: Uplink (UL) or Downlink (DL)*	*Identification method*	
LCH	BCCH (Broadcast Control CHannel)	system information (broadcast)	N/A	DL	N/A	BCCH -> BCH
	CCCH (Common Control CHannel)	common service control (unicast)	N/A	UL or DL	N/A, Note: this logical channel is mainly used for transmission of control plane information prior to identifier assignment to UE by radio access network	CCCH -> FACH, RACH
	DCCH (Dedicated Control CHannel)	dedicated service control (unicast)	N/A	UL or DL	N/A	DCCH -> FACH, RACH, DCH

TrCH	BCH (Broadcast CHannel)	N/A	Common channel with static configuration	DL	N/A due to broadcast data type	N/A
	FACH (Forward Access CHannel)	N/A	Common channel with semi-static configuration	DL	Layer 2 inband when carrying DCCH, N/A otherwise	N/A
	RACH (Random Access CHannel)	N/A	Common channel with semi-static configuration and contention-based access	UL	Layer 2 inband when carrying DCCH, N/A otherwise	N/A
	DCH (Dedicated CHannel)	N/A	Dedicated channel with semi-static configuration	UL or DL	N/A since this is dedicated transport channel	N/A

Please note that mapping of DCCH in the table above may be possible on a Fractional Dedicated Channel in downlink direction for UMTS Release 6 and on Enhanced Dedicated Transport Channel in uplink for UMTS Release 6 of the Evolved UTRA. These options have however not been considered in the table for the sake of simplicity.

For UTRA, identification of transport channels in shown in the table above is Layer 2 inband. Layer 2 inband identification means that header of a Layer 2 MAC PDU contains UE identifier pointing at a specific UE as a destination or source of information for downlink or uplink direction, respectively. Consequently, for mapping of logical channels containing data of system information and common service control type identification is not needed. Identification is applicable only to common transport channels (RACH and FACH) apart from broadcast common transport channel (BCH).

The following table shows an exemplary description of logical channels and transport channels in the Evolved UTRA (E-UTRA).

	Channel characteristic	***Mapping***

Logical (LCH) or Transport Channel (TrCH) type vs. channel characteristic and mapping		***Data Type***	***Transmission Type***	***Direction: Uplink (UL) or Downlink (DL)***	***Identification method***	***(LCH -> TrCH)***
LCH	BCCH (Broadcast Control CHannel)	system information (broadcast)	N/A	DL	N/A	BCCH -> Evolved-BCH
	CCCH (Common Control CHannel)	common service control (unicast)	N/A	UL or DL	N/A, Note: this logical channel is mainly used for transmission of control plane information prior to identifier assignment to UE by radio access network	CCCH -> SDCH (in downlink direction only), CACH
	DCCH (Dedicated Control CHannel)	dedicated service control (unicast)	N/A	UL or DL	N/A	DCCH-> SDCH, SUCH
TrCH	Evolved-BCH (Evolved Broadcast CHannel)	N/A	Common channel with static configuration	DL	N/A due to broadcast data type	N/A
	CACH (Contention Access CHannel)	N/A	Common channel with semi-static configuration and contention-based access	UL	Layer 2 inband when carrying DCCH, N/A otherwise	N/A

	SDCH (Shared Downlink CHannel)	N/A	Shared channel with dynamic configuration and scheduled access	DL	Layer 1 outband	N/A
	SUCH (Shared Uplink CHannel)	N/A	Dedicated channel with semi-static configuration	UL	Layer 1 outband	N/A

It can be noted that legacy FACH is not used and that shared channels are used instead of legacy DCH. It is assumed that associated physical channels in downlink direction are used for both SDCH and SUCH. An example of associated physical channel could be Shared Control Signaling CHannel (SCSCH).

The transmission types description in the respective column of the table above should be understood as follows. A static configuration means that the transport format attributes of the channel, e.g. modulation, forward error correction scheme etc. are system-specific and are not subject to change by the network. In a semi-static configuration the transport format attributes of the channel, e.g. modulation, forward error correction scheme etc. are subject to change by reconfiguration procedure. The procedure is fairly slow introducing latency of the order of 100 ms. Finally, in a dynamic configuration the transport format attributes of the channel, e.g. modulation, forward error correction scheme etc. are subject to change by signaling on associated control channels. The procedure is fairly fast relative to semi-static reconfiguration and may introduce a delay of the order of several sub-frames (1 sub-frame ~ 100 ms). Dynamic configuration may be carried out so as to optimally match transmission format to temporal variations of radio channel in which case it may be referred to as link adaptation.

Information that may be transmitted by this channel is given in the table below:

	Control signaling for downlink	Control signaling for uplink
Physical control	➢ Demodulation • Chunk allocation information • Data modulation • Transport block size	➢ Transmission power control bits ➢ Transmission timing control bits ➢ ACK/NACK bit for the reservation channel and fast access channel
L2 control	➢ Scheduling • UE identity ➢ H-ARQ • H-ARQ process information • Redundancy version • New data indicator	➢ Scheduling • UE identity • Chunk allocation information • Data modulation • Transport block size ➢ H-ARQ • ACK/NACK

It can be seen from the table that UE identification information is contained in both downlink and uplink directions. Thus, by virtue of Layer 1 outband identification, it is only after decoding of SCSCH and after finding out that identifier transmitted on the physical channel corresponds to the identifier assigned to the UE during the RRC connection establishment procedure that the UE can receive physical channels on which respective shared transport channels are mapped and further process Layer 2 PDUs (Protocol Data Units) corresponding to SDCH and SUCH shared transport channels. Identification for CACH transport channel is analogous to the identification for RACH transport channel in E-UTRA. Finally it can be concluded that identification is applicable to common and shared transport channels (CACH, SDCH and SUCH) apart from evolved broadcast common transport channel (Evolved-BCH). Identification for said common transport channels is of L2 inband type, while the identification for shared transport channels is of Layer 1 outband type.

From the definitions of "Layer 2 inband" and "Layer 1 outband" identification one could infer that there is one and only one identifier per UE. Hence, once a Signaling Radio Bearer has been established, the UE has been assigned identifier that can be used for Traffic Radio Bearer as well. However, it is possible that multiple identifiers per UE are defined and used.

Radio Resource Control Protocol State Model in UTRAN and Evolved UTRAN

The explanation in this subsection is applicable once UMTS Attach procedure (registration) has been performed.

Radio Resource Control Protocol State Model in UTRA

The Radio Resource Control protocol in UTRA has two modes, idle mode and connected mode, and four service states (URA_PCH, Cell_PCH, Cell_FACH and Cell_DCH). A UE is in idle mode, if no RRC connection has been established. It is in connected mode once RRC connection has been established, i.e. after sending a RRC Connection Setup Complete message to the RNC.

In the following, a brief explanation of each of the states is provided from the aspect of transport channels that can be received, location management and UE identification.

In the Cell_DCH state of the RRC connected mode, a dedicated transport channel (DCH) is allocated to UE and the UE is known by its serving RNC on a cell level. RRC connection mobility is managed by Active Set Update or Hard Handover function. It should be noted that high speed downlink shared transport channel (HS-DSCH) and enhanced dedicated transport channel (EDCH) can be allocated to UE in Cell_DCH from Rel5 and Rel6 respectively.

In the Cell_FACH state of the RRC connected mode, FACH and RACH transport channels can be used for downlink and uplink transmission and cell reselection is used for managing RRC connection mobility. Location of the UE on cell level is reported to the network by Cell Update function.

In the Cell_PCH state of the RRC connected mode, UE can be reached only via the paging channel (PCH). When wishing to perform a cell reselection while being in Cell_PCH state, UE will autonomously transit to Cell_FACH state and return to Cell_PCH state after completing the procedure if no other activity has been detected.

In the URA_PCH state of the RRC connected mode, UE can be reached only via the paging channel (PCH). When wishing to perform a cell reselection while being in URA_PCH state, UE will autonomously transit to Cell_FACH state and return to URA_PCH state after completing the procedure if no other activity has been detected.

UE identification

In the following UE identifiers used for Layer 2 inband identification of FACH and RACH transport channels are described (see also 3GPP TS 25.321, "Medium Access Control (MAC) protocol specification (Release 6)", version 6.6.0, available at

http://www.3gpp.org). These identifiers (RNTI = radio network temporary identifier) are allocated once a UE enters RRC connected mode in a service state in which transport channels to which respective identification is applicable can be received.

- S-RNTI is an identifier allocated by SRNC and unique within SRNC,
- C-RNTI is an identifier allocated by CRNC and unique within cell and
- U-RNTI is an identifier obtained as a combination of SRNTI and SRNC ID. It is unique within UTRAN.

Further, the following UE identifiers used for Layer 1 outband identification of HS-DSCH and E-DCH are described 3GPP TS 25.331 "Radio Resource Control (RRC) Protocol Specification", version .6.6.0, chapter 13.4.8o and 10.3.3.10a:

- H-RNTI is an identifier allocated by SRNC and it is unique within SRNC controlling serving HS-DSCH cells and
- Primary and secondary E-RNTI are identifiers allocated by Node B controlling serving E-DCH cell and are unique within that cell.

The UE variables storing the values of assigned identifiers are cleared once the UE leaves RRC connected mode. The variables are named after corresponding identifiers as S_RNTI, C_RNTI, U_RNTI, H_RNTI and Primary/Secondary E_RNTI respectively.

Radio Resource Control Protocol State Model in the Evolved UTRAN

For the presently discussed enhancements of the UTRAN, the so called Enhanced UTRAN, the following main RRC protocol states have been defined:

In the LTE_Idle RRC state no RRC connection has been established.

In the LTE_Active RRC state, a RRC connection has been established. In this state, Evolved-BCH, CACH, SDCH and SUCH transport channels may be used for broadcast, paging and data transmission in uplink/downlink direction. Location may be managed on cell/Node B level by means of a cell change or similar procedure. Identifiers for Layer 2 inband and Layer 1 outband identification of UE on respective transport channels may be assigned to the UE when entering LTE_Active RRC state and corresponding variables in the UE may be cleared once LTE_Active RRC state has been left. Precise definition of identifiers has not been formulated yet. Hence in this document, a general identifier will be referred to as LTE-RNTI.

A power saving substate wherein a UE may use discontinuous reception (DRX) cycles of the MAC protocol belonging to the LTE_Active RRC state may also be defined.

RRC connection establishment procedure

Fig. 6 illustrates a standard RRC connection establishment procedure. The RNC broadcast a System Information message via BCCH/BCH (notation: logical channel / transport channel, see tables above) to the UEs. This System Information message comprises information on e.g. secondary common control physical channel configuration, UE parameters on idle and connected mode to enable the UE to perform system access. Detailed description of the contents of the message may be found in the 3GGP TS 25.331, V.6.7.0 , section 8.1.1.

In order to begin the establishment of a signaling radio bearer the UE sends a RRC Connection Request message via CCCH/RACH to the network. Upon receiving an RRC Connection Request message, the UTRAN will proceed with configuring a radio link (Radio Link Configuration) by negotiating radio bearer, transport channel and physical channel parameters with and reserving resources at the Node B serving the UE.

If the radio link connection setup is successful, the UTRAN accepts the request and transmits an RRC Connection Setup message via CCCH/FACH to the UE. In case the radio link connection setup is not successful the RNC transmits a RRC Connection reject message to the UE. In the RRC Connection Reject message, the UTRAN may direct the UE to another UTRA carrier or to another system. After the RRC Connection Reject message has been sent, all context information for the UE may be deleted in UTRAN.

The RRC Connection Setup message is used by the network to accept the request for the establishment of an RRC connection for a UE. The message includes and assignment of a set of radio bearer information, transport channel information and optionally physical channel information.

Upon reception of the RRC Connection Setup message the UE initiates the radio bearer, transport channel and physical channel configuration in accordance with parameters set in the radio bearer, transport channel and physical channel information elements of the RRC Connection Setup Message. Typically, the UE will be in the CELL_DCH state and will proceed with performing physical layer synchronization with the Node B and enter into the RRC connected mode.

Upon having finished this procedure, the UE sends a RRC Connection Setup Complete message via DCCH/DCH to the UTRAN to confirm the establishment of the RRC connection, i.e. the signaling radio bearer.

As indicated in Fig. 6, each message exchange implies a delay for changing from RRC idle mode to RRC connected mode. The delay budget of the RRC Connection Establishment Procedure may be defined in the following way. Delays for a typical Signaling Radio Bearer Settings have been found to be roughly:

- L1+L2+L3+L4 ≈ 441ms,
- L2 ≈ 126 ms and
- L3 ≈ 51 ms.

The current requirement for the latency for transition between a camped state such as the RRC idle mode (or E-UTRA LTE_Idle state) to an active state such as the Cell_DCH RRC connected mode (or E-UTRA LTE_Active state) shall be less than 100 ms. However, in current system the delay for RRC connection establishment procedure has been estimated to be 441 ms. Therefore, RRC connection establishment delay in UTRA is overly long.

SUMMARY OF THE INVENTION

The object of the invention is to suggest an improved radio bearer establishment procedure that allows reducing the delays implied by the signaling in the procedure.

The object is solved by the subject matter of the independent claims. Advantageous embodiments of the invention are subject matters to the dependent claims.

According to different embodiments of the invention, two mechanisms for reducing the delay are suggested. The first mechanism aims at reducing the delay implied by setting up the radio link for the radio bearer in the radio bearer establishment procedure. According to this mechanism, a pool of resources comprising a set of at least radio bearer configuration is preconfigured and the available radio bearer configurations are made known to at least one mobile terminal. By means of this mechanism the contexts defining the radio bearer in the mobile terminal and the network elements may be established autonomously eliminating the need for a radio link setup procedure.

The second mechanism aims at avoiding the delay implied by the explicit assignment of a radio network temporary identifier to the mobile terminal requesting the setup of a radio bearer. According to the second mechanism, a set of available identifiers from which the mobile terminal may choose is signaled, so that no explicit assignment of the radio network temporary identifier is necessary. Both mechanisms may also be advantageously combined.

One embodiment of the invention provides a method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal. The radio access network may signal a set of identifiers comprising at least one available radio network temporary identifier for identification of a mobile terminal to at least one mobile terminal. A connection setup request message from a mobile terminal may be received at the network element terminating the radio resource control protocol in the radio access network. The connection setup request message comprises a radio network temporary identifier selected by the mobile terminal from the set of identifiers. In response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network may be established, wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal in a communication on the established radio bearer.

In a further embodiment of the invention, the connection setup request message received from the mobile terminal may also comprise a configuration identifier of a radio bearer configuration to be utilized for communication on the radio bearer to be established, wherein the radio bearer configuration is selected by the mobile terminal from a set of radio bearer configurations being each identified by a respective configuration identifier.

In a variation of this embodiment, the radio access network may preconfigure a pool of resources according to at least one set of radio bearer parameters describing individual radio bearer configurations of said set of radio bearer configurations, wherein each radio bearer configuration is associated to a configuration identifier.

Further, the radio access network may signal information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set to at least the mobile terminal.

Another embodiment of the invention provides an alternative method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal. According to this method, the radio access network may preconfigure a pool of resources according to at least one set of radio bearer parameters describing individual radio bearer configurations of a set of radio bearer configurations. Each radio bearer configuration may be associated to a configuration identifier. The radio access network may further signal on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set to at least the mobile terminal information. Further, it may receive a connection setup request message from a mobile terminal at the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises a configuration identifier of a radio bearer configuration selected by the mobile terminal and to be utilized for communication on the radio bearer to be established.

In response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol may be established using the radio bearer configuration associated to the configuration identifier in the connection setup request message.

In a variation of this embodiment the radio access network may signal information on a set of identifiers comprising at least one available radio network temporary identifier for identification of a mobile terminal. The connection setup request message from a mobile terminal may further comprise a radio network temporary identifier selected by the mobile terminal from the set of identifiers and the selected radio network temporary identifier is utilized for identifying the mobile terminal in a communication on the established radio bearer.

The information on the set of radio bearer configurations may comprises the sets of radio bearer parameters of the configured radio bearers. The set of identifiers or the at least one set of radio bearer parameters describing individual radio bearer configurations and the configuration identifiers may be broadcast to mobile terminals by radio access network.

The radio bearer to be established in the embodiments above may be a signaling radio bearer for transmitting control plane information or wherein the radio bearer is a traffic radio bearer used for transmitting user plane data. The control plane information may be

radio resource control protocol information or non-access stratum data encapsulated in radio resource control protocol messages.

The selected radio network temporary identifier may be utilized to uniquely identify the mobile terminal on a transport channel in an exchange of data between the mobile terminal and the network element terminating radio resource control protocol in a radio access network utilizing the established radio bearer.

In a further embodiment, the radio access network may further determine whether the selected radio network temporary identifier comprised in the connection setup request message from a mobile terminal has not been already selected by another mobile terminal. If so, it may select a new radio network temporary identifier not utilized by another mobile terminal and providing the new radio network temporary identifier to the mobile terminal, which will use the new radio network temporary identifier for identifying the requesting mobile terminal in a communication on the established radio bearer.

In a variation of this embodiment, the radio access network may further notify the mobile terminal that it may not use the selected radio network temporary identifier for identification, if it has been determined that the radio network temporary identifier comprised in the connection setup request message has been already selected for identifying another mobile terminal.

In a further variation of this embodiment, the mobile terminal is notified that it may not use the selected radio network temporary identifier for identification by transmitting the selected radio network temporary identifier and a collision flag being set on a downlink physical control channel associated to a shared or dedicated transport channel for which the selected radio network temporary identifier is intended to be used.

Moreover, a connection setup message comprising a new radio network temporary identifier to be used by the mobile terminal may be transmitted to the requesting mobile terminal. When sending the connection setup message, the mobile terminal may be identified as the recipient of the message by a non-access stratum temporary identifier or a permanent identifier assigned to the requesting mobile terminal.

In another embodiment of the invention, the mobile terminal may be notified that it may not use the selected radio network temporary identifier for identification of the requesting mobile terminal by transmitting a non-access stratum temporary identifier or a permanent identifier of the requesting mobile terminal on a downlink physical control channel

associated to a shared transport channel for which the selected radio network temporary identifier is intended to be used.

In a variation of the embodiment, the radio access network may transmit a downlink message of a non-access stratum protocol encapsulated in a radio resource control protocol message to the mobile terminal, wherein the new radio network temporary identifier is provided within a layer 2 packets' header of said radio resource control protocol message packet encapsulating the downlink message of the non-access stratum protocol.

In a further variation, the message providing the new radio network temporary identifier to the mobile terminal further indicates the time instant (also denoted activation time) at which the requesting mobile terminal and the radio access network start using the new radio network temporary identifier.

According to a further embodiment of the invention the set of identifiers may be updated in response to reception of a connection setup request message, if the selected radio network temporary identifier comprised in the connection setup request message is not utilized by another mobile terminal. Further, the radio access network may signal the information on the updated set of identifiers and an indication that the set of identifiers has been updated.

In another embodiment of the invention the set of radio bearer configurations may be updated in response to the establishment of the radio bearer, and information on the updated set of radio bearer configurations and an indication that the set of radio bearer configurations has been updated may be signaled to the mobile terminals.

In the different embodiments of the invention as well as in their variations, the radio access network may be an UMTS radio access network and the radio network temporary identifier may be one of a H-RNTI associated to a high speed shared downlink, a Primary or Secondary E-RNTI associated to an enhanced uplink dedicated transport channel and a LTE-RNTI associated to a shared uplink and downlink transport channel.

A further embodiment of the invention relates to the mobile terminal behavior. The embodiment provides a method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal. The mobile terminal may receive a set of identifiers comprising at least one radio network temporary identifier available for identification of mobile terminals from

the radio access network It may select a radio network temporary identifier from the set of identifiers and transmit a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup message comprises the selected radio network temporary identifier. The mobile terminal may further establish a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network, wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal on the established radio bearer.

For example, the selected radio network temporary identifier may be utilized for identifying the mobile terminal on a shared transport channel to which the established radio bearer is mapped.

Tin a variation of this embodiment, the connection setup request message may further comprise a configuration identifier that is identifying a configured radio bearer from a set of radio bearer configurations to be utilized for communication on the radio bearer between the mobile terminal and the network element terminating radio resource control protocol in a radio access network.

Moreover, the mobile terminal may receive information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set in at least the mobile terminal and may select a radio bearer configuration identified by a configuration identifier from the set of radio bearer configurations. The configuration identifier in the connection setup request message indicates the selected radio bearer configuration to the network element terminating the radio resource control protocol.

Another embodiment of the invention relates to an alternative method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal. According to this method, the mobile terminal receives information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set from the radio access network. Further, the terminal selects a radio bearer configuration associated to a configuration identifier from the set of radio bearer configurations and transmits a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection

setup message a configuration identifier that is associated the selected configured radio bearer.

Further, the mobile terminal may establish a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network using the selected radio bearer configuration.

In a variation of this embodiment, the terminal may further receive a set of identifiers comprising at least one radio network temporary identifier available for identification of mobile terminals from the radio access network, and may select a radio network temporary identifier from the set of identifiers. The connection setup request message may further comprise the selected radio network temporary identifier which is utilized for identifying the mobile terminal on the established radio bearer

According to another embodiment of the invention the mobile terminal further receives a new radio network temporary identifier not assigned to another mobile terminal from the radio access network, in case the selected radio network temporary identifier comprised in the connection setup request has already been assigned to another mobile terminal. This new radio network temporary identifier is used for identifying the mobile terminal on a shared transport channel used in a communication on the established radio bearer.

In a variation, the mobile terminal may receive a notification that the selected radio network temporary identifier may not be used for identification, if the radio network temporary identifier comprised in the connection setup request has been already assigned to another mobile terminal.

The mobile terminal may be notified that it may not use the selected radio network temporary identifier for identification by receiving the selected radio network temporary identifier and a collision flag being set on a downlink physical control channel associated to shared transport channel for which the selected radio network temporary identifier is intended to be used. The mobile terminal may further receive a message comprising the new radio network temporary identifier to be used by the mobile terminal. When receiving the message, the mobile terminal may identified as the recipient of the message by a non-access stratum temporary identifier or a permanent identifier assigned to the requesting mobile terminal.

In another embodiment of the invention, the mobile terminal is notified that it may not use the selected radio network temporary identifier for identification by receiving a non-

access stratum temporary identifier or a permanent identifier of the mobile terminal on a downlink physical control channel.

In a variant of this embodiment, the mobile terminal may receive a downlink message of a non-access stratum protocol, wherein the new radio network temporary identifier is received with a layer 2 packets' header of a radio resource control protocol message encapsulating the downlink message of the non-access stratum protocol.

Another embodiment of the invention suggests that the mobile terminal may receive (e.g. via broadcast) an updated set of identifiers and an indication that the set of identifiers has been updated.

The mobile terminal may also receive information on an updated set of radio bearer configurations and an indication that the set of radio bearer configurations has been updated (e.g. via broadcast).

In another embodiment, the mobile terminal may estimate the resources available on the air interface to the radio access network based on information on at least one set of radio link parameters received from the radio network during cell selection or reselection procedure.

A further embodiment of the invention provides a network element in a radio access network terminating radio resource control protocol establishing a radio bearer between the network element terminating radio resource control protocol and a mobile terminal, The network element comprises a transmitter for signaling to at least one mobile terminal set of identifiers comprising at least one available radio network temporary identifier for identification of a mobile terminal, a reception unit for receiving a connection setup request message from a mobile terminal at the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises a radio network temporary identifier selected by the mobile terminal from the set of identifiers and a processing unit for establishing in response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network, wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal in a communication on the established radio bearer.

Another embodiment of the invention provides an alternative network element in a radio access network terminating radio resource control protocol establishing a radio bearer

between the network element terminating radio resource control protocol and a mobile terminal. This network element may comprise a configuration unit for preconfiguring a pool of resources according to at least one set of radio bearer parameters describing individual radio bearers of a set of radio bearer configurations, wherein an individual radio bearer configuration is associated to a configuration identifier, a transmitter for signaling to at least the mobile terminal information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set, a receiver for receiving a connection setup request message from a mobile terminal at the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises a configuration identifier of a radio bearer configuration selected by the mobile terminal and to be utilized for communication on the radio bearer to be established, and a processing unit for establishing in response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol using the configured radio bearer associated to the configuration identifier in the connection setup request message.

Both network elements above may comprise further means adapted to perform the method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal according to one of the various embodiments of the invention and variations described above.

A further embodiment of the invention relates of a mobile terminal establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and the mobile terminal. The mobile terminal may comprise a receiver for receiving from the radio access network a set of identifiers comprising at least one radio network temporary identifier available for identification of mobile terminals, a processing unit for selecting a radio network temporary identifier from the set of identifiers, and a transmitter transmitting a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup message comprises the selected radio network temporary identifier. The processing unit of the mobile terminal may be adapted to establish a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network, and selected radio network temporary identifier is utilized for identifying the requesting mobile terminal on the shared transport channel used in a communication on the established radio bearer.

An alternative mobile terminal establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and the mobile terminal is provided in a further embodiment of the invention. This mobile terminal may comprise a receiver for receiving information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set from the radio access network, a processing unit for selecting a radio bearer configuration associated to a configuration identifier from the set of radio bearer configurations, and a transmitter for transmitting a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup message a configuration identifier that is associated the selected configured radio bearer. The processing unit is adapted to establish a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network using the selected radio bearer configuration.

The mobile terminals above may comprise further means adapted to perform the method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal according to one of the various embodiments of the invention and variations described above.

Another embodiment relates to a mobile communication system comprising a network element and one or more mobile terminals.

Further, another embodiment of the invention provides a computer readable medium storing instructions that, when executed by a processing unit cause the execution of the steps of the method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal according to one of the various embodiments of the invention and variations described above in the network element. Accordingly, another embodiment of the invention provides a computer readable medium storing instructions that, when executed by a processing unit cause the execution of the steps of the method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal according to one of the various embodiments of the invention and variations described above

BRIEF DESCRIPTION OF THE FIGURES

In the following the invention is described in more detail in reference to the attached figures and drawings. Similar or corresponding details in the figures are marked with the same reference numerals.

Fig. 1 shows the high-level architecture of UMTS,

Fig. 2 shows the architecture of the UTRAN according to UMTS R99/4/5,

Fig. 3 shows a Drift and a Serving Radio Subsystem in a UMTS network,

Fig. 4 shows an overview of the protocol model of the UTRAN in an UMTS network,

Fig. 5 shows an overview of the radio interface protocol architecture of the UTRAN,

Fig. 6 shows a standard UMTS RRC connection setup procedure,

Fig. 7 shows a radio bearer establishment procedures according to an embodiment of the invention,

Fig. 8 and 9 show two alternative collision avoidance mechanisms in a radio bearer establishment procedures according to different embodiments of the invention,

Fig. 10 shows an exemplary format of additional layer 2 PDU header information according to an embodiment of the invention, and

Fig. 11 to 13 show different formats for providing sets of radio bearer parameters of a set of radio bearer configurations according to different embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The following paragraphs will describe various embodiments of the invention. For exemplary purposes only, most of the embodiments are outlined in relation to a UMTS communication system and the terminology used in the subsequent sections mainly relates to the UMTS terminology, as the invention may be advantageously used in this

type of communication network. However, the terminology used and the description of the embodiments with respect to a UMTS architecture is not intended to limit the principles and ideas of the inventions to such systems.

Also the detailed explanations given in the Technical Background section above are intended to better understand the mostly UMTS specific exemplary embodiments described in the following and should not be understood as limiting general ideas underlying the invention to the described specific implementations of processes and functions in the mobile communication network.

Before discussing the different exemplary embodiments of the invention, some definitions of terms are provided in the following.

A *preconfiguration* may be defined as a procedure aimed at informing one or more target objects of a configuration related to an operational context to be created later by means of an establishment procedure. Exceptionally, an operational context may be created in one or more target objects by means of preconfiguration. The target object may store configuration that will be used later in establishment of a related logical entity. Further, it is important to notice that a preconfiguration in the context of this document includes a reservation of resources (or establishment of a pool of resources) that are to be utilized for the related logical entity.

With respect to a standard UMTS system, it should be noted that the UMTS radio access network may "preconfigure" RB in the UE by signaling respective configuration. The use of "preconfigurations" in the standard system is aimed to reduce the size of signaling messages to be used in the RB establishment procedure as only a simple pointer to the configuration already stored in target objects can be used in the messages instead of signaling complete configuration. However, in contrast to the document's definition of preconfiguration, no resources in the network are reserved when using a "preconfiguration". The reservation of resources is a separate procedure to be performed when the resources to be reserved are actually needed to serve a UE.

A *configuration* of a certain logical entity may be defined as a set of attributes describing the entity. A configuration may comprise operational settings and identification means related to the entity: For example, in a UMTS system, a service provided by UTRAN (UMTS Terrestrial Radio Access Network) for transmission of information between CN (Core Network) and UE (User Equipment) is denoted as RAB (Radio Access Bearer). This RAB as a logical entity is completely described in terms of RB (Radio Bearer)

attributes, TrCH (Transport Channel) attributes and PhyCH (Physical Channel) attributes. In the following we will refer to a set comprising RB attributes, TrCH attributes and optionally PhyCH attributes as a set of radio bearer parameters.

Obviously, a hierarchical relation exists between numbered logical entities in that PhyCH may be defined as a means for transmission of coded bits by physical layer. A TrCH may be defined as a service offered by physical layer to Layer 2, and, finally, Traffic Radio Bearer (TRB) / Signaling Radio Bearer (SRB) may be defined as a service offered to higher layer in User Plane and Control Plane respectively. For exemplary purposes, it is assumed that a signaling or traffic radio bearer is provided between a network element in the radio access network responsible for radio network-related control signaling (in contrast to transport-network related control signaling) and a mobile terminal. Another usage of the term network element in the radio access network refers to a network element controlling radio resource management in the radio access network and therefore typically terminating the radio resource control protocol.

Concerning the different types of parameters that may be included in the set of radio bearer parameters, some examples are provided below. Typical PhyCH attributes may for example relate to modulation format, coding scheme and orthogonalization means for given radio access method. The latter for WCDMA (Wideband Code Division Multiple Access) may comprise identification of orthogonal and scrambling codes in the downlink and identification of scrambling codes in the uplink. Alternatively, the latter for OFDMA (Orthogonal Frequency Division Multiple Access) may comprise identification of chunks (resource allocation units in time-frequency plane). A very detailed example of parameters for new OFDMA based radio access may be found in Tdoc R1-050707 3GPP TSG RAN WG1#42 on LTE "Physical Channels and Multiplexing in Evolved UTRA Downlink", by NTT DoCoMo, NEC, Sharp.

Radio Bearer attributes may for example comprise identification of Layer 2 RLC protocol settings etc. Finally, the attribute a configuration of each logical entity may comprise is an identifier to be assigned to the logical entity. A very detailed example of a RAB configuration and its parameters may be found in the section 10.3.4.8 of 3GPP TS 25.331.

As can be seen from the above definitions each configuration may comprise operational settings and identification means related to the entity being configured.

A set of radio bearer configurations refers to a set of at least one radio bearer for which a preconfiguration is performed. The radio bearers are each described by a set of radio bearer parameters (as defined above). Obviously, more than one radio bearer may have the same sat of radio bearer parameters

Establishment of a certain logical entity may be defined as a *procedure* aimed at creating operational context in two or more objects representing logical termination points of the entity being established. These objects will be referred to as target objects. An operational context may be directly related to a configuration in that it may comprise operational settings and identifications means. In the following, identification means may be often referred to as identifier.

A *temporary UE identifier* or *temporary identifier* may be defined as a unique integer number assigned to a terminal by the communication system or as a unique integer number chosen by terminal and confirmed by the communication system.

A *radio network temporary UE identifier* or *radio network temporary identifier* is used for identification of a mobile terminal on transport channels. The identification may be of Layer 1 outband or of Layer 2 inband type. This type of identifier is for example typically assigned during RRC Connection Establishment procedure by network element in a radio access network terminating radio resource control protocol, as has been described above. Examples of this identifier in a UMTS legacy system are Primary and Secondary E-RNTI, H-RNTI, U-RNTI, etc.

A *non-access stratum temporary UE identifier* or *non-access stratum temporary identifier* is used for identification of a mobile terminal during Core Network procedures. Considering a UMTS system for exemplary purposed, this type of identifier is typically assigned during GPRS Attach / Registration procedure by network element in a core network terminating GPRS mobility management protocol. An example of this identifier in legacy system is P-TMSI (Packet Temporary Mobile Subscriber Identity).

Finally, the difference between permanent identifiers and temporary identifiers should be noted. A *permanent (UE) identifier* may be defined as a unique integer number assigned to the SIM card of a terminal. An example of this identifier in the UMTS legacy system is IMSI (International Mobile Subscriber Identity).

In the following, an example of establishment procedure is given. For example, in a UMTS system, RRC (Radio Resource Control) context is created when establishing

connection (signaling connection or Signaling RB) in RNC (Radio Network Controller) and UE. When establishing RB for multicast service, operational context may be created in RNC and in a multiplicity of UEs.

Fig. 7 shows an exemplary signaling procedure according to an embodiment of the invention for establishing a radio bearer (signaling radio bearer or traffic radio bearer) between a mobile terminal and a network element in the radio access network that is terminating the radio resource control protocol.

In a first step, a radio link preconfiguration is performed in the access network in order to preconfigure a set of radio bearer configurations. The network element in the radio access network that is terminating the radio resource control protocol provides set(s) of radio bearer parameters describing different settings for the radio bearer in the set of radio bearer configurations to the base station(s). A base station will reserve resources on the air interface and on the wired interface to the network element in the radio access network that is terminating the radio resource control protocol depending on the parameters in the set(s). Moreover, the operational context for setting up the different radio bearers of the radio bearer configurations is established in the network element terminating the radio resource control protocol and the base stations. Further, the different set(s) of radio bearer parameters may be each assigned a configuration identifier (or index), which can be used to identify a respective set of radio bearer parameters, i.e. a respective preconfigured radio bearer. By means of this configuration of a set of radio bearer configurations, the latency in establishing a radio link upon receiving a connection setup from a mobile terminal may be significantly reduced.

Further, the mobile terminals in a cell controlled by the base stations are informed on the available settings for the radio bearers, i.e. the available sets of radio bearer configurations according to which the radio bearers are already configured according to the set of radio bearer parameters at the base stations. For this purpose, a System Information Message is provided from the radio access network to the mobile terminals, e.g. by means of broadcast (or unicast, which is however less efficient). Considering an exemplary UMTS system, the System Information message may for example be broadcast on BCCH logical channel. BCCH logical channel may be further mapped upon Evolved-BCH transport channel.

The System Information Message comprises an indication of the radio bearer configurations, i.e. their configured sets of radio bearer parameters, as well as the

configuration identifier (or index) of each of the configured radio bearers for allowing the mobile terminal to select a configuration.

Considering again for exemplary purposes a UMTS system, by means of providing the information on the available radio bearer configurations to the mobile terminal the UE may create the operational context (e.g. comprising Signaling Radio Bearer settings / RRC connection settings and UE identification means) autonomously during RRC connection establishment procedure without signaling the requirement to signal the content of this context from the network. A Node B is preconfigured by RNC so that pool of resources is established and the operational context (e.g. RRC connection settings and identification means) are stored.

Exemplary formats for communicating the radio bearer configurations, i.e. their set(s) of radio bearer parameters describing the radio bearers, to the mobile terminals are shown in Fig. 11 to 13. In Fig. 11, each row comprises a configuration identifier (or index) and a set of radio bearer parameters. It should be noted that each configured radio bearer is assigned a radio bearer identity which allows a respective one of the mobile terminals to use and distinguish different radio bearers. This radio bearer identity may be typically included in the set of radio bearer parameters describing the respective radio bearer. In the example shown in Fig. 11, all radio bearer configurations for which resources are reserved are indicated to the mobile terminals.

To reduce the size of configuration data included in the System Information Message, the notation as used in Fig. 12 may be used to indicate the available configured radio bearers (and their settings) to the mobile terminals. In the example of Fig. 12, multiple radio bearers are grouped. The radio bearers in each group are associated with a single configuration identifier (or index) and are distinguished by the different radio bearer identities. Each pair of the configuration identifier (or index) and the radio bearer identity is associated to a configured set of radio bearer parameters (e.g. for a signaling radio bearer or a traffic radio bearer). In case a radio bearer is configured with the same set of parameters as a previously defined parameter, the set of parameters may be defined by referencing the previously defined set of parameters. This may for example be implemented by including the pair of the configuration identifier (or index) and the radio bearer identity in the description of the parameters to reference the previously defined parameter set, as indicated in Fig. 12 by the dotted arrow.

A further alternative for communication the available configured radio bearers to the mobile terminals is shown in Fig. 13. In this example, each row comprises a configuration identifier (or index) for indexing the respective radio bearer configuration and the number of configurations available. I.e. this format allows indicating the presence of several radio bearers in the resource pool with the same configuration (i.e. with the same set of radio bearer parameters). In case the access network distinguishes connections of a single mobile terminal on the "radio-bearer level" by the radio bearer identifier and an identifier assigned to the respective mobile terminal, the solution of Fig. 13 for communicating the available radio bearers in resource pool may be problematic: the mobile terminal may only select a single bearer of each configuration, as the set of parameters for each configuration typically only comprises a single radio bearer identifier for identifying the bearer.

In case the available reserved resources change in the network, e.g. due to mobile terminals establishing or tearing down radio bearers, the information in the System Information message are updated accordingly.

With respect to the update of changing preconfigured resources in the access network, it may be important for the mobile terminal to know the time instant at which the change occurs exactly. In these cases, the radio access network may inform the terminal by paging or broadcast message (for example a [RRC] SYSTEM INFORMATION CHANGE INDICATION) that a change in the set of radio bearer configurations has occurred.

As indicated above, the preconfiguration of radio bearers and the communication of the available configurations to the mobile terminals may reduce or eliminate the latency for setting up a radio link upon receiving a connection request for a radio bearer from a mobile terminal.

Another solution for reducing the latency in a radio bearer setup procedure is to eliminate the explicit assignment of a temporary identifier to the mobile terminals upon connection setup, as shown in Fig. 6 ([RRC] Connection Setup message). For this purpose, another embodiment of the invention suggests to indicate a set of identifiers comprising the available radio network temporary identifiers that can be selected for communication on a radio bearer, to the mobile terminals. The mobile terminals may select a radio network temporary identifier for identification of the respective mobile terminal when setting up the radio bearer.

The information on the available radio network temporary identifier(s) may be communicated to the mobile terminals using the above mentioned System Information message. This message may also include information on the available configured radio bearers, as outlined above. The available radio network temporary identifier may for example be included by specifying ranges of radio network temporary identifiers, providing a list of radio network temporary identifiers, etc.

Taking UMTS as an example, the Primary and Secondary E-RNTI (set by Node B in the legacy system) may be obtained by the network element terminating the radio resource control protocol (in this example RNC) from Node B and may be broadcast by the network element terminating the radio resource control protocol afterwards. The mobile terminal will store the set of identifiers locally to select one of the identifiers upon connection setup.

Prior to sending a Connection Setup Request message, the mobile terminal may select one of the radio link temporary identifiers included in the set of identifiers received from the radio access network. Further, the mobile terminal may select a radio bearer configuration and may initiate the operational context for the radio bearer, the transport channel and optionally for the physical channel configuration in accordance with the radio bearer parameters of the selected radio bearer configuration.

To initiate setup of a radio bearer, a mobile terminal in idle mode transmits a Connection Setup Message to the network element terminating the radio resource control protocol. Considering an exemplary UMTS system, the Connection Setup Message may for example be transmitted via a CCCH logical channel that is further mapped on a CACH transport channel.

The Connection Setup Message includes the radio network temporary identifiers selected by the mobile terminal. Further, the Connection Setup Message may also comprise a configuration identifier (or index) of the selected radio bearer configuration. By the inclusion of the selected radio network temporary identifier to the Connection Setup message the mobile terminal indicates that it intends to use this identifier as an identifier of the terminal for communication on the radio bearer. According to one embodiment of the invention, the selected radio network temporary identifier is utilized for identifying the mobile terminal on a shared or dedicated transport channel onto which the radio bearer to be established is mapped. The configuration identifier (or index) specifies the set of radio bearer parameters describing the radio bearer to be set up.

Upon reception of the setup message at the network element terminating the radio resource control protocol receives, the network element determines, whether the radio network temporary identifier selected by the mobile terminal is already used or is simultaneously chosen by another mobile terminal. Assuming that the mobile terminal is the only terminal that has selected the radio network temporary identifier, no collision in the radio network temporary identifier is detected.

In case a collision is detected, according to a further embodiment of the invention, the network element will indicate the collision to the mobile terminal(s), as will described below. According to this exemplary embodiment, the radio access network may indicate the presence of a collision by means of setting a collision flag on a downlink physical control channel being associated to the transport channel on which established radio bearer is mapped.

The mobile terminal reads a downlink physical control channel to detect, whether the collision flag is set or not. If no collision flag is set on the downlink physical control channel, the mobile terminal may send a connection Setup Complete message to the network element terminating the radio resource control protocol to finish the setup of the radio bearer and switches to connected mode. Considering an exemplary UMTS system, the Connection Setup Complete message may for example be transmitted via a DCCH logical channel that is further mapped on a SUCH transport channel.

Otherwise, collision recovery may be performed, as will be outlined below with reference to Fig. 8.

Comparing this radio bearer setup procedure according to an embodiment of the invention to the standard radio bearer setup procedure in Fig. 6 it is noted that the latency L2 for establishing the radio link as well as the latency L3 for assigning the radio network temporary identifier to the mobile terminal may be avoided by preconfiguration of radio bearers including a reservation of resources and allowing the mobile terminals to select a radio network temporary identifier from a set of available radio network temporary identifier.

Due to the establishment and tear-down of radio bearers, the available radio network temporary identifiers as well as the available preconfigure radio bearers in the radio access network may change constantly. According to another embodiment of the invention, the set of identifiers may be updated accordingly and the updated set of identifiers may be signaled to the mobile terminals. Since a change in the set of

identifiers also implies that the pool of resources preconfigured in the network is changing, an update of the radio bearer configurations may also be performed and the updated radio bearer configurations may be provided to the mobile terminals as described above. In this context, it may be also beneficial to synchronize the signaling of an updated set of identifiers and an updated set of radio bearer configurations. This may for example be achieved by including an activation time, i.e. a time instant at which the update is to be applied, to the signaling message providing the updated set of identifiers and an updated set of radio bearer configurations to the terminals.

Further embodiments of the invention relate to resolving a situation, in which more than one mobile terminal select the same radio network temporary identifier or in which a mobile terminal selects a radio network temporary identifier already used by another terminal, e.g. due to an update of the set of identifiers has not been performed yet or in time. Generally, it should be noted that the occurrence of these situations should be very rare (0.01% and less in typical scenarios), nevertheless a mechanism to overcome this collision of the radio network temporary identifiers may be defined.

A first embodiment of the invention allowing to resolve the collision problem outlined above will be described with reference to Fig. 8. The figure shows the exemplary signaling in a radio bearer setup procedure. The procedure is similar to the one illustrated in Fig. 7 described above, so that only the differences between the two figures are discussed in the following. In contrast to the signaling procedure in Fig. 7, it is assumed in Fig. 8 that the mobile terminal has selected a radio network temporary identifier already used by another mobile terminal. The network element terminating the radio resource control protocol has detected the collision and has set the collision flag on the downlink shared physical control channel to which the radio bearer to be established is mapped according to the radio bearer parameters describing the radio bearer.

Upon having sent the Connection Setup Request message, the mobile terminal will monitor the downlink shared physical control channel, for example for a given time span. As the physical control channel is a shared channel shared by the mobile terminals in the cell, the mobile terminal may be notified by "writing" the selected radio network temporary identifier on the downlink shared physical control channel and setting the collision flag. When monitoring the downlink shared physical control channel, the mobile terminal will detect its selected radio network temporary identifier and will thus know that the information following the radio network temporary identifier on the physical channel

are destined to it. The information following the radio network temporary identifier on the physical channel includes the collision flag that has been set to indicate the collision.

In an exemplary UMTS scenario, the newly established radio bearer is mapped to a SUCH transport channel in the uplink. In this example, the downlink shared physical control channel is the physical control channel for the SUCH transport channel in the uplink used for communicating control information to the mobile terminal.

If the selected radio network temporary identifier and the set collision flag have been detected downlink shared physical control channel, the mobile terminal will await a Connection Setup Message from the network element terminating the radio resource control protocol (for example a RRC Connection Setup message), which is addressed to the mobile terminal by means of a permanent identifier of the mobile terminal (for example the IMSI or P-IMSI of the UE) and includes a new radio network temporary identifier (for example new RNTI) that is to be used by the mobile terminal.

After having received the Connection Setup Message from the network element terminating the radio resource control protocol, the mobile terminal may respond by a Connection Setup Complete message to finish the radio bearer establishment procedure and switches to connected mode.

In the embodiment of the invention described with respect to Fig. 8, Layer 1 outband signaling has been used to recover the collision in the radio network temporary identifier. Fig. 9 illustrates the exemplary signaling in a radio bearer setup procedure according to another embodiment of the invention, where the collision is resolved by means of Layer 2 inband signaling.

The first steps of performing the radio link preconfiguration, the transmission and handling of the information in the System Information Message as well as the transmission the Connection Setup Request message and related procedures are similar to those described with respect to Fig. 7 and 8.

Also in the example shown in Fig. 9 the collision situation is indicated to the mobile terminal by means of a downlink shared physical control channel. In contrast to the solution proposed in Fig. 8, a permanent identifier is written to the physical control channel to indicate to the mobile terminal that the information following the permanent identifier is destined to the mobile terminal. The collision flag is comprised in this information. In the exemplary scenario assumed in Fig. 9, the mobile terminal may not

use its selected radio network temporary identifier, so that the collision flag has been set by the network element terminating the radio resource control protocol.

Upon detecting the collision flag on the downlink shared physical control channel, the mobile terminal proceeds with finishing the radio bearer setup procedure and switches to connected mode. To establish the service via the established radio bearer, the mobile terminal next transmits an uplink message of a non-access stratum protocol (for example an Initial Transfer - Service Request message) to the radio network via the radio bearer.

The network element terminating the radio resource control protocol detects that an uplink message of a non-access stratum protocol is relayed through the new established radio access bearer assigned to the terminal that has selected the radio network temporary identifier already in use. Upon relaying the first downlink message of the non-access stratum protocol (for example a Security Mode Command), the network element includes additional header information to the Layer 2 PDU header(s) of the Layer 2 PDU(s) that encapsulate(s) the downlink message of the non-access stratum protocol. This additional header information includes a new radio network temporary identifier to the mobile terminal that has previously selected a radio network temporary identifier already in use by another mobile terminal.

An exemplary format of the additional header information included in the Layer 2 PDU(s) is illustrated in Fig. 10. The header information according to this example has three fields: a first field ("IMSI") that comprises a permanent identifier or a non-access stratum identifier of the mobile terminal to which the new radio network temporary identifier is to be assigned, a second field ("activation time") for indicating at which time instant the new radio network temporary identifier is to be used by the mobile terminal and a third field ("new RNTI") comprising the new radio network temporary identifier. Each of the three fields is preceded by a flag (F1, F2 and F3 respectively) that indicates whether a respective one of the fields is set, i.e. contains data, within the header information.

The first field comprising the permanent identifier (e.g. IMSI) or a non-access stratum identifier (e.g. P-IMSI) is used to uniquely identify the mobile terminal to which the new radio network temporary identifier is to be assigned. Since the Layer 2 PDU(s) encapsulating the non-access stratum protocol message (referred to as "Control Plane Data" in Fig. 10) may be transmitted on the downlink via a shared physical control channel all mobile terminals will read the data on the physical channel providing the Layer 2 PDU(s). To destine the data to the correct mobile terminal, the first field

comprising the permanent identifier or a non-access stratum identifier is used. I.e. the destination of the downlink physical layer data is determined in Layer 2 in this exemplary embodiment.

To confirm the assignment of the new radio network temporary identifier, the mobile terminal responds with reflecting the permanent identifier/non-access stratum identifier and the new radio network temporary identifier (optionally also the activation time) in the header information in Layer 2 PDU(s) encapsulating the next uplink message of the non-access stratum protocol (for example Security Mode Complete message).

In an exemplary implementation of the collision avoidance mechanism described with respect to Fig. 9 above in a UMTS system, the non-access stratum protocol messages in the uplink may be provided via a DCCH logical channel mapped to a SUCH transport channel to the radio access network. The non-access stratum protocol messages in the downlink may be provided via a DCCH logical channel mapped to a SDCH transport channel to the UEs.

The benefit of the collision avoidance mechanism of Fig. 9 is that the mobile terminal may continue call setup while negotiating new radio network temporary identifier with the network. A disadvantage relative to the mechanism illustrated in Fig. 8 is that the Layer 1 processing chain has to be fully completed prior to being able to detect the permanent identifier/ non-access stratum identifier addressing the mobile terminal in the Layer 2 PDU(s) which may negatively influence the mobile terminal's power consumption.

In the embodiments described above, the setup of a signaling radio bearer has been considered. It is also recognized that the procedures according to the different embodiments of the invention may also be used to establish a traffic radio bearer for the transmission of User Plane data. In the embodiments of the invention, the identification of mobile terminal is associated to the transport channel level. Given that definition of transport channels is bidirectional, there may be, in most general case, one identifier per uplink and downlink transport channel on which the corresponding radio bearer of a mobile terminal is mapped. Hence, a mobile terminal may select or may be assigned a plurality of different radio network temporary identifiers. The number of radio network temporary identifiers may for example depend on the number of transport channels and the type of the transport channel.

Depending on the transport channel on which the traffic radio bearer is mapped, the selection of a new radio network temporary identifier by the mobile terminal may be required. If the signaling radio bearer and traffic radio bearer are mapped on the same transport channel, a single radio network temporary identifier may be used and the two radio bearers may be distinguished by the radio bearer identity parameter. Accordingly, also the mechanisms for collision avoidance would not be needed when setting up the second bearer. Otherwise, when signaling radio bearer and traffic radio bearer are mapped upon separate transport channels, a new radio network temporary identifier is selected by/assigned to the mobile terminal for use in conjunction with the traffic radio bearer as described above.

Further it should be noted that in a UMTS access network architecture, a central node, the RNC, provides RRC connection establishment functionality. However, this functionality may also be implemented in another network element of the network. Further, different types of access network architectures are possible (e.g. architecture based on new location of radio functions). In the later example, RRC connection establishment functionality may reside in the Node Bs or an equivalent node while a central node may be reduced to the function of a gateway towards the Core Network. In This example, the step of preconfiguring and establishing the pool of resources in Node Bs may be superfluous..

Another embodiment relates to further considerations, when implementing the different procedures described above in a UMTS system. According to the current UMTS specification, the UE may (re)select a certain cell following the results of satisfactory assessment of quality level threshold criteria. These criteria are specified against reception quality of Common PIlot CHannel (CPICH) and Primary Common Control Physical CHannel (P-CCPCH). However, available resources in the target cell are not taken into account. In UTRA, BCH transport channel is mapped on the P-CCPCH. According to this embodiment, the UE may monitor information of preconfigured resources that is broadcast and (re)selects cell based also on resource availability. By taking this additional criterion into account, a likely UE behavior is that not the cell having best downlink signal quality may be selected but a cell having slightly worse downlink signal quality and more (preconfigured) resources available may be selected.

Another embodiment of the invention relates to the implementation of the above described various embodiments using hardware and software. It is recognized that the various embodiments of the invention above may be implemented or performed using

computing devices (processors), as for example general purpose processors, digital signal processors (DSP), application specific integrated circuits (ASIC), field programmable gate arrays (FPGA) or other programmable logic devices, etc. The various embodiments of the invention may also be performed or embodied by a combination of these devices.

Further, the various embodiments of the invention may also be implemented by means of software modules, which are executed by a processor or directly in hardware. Also a combination of software modules and a hardware implementation may be possible. The software modules may be stored on any kind of computer readable storage media, for example RAM, EPROM, EEPROM, flash memory, registers, hard disks, CD-ROM, DVD, etc.

CLAIMS

1. A method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal, the method comprising the following steps performed by the radio access network:

signaling to at least one mobile terminal set of identifiers comprising at least one available radio network temporary identifier for identification of a mobile terminal,

receiving a connection setup request message from a mobile terminal at the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises a radio network temporary identifier selected by the mobile terminal from the set of identifiers and

establishing in response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network, wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal in a communication on the established radio bearer.

2. The method according to claim 1, wherein the connection setup request message received from the mobile terminal further comprises a configuration identifier of a radio bearer configuration to be utilized for communication on the radio bearer to be established, wherein the radio bearer configuration is selected by the mobile terminal from a set of radio bearer configurations being each identified by a respective configuration identifier.

3. The method according to claim 2, further comprising the steps of preconfiguring a pool of resources according to at least one set of radio bearer parameters describing individual radio bearer configurations of said set of radio bearer configurations, wherein each radio bearer configuration is associated to a configuration identifier.

4. The method according to claim 3, further comprising the step of signaling information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set to at least the mobile terminal.

5. A method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal, the method comprising the following steps performed by the radio access network:

preconfiguring a pool of resources according to at least one set of radio bearer parameters describing individual radio bearer configurations of a set of radio bearer configurations, wherein an individual radio bearer configuration is associated to a configuration identifier,

signaling to at least the mobile terminal information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set,

receiving a connection setup request message from a mobile terminal at the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises a configuration identifier of a radio bearer configuration selected by the mobile terminal and to be utilized for communication on the radio bearer to be established, and

establishing in response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol using the radio bearer configuration associated to the configuration identifier in the connection setup request message.

6. The method according to claim 5, further comprising the step of signaling a set of identifiers comprising at least one available radio network temporary identifier for identification of a mobile terminal to at least one mobile terminal,

wherein the connection setup request message from a mobile terminal further comprises a radio network temporary identifier selected by the mobile terminal from the set of identifiers, and

wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal in a communication on the established radio bearer.

7. The method according to one of claims 4 to 6, wherein the information on the set of radio bearer configurations comprises the sets of radio bearer parameters of the configured radio bearers.

8. The method according to one of claims 1 to 7, wherein the set of identifiers or the at least one set of radio bearer parameters describing individual radio bearer configurations and the configuration identifiers are broadcast to mobile terminals by radio access network.

9. The method according to one of claims 1 to 8, wherein the radio bearer is a signaling radio bearer for transmitting control plane information or wherein the radio bearer is a traffic radio bearer used for transmitting user plane data.

10. The method according to claim 9, wherein the control plane information is radio resource control protocol information or non-access stratum data encapsulated in radio resource control protocol messages.

11. The method according to one of claims 1 to 10, wherein the selected radio network temporary identifier is utilized to uniquely identify the mobile terminal on a transport channel in an exchange of data between the mobile terminal and the network element terminating radio resource control protocol in a radio access network utilizing the established radio bearer.

12. The method according to one of claims 1 to 11, further comprising the steps of:

determining whether the selected radio network temporary identifier comprised in the connection setup request message from a mobile terminal has not been already selected by another mobile terminal,

if so, selecting a new radio network temporary identifier not utilized by another mobile terminal and providing the new radio network temporary identifier to the mobile terminal,

wherein the new radio network temporary identifier is used for identifying the requesting mobile terminal in a communication on the established radio bearer.

13. The method according to claim 12, further comprising the step of notifying the mobile terminal that it may not use the selected radio network temporary identifier for identification, if it has been determined that the radio network temporary identifier comprised in the connection setup request message has been already selected for identifying another mobile terminal.

14. The method according to claim 13, wherein the mobile terminal is notified that it may not use the selected radio network temporary identifier for identification by transmitting the selected radio network temporary identifier and a collision flag being set on a downlink physical control channel associated to a shared or dedicated transport channel for which the selected radio network temporary identifier is intended to be used.

15. The method according to claim 14, further comprising the step of transmitting connection setup message comprising a new radio network temporary identifier to be used by the mobile terminal to the requesting mobile terminal.

16. The method according to claim 15, wherein the mobile terminal is identified as the recipient of the message by a non-access stratum temporary identifier or a permanent identifier assigned to the requesting mobile terminal.

17. The method according to claim 13, wherein the mobile terminal is notified that it may not use the selected radio network temporary identifier for identification of the requesting mobile terminal by transmitting a non-access stratum temporary identifier or a permanent identifier of the requesting mobile terminal on a downlink physical control channel associated to a shared transport channel for which the selected radio network temporary identifier is intended to be used.

18. The method according to claim 17, further comprising the step of transmitting a downlink message of a non-access stratum protocol encapsulated in a radio resource control protocol message to the mobile terminal,

wherein the new radio network temporary identifier is provided within a layer 2 packets' header of said radio resource control protocol message packet encapsulating a downlink message of the non-access stratum protocol.

19. The method according to claim 18, wherein the message providing the new radio network temporary identifier to the mobile terminal further indicates the time instant at which the requesting mobile terminal and the radio access network start using the new radio network temporary identifier.

20. The method according to one of claims 1 to 19, further comprising the steps of:

updating the set of identifiers in response to reception of a connection setup request message, if the selected radio network temporary identifier comprised in the connection setup request message is not utilized by another mobile terminal, and

signaling the information on the updated set of identifiers and an indication that the set of identifiers has been updated.

21. The method according to one of claims 1 to 20, further comprising the steps of:

updating the set of radio bearer configurations in response to the establishment of the radio bearer, and

signaling information on the updated set of radio bearer configurations and an indication that the set of radio bearer configurations has been updated.

22. The method according to one of claims 1 to 21, wherein the radio access network is a UMTS radio access network and the radio network temporary identifier is one of an H-RNTI associated to a high speed shared downlink, a Primary or Secondary E-RNTI associated to an enhanced uplink dedicated transport channel and an LTE-RNTI associated to a shared uplink and downlink transport channel.

23. A method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal, the method comprising the following steps performed by the mobile terminal:

receiving from the radio access network a set of identifiers comprising at least one radio network temporary identifier available for identification of mobile terminals,

selecting a radio network temporary identifier from the set of identifiers,

transmitting a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises the selected radio network temporary identifier and

establishing a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network, wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal on the established radio bearer.

24. The method according to claim 23, wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal on a shared transport channel to which the established radio bearer is mapped.

25. The method according to claim 23 or 24, wherein the connection setup request message further comprises a configuration identifier that is identifying a radio bearer configuration from a set of radio bearer configurations to be utilized for communication on the radio bearer between the mobile terminal and the network element terminating radio resource control protocol in a radio access network.

26. The method according to claim 25, further comprising the steps of receiving information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearer configuration of said set in at least the mobile terminal and

selecting a radio bearer configuration identified by a configuration identifier from the set of radio bearer configurations,

wherein the configuration identifier in the connection setup request message indicated the selected radio bearer configuration to the network element terminating the radio resource control protocol.

27. A method for establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and a mobile terminal, the method comprising the following steps performed by the mobile terminal:

receiving information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set from the radio access network,

selecting a radio bearer configuration associated to a configuration identifier from the set of radio bearer configurations,

transmitting a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup message comprises a configuration identifier that is associated to the configuration of selected radio bearer and

establishing a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network using the selected radio bearer configuration.

28. The method according to claim 27, further comprising the steps of:

receiving from the radio access network a set of identifiers comprising at least one radio network temporary identifier available for identification of mobile terminals, and

selecting a radio network temporary identifier from the set of identifiers,

wherein the connection setup request message further comprises the selected radio network temporary identifier and

wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal on the established radio bearer

29. The method according to one of claims 23 to 28, further comprising the steps of:

receiving a new radio network temporary identifier not assigned to another mobile terminal from the radio access network, in case the selected radio network temporary identifier comprised in the connection setup request has already been assigned to another mobile terminal,

wherein the new radio network temporary identifier is used for identifying the mobile terminal on a shared transport channel used in a communication on the established radio bearer.

30. The method according to claim 29, further comprising the step of receiving a notification that the selected radio network temporary identifier may not be used for identification, if the radio network temporary identifier comprised in the connection setup request message has been already assigned to another mobile terminal.

31. The method according to claim 30, wherein the mobile terminal is notified that it may not use the selected radio network temporary identifier for identification by receiving the selected radio network temporary identifier and a collision flag being set on a downlink physical control channel associated to shared transport channel for which the selected radio network temporary identifier is intended to be used.

32. The method according to claim 31, further comprising the step of receiving a message comprising the new radio network temporary identifier to be used by the mobile terminal.

33. The method according to claim 32, wherein the mobile terminal is identified as the recipient of the message by a non-access stratum temporary identifier or a permanent identifier assigned to the requesting mobile terminal.

34. The method according to claim 29, wherein the mobile terminal is notified that it may not use the selected radio network temporary identifier for identification by receiving a non-access stratum temporary identifier or a permanent identifier of the mobile terminal on a downlink physical control channel associated to shared transport channel for which the selected radio network temporary identifier is intended to be used.

35. The method according to claim 34, further comprising the step of receiving a downlink message of a non-access stratum protocol,

wherein the new radio network temporary identifier is received with a layer 2 packets' header of a radio resource control protocol message encapsulating the downlink message of the non-access stratum protocol.

36. The method according to one of claims 23 to 35, further comprising the step of receiving via broadcast an updated set of identifiers and an indication that the set of identifiers has been updated.

37. The method according to one of claims 23 to 36, further comprising the step of receiving via broadcast information on an updated set of radio bearer configurations and an indication that the set of radio bearer configurations has been updated.

38. The method according to one of claims 23 to 37, further comprising the step of estimating the resources available on the air interface to the radio access network based on information on at least one set of radio link parameters received from the radio network during cell selection or reselection procedure.

39. A network element in a radio access network terminating radio resource control protocol establishing a radio bearer between the network element terminating radio resource control protocol and a mobile terminal, the network element comprising:

a transmitter for signaling to at least one mobile terminal set of identifiers comprising at least one available radio network temporary identifier for identification of a mobile terminal,

a reception unit for receiving a connection setup request message from a mobile terminal at the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises a radio network temporary identifier selected by the mobile terminal from the set of identifiers and

a processing unit for establishing in response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network, wherein the selected radio network temporary identifier is utilized for identifying the mobile terminal in a communication on the established radio bearer.

40. The network element according to claim 39, further comprising means adapted to perform the method according to one of claims 2 to 4 or 8 to 22.

41. A network element in a radio access network terminating radio resource control protocol establishing a radio bearer between the network element terminating radio resource control protocol and a mobile terminal, the network element comprising:

a configuration unit for preconfiguring a pool of resources according to at least one set of radio bearer parameters describing individual radio bearers of a set of radio bearer configurations, wherein an individual radio bearer configuration is associated to a configuration identifier,

a transmitter for signaling to at least the mobile terminal information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearers of said set,

a receiver for receiving a connection setup request message from a mobile terminal at the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup request message comprises a configuration identifier of a radio bearer configuration selected by the mobile terminal and to be utilized for communication on the radio bearer to be established, and

a processing unit for establishing in response to the connection setup request message a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol wherein the configuration of the established radio bearer is associated to the configuration identifier in the connection setup request message.

42. The network element according to claim 41, further comprising means adapted to perform the method according to one of claims 6 to 22.

43. A mobile terminal establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and the mobile terminal, the mobile terminal comprising:

a receiver for receiving from the radio access network a set of identifiers comprising at least one radio network temporary identifier available for identification of mobile terminals,

a processing unit for selecting a radio network temporary identifier from the set of identifiers, and

a transmitter for transmitting a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup message comprises the selected radio network temporary identifier,

wherein the processing unit is adapted to establish a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network, and

wherein the selected radio network temporary identifier is utilized for identifying the requesting mobile terminal in a communication on the established radio bearer.

44. The mobile terminal according to claim 43, further comprising means adapted to perform the method according to one of claims 23 to 26 or 29 to 38.

45. A mobile terminal establishing a radio bearer between a network element in a radio access network terminating radio resource control protocol and the mobile terminal, the mobile terminal comprising:

a receiver for receiving information on the set of radio bearer configurations and the configuration identifiers associated to the individual radio bearer configurations of said set from the radio access network,

a processing unit for selecting a radio bearer configuration associated to a configuration identifier from the set of radio bearer configurations, and

a transmitter for transmitting a connection setup request message to the network element terminating the radio resource control protocol in the radio access network, wherein the connection setup message a configuration identifier that is associated the selected configuration of radio bearer,

wherein the processing unit is adapted to establish a radio bearer between the requesting mobile terminal and the network element terminating radio resource control protocol in a radio access network using the selected radio bearer configuration.

46. The mobile terminal according to claim 45, further comprising means adapted to perform the method according to one of claims 27 to 38.

47. A mobile communication system comprising a network element according to one of claims 39 to 42 and one or more mobile terminals according to one of claims 43 to 46.

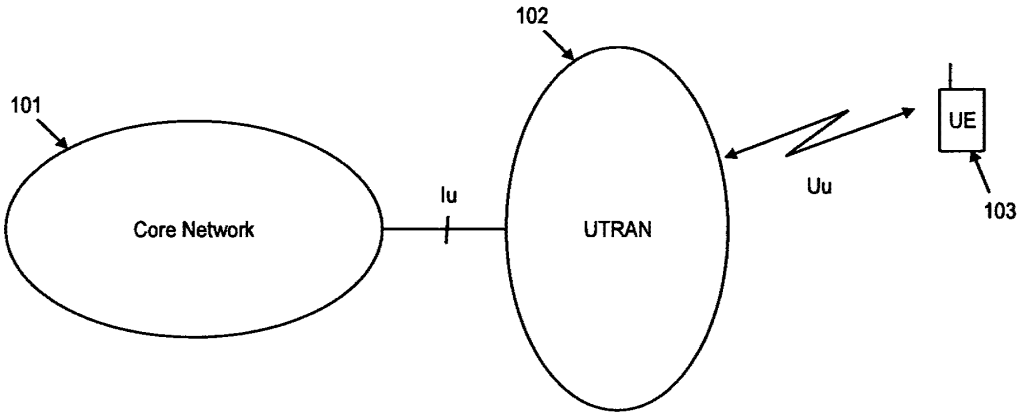

102
101
UE
Core Network
Iu
UTRAN
Uu
103

Fig. 1

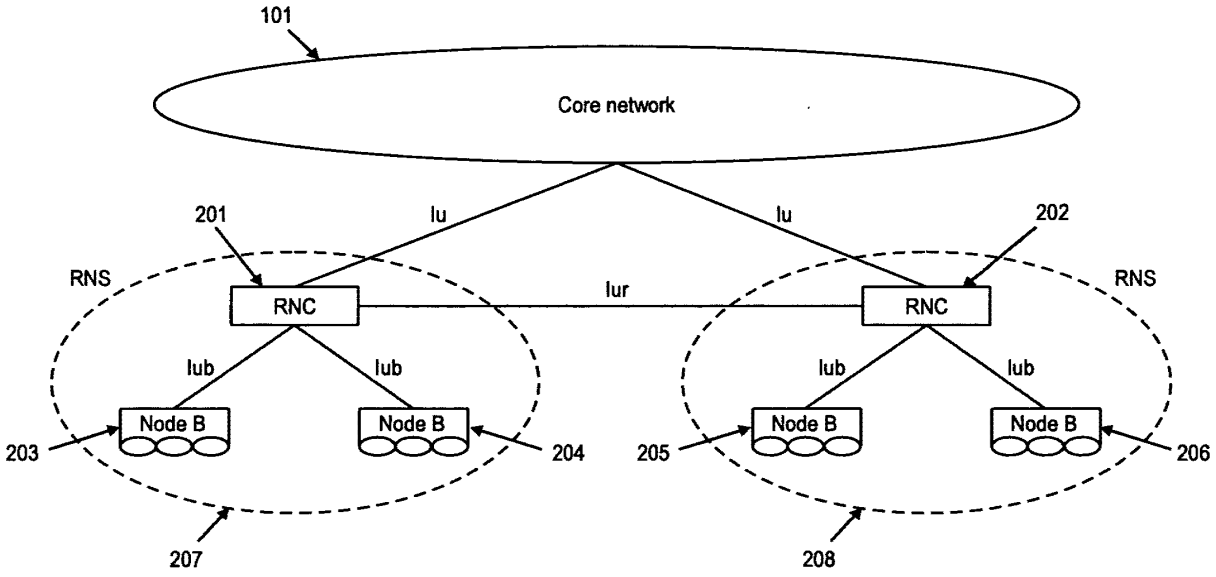

101
Core network
201
Iu
Iu
202
RNS
RNC
Iur
RNC
RNS
Iub
Iub
Iub
Iub
Node B
Node B
Node B
Node B
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Fig. 2

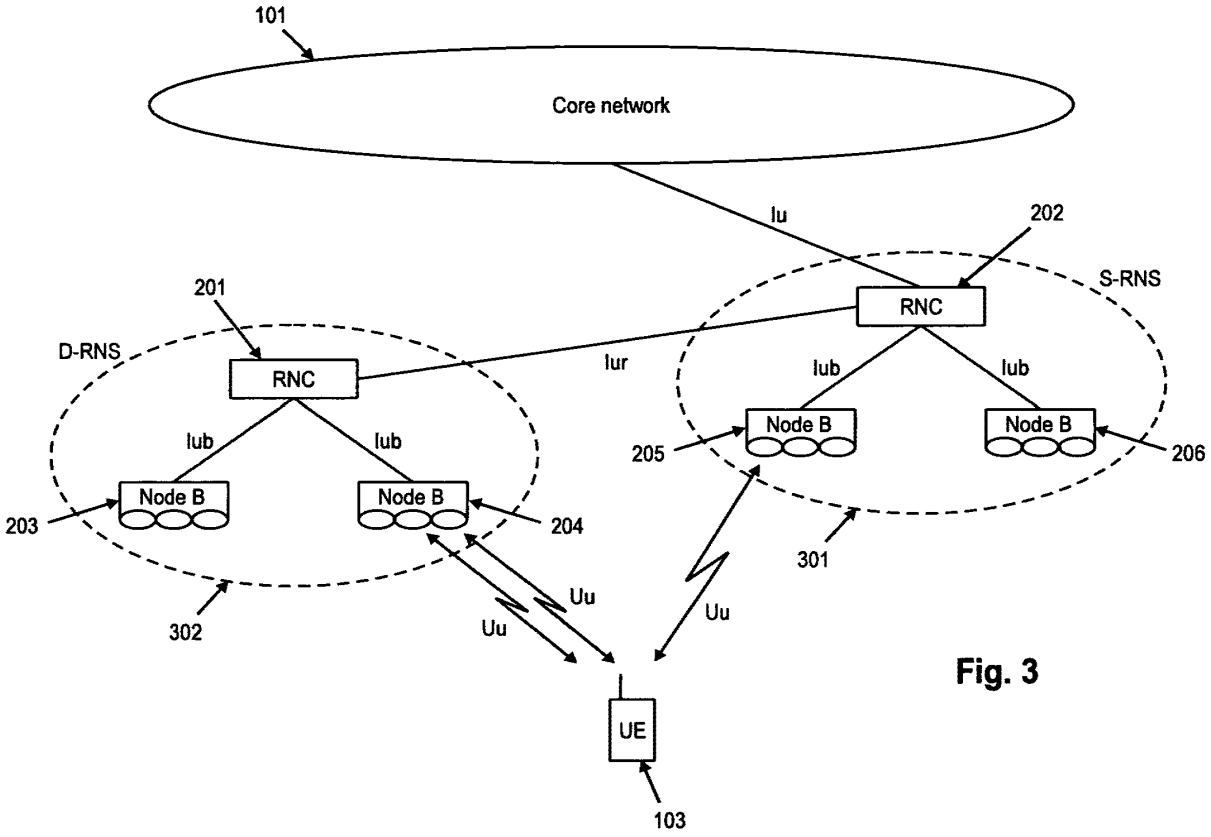

101
Core network
Iu
202
S-RNS
RNC
201
D-RNS
RNC
Iur
Iub
Iub
Iub
Iub
Node B
Node B
Node B
Node B
203
204
205
206
301
302
Uu
Uu
Uu
UE
103

Fig. 3

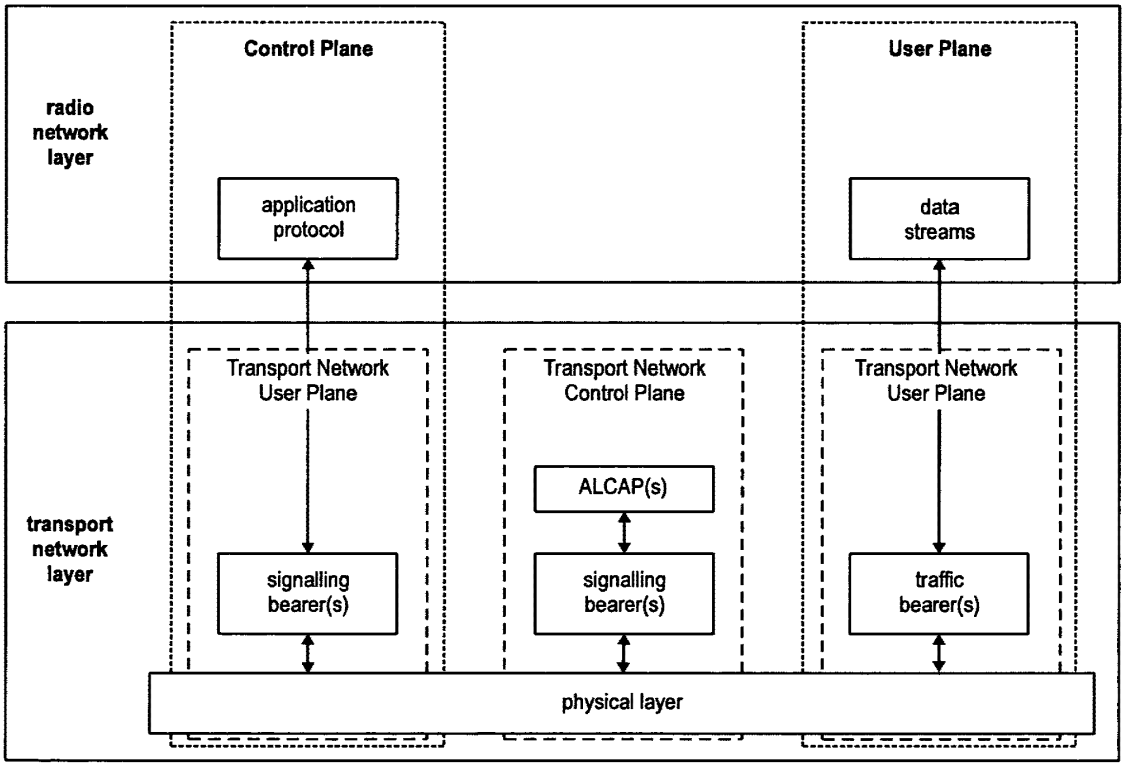

Control Plane
User Plane
radio network layer
application protocol
data streams
Transport Network User Plane
Transport Network Control Plane
Transport Network User Plane
ALCAP(s)
transport network layer
signalling bearer(s)
signalling bearer(s)
traffic bearer(s)
physical layer

Fig. 4

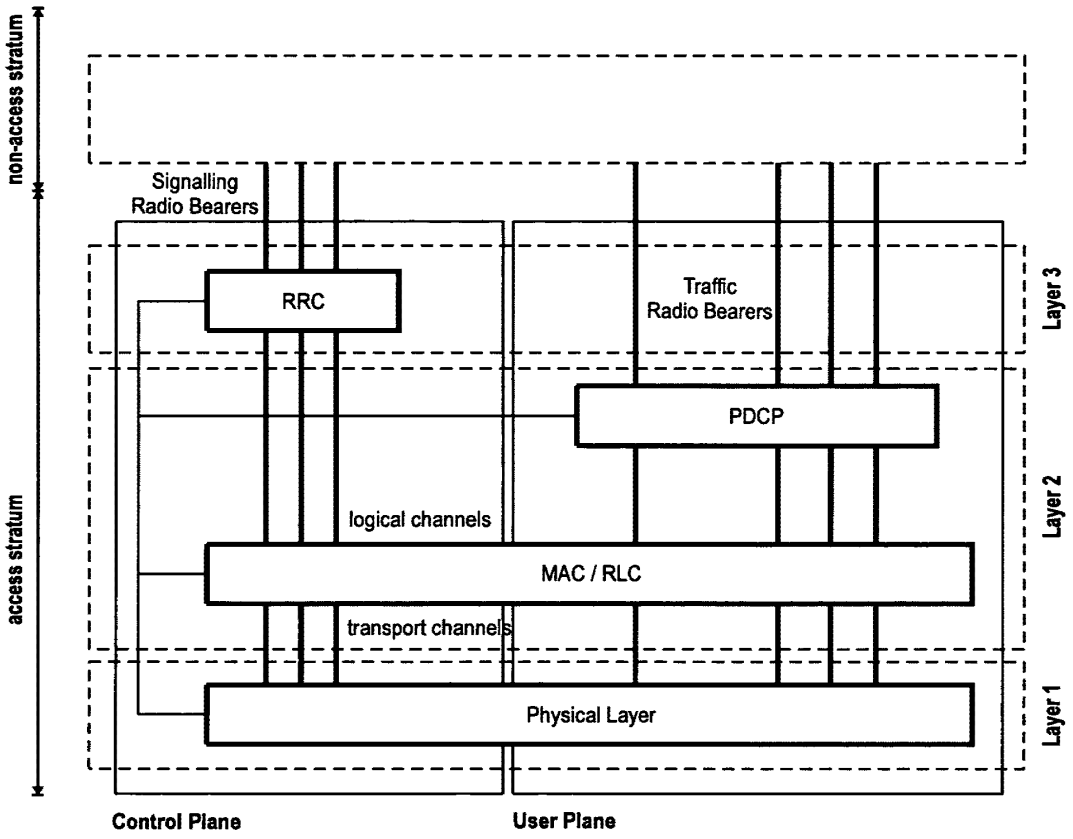

non-access stratum
access stratum
Signalling
Radio Bearers
RRC
Traffic
Radio Bearers
PDCP
logical channels
MAC / RLC
transport channels
Physical Layer
Layer 3
Layer 2
Layer 1
Control Plane
User Plane

Fig. 5

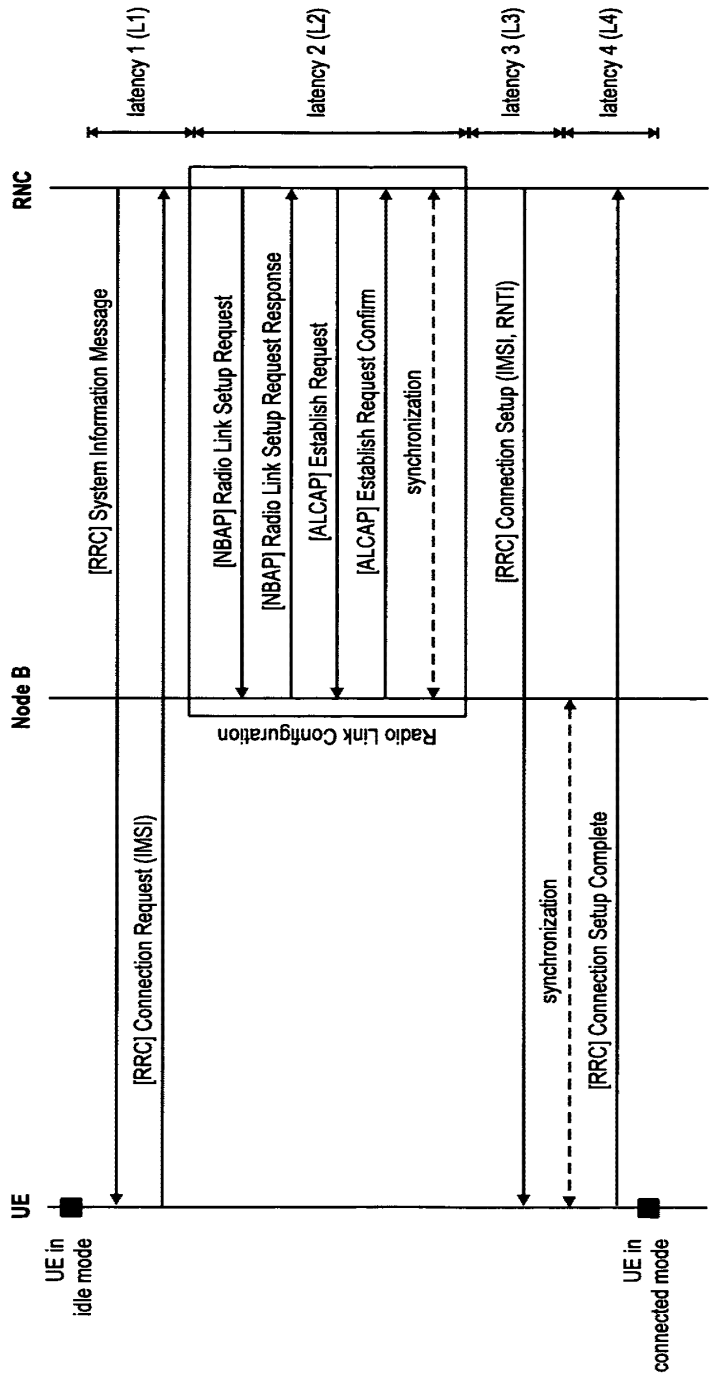

latency 1 (L1)
latency 2 (L2)
latency 3 (L3)
latency 4 (L4)
RNC
Node B
UE
UE in idle mode
UE in connected mode
[RRC] System Information Message
[RRC] Connection Request (IMSI)
[NBAP] Radio Link Setup Request
[NBAP] Radio Link Setup Request Response
[ALCAP] Establish Request
[ALCAP] Establish Request Confirm
synchronization
Radio Link Configuration
[RRC] Connection Setup (IMSI, RNTI)
synchronization
[RRC] Connection Setup Complete

Fig. 6

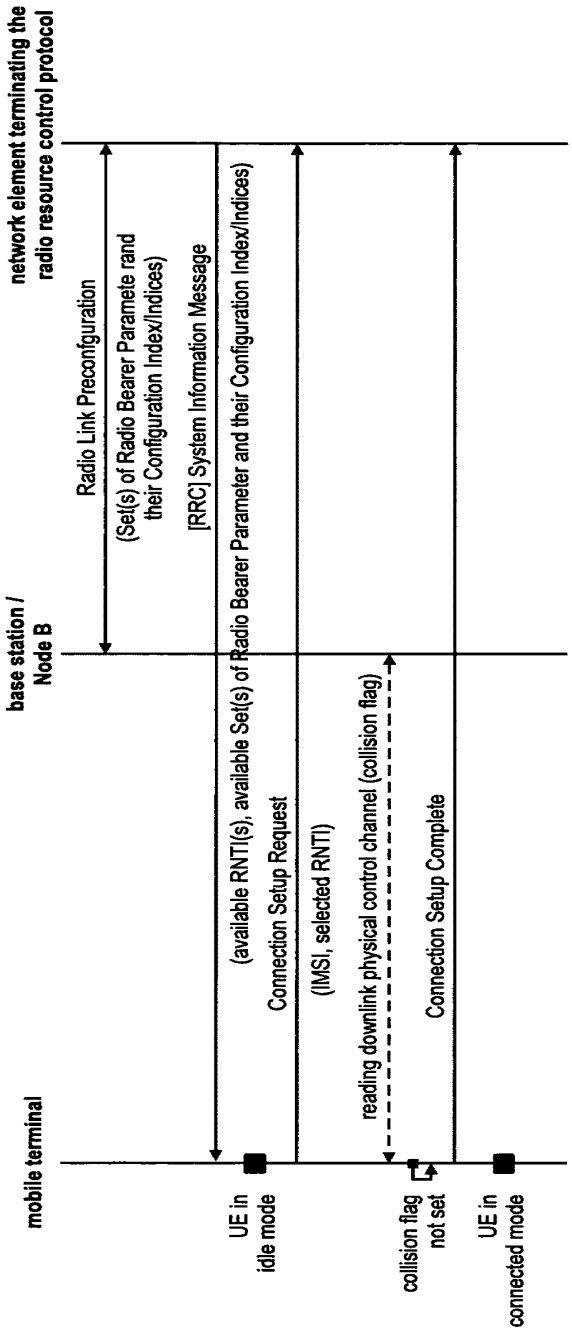

mobile terminal
base station / Node B
network element terminating the radio resource control protocol
Radio Link Preconfguration
(Set(s) of Radio Bearer Paramete rand their Configuration Index/Indices)
[RRC] System Information Message
(available RNTI(s), available Set(s) of Radio Bearer Parameter and their Configuration Index/Indices)
Connection Setup Request
(IMSI, selected RNTI)
reading downlink physical control channel (collision flag)
Connection Setup Complete
UE in idle mode
collision flag not set
UE in connected mode

Fig. 7

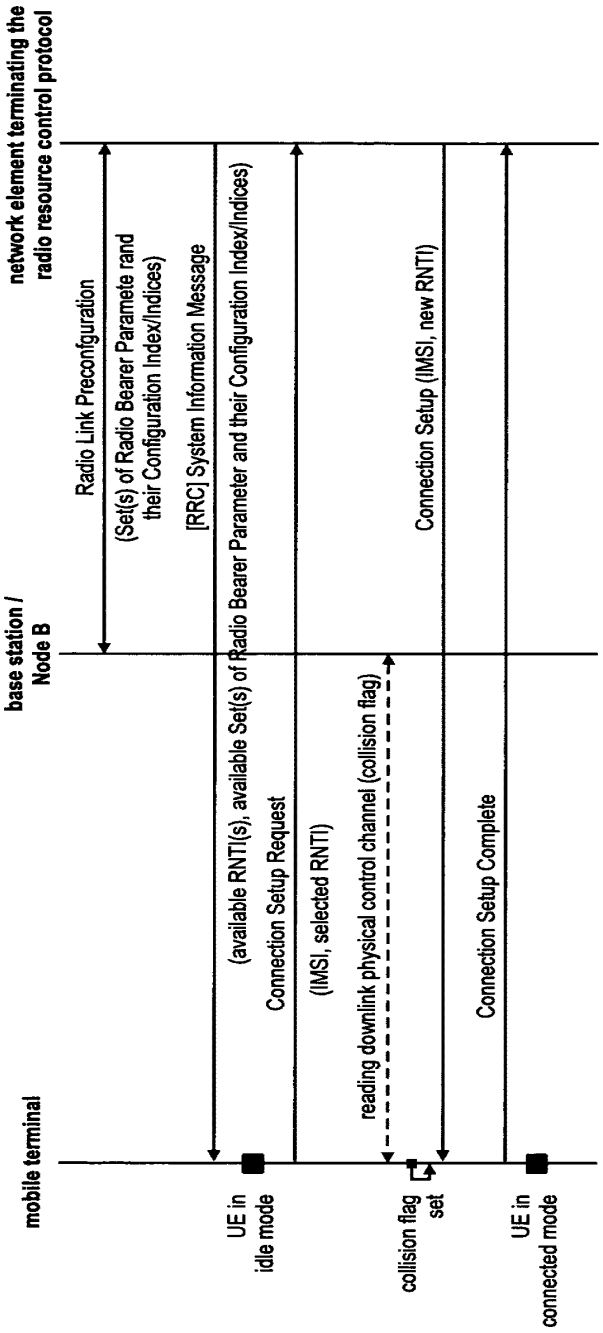

mobile terminal
base station / Node B
network element terminating the radio resource control protocol
Radio Link Preconfiguration
(Set(s) of Radio Bearer Paramete rand their Configuration Index/Indices)
[RRC] System Information Message
(available RNTI(s), available Set(s) of Radio Bearer Parameter and their Configuration Index/Indices)
Connection Setup Request
(IMSI, selected RNTI)
reading downlink physical control channel (collision flag)
Connection Setup (IMSI, new RNTI)
Connection Setup Complete
UE in idle mode
collision flag set
UE in connected mode

Fig. 8

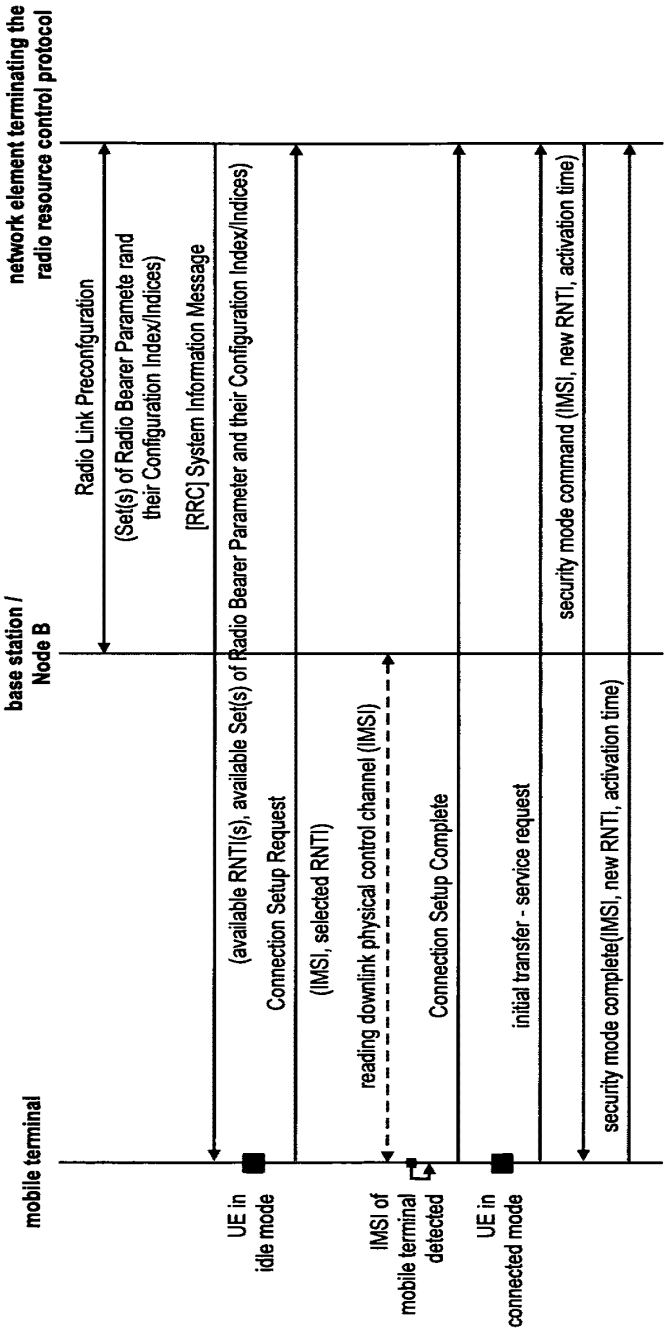

mobile terminal
base station / Node B
network element terminating the radio resource control protocol
Radio Link Preconfiguration
(Set(s) of Radio Bearer Paramete rand their Configuration Index/Indices)
[RRC] System Information Message
(available RNTI(s), available Set(s) of Radio Bearer Parameter and their Configuration Index/Indices)
Connection Setup Request
(IMSI, selected RNTI)
reading downlink physical control channel (IMSI)
Connection Setup Complete
initial transfer - service request
security mode command (IMSI, new RNTI, activation time)
security mode complete(IMSI, new RNTI, activation time)
UE in idle mode
IMSI of mobile terminal detected
UE in connected mode

Fig. 9

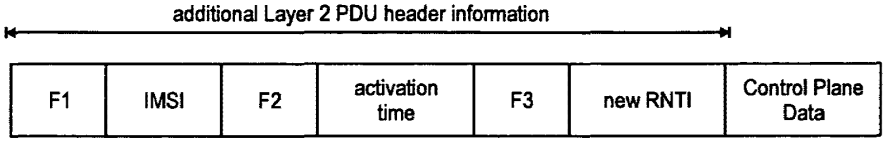


Fig. 10

Conf. ID #1	Set of RB parameters for Signalling Radio Bearer
Conf. ID #2	Set of RB parameters for VoIP
Conf. ID #3	Set of RB parameters for streaming services
⋮	⋮
Conf. ID #n	Set of RB parameters for ...

Fig. 11

Conf. ID #1	RB Identity a	Set of RB parameters for Signalling Radio Bearer
	RB Identity b	Set of RB parameters for VoIP
	RB Identity c	Set of RB parameters for streaming service
Conf. ID #2	RB Identity d	Set of RB parameters for Signalling Radio Bearer
	RB Identity e	Conf. ID #1, RB Identity b

Fig. 12

Conf. ID #1	no. of available config.	Set of RB parameters for Signalling Radio Bearer
Conf. ID #2	no. of available config.	Set of RB parameters for VoIP
Conf. ID #3	no. of available config.	Set of RB parameters for streaming service

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/009100

A. CLASSIFICATION OF SUBJECT MATTER
INV. 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)
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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Universal Mobile Telecommunications System (UMTS); Radio Resource Management strategies (3GPP TR 25.922 version 6.0.1 Release 6); ETSI TR 125 922" ETSI STANDARDS, EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE, SOPHIA-ANTIPO, FR, no. v601, April 2004 (2004-04), pages i,15-31, XP002338707 ISSN: 0000-0001	5,27,41, 45,47
A	* section 5.1.5.2.2 and 5.1.7 to 5.1.7.2 *	1-4, 6-26, 28-40, 42-44,46

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"E" earlier document but published on or after the international filing date

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"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
9 November 2006	20/11/2006

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/009100

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	SAMSUNG: "Introducing preconfiguration upon radio bearer establishment, 3GPP TSG-RAN2 Meeting #46-bis R2-051044"[Online] 30 March 2005 (2005-03-30), pages 1-4, XP002375551 Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_46bis/Documents/> [retrieved on 2006-04-03] the whole document	1-47
A	WO 2004/017581 A (SAMSUNG ELECTRONICS CO., LTD; BEIJING SAMSUNG TELECOM R & D CENTER; KI) 26 February 2004 (2004-02-26) page 17, line 33 - page 18, line 11	1-47
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A	US 5 428 823 A (NESS-COHN ET AL) 27 June 1995 (1995-06-27) column 2, line 48 - column 3, line 16	1-47

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2006/009100

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		WO 9748248 A2	18-12-1997
US 5428823 A	27-06-1995	NONE	

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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR CELL UPDATE WHILE IN AN ENHANCED CELL_FACH STATE

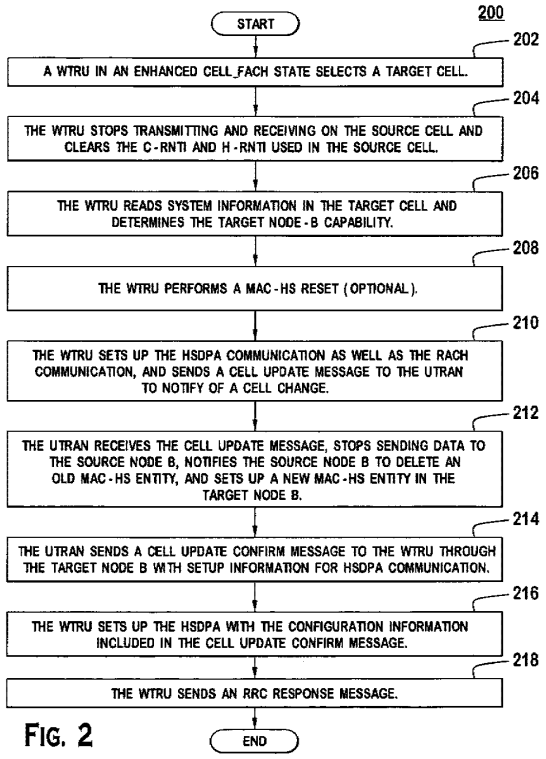


FIG. 2

(57) Abstract: A method and apparatus for cell update while in a Cell_FACH state are disclosed. After selecting a target cell, system information is read from the target cell including high speed downlink shared channel (HS-DSCH) common system information. A radio network temporary identity (RNTI) received in a source cell is cleared and a variable HS_DSCH_RECEPTION is set to TRUE. An HS-DSCH medium access control (MAC-hs) entity is configured based on the HS-DSCH common system information. High speed downlink packet access (HSDPA) transmission is then received in the target cell. A CELL UPDATE message is sent to notify of a cell change. The HSDPA transmission may be received using a common H-RNTI broadcast in the system information, a reserved H-RNTI as requested in a CELL UPDATE message, or a temporary identity which is a subset of a U-RNTI. The MAC-hs entity may be reset.

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Published:

— *without international search report and to be republished upon receipt of that report*

[0001] # METHOD AND APPARATUS FOR CELL UPDATE WHILE IN AN ENHANCED CELL_FACH STATE

[0002] ## FIELD OF INVENTION

[0003] The present invention is related to wireless communications.

[0004] ## BACKGROUND

[0005] Wireless transmit/receive units (WTRUs) in a UTRAN may be in either an idle mode or a connected mode. Based on WTRU mobility and activity while in the connected mode, the universal terrestrial radio access network (UTRAN) may direct the WTRU to transition between a number of radio resource control (RRC) sub-states: Cell_PCH, URA_PCH, Cell_FACH, and Cell_DCH states. User plane communication between the WTRU and the UTRAN is only possible while in Cell_FACH and Cell_DCH states. The Cell_DCH state is characterized by dedicated channels in both the uplink and the downlink. On the WTRU side, this corresponds to continuous transmission and reception and can be demanding on user power requirements. The Cell_FACH state does not use dedicated channels and thus allows better power consumption, at the expense of a lower uplink and downlink throughput.

[0006] The Cell_FACH state is well-suited for signalling traffic, (e.g., transmission of a CELL UPDATE message), and for applications requiring very low uplink throughput. Uplink communication is achieved through a random access channel (RACH) that is mapped to a physical random access channel (PRACH). The RACH is a contention-based channel with a power ramp-up procedure to acquire the channel and to adjust transmit power. Downlink communication is through a forward access channel (FACH) that is mapped to a secondary common control physical channel (S-CCPCH). System information including the setup details for the uplink (i.e., RACH) and

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downlink (i.e., FACH) channels to be used in Cell_FACH is read from a broadcast channel (BCH).

[0007] In the Cell_FACH state, mobility is handled autonomously by the WTRU. The concept of soft handover does not currently (as of Release 6 of the third generation partnership project (3GPP) standard) exist within Cell_FACH. A WTRU independently takes measurements, and determines which cell to camp on.

[0008] The possibility of using high speed downlink packet access (HSDPA) in the Cell_FACH state, (i.e., enhanced Cell_FACH state), has been studied by the standardization bodies. HSDPA is a feature that was introduced in Release 5 of the 3GPP specifications to operate in the Cell_DCH state. HSDPA tries to make better use of the downlink shared capacity by using three key concepts: adaptive modulation and coding (AMC), retransmissions using a hybrid automatic repeat request (HARQ) scheme, and Node-B scheduling - all operating at a very fast rate.

[0009] Every WTRU having an HSDPA connection is assigned an HS-DSCH radio network temporary identifier (H-RNTI). The H-RNTI is unique within a cell and assigned by the serving radio network controller (SRNC). A WTRU is attached to a single serving cell, (i.e., Node B). The WTRU has to be told about the physical channel resources to use (high speed physical downlink shared channel (HS-PDSCH) information), as well as how to set up the HARQ processes and the HARQ memory.

[0010] As a result of mobility, the WTRU may change from one serving cell (source Node B) to another (target Node B). The UTRAN controls the timing of this change. The SRNC must stop sending data to the source Node B and begin sending data to the target Node B with the new configuration. At the same time, the RNC must send a control message (RRC message) to reset the HS-DSCH medium access control (MAC-hs) entity at the WTRU.

[0011] The MAC-hs reset would entail flushing soft buffer for all configured HARQ processes; stopping all active re-ordering release timers (T1) and setting all timers (T1) to their initial value; starting transmission

sequence number (TSN) with value 0 for the next transmission on every configured HARQ process; initialising the variables RcvWindow_UpperEdge and next_expected_TSN to their initial values; disassembling all MAC-hs protocol data units (PDUs) in the re-ordering buffer and delivering all dedicated channel medium access control (MAC-d) PDUs to the MAC-d entity; flushing the re-ordering buffer; and in some cases, indicating to all acknowledged mode (AM) radio link control (RLC) entities mapped on a high speed downlink shared channel (HS-DSCH) to generate a status report.

[0012] When trying to transmit HSDPA while in the enhanced Cell_FACH state, there are many problems that need to be addressed. HSDPA is currently standardized to operate only in the Cell_DCH state. The WTRU makes use of variable HS_DSCH_RECEPTION to verify whether or not HSDPA reception is allowed. In the enhanced Cell_FACH state, the WTRU receives common channel set up information in the broadcast system information. However, no HSDPA configuration information is carried in the broadcast information.

[0013] The enhanced Cell_FACH state will use downlink signalling radio bearers on common logical channels (common control channel (CCCH) and common traffic channel (CTCH)). Typical RRC messages carried on these radio bearers include RRC CONNECTION SETUP message and CELL UPDATE CONFIRM message. The former message poses a problem as the HSDPA configuration details are included inside this message. For Cell_DCH, WTRUs wait until reading the configuration details before allowing HSDPA communication. This is not possible for enhanced Cell_FACH, as the message must be received using HSDPA communication. Conventional 3GPP Release 6 specifications do not provide support for operation of HS-DSCH in Cell_FACH.

[0014] When a WTRU is in an enhanced Cell_FACH state, the WTRU will execute the cell update procedure for a number of reasons, (e.g., cell reselection, radio link failure, radio link control (RLC) unrecoverable error, etc.). With respect to the cell update procedure, many difficulties may arise.

For example, the WTRU may be asked to transition to enhanced Cell_FACH, but it requires a way to retrieve HSDPA configuration information. The cell reselection procedures are controlled by the WTRU. As a result, the UTRAN is not able to execute a timely and synchronized MAC-hs reset. In fact, after a cell reselection, the source Node B would continue to send information to the WTRU, even though the latter has stopped listening. The UTRAN would only be aware of the change after receiving a CELL UPDATE message. An additional problem may occur if the WTRU needs to send an RLC status report as a result of the MAC-hs reset. After a cell reselection, the UTRAN is notified with a CELL UPDATE message. The UTRAN responds with a CELL UPDATE CONFIRM message using a dedicated control channel (DCCH). This message has to be sent to a dedicated WTRU but the WTRU has not yet been assigned a dedicated H-RNTI (the information would typically be contained within the message itself).

[0015] When a WTRU is in an enhanced Cell_FACH state, it is generally agreed that the MAC-c/sh functionality can be reduced. In particular, the WTRU identity (ID) is already carried in the MAC-hs header and as a result it need not be repeated in the MAC header.

[0016] SUMMARY

[0017] The present application is related to a method and apparatus for cell update while in a Cell_FACH state. After selecting a target cell, system information is read from the target cell. This system information includes the HS-DSCH common system information, if supported in the target cell. The H-RNTI and C-RNTI received in source cell are cleared and a radio resource control (RRC) HS_DSCH_RECEPTION variable is used to control HS_DSCH reception. A MAC-hs entity is configured based on the HS-DSCH common system information. HSDPA transmission is then received in the target cell. A CELL UPDATE message is sent to notify of a cell change. The HSDPA transmission may be received using a common H-RNTI broadcast in the system information, a reserved H-RNTI as requested in a CELL UPDATE

message, or a temporary identity which is a subset of a U-RNTI. Following a cell reselection, radio link failure, or RLC unrecoverable error, the MAC-hs entity may be reset.

[0018] BRIEF DESCRIPTION OF THE DRAWINGS

[0019] A more detailed understanding may be had from the following description of the embodiments, given by way of example and to be understood in conjunction with the accompanying drawings wherein:

[0020] Figure 1 shows an example WTRU and UTRAN;

[0021] Figure 2 is a flow diagram of an example process for cell update in accordance with one embodiment;

[0022] Figure 3 is a flow diagram of an example process for cell update in accordance with another embodiment;

[0023] Figure 4 is a flow diagram of an example process for cell update in accordance with yet another embodiment;

[0024] Figure 5 is a flow diagram of an example process for cell update in accordance with still another embodiment;

[0025] Figure 6 is a flow diagram of an alternative process to the process in Figure 5; and

[0026] Figure 7 is a block diagram of an example apparatus.

[0027] DETAILED DESCRIPTION

[0028] When referred to hereafter, the terminology "WTRU" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of user device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

[0029] When referred to hereafter, the terminology "MAC-hs entity" includes not only the conventional MAC-hs entity but also the high speed MAC entity that supports HS-DSCH reception in CELL_FACH, CELL_PCH and URA_PCH states, that is also known as "enhanced MAC-hs (MAC-ehs) entity."

[0030] Figure 1 shows an example WTRU 110 and UTRAN including Node-Bs 120a, 120b. Figure 1 illustrates only two cells 122a, 122b and two Node-Bs 120a, 120b for simplicity. For HSDPA transmissions, the WTRU 110 receives a WTRU identity, (i.e., H-RNTI), and HSDPA configuration information from the UTRAN. The methods for assigning the H-RNTI and HSDPA configuration information to the WTRU 110 in a Cell_FACH state are explained hereinafter.

[0031] In a Cell_DCH state, every WTRU with an active HSDPA communication is assigned a unique (cell-specific) H-RNTI. However, this is not always possible in a Cell_FACH state. It has been proposed to use both a common H-RNTI and a dedicated H-RNTI while in the Cell_FACH state. A CCCH transmission mapped to the HS-DSCH uses the common H-RNTI, and DCCH and DTCH transmissions mapped to the HS-DSCH use the dedicated H-RNTI. The common H-RNTI may be broadcast as part of the system information either by adding a new information element to a conventional system information block (SIB), or by defining a new SIB and associated schedule.

[0032] The information regarding the dedicated H-RNTI may be carried in RRC messages. However, a problem occurs if the WTRU 110 does not yet have a dedicated H-RNTI but the downlink RRC message, (e.g., CELL UPDATE CONFIRM), is sent using a DCCH mapped to the HS-DSCH while the WTRU is in a Cell_FACH state. In accordance with one embodiment, an RRC message including the WTRU identity, (e.g., a CELL UPDATE CONFIRM message), may be sent via a CCCH over the HS-DSCH using the common H-RNTI and the dedicated H-RNTI may be included in the RRC message. Alternatively, the RRC message, (e.g., CELL UPDATE CONFIRM

message), may be sent using a DCCH over an FACH, and a MAC-c header includes the WTRU identity.

[0033] Alternatively, a bank of reserved H-RNTIs (RH-RNTIs) may be used solely for the purpose of the DCCH messages transmitted via the HS-DSCH when a WTRU 110 has no dedicated H-RNTI. The bank of RH-RNTIs may be broadcast as part of the system information and may be indexed. The WTRU 110 randomly selects one of the RH-RNTI indices and sends this information in a CELL UPDATE message. The CELL UPDATE message may be expanded to include a new information element (IE) which includes the index of the RH-RNTI. The UTRAN responds with a CELL UPDATE CONFIRM message via the DCCH that is mapped to HS-DSCH using the indexed RH-RNTI, (i.e., the indexed RH-RNTI is signalled in the HS-SCCH). An address collision may occur if multiple WTRUs select the same RH-RNTI. The UTRAN makes sure that multiple WTRUs do not select the same RH-RNTI. If an address collision occurs, the UTRAN may simply refrain from sending the CELL UPDATE CONFIRM message and wait for retransmission of the CELL UPDATE message.

[0034] Alternatively, when assigning a U-RNTI, the U-RNTI may be assigned in a way that a WTRU 110 may use a subset of the U-RNTI, (e.g., the least significant 16-bits), as a temporary dedicated H-RNTI, and this temporary H-RNTI may be used for the DCCH transmissions, (e.g., transmission of the CELL UPDATE CONFIRM message), via the HS-DSCH. The UTRAN is responsible for preventing the address collision in this case.

[0035] For a WTRU 110 to receive HSDPA transmission, the WTRU 110 requires HSDPA configuration information from the UTRAN. Typically, the HSDPA configuration information is provided in an RRC message, (such as RRC CONNECTION SETUP message, CELL UPDATE CONFIRM message, or the like). For a WTRU 110 in a Cell_FACH state, HSDPA has to be configured even before these RRC messages can be received.

[0036] Common HS-DSCH system information may be sent as part of the broadcast system information. The broadcast information may include

enhanced Cell_FACH capability, (i.e., indication that the cell supports enhanced Cell_FACH WTRUs), common high speed physical downlink shared channel (HS-PDSCH) information, (e.g., an HS-SCCH scrambling code and channelization code, channel quality indicator (CQI) feedback information, etc.), common HARQ information, (e.g., the number of HARQ processes and memory partitioning, etc.), and optionally RH-RNTIs to be used for sending DCCH messages when no dedicated H-RNTI is available. The broadcast system information may include a set of default common HSDPA configurations, and a WTRU may choose one of them, (for example, based on its initial WTRU identity).

[0037] After receiving the HSDPA configuration information, the WTRU 110 configures a MAC-hs entity. A separate MAC-hs entity may be configured for each RNTI address. For example, if a WTRU 110 in an enhanced Cell_FACH state is configured with a common H-RNTI and a dedicated H-RNTI, two separate MAC-hs entities may be configured, (one for the common H-RNTI and the other for the dedicated H-RNTI).

[0038] Alternatively, a single MAC-hs entity may be setup per WTRU, and traffic is segregated by storing in different priority queues based on the logical channel. The Node B would be required to change the H-RNTI used for transmission depending on the priority queue selected by the scheduler.

[0039] The WTRU 110 evaluates a variable HS_DSCH_RECEPTION in numerous occasions as defined in 3GPP technical specification (TS) 25.331. The variable HS_DSCH_RECEPTION denotes "high speed shared control channel (HS-SCCH) and HS-DSCH reception procedures are ongoing." When the variable HS_DSCH_RECEPTION is evaluated to FALSE, it forces the WTRU 110 to perform a complete HSDPA reset (including a MAC-hs reset and a clearing all HARQ resources). The variable HS_DSCH_RECEPTION shall be set to TRUE when certain conditions are met. In order to operate HSDPA in a Cell_FACH state, the a HS_DSCH_RECEPTION variable must evaluate to TRUE when the following three conditions are met: (1) a WTRU is in an enhanced Cell_FACH state; (2) a downlink radio link is configured as a

serving HS-DSCH radio link; and (3) there is at least one radio bearer mapped to an HS-DSCH. It should be noted that the variable "HS_DSCH_RECEPTION" may be the same variable as the one in a CELL_DCH state, or new variables may be defined for WTRUs operating in a CELL_FACH state. It should also be noted that the variable "HS_DSCH_RECEPTION" may be referred to as different names, or other variable may be used for the same function.

[0040] Cell update procedures are explained hereinafter. Figure 2 is a flow diagram of a process 200 for cell update in accordance with one embodiment. In this example, a WTRU 110 moves from a source cell 122a with enhanced Cell_FACH support to a target cell 122b with enhanced Cell_FACH support. A WTRU 110 in an enhanced Cell_FACH state selects a target cell 122b, (step 202). The WTRU 110 stops transmitting and receiving on the source cell 122a and clears the C-RNTI and H-RNTI used in the source cell 122a (step 204). The WTRU 110 reads system information in the target cell 122b and determines the target Node B capability (step 206).

[0041] If the target Node B 120b has enhanced Cell_FACH capability, the following steps are performed. If the target Node B 120b does not have enhanced Cell_FACH capability, (i.e., cell reselection from an enhanced Cell_FACH cell to a non-enhanced Cell_FACH cell), the process 300 in Figure 3 is performed. The WTRU 110 may perform a MAC-hs reset (step 208). This will flush the soft buffers and begin the disassembly process. The MAC-hs reset may need to be performed for both the common H-RNTI queue and dedicated H-RNTI queue.

[0042] The WTRU 110 may always perform a MAC-hs reset for both the common H-RNTI and dedicated H-RNTI. Alternatively, the WTRU 110 may perform a MAC-hs reset only when the cell reselection results in an inter-Node B cell change or an intra-node B cell change for a Node B that does not support MAC-hs preservation. In this case, the intra-Node B cell change does not result in a MAC-hs reset if the Node B can maintain the MAC-hs entity. This requires some indication to the WTRU 110 about the Node B identity and

capability, which may be broadcast as part of the system information either as a new information element to an existing SIB, or as a new SIB.

[0043] Alternatively, the WTRU 110 may perform a MAC-hs reset only for the case where reordering queues are used. If the WTRU 110 in enhanced Cell_FACH is not using reordering queues (for traffic on either the common H-RNTI or the dedicated H-RNTI), then a MAC-hs reset is not required. Optionally, the WTRU 110 may decide to flush the HARQ soft buffers instead of performing the MAC-hs reset.

[0044] Alternatively, the WTRU 110 may perform a MAC-hs reset only when reordering queues are used and the cell reselection results in an inter-Node B cell change or an intra-node B cell change for a Node B that does not support MAC-hs preservation.

[0045] The WTRU 110 then sets up the HSDPA communication as well as the RACH communication, and sends a CELL UPDATE message to the UTRAN to notify of a cell change (step 210). Optionally, the WTRU 110 may select an RH-RNTI index and provide this information in the CELL UPDATE message. The WTRU 110 begins downlink reception. The WTRU 110 looks for its H-RNTI in the HS-SCCH. The choice of the H-RNTI depends on the rules for assigning the H-RNTI as explained above. The WTRU 110 may use the common H-RNTI broadcast in the system information, may use an RH-RNTI as requested in the CELL UPDATE message, or may use a temporary H-RNTI based on a subset of the U-RNTI.

[0046] The UTRAN receives the CELL UPDATE message, stops sending data to the source Node B, notifies the source Node B to delete an old MAC-hs entity, and sets up a new MAC-hs entity in the target Node B (step 212). The UTRAN sends a CELL UPDATE CONFIRM message to the WTRU 110 through the target Node B with setup information for the HSDPA communication (in particular a dedicated H-RNTI) (step 214). The H-RNTI used for the CELL UPDATE CONFIRM message depends on the rules for assigning the H-RNTI. The UTRAN may use the common H-RNTI broadcast in the system information, may use an RH-RNTI as requested in the CELL

UPDATE message, or may use a temporary H-RNTI based on a subset of the U-RNTI. Alternatively, the CELL UPDATE CONFIRM message may be sent via the FACH.

[0047] The WTRU 110 sets up the HSDPA with the configuration information included in the CELL UPDATE CONFIRM message (step 216). The WTRU 110 responds with an RRC message, (for instance, a PHYSICAL CHANNEL RECONFIGURATION COMPLETE or a UTRAN MOBILITY INFORMATION CONFIRM, depending on whether physical layer parameters have been changed or not) (step 218).

[0048] In addition, performance may be improved if the WTRU 110 sends an RLC status report to allow the UTRAN to know which PDUs require retransmission after the WTRU MAC-hs reset. The RLC status report may be sent prior to sending the CELL UPDATE message but after selecting the target cell 122b. For this, the process 200 is modified. For example, after selecting the target cell 122b, the WTRU 110 stops receiving in the source cell 122a. The WTRU 110 then performs a MAC-hs reset. The WTRU 110 then sends an RLC status report to the source Node B 120a, providing the sequence number of the last PDU received. The WTRU 110 then stops transmitting at the source cell 122a, and continues with step 210. Alternatively, the WTRU 110 may include the RLC status information as an IE in the CELL UPDATE message. This status information includes the last sequence number received at the WTRU 110. Alternatively, the WTRU 110 may wait until receiving the CELL UPDATE CONFIRM message to send an RLC status to the UTRAN, providing an indication of the sequence number of the last received PDU. The status information may be included in a PHYSICAL CHANNEL RECONFIGURATION COMPLETE message or a UTRAN MOBILITY INFORMATION CONFIRM message.

[0049] Optionally, the MAC-hs reset may be removed and replaced with a reset indication from the UTRAN, carried in the CELL UPDATE CONFIRM message. In the CELL UPDATE message, the WTRU 110 may inform the UTRAN about its use of reordering queues (and if a reset is necessary). As the

UTRAN is controlling the procedure, it can ensure that an intra-Node B cell change (with MAC-hs preservation) will not result in a MAC-hs reset, and a WTRU 110 with no re-reordering queues will not result in a MAC-hs reset. In lieu of the MAC-hs reset, the WTRU 110 may flush its HARQ soft buffers.

[0050] Figure 3 is a flow diagram of a process 300 for cell update in accordance with another embodiment. In this embodiment, a WTRU 110 moves from a source cell 122a with enhanced Cell_FACH support to a target cell 122b with no enhanced Cell_FACH support. The WTRU 110 selects the target cell 122b (step 302). The WTRU 110 stops transmitting and receiving at the source cell 122a, and clears the C-RNTI and H-RNTI used in the source cell 122a (step 304). The WTRU 110 reads the system information from the target cell 122b and determines the target Node B capability (step 306). If the target Node B does not have enhanced Cell_FACH capability, the WTRU 110 performs a MAC-hs reset (step 308).

[0051] The WTRU 110 sets up the S-CCPCH and the RACH communication and sends a CELL UPDATE message to the UTRAN to notify of a cell change (step 310). The WTRU 110 begins downlink reception on the selected S-CCPCH.

[0052] The UTRAN receives the CELL UPDATE message, stops sending data to the source Node B, and notifies the source Node B to delete the MAC-hs entity (step 312). The UTRAN sends a CELL UPDATE CONFIRM in the target Node B with information regarding the remapping of the radio bearers over the FACH using the S-CCPCH (step 314). The WTRU 110 reconfigures the radio bearers to use the FACH over the selected S-CCPCH (step 316). The WTRU 110 sends an RRC response message, (for instance, an RADIO BEARER RECONFIGURATION COMPLETE message) (step 318).

[0053] The WTRU 110 has three options to send the RLC status to the UTRAN as stated in the embodiment where the WTRU moves from a source cell with Enhanced Cell_FACH support to a target cell with Enhanced Cell_FACH support.

[0054] Figure 4 is a flow diagram of a process 400 for cell update in accordance with yet another embodiment. In this embodiment, a WTRU 110 moves from a source cell 122a with no enhanced Cell_FACH support to a target cell 122b with enhanced Cell_FACH support. The WTRU 110 selects the target cell 122b (step 402). The WTRU 110 stops transmitting and receiving at the source cell 122a and clears the C-RNTI used in the source cell 122a (step 404). The WTRU 110 reads the system information from the target cell 122b and determines the target Node B capability (step 406). If the target Node B has enhanced Cell_FACH capability, the WTRU 110 sets up the HSDPA communication as well as the RACH communication (step 408). If the target Node B does not have enhanced Cell_FACH capability, the conventional cell reselection procedure is performed.

[0055] The WTRU 110 sends a CELL UPDATE message to the UTRAN to notify of a cell change (step 410). Optionally, the WTRU 110 may select an RH-RNTI index and provide this information in the CELL UPDATE message. The WTRU 110 begins downlink reception. The WTRU 110 looks for its H-RNTI in the HS-SCCH. The choice of H-RNTI depends on the rules for assigning H-RNTIs. The WTRU 110 may use the downlink common H-RNTI as found in the system information, may use an RH-RNTI as requested in the CELL UPDATE message, or may use a temporary H-RNTI based on a subset of the U-RNTI.

[0056] The UTRAN receives the CELL UPDATE message and stops sending data to the source Node B (step 412). The UTRAN sends a CELL UPDATE CONFIRM to the WTRU through the target Node B with setup information for the HSDPA communication (in particular a dedicated H-RNTI) as well as information regarding the remapping of the FACH to the HS-DSCH (step 414). The H-RNTI used for the CELL UPDATE CONFIRM message depends on the rules for assigning H-RNTIs. The UTRAN may use a downlink common H-RNTI as broadcast in the system information, may use an RH-RNTI as requested in the CELL UPDATE message may be used, or may use a temporary H-RNTI based on a subset of the U-RNTI.

[0057] The WTRU 110 sets up the HSDPA with the configuration information included in the CELL UPDATE CONFIRM message (step 416). The WTRU 110 sends an RRC response message, (for instance, a TRANSPORT CHANNEL RECONFIGURATION COMPLETE message) (step 418). The WTRU 110 may send an RLC status report to the UTRAN as stated in the embodiment where the WTRU moves from a source cell with Enhanced Cell_FACH support to a target cell with Enhanced Cell_FACH support.

[0058] Figure 5 is a flow diagram of a process 500 for cell update in accordance with still another embodiment. In this embodiment, a WTRU 110 transitions from a Cell_DCH state to an enhanced Cell_FACH state. As the WTRU 110 is already in a Cell_DCH state, the WTRU 110 already has a dedicated H-RNTI and a valid HSDPA configuration. Rather than resetting the MAC-hs and re-establishing the already existing HSPDA link, the WTRU 110 may continue to use the configured HSDPA setup.

[0059] Upon detection of a radio link failure or RLC unrecoverable error, the WTRU 110 stops transmitting and receiving in a cell (step 502). The WTRU 110 reads the system information from a target cell 122b (step 504). If the target Node B has an enhanced Cell_FACH capability, the following steps are performed. If the target Node B does not have an enhanced Cell_FACH capability, the conventional cell reselection procedure is performed. The WTRU 110 sets up the RACH communication (step 506). The WTRU 110 sends a CELL UPDATE message to the UTRAN, and waits for the CELL UPDATE CONFIRM message via an HS-DSCH using the existing dedicated H-RNTI (step 508). The UTRAN receives the CELL UPDATE message, and responds with a CELL UPDATE CONFIRM message with the new radio bearer configuration (step 510). The H-RNTI used for the CELL UPDATE CONFIRM message is the same dedicated H-RNTI that was used in the Cell_DCH state. The WTRU 110 reconfigures the radio bearers, and sends an RRC response message, (for instance, a RADIO BEARER RECONFIGURATION COMPLETE message) (step 512). The WTRU 110 may send an RLC status report to the UTRAN as stated in the embodiment where

the WTRU moves from a source cell with Enhanced Cell_FACH support to a target cell with Enhanced Cell_FACH support.

[0060] Alternatively, the MAC-hs entity may be reset and a new HSDPA configuration may be used. Figure 6 is a flow diagram of an alternative process 600 to the process 500 in Figure 5, where the WTRU uses a common H-RNTI instead of a dedicated H-RNTI. A WTRU 110 transitions from a Cell_DCH state in a source cell 122a to an enhanced Cell_FACH state in a target cell 122b. Source and target cell may be the same cell. Upon detection of radio link failure or RLC unrecoverable error, the WTRU 110 stops transmitting and receiving in a cell and performs a MAC-hs reset (step 602). The WTRU 110 reads the system information from a target cell 122b (step 604). If a target Node B has an enhanced Cell_FACH capability, the following steps are performed. If the target Node B does not have an enhanced Cell_FACH capability, the conventional cell reselection procedure is performed. The WTRU clears the C-RNTI and H-RNTI and performs a MAC-hs reset (step 605). The WTRU 110 sets up the HSDPA communication as well as the RACH communication (step 606). The WTRU 110 sends a CELL UPDATE message to the UTRAN, and waits for the CELL UPDATE CONFIRM message via an HS-DSCH using a common H-RNTI (step 608).

[0061] The UTRAN receives the CELL UPDATE message and performs a MAC-hs reset in a source cell (step 610). The UTRAN responds with a CELL UPDATE CONFIRM message with the new radio bearer configuration (step 612). The H-RNTI used for the CELL UPDATE CONFIRM message is the selected common H-RNTI. The WTRU 110 reconfigures the radio bearers, and responds with an RRC message, (for instance, a RADIO BEARER RECONFIGURATION COMPLETE message) (step 614). The WTRU 110 may send an RLC status report to the UTRAN as stated in the embodiment where the WTRU moves from a source cell with Enhanced Cell_FACH support to a target cell with Enhanced Cell_FACH support.

[0062] Figure 7 is a block diagram of an example apparatus 700, (WTRU 110 or Node-B 120a, 120b). The apparatus 700 includes a transceiver

702, a MAC-hs entity 704, and a controller 706. The transceiver 702 transmits and receives signals via physical medium. The MAC-hs entity 704 is for HSDPA communication. The controller 706, (e.g., an RRC entity), controls the transceiver 702 and the MAC-hs entity 704 for performing the procedures 200-600 for the cell update and for transmission and reception while in a Cell_FACH state. The controller 706 is configured to, while in a Cell_FACH state, select a target cell 122b, read system information from the target cell 122b, clear a RNTI received in a source cell 122a, set a HS_DSCH_RECEPTION control variable accordingly, and configure HSDPA communication based on HS-DSCH common system information included in the system information, reset the MAC-hs entity, etc.

[0063] Embodiments.

[0064] 1. A method for performing cell reselection while in a Cell_FACH state when a target cell supports Enhanced Cell_FACH.

[0065] 2. The method of embodiment 1 comprising selecting a target cell.

[0066] 3. The method of embodiment 2 comprising reading system information from the target cell, the system information including HS-DSCH common system information.

[0067] 4. The method as in any one of embodiments 2-3, comprising clearing an RNTI received in a source cell.

[0068] 5. The method as in any one of embodiments 2-4, comprising enabling HS-DSCH reception by setting an HS-DSCH reception variable to TRUE.

[0069] 6. The method as in any one of embodiments 2-5, comprising setting up RACH communication.

[0070] 7. The method as in any one of embodiments 2-6, comprising sending a CELL UPDATE message.

[0071] 8. The method as in any one of embodiments 3-7, comprising configuring a MAC-hs entity based on the HS-DSCH common system information.

[0072] 9. The method of embodiment 8 comprising receiving HSDPA transmission in the target cell.

[0073] 10. The method as in any one of embodiments 7-9, wherein an index to one of a plurality of RH-RNTIs is included in the CELL UPDATE message.

[0074] 11. The method of embodiment 10, wherein the HSDPA transmission is received using an RH-RNTI as requested in the CELL UPDATE message.

[0075] 12. The method of embodiment 9, wherein the HSDPA transmission is received using a temporary identity which is a subset of a U-RNTI.

[0076] 13. The method as in any one of embodiments 3-12, further comprising resetting the MAC-hs entity.

[0077] 14. The method of embodiment 13, wherein the MAC-hs entity is reset for both a common H-RNTI and a dedicated H-RNTI, if the common H-RNTI and the dedicated H-RNTI are configured with separate MAC-hs entities.

[0078] 15. The method of embodiment 13, wherein the MAC-hs entity is reset only when cell reselection results in an inter-Node B cell change.

[0079] 16. The method of embodiment 13, wherein the MAC-hs entity is reset only when cell reselection results in an intra-node B cell change for a Node B that does not support MAC-hs preservation.

[0080] 17. The method of embodiment 13, wherein the MAC-hs entity is reset only if reordering queues are used.

[0081] 18. The method of embodiment 13, wherein the MAC-hs entity is reset only if reordering queues are used and cell reselection results in an inter-Node B cell change or an intra-node B cell change for a Node B that does not support MAC-hs preservation.

[0082] 19. The method as in any one of embodiments 3-12, further comprising resetting the MAC-hs entity in accordance with an indication from a network.

[0083] 20. The method as in any one of embodiments 3-19, further comprising flushing HARQ soft buffers.

[0084] 21. The method as in any one of embodiments 2-20, further comprising sending an RLC status report upon cell reselection.

[0085] 22. The method of embodiment 21, wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

[0086] 23. The method of embodiment 21, wherein the RLC status report is included in the CELL UPDATE message.

[0087] 24. The method of embodiment 21, wherein the RLC status report is sent after receiving a CELL UPDATE CONFIRM message.

[0088] 25. The method as in any one of embodiments 3-24, wherein the system information includes an indication of enhanced Cell_FACH capability.

[0089] 26. The method as in any one of embodiments 3-25, wherein the HS-DSCH common system information includes at least one of an HS-SCCH scrambling code and channelization code, CQI feedback information, the number of HARQ processes, memory partitioning, and a set of reserved H-RNTIs.

[0090] 27. A method for performing cell reselection while in a Cell_FACH state when only a source cell supports Enhanced Cell_FACH.

[0091] 28. The method of embodiment 27 comprising selecting a target cell.

[0092] 29. The method of embodiment 28 comprising reading system information from the target cell.

[0093] 30. The method as in any one of embodiments 28-29, comprising clearing an RNTI received in a source cell.

[0094] 31. The method as in any one of embodiments 28-30, comprising resetting a MAC-hs entity.

[0095] 32. The method as in any one of embodiments 28-31, comprising preventing HS-DSCH reception by setting an HS-DSCH reception variable to FALSE.

[0096] 33. The method as in any one of embodiments 28-32, comprising setting up S-CCPCH and RACH communication.

[0097] 34. The method of embodiment 33, comprising sending a CELL UPDATE message.

[0098] 35. The method of embodiment 34, comprising receiving downlink transmission on an S-CCPCH.

[0099] 36. The method as in any one of embodiments 28-35, further comprising sending an RLC status report upon cell reselection.

[00100] 37. The method of embodiment 36, wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

[00101] 38. The method of embodiment 36, wherein the RLC status report is included in the CELL UPDATE message.

[00102] 39. The method of embodiment 36, wherein the RLC status report is sent after receiving the CELL UPDATE CONFIRM message.

[00103] 40. A method for performing cell update while in a Cell_FACH state.

[00104] 41. The method of embodiment 40 comprising detecting a cell update triggering event while receiving HSDPA transmission in a Cell_DCH state using a dedicated H-RNTI, the cell update triggering event being one of a radio link failure and an RLC unrecoverable error.

[00105] 42. The method as in any one of embodiments 40-41, comprising reading system information in a target cell.

[00106] 43. The method as in any one of embodiments 41-42, comprising clearing an RNTI received in a source cell.

[00107] 44. The method as in any one of embodiments 41-43, comprising setting up RACH communication.

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[00108] 45. The method of embodiment 44, comprising sending a CELL UPDATE message via an RACH.

[00109] 46. The method as in any one of embodiments 41-45, comprising enabling HS-DSCH reception by setting an HS-DSCH reception variable to TRUE, if it is determined from the system information that the target cell supports an enhanced Cell_FACH state.

[00110] 47. The method of embodiment 46 comprising receiving HSDPA transmission using the dedicated H-RNTI.

[00111] 48. The method as in any one of embodiments 41-47, further comprising resetting a MAC-hs entity upon detection of one of radio link failure and RLC unrecoverable error.

[00112] 49. The method of embodiment 48, comprising setting up HSDPA communication based on HS-DSCH common system information included in the system information.

[00113] 50. A WTRU for performing cell reselection while in a Cell_FACH state.

[00114] 51. The WTRU of embodiment 50, comprising a transceiver.

[00115] 52. The WTRU of embodiment 51, comprising a MAC-hs entity for HSDPA communication.

[00116] 53. The WTRU of embodiment 52, comprising a controller configured to, while in a Cell_FACH state, select a target cell.

[00117] 54. The WTRU of embodiment 53, wherein the controller is configured to read system information from the target cell.

[00118] 55. The WTRU as in any one of embodiments 53-54, wherein the controller is configured to clear an RNTI received in a source cell.

[00119] 56. The WTRU as in any one of embodiments 53-55, wherein the controller is configured to enable HS-DSCH reception by setting an HS-DSCH reception variable to TRUE.

[00120] 57. The WTRU as in any one of embodiments 53-56, wherein the controller is configured to set up RACH communication.

[00121] 58. The WTRU as in any one of embodiments 53-57, wherein the controller is configured to send a CELL UPDAATE message.

[00122] 59. The WTRU as in any one of embodiments 53-58, wherein the controller is configured to configure HSDPA communication based on HS-DSCH common system information included in the system information.

[00123] 60. The WTRU as in any one of embodiments 58-59, wherein an index to one of a plurality of RH-RNTIs is included in the CELL UPDATE message.

[00124] 61. The WTRU of embodiment 60, wherein the HSDPA communication is received using an RH-RNTI as requested in a CELL UPDATE message.

[00125] 62. The WTRU of embodiment 59, wherein the HSDPA communication is received using a temporary identity which is a subset of a U-RNTI.

[00126] 63. The WTRU as in any one of embodiments 53-62, wherein the controller resets the MAC-hs entity configured in the source cell.

[00127] 64. The WTRU of embodiment 63, wherein the MAC-hs entity is reset for both a common H-RNTI and a dedicated H-RNTI if the common H-RNTI and the dedicated H-RNTI are configured with separate MAC-hs entities.

[00128] 65. The WTRU of embodiment 63, wherein the MAC-hs entity is reset only when cell reselection results in an inter-Node B cell change.

[00129] 66. The WTRU of embodiment 63, wherein the MAC-hs entity is reset only when cell reselection results in an intra-node B cell change for a Node B that does not support MAC-hs preservation.

[00130] 67. The WTRU of embodiment 63, wherein the MAC-hs entity is reset only if reordering queues are used.

[00131] 68. The WTRU of embodiment 63, wherein the MAC-hs entity is reset only if reordering queues are used and cell reselection results in an inter-Node B cell change or an intra-node B cell change for a Node B that does not support MAC-hs preservation.

[00132] 69. The WTRU as in any one of embodiments 53-62, wherein the controller resets the MAC-hs entity in accordance with an indication from a network.

[00133] 70. The WTRU as in any one of embodiments 53-69, wherein the controller flushes HARQ soft buffers.

[00134] 71. The WTRU as in any one of embodiments 53-70, further comprising an RLC entity configured to send an RLC status report upon cell reselection.

[00135] 72. The WTRU of embodiment 71, wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

[00136] 73. The WTRU of embodiment 71, wherein the RLC status report is included in the CELL UPDATE message.

[00137] 74. The WTRU of embodiment 71, wherein the RLC status report is sent after receiving a CELL UPDATE CONFIRM message.

[00138] 75. The WTRU as in any one of embodiments 54-74, wherein the system information includes an indication of enhanced Cell_FACH capability.

[00139] 76. The WTRU as in any one of embodiments 54-75, wherein the HS-DSCH common system information includes at least one of an HS-SCCH scrambling code and channelization code, CQI feedback information, the number of HARQ processes, memory partitioning, and a set of reserved H-RNTIs.

[00140] 77. A WTRU for performing cell reselection while in a Cell_FACH state when only a source cell supports Enhanced Cell_FACH.

[00141] 78. The WTRU of embodiment 77 comprising a transceiver.

[00142] 79. The WTRU of embodiment 78 comprising a MAC-hs entity for HSDPA communication.

[00143] 80. The WTRU of embodiment 79 comprising a controller configured to, while in a Cell_FACH state, select a target cell.

[00144] 81. The WTRU of embodiment 80, wherein the controller is configured to read system information from the target cell.

[00145] 82. The WTRU as in any one of embodiments 80-81, wherein the controller is configured to clear an RNTI received in a source cell.

[00146] 83. The WTRU as in any one of embodiments 80-82, wherein the controller is configured to reset a MAC-hs entity.

[00147] 84. The WTRU as in any one of embodiments 80-83, wherein the controller is configured to prevent HS-DSCH reception by setting an HS-DSCH reception variable to FALSE.

[00148] 85. The WTRU as in any one of embodiments 80-84, wherein the controller is configured to set up S-CCPCH and RACH communication.

[00149] 86. The WTRU as in any one of embodiments 80-85, wherein the controller is configured to send a CELL UPDATE message.

[00150] 87. The WTRU as in any one of embodiments 80-86, wherein the controller configures the transceiver to receive downlink transmission on an S-CCPCH.

[00151] 88. The WTRU as in any one of embodiments 80-87, further comprising an RLC entity for sending an RLC status report upon cell reselection.

[00152] 89. The WTRU of embodiment 88, wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

[00153] 90. The WTRU of embodiment 88, wherein the RLC status report is included in the CELL UPDATE message.

[00154] 91. The WTRU of embodiment 88, wherein the RLC status report is sent after receiving a CELL UPDATE CONFIRM message.

[00155] 92. A WTRU for performing cell update while in a Cell_FACH state.

[00156] 93. The WTRU of embodiment 92 comprising a transceiver.

[00157] 94. The WTRU of embodiment 93 comprising a MAC-hs entity for HSDPA communication.

[00158] 95. The WTRU of embodiment 94 comprising a controller configured to, while in a Cell_FACH state, detect a cell update triggering event while receiving HSDPA transmission in a Cell_DCH state using a dedicated H-RNTI, the cell update triggering event being one of a radio link failure and an RLC unrecoverable error.

[00159] 96. The WTRU of embodiment 95, wherein the controller is configured to read system information in a target cell.

[00160] 97. The WTRU as in any one of embodiments 95-96, wherein the controller is configured to clear an RNTI received in a source cell.

[00161] 98. The WTRU as in any one of embodiments 95-97, wherein the controller is configured to set up RACH communication, if it is determined from the system information that the target cell supports an enhanced Cell_FACH state.

[00162] 99. The WTRU as in any one of embodiments 95-98, wherein the controller is configured to send a CELL UPDATE message via an RACH.

[00163] 100. The WTRU as in any one of embodiments 95-99, wherein the controller is configured to enable HS-DSCH reception by setting an HS-DSCH reception variable to TRUE.

[00164] 101. The WTRU as in any one of embodiments 95-100, wherein the controller configures the MAC-hs entity based on the common HS-DSCH system information included in the system information to receive HSDPA transmission in the target cell.

[00165] 102. The WTRU as in any one of embodiments 95-101, wherein the MAC-hs entity is reset upon detection of one of and RLC unrecoverable error.

[00166] Although the features and elements are described in embodiments in particular combinations, each feature or element can be used alone without the other features and elements of the embodiments or in various combinations with or without other features and elements. The methods or flow charts provided may be implemented in a computer program, software, or firmware tangibly embodied in a computer-readable storage

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medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[00167] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

[00168] A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet browser, and/or any wireless local area network (WLAN) module.

* * *

CLAIMS

What is claimed is:

1. A method for performing cell reselection while in a Cell_FACH state when a target cell supports Enhanced Cell_FACH, the method comprising:

selecting a target cell;

reading system information from the target cell, the system information including high speed downlink shared channel (HS-DSCH) common system information;

clearing a radio network temporary identity (RNTI) received in a source cell, the RNTI being at least one of an HS-DSCH RNTI (H-RNTI) and a cell RNTI (C-RNTI);

resetting an HS-DSCH medium access control (MAC-ehs) entity configured in the source cell;

setting up random access channel (RACH) communication;

sending a CELL UPDATE message;

configuring a MAC-ehs entity based on the HS-DSCH common system information; and

receiving high speed downlink packet access (HSDPA) transmission in the target cell.

2. The method of claim 1 wherein an index to one of a plurality of reserved HS-DSCH radio network temporary identities (RH-RNTIs) is included in the CELL UPDATE message.

3. The method of claim 2 wherein the HSDPA transmission is received using an RH-RNTI as requested in the CELL UPDATE message.

4. The method of claim 1 wherein the HSDPA transmission is received using a temporary identity which is a subset of a universal terrestrial radio access network (UTRAN) radio network temporary (U-RNTI).

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5. The method of claim 1 further comprising:

enabling HS-DSCH reception by setting an HS-DSCH reception variable to TRUE.

6. The method of claim 1 wherein the MAC-ehs entity is reset for both a common H-RNTI and a dedicated H-RNTI, if the common H-RNTI and the dedicated H-RNTI are configured with separate MAC-ehs entities.

7. The method of claim 1 wherein the MAC-ehs entity is reset only when cell reselection results in an inter-Node B cell change.

8. The method of claim 1 wherein the MAC-ehs entity is reset only when cell reselection results in an intra-node B cell change for a Node B that does not support MAC-ehs preservation.

9. The method of claim 1 wherein the MAC-ehs entity is reset only if reordering queues are used.

10. The method of claim 1 wherein the MAC-ehs entity is reset only if reordering queues are used and cell reselection results in an inter-Node B cell change or an intra-node B cell change for a Node B that does not support MAC-ehs preservation.

11. The method of claim 1 wherein the MAC-ehs entity is reset in accordance with an indication from a network.

12. The method of claim 1 further comprising:

flushing hybrid automatic repeat request (HARQ) soft buffers.

13. The method of claim 1 further comprising:

sending a radio link control (RLC) status report upon cell reselection.

14. The method of claim 13 wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

15. The method of claim 13 wherein the RLC status report is included in the CELL UPDATE message.

16. The method of claim 13 wherein the RLC status report is sent after receiving the CELL UPDATE CONFIRM message.

17. The method of claim 1 wherein the system information includes an indication of enhanced Cell_FACH capability.

18. The method of claim 1 wherein the HS-DSCH common system information includes at least one of a high speed shared control channel (HS-SCCH) scrambling code and channelization code, channel quality indicator (CQI) feedback information, the number of hybrid automatic repeat request (HARQ) processes, memory partitioning, and a set of reserved HS-DSCH RNTIs (H-RNTIs).

19. A method for performing cell reselection while in a Cell_FACH state when only a source cell supports Enhanced Cell_FACH, the method comprising:

selecting a target cell;

reading system information from the target cell;

clearing a radio network temporary identity (RNTI) received in a source cell;

resetting an HS-DSCH medium access control (MAC-ehs) entity configured in the source cell;

preventing HS-DSCH reception by setting an HS-DSCH reception variable to FALSE;

setting up secondary common control physical channel (S-CCPCH) and random access channel (RACH) communication;

sending a CELL UPDATE message; and

receiving downlink transmission on an S-CCPCH.

20. The method of claim 19 further comprising:

sending a radio link control (RLC) status report upon cell reselection.

21. The method of claim 20 wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

22. The method of claim 20 wherein the RLC status report is included in the CELL UPDATE message.

23. The method of claim 20 wherein the RLC status report is sent after receiving a CELL UPDATE CONFIRM message.

24. A method for performing cell update while in a Cell_FACH state, the method comprising:

detecting a cell update triggering event while receiving HSDPA transmission in a Cell_DCH state using a dedicated high speed downlink shared channel (HS-DSCH) radio network temporary identity (H-RNTI), the cell update triggering event being one of a radio link failure and a radio link control (RLC) unrecoverable error;

reading system information in a target cell;

clearing a radio network temporary identity (RNTI) received in a source cell;

setting up random access channel (RACH) communication,

sending a CELL UPDATE message via an RACH;

enabling HS-DSCH reception by setting an HS-DSCH reception variable to TRUE, if it is determined from the system information that the target cell supports an enhanced Cell_FACH state; and

receiving HSDPA transmission using the dedicated H-RNTI.

25. The method of claim 24 further comprising:

resetting an HS-DSCH medium access control (MAC-ehs) entity upon detection of one of radio link failure and RLC unrecoverable error; and

setting up HSDPA communication based on HS-DSCH common system information included in the system information.

26. A wireless transmit/receive unit (WTRU) for performing cell reselection while in a Cell_FACH state, the WTRU comprising:

a transceiver;

a high speed downlink shared channel (HS-DSCH) medium access control (MAC-ehs) entity for high speed downlink packet access (HSDPA) communication; and

a controller configured to, while in a Cell_FACH state, select a target cell, read system information from the target cell, clear a radio network temporary identity (RNTI) received in a source cell, the RNTI being at least one of an HS-DSCH RNTI (H-RNTI) and a cell RNTI (C-RNTI), reset the MAC-ehs entity configured in the source cell, set up random access channel (RACH) communication, send a CELL UPDAATE message, and configure HSDPA communication based on HS-DSCH common system information included in the system information.

27. The WTRU of claim 26 wherein an index to one of a plurality of reserved HS-DSCH radio network temporary identities (RH-RNTIs) is included in the CELL UPDATE message.

28. The WTRU of claim 26 wherein the HSDPA communication is received using an RH-RNTI as requested in the CELL UPDATE message.

29. The WTRU of claim 26 wherein the HSDPA communication is received using a temporary identity which is a subset of a universal terrestrial radio access network (UTRAN) radio network temporary (U-RNTI).

30. The WTRU of claim 26 wherein the controller enables HS-DSCH reception by setting an HS-DSCH reception variable to TRUE.

31. The WTRU of claim 26 wherein the MAC-ehs entity is reset for both a common H-RNTI and a dedicated H-RNTI if the common H-RNTI and the dedicated H-RNTI are configured with separate MAC-ehs entities.

32. The WTRU of claim 26 wherein the MAC-ehs entity is reset only when cell reselection results in an inter-Node B cell change.

33. The WTRU of claim 26 wherein the MAC-ehs entity is reset only when cell reselection results in an intra-node B cell change for a Node B that does not support MAC-ehs preservation.

34. The WTRU of claim 26 wherein the MAC-ehs entity is reset only if reordering queues are used.

35. The WTRU of claim 26 wherein the MAC-ehs entity is reset only if reordering queues are used and cell reselection results in an inter-Node B cell change or an intra-node B cell change for a Node B that does not support MAC-ehs preservation.

36. The WTRU of claim 26 wherein the controller resets the MAC-ehs entity in accordance with an indication from a network.

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37. The WTRU of claim 26 wherein the controller flushes hybrid automatic repeat request (HARQ) soft buffers.

38. The WTRU of claim 26 further comprising a radio link control (RLC) entity configured to send an RLC status report upon cell reselection.

39. The WTRU of claim 38 wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

40. The WTRU of claim 38 wherein the RLC status report is included in the CELL UPDATE message.

41. The WTRU of claim 38 wherein the RLC status report is sent after receiving a CELL UPDATE CONFIRM message.

42. The WTRU of claim 26 wherein the system information includes an indication of enhanced Cell_FACH capability.

43. The WTRU of claim 26 wherein the HS-DSCH common system information includes at least one of a high speed shared control channel (HS-SCCH) scrambling code and channelization code, channel quality indicator (CQI) feedback information, the number of hybrid automatic repeat request (HARQ) processes, memory partitioning, and a set of reserved HS-DSCH RNTIs (H-RNTIs).

44. A wireless transmit/receive unit (WTRU) for performing cell reselection while in a Cell_FACH state when only a source cell supports Enhanced Cell_FACH, the WTRU comprising:

a transceiver;

a high speed downlink shared channel (HS-DSCH) medium access control (MAC-ehs) entity for high speed downlink packet access (HSDPA) communication; and

a controller configured to, while in a Cell_FACH state, select a target cell, read system information from the target cell, clear a radio network temporary identity (RNTI) received in a source cell, reset the MAC-ehs entity configured in the source cell, prevent HS-DSCH reception by setting an HS-DSCH reception variable to FALSE, set up secondary common control physical channel (S-CCPCH) and random access channel (RACH) communication, send a CELL UPDATE message, and configure the transceiver to receive downlink transmission on an S-CCPCH.

45. The WTRU of claim 44 further comprising:

a radio link control (RLC) entity for sending an RLC status report upon cell reselection.

46. The WTRU of claim 45 wherein the RLC status report is sent prior to sending the CELL UPDATE message and after selecting the target cell.

47. The WTRU of claim 45 wherein the RLC status report is included in the CELL UPDATE message.

48. The WTRU of claim 45 wherein the RLC status report is sent after receiving a CELL UPDATE CONFIRM message.

49. A wireless transmit/receive unit (WTRU) for performing cell update while in a Cell_FACH state, the WTRU comprising:

a transceiver;

a high speed downlink shared channel (HS-DSCH) medium access control (MAC-ehs) entity for high speed downlink packet access (HSDPA) communication; and

a controller configured to, while in a Cell_FACH state, detect a cell update triggering event while receiving HSDPA transmission in a Cell_DCH state using a dedicated high speed downlink shared channel (HS-DSCH) radio network temporary identity (H-RNTI), the cell update triggering event being one of a radio link failure and a radio link control (RLC) unrecoverable error, read system information in a target cell, clear a radio network temporary identity (RNTI) received in a source cell, set up random access channel (RACH) communication, if it is determined from the system information that the target cell supports an enhanced Cell_FACH state, send a CELL UPDATE message via an RACH, enable HS-DSCH reception by setting an HS-DSCH reception variable to TRUE, and configure the MAC-ehs entity based on the common HS-DSCH system information included in the system information to receive HSDPA transmission in the target cell.

50. The WTRU of claim 49 wherein the MAC-ehs entity is reset upon detection of one of radio link failure and radio link control (RLC) unrecoverable error.

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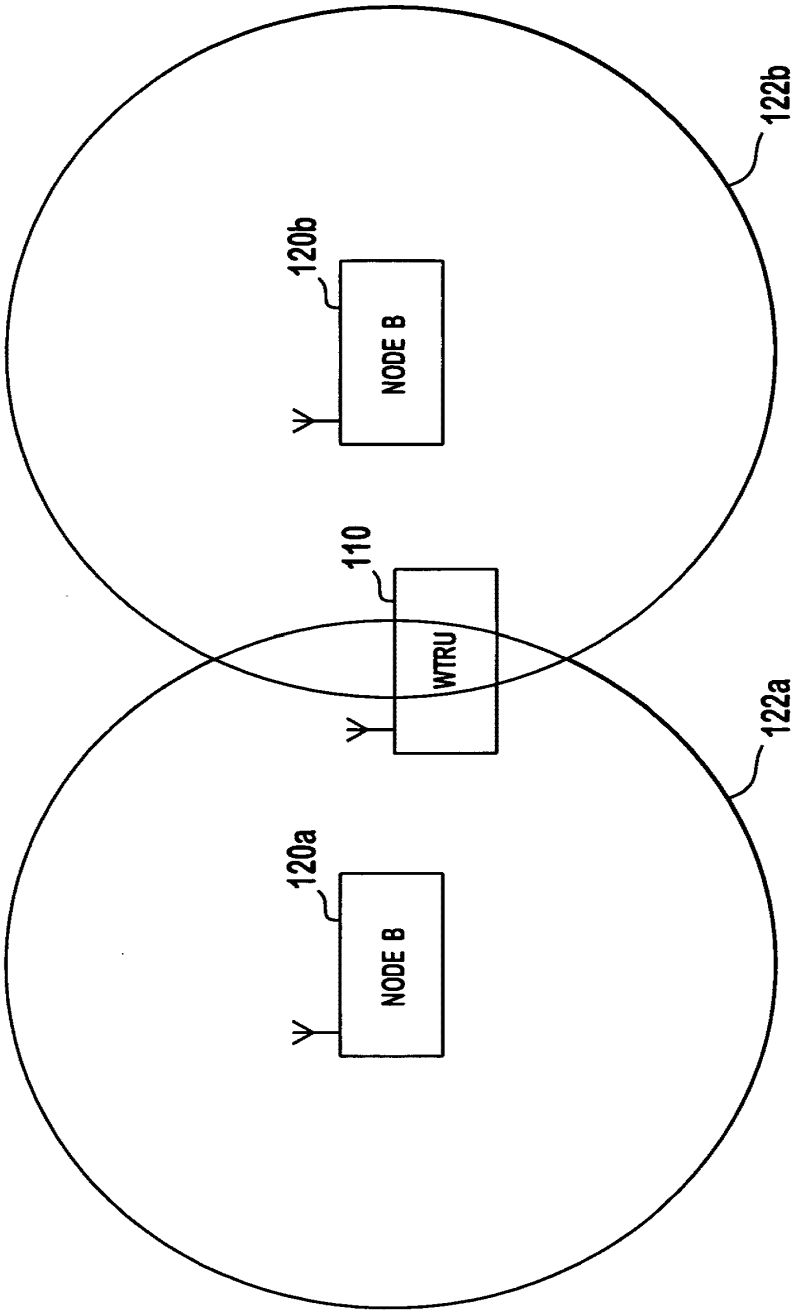


FIG. 1

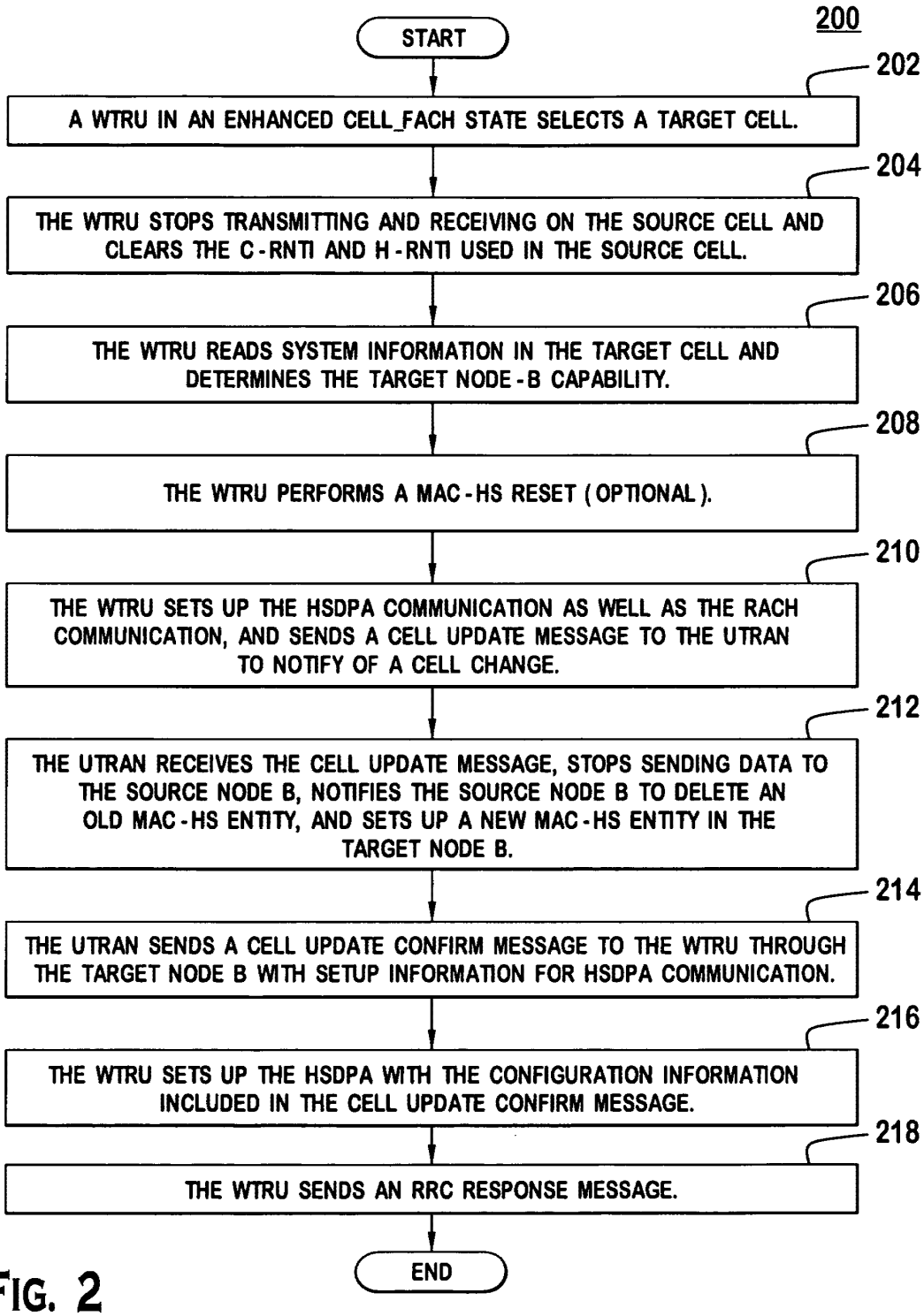

200
START
202
A WTRU IN AN ENHANCED CELL_FACH STATE SELECTS A TARGET CELL.
204
THE WTRU STOPS TRANSMITTING AND RECEIVING ON THE SOURCE CELL AND CLEARS THE C-RNTI AND H-RNTI USED IN THE SOURCE CELL.
206
THE WTRU READS SYSTEM INFORMATION IN THE TARGET CELL AND DETERMINES THE TARGET NODE-B CAPABILITY.
208
THE WTRU PERFORMS A MAC-HS RESET (OPTIONAL).
210
THE WTRU SETS UP THE HSDPA COMMUNICATION AS WELL AS THE RACH COMMUNICATION, AND SENDS A CELL UPDATE MESSAGE TO THE UTRAN TO NOTIFY OF A CELL CHANGE.
212
THE UTRAN RECEIVES THE CELL UPDATE MESSAGE, STOPS SENDING DATA TO THE SOURCE NODE B, NOTIFIES THE SOURCE NODE B TO DELETE AN OLD MAC-HS ENTITY, AND SETS UP A NEW MAC-HS ENTITY IN THE TARGET NODE B.
214
THE UTRAN SENDS A CELL UPDATE CONFIRM MESSAGE TO THE WTRU THROUGH THE TARGET NODE B WITH SETUP INFORMATION FOR HSDPA COMMUNICATION.
216
THE WTRU SETS UP THE HSDPA WITH THE CONFIGURATION INFORMATION INCLUDED IN THE CELL UPDATE CONFIRM MESSAGE.
218
THE WTRU SENDS AN RRC RESPONSE MESSAGE.
END

FIG. 2

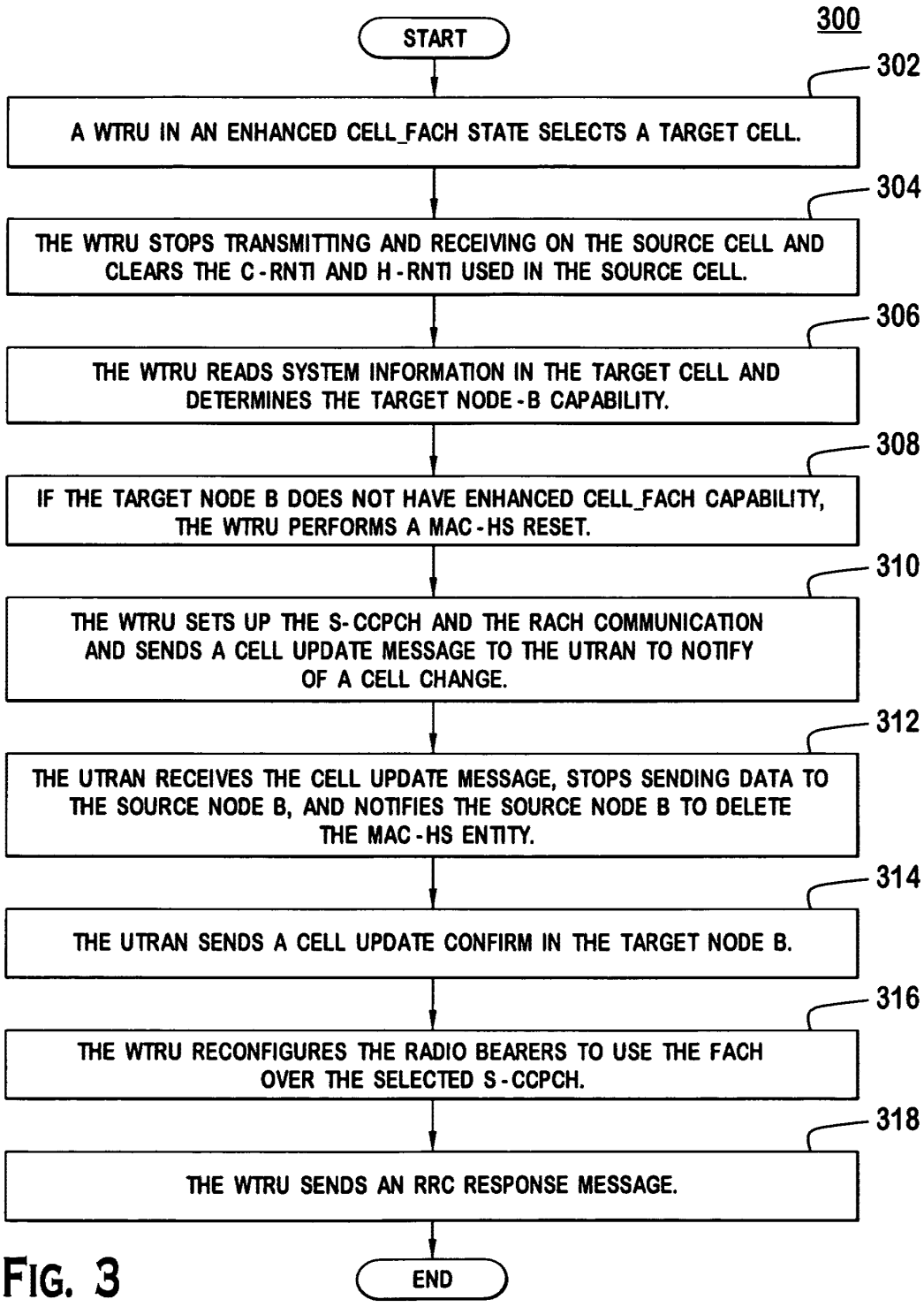

300
START
302
A WTRU IN AN ENHANCED CELL_FACH STATE SELECTS A TARGET CELL.
304
THE WTRU STOPS TRANSMITTING AND RECEIVING ON THE SOURCE CELL AND CLEARS THE C-RNTI AND H-RNTI USED IN THE SOURCE CELL.
306
THE WTRU READS SYSTEM INFORMATION IN THE TARGET CELL AND DETERMINES THE TARGET NODE-B CAPABILITY.
308
IF THE TARGET NODE B DOES NOT HAVE ENHANCED CELL_FACH CAPABILITY, THE WTRU PERFORMS A MAC-HS RESET.
310
THE WTRU SETS UP THE S-CCPCH AND THE RACH COMMUNICATION AND SENDS A CELL UPDATE MESSAGE TO THE UTRAN TO NOTIFY OF A CELL CHANGE.
312
THE UTRAN RECEIVES THE CELL UPDATE MESSAGE, STOPS SENDING DATA TO THE SOURCE NODE B, AND NOTIFIES THE SOURCE NODE B TO DELETE THE MAC-HS ENTITY.
314
THE UTRAN SENDS A CELL UPDATE CONFIRM IN THE TARGET NODE B.
316
THE WTRU RECONFIGURES THE RADIO BEARERS TO USE THE FACH OVER THE SELECTED S-CCPCH.
318
THE WTRU SENDS AN RRC RESPONSE MESSAGE.
END

FIG. 3

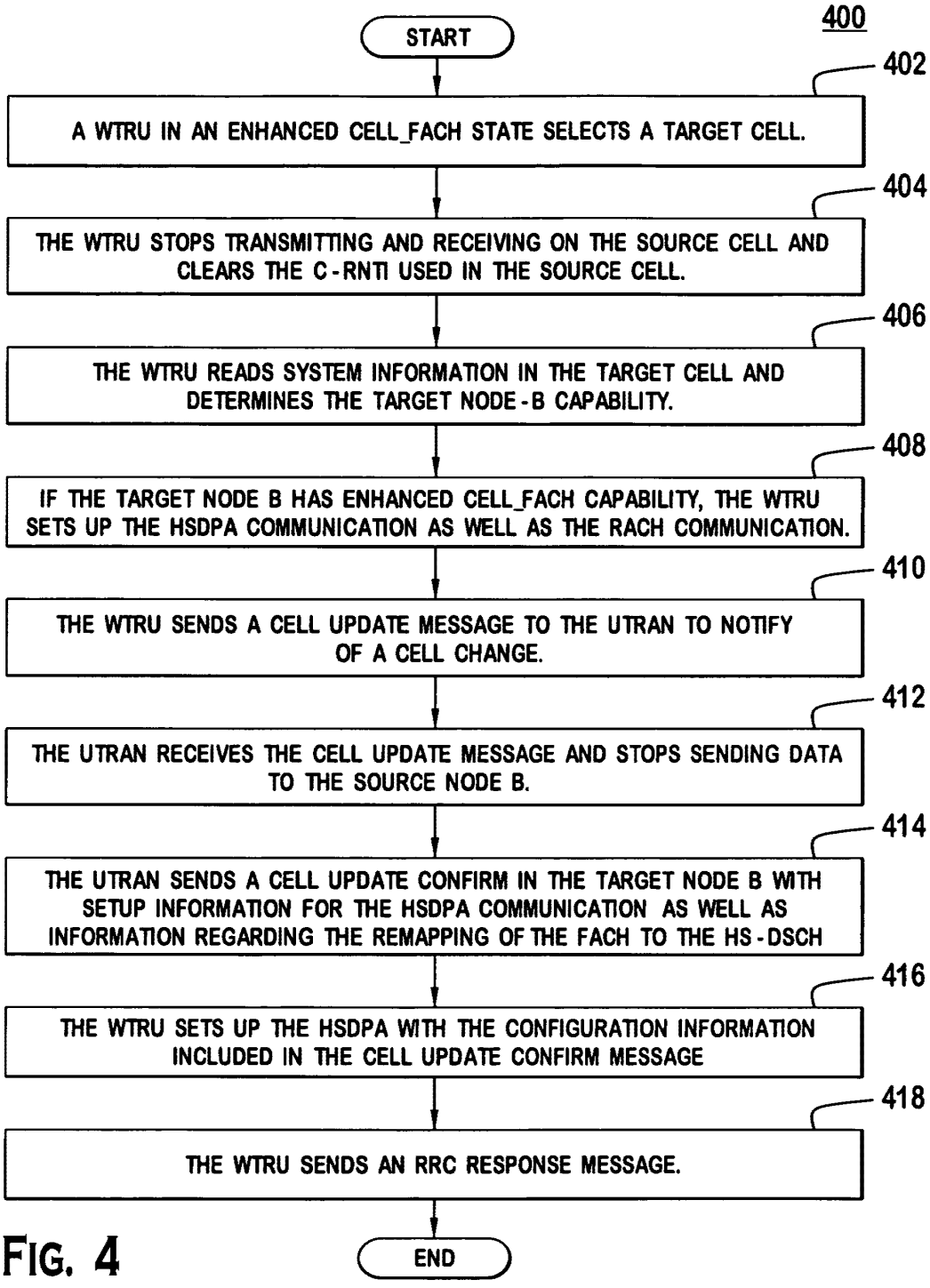

400
START
402
A WTRU IN AN ENHANCED CELL_FACH STATE SELECTS A TARGET CELL.
404
THE WTRU STOPS TRANSMITTING AND RECEIVING ON THE SOURCE CELL AND CLEARS THE C-RNTI USED IN THE SOURCE CELL.
406
THE WTRU READS SYSTEM INFORMATION IN THE TARGET CELL AND DETERMINES THE TARGET NODE-B CAPABILITY.
408
IF THE TARGET NODE B HAS ENHANCED CELL_FACH CAPABILITY, THE WTRU SETS UP THE HSDPA COMMUNICATION AS WELL AS THE RACH COMMUNICATION.
410
THE WTRU SENDS A CELL UPDATE MESSAGE TO THE UTRAN TO NOTIFY OF A CELL CHANGE.
412
THE UTRAN RECEIVES THE CELL UPDATE MESSAGE AND STOPS SENDING DATA TO THE SOURCE NODE B.
414
THE UTRAN SENDS A CELL UPDATE CONFIRM IN THE TARGET NODE B WITH SETUP INFORMATION FOR THE HSDPA COMMUNICATION AS WELL AS INFORMATION REGARDING THE REMAPPING OF THE FACH TO THE HS-DSCH
416
THE WTRU SETS UP THE HSDPA WITH THE CONFIGURATION INFORMATION INCLUDED IN THE CELL UPDATE CONFIRM MESSAGE
418
THE WTRU SENDS AN RRC RESPONSE MESSAGE.
END

FIG. 4

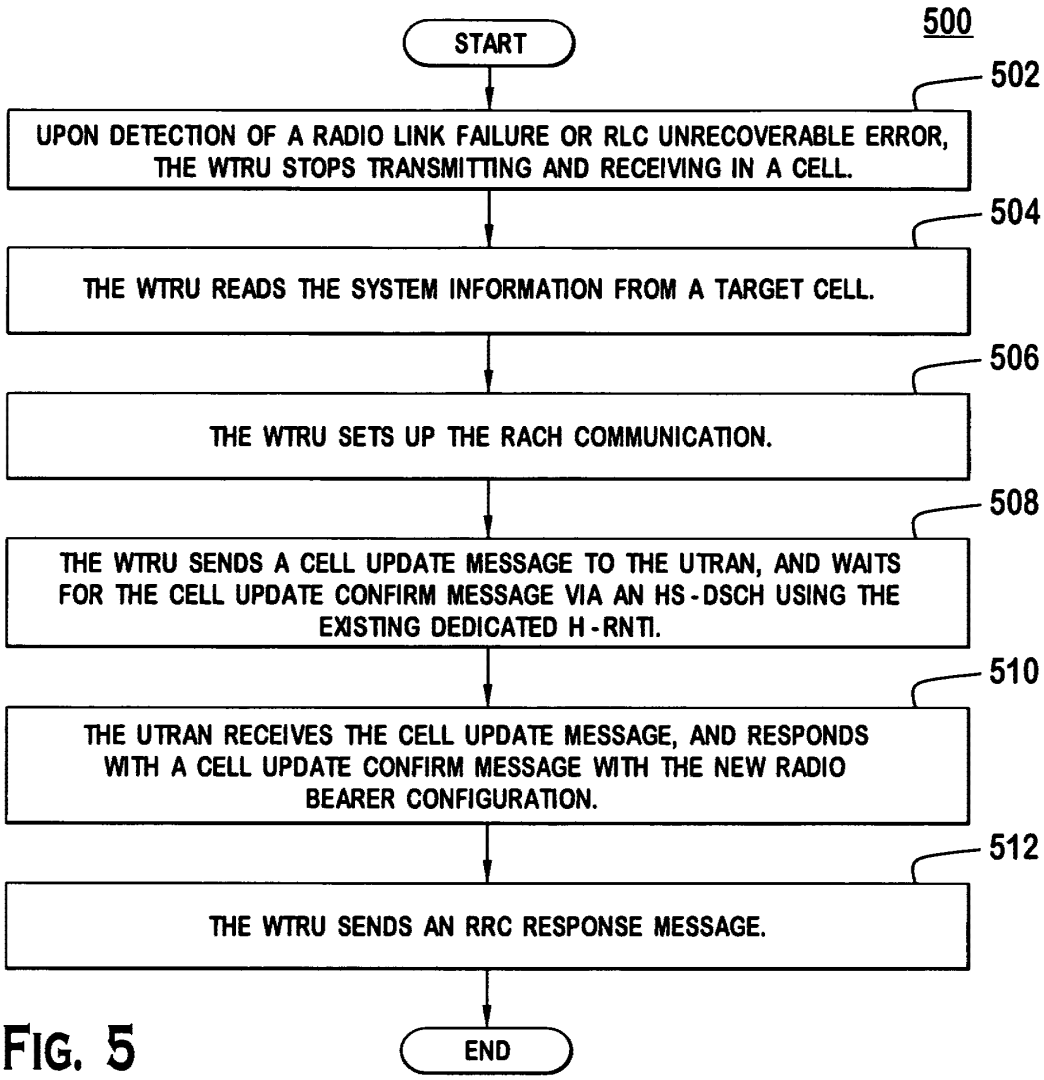

500
START
502
UPON DETECTION OF A RADIO LINK FAILURE OR RLC UNRECOVERABLE ERROR, THE WTRU STOPS TRANSMITTING AND RECEIVING IN A CELL.
504
THE WTRU READS THE SYSTEM INFORMATION FROM A TARGET CELL.
506
THE WTRU SETS UP THE RACH COMMUNICATION.
508
THE WTRU SENDS A CELL UPDATE MESSAGE TO THE UTRAN, AND WAITS FOR THE CELL UPDATE CONFIRM MESSAGE VIA AN HS-DSCH USING THE EXISTING DEDICATED H-RNTI.
510
THE UTRAN RECEIVES THE CELL UPDATE MESSAGE, AND RESPONDS WITH A CELL UPDATE CONFIRM MESSAGE WITH THE NEW RADIO BEARER CONFIGURATION.
512
THE WTRU SENDS AN RRC RESPONSE MESSAGE.
END

FIG. 5

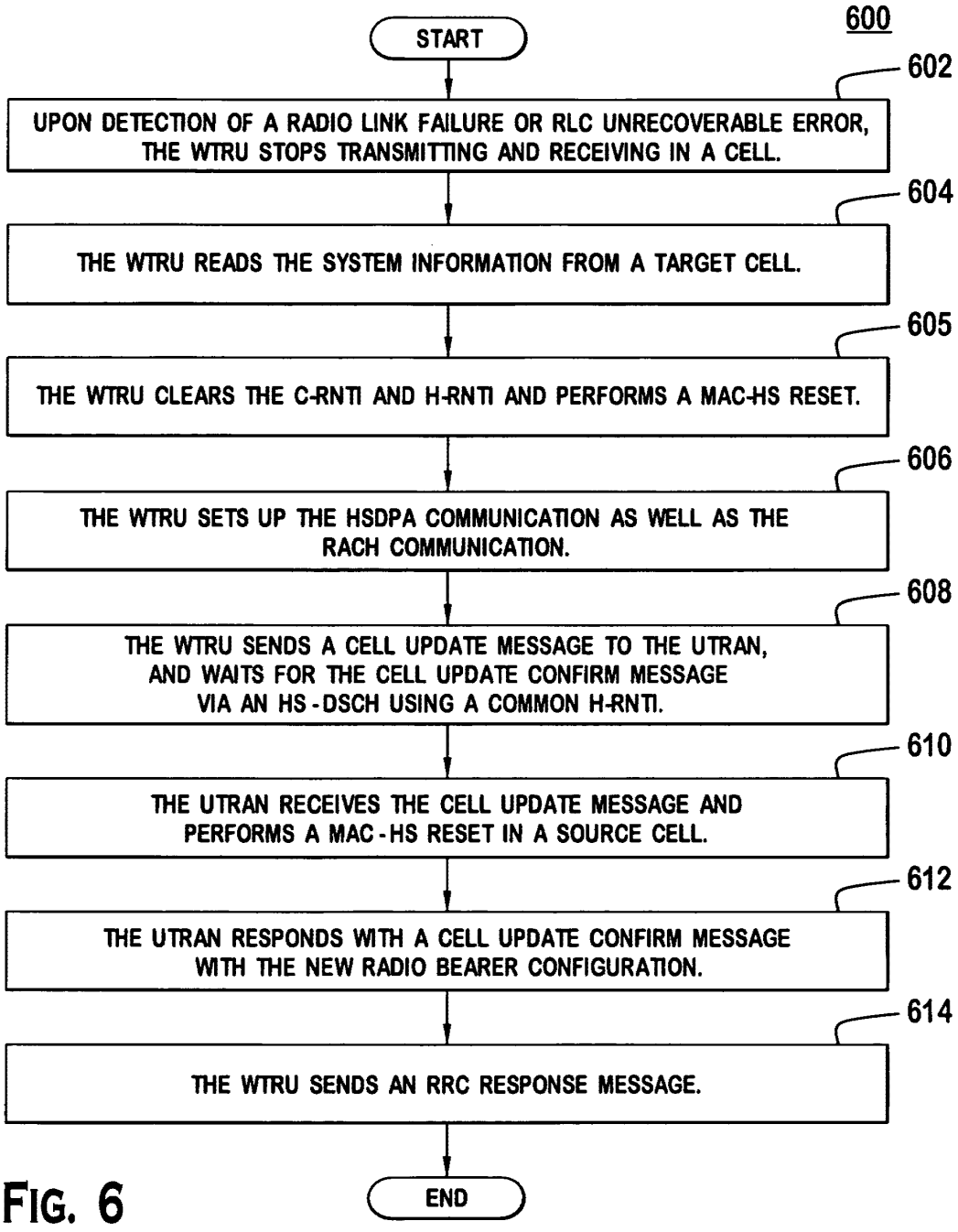

600
START
602
UPON DETECTION OF A RADIO LINK FAILURE OR RLC UNRECOVERABLE ERROR, THE WTRU STOPS TRANSMITTING AND RECEIVING IN A CELL.
604
THE WTRU READS THE SYSTEM INFORMATION FROM A TARGET CELL.
605
THE WTRU CLEARS THE C-RNTI AND H-RNTI AND PERFORMS A MAC-HS RESET.
606
THE WTRU SETS UP THE HSDPA COMMUNICATION AS WELL AS THE RACH COMMUNICATION.
608
THE WTRU SENDS A CELL UPDATE MESSAGE TO THE UTRAN, AND WAITS FOR THE CELL UPDATE CONFIRM MESSAGE VIA AN HS-DSCH USING A COMMON H-RNTI.
610
THE UTRAN RECEIVES THE CELL UPDATE MESSAGE AND PERFORMS A MAC-HS RESET IN A SOURCE CELL.
612
THE UTRAN RESPONDS WITH A CELL UPDATE CONFIRM MESSAGE WITH THE NEW RADIO BEARER CONFIGURATION.
614
THE WTRU SENDS AN RRC RESPONSE MESSAGE.
END

FIG. 6

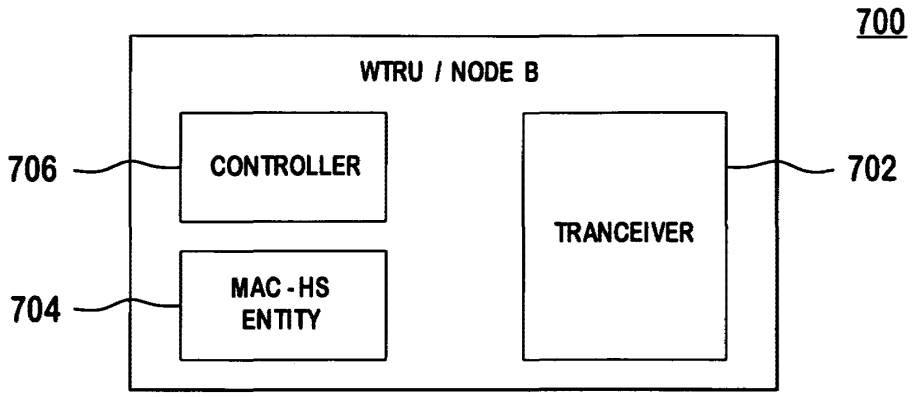

700
WTRU / NODE B
706
CONTROLLER
704
MAC - HS ENTITY
TRANCEIVER
702

FIG. 7

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(54) Title: METHOD AND APPARATUS FOR HANDLING CELL RESELECTIONS AND TRANSITIONS TO AND FROM AN ENHANCED CELL_FACH STATE

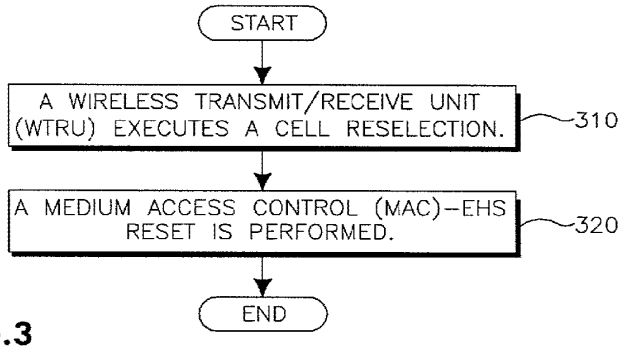


FIG.3

(57) Abstract: A method and apparatus for handling cell reselections and transitions includes executing a cell reselection. A medium access control (MAC)-ehs reset is performed.

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[0001] # METHOD AND APPARATUS FOR HANDLING CELL RESELECTIONS AND TRANSITIONS TO AND FROM AN ENHANCED CELL_FACH STATE

[0002] ## FIELD OF INVENTION

[0003] This application is related to wireless communications.

[0004] ## BACKGROUND

[0005] User equipments (UEs) in a universal telecommunications radio access network (UTRAN) are typically in either of two modes: Idle or Connected. Based on UE mobility and activity while in connected mode, the UTRAN can direct the UE to transition between a number of sub-states, such as cell paging channel (Cell_PCH), UTRAN Registration Area Paging Channel (URA_PCH), cell forward access channel (Cell_FACH), and Cell_DCH. This is typically accomplished through a network based reconfiguration procedure or as a result of a cell update procedure. The latter is initiated by the UE to tell the network about its current location. The Cell_DCH state is characterized by dedicated channels in both the uplink and the downlink. On the UE side, this corresponds to continuous transmission and reception and can be demanding on user power requirements. The Cell_FACH state does not use dedicated channels and thus allows better power consumption, at the expense of a lower uplink and downlink throughput.

[0006] Recent work by the standardization bodies has identified the possibility of using High-Speed Downlink Packet Access (HSDPA) in Cell_FACH and Cell/URA_PCH. HSDPA is a feature that was introduced in Release 5 of the Third Generation Partnership Project (3GPP) specifications to operate in Cell_DCH. HSDPA tries to make better use of the downlink shared capacity by using concepts such as Adaptive Modulation and Coding (AMC), retransmissions using a Hybrid-ARQ (HARQ) scheme, and Node B scheduling – all operating at a very fast rate. Packet data units (PDUs) are combined by the HARQ, and subsequently stored in a reordering queue to deal with possible out-of-order

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reception. Downlink transmissions are addressed to a UE via an HS-DSCH Radio Network Identifier (H-RNTI).

[0007] It is assumed that if the UE supports HSDPA in Release 7, then it also supports HSDPA in CELL_FACH and in CELL/URA_PCH. HS-DSCH reception in CELL_FACH can be configured without HS-DSCH reception in CELL_PCH and URA_PCH. High speed downlink shared channel (HS-DSCH) reception in CELL_PCH and URA_PCH without the support of HS-DSCH reception in CELL_FACH is not supported. The UE support for these features is signaled to the network. It should be understood that the embodiments presented can be extended to cases where the support for HSDPA in CELL_FACH and/or CELL_PCH/URA_PCH can be individually signaled to the network.

[0008] On the other hand, the network signals its support for enhanced CELL_FACH via the System Information Block (SIB5/5bis). Two new information elements (IEs) have been introduced:

- "HS-DSCH common system information" – indicating the HSDPA reception is supported for CELL_FACH state; and
- "HS-DSCH paging system information" – indicating that HSDPA reception is supported for CELL/URA_PCH state.

[0009] To indicate whether HS-DSCH reception is ongoing in CELL_FACH, two new Boolean variables have been added:

- HS_DSCH_RECEPTION_CELL_FACH_STATE: If TRUE indicates that HS_DSCH reception in CELL_FACH is ongoing; and
- HS_DSCH_RECEPTION_OF_CCCH_ENABLED: If TRUE indicates that HS-DSCH reception is enabled for CCCH. This variable is set to TRUE when the UE is using a common H-RNTI to receive HSDPA traffic, and is set to FALSE when the UE is not.

[0010] A UE is assigned a common H-RNTI to receive traffic when it has not been assigned a dedicated H-RNTI. Three such situations are as follows:

1) UE sends a Radio Resource Control (RRC) CONNECTION REQUEST message (and UE is waiting for an RRC CONNECTION SETUP response from the network).

2) UE sends a CELL UPDATE message and is waiting for a CELL UPDATE CONFIRM response from the network.

3) UE sends a URA UPDATE message and is waiting for a URA UPDATE CONFIRM response from the network.

[0011] No new variable has been proposed for CELL/URA_PCH HS-DSCH reception indication. When in CELL/URA_PCH, and if the IE "HS-DSCH paging system information" is broadcast, the UE sets up HSDPA reception. In some cases, a UE will no longer be able to continue reception of high speed PDUs, (e.g., as a result of a hard handover, cell reselection, radio link failure, and the like). In these cases, the MAC should be reset. The reset procedure allows the UE to forward all PDUs in the reordering queues up to higher layers, and to re-initialize all high speed state variables.

[0012] In 3GPP Release 6, HSDPA was only supported in CELL_DCH. As a result, MAC resets, (e.g., a mac-hs reset) were performed under the following conditions: the UE underwent a radio link failure, the UE experienced an RLC unrecoverable error, or the UE was ordered to transition to a state where HSDPA was not supported (all states except CELL_DCH).

[0013] In Release 7, as currently defined, a UE may be required to perform a MAC reset in the following states: CELL_DCH, CELL_FACH, CELL/URA_PCH. In addition to the conditions specified above, (i.e., that apply to a UE in CELL_DCH), the UE is required to perform a MAC reset after ALL cell reselections. Currently this is only done when the WTRU with a dedicated H-RNTI performs a cell reselection. There are a number of scenarios where this reset is not performed, resulting in possible reordering errors.

[0014] Transitions to/from IDLE have also been impacted by the introduction of Enhanced CELL_FACH. If a Release 7 UE supports HSDPA reception in CELL_FACH state, this UE also supports limited HSDPA reception while in IDLE mode ; in particular after a UE has issued an RRC CONNECTION REQUEST, and is waiting for an RRC CONNECTION SETUP message from the network. Three issues have been identified:

1) If the UE has begun HSDPA reception while in IDLE (after issuing a RRC CONNECTION SETUP message), any cell reselections should result in a MAC reset.

2) If an RRC connection procedure is aborted, the UE should clear all its HSDPA resources.

3) While in IDLE mode, a UE may cell reselect from a cell that supports Enhanced CELL FACH to one that does not, and vice versa. If the UE has initiated an RRC connection procedure, two issues may need to be addressed. First, for a Release 6 to a Release 7 transition, the UE is required to setup the HSDPA resources so that it can receive the RRC CONNECTION SETUP message on the HS-DSCH. Second, for a Release 7 to Release 6 transition, the UE should release all HSDPA resources, as no traffic is expected on the HS-DSCH.

[0015] Another new feature of Enhanced CELL_FACH is that the UE will be able to receive dedicated control messages while in CELL_PCH (over the DCCH). Accordingly, a UE may be asked to perform a reconfiguration, (e.g., radio bearer, transport channel, physical channel). Reconfiguration messages can also result in a state change.

[0016] In order to allow proper configuration of HSDPA resources the UE should properly manage the setting or clearing of the variable HS_DSCH_RECEPTION_OF_CCCH_ENABLED to ensure that it is only set to TRUE when the UE is using the common H-RNTI while in an enhanced Cell_FACH state. It should be set to FALSE in all other. Lastly, cell reselections occurring during ongoing cell update or URA update procedures should behave similarly to cell reselections when these procedures are not ongoing.

[0017] It would therefore be beneficial to provide a method and apparatus for handling cell reselections and transitions to and from an enhanced CELL_FACH state.

[0018] SUMMARY

[0019] A method and apparatus for handling cell reselections, transitions, and Cell_DCH radio link failures is disclosed. The method includes executing a cell reselection. A medium access control (MAC)-ehs reset is performed.

[0020] BRIEF DESCRIPTION OF THE DRAWINGS

[0021] A more detailed understanding may be had from the following description, given by way of example in conjunction with the accompanying drawings wherein:

[0022] Figure 1 shows an example wireless communication system including a plurality of wireless transmit/receive units (WTRUs) and a Node B;

[0023] Figure 2 is an example functional block diagram of a WTRU and the Node B of Figure 1; and

[0024] Figure 3 is a flow diagram of a method for handling cell reselections and transitions to and from an enhanced CELL_FACH state.

[0025] DETAILED DESCRIPTION

[0026] When referred to hereafter, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of user device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

[0027] When referred to hereafter, the terminology "Release 7 (R7)", includes but is not limited to a WTRU or Node B that supports HS-DSCH in CELL_FACH and/or CELL/URA_PCH and "Release 6 (R6)" includes but is not limited to a WTRU or Node B that does not support HS-DSCH in CELL_FACH and/or CELL/URA_PCH.

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[0028] HS-DSCH in CELL_FACH also includes HS-DSCH reception in idle mode for the reception of RRC connection procedures.

[0029] When referred to hereafter, the terminology "enhanced CELL_FACH state" includes but is not limited to a WTRU that is using HSDPA resources in a state other than CELL_DCH.

[0030] Figure 1 shows an example wireless communication system 100 including a plurality of WTRUs 110, a Node B 120, and a radio network controller (RNC) 130. As shown in Figure 1, the WTRUs 110 are in communication with the Node B 120, which is in communication with the RNC 130. It should be noted that, although an example configuration of WTRUs 110, Node B 120, and RNC 130 is depicted in Figure 1, any combination of wireless and wired devices may be included in the wireless communication system 100.

[0031] Figure 2 is an example functional block diagram 200 of a WTRU 110 and the Node B 120 of the wireless communication system 100 of Figure 1. As shown in Figure 2, the WTRU 110 is in communication with the Node B 120. The Node B 120 is configured to handle cell reselections and transitions to and from an enhanced Cell_FACH state.

[0032] In addition to the components that may be found in a typical WTRU, the WTRU 110 includes a processor 115, a receiver 116, a transmitter 117, and an antenna 118. The receiver 116 and the transmitter 117 are in communication with the processor 115. The antenna 118 is in communication with both the receiver 116 and the transmitter 117 to facilitate the transmission and reception of wireless data. The processor 115 of the WTRU 110 is configured to handle cell reselections and transitions to and from an enhanced Cell_FACH state.

[0033] In addition to the components that may be found in a typical Node B, the Node B 120 includes a processor 125, a receiver 126, a transmitter 127, and an antenna 128. The receiver 126 and the transmitter 127 are in communication with the processor 125. The antenna 128 is in communication with both the receiver 126 and the transmitter 127 to facilitate the transmission and reception of wireless data.

[0034] Figure 3 is a flow diagram of a method 300 for handling cell reselections out of an enhanced CELL_FACH state. Although specifics of the method 300 will be described in greater detail below, in general, a WTRU 110 executes a cell reselection (step 310). Upon executing the cell reselection, a medium access control (MAC)-ehs reset is performed (step 320) due to the fact that the source of the HS-DSCH may have changed. Depending on the reselected cell, the WTRU 110 may clear HSDPA resources and stop HS-DSCH reception procedures.

[0035] In one example, the MAC-hs/ehs reset is performed when a cell reselection occurs while the WTRU 110 is waiting for a CELL_UPDATE_CONFIRM message. The reset may be performed in all cases upon cell reselection, (i.e., even when the WTRU does not have a dedicated H-RNTI), or only when the WTRU has ongoing HSDPA reception, (i.e., when the WTRU is receiving HS-DSCH prior to cell reselection).

[0036] For example, if cell update/URA update timer expires or a reselection to another UTRA cell occurs prior to completion of the cell update or URA update procedure, the WTRU 110 may detect "in service area" if it has not entered idle mode. In this case, if the cell update or URA update procedure counter is less than or equal to a maximum number of retransmissions of the cell update/URA update message, then the WTRU 110 may perform a cell reselection.

[0037] For frequency division duplex (FDD), for example, if the WTRU 110 supports HS-DSCH reception and the information element (IE) "HS-DSCH common system information" is included in SIB5 or SIB5bis, then the WTRU 110 may reset the MAC-ehs entity.

[0038] Alternatively, the WTRU 110 may, after performing cell selection, reset the MAC-ehs entity after a radio link failure from CELL_DCH. As the WTRU 110 may be using a common H-RNTI, rather than a dedicated H-RNTI, a reset may allow reception of a new MAC flow, (e.g., for CCCH and SRB1).

[0039] For example, the WTRU 110 may initiate a cell update procedure as a result of a radio link failure while in CELL_DCH. For FDD, if the WTRU 110 supports HS-DSCH reception and the information element (IE) "HS-DSCH

common system information" is included in SIB5 or SIB5bis, then the WTRU 110 may reset the MAC-ehs entity.

[0040] Alternatively, the WTRU 110 may, after performing a cell reselection without a dedicated H-RNTI, reset the MAC-ehs entity.

[0041] For example, the WTRU 110 may initiate a URA update or cell update procedure. If the WTRU 110 performed a cell reselection, then for FDD, if the WTRU 110 supports HS-DSCH reception and the information element (IE) "HS-DSCH common system information" is included in SIB5 or SIB5bis, then the WTRU 110 may reset the MAC-ehs entity.

[0042] WTRU 110 is allowed to use HS-DSCH reception in IDLE mode (such as after transmitting a RRC CONNECTION REQUEST). When the WTRU 110 transmits a RRC CONNECTION REQUEST, it monitors the downlink transmissions to determine the RNC response. During this time the WTRU 110 may perform cell reselections.

[0043] Depending on the reselected cell, the WTRU 110 may transition from a cell that supports HSDPA reception in CELL_FACH and CELL/URA_PCH to one that no longer supports HS-DSCH reception. The WTRU 110 may clear, or release HSDPA resources and stop HS-DSCH reception procedures.

[0044] For example, if the WTRU 110 has transmitted a RRC CONNECTION REQUEST and has not yet received an RRC CONNECTION SETUP message with the value of the IE "Initial UE identity" equal to the value of the variable INITIAL_UE_IDENTITY, and if cell re-selection or expiry of RRC CONNECTION REQUEST timers (currently referred to in the standard as T300 or T318) occurs, WTRU 110 may check that the RRC CONNECTION procedure counter (currently referred to in the standard as V300) is less than or equal to the maximum number of retransmissions of the RRC CONNECTION REQUEST message (currently referred to in the standard as N300), and if cell reselection occurred, for FDD, and if the WTRU 110 supports HS-DSCH reception and if IE: "HS-DSCH common system information" is not included in SIB5 or SIB5bis, then , the WTRU 110 may release HSDPA resources by stopping HS_SCCH and HS-

DSCH reception procedures. Additionally, the WTRU 110 may clear the variable H_RNTI and remove any stored H-RNTI. In addition to resetting the MAC-ehs entity, the WTRU 110 may also release all HARQ resources.

[0045] Alternatively, the WTRU 110 may choose to perform the above only when HSDPA resources are being used prior to cell reselection.

[0046] Also, the WTRU 110 actions can be triggered by using an existing HS_DSCH_RECEPTION variable, or a new HS_DSCH_RECEPTION variable may be defined as a flag to denote HSDPA resource use, thereby triggering a resource release.

[0047] Depending on the reselected cell, the WTRU 110 may transition across cells that support HSDPA reception in CELL_FACH and CELL/URA_PCH. The WTRU may perform a MAC-ehs reset.

[0048] For example, if the WTRU 110 has transmitted a RRC CONNECTION REQUEST and has not yet received an RRC CONNECTION SETUP message with the value of the IE "Initial UE identity" equal to the value of the variable INITIAL_UE_IDENTITY, and if cell re-selection or expiry of RRC CONNECTION REQUST timers (T300 or T318) occurs, WTRU 110 may check that the RRC CONNECTION procedure counter (V300) is less than or equal to the maximum number of retransmissions of the RRC CONNECTION REQUEST message (N300), and if cell reselection occurred, for FDD, and if the WTRU 110 supports HS-DSCH reception and if IE: "HS-DSCH common system information" is included in SIB5 or SIB5bis, and if the variable "HS-DSCH_RECEPTION_OFF_CCCH_ENABLED" is set to TRUE, then , the WTRU 110 may reset the MAC-ehs entity.

[0049] Depending on the reselected cell, the WTRU 110 may transition from a cell that does not support HSDPA reception in CELL_FACH and CELL/URA_PCH to one that does support HS-DSCH reception. In such a case, the WTRU 110 may be required to setup the HS-DSCH, (e.g., HARQ resources, common H-RNTI, MAC flow for CCCH traffic, and the like).

[0050] In this situation, a number of scenarios may be utilized. For example, if the WTRU 110 has transmitted a RRC CONNECTION REQUEST

and has not yet received an RRC CONNECTION SETUP message with the value of the IE "Initial UE identity" equal to the value of the variable INITIAL_UE_IDENTITY, and if cell re-selection or expiry of RRC CONNECTION REQUST timers (T300 or T318) occurs, WTRU 110 may check that the RRC CONNECTION procedure counter (V300) is less than or equal to the maximum number of retransmissions of the RRC CONNECTION REQUEST message (N300), and if cell reselection occurred, for FDD, and if the WTRU 110 supports HS-DSCH reception and if IE: "HS-DSCH common system information" is included in SIB5 or SIB5bis, and if the variable "HS-DSCH_RECEPTION_OFF_CCCH_ENABLED" is set to FALSE, then, the WTRU 110 may set the variable "HS-DSCH_RECEPTION_OFF_CCCH_ENABLED" to TRUE, and start receiving HS-DSCH.

[0051] Alternatively, a WTRU 110 in IDLE mode may set the CCCH flag to TRUE in an R6 cell. In order to guarantee that HS_DSCH_RECEPTION_OF_CCCH_ENABLED is TRUE in an R6 cell the variable should be set to TRUE each time the system information is read in an R6 cell or anytime the WTRU 110 is in an R6 cell and transitions to IDLE mode from connected mode. This can be achieved by changing the actions when entering idle mode from connected mode.

[0052] As another alternative, every time a WTRU 110 in IDLE mode with an ongoing RRC connection procedure performs a cell reselection, the WTRU 110 sets the CCCH flag to TRUE and then performs the actions related to this variable. For example, the WTRU 110 may send an RRC CONNECTION REQUEST message and be waiting for an RRC CONNECTION SETUP MESSAGE. If there is a cell reselection, and the transition is from an R7 to R7 cell, the MAC-ehs entity is reset only. If the transition is from an R6 to R7 cell, the variable HS_DSCH_RECEPTION_OF_CCH_ENABLED is set to "true" and the WTRU 110 begins receiving the HS-DSCH. If the transistion is from an R7 to R6 cell, then HS_SCCH reception procedures are stopped, HS-DSCH reception procedures are stopped, the MAC-ehs entity is reset, HARQ resources are released, and store "HARQ info" IEs are cleared.

[0053] The variable HS_DSCH_RECEPTION_OF_CCCH_ENABLED is used as a flag to denote that the WTRU 110 is using a common H-RNTI. This variable should be set to "FALSE" when the WTRU 110 is not using its common H-RNTI. This may ensure that evaluation of the variable HS_DSCH_RECEPTON_CELL_FACH_STATE will correctly clear resources only when a dedicated H-RNTI is assigned to the WTRU 110. Receiving on the common H-RNTI is typically possible when the WTRU 110 has performed a cell reselection and is waiting for the CELL UPDATE CONFIRM message, or when the WTRU 110 has performed a URA reselection and is waiting for the URA UPDATE CONFIRM message, or when the WTRU 110 has initiated an RRC setup and is waiting for the RRC CONNECTION SETUP message.

[0054] After receiving an RRC CONNECTION SETUP message that will send the WTRU 110 in the CELL_DCH state, then the WTRU 110 sets variable HS_DSCH_RECEPTION_OF_CCCH_ENABLED to "FALSE".

[0055] The WTRU 110 may terminate activities associated with CELL_PCH. For example, the WTRU 110 should stop the periodic cell update timer. If the network requests a transition to CELL_FACH or if a new configuration is provided for CELL_PCH, the WTRU 110 should perform actions similar to those when transitioning to CELL_FACH.

[0056] For example, if the IE "Frequency info" is included in the received reconfiguration message, the WTRU 110 may select a suitable cell on the provided frequency. If the if IE "Frequency info" is not included in the received reconfiguration message, the WTRU 110 may prohibit periodical status transmission in the RLC, and it may start the timer currently referred to in the standard as T305. If the IE "New C-RNTI" is not included in the reconfiguration message, the WTRU 110 can clear variables C_RNTI, H_RNTI, as well as any stored HARQ information, and may also reset the MAC-ehs entity. The WTRU 110 may start monitoring the paging occasions on the selected PICH, and if the IE "UTRAN DRX cycle length coefficient" is included, it can use this value to determining the paging occasions.

[0057] Although features and elements are described above in particular combinations, each feature or element can be used alone without the other features and elements or in various combinations with or without other features and elements. The methods or flow charts provided herein may be implemented in a computer program, software, or firmware incorporated in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[0058] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

[0059] A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet browser, and/or any wireless local area network (WLAN) or Ultra Wide Band (UWB) module.

[0060] Embodiments:

1. A method for handling cell reselections and transitions.

2 The method of embodiment 1, further comprising executing a cell reselection.

3. A method as in any preceding embodiment, further comprising performing a medium access control (MAC)-ehs reset.

4. A method as in any preceding embodiment, further comprising sending a cell update message.

5. A method as in any preceding embodiment, further comprising waiting for a cell update confirm message.

6. A method as in any preceding embodiment wherein the reset is performed without a dedicated high speed downlink shared channel (HS-DSCH) radio network identifier (H-RNTI).

7. A method as in any preceding embodiment, further comprising setting a variable HS_DSCH_RECEPTION_OF_CCCH_ENABLED to true.

8. A method as in any preceding embodiment, further comprising releasing high speed downlink packet access (HSDPA) resources.

9. A method as in any preceding embodiment, further comprising stopping high speed shared control channel (HS-SCCH) reception procedures.

10. A method as in any preceding embodiment, further comprising stopping high speed downlink shared channel (HS-DSCH) reception procedures.

11. A method as in any preceding embodiment, further comprising clearing an H-RNTI variable and removing a stored H-RNTI.

12. A method as in any preceding embodiment, further comprising releasing hybrid automatic repeat request (HARQ) resources.

13. A method as in any preceding embodiment, further comprising setting a common control channel (CCCH) flag to a first state.

14. A method as in any preceding embodiment wherein the first state is a true state.

15. A method as in any preceding embodiment wherein the first state is a false state.

16. A method as in any preceding embodiment, further comprising terminating CELL_PCH procedures.

17. A method as in any preceding embodiment wherein a periodic cell update timer is terminated.

18. A method as in any preceding embodiment, further comprising establishing an HSDPA link.

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

20. The WTRU of embodiment 19, further comprising a receiver.

21. A WTRU as in any of embodiments 19-20, further comprising a transmitter.

22. A WTRU as in any of embodiments 19-21, further comprising a processor in communication with the receiver and the transmitter.

23. A WTRU as in any of embodiments 19-22 wherein a processor is configured to execute a cell reselection.

24. A WTRU as in any of embodiments 19-23 wherein a processor is configured to perform a medium access control (MAC)-ehs reset.

25. A WTRU as in any of embodiments 19-24 wherein a processor is configured to transmit a cell update message.

26. A WTRU as in any of embodiments 19-25 wherein a processor is configured to set a variable HS_DSCH_RECEPTION_OF_CCCH_ENABLED to true.

27. A WTRU as in any of embodiments 19-26 wherein a processor is configured to release high speed downlink packet access (HSDPA) resources.

28. A WTRU as in any of embodiments 19-27 wherein a processor is configured to stop high speed shared control channel (HS-SCCH) reception procedures.

29. A WTRU as in any of embodiments 19-28 wherein a processor is configured to stop high speed downlink shared channel (HS-DSCH) reception procedures.

30. A WTRU as in any of embodiments 19-29 wherein a processor is configured to clear an H-RNTI variable and remove a stored H-RNTI.

31. A WTRU as in any of embodiments 19-30 wherein a processor is configured to release hybrid automatic repeat request (HARQ) resources.

32. A WTRU as in any of embodiments 19-31 wherein a processor is configured to set a common control channel (CCCH) flag to a true state.

33. A WTRU as in any of embodiments 19-32 wherein a processor is configured to set a common control channel (CCCH) flag to a false state.

34. A WTRU as in any of embodiments 19-33 wherein a processor is configured to terminate CELL_PCH procedures.

35. A WTRU as in any of embodiments 19-34 wherein a processor is configured to establish an HSDPA link.

36. An integrated circuit (IC) configured to perform a method as in any of embodiments 1-18.

37. The IC of embodiment 36, further comprising a receiver.

38. An IC as in any of embodiments 36-37, further comprising a transmitter.

39. An IC as in any of embodiments 36-38, further comprising a processor in communication with the receiver and the transmitter.

40. An IC as in any of embodiments 36-39 wherein a processor is configured to execute a cell reselection.

41. An IC as in any of embodiments 36-40 wherein a processor is configured to perform a medium access control (MAC)-ehs reset.

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42. A method as in any of embodiments 1-18, further comprising waiting for a first message.

43. A method as in any of embodiments 1-18 and 42, further comprising performing a cell reselection while waiting for a first message.

44. A method as in any of embodiments 1-18 and 42-43 wherein a first message is any one of a first message is a CELL UPDATE CONFIRM message or a URA UPDATE CONFIRM message.

45. A method as in any of embodiments 1-18 and 42-44, further comprising operating in a CELL_DCH state.

46. A method as in any of embodiments 1-18 and 42-45, further comprising undergoing a radio link failure.

47. A method as in any of embodiments 1-18 and 42-46, further comprising receiving an RRC CONNECTION SETUP message, wherein the RRC CONNECTION SETUP message indicates a transition to a CELL_DCH state.

48. A method as in any of embodiments 1-18 and 42-47, further comprising clearing an HS_DSCH_RECEPTION_OF_CCCH_ENABLED variable.

49. T A method as in any of embodiments 1-18 and 42-48 wherein a HS_DSCH_RECEPTION_OF_CCCH_ENABLED variable is set to false

* * *

CLAIMS

What is claimed is:

1. A method for handling cell reselections and transitions, comprising:
executing a cell reselection; and
performing a medium access control (MAC)-ehs reset.

2. The method of claim 1, further comprising sending a cell update message.

3. The method of claim 2, further comprising waiting for a cell update confirm message.

4. The method of claim 1 wherein the reset is performed without a dedicated high speed downlink shared channel (HS-DSCH) radio network identifier (H-RNTI).

5. The method of claim 1, further comprising setting a variable HS_DSCH_RECEPTION_OF_CCCH_ENABLED to true.

6. The method of claim 1, further comprising releasing high speed downlink packet access (HSDPA) resources.

7. The method of claim 6, further comprising stopping high speed shared control channel (HS-SCCH) reception procedures.

8. The method of claim 6, further comprising stopping high speed downlink shared channel (HS-DSCH) reception procedures.

9. The method of claim 6, further comprising clearing an H-RNTI variable and removing a stored H-RNTI.

10. The method of claim 6, further comprising releasing hybrid automatic repeat request (HARQ) resources.

11. The method of claim 1, further comprising setting a common control channel (CCCH) flag to a first state.

12. The method of claim 11 wherein the first state is a true state.

13. The method of claim 11 wherein the first state is a false state.

14. The method of claim 1, further comprising terminating CELL_PCH procedures.

15. The method of claim 14 wherein a periodic cell update timer is terminated.

16. The method of claim 1, further comprising establishing an HSDPA link.

17. A wireless transmit/receive unit (WTRU), comprising:

a receiver;

a transmitter; and

a processor in communication with the receiver and the transmitter, the processor configured to execute a cell reselection, and perform a medium access control (MAC)-ehs reset.

18. The WTRU of claim 17 wherein the processor is further configured to a cell update message.

19. The WTRU of claim 17 wherein the processor is further configured to a variable HS_DSCH_RECEPTION_OF_CCCH_ENABLED to true.

20. The WTRU of claim 17 wherein the processor is further configured to release high speed downlink packet access (HSDPA) resources.

21. The WTRU of claim 20 wherein the processor is further configured to stop high speed shared control channel (HS-SCCH) reception procedures.

22. The WTRU of claim 20 wherein the processor is further configured to stop high speed downlink shared channel (HS-DSCH) reception procedures.

23. The WTRU of claim 20 wherein the processor is further configured to clear an H-RNTI variable and remove a stored H-RNTI.

24. The WTRU of claim 20 wherein the processor is further configured to release hybrid automatic repeat request (HARQ) resources.

25. The WTRU of claim 17 wherein the processor is further configured to set a common control channel (CCCH) flag to a true state.

26. The WTRU of claim 17 wherein the processor is further configured to set a common control channel (CCCH) flag to a false state.

27. The WTRU of claim 17 wherein the processor is further configured to terminate CELL_PCH procedures.

28. The WTRU of claim 17 wherein the processor is further configured to establish an HSDPA link.

29. An integrated circuit (IC), comprising:

a receiver;

a transmitter; and

a processor in communication with the receiver and the transmitter, the processor configured to execute a cell reselection, and perform a medium access control (MAC)-ehs reset.

30. A method for handling cell reselections and transitions, comprising:

waiting for a first message;

performing a cell reselection while waiting for the first message; and

performing a medium access control (MAC)-ehs reset.

31. The method of claim 30 wherein the first message is a CELL UPDATE CONFIRM message or a URA UPDATE CONFIRM message.

32. A method for handling cell reselections and transitions, comprising:

operating in a CELL_DCH state;

undergoing a radio link failure; and

performing a medium access control (MAC)-ehs reset.

33. A method for handling cell reselections and transitions, comprising:

receiving an RRC CONNECTION SETUP message, wherein the RRC CONNECTION SETUP message indicates a transition to a CELL_DCH state; and

clearing an HS_DSCH_RECEPTION_OF_CCCH_ENABLED variable.

34. The method of claim 33 wherein the HS_DSCH_RECEPTION_OF_CCCH_ENABLED variable is set to false.

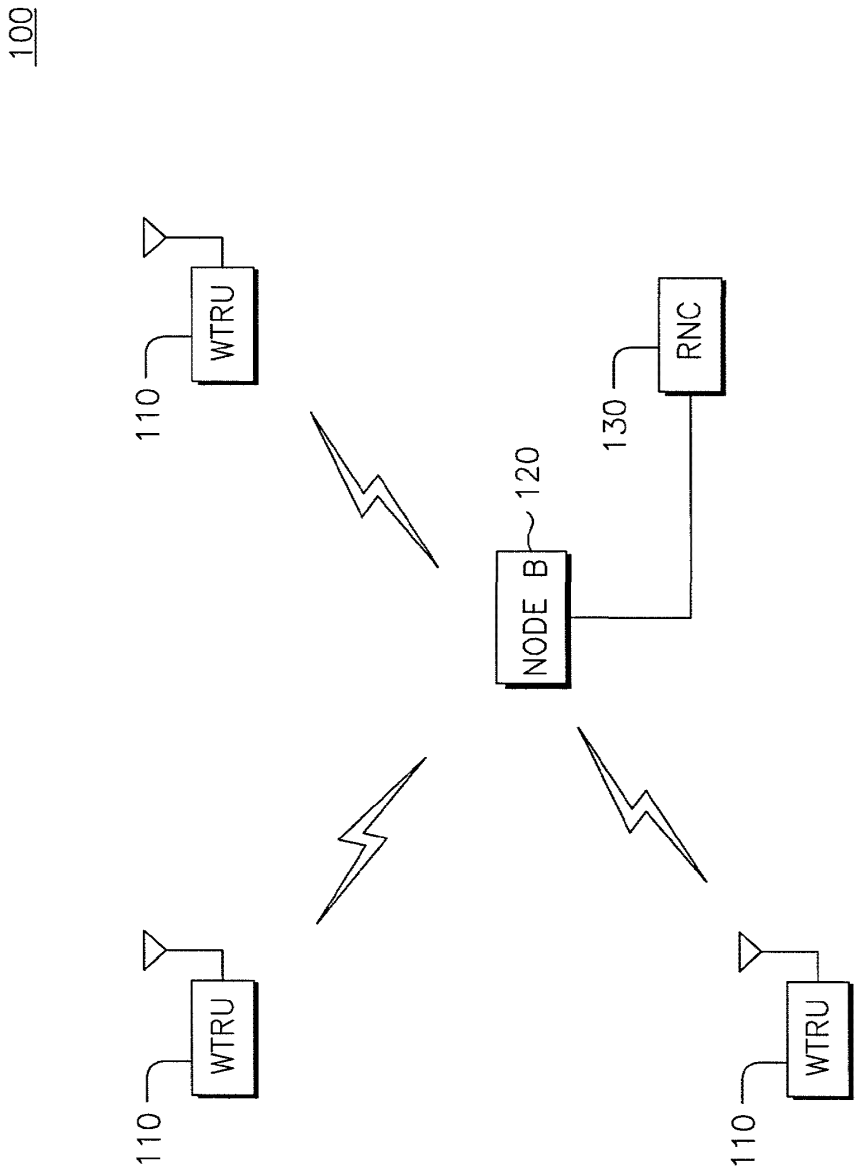


FIG.1

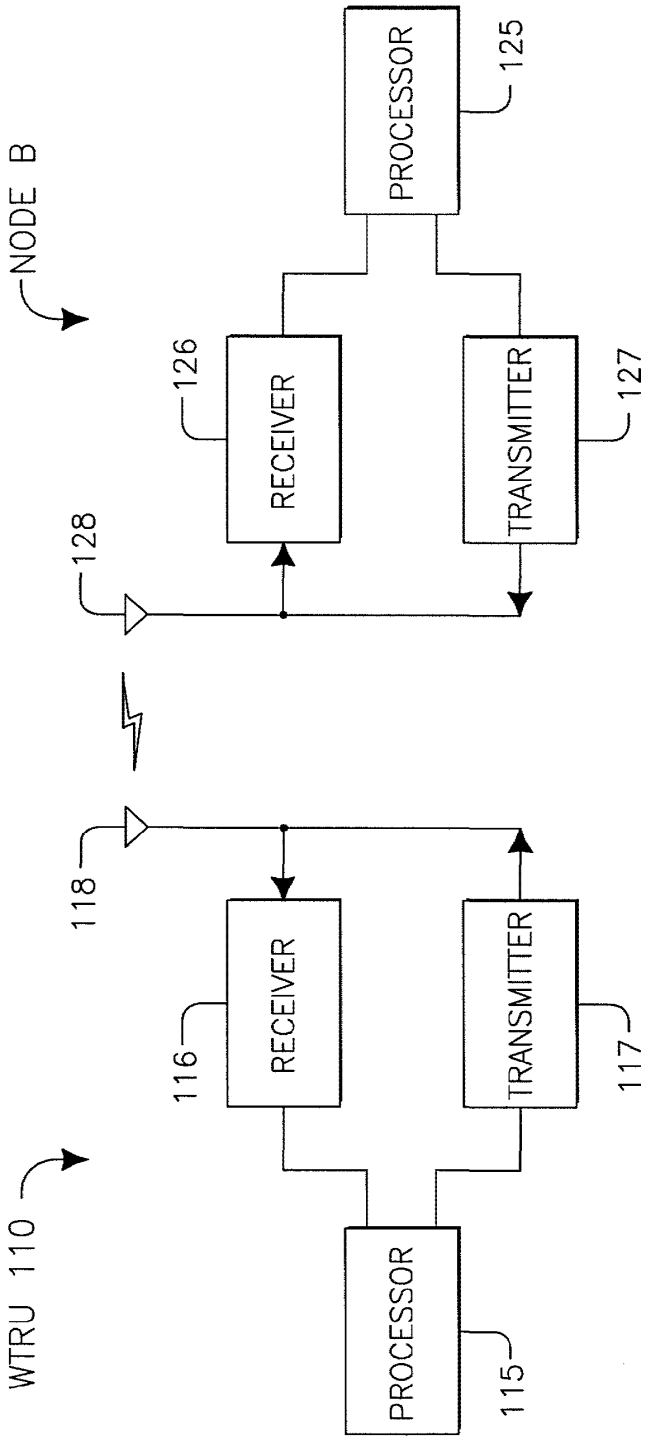

200
NODE B
PROCESSOR
125
126
RECEIVER
TRANSMITTER
127
128
118
RECEIVER
116
TRANSMITTER
117
WTRU 110
PROCESSOR
115

FIG.2

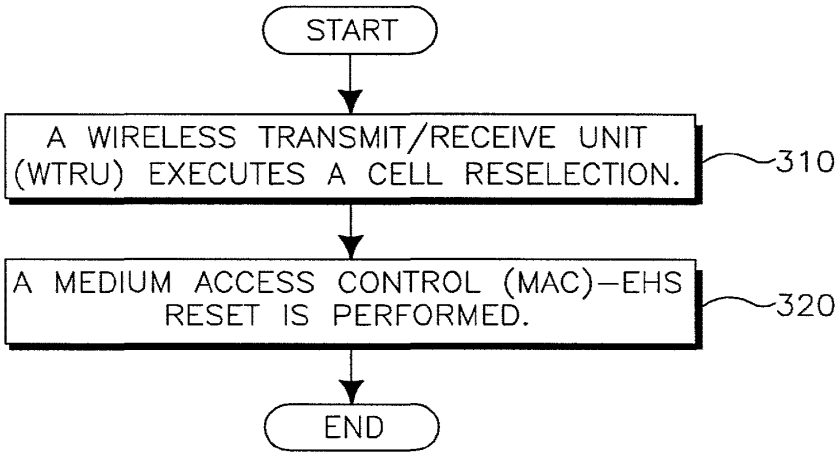

START
A WIRELESS TRANSMIT/RECEIVE UNIT (WTRU) EXECUTES A CELL RESELECTION.
310
A MEDIUM ACCESS CONTROL (MAC)–EHS RESET IS PERFORMED.
320
END

FIG.3

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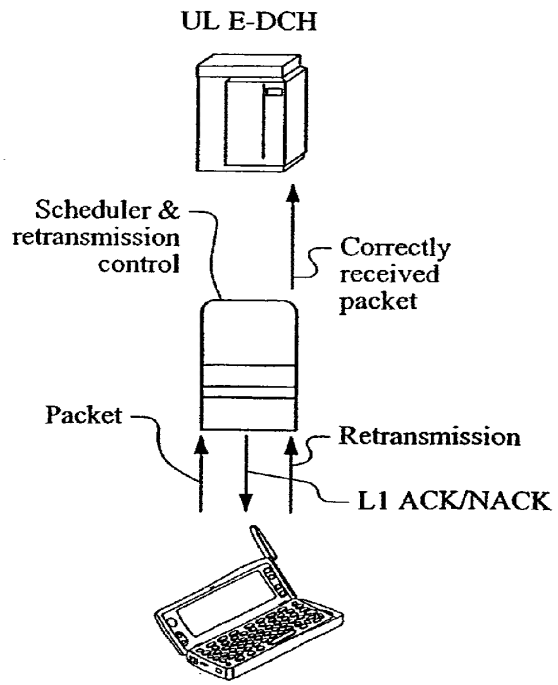
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(54) Title: ENHANCED UPLINK DEDICATED CHANNEL - APPLICATION PROTOCOL OVER IUB/IUR



(57) Abstract: Parameters are defined for use on an interface (Iub/Iur) between network elements to enable configuration setup of an enhanced radio uplink (UL E-DCH). The basic Information Elements (IEs) are defined to support UL E-DCH functionality in the network on Iub/Iur. Particular parameters are shown for communication over the Iub/Iur. Particular parameters are shown for communication over the Iub/Iur interface between the RNCs and the Node Bs in order to be able to setup and re-configure the UL E-DCH chanel. Flexibility is provided so as not to be restricted to any particular message or information element, but to be applicable to any selected message or messages in a given protocol.

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Enhanced Uplink Dedicated Channel - Application protocol over Iub/Iur

BACKGROUND OF THE INVENTION

1. Field the Invention

The present invention relates to an enhanced mobile communications uplink (the direction of the radio link from the user equipment to the network) and, more particularly, to the content of messages needed between a third generation a radio network controller (RNC) and base station (Node B) to carry out the enhancement within a mobile communications network.

2. Discussion of Related Art

To enhance the DCH (Dedicated Channel) performance, the Third Generation Partnership Project (3GPP) agreed on a Release 6 Study Item, 'Uplink Enhancements for Dedicated Transport Channels' in October 2002. The justification of the study item was that since the use of IP (Internet Protocol) based services is becoming more important there is an increasing demand to improve the coverage and throughput as well as to reduce delay in the uplink. Applications that could benefit from an enhanced uplink (UL E-DCH) may include services like video-clips, multimedia, e-mail, telematics, gaming, video-streaming, etc. This study item investigates enhancements that can be applied to UMTS (Universal Mobile Telecommunications System) Terrestrial Radio Access (UTRA) in order to improve the performance on uplink dedicated transport channels.

The study includes the following topics related to enhanced uplink for UTRA FDD (Frequency Division Duplex) to enhance uplink performance in

general or to enhance the uplink performance for background, interactive and streaming based traffic:

Adaptive modulation and coding schemes

Hybrid ARQ (Automatic Repeat Request) protocols

Node B controlled scheduling

Physical layer or higher layer signaling mechanisms to support the enhancements

Fast DCH setup

Shorter frame size and improved QoS (Quality of Service)

This UL E-DCH can be compared to HSDPA (High Speed Downlink Packet Access) since HSDPA was for a similar enhancement in the downlink (DL).

SUMMARY OF THE INVENTION

In this invention disclosure, signalling over the interfaces (Iub/Iur) between the 3GPP radio network controller (RNC) and Node B and between RNCs, including parameters, is shown to support the air interface enhancement on UL DCHs.

Currently no description can be found from 3GPP specifications or technical reports as to what kind of parameters should be added in which messages in the Iub/Iur application protocol to support UL E-DCH. The present invention defines the basic Information Elements (IEs), which should be provided to set up and to support E-DCH functionality in the network on Iub/Iur.

Thus the goal of this invention is to provide general signalling methods for the Iub/Iur interface between the RNCs and the Node Bs in order to be able to setup and re-configure the UL E-DCH channel. It is another object to do so with maximum flexibility so as not to be restricted to any particular

message, but to be later applicable to any selected message or messages in the yet undefined protocol.

According to a first aspect of the present invention, a method for configuring a radio uplink from a user equipment to a network element, comprises the steps of sending an information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages on an interface between the network element and a radio network controller for said configuring the radio uplink, configuring the radio uplink at the network element after signalling between the network element and the user equipment, and sending a payload packet from the user equipment to the network element over the radio uplink after the uplink is configured at the network element for sending the payload packet to the radio network controller.

In further accord with the first aspect of the present invention, the method further comprises the steps of acknowledging correct reception of the payload packet at the network element on a radio downlink from the network element to the user equipment, and sending the payload packet from the network element to the radio network controller following the correct reception from the user equipment.

In still further accord with the first aspect of the present invention, the method further comprises the step of sending the information element on an interface between the radio network controller and another radio network controller for relay to another network element for configuring an uplink between the other network element and the user equipment.

According to a second aspect of the present invention, a mobile telecommunications system comprises a network element and a radio network controller connected by a signalling interface for configuring a radio uplink from a user equipment to the network element, the interface for

conveying messages having information elements containing parameters, characterized in that an information element having a cell specific parameter, a radio link specific parameter, or both, is conveyed in one or more messages on the interface between the network element and the radio network controller for said configuring the radio uplink at the network element after signalling between the network element and the user equipment, and that a payload packet is sent from the user equipment to the network element over the radio uplink after the uplink is configured at the network element for sending the payload packet to the radio network controller.

In further accord with the second aspect of the present invention, the system is further characterized in that reception of the payload packet is acknowledged by the network element on a radio downlink from the network element to the user equipment, and that the payload packet is sent from the network element to the radio network controller following the reception from the user equipment.

In still further accord with the second aspect of the present invention, the system is further characterized in that the information element is sent on an interface between the radio network controller and another radio network controller for relay to another network element.

According to a third aspect of the present invention, a data structure is provided for at least temporary storage in a computer readable medium, the data structure comprising an information element having a cell specific parameter, a radio link specific parameter, or both for transfer in one or more messages on an interface between a network element and a radio network controller for configuring a radio uplink from a user equipment to the network element wherein the configuring is carried out at the network element for enabling transmission of a payload packet from the user

equipment to the network element over the radio uplink and from there to the radio network controller.

In further accord with the third aspect of the present invention, the data structure is characterized in that the transmission of the payload packet from the user equipment to the network element is followed by acknowledgement of correct reception of the payload packet by the network element on a radio downlink from the network element to the user equipment and transmission of the payload packet from the network element to the radio network controller.

According to a fourth aspect of the present invention, a radio network controller for configuring a radio uplink from user equipment to a network element, comprises a first interface for communicating an information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages on the first interface between the network element and the radio network controller for said configuring the radio uplink; and a second interface for communicating the information element having a cell specific parameter, a radio link specific parameter, or both in the one or more messages on the second interface between the radio network controller and a second radio network controller connected to a second network element, wherein the information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages is for configuring a second radio uplink between the second network element and the user equipment, the first radio network controller for receiving a payload packet from the network element over the first interface, the second radio network controller for receiving the payload packet from the second network element after receipt by the second network element from the user equipment over the second radio uplink, the second network element for sending the payload packet received from the second network element to the radio network controller following the

reception by the second network element from the user equipment for transfer from the second network controller to the first network controller.

According to a fifth aspect of the present invention, a network element for receiving an uplink channel on a radio link from user equipment to the network element, comprises a non-radio interface for communicating an information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages between the network element and a radio network controller for configuring the uplink channel on the radio link; and a radio interface for communicating signalling relating to the configuring the uplink channel between the network element and the user equipment and for receiving a payload packet from the user equipment to the network element over the radio uplink after the configuring the uplink channel on the radio link is carried out by the network element, wherein the non-radio interface is for conveying the payload packet from the network element to the radio network controller following the reception by the network element from the user equipment.

According to a sixth aspect of the present invention, a user equipment for communicating packets on an enhanced uplink from the user equipment to a network element, the user equipment having a transmitter (192) and a receiver (190) together connected to an antenna for transmitting and receiving signals over a radio interface between the user equipment and the network element is characterized in that the user equipment also includes a control for processing signalling between the network element and the user equipment for configuring a radio uplink from the user equipment to a network element, wherein an information element is sent having a cell specific parameter, a radio link specific parameter, or both in one or more messages on an interface between the network element and a radio network controller for the configuring the radio uplink,
wherein the radio uplink is configured at the network element, the user equipment, or both, after signalling between the network element and the

user equipment, and wherein a payload packet is sent from the user equipment to the network element over the radio uplink after the uplink is configured and then sent from the network element to the radio network controller.

According to a seventh aspect of the present invention, a data structure for at least temporary storage in a computer readable medium, the data structure is characterized by an information element having a cell specific parameter, a radio link specific parameter, or both for transfer in one or more messages on an interface between a network element and a user equipment for configuring a radio uplink from the user equipment to the network element wherein the configuring is carried out at the network element, the user equipment, or both for enabling transmission of a payload packet from the user equipment to the network element over the radio uplink and from there to the radio network controller.

In further accord with the seventh aspect of the present invention, the data structure is characterized in that the transmission of the payload packet from the user equipment to the network element is followed by acknowledgement of correct reception of the payload packet by the network element on a radio downlink from the network element to the user equipment and transmission of the payload packet from the network element to the radio network controller.

These and other objects, features and advantages of the present invention will become more apparent in light of a detailed description of a best mode embodiment thereof which follows, as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows signalling between the interfaces (Iub/Iur) between the 3GPP network element called "Node B" (or "base station") and radio network controller (RNC) and between RNCs, including parameters, according to the present invention, to support the air interface uplink enhancement.

Fig. 2 shows a prior art packet transmission on a radio uplink from a User Equipment (UE) to a Radio Network Controller (RNC) via a Node B which is comparable to a base station of a second generation system and a retransmission of the packet upon receiving a negative acknowledgement from the RNC to the UE.

Fig. 3 shows a proposal, according to an enhanced uplink dedicated channel (E-DCH) concept to enhance the uplink by moving the scheduler and retransmission control from the RNC to the Node B but which proposal has not yet explained the information elements and parameters needed for exchange between an RNC and a Node B and between RNCs.

Fig. 4 shows a User Equipment (UE) such as the user equipment of Figs. 1 and 3, according to the present invention.

DETAILED DESCRIPTION OF INVENTION

An enhanced uplink dedicated channel is currently proposed in 3GPP standardization committees in order to provide uplink enhancements for Dedicated Transport Channels. In relation to enhanced uplink for UTRA FDD (Frequency Division Duplex) uplink performance may be enhanced by improved Hybrid ARQ (Automatic Repeat Request) protocols and Node B

controlled scheduling. Physical layer or higher layer signaling mechanisms may also be provided to support the enhancements.
An UL E-DCH can be compared to HSDPA (High Speed Downlink Packet Access) since HSDPA was for a similar enhancement in the downlink (DL).

Fig. 2 shows a payload packet sent from a User Equipment (UE) over an uplink radio interface to a base station (Node B) and from there to a Radio Network Controller (RNC) connected to the Node B by means other than a radio link. The RNC replies with a radio link control (RLC) acknowledgment, indicating either success (ACK) or failure (NACK) in receipt of the payload packet. By "payload" is meant information distinct from configuration information such as setup, scheduling or retransmission control signalling, i.e., for use by the user of the user equipment after setup or reconfiguration in an application such as a web page, video, text, etc. Thus, preceding any exchange of payload information there will be a distinct configuration setup, scheduling, or retransmission control signalling procedure. Examples of third generation signalling procedures are shown in detail in 3GPP TR 25.931 v5.1.0 (2002-06).

Fig. 3 shows a proposal, according to an enhanced uplink dedicated channel (E-DCH) concept. One aspect of the improvement is to enhance the uplink by moving the acknowledgement function from the RNC to the Node B. The acknowledgement function is a known retransmission control function that is normally controlled at the RNC and need not be described here. What is important here is the network entity selected to perform this function. The E-DCH concept helps reduce delays by making the Node B take on control of this important function closer to the UE. The E-DCH proposal has not yet explained the information elements and parameters needed to be exchanged in the above-mentioned distinct signalling procedures between an RNC and a Node B, between the Node B and the user equipment, and also between RNCs in order to carry out such a change.

Another aspect of the E-DCH concept is "fast" Node B configuration control for uplink scheduling/loading. In other words, instead of the RNC, the Node B would be in configuration control of scheduling and/or congestion. Again, this reduces delays. The RNC sends information about the user equipment capabilities, cell specific parametrization and user equipment specific parametrization information related to E-DCH to the Node B. The configuration capabilities signalled might for instance include the number of HARQ processes, the modulation supported, the maximum data rate, etc. The cell specific parametrization could include setting up shared control channels, allocation of hardware and power resources for E-DCH, etc. The user equipment specific parametrization could include maximum data rate RNC allows the Node B to allocate to the UE, the power offsets and signalling repetition factors to be used for signalling to that UE and by that UE etc. Generally, the user equipment may send signalling to the Node B to assist the Node B scheduler and the Node B may send signalling back to the user equipment that informs the user equipment of its data rates or limits them. Thus, the user equipment may (or may not) signal the Node B information to help the Node B scheduler. As examples, the user equipment could request a data rate from the Node B or it could just send information on how much data it has and how much transmit power it is able to use. The Node B may (or may not) signal the scheduling commands to the UE. For instance, the Node B could signal the user equipment with a (maximum) data rate. This maximum data rate might then be valid until a new one is signalled by the Node B, or for a specific time period; or, it may change according to some specific rules, e.g., related to the usage of data rates.

Fig. 1 shows an exchange of information elements and parameters in such a distinct configuration signalling procedure such as a setup procedure. Configuration messages are exchanged between a Radio Network Controller (RNC) which in this case is shown as a "serving" RNC 130 and

a so-called "Node B" 132, according to the present invention, for configuring an enhanced uplink dedicated channel (E-DCH) for a User Equipment 160. The Node B 132 is a third generation base station. Between the SRNC 130 and the Node B 132 is a so-called Iub interface (non-radio). According to the present invention, configuration messages for E-DCH are defined for exchange over the Iub interface, for example, on a signalling line 133 from the SRNC 130 to the Node B 132 and on a signalling line 134 in the reverse direction from the Node B 132 to the SRNC 130.

As known in the art, when the UE moves into the range of another Node B 110 which may be connected to another RNC 100, there may be a need for communication of signalling similar to that exchanged over the Iub interface lines 133, 134 over a so-called Iur interface between the SRNC 130 and another RNC 100 which may be designated a "drift" RNC (DRNC) connected to the other Node B 110. Between the SRNC 130 and the DRNC 100, a configuration setup message signal is shown on a line 150 from the SRNC 130 to the DRNC 100 and a configuration setup message signal in the reverse direction is shown on a line 140 between the DRNC 100 and the SRNC 130. These signals are provided over a so-called Iur interface which is a non-radio interface. A message signal is shown on a line 120 from the DRNC 100 to the other Node B and a message signal in the reverse direction is shown on a line 122 from the Node B 110 to the DRNC 100. Together, these signals form another Iub interface which is also a non-radio interface. For a given situation, the information elements and parameters of the present invention may be carried over one or all of these Iur and Iub interfaces. It should be understood that the example given is not exhaustive as will be made clear by reference to 3GPP TS 25.931. The other Node B 110 is shown in communication with the UE 160 via a radio downlink 170 and a radio uplink 180. Similarly, the Node B 132 is shown in communication with the UE 160 via a radio downlink 135 and a radio uplink 136.

For background information, in third generation systems, it will thus be understood, the RNC 130 may be in communication with another RNC 100 which may, with respect to a given UE, be a Drift RNC (DRNC) or a Serving RNC (SRNC) over the so-called Iur interface. The SRNC 130 of Fig. 1 is the "serving" RNC for UE 160. It is connected to other Node Bs (not shown) in other cells. The UE 160 is currently located in the cell of one of the Node Bs connected to the SRNC 130 and is in radio communication with that Node B as well as the Node B 110 because it may be in proximity to the other Node B 110. The UE 160 is currently being "served" by the SRNC 130. The UE 160 may however be travelling toward the cell of Node B 110 connected to RNC 100 (called the "drift" RNC) and could be handed over to that cell. The UE would then either be "served" by RNC 100 and RNC 100 would become the SRNC for the UE or the RNC 130 may still continue "serving" the UE i.e. functioning as SRNC and the RNC 100 would still remain as "drift" RNC. By establishing the Iur interface, the third generation improves over the "hard-handover" situation of the second generation by providing the UE the ability to communicate with multiple Node Bs at the same time. A "soft-handover" is thereby enabled that does not require re-synchronization and, unlike second generation systems, makes the handover imperceptible to the user. For purposes of the present invention, however, the details of the soft handover process is secondary. The important thing here is the nature of the parameters disclosed below and transmitted in information elements contained in messages transmitted over the Iur/Iub interface.

The message signal on the line 122 from the Node B 110 may therefore be forwarded on a line 140 to the SRNC 130. Likewise, the message signal on the line 120 from the RNC 100 most likely would have originated as a signal on a line 150 from the SRNC 130 to the RNC 100 and forwarded from there on the line 120 to the Node B 110.

Fig. 4 shows the UE of Fig. 1 or Fig. 3 at a level of detail sufficient to show the elements needed to carry out the present invention. The UE 160 includes a receiver 190 responsive to the downlink 170 from the Node B 110 and the downlink 138 from the Node B 132. The UE 160 also includes a transmitter 192 for providing the uplink 180 from the UE to the Node B 110 and the uplink 136 from the UE 162 the Node B 132. A retransmission control 194 provides a signal on a line 196 to the transmitter 192 and receives a signal 198 from the receiver 190. Referring both to Figs. 3 and 4, an acknowledge/negative acknowledge signal may be received on one or both of the downlinks 138, 170 by the receiver 190 which in turn provides the received signal on the line 198 to the retransmission control 194. The retransmission control in turn evaluates the acknowledgement or negative acknowledgement signal and decides whether a retransmission is required or not. If a retransmission is required, the retransmission control sees to it that the retransmission is provided on the signal line 196 to the transmitter 192 which in turn transmits a retransmission on one or both of the uplinks 136, 180. The retransmission control 194 can be viewed as a transmission control or a transmission/retransmission control. In other words, a packet is transmitted, retransmitted or both by the control 194.

It should be realized that although a majority of the configuration parameters disclosed herein are disclosed in a way that is more related to how the Node B is to control the data rate of the UE, it is quite possible for the UE to control or have a role in the control of its own data rate. It can be possible for the UE control 194 to take care of not only transmission/retransmission but also data rate adjustments and timing of the transmissions based on the control information received in the downlink.

The present invention discloses various information elements and parameters in general terms without necessarily specifying exactly which existing or new message signal is to be used to communicate the

information elements and parameters. There are of course numerous existing messages that may be used for conveying the disclosed information elements (IEs) and parameters and some of them are mentioned hereafter as candidates but it is foreseen that others may be used as well some of which may not yet be defined. One of the more important decisions yet to be made involves which network entity, node, or element will decide the values of parameters.

A radio network controller, according to the present invention, has an E-DCH configuration signalling interface comprising the information elements and parameters described in further detail below and exchanged over the Iub lines 133, 134 or over the Iur lines 140, 150, or both. A Node B, according to the present invention, has an E-DCH configuration signalling interface comprising the information elements and parameters described in further detail below and exchanged over the Iub lines 133, 134 or 120, 122. A system, according to the present invention, has one or more radio network controllers and at least one Node B each with an E-DCH configuration signalling interface as described above and comprising the information elements and parameters described in further detail below.

Depending on which network node will decide the values of the parameters, the following cases can be considered:

1) The RNC decides the value and informs Node B. Node B follows the decision. Even though the Node B may now be taking on functions that were previously the RNC's responsibility, it does not work completely independently. The RNC provides the Node B with a set of parameters according to which it should then perform these functions. One could think of the RNC as a manager and Node B as the worker working according to the guidelines and on the UEs the RNC has commanded the Node B to work on. But the manager is always right and in overall control.

2) The RNC gives the boundaries within which choices may be made by Node B. Node B can decide the value according to its present condition within the boundaries given. The RNC could signal the UE capabilities, such as its maximum supported data rate capability, to the Node B, but as well it should signal some parametrization like how Node B resources are to be allocated for E-DCH, what are the repetition factors and power offsets etc. to be used for that UE, what is the maximum data rate currently allowed by the RNC to be given to the UE, etc.

3) Node B proposes a value to RNC and RNC confirms or decides the value. (In this case RNC has freedom not to accept Node B's proposal.)

4) Node B decides the value dynamically and RNC doesn't need to know it.

5) Others can certainly be contemplated as well and these are just examples.

It should be also considered whether both the UE and the network have to have the same value for a certain parameter. In this case the SRNC has to know the value of the parameter to inform it to UE via an RRC (Radio Resource Control) message. Case(1) and Case(3) can be used for this case.

Case(2) is a typical procedure for a Cell specific parameter. That means RNC configures the E-DCH resource pool and Node B decides the exact value according to the air interface situation.

Case(3) is valid in case that Node B knows the resource situation, the air interface condition, other E-DCH parameter usage but SRNC has to manage the overall resource situation.

Since the Layer 1 concept of E-DCH is still under discussion in 3GPP and UTRAN signalling hasn't been discussed, this invention covers all the

possibilities. The parameters which are proposed in this invention can be delivered to another network node (Node B or RNC) in any of the procedures listed above and the message used to carry out a given procedure can already exist in the existing Iub/Iur Application protocol (i.e., reuse the existing procedures) or new procedures (i.e., define new procedures and messages for E-DCH parameter delivery).

According to the present invention, parameters are provided on the Iub interface, the Iur interface, or both, that define either cell-specific parameters, RL-specific parameters, or both, for E-DCH. Such may include but are not limited to the following parameters: (1)Prx_nrt_Node B, (2)Prx_Target, (3)Node B TFCI Threshold, (4)UE TFCI Threshold, (5)ACK-NACK Power Offset, (6)ACK-NACK Repetition Factor, (7)Rate Grant Power Offset, (8)Rate Grant Repetition Factor, (9)UE Threshold Dtx, (10)UE Threshold Dtx Delay, (11)UE Capability Information, (12)HARQ Memory Partitioning, (13)Guideline Information for Node B Scheduling, (14) QoS, (15) delay due to UE Ptx Power and (16) TrCH under Node B control. The nature of each of these parameters is explained in more detail below.

To support the E-DCH in a cell, new semi-static IEs (cell related parameters) which configure E-DCH resources in a cell can be added in Cell Setup/Cell Reconfiguration procedure or Common Transport Channel Setup/Common Transport Channel Reconfiguration procedure or Physical Shared Channel Reconfiguration procedure or a new procedure.

- Prx_nrt_Node B
- Prx_Target

These parameters are given to Node B by the CRNC (Controlling Radio Network Controller) to limit the Node B scheduling freedom. The meaning of each parameter will be explained below.

Radio Link (RL) related IEs, to setup and re-configure E-DCH channels are listed below. The parameters conveyed on the line 130 from the SRNC to the Node B 132 can be added into a Radio Link Setup Request message, in a Radio Link Reconfiguration Prepare message, in a Radio Link Reconfiguration Request message or in some new message yet to be defined.

The parameters conveyed on the line 134 from Node B 132 to SRNC 130 can be added into a Radio Link Setup Response message, a Radio Link Reconfiguration Ready message, a Radio Link Reconfiguration Response message or can be conveyed in a new message that has not yet been defined or standardized. As in the Case (3), if Node B 132 has to propose a value for a parameter, it can reuse the Radio Link Parameter Update Indication message or define a new message for delivery on the line 134 to the RNC 130. After the SRNC 130 receives the proposal from Node B 132 , it can reuse the Synchronised/Unsynchronised Radio Link Reconfiguration procedure or define a new procedure. The same parameters to setup and re-configure may be exchanged between the SRNC 130 and the other Node B 110 via the DRNC 100 using the Iur interface 140, 150 between the SRNC 130 and the DRNC 100 and the Iub interface 120, 122 between the DRNC 100 and the other Node B 110.

- E-DCH Information
    - Payload CRC Presence Indicator
    - UL FP Mode
    - ToAWS
    - ToAWE
    - DCH ID
    - UL Transport Format Set
    - DL Transport Format Set
    - Allocation/Retention Priority
- Frame Handling Priority

- QE-Selector
- Unidirectional DCH Indicator
- Node B TFCI Threshold
- UE TFCI Threshold
- ACK PO
- NACK PO
- ACK Repetition Factor
- NACK Repetition Factor
- Rate Grant PO
- Rate Grant Repetition Factor
- Rate Request PO
- Rate Request Repetition Factor
- Guideline Information for Node B Scheduling
- QoS Parameters (like Traffic Handling Priority, GBR, discard timer etc.)
- UE Threshold Dtx
- UE Threshold Dtx Delay
- Delay due to UE Ptx Power
- TrCH under Node B control
- UE Capability Information
    - HARQ Capacity
        - NumOfChannel
        - MaxAttempt
        - RedundancyVer

- E-DCH Information Response
    - DCH ID
    - Binding ID
    - Transport Layer Address

- HARQ Memory Partitioning

- E-DCH Information to modify: Same with E-DCH Information

The meanings of IEs, which are defined in the DCH FDD Information IE group and DCH Information Response IE group, are same with the definitions in 3GPP specification. The additional IEs will be explained further below. Furthermore, the IE structure shows only one example. Thus it could be vary without contradicting the main concept of invention.

Cell Specific parameters

These IEs can be included in CELL SETUP REQUEST message or/and CELL RECONFIGURATION REQUEST message or Common Transport Channel Setup message or/and Common Transport Channel Reconfiguration Request message or Physical Shared Channel Reconfiguration Request message or a new message from CRNC to Node B.

IE/Group Name	Presence	Range	IE type and Reference	Semantics description	Criticality	Assigned Criticality
E-DCH Information		0...1			YES	reject
>Prx_nrt_NodeB						
>Prx Target						

Prx_nrt_NodeB

The *Prx_nrt_NodeB* IE defines the total allowable interference due to E-DCH users. Node B scheduler has to take this into account when it grants bit rates to UEs. The scheduler may not let the sum of E-DCH users' noise rise exceed this value. In principle this is the part of load reserved for E-DCH users.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Prx_nrt_NodeB				

In case the throughput based RRM is used, some other parameter than *Prx_nrt_NodeB* IE can be used like allowed bitrate. Which RRM algorithm will be used should be decided later. In addition to Prx_nrt_NodeB, Node B needs to have knowledge to link between the data rate it will assign to UE and the consumption of Prx_nrt_NodeB as well. How Node B will obtain this information has to be decided later.

Prx_Target

The *Prx Target* IE defines the target of the total uplink load of the cell to help Node B scheduling. Thus Node B can optimize the capacity in a cell even if there are not so many E-DCH users in a cell.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Prx Target				

RL Specific parameters

The following explains RL specific parameters. Parameters from SRNC to Node B can be included in a Radio Link Setup Request message, a Radio Link Reconfiguration Prepare message, or a Radio Link Reconfiguration Request message. Otherwise a new message can be defined for E-DCH parameter delivery. Parameters from Node B to SRNC can be added in a Radio Link Setup Response message, a Radio Link Reconfiguration Ready message, or a Radio Link Reconfiguration Response message. Otherwise

a new message can be defined for this purpose. Parameters which have to have the same values in both the network and the UE have to have the same values (e.g., Power Offsets, Repetition Factors, etc...) and on which Node B has better idea than SRNC, can be included in the Radio Link Parameter Update Indication message or a new message to allow Node B to be able to indicated its willingness of changing the parameter to SRNC.

Since the E-DCH users are basically DCH user, basic parameters (i.e., not E-DCH specific) are already defined in the earlier release. (e.g., TFCI) Therefore in this section, only new E-DCH parameters are explained.

Node B TFCI Threshold (SRNC -> Node B)
The *Node B TFCI Threshold* IE sets the maximum data rate TFC the Node B scheduler is allowed to grant to the UE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Node B TFC Threshold			INTEGER	

UE TFCI Threshold (SRNC -> Node B)
The *UE TFCI Threshold* IE sets the maximum data rate TFC the UE is allowed to use. After receiving this value from the RNC, the Node B scheduler can adjust this parameter independently and signal it to the UE in the limits of Node B TFCI Threshold.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
UE TFC Threshold			INTEGER	

ACK/NACK Power Offset (SRNC-> Node B)
The *ACKNACK PO* IE is assigned by SRNC as similar way than HSDPA. With this PO Node B can set the power of Hybrid ARQ ACK/NACK

information transmission to the UE. Note that ACK and NACK could be signalled with different power offsets thus having a dedicated IE for ACK power offset and NACK power offset. Further this or these could be cell specific parameters applicable to all the E-DCH users or radio link specific, i.e. defined separately for each UE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
ACKNACK PO			INTEGER	

ACK/NACK Repetition Factor (SRNC-> Node B)

The *ACKNACK Repetition Factor* IE is assigned by SRNC as similar way than HSDPA. It defines, how many times the Hybrid ARQ ACK/NACK is repeated. Since ACK/NACK repetition Factor for HSDPA is defined in HSDPA IE group, it is not supposed to be reused.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
ACKNACK Repetition Factor			INTEGER	

Rate Grant Power Offset (SRNC-> Node B)

The *Rate Grant PO* IE is assigned by SRNC as similar way than ACK/NACK PO. With this PO Node B can set the power of the scheduling related downlink signalling. This could be cell specific parameter applicable to all the E-DCH users or radio link specific, i.e. defined separately for each UE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Rate Grant PO			INTEGER	

Rate Grant Repetition Factor (SRNC-> Node B)

The *Rate Grant Repetition Factor* IE is assigned by SRNC. It defines, how many times the scheduling related downlink signalling is repeated.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Rate Grant Repetition Factor			INTEGER	

Rate Request Power Offset (SRNC-> Node B)

The *Rate Request PO* IE is assigned by SRNC as similar way than ACK/NACK PO. With this PO Node B knows the power offset applied by the UE to the uplink related scheduling signalling. This parameter makes Node B receiver simpler when it acquires the uplink scheduling signalling information from UE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Rate Request PO			INTEGER	

Rate Request Repetition Factor (SRNC-> Node B)

The *Rate Request Repetition Factor* IE is assigned by SRNC. Node B will use this value when it receives Rate Request Information from UE. It defines, how many times the scheduling related uplink signalling is repeated.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Rate Grant Repetition Factor			INTEGER	

UE Threshold Dtx (SRNC-> Node B)

The *UE Threshold Dtx* IE is assigned by SRNC. Node B scheduler will lower the UE TFCI Threshold to this value after the UE has been inactive for a period set by UE Threshold Dtx Delay

IE/Group Name	Presence	Range	IE type and reference	Semantics description
UE Threshold Dtx			INTEGER	

UE Threshold Dtx Delay (SRNC-> Node B)

The *UE Threshold Dtx Delay* IE defines the inactivity period after which the UE should set the UE TFCI Threshold = UE Threshold Dtx after getting into DTX mode. I.e. If the UE has been inactive (not transmitting any data on E-DCH) for the duration of this delay, the Node B assumes that the UE has no data to transmit or it cannot transmit that data and can perform accordingly.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
UE Threshold Dtx Delay			INTEGER	

Delay due to UE Ptx Power (SRNC-> Node B)

The *Delay due to UE Ptx Power* IE defines the period in which UE is not using the maximum bit rate due to the UE Ptx Power limitation. If the UE has not been using the maximum allowed data rate for the duration of the delay but has not been completely inactive (i.e. has transmitted some data on E-DCH during the delay but has not been using the maximum allowed data rate), for the duration of this delay, the Node B assumes that the UE is

not capable of transmitting with that high a data rate due to power limitation or the UE produces data to transmit in a lower rate than would be the maximum allowed, and can perform accordingly. A proposed functionality would be to drop the maximum allowed data rate to what is indicated by 'UE Threshold DTX' IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Delay due to UE Ptx Power			INTEGER	

TrCH under Node B control (SRNC-> Node B)

The *TrCH under Node B control* IE indicates which transport channels are under Node B scheduling control. Thus Node B can use this information for scheduling. (One Coded Composite Transport Channel (CCTrCH) may have a number of transport channels (TrCH) combined to it and it is possible that some of the TrCHs may be controllable to the Node B and some not.)

IE/Group Name	Presence	Range	IE type and reference	Semantics description
TrCH under Node B control				

UE Capabilities Information or UE Category Information (SRNC-> Node B)

The *UE Capabilities Information* IE provides information related to UE capabilities for E-DCH or alternatively the UE capabilities may be categorized and the UE category parameter can be signalled to the Node B.

IE/Group Name	Presence	Range	IE type and reference	Semantics descrip-tions	Criticality	Assigned Criticality
UE Capabilities Information					–	
>Num of HARQ Process	M					

Number of HARQ process could be one example in this IE group. And further UE Capability parameters will be defined.

HARQ Memory Partitioning (Node B -> SRNC)

The *HARQ Memory Partitioning* IE provides information for HARQ memory usage.

IE/Group Name	Presence	Range	IE type and reference	Semantics descriptions	Critical-ity	Assigned Criticality
Num of Process	M		INTEGER			
HARQ Memory Partitioning		*1..<maxnoofHARqprocesses>*				
>Process Memory Size	M		INTEGER		–	

Range bound	Explanation
Maxnoof HARQprocesses	Maximum number of HARQ processes.

One possible operation mode of this parameter can be that Node B, depending on the scheduler processing speed etc, decides how many ARQ processes are needed. If the TTI is 10 ms then the number of ARQ

processes should be less than with the 2 ms HSDPA TTI. (There were 8 processes with HSDPA, impact of the timing of downlink signaling to be taken into account as well).

Node B informs UE (via SRNC) the number of processes to be used and the memory per ARQ process. One possible way is that UE would be assuming even memory partitioning for all ARQ processes to avoid UE having to determine separately every TTI how much data with what coding can be transmitted in a given TTI.

Further information to give a guideline to Node B scheduling might need. For example Transmission Delay that the UE has to expect before it is allowed to ask for a higher data rate or RLC Buffer size (or RLC Window Size) might need to be signaled to Node B.

Some QoS Parameter (SRNC -> Node B)
To help Node B scheduling, information on which UEs have priority when scheduling the data rates, e.g. some QoS parameter (like traffic class, SPI, GBR parameter, discard timer etc...) might be needed.

Referring back to Fig. 1, each of the network elements including the RNCs 100, 130, the Node Bs 110, 132 and the UE 160 will typically include a signal processor that may be a special or general-purpose signal processor. A central processing unit (CPU) may be provided along with memory devices including both permanent memory and memory for storing information temporarily. Input/output ports are provided and all of these various devices are interconnected by data, address, and control signal lines. The permanent memory may be used to store instructions coded according to a selected computer programming language for carrying out the formation of the messages described above with information elements for conveying the above-described parameters. Therefore, it should be understood that these various components within a given network element

or device constitute means for implementing the interfaces disclosed above.

Although the invention has been shown and described with respect to a best mode embodiment thereof, it should be understood by those skilled in the art that various changes, omissions and deletions in the form and detail of the foregoing may be made therein without departing from the spirit and scope of the invention.

Abbreviations

CCTrCH	Coded Composite Transport Channel	
CRNC	Control RNC	(network element)
E-DCH	Enhanced Dedicated Channel	(transport channel)
FDD	Frequency Division Duplex	(operation mode)
GBR	Guaranteed Bit Rate	(parameter)
HARQ	Hybrid Automatic Repeat Request	(function)
HSDPA	High Speed Downlink Packet Access	(concept)
IE	Information Element	(protocol)
RNC	Radio Resource Controller	(network element)
RG	Rate Grant	(L1 message)
RR	Rate Request	(L1 message)
SPI	Scheduling Priority Indicator	(parameter)
SRNC	Serving RNC	(network element)
TrCH	Transport Channel	
UE	User Equipment	(user device)

Claims

1. Method for configuring a radio uplink (136) from user equipment (160) to a network element (132), comprising the steps of:

sending an information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages on an interface (133, 134) between the network element and a radio network controller (130) for said configuring the radio uplink,

configuring the radio uplink at the network element after signalling between the network element and the user equipment, and

sending a payload packet from the user equipment to the network element over the radio uplink after the uplink is configured at the network element for sending the payload packet to the radio network controller.

2. The method of claim 1, further comprising the steps of:

acknowledging correct reception of the payload packet at the network element on a radio downlink from the network element to the user equipment, and

sending the payload packet from the network element to the radio network controller following said correct reception from the user equipment.

3. The method of claim 1, further comprising the step of sending the information element on an interface (140, 150) between the radio network controller (130) and another radio network controller (100) for relay to another network element (110) for configuring an uplink between the other network element and the user equipment.

4. A mobile telecommunications system, comprising:

a network element (132) and a radio network controller (130) connected by a signalling interface (133, 134) for configuring a radio uplink (136) from a user equipment (160) to the network element (132), the interface for conveying messages having information elements containing parameters characterized in that

an information element having a cell specific parameter, a radio link specific parameter, or both is conveyed in one or more messages on the interface (133, 134) between the network element (132) and the radio network controller (130) for said configuring the radio uplink at the network element after signalling between the network element and the user equipment, and that

a payload packet is sent from the user equipment to the network element over the radio uplink after the uplink is configured at the network element for sending the payload packet to the radio network controller.

5. The system of claim 4, further characterized in that reception of the payload packet is acknowledged by the network element on a radio downlink (135) from the network element to the user equipment, and that

the payload packet is sent from the network element to the radio network controller following reception from the user equipment.

6. The system of claim 5, further characterized in that the information element is sent on an interface (140, 150) between the radio network controller (130) and another radio network controller (100) for relay to another network element 110.

7. A data structure for at least temporary storage in a computer readable medium, the data structure comprising an information element having a cell specific parameter, a radio link specific parameter, or both for transfer in one or more messages on an interface (133, 134; 120, 122) between a network element (132; 110) and a radio network controller (130; 100) for configuring a radio uplink from a user equipment (160) to the network element (132; 110) wherein said configuring is carried out at the network element for enabling transmission of a payload packet from the user equipment to the network element over the radio uplink and from there to the radio network controller.

8. The data structure of claim 7, characterized in that transmission of the payload packet from the user equipment to the network element is followed by acknowledgement of correct reception of the payload packet by the network element on a radio downlink from the network element to the user equipment and transmission of the payload packet from the network element to the radio network controller.

9. Radio network controller (130) for configuring a radio uplink (136) from user equipment (160) to a network element (132), comprising:

a first interface (133, 134) for communicating an information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages on the first interface (133, 134) between the network element (132) and the radio network controller (130) for said configuring the radio uplink; and

a second interface (140, 150) for communicating the information element having a cell specific parameter, a radio link specific parameter, or both in the one or more messages on the second interface (140, 150) between the radio network controller (130) and a second radio network controller (100) connected (120, 122) to a second network element (110), wherein the information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages is for configuring a second radio uplink (180) between the second network element (110) and the user equipment (160), the first radio network controller (130) for receiving a payload packet from the network element (132) over the first interface (133, 134), the second radio network controller (100) for receiving the payload packet from the second network element (110) after receipt by the second network element (110) from the user equipment over the second radio uplink (180), the second network element (100) for sending the payload packet received from the second network element (110) to the radio network controller (130) following the reception by the second network element from the user equipment (160) for transfer from the second network controller (100) to the first network controller (130).

10. Network element (132; 110) for receiving an uplink channel on a radio link (136; 180) from user equipment (160) to the network element, comprising:

a non-radio interface (133, 134; 120, 122) for communicating an information element having a cell specific parameter, a radio link specific parameter, or both in one or more messages between the network element and a radio network controller (130; 100) for configuring the uplink channel on the radio link; and

a radio interface for communicating signalling relating to said configuring the uplink channel between the network element and the user equipment and for receiving a payload packet from the user equipment to the network element over the radio uplink after the configuring the uplink channel on the radio link is carried out by the network element, wherein the non-radio interface (133, 134; 120, 122) is for conveying the payload packet from the network element to the radio network controller (130; 100) following the reception by the network element (132;110) from the user equipment (160).

11. User equipment (160) for communicating packets on an enhanced uplink from (136,180) from the user equipment to a network element (132, 110), the user equipment having a transmitter (192) and a receiver (190) together connected to an antenna for transmitting and receiving signals over a radio interface between the user equipment and the network element wherein the user equipment also includes a control (194) for processing signalling between the network element and the user equipment for configuring a radio uplink (136) from user equipment (160) to a network element (132), wherein an information element is sent having a cell specific parameter, a radio link specific parameter, or both in one or more messages on an interface (133, 134) between the network element and a radio network controller (130) for the configuring the radio uplink,

wherein the radio uplink is configured at the network element, the user equipment, or both, after signalling between the network element and the user equipment, and wherein a payload packet is sent from the user equipment to the network element over the radio uplink after the uplink is configured and then sent from the network element to the radio network controller.

12. A data structure for at least temporary storage in a computer readable medium, the data structure comprising an information element having a cell specific parameter, a radio link specific parameter, or both for transfer in one or more messages on an interface (136, 138; 170, 180) between a network element (132; 110) and a user equipment (160) for configuring a radio uplink from the user equipment to the network element (132; 110) wherein said configuring is carried out at the network element, the user equipment, or both, for enabling transmission of a payload packet from the user equipment to the network element over the radio uplink and from there to the radio network controller.

13. The data structure of claim 12, characterized in that transmission of the payload packet from the user equipment to the network element is followed by acknowledgement of correct reception of the payload packet by the network element on a radio downlink from the network element to the user equipment and transmission of the payload packet from the network element to the radio network controller.

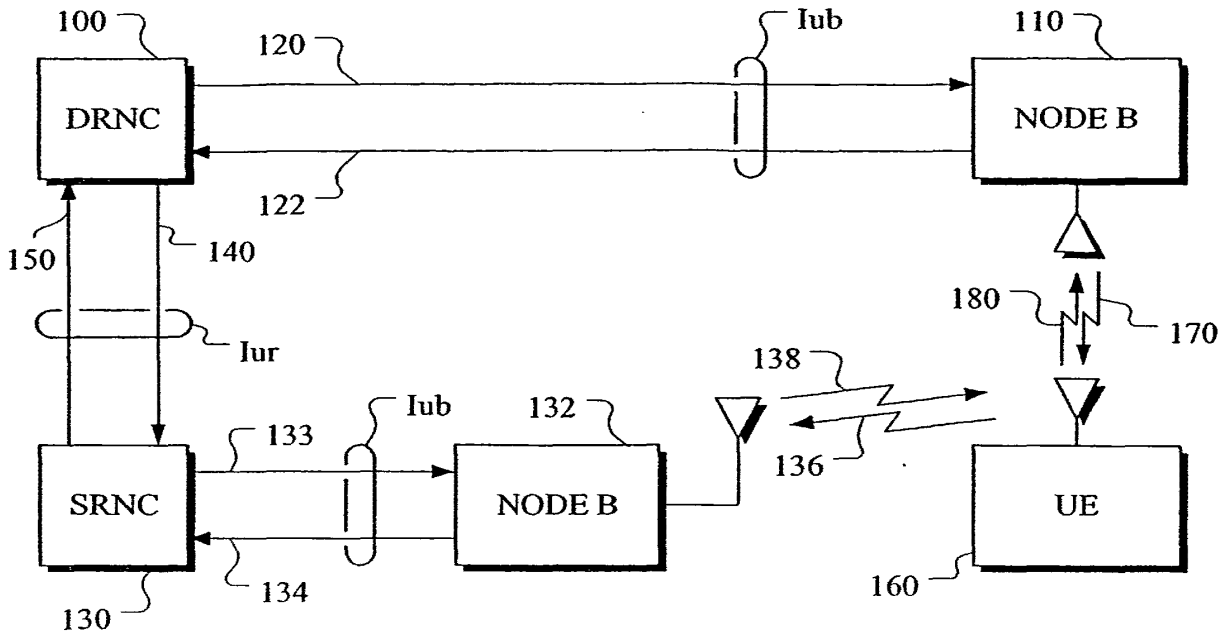


FIG. 1

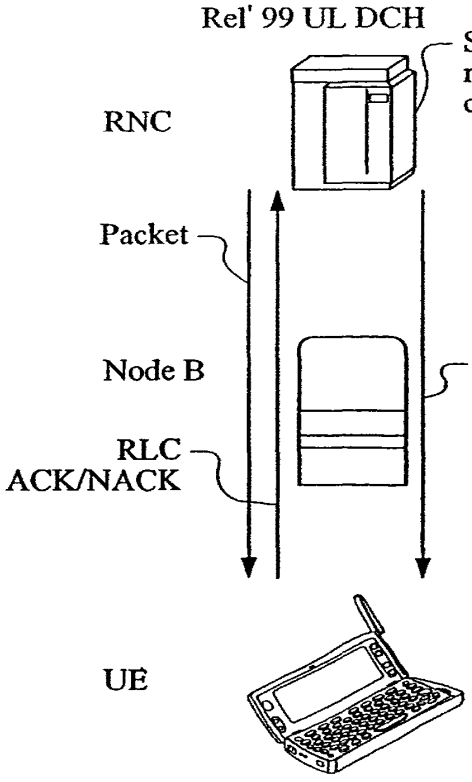


FIG. 2
PRIOR ART

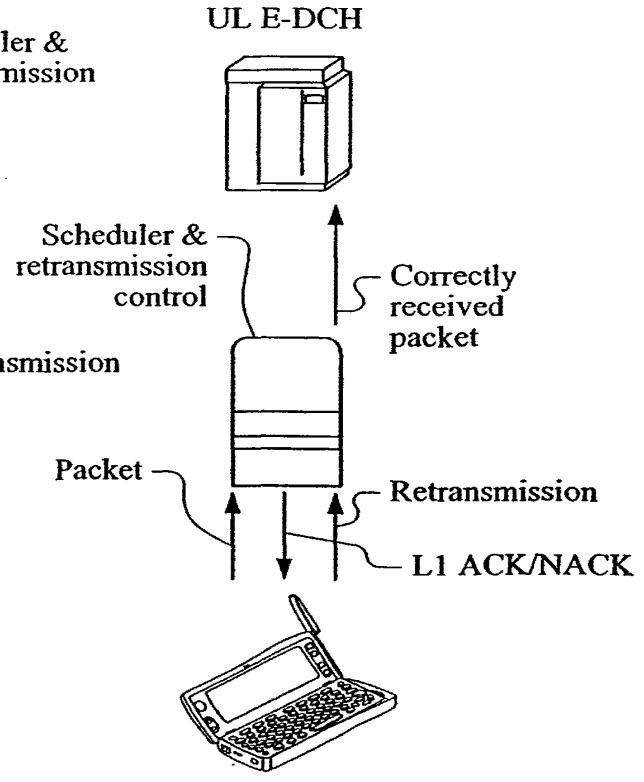


FIG. 3

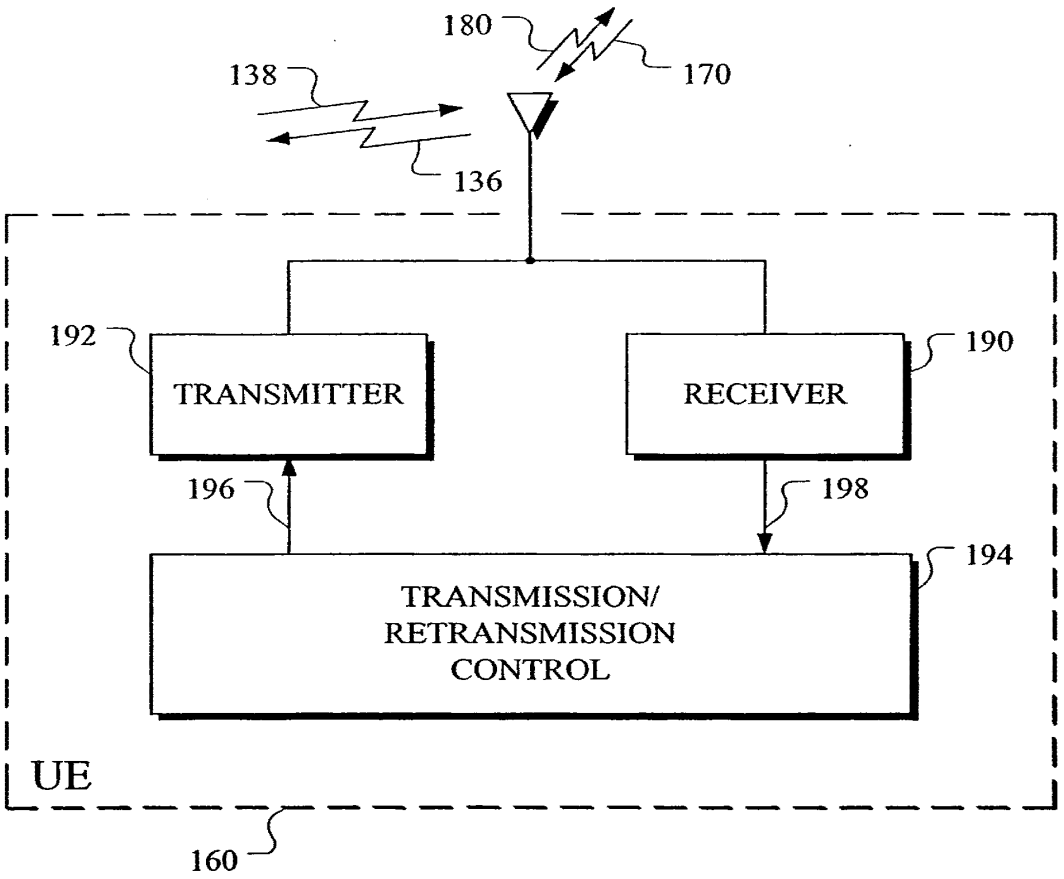

180
170
138
136
192
TRANSMITTER
190
RECEIVER
196
198
194
TRANSMISSION/
RETRANSMISSION
CONTROL
UE
160

FIG. 4

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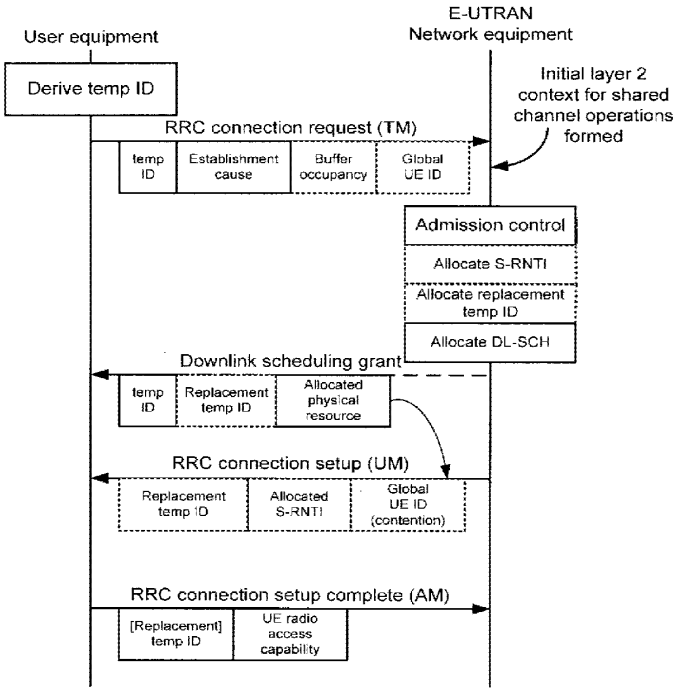
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[Continued on next page]

(54) Title: INITIAL CONNECTION ESTABLISHMENT IN A WIRELESS COMMUNICATION SYSTEM



Scheduled downlink connection procedure

(57) Abstract: A method, user equipment, network equipment and a system for initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between user equipment and network equipment comprising: processing a UE-derived temporary identifier; determining a set of channels that the user equipment will monitor; implicitly or explicitly communicating this channel set; communicating the temporary identifier as an identifier to the network equipment; communicating a downlink message on a channel belonging to the determined channel set conveying the temporary identifier and a description of a scheduled resource on a shared channel, the scheduled resource comprising a resource allocated to the user equipment by the network equipment; and communicating data on the scheduled resource in response to the downlink message.

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INITIAL CONNECTION ESTABLISHMENT IN A WIRELESS COMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to wireless communication technology, and more particularly to an initial connection procedure between user equipment and network equipment in a wireless communication system.

Description of the Related Art.

In wireless communication systems there is the need for a logical connection between a mobile station (also referred to as user equipment (UE), a user terminal, a mobile terminal, a wireless data terminal and a cellular phone) and radio access network. The radio access network may comprise one or more base stations (also referred to as a Node B, for example in 3GPP nomenclature) together with one or more radio network controllers (RNCs). The logical connection provides a context for a particular network to UE communication link over which data may be transferred without miscommunication of the data to network elements or UEs in the system that are not intended to take part in the communication.

In the radio access network system defined by 3GPP, the logical connection between the user terminal and the radio access network is defined by radio resource control (RRC) connection states. Two of the main RRC connection states are defined as RRC connected and RRC idle.

If there is a logical connection between the user terminal and the radio access network, then the user terminal is said to be in RRC connected state. The existence of a user terminal in RRC

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connected state can be determined within a cell or multiple cells. Therefore, the radio resources for a particular user terminal can be managed efficiently by the wireless network. In contrast to RRC connected state, a user terminal in RRC idle state has no logical connection to the wireless access network. Thus, the user terminal in RRC idle state can only be determined within the core network or area that is larger than the cell, such as a location area or routing area.

When the user terminal is initially switched on by the user, a public land mobile network (PLMN) is selected and the user terminal searches for a suitable cell to be camped on to and remains in RRC idle state in the corresponding cell. An initial RRC connection may be initiated either by the network or by the user equipment. For example, in the case of a UE initiated connection for a UE in the RRC idle state, the UE requires an initial connection to the network and sends a RRC connection request message to the network. By means of a further example, in the case of a network initiated connection, an RRC connection request message may also be sent by the UE in response to receipt of a paging message from the network (the network having sent the paging message to the UE to illicit the commencement of an RRC connection procedure).

There are thus a number of reasons for RRC connection request by the UE. For example: (1) Initial cell access: when the UE attempts to make a call, the UE needs to establish an RRC connection; (2) Paging response: when transmitting a response message to a paging message; (3) Cell update: when the UE selects a suitable cell while in idle mode; (4) UTRAN Routing Area (URA) update: when the UE selects a suitable URA while in idle mode; and (5) Multimedia Broadcast and Multicast (MBMS) connection: in

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order to receive MBMS service and request for MBMS point-to-point connection.

In the conventional RRC connection procedure, the user terminal initiates the connection procedure by transmitting a RRC connection request message to the network using common uplink transport channels. The common uplink transport channels are shared by a plurality of UEs and are used for non-scheduled data transmission.

The network considers the connection request and may return on downlink either an RRC connection setup message (in the event of a successful admission) or an RRC connection reject message (in the event of an unsuccessful admission). In both cases the message is sent using common downlink transport channels which are (similar to the uplink common channels) shared by a plurality of UEs and used for non-scheduled data transmission.

The common transport channel over which messages from the user terminal to the network are transmitted during this initial RRC connection phase are termed random access channels. Random access transmission may similarly be referred to as unscheduled transmissions, as no explicit scheduling or coordination of the transmissions is carried out. Due to this lack of explicit coordination, there exists a probability that one mobile will transmit using the same uplink transmission resources or uplink identity as another user. In this instance, the communication reliability of both transmissions may be compromised due to the mutual logical or actual interference the uplink messages generate at the receiving base station. These cases, in which more than one mobile transmits on a defined set of uplink resources, may be referred to as collisions.

A further description of collisions, unscheduled access and scheduled access may be found in U.S. Patent Application No. 11/263,044, filed on October 31, 2005, titled "FREQUENCY DOMAIN UNSCHEDULED TRANSMISSION IN A TDD WIRELESS COMMUNICATIONS SYSTEM" to inventor Nicholas W. ANDERSON, and which is hereby incorporated by reference.

The common downlink transport channels used to convey the corresponding messages from the network to the user terminal are termed forward access channels (FACH).

System resources are typically reserved for these uplink and downlink common transport channels. The radio resources used for common channels are typically separated from the radio resources used for other transport channels. Examples of other types of transport channel comprise dedicated transport channels and shared transport channels. In the case of dedicated transport channels the data is mapped to a sub-set of the total radio resources assigned on a long term basis to a particular user or connection. Conversely, in the case of shared channels, the data for each user is more dynamically mapped to a part of a pool of radio resources assigned within the set of total radio resources under control of a resource scheduler located typically within the MAC layer (layer 2) of the network. The radio resource in this instance is thus shared amongst users and is arbitrated by the scheduler. This is to be contrasted against the case for common channels in which the users share the radio resource but in a non-scheduled manned.

The use of shared channels only can provide benefits in terms of system capacity when compared to the use of multiple channel types within the system (such as mixtures of common, shared and dedicated types) wherein each is assigned for a particular traffic type. This is because, by multiplexing all traffic types

onto only shared channels, the scheduler can dynamically adapt the resources assigned to the varying instantaneous loads presented by each traffic type. In contrast, if for example we assign one traffic type exclusively to common channels and another traffic type exclusively to shared channels, then variations in the traffic loads offered by each traffic type cannot be accommodated without reconfiguring the respective portions of the total radio resource space assigned firstly to common and secondly to shared channels. This reconfiguration of radio resources is typically a slow process and the system is therefore unresponsive to fast variations in load. A consequence of this is that in current systems, the fraction of the total radio resource space assigned to common channels often has to be designed with a worst-case consideration in mind and radio resource usage efficiency is therefore suboptimum.

Following a conventional RRC connection establishment procedure, the existence of the UE is known by the network and a shared channel address or UE ID may then be assigned by the network only at the completion of the connection establishment procedure. Therefore, shared channels may only be used after the normal RRC connection procedure has been accomplished using the common channel procedures. A significant portion of the total radio resource space must therefore be pre-assigned to the common channels to carry the connection establishment traffic. The user terminal specific layer 2 connection context used for the shared channel operation can only be established at the completion of the RRC connection procedure.

In addition, known wireless communication systems expend a substantial amount of time and exchange a number of signaling messages on unshared and common channels to establish an initial layer 2 context for shared channel operations and this can

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contribute to communication delay. Furthermore, the existence of a plurality of channel types and associated protocols, procedures and attributes can significantly increase system implementation complexity.

For the abovementioned reasons, an improvement to the initial system access and RRC connection procedure is desirable in order to improve radio resource usage efficiency, to reduce communication delay and to simplify system implementation complexity.

BRIEF SUMMARY OF THE INVENTION

Some embodiments of the present invention provide a prompt establishment of a layer 2 shared channel context by allowing the UE to derive its own layer 2 address as a temporary identifier until the network decides to replace the UE-derived temporary identifier with a network selected identifier and allowing the UE to communicate a set of channels that it will monitor for downlink messages from the network. This combination enables the system to utilize shared channels in lieu of common channels at a very early stage of the connection establishment, helps to minimizes the volume of traffic carried on common channels and also assists in conflict avoidance.

Some embodiments of the present invention provide for a method of initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between user equipment and network equipment, the method, by the user equipment, comprising: deriving a temporary identifier; deriving a channel set; transmitting an initial message to the network equipment, the initial message comprising the temporary identifier; receiving a downlink message on a channel belonging to the derived channel set conveying the

temporary identifier and a description of a scheduled resource on a shared channel, the scheduled resource comprising a resource allocated to the user equipment by the network equipment; and communicating data on the scheduled resource in response to the downlink message.

Some embodiments of the present invention provide for one or more of the following options in various combinations: the channel set comprises multiple channels; the deriving of the channel set comprises randomly selecting the channel set from a plurality of channel sets; the deriving of the channel set comprises determining the channel set based on a global UE identifier, for example, wherein the global UE identifier comprises one of a temporary mobile subscriber identity (TMSI), an international mobile subscriber identity (IMSI), or an international mobile equipment identity (IMEI); the deriving of the channel set comprises determining the channel set as a function of one or more characteristics of a physical resource, and wherein the transmitting of the initial message comprises transmitting the initial message on the physical resource, for example, wherein the characteristic of the physical resource comprises one or more of a parameter of time, a parameter of frequency, and/or a parameter of a code; the deriving of the channel set comprises determining the channel set based on one or more of a characteristic of a physical resource, a global UE identifier, and the temporary identifier; the initial message further comprises a global UE identifier; further comprising determining a physical resource and wherein the transmitting of the initial message comprises transmitting the initial message in accordance with the determined physical resource; further comprising signaling an indication of the channel set; further comprising implicitly communicating an indication of the channel set; the transmitting of the initial message to the network equipment

comprises transmitting a scheduling request message; the transmitting of the initial message to the network equipment comprises transmitting an RRC connection request message; further comprising: timing out after the transmitting the initial message and before the receiving of the downlink message; determining a different physical resource; and retransmitting the initial message on the different physical resource; and/or wherein the wireless communication system comprises an evolved UMTS Terrestrial Radio Access Network (E-UTRAN).

Some embodiments of the present invention provide for user equipment used in initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between the user equipment and network equipment, the user equipment comprising: a memory; a processor coupled to the memory; and program code executable on the processor, the program code operable for: deriving a temporary identifier; deriving a channel set; transmitting an initial message to the network equipment, the initial message comprising the temporary identifier; receiving a downlink message on a channel belonging to the derived channel set conveying the temporary identifier and a description of a scheduled resource on a shared channel, the scheduled resource comprising a resource allocated to the user equipment by the network equipment; and communicating data on the scheduled resource in response to the downlink message.

Some embodiments of the present invention provide for one or more of the following options in various combinations: the deriving of the channel set comprises randomly selecting the channel set from a plurality of channel sets; the deriving of the channel set comprises determining the channel set as a function of one or more characteristics of a physical resource, for example time,

frequency and code, and wherein the transmitting of the initial message comprises transmitting the initial message on the physical resource; the transmitting of the temporary identifier to the network equipment includes transmitting the temporary identifier within a first uplink message containing the temporary identifier and a request for the scheduled resource; the deriving of the channel set comprises determining the channel set based on one or more of a characteristic of a physical resource, a global UE identifier, and the temporary identifier; the program code is further operable for determining a physical resource and wherein the transmitting of the initial message comprises transmitting the initial message in accordance with the determined physical resource; and/or the program code is further operable for signaling an indication of the channel set, for example, wherein the program code is further operable for implicitly communicating an indication of the channel set.

Some embodiments of the present invention provide for network equipment used in initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between user equipment and the network equipment, the network equipment comprising: a memory; a processor coupled to the memory; and program code executable on the processor, the program code operable for: receiving an initial message sent by the user equipment; determining a channel set; allocating a scheduled resource to the user equipment, the scheduled resource comprising a resource on a shared channel; transmitting a downlink message on a channel belonging to the determined channel set, the downlink message conveying the temporary identifier and a description of the scheduled resource; and communicating data on the scheduled resource in response to the downlink message.

Some embodiments of the present invention provide for: determining the channel set wherein the determining the channel set comprises extracting a channel indication from the initial message, the channel indication indicating the channel set; or determining the channel set wherein the determining the channel set comprises determining the channel set from the physical resource carrying the initial message.

Some embodiments of the present invention provide for a computer program product comprising program code for initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between user equipment and network equipment, the computer program product comprising program code for: deriving a temporary identifier; deriving a channel set; transmitting an initial message to the network equipment, the initial message comprising the temporary identifier; receiving on a downlink channel belonging to the derived channel set a downlink message conveying the temporary identifier and a description of a scheduled resource on a shared channel, the scheduled resource comprising a resource allocated to the user equipment by the network equipment; and communicating data on the scheduled resource in response to the downlink message.

Other features and aspects of the invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings which illustrate, by way of example, the features in accordance with embodiments of the invention. The summary is not intended to limit the scope of the invention, which is defined solely by the claims attached hereto.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIGURES 1A and 1B show a conventional sequence of messages for transitioning from an RRC idle state to an RRC connected state in a conventional UMTS system.

FIGURES 2, 3A and 3B compare a UTRAN network and an evolved UTRAN (E-UTRAN) network operating with user equipment (UEs) and a core network (CN).

FIGURES 3A and 3B illustrate an evolved UTRAN (E-UTRAN) network operating with user equipment and a core network in accordance with the present invention.

FIGURE 4 shows components of user equipment in accordance with the present invention.

FIGURES 5A and 5B show initial signaling sequences in accordance with the present invention.

FIGURES 6A and 6B show detailed signaling sequences using a scheduled downlink in

FIGURES 7A and 7B show detailed signaling sequences using a scheduled downlink and both non-scheduled and scheduled uplink in accordance with the present invention.

FIGURES 8A and 8B show detailed signaling sequences using a scheduled downlink and a

FIGURES 9 and 10 illustrate processes of contention resolution in accordance with the present invention.

FIGURES 11 and 12 illustrate processes of contention avoidance and resolution using multiple scheduling grant channels in accordance with the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

In the following description, reference is made to the accompanying drawings which illustrate several embodiments of the present invention. It is understood that other embodiments may be utilized and mechanical, compositional, structural, electrical, and operational changes may be made without departing from the spirit and scope of the present disclosure. The following detailed description is not to be taken in a limiting sense, and the scope of the embodiments of the present invention is defined only by the claims of the issued patent.

Some portions of the detailed description which follows are presented in terms of procedures, steps, logic blocks, processing, and other symbolic representations of operations on data bits that can be performed on computer memory. A procedure, computer executed step, logic block, process, etc., are here conceived to be a self-consistent sequence of steps or instructions leading to a desired result. The steps are those utilizing physical manipulations of physical quantities. These quantities can take the form of electrical, magnetic, or radio signals capable of being stored, transferred, combined, compared, and otherwise manipulated in a computer system. These signals may be referred to at times as bits, values, elements, symbols, characters, terms, numbers, or the like. Each step may be performed by hardware, software, firmware, or combinations thereof.

Though the following figures illustrate the invention with reference to a conventional Universal Mobile Telecommunications System (UMTS system), embodiments of the invention may apply to other wireless radio systems as well. A conventional UMTS system usually includes multiple user equipment (UE), which are sometimes referred to as user terminals, mobile stations, mobile

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terminals, wireless data terminals and cellular phones. The conventional UMTS system also includes network equipment including a Node B, also referred to as a base station, which provides a radio access connection between the UEs and the network, and also including a radio network controller (RNC).

FIGURES 1A and 1B show a conventional sequence of messages for transitioning from a radio resource connection (RRC) idle state to an RRC connected state in a conventional UMTS system. In a conventional UMTS system, a UE in an RRC idle state may initiate an RRC connection through a procedure as indicated in FIGURES 1A and 1B. The UE and network may exchange messages over logical control channels where each logical control channel is mapped to a common transport channel.

Figure 1A shows the messaging exchanged over the air interface (Uu). The first message shown is the RRC connection request message, which includes the network-known UE identifier, shown as a global UE identifier (ID) and an establishment cause. The network-known UE identifier may be one of the network assigned temporary mobile subscriber identity (TMSI), the UE's international mobile subscriber identity (IMSI), or the UE's international mobile equipment identity (IMEI). The establishment cause indicates the reason for the UE requesting a connection with the network. A UE may request a connection when transmitting a response message to a paging message (paging response), when selecting a suitable cell while in idle mode (cell update), when selecting a suitable URA while in idle mode (URA update), and when receiving MBMS service or an MBMS point-to-point connection (MBMS connection).

Next, the network performs admission control and allocates Radio Network Temporary Identifier (RNTI) values. The network uses an admission control process to determine whether a requested

service from the establishment cause can be supported by the network. Factors considered when performing admission control may include mobile access class for determining privileges, the Radio Resource Management status (RRM status) to determine availability of resources, details of the user's subscription, and equipment registers including lists of valid and stolen terminals.

The allocation of the RNTI values involves the network allocating a Serving Radio Network Controller (RNC) RNTI (S-RNTI), which is used by UE to identify itself to the serving RNC. The S-RNTI is also used by the SRNC to address the UE. An S-RNTI value is allocated by the Serving RNC to each UE having an RRC connection and is unique within the Serving RNC. The S-RNTI may be reallocated after the Serving RNC for the RRC connection has changed. The S-RNTI may be concatenated with an SRNC identifier (SRNC ID) received in a broadcast channel to form a unique RNTI (U-RNTI) within UTRAN. Optionally, the network may allocate a Cell Radio Network Temporary Identifier (C-RNTI). The C-RNTI may be allocated and used on common transport channels. The C-RNTI value may be used to identify the UE on a cell basis. In a conventional network, the decision to use the C-RNTI is made by the Controlling Radio Network Controller (CRNC).

After the network equipment performs a successful admission control process and allocation process, the network responds to the RRC connection request message with an RRC connection setup message including the global UE ID, the newly-allocated S-RNTI value, optionally a C-RNTI value, and a radio bearer configuration.

Once the RRC connection setup message is processed by the UE, the UE responds with an RRC connection setup complete message. The RRC connection setup complete message is accompanied by the C-

RNTI value in a header field and includes the UE radio access capability. At this point, the UE enters an RRC connected state.

In response to receiving the RRC connection setup complete message, and if the high speed downlink shared channel (HS-DSCH) is to be used for downlink data transfer, the network may allocate an H-RNTI value to the UE within an RRC radio bearer setup message to the UE. The H-RNTI value is used to identify the UE on the high speed downlink shared channel. The RRC radio bearer setup message includes the allocated S-RNTI, the allocated H-RNTI and a shared channel radio bearer configuration. The UE completes the process by responding with an RRC radio bearer setup complete message. At this point, the UE and network have established a layer 2 context for shared channel operations.

FIGURE 1B shows elements of the UE and network equipment and the messaging between these elements. The UE includes a layer 3 comprising an RRC layer, a layer 2 comprising a Radio Link Control (RLC) layer and a medium access control (MAC) layer, and a layer 1 comprising a physical layer (L1). The Node B includes a layer 1 physical layer (L1). The RNC includes a layer 2 comprising a MAC layer and an RLC layer, and a layer 3 comprising an RRC layer and an RRM layer. Note additional layer 1 functions also exist in both the Node B and the RNC to provide physical connections between these entities (lub interface) although these are not shown for diagrammatical clarity. The RRC connection request message is initiated by the RRC layer in the UE. The RRC sends a message to the RLC layer which sends the RRC connection request message a common control channel (CCCH) mapped onto a random access channel (RACH) using an RLC transparent mode (TM). When using a transparent mode (TM) the message sender does not include a message sequence identifier unlike acknowledged mode (AM) and unacknowledged mode (UM), which both include a message

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sequence identifier that may be used for identifying/reordering out of sequence packets and for identifying missing packets. The acknowledged mode (AM) additionally provides for message retransmission. The CCCH is a common logical control channel between the RLC and MAC layers and the RACH is a common transport channel between the MAC and L1 layers. The RRC connection request message is transmitted over the air interface (Uu) to the network.

Upon receipt of the RRC connection request message, the Node B's layer 1 sends the message on a Random Access Channel (RACH) channel to the MAC layer of the RNC. The RACH channel is a common uplink transport channel used to carry control and data information from a UE over random access physical resources which may be shared by a plurality of UEs and are used for unscheduled data transmission. The MAC layer sends the message to the RLC layer over a CCCH channel. In turn, the RLC layer sends the message to the RRC layer, which sends the message to the RRM layer for admission control, allocation of the S-RNTI value, and optional allocation of the C-RNTI value.

After successful admission control and allocation of the S-RNTI value, the RRM returns the allocated S-RNTI value to the RRC layer, which forms the RRC connection setup message to be sent in an unacknowledged mode (UM). A C-RNTI, which identifies the UE within the cell, is also typically allocated. However, if a dedicated physical channel connection is to be immediately configured, the C-RNTI may be omitted. The RRC sends the RRC connection setup message to the RLC layer. The RLC layer sends the message over a CCCH channel to the MAC layer. CCCH is used because a common RNTI context does not yet exist between the network and the UE. That is, the network knows the RNTI values but the UE does not know the RNTI values at this stage. The MAC

layer sends the message over a Forward Access Channel (FACH). The FACH channel is a common downlink transport channel that may be used to carry control and data information to the UE when the network knows the location cell of the UE. The FACH may be shared by a plurality of UEs for unscheduled downlink data transmission. The Node B layer 1 transmits the message to the UE over the air interface (Uu).

Unfortunately, each UE monitoring the FACH channel decodes each and every RRC connection setup message and other messages in order to determine whether the enclosed message was addressed to it. Upon receipt of the RRC connection setup message by the UE, the UE's layer 1 sends the message over a FACH channel to its MAC layer, which sends the message over a CCCH channel to the RLC layer, which in turn sends the message to the RRC layer of the UE. The UE RRC layer may then inspect the global ID field contained within the connection setup message to determine whether or not it matches the UE's own global ID. If not, the message is discarded. If the IDs match, the message is decoded and the UE registers the assignment of the S-RNTI and possibly the C-RNTI values. At this point, the UE now has a dedicated control channel (DCCH) allocated to it.

Next, the UE responds using the RRC connection setup complete message, which is sent using an acknowledge mode (AM) to the network. The RRC layer sends a message to the RLC layer, which uses the DCCH channel to send the RRC connection setup complete message to the MAC layer. The MAC layer sends the message on a RACH (common transport) channel to the physical layer (L1), which transmits the message over the air interface (Uu) to the Node B. Data sent on DCCH on common transport channel resources is accompanied by a header field in which the C-RNTI is contained to distinguish the UE on a cell basis from the plurality of other

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UEs using the RACH (common transport) channel in that cell. For data sent on dedicated or shared transport channels, no C-RNTI is required in the header since user identification/addressing is accomplished at the physical resource level (the mapping between physical resource and user terminal is known at the physical layer). Once the UE has communicated the RRC connection setup complete message, the UE enters an RRC connected state.

Next, the Node B receives the RRC connection setup complete message over the air interface (Uu). Its layer 1 sends the message to the RNC's MAC layer using a RACH channel. The MAC layer reads the header (containing the C-RNTI) and sends the message to the appropriate RLC entity using the appropriate DCCH channel. The RLC sends the message to the RRC layer.

The network uses another value to identify a UE when the UE communicates over a high speed-downlink shared channel (HS-DSCH). This value is allocated by the RRC layer and is designated the HS-DSCH RNTI (H-RNTI) value. The H-RNTI value is used as a temporary identifier while the UE is has an established connection over the HS-DSCH channel. The network sends the allocated H-RNTI value to the UE within a Radio Bearer Setup message using a DCCH channel between the RLC and MAC layers, and a FACH channel between the MAC layer and the UE's layer 1. The Node B transmits the message over the air interface (Uu) to the UE. The UE's layer 1 sends the message over a FACH channel to its MAC layer, which sends the message to the RLC on a DCCH channel. The RLC sends the message to the RRC layer, which responds with an RRC radio bearer setup complete message sent to the network using an RLC acknowledged mode (AM). The channel path between the UE's RRC layer and the RNC's RRC layer replicates the channel path described above for signaling the RRC connection complete message.

Upon being allocated an H-RNTI, the UE may subsequently utilize the high speed (hs) downlink shared (transport) channel for downlink communication. Resource allocations for this channel are granted by a scheduler located in a MAC-hs entity in Node-B. The MAC-hs entity can address the UE within the cell when making high speed downlink shared channel allocations by using the H-RNTI as a UE identifier.

The MAC-hs entity is not shown in the figure as it does not take part in the connection setup procedure and associated messaging. Messaging used to establish the RRC connection is not conveyed on shared transport channels.

At this point, the UE and the network have established and formed a layer 2 shared channel context and the network has allocated a shared channel identifier to the UE. In forming this layer 2 context, the network allocated the identifier and exchanged three uplink messages and two downlink messages.

According to embodiments of the present invention, a UE derives a temporary identifier (temp ID) to promptly establish a layer 2 context for more immediate communication over shared transport channels. This more immediate layer 2 context can obviate the need for extensive communication over common transport channels and can avoid a need to reserve significant portions of the total available radio resources for common channels. Such an assignment is typically slow to reconfigure and hence is not responsive to rapid changes in traffic loads. If the UE derived temporary identifier is unique in the network during the duration of use, the UE may be uniquely identified on the shared channel and data may be communicated via dynamic assignment of shared channel resources rather than via statically-assigned common resources as is the case in conventional systems. Additionally,

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the network may update the UE derived temporary identifier during or subsequent to the RRC connection process.

FIGURES 2, 3A and 3B compare a UTRAN network to an evolved UTRAN (E-UTRAN) network operating with user equipment (UEs) and a core network (CN) in accordance with the present invention.

FIGURE 2 shows multiple UEs and UTRAN network equipment. The UTRAN network equipment provides a link for the UE to the core network. The UTRAN network equipment, also referred to as a Radio Access Network (RAN), includes one or more Radio Network Subsystem (RNS). Each RNS includes a Radio Network Controller (RNC) and one or more Node Bs. For RRC signaling, the RNC provides RRM, RRC, RLC and MAC signaling layers and the Node B provides layer 1.

FIGURE 3A shows an architecture to implement the invention in accordance with some embodiments of the present invention. An evolved UTRAN (E-UTRAN) network provides a long term evolution (LTE) platform to simply the UTRAN architecture and reduce the number of interfaces between components. The "evolved" and "E-" designation may be used to distinguish conventional components or elements that may be similar to the corresponding components or elements of the present invention. The E-UTRAN network provides a link for the UE to communicate with the core network (CN). The E-UTRAN includes an LTE gateway (LTE GW) coupled to one or more evolved Node Bs (E-Node Bs), which perform functions of both the Node B and the RNC of FIGURE 2. The LTE gateway provides an interface between the core network and the E-Node Bs. For RRC signaling, the E-Node B provides RRM, RRC, RLC, MAC and L1 signaling layers. Here, the "evolved" and "E-" designations have been omitted from some labeled components within the E-UTRAN network for brevity purposes.

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FIGURE 3B shows an alternate architecture for an E-UTRAN network. The LTE gateway provides an interface between the core network and the E-Node Bs and also provides RRM and RRC layers for RRC signaling. In this architecture, the E-Node B provides RLC, MAC and L1 signaling layers.

The embodiments of FIGURES 3A and 3B provide a MAC layer and an RLC layer collocated with the layer 1 processing, which aides in reducing signaling latencies. FIGURE 3A shows the collection of each of the layers used during the RRC connection establishment procedure, which further assists with reducing signal latencies.

FIGURE 4 shows components of user equipment in accordance with the present invention. User equipment comprises a memory for holding the UE-derived temporary identifier, a processor, program code executable to derive the UE-derived temporary identifier and store the identifier into the memory, and a transceiver to communicate with the E-UTRAN network equipment. The memory may be volatile memory such as RAM or non-volatile memory such as flash (EEPROM). The memory may be a component of the UE's circuitry or may be on a smart card installed in the UE's housing. The processor may be a reduced instruction set computer (RISC), a general processor, a specialized processor, a gate-logic implemented processor, or the like. The program code may be executable machine code, object code, scripts or other computer interpreted or compiled code. The program code may be compressed or uncompressed and may be encoded or not coded. The transceiver may be a code division multiple access (CDMA) transmitter/receiver pair operating in either a time division duplex (TDD) scheme or frequency division duplex (FDD) scheme.

FIGURES 5A and 5B show initial signaling sequences in accordance with the present invention. In each figure, the UE first derives a temporary identifier (temp ID). The process of deriving a

temporary identifier may vary among different implementations of the present invention. Derivation of a temporary identifier provides an immediate layer 2 context for layer 2 messaging over shared transport channels which are scheduled by the E-MAC entity in E-Node B. Derivation of a temporary identifier preferably occurs in a manner to minimize the probability to an acceptable level of two UEs deriving the same temporary identifier. If two UEs derive the same temporary identifier within a cell and attempt to use these during an overlapping period of time, additional collision detection and recovery procedures may be implemented.

In some embodiments of the present invention, a UE derives a temporary identifier by forming the temporary identifier from a portion of a network-known UE identifier. The network-known UE identifier may be one of the network assigned temporary mobile subscriber identity (TMSI), the UE's international mobile subscriber identity (IMSI), or the UE's international mobile equipment identity (IMEI). The UE may use a predetermined number of the lower significant bits of the TMSI, IMSI or IMEI. For example, if the TMSI is available, a UE may derive the temp ID by using the lower 16 bits of a 32-bit TMSI. If the TMSI is not available, the UE may use the lower 16 bits of its 32-bit IMSI. If neither the TMSI nor IMSI is available, the UE may use the lower 16 bits of its 32-bit IMEI.

In some embodiments of the present invention, a UE derives a temporary identifier by selecting the temporary identifier from a plurality of temporary identifiers. The plurality of temporary identifiers may comprise a subset of possible values of common bit length. For example, the plurality of temporary identifiers may include $1/8^{th}$ of the possible permutations of 16 bits. A network may re-allocate a temporary identifier by selection of a

value from the remaining 7/8th possible permutations in order to eliminate a possibility of potential conflict with future UE-derived values. The plurality of temporary identifiers may be in the form of a table stored in RAM or ROM. In some embodiments, the plurality of temporary identifiers is generated by the UE. In some embodiments, the plurality of temporary identifiers is signaled from the network to the UE. In some embodiments, an indication of the plurality of temporary identifiers is broadcast over a broadcast channel (BCH) from the network to the UE. In some embodiments, the plurality of temporary identifiers is saved in non-volatile memory.

In some embodiments the UE-derived temporary identifier may also be a function of time or radio frame number. The function may vary in accordance with a pre-determined pattern or one signaled to the UE for example over a broadcast channel (BCH). Alternatively the variation pattern may contain a random element in its derivation. The use of a time-varying component or a time parameter (such as the system clock, super frame number, radio frame number, sub-frame number, time slot number) by the user equipment when deriving the temporary identifier may advantageously assist in reducing the probability of two or more users selecting the same temporary identifier within a given time-frame.

After deriving the temporary identifier, the UE transmits this UE-derived temporary identifier to the E-UTRAN network in a first uplink message. An initial L2 shared channel context is formed as soon as the network has received the initial temporary identifier; at this stage both the UE and the network know the value of the temporary identifier. However, this connection may be subject to collision, and a more permanent connection (without

possibility for collision) may be formed once the network has reassigned a replacement temporary identifier.

Upon receipt of the temp ID, the network allocates a physical resource. An allocated physical resource describes the resources allocated to the UE such as would allow for the UE to correctly encode and transmit or receive and decode the data message. The description may include attributes such as: (1) an explicit or relational time of transmission; (2) description of a physical channel resources, such as codes, frequencies, sub-carriers, time/freq codes, and/or the like; (3) a formatting type of the data on the resources; and/or (4) FEC encoding type, block size, modulation format and/or the like.

This physical resource may be either an uplink resource (as shown in FIGURE 5A) or a downlink resource (as shown in FIGURE 5B). The network transmits a first downlink message to the UE including the UE-derived temporary identifier as a destination address and also including a description of the allocated physical resource. Next, the UE and network communicate user traffic data or signaling data (data) over the allocated physical resource.

FIGURE 5A shows data being communicated on an uplink scheduled, shared resource allocated by the network and described in the first downlink message. For uplink data, the UE can only transmit the data after the UE has received and processed the first downlink message containing the description of the allocated physical resource. The UE may initiate this sequence of deriving a temp ID and acquiring an uplink physical resource when the UE intends to send user traffic data or signaling data to the network.

FIGURE 5B shows data being communicated on a downlink scheduled, shared resource allocated by the network and described in the first downlink message. For downlink data, the UE can only receive and process the data after the UE has received and processed the first downlink message containing the description of the allocated physical resource. In some embodiments, the first downlink message is carried and received in a burst also containing the second downlink message. In this case, the UE processes the received burst to obtain the allocated physical resource. If the allocation indicates that the user traffic data or signaling data is contained in the same burst as the first downlink message containing the allocation, the UE may re-process the received burst to obtain the second downlink message.

A conventional system configures both common and shared channels. The segmentation of resources limits the efficient use of the combined resources. For example, if most traffic at a particular time uses common channels, then the shared channels are left idle. Conversely, if most traffic is using the configured shared channels, then the common channels are left under utilized.

In accordance with some embodiments of the present invention, a minimal set of resources may be assigned for unscheduled messages such as the first uplink message of FIGURES 5A and 5B. Uplink messages on this channel may be limited to short messages containing only the temp ID or alternatively containing the temp ID and an indication of what type of resource is being requested. Unscheduled downlink channels (e.g., FACH) may be removed from the configured channels since each UE initiates contact with the network using a layer 2 addressable temp ID. The remainder of the resources may be dynamically allocated between control channel message (e.g., the first downlink message) and user traffic data or signaling data (i.e., second downlink or uplink

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message). Such an allocation of resources provides a higher bandwidth system due to the more efficient use of resources.

As shown in FIGURES 6A and 6B, some embodiments of the present invention utilize a random access channel (RACH) for a first uplink message, a scheduled channel for downlink messages, and a common channel for subsequent uplink messages. As shown in FIGURES 7A and 7B, some embodiments of the present invention utilize a random access channel (RACH) for a first uplink message and scheduled channels for subsequent downlink and uplink messages. As shown in FIGURES 8A and 8B, some embodiments of the present invention utilize a random access channel (RACH) for an abbreviated initial uplink message and scheduled channels for subsequent downlink and uplink messages.

FIGURES 6A and 6B show detailed signaling sequences using a scheduled downlink in accordance with the present invention. A UE derives a temporary identifier and sends the temporary identifier in a first uplink message to the network. In addition to the temp ID, the first uplink message contains an establishment cause parameter and two optional parameters: buffer occupancy and a global UE ID. The establishment cause and the global UE ID may be the same or similar to the corresponding parameters described above with reference to FIGURE 1A.

The buffer occupancy may be used as an indication of the current pending data volume for transmission in the UE's transmission buffer and may be used by a scheduler at Node B to determine the extent of resources to grant for uplink transmission. The buffer occupancy could be a single bit, a range of quantized values, an absolute value in bytes, or a list of values, for example, one for each of a number of transmission flows, types or priority streams.

The UE may transmit the RRC connection request message using transparent mode (TM). Upon receipt of the RRC connection request message by the network equipment, the network performs admission control (described above with reference to FIGURE 1A) and allocates a physical resource: either an uplink shared channel (UL-SCH) or a downlink shared channel (DL-SCH) as indicated by the establishment cause parameter. Optionally, the network may also allocate an S-RNTI and a replacement temp ID.

The network transmits a first downlink message containing a downlink scheduling grant indication including the temp ID to address the particular UE and a description of the allocated physical resource. The first downlink message may be transmitted on a shared physical control channel (SPCCH) monitored my UEs expecting or waiting for possible scheduling messages. A network may also send a replacement temporary identifier. The network may select the replacement temporary identifier from a list or table of unique identifiers not selectable by UEs. Such replacement temporary identifier insures that a message containing a UE-derived temporary identifier from a first UE will not collide with a message containing the same temporary identifier derived by a second UE. In effect, the UE-derived temporary identifier provides a limited duration hopefully-unique identifier that may be replaced by a more certain network selected unique identifier. The replacement temporary identifier may be sent in an RRC connection setup message, or may also be contained within the SPCCH grant message.

Upon receipt of the downlink scheduling grant message, UEs decode the short scheduling message and inspect the temp ID. Only the UE address by the temp ID needs to decode the longer message sent or to be sent on a downlink shared channel (DL-SCH). Other UEs not addressed by the scheduling grant message need not spend CPU

cycles or battery resources to decode an RRC connection setup or other long messages to determine if the message is directed to it.

The UE identified by the temp ID receives and decodes the message transmitted in the allocated physical resource described in the downlink scheduling grant message. This second downlink message to the UE may contain a RRC connection setup message transmitted by the network using unacknowledged mode (UM). The RRC connection setup message may optionally contain a replacement temp ID, an allocated S-RNTI value, and/or a global UE ID. If the UE receives a replacement temp ID, it uses this replacement temp ID as its temporary identifier when signaling messages with the network. Additionally, the global UE ID may be included in this first downlink message if received by the network from the RRC connection request message and if a conflict between overlapping temp IDs is detected by the network. In some embodiments, the global UE ID is incorporated explicitly in the message. In other embodiments, the global UE ID is used for encoding the downlink message (e.g., CRC).

The contention resolution process of handling conflicts is further described below with reference to FIGURES 9 and 10. Furthermore, in some embodiments, a radio bearer configuration may be transmitted to multiple UEs using a broadcast channel (BCH).

Next, the UE responds to receiving and processing the RRC connection setup message by preparing and transmitting a RRC connection setup complete message using acknowledge mode (AM). If a replacement temp ID was provided by the network, the UE uses this new value as its temporary identifier. The RRC connection setup complete message may also contain UE radio access capability parameters indicating various capabilities of the UE.

In accordance with the present invention, information contained within the conventional RRC radio bearer setup message (FIGURE 1A) may be broadcast on a BCH rather than signaled individually to each UE since the information describing a shared channel may be used by multiple UEs in a cell.

FIGURE 6B shows elements of the UE and network equipment and the messaging between these elements. The UE includes a layer 3 comprising an evolved RRC (E-RRC) layer, a layer 2 comprising an evolved Radio Link Control (E-RLC) layer and an evolved MAC (E-MAC) layer, and a layer 1 comprising a physical layer (L1). The E-UTRAN network includes a layer 1 physical layer (L1), a layer 2 comprising an evolved MAC (E-MAC) layer and an evolved RLC (E-RLC) layer, and a layer 3 comprising an evolved RRC (E-RRC) layer and an evolved RRM (E-RRM) layer.

The RRC connection request message is initiated by the E-RRC layer in the UE. The E-RRC sends a message to the E-RLC layer which sends the RRC connection request message a common control channel (CCCH) mapped onto a random access channel (RACH) using a transparent mode (TM). The CCCH is a logical control channel between the E-RLC and E-MAC layers and the RACH is a common transport channel between the E-MAC and L1 layers. The RRC connection request message is transmitted over the air interface (Uu) to the network.

Upon receipt of the RRC connection request message, the network equipment's layer 1 sends the message on a Random Access Channel (RACH) channel to the MAC layer. The MAC layer sends the message to the E-RLC layer over a CCCH channel. In turn, the E-RLC layer sends the message to the E-RRC layer, which sends the message to the E-RRM layer for admission control and allocation of the replacement temporary identifier and optionally the replacement S-RNTI value.

After admission control and optional replacement of the temporary ID and optional allocation of the S-RNTI value, the E-RRM returns the allocated values to the E-RRC layer, which forms the RRC connection setup message to be sent in an unacknowledged mode (UM). The E-RLC sends the RRC connection setup message to the E-RLC layer. The E-RLC layer sends the message over a DCCH or a CCCH channel to the E-MAC layer.

Instead of simply forwarding the RRC connection setup message, the E-MAC layer sends a scheduling grant message over a shared physical control channel (SPCCH) to layer 1 for transmission to the UE. The UE's layer 1 receives the scheduling grant, which indicates the physical resource that will carry the RRC connection setup message. The E-MAC layer also transmits, either concurrently or subsequently, the RRC connection setup message to layer 1 on the allocated physical resource on the downlink shared channel (DL-SCH). Layer 1 transmits the RRC connection setup message over the air interface (Uu) to the UE. Fortunately, each UE monitoring the air interface decodes only the short scheduling messages in order to determine whether the enclosed message was addressed to it rather than the longer RRC connection setup message and other messages.

Upon receipt of the RRC connection setup message by the UE, the UE's layer 1 sends the message over a DL-SCH channel to its E-MAC layer, which sends the message over a DCCH or CCCH channel to the E-RLC layer, which in turn sends the message to the E-RRC layer of the UE.

Next, the UE responds using the RRC connection setup complete message, which is sent using an acknowledge mode (AM) to the network. The E-RRC layer sends a message to the E-RLC layer, which uses the DCCH channel to send the RRC connection setup complete message to the E-MAC layer. The E-MAC layer sends the

message on a RACH channel to the physical layer (L1), which transmits the message over the air interface (Uu) to the network. Once the UE has communicated the RRC connection setup complete message, the UE enters an RRC connected state.

Next, the network receives the RRC connection setup complete message over the air interface (Uu). Its layer 1 sends the message to the E-MAC layer using a RACH channel. The E-MAC layer sends the message to the E-RLC using a DCCH channel. The E-RLC sends the message to the E-RRC layer.

FIGURES 7A and 7B show detailed signaling sequences using a scheduled downlink and both non-scheduled and scheduled uplink in accordance with the present invention. The scheduling and exchange of the RRC connection request message and the RRC connection setup message, as well as admission control and allocation of resources are as described above with reference to FIGURES 6A and 6B. FIGURES 7A and 7B depart from the previous embodiment by sending subsequent uplink messages on shared resources.

Specifically, when the UE's E-MAC layer receives the RRC connection setup complete message from its E-RLC layer, the UE's E-MAC layer first sends a scheduling request message on a RACH channel or an evolved RACH (E-RACH) channel. The short scheduling request message requests allocation of an uplink physical resource from the network. The scheduling request message is transmitted over the air interface (Uu) to the network. Upon receipt of the scheduling request message by the network's layer 1, the scheduling request message is forwarded on the RACH channel to the network's E-MAC layer. The E-MAC layer allocates an uplink shared channel (UL-SCH) to the UE and describes the uplink allocation in a scheduling grant message sent on a shared physical control channel (SPCCH) from the E-MAC

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layer to layer 1, then over the air interface (Uu) to the UE's layer 1, which forwards the scheduling grant message on an SPCCH channel to the E-MAC layer. The E-MAC layer forwards the RRC connection setup complete message to layer 1 on the allocated UL-SCH resource for transmission to the network.

By using a shared, scheduled uplink and/or downlink scheme in accordance with some embodiments of the present invention, one or more advantages may be realized. For example, in some embodiments, shorter messages on the initial uplink resource may reduce the number collisions at the physical layer over the air interface. In some embodiments, logical collisions (occurring due to a common temporary identifier independently derived by two UEs during an overlapping time period) may be overcome by collision recovery procedures at the UE and/or by collision recovery procedures in the network. In some embodiments, resources that would otherwise be dedicated to RACH and/or FACH common channels may be either reduced or possibly eliminated; thus these resources are available for allocation to other channel traffic types. Thus a more efficient usage of radio resources may be realized when compared to the case in which multiple traffic types are not allowed to share the same shared channel resources and instead need to be assigned separate resources. This is because, by multiplexing all traffic types onto only shared channels, the scheduler can dynamically adapt the resources assigned to the varying instantaneous loads presented by each traffic type. In contrast, if separate radio resources are statically assigned to each traffic type then variations in the traffic loads offered by each traffic type cannot be accommodated without reconfiguring the respective portions of the total radio resource space assigned firstly to common and secondly to shared channels. In some embodiments, signaling latency and response time as viewed by the UE may be

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reduced. In some embodiments, the use of scheduled channels means that a UE decodes short scheduling messages and no longer needs to monitor and decode each common channel message address to other UEs, which may lead to more efficient use of the UE's battery life. Furthermore, in some embodiments, the connection setup signaling exchange over a high speed channel may occur faster than over a conventional common channel.

FIGURES 8A and 8B show detailed signaling sequences using a scheduled downlink and a scheduled uplink in accordance with the present invention. In the embodiment shown, the initial uplink communication is scheduled as well as subsequent communications. Rather than transmitting an initial message containing the RRC connection request, the UE first sends a short scheduling request message to request the network allocate an uplink physical resource. The UE derives and includes a temporary identifier in the short uplink message. The message may optionally include a buffer occupancy parameter (described above) and a cause parameter. The cause parameter may indicate the reason for the request (e.g., uplink physical resource requested). The network allocates an uplink shared channel (UL-SCH) and transmits a scheduling grant on a shared physical control channel (SPCCH) including the UE-derived temporary identity and a description of the UL-SCH. The E-MAC layer of the UE receives the uplink scheduling grant message on the SPCCH channel and responds by sending the RRC connection request on the allocated UL-SCH physical channel. The RRC connection request message is received by the network which performs admission control and additional resource allocation as describe above with reference to FIGURES 7A and 7B. Furthermore, FIGURE 8A shows some embodiments may use acknowledged mode (AM) while other embodiments may use unacknowledged mode (UM) when communicating either or both of the RRC connection request and RRC connection setup messages.

FIGURES 9 and 10 illustrate processes of contention resolution in accordance with the present invention. This contention scenario occurs when two UEs derive and are using a common temporary identifier. Each UE transmits an RRC connection request message as described with reference to FIGURES 5A, 5B, 6A-B, 7A-B or 8A-B. Derivation of a temporary identifier preferably occurs in a manner to minimize the probability to an acceptable level of two UEs deriving the same temporary identifier. However, in some embodiments two UEs might derive the same temporary identifier within a cell. Therefore, additional collision detection and recovery procedures may be implemented.

FIGURE 9 illustrates a remedy primarily instigated by the UEs. Two UEs each transmit an uplink message to the network using an identical temporary identifier (1st temp ID). The uplink message may be a message transmitted on a RACH channel or an E-RACH. The message may be a scheduling request message (as shown) or some other message. The network may detect the duplicate identical temporary identifier in the two uplink messages. The network may elect to perform no following processing and will allow each UE to time out. After not receiving the expected downlink response, each UE discards the initially derived temporary identifier and derives another temporary identifier (2nd temp ID and 3rd temp ID, respectively). Each UE then retransmits the original uplink message using the newly derived temporary identifier. Upon receipt of the newer temporary identifier, an initial layer 2 context is established between the respective UE and the network for shared channel operations. The network then responds to each UE having a unique temp ID as described above.

FIGURE 10 illustrates a remedy primarily instigated by the network. Again, two UEs each transmit an uplink message to the network using an identical temporary identifier (temp ID). The

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uplink message may be a message transmitted on a RACH channel or an E-RACH. The message may be an RRC connection request message (as shown) or some other message. The network may detect an identical temporary identifier in the two uplink messages. In this case, two UEs have derived the same temp ID and may each may expect downlink signaling including this temp ID to be address to it. In such a case, the network may determine that a conflict or collision has occurred. However, if one or both of the uplink messages includes a global UE ID, the UEs may be distinguished from one another. At this point, an initial layer 2 context is established between the respective UE and the network for shared channel operations.

The network may transmit, on a control channel, a scheduling grant message allocated a downlink resource. The network may also transmit, on a traffic channel described in the scheduling grant message, a message incorporating a global UE ID. For example, the network may transmit an RRC connection setup complete message incorporating addressed to the UEs using the conflicting UE-derived temporary identification. In some embodiments, the network explicitly incorporates the global UE ID in the downlink message by including the global UE ID as a parameter. Alternatively, the network may incorporate the global UE ID by using the global UE ID to encode the downlink message. For example, the incorporating may comprise computing a cyclic redundancy check (CRC) value using the network-known UE identifier. When decoding the downlink message, each UE may use its global UE ID to determine whether the global UE ID was incorporated explicitly as a parameter or alternatively to decode the message to determine whether the previously-transmitted global UE ID was used by the network to encode the message. Additionally, the network may respond by allocating a replacement temp ID to the UE that transmitted its global UE ID. Once one of

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the UEs receives a replacement temp ID, a unique layer 2 context is formed for both UEs for shared channel operation. The first UE will receive and properly decode the RRC connection setup message, which is encoded with its UE. The second UE will attempt to decode the RRC connection setup message but will fail because the message is encoded with an unknown global UE ID causing the second UE to discard the message and return to the downlink scheduling channel (SPCCH). The second UE will then receive a second downlink scheduling grant message sent by the network. The second UE will then properly receive and decode the RRC connection setup message addressed to it. Both UEs may complete the process by responding with an RRC connection setup complete message.

FIGURES 11 and 12 illustrate processes of contention avoidance and resolution using multiple scheduling grant channels in accordance with the present invention. Some systems may configure multiple channels (e.g., multiple SPCCH channels) for communicating scheduling grant messages from the network to UEs. These channels may be pre-configured, may be defined by a standard, or may be sent to the UE (for example, sent via a broadcast channel or other system control signaling).

A UE may derive or select a subset (i.e., a single channel or multiple channels) from the configured multiple channels for later monitoring of scheduling grant messages. The derived subset of channels that a UE will monitor may be referred to as a channel set. Using an uplink message, a UE may communicate the channel set either explicitly using a parameter or implicitly by use of a particular physical resource. By communicating a channel set or an indication of a channel set, a network may differentiate UEs that happened to have derived the same temporary identifier but have fortunately derived different

channel sets. FIGURE 11 illustrates an example of a UE explicitly communicating a channel set to a network by transmitting an initial message containing an indication of the channel set. FIGURE 12 illustrates an example of a UE implicitly communicating a channel set by way of using a particular uplink physical resource to transmit an initial message to the network.

In FIGURE 11, prior to establishing a connection with the network equipment, a first UE derives a temporary identifier (temp ID) as discussed above. The first UE also derives a channel set. That is, the UE selects a scheduling grant channel (SPCCH) that it will monitor for future scheduling grant messages. Alternatively, a UE may select more than one of the configured scheduling grant channels (SPCCHs), this being termed a channel set.

To derive a channel set containing a single channel or multiple channels that the UE monitors for scheduling grant messages, a UE may select the channel set based on one or a combination of the following parameters: (1) the UE's global UE identifier such as its TMSI, IMSI or IMEI; (2) the derived temporary identifier; and (3) one or more characteristics of the physical resource the UE will use to transmit the initial message. The characteristics of the physical resource include a time parameter (such as a system clock, super frame number, radio frame number, sub-frame number, time slot number), a frequency parameter (such as a frequency band, channel number or sub-carrier number) and a code (such as a midamble code, a scrambling code, a channelization code, a time-frequency code or an orthogonal code).

The example shows a first UE deriving a temporary identifier (temp ID) in conjunction with a channel set. The channel set may be a single SPCCH channel number or a set of multiple SPCCH channel numbers. The channel set may be represented by a channel

indication (e.g., channel indication #1). For example, the channel set may be communicated by transmitting a channel indication value that represents an index to a table known to both the UE and the network. The table entries may represent a single channel number or may represent multiple channels from the set of possible channels.

Next, the first UE sends an initial message containing both the selected temporary identifier and a channel indication to communicate to the network which one or more channels the network should use to send scheduling grant messages. For example, the initial message may be a scheduling request for scheduled uplink radio resources or an RRC connection request message sent as a first message during a connection setup process on non-scheduled uplink radio resources. In some embodiments, the UE may also send a global UE identifier (such as a TMSI, IMSI or IMEI) for use in conflict detection and resolution as discussed above with reference to FIGURE 10. Upon receipt of the initial message, the network may associate the temporary identifier and the channel set pair with a particular UE (e.g., the first UE).

The example further shows a second UE initiating a connection simultaneously or a short time later. The second UE similarly derives a temporary identifier and a channel set represented by a channel indication (e.g., channel indication #2). For illustrative purposes, the example shows that the second UE derived the same temporary identifier (temp ID #1) as did the first UE. However, the second UE happens to have selected a different channel set. The second UE then sends the temporary identifier and the channel indication to the network in an initial message. Upon receipt of the initial message, the network may associate the received temporary identifier and channel set pair with the second UE.

At this point, both UE's are associated with the same temporary ID, however, due to their selection of different and non-overlapping SPCCH channel sets as indicated in their channel indication parameters, unintended cross communication may be avoided. The first and second UE will monitor different SPCCH channels, therefore a common derived temporary identifier may be used by the network to address both UEs. The network will address both UEs with the same temporary identifier but will send a scheduling message to the first UE on one of the channels indicated by channel indication #1 and will send another scheduling message to the second UE on one of the channels indicated by channel indication #2. Hence, each UE will not process a scheduling grant message addressed to the other UE.

Thus, a unique shared channel communication context has been formed by the system for each UE by virtue of the two UEs selecting different SPCCH channel sets. Communicating a channel indication may not completely remove the possibility for contention because two UEs may still derive the same temporary identifier and the same channel set. In this event, the contention resolution procedures discussed above with reference to FIGURES 9 and 10 may be applied within the context of the present invention.

As further shown in FIGURE 11, the network may communicate data with the first UE over a scheduled shared channel using the steps of: (1) receiving a temporary identifier (temp ID #1) and a channel indication (channel indication #1); (2) allocating downlink or uplink shared channel resources; (3) determining a scheduling grant channel (channel #1) from the received channel indication; (4) sending a scheduling grant message addressed to temp ID #1 over channel #1 and including a description of the allocated uplink or downlink shared channel resources; and (5)

communicating data by transmitting or receiving the data on the allocated shared channel resources. Similarly, the network may simultaneously or substantially simultaneously communicate with the second UE over a scheduled shared channel using the steps of: (1) receiving a temporary identifier (temp ID #1) and a channel indication (channel indication #2); (2) allocating downlink or uplink shared channel resources; (3) determining a scheduling grant channel (channel #2) from the received channel indication; (4) sending a scheduling grant message addressed to temp ID #1 over channel #2 and including a description of the allocated uplink or downlink shared channel resources; and (5) communicating data by transmitting or receiving the data on the allocated shared channel resources.

In a similar manner to that described above with reference to FIGURES 6A, 7A and 8A, the network may further re-assign a replacement temporary identifier to one or both UEs in order that each UE is assigned a unique temporary identifier, thus potentially obviating the need for grant channel restrictions when sending scheduling grant messages to each UE. Furthermore, in some embodiments, the network may allow a UE to use a different set of SPCCH channels. For example, the network could re-assign a unique replacement temporary identifier to the UE and allowing the network to convey scheduling grants of uplink or downlink shared channel resources on any downlink SPCCH channel.

In FIGURE 12, UEs communicate the channel set implicitly. A first UE derives a temporary identifier and derives a physical resource (physical resource #1) before establishing a connection with the network equipment. The physical resource may be characterized by its time, frequency and code parameters. In the embodiment shown, a UE may communication the channel set implicitly by the very use of the physical resource. The network

may use one or more characteristics of the physical resource to infer the channel set to be used by the UE.

In some embodiments, the UE may determine a channel set then determine on which physical resource to send an initial message based on the determined channel set. In other embodiments, the UE may determine a physical resource to send an initial message then determine a channel set based on the determined physical resource. The network uses characteristics of the physical resource used by the UE to determine the channel set. For example, the time (e.g., time slot) of the initial message may indicate to the network that a particular downlink scheduling channel or set of channels will be monitored by the UE. Upon receipt of the temporary identifier, the network may associate the temporary identifier with a particular one or more scheduling grant channels (SPCCHs) based on one or more characteristics of the physical resource (physical resource #1). In some embodiments, the association of the temporary identifier or a physical resource with an SPCCH channel number or a channel set may vary as a function of the time. Alternatively, the association may be based upon a global UE ID received within an RRC connection request message. Each UE forms the same association between the transmitted temporary identifier and channel set as is formed by the network. This association may be accomplished similarly in both the UE and in the network. The network further associates the temporary identifier and channel set pair with a particular UE (in this case, the first UE).

Simultaneously or some time later, a second UE is shown to begin a connection establishment procedure. The second UE derives a temporary identifier and transmits an initial message to the network. Upon receipt of the initial message, the network similarly determines the channel set and associates the temporary

identifier with one or more particular SPCCH channel numbers based on a characteristic of the physical resource (physical resource #2).

In some embodiments, an association between the temporary identifier and the implied channel set is based on a periodic function of time. Thus, a finite set of access period instances within the time period spanned between the sending of the two initial messages is configured such that the association between a temporary identifier and a channel set does not repeat. As such, the transmission of temp ID #1 by the second UE at a later time causes its temp ID #1 to be associated with a different SPCCH channel number of that which is associated with the first UE. In the example shown, temp ID #1 is associated with SPCCH channel #1 for the first UE, whereas temp ID #1 is associated with SPCCH channel #2 for the second UE. Thus, the network may send scheduling grant messages to a UE using a scheduling grant channel known *a priori* to both the UE and the network and may communicate data uniquely with the first and second UEs over one or more scheduled shared channels as indicated by the scheduling grant messages.

At this point, both UEs are associated with the same temporary identifier, however, due to their association with differing SPCCH channel numbers, unintended cross communication may be avoided as discussed above. Thus, a unique shared channel communication context has been formed by the system for each UE, attributed to the fact that the connection establishments were initiated using different physical resources and hence the UEs may be associated with different SPCCHs. In some embodiments, this method completely removes the possibility of connection for non-simultaneous access attempts within a given time period. If a plurality of UEs derives a common temporary identifier but each

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transmits the initial message on different physical resources, then conflicts may be avoided if the UEs are reallocated replacement temporary identifiers. On the other hand, if a plurality of UEs derives a common temporary identifier and also transmits the initial message on the same physical resources, then contentions may be experienced and conflicts may be resolved using contention resolution procedures such as described above with reference to FIGURES 9 and 10.

The length of the substantially contention-free access may be a function of the number of available SPCCH and the length and nature of the pattern describing the association between a temporary identifier and SPCCH channel number. It would therefore be advantageous for the network to assign unique replacement temporary identifiers to each UE accessing the system before the association pattern repeats in time. Thus, by designing the association pattern to have a length commensurate with the maximum expected time required to assign a replacement temporary identifier, the efficiency of the scheme may be optimized.

While the invention has been described in terms of particular embodiments and illustrative figures, those of ordinary skill in the art will recognize that the invention is not limited to the embodiments or figures described. For example, many of the embodiments described above are referenced to 3GPP systems and evolved UMTS Terrestrial Radio Access Network (E-UTRAN) nomenclature. More generally, some embodiments may include a transceiver using a code division multiple access (CDMA) transmitter/receiver pair operating in either a time division duplex (TDD) scheme or frequency division duplex (FDD) scheme. Alternatively, the transceiver may be a non-code division transceiver, such as used in a TDMA system, an FDMA system, an

OFDM system or hybrids thereof (e.g. TMDA/FDMA, TDMA/CDMA, TDMA/OFDM, and TDMA/OFDM/CDMA). The transceiver may operate on bursts or may operate on a signal stream.

The figures provided are merely representational and may not be drawn to scale. Certain proportions thereof may be exaggerated, while others may be minimized. The figures are intended to illustrate various implementations of the invention that can be understood and appropriately carried out by those of ordinary skill in the art. Therefore, it should be understood that the invention can be practiced with modification and alteration within the spirit and scope of the appended claims. The description is not intended to be exhaustive or to limit the invention to the precise form disclosed. It should be understood that the invention can be practiced with modification and alteration and that the invention be limited only by the claims and the equivalents thereof.

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CLAIMS

What is claimed is:

1. A method of initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between user equipment and network equipment, the method, by the user equipment, comprising:

deriving a temporary identifier;

deriving a channel set;

transmitting an initial message to the network equipment, the initial message comprising the temporary identifier;

receiving a downlink message conveying the temporary identifier and a description of a scheduled resource on a shared channel, the scheduled resource comprising a resource allocated to the user equipment by the network equipment; and

communicating data on the scheduled resource in response to the downlink message.

2. The method of claim 1, wherein the channel set is a single channel.

3. The method of claim 1, wherein the channel set comprises multiple channels.

4. The method of claim 1, wherein the deriving of the channel set comprises randomly selecting the channel set from a plurality of channel sets.

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5. The method of claim 1, wherein the deriving of the channel set comprises determining the channel set based on a global UE identifier.

6. The method of claim 5, wherein the global UE identifier comprises one of a temporary mobile subscriber identity (TMSI), an international mobile subscriber identity (IMSI), or an international mobile equipment identity (IMEI).

7. The method of claim 1, wherein the deriving of the channel set comprises determining the channel set as a function of one or more characteristics of a physical resource, and wherein the transmitting of the initial message comprises transmitting the initial message on the physical resource.

8. The method of claim 7, wherein the characteristic of the physical resource comprises a parameter of time.

9. The method of claim 7, wherein the characteristic of the physical resource comprises a parameter of frequency.

10. The method of claim 7, wherein the characteristic of the physical resource comprises a parameter of a code.

11. The method of claim 1, wherein the deriving of the channel set comprises determining the channel set based on one or more of a characteristic of a physical resource, a global UE identifier, and the temporary identifier.

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12. The method of claim 1, wherein the initial message further comprises a global UE identifier.

13. The method of claim 1, further comprising determining a physical resource and wherein the transmitting of the initial message comprises transmitting the initial message in accordance with the determined physical resource.

14. The method of claim 1, further comprising signaling an indication of the channel set.

15. The method of claim 1, further comprising implicitly communicating an indication of the channel set.

16. The method of claim 1, wherein the transmitting of the initial message to the network equipment comprises transmitting a scheduling request message.

17. The method of claim 1, wherein the transmitting of the initial message to the network equipment comprises transmitting an RRC connection request message.

18. The method of claim 1, further comprising:

timing out after the transmitting the initial message and before the receiving of the downlink message;

determining a different physical resource; and

transmitting a new initial message on the different physical resource.

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19. The method of claim 1, further comprising changing an association between channel sets and temporary identifiers.

20. The method of claim 1, further comprising changing an association between channel sets and one or more characteristics of a physical resource.

21. The method of claim 1, further comprising changing an association of channel sets as a function of time.

22. The method of claim 1, further comprising changing an association of channel sets in response to receiving a signal from the network equipment.

23. The method of claim 1, wherein the wireless communication system comprises an evolved UMTS Terrestrial Radio Access Network (E-UTRAN).

24. User equipment used in initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between the user equipment and network equipment, the user equipment comprising:

a memory;

a processor coupled to the memory; and

program code executable on the processor, the program code operable for:

deriving a temporary identifier;

deriving a channel set;

transmitting an initial message to the network equipment, the initial message comprising the temporary identifier;

receiving a downlink message conveying the temporary identifier and a description of a scheduled resource on a shared channel, the scheduled resource comprising a resource allocated to the user equipment by the network equipment; and

communicating data on the scheduled resource in response to the downlink message.

25. The user equipment of claim 24, wherein the deriving of the channel set comprises randomly selecting the channel set from a plurality of channel sets.

26. The user equipment of claim 24, wherein the deriving of the channel set comprises determining the channel set as a function of one or more characteristics of a physical resource, and wherein the transmitting of the initial message comprises transmitting the initial message on the physical resource.

27. The user equipment of claim 24, wherein the transmitting of the temporary identifier to the network equipment includes transmitting the temporary identifier within a first uplink message containing the temporary identifier and a request for the scheduled resource.

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28. The user equipment of claim 24, wherein the deriving of the channel set comprises determining the channel set based on one or more of a characteristic of a physical resource, a global UE identifier, and the temporary identifier.

29. The user equipment of claim 24, wherein the program code is further operable for determining a physical resource and wherein the transmitting of the initial message comprises transmitting the initial message in accordance with the determined physical resource.

30. The user equipment of claim 24, wherein the program code is further operable for signaling an indication of the channel set.

31. The user equipment of claim 24, wherein the program code is further operable for implicitly communicating an indication of the channel set.

32. Network equipment used in initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between user equipment and the network equipment, the network equipment comprising:

a memory;

a processor coupled to the memory; and

program code executable on the processor, the program code operable for:

receiving an initial message sent by the user equipment;

determining a channel set;

allocating a scheduled resource to the user equipment, the scheduled resource comprising a resource on a shared channel;

transmitting a downlink message on a channel indicated by the channel set, the downlink message conveying the temporary identifier and a description of the scheduled resource; and

communicating data on the scheduled resource in response to the downlink message.

33. The network equipment of claim 32, wherein the determining the channel set comprises extracting a channel indication from the initial message, the channel indication indicating the channel set.

34. The network equipment of claim 32, wherein the determining the channel set comprises determining the channel set from the physical resource carrying the initial message.

35. The network equipment of claim 32, wherein the program code is further operable for communicating to the UE a change in an association between channel sets and one or more characteristics of a physical resource.

36. A computer program product comprising program code for initiating a wireless connection and subsequent communication over a shared physical resource in a wireless communication system between user equipment and network equipment, the computer program product comprising program code for:

deriving a temporary identifier;

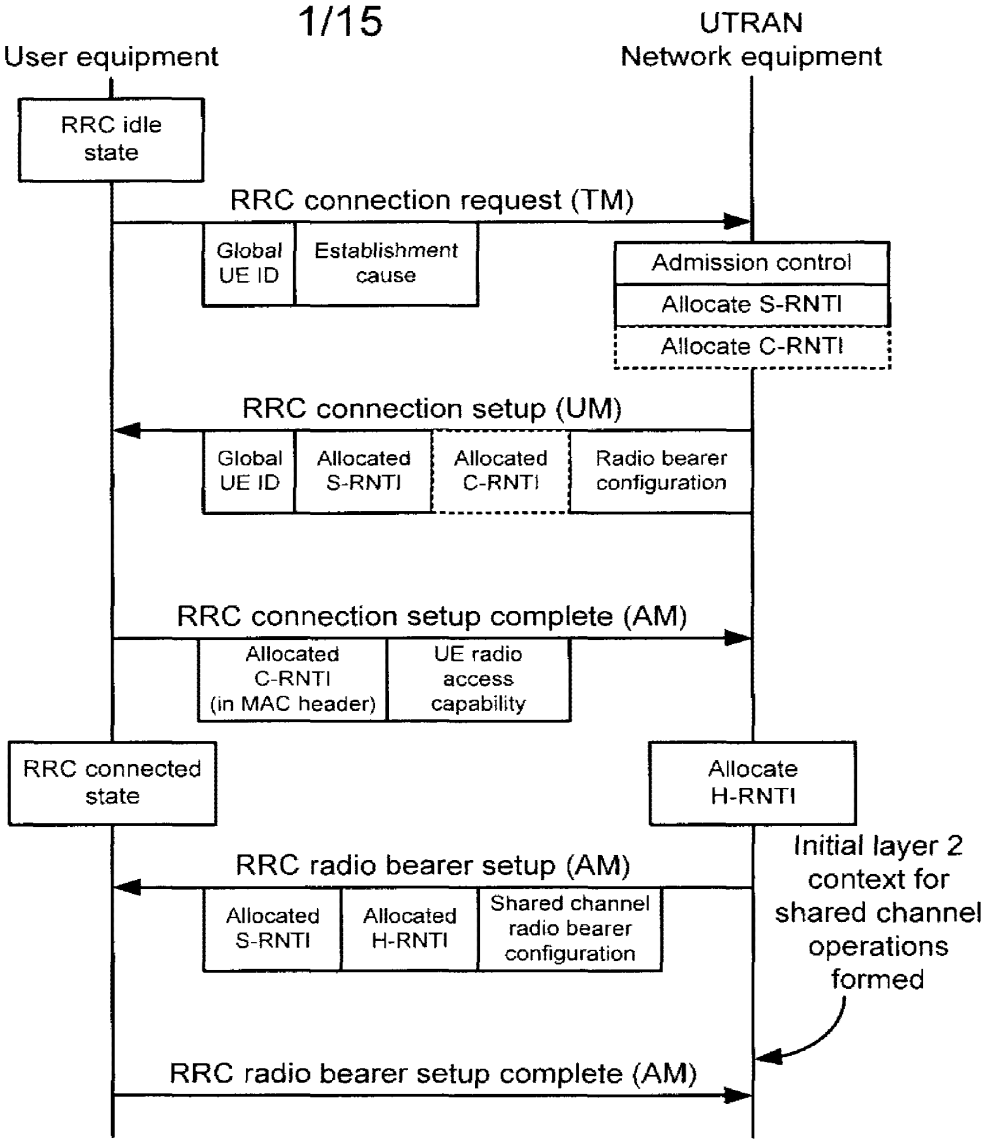
deriving a channel set;

transmitting an initial message to the network equipment, the initial message comprising the temporary identifier;

receiving a downlink message conveying the temporary identifier and a description of a scheduled resource on a shared channel, the scheduled resource comprising a resource allocated to the user equipment by the network equipment; and

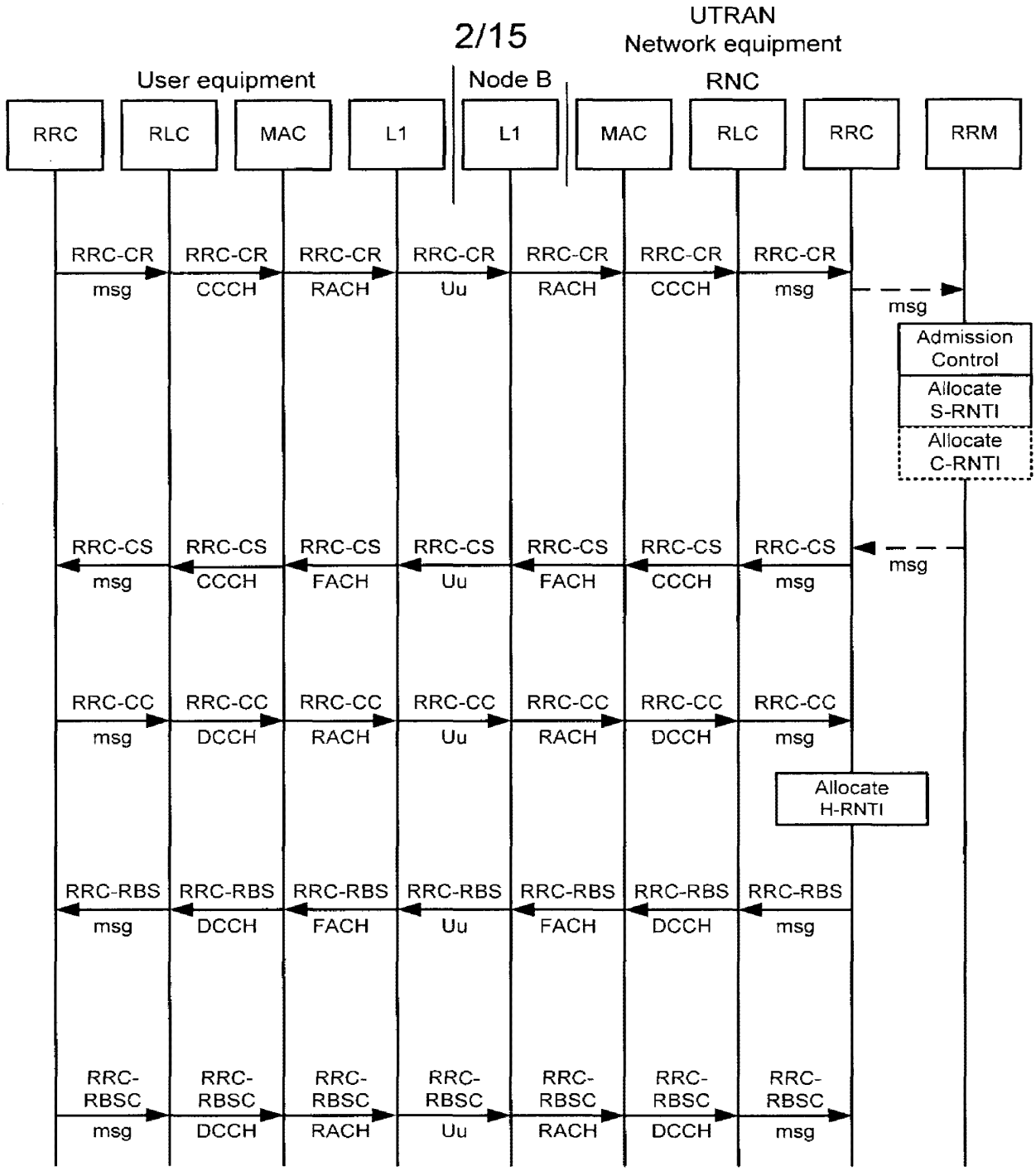
communicating data on the scheduled resource in response to the downlink message.

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Conventional RRC connection procedure
using common channel signalling
in a UTMS system
(PRIOR ART)

FIGURE 1A



Conventional RRC connection procedure
using common channel signalling
in a UTMS system
(PRIOR ART)

FIGURE 1B

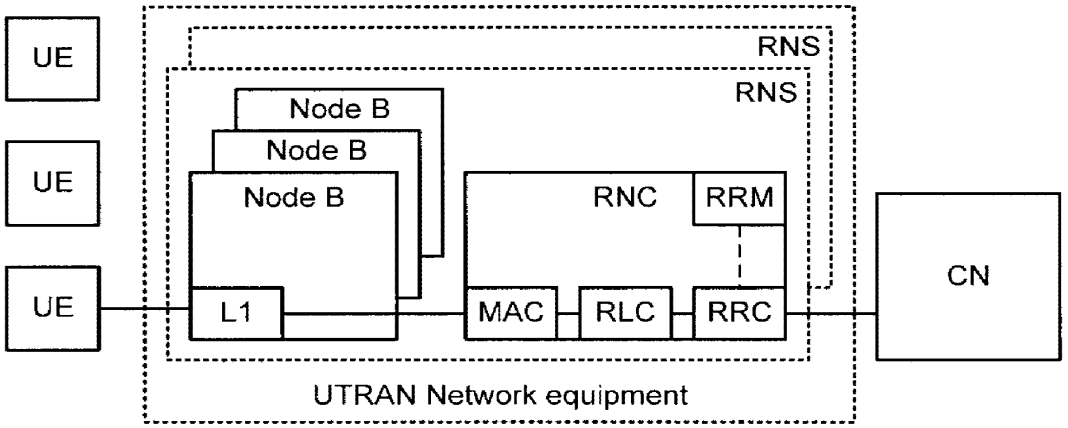


FIGURE 2

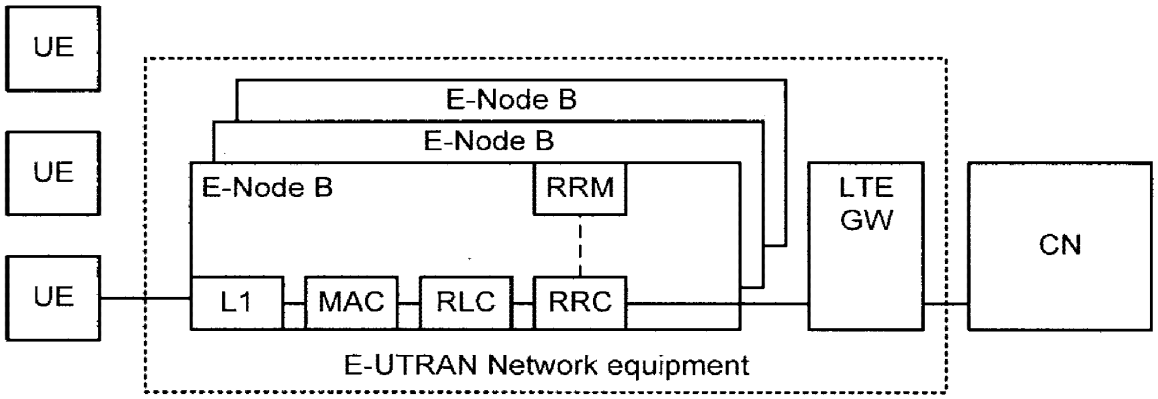


FIGURE 3A

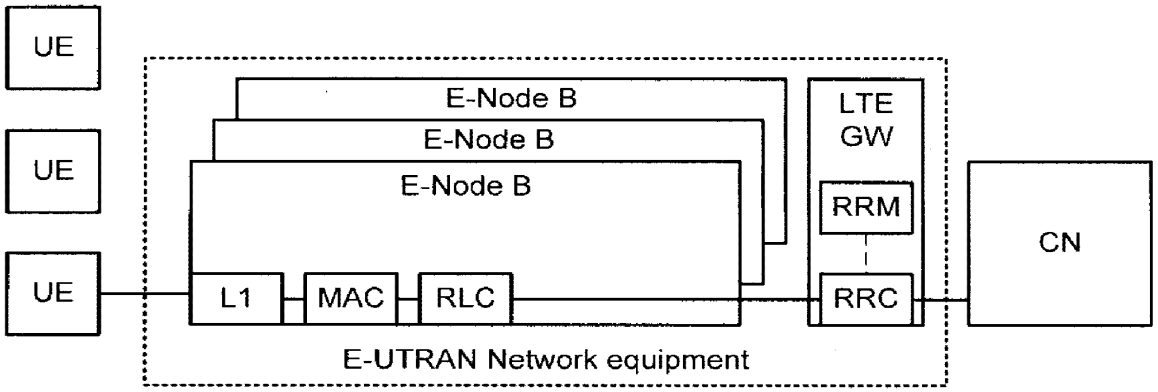


FIGURE 3B

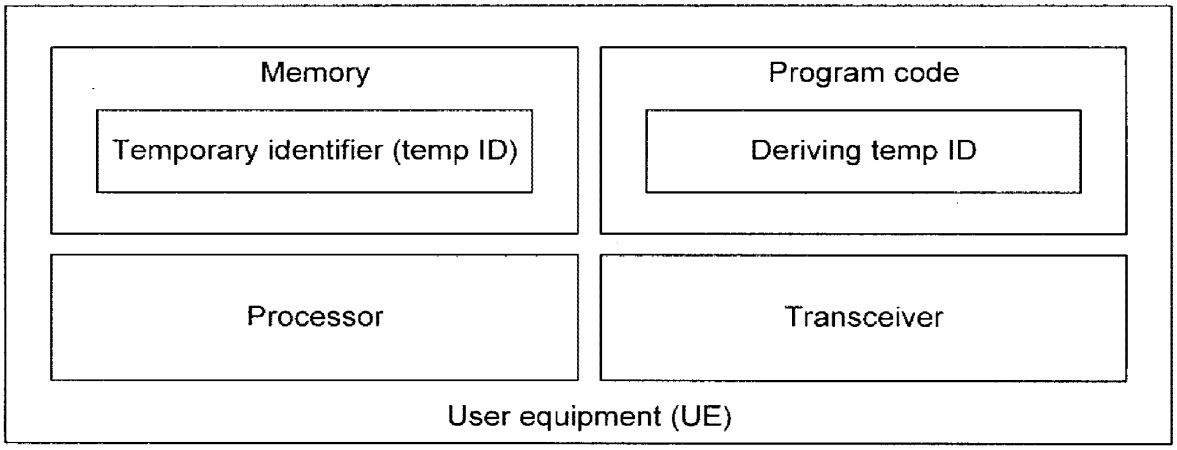

Memory
Temporary identifier (temp ID)
Program code
Deriving temp ID
Processor
Transceiver
User equipment (UE)

FIGURE 4

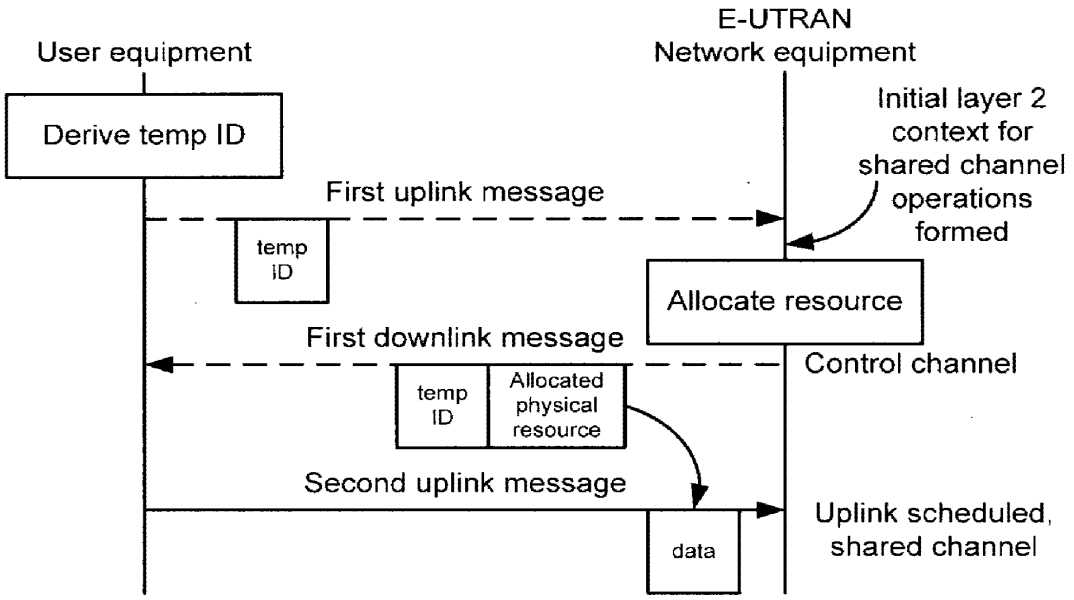


FIGURE 5A

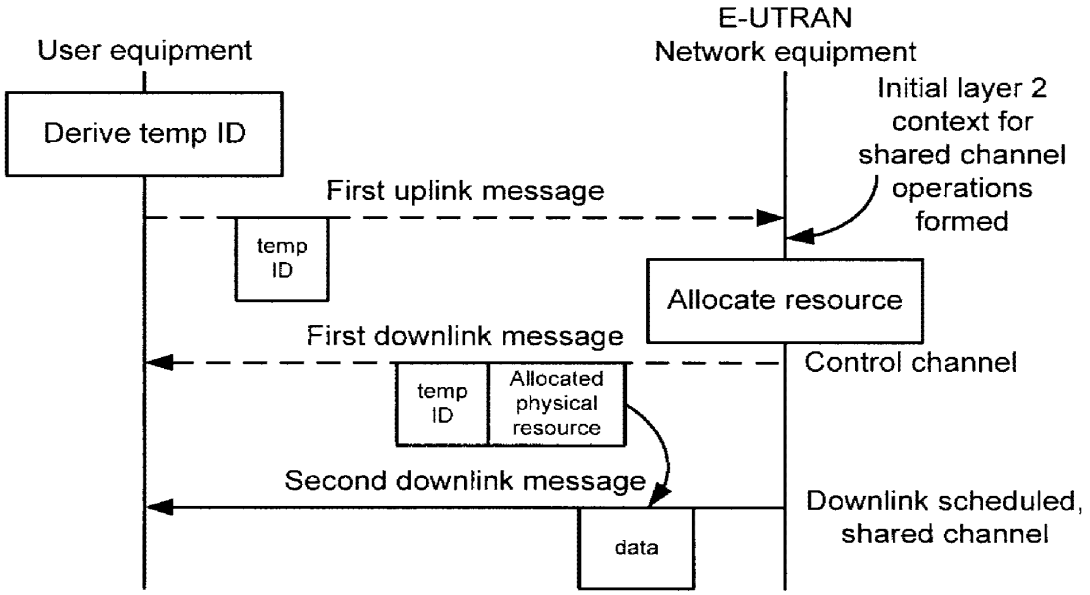
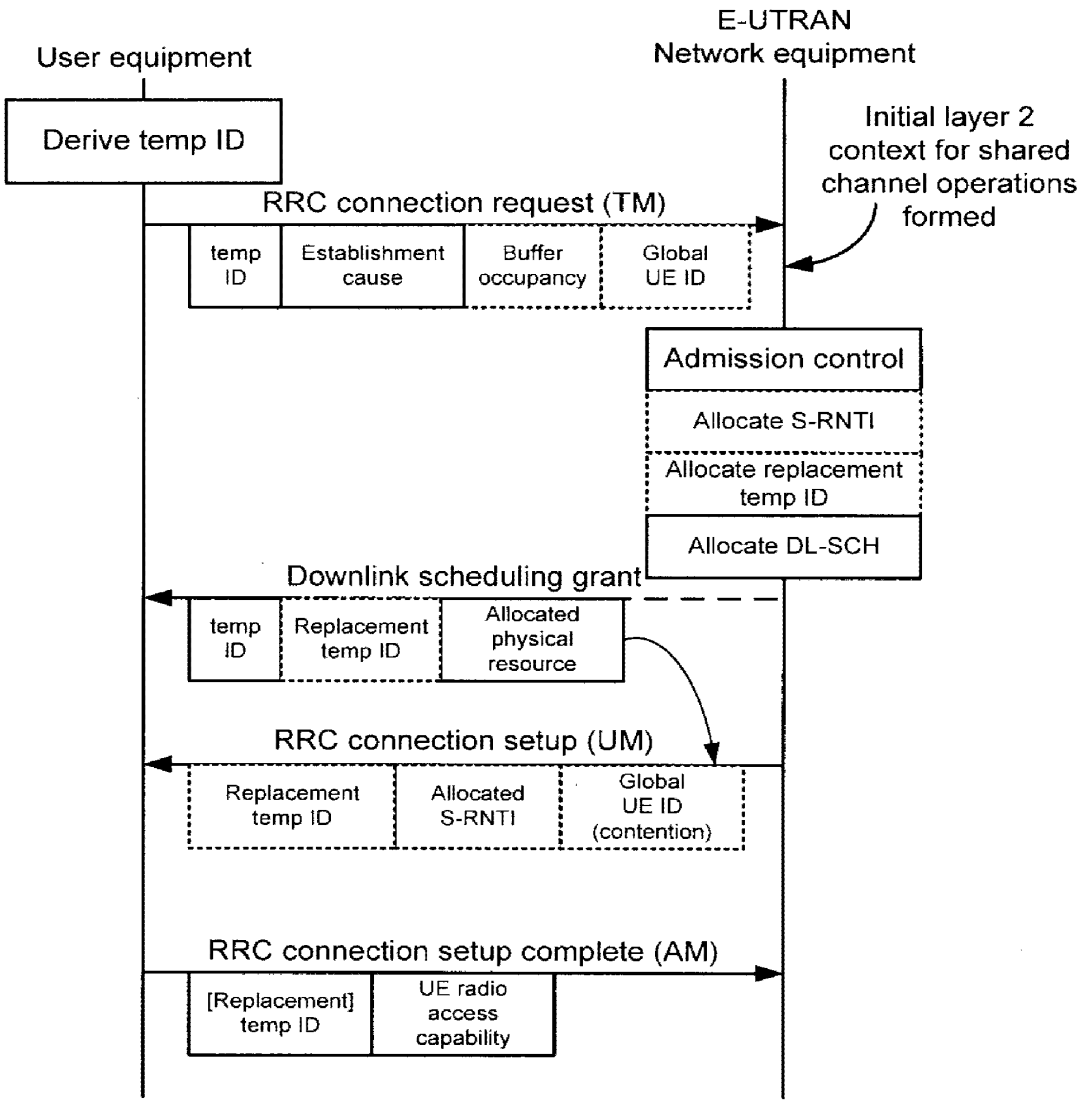


FIGURE 5B



Scheduled downlink connection procedure

FIGURE 6A

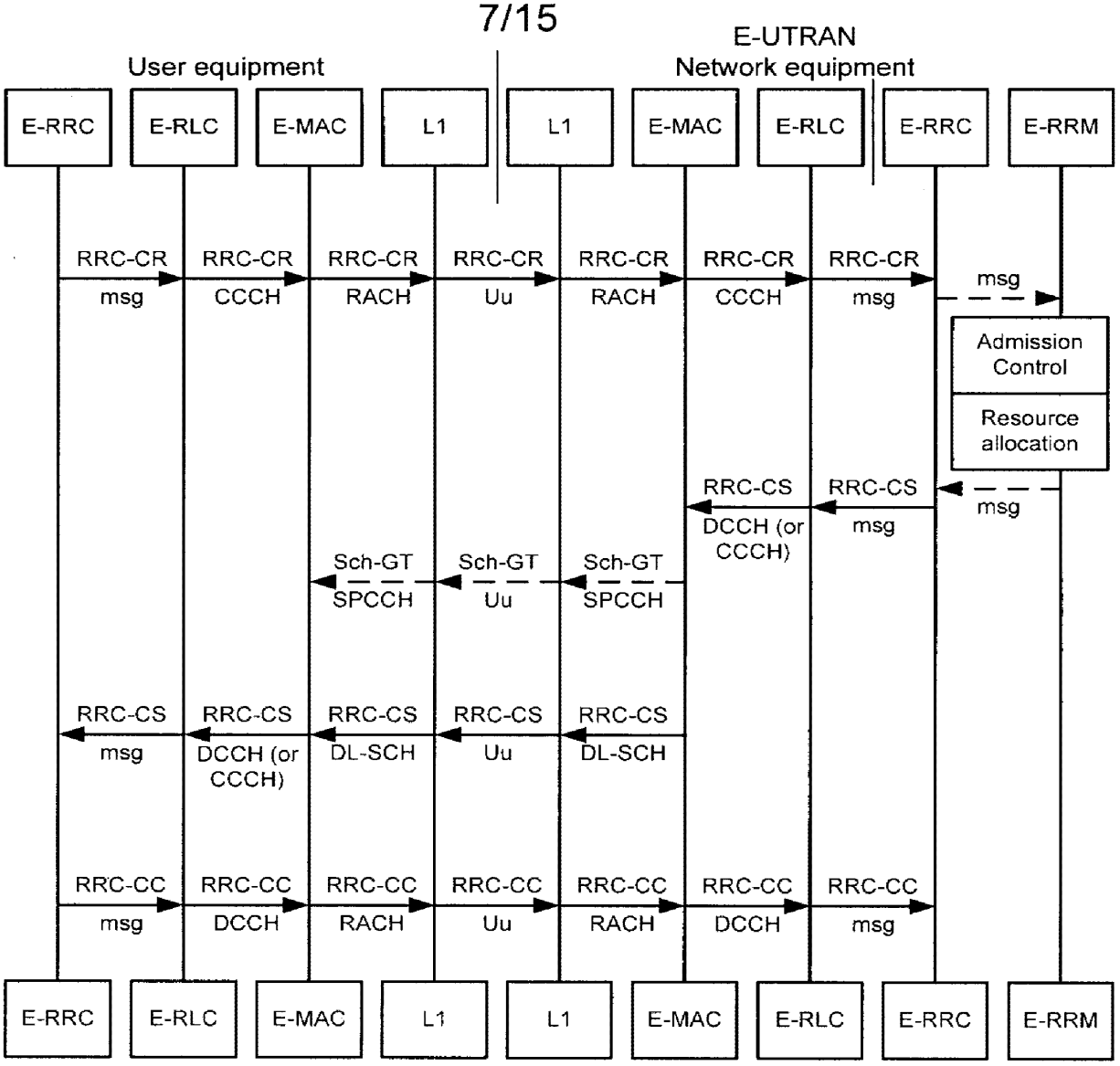
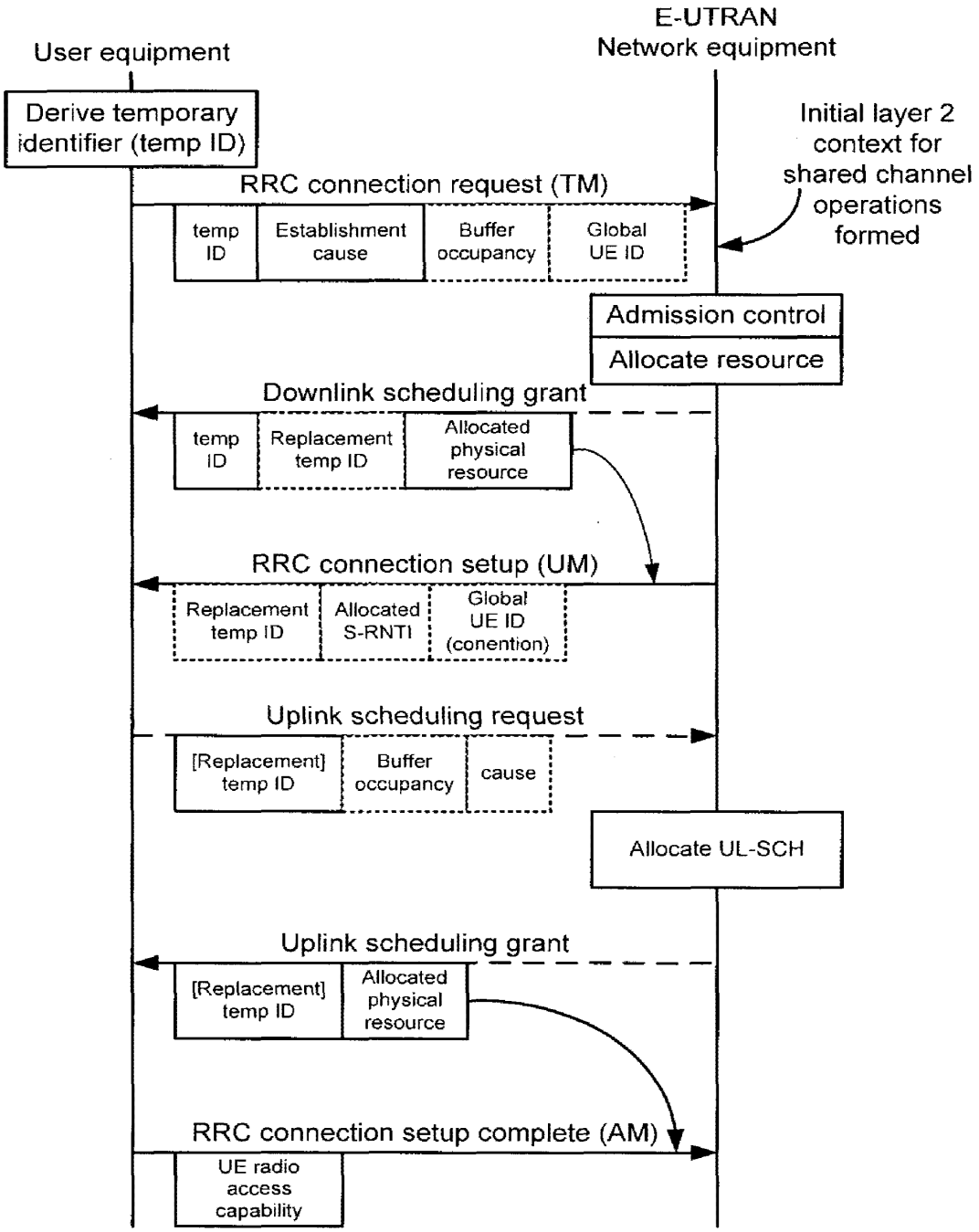

User equipment
E-UTRAN
Network equipment
E-RRC
E-RLC
E-MAC
L1
L1
E-MAC
E-RLC
E-RRC
E-RRM
RRC-CR
msg
RRC-CR
CCCH
RRC-CR
RACH
RRC-CR
Uu
RRC-CR
RACH
RRC-CR
CCCH
RRC-CR
msg
msg
Admission Control
Resource allocation
RRC-CS
DCCH (or CCCH)
RRC-CS
msg
msg
Sch-GT
SPCCH
Sch-GT
Uu
Sch-GT
SPCCH
RRC-CS
msg
RRC-CS
DCCH (or CCCH)
RRC-CS
DL-SCH
RRC-CS
Uu
RRC-CS
DL-SCH
RRC-CC
msg
RRC-CC
DCCH
RRC-CC
RACH
RRC-CC
Uu
RRC-CC
RACH
RRC-CC
DCCH
RRC-CC
msg
E-RRC
E-RLC
E-MAC
L1
L1
E-MAC
E-RLC
E-RRC
E-RRM

FIGURE 6B



Non-scheduled & scheduled uplink, scheduled downlink

FIGURE 7A

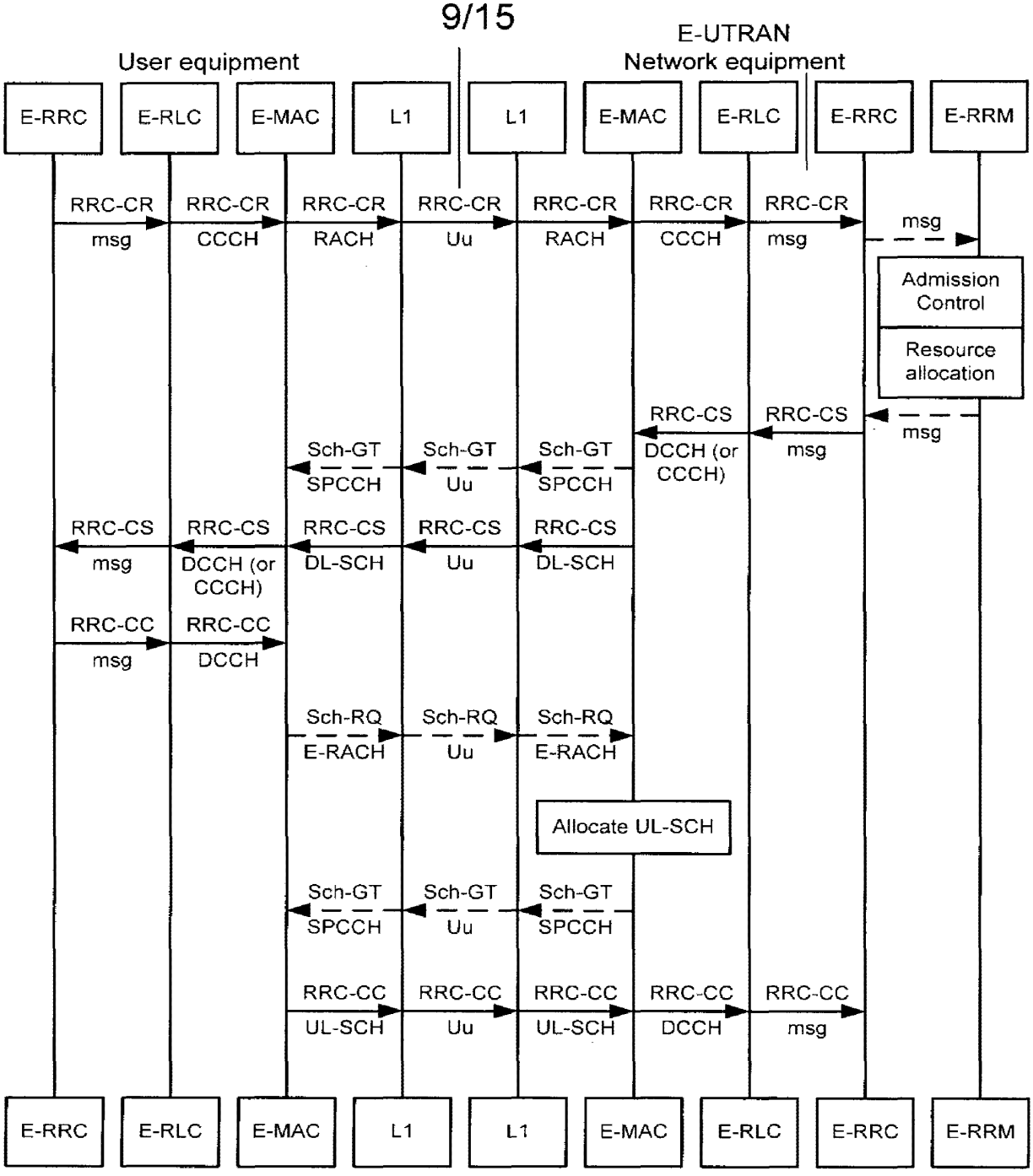
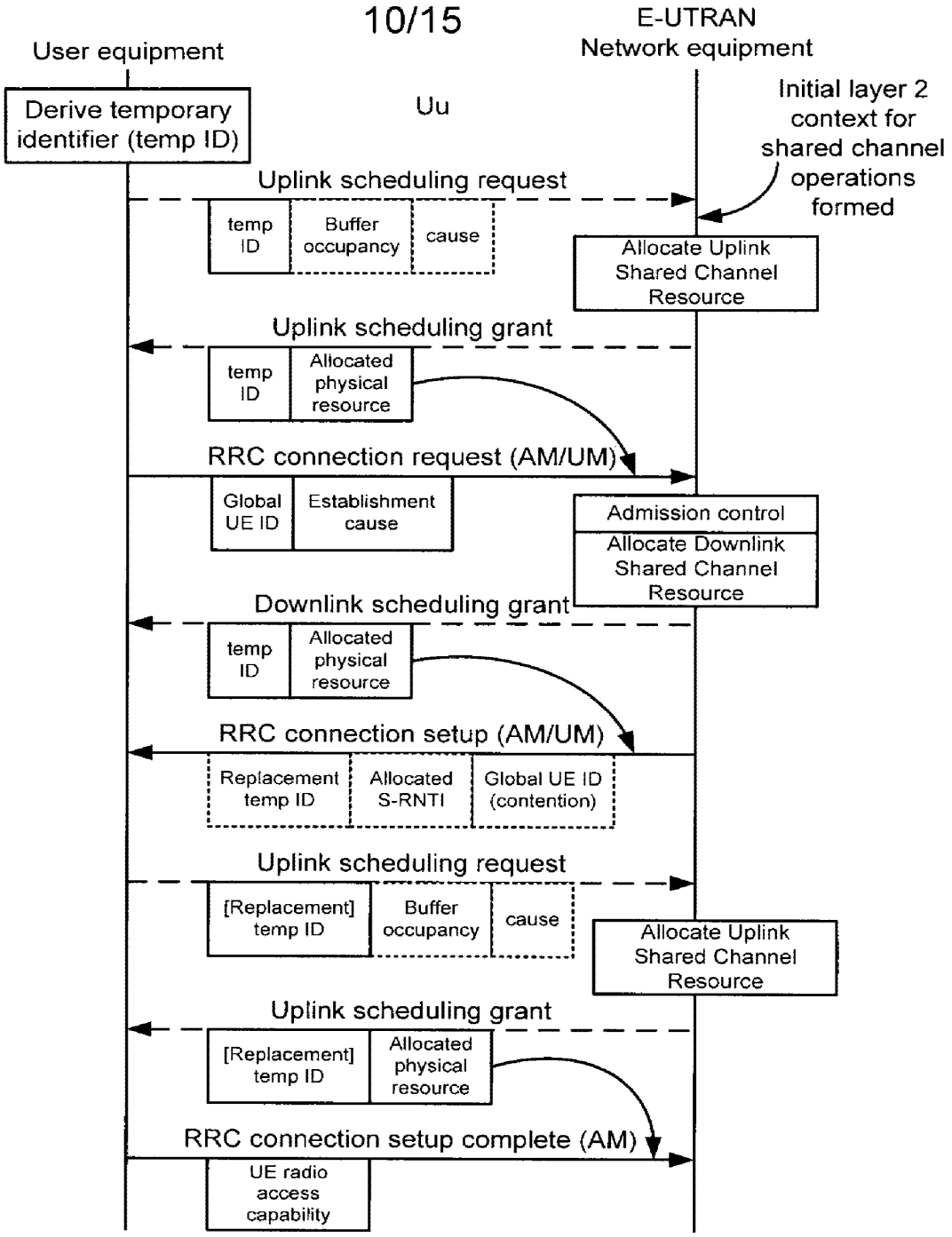

User equipment
E-UTRAN
Network equipment
E-RRC
E-RLC
E-MAC
L1
L1
E-MAC
E-RLC
E-RRC
E-RRM
RRC-CR
msg
RRC-CR
CCCH
RRC-CR
RACH
RRC-CR
Uu
RRC-CR
RACH
RRC-CR
CCCH
RRC-CR
msg
msg
Admission Control
Resource allocation
RRC-CS
msg
RRC-CS
msg
Sch-GT
SPCCH
Sch-GT
Uu
Sch-GT
SPCCH
RRC-CS
DCCH (or CCCH)
RRC-CS
msg
RRC-CS
DCCH (or CCCH)
RRC-CS
DL-SCH
RRC-CS
Uu
RRC-CS
DL-SCH
RRC-CC
msg
RRC-CC
DCCH
Sch-RQ
E-RACH
Sch-RQ
Uu
Sch-RQ
E-RACH
Allocate UL-SCH
Sch-GT
SPCCH
Sch-GT
Uu
Sch-GT
SPCCH
RRC-CC
UL-SCH
RRC-CC
Uu
RRC-CC
UL-SCH
RRC-CC
DCCH
RRC-CC
msg
E-RRC
E-RLC
E-MAC
L1
L1
E-MAC
E-RLC
E-RRC
E-RRM

FIGURE 7B



RRC connection procedure
using a shared physical control channel (SPCCH) and
shared transport channels (DL-SCH & UL-SCH)

FIGURE 8A

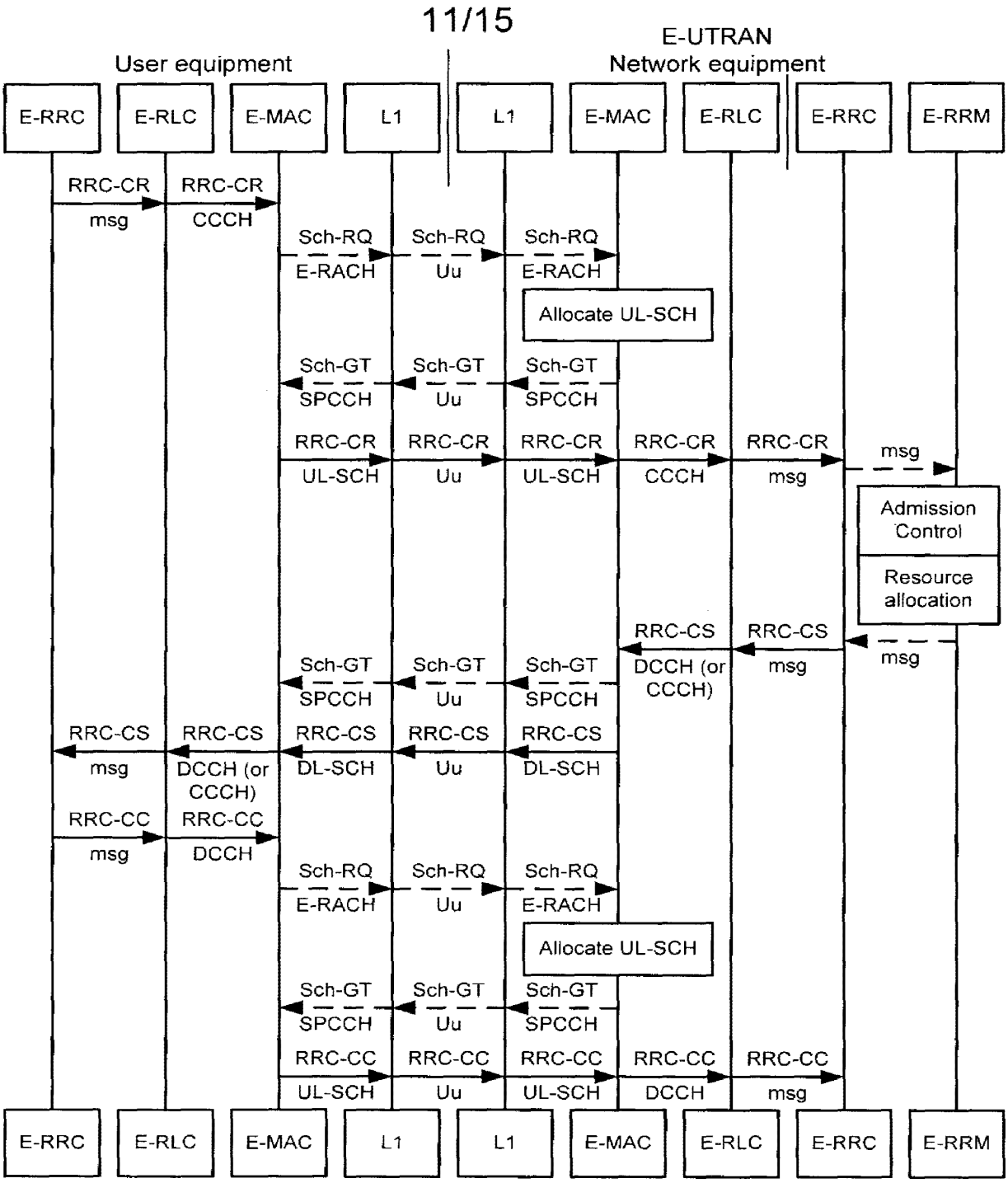
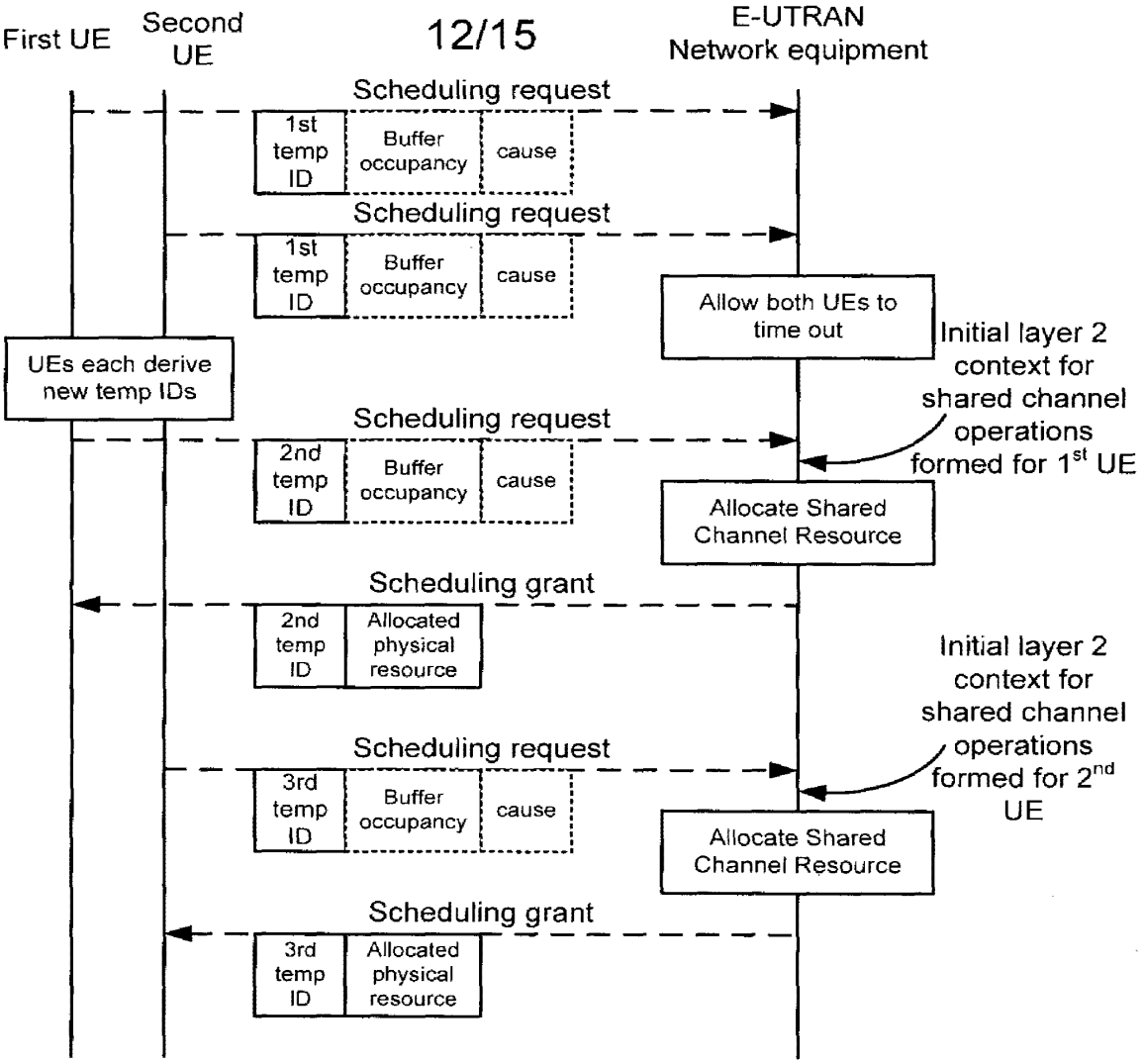
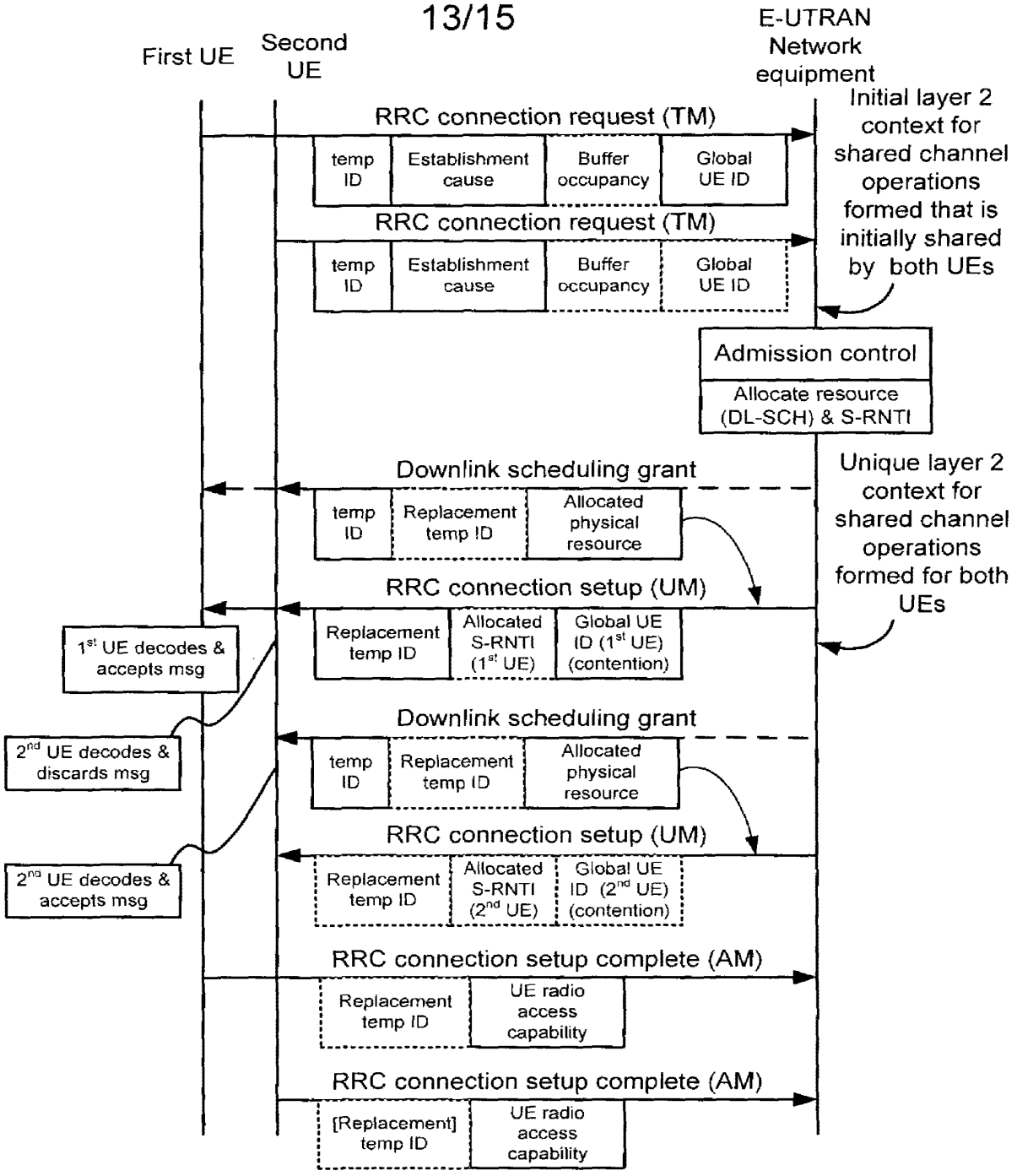

User equipment
E-UTRAN
Network equipment
E-RRC
E-RLC
E-MAC
L1
L1
E-MAC
E-RLC
E-RRC
E-RRM
RRC-CR
msg
RRC-CR
CCCH
Sch-RQ
E-RACH
Sch-RQ
Uu
Sch-RQ
E-RACH
Allocate UL-SCH
Sch-GT
SPCCH
Sch-GT
Uu
Sch-GT
SPCCH
RRC-CR
UL-SCH
RRC-CR
Uu
RRC-CR
UL-SCH
RRC-CR
CCCH
RRC-CR
msg
msg
Admission Control
Resource allocation
RRC-CS
msg
RRC-CS
msg
Sch-GT
SPCCH
Sch-GT
Uu
Sch-GT
SPCCH
RRC-CS
DCCH (or CCCH)
RRC-CS
msg
DCCH (or CCCH)
RRC-CS
DL-SCH
RRC-CS
Uu
RRC-CS
DL-SCH
RRC-CC
msg
RRC-CC
DCCH
Sch-RQ
E-RACH
Sch-RQ
Uu
Sch-RQ
E-RACH
Allocate UL-SCH
Sch-GT
SPCCH
Sch-GT
Uu
Sch-GT
SPCCH
RRC-CC
UL-SCH
RRC-CC
Uu
RRC-CC
UL-SCH
RRC-CC
DCCH
RRC-CC
msg
E-RRC
E-RLC
E-MAC
L1
L1
E-MAC
E-RLC
E-RRC
E-RRM

FIGURE 8B



Contention based RRC connection procedure using a shared physical control channel (SPCCH) and shared transport channels (DL-SCH & UL-SCH)

FIGURE 9



Scheduled downlink connection & conflict resolution procedure

FIGURE 10

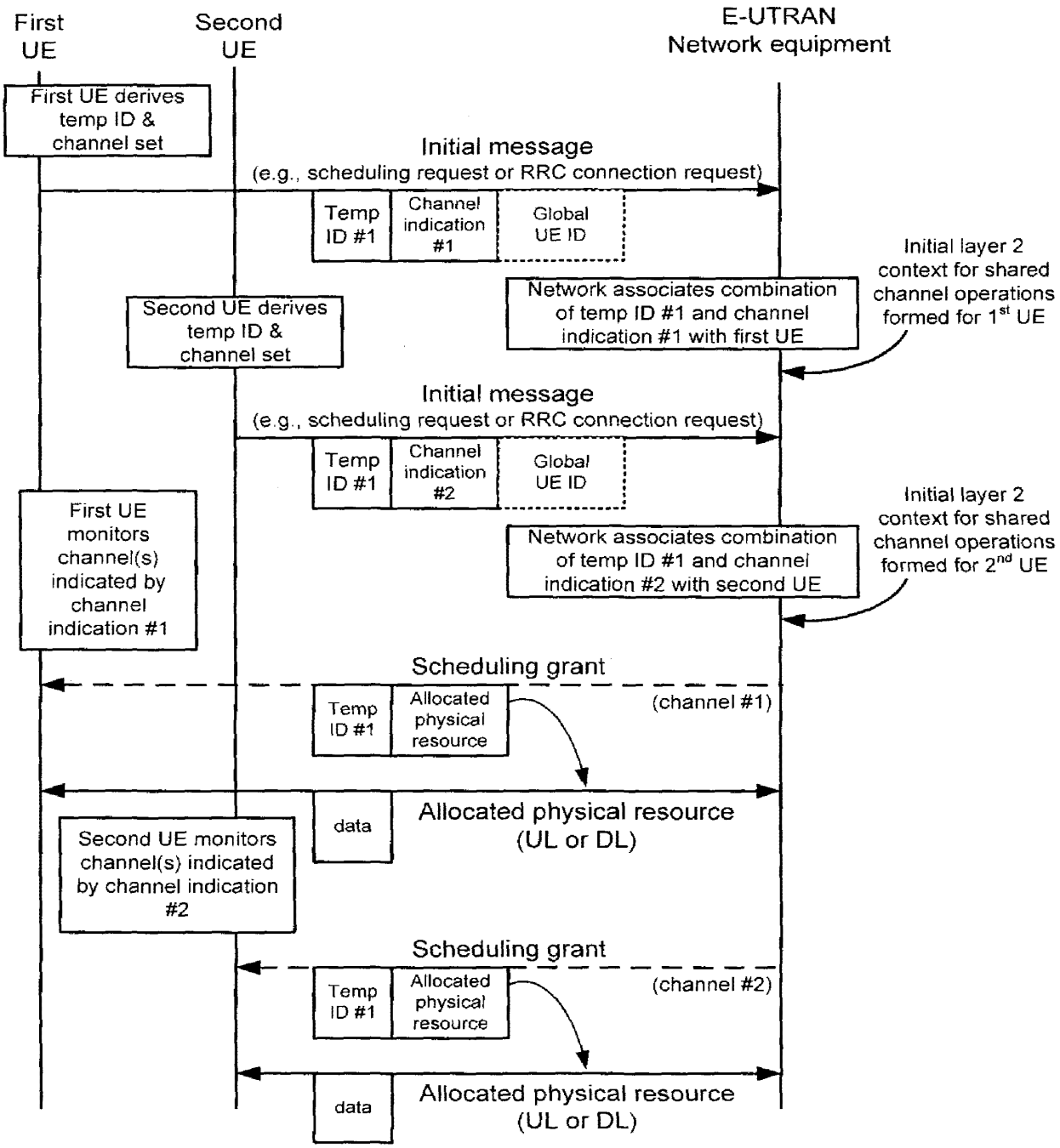

First UE
Second UE
E-UTRAN Network equipment
First UE derives temp ID & channel set
Initial message
(e.g., scheduling request or RRC connection request)
Temp ID #1
Channel indication #1
Global UE ID
Initial layer 2 context for shared channel operations formed for 1st UE
Network associates combination of temp ID #1 and channel indication #1 with first UE
Second UE derives temp ID & channel set
Initial message
(e.g., scheduling request or RRC connection request)
Temp ID #1
Channel indication #2
Global UE ID
Initial layer 2 context for shared channel operations formed for 2nd UE
Network associates combination of temp ID #1 and channel indication #2 with second UE
First UE monitors channel(s) indicated by channel indication #1
Scheduling grant
Temp ID #1
Allocated physical resource
(channel #1)
data
Allocated physical resource (UL or DL)
Second UE monitors channel(s) indicated by channel indication #2
Scheduling grant
Temp ID #1
Allocated physical resource
(channel #2)
data
Allocated physical resource (UL or DL)

FIGURE 11

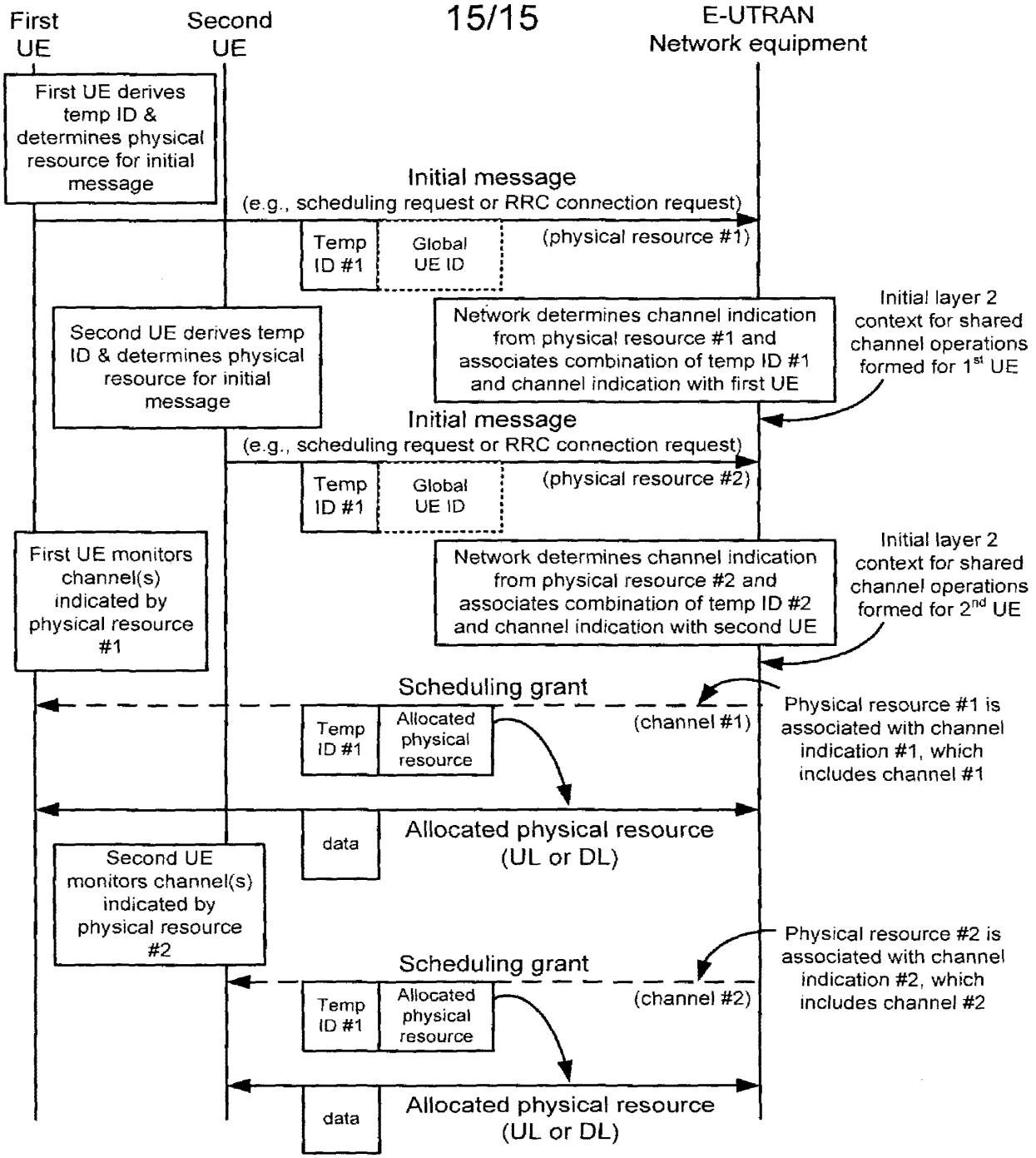

First UE
Second UE
E-UTRAN Network equipment
First UE derives temp ID & determines physical resource for initial message
Initial message
(e.g., scheduling request or RRC connection request)
Temp ID #1
Global UE ID
(physical resource #1)
Second UE derives temp ID & determines physical resource for initial message
Network determines channel indication from physical resource #1 and associates combination of temp ID #1 and channel indication with first UE
Initial layer 2 context for shared channel operations formed for 1st UE
Initial message
(e.g., scheduling request or RRC connection request)
Temp ID #1
Global UE ID
(physical resource #2)
First UE monitors channel(s) indicated by physical resource #1
Network determines channel indication from physical resource #2 and associates combination of temp ID #2 and channel indication with second UE
Initial layer 2 context for shared channel operations formed for 2nd UE
Scheduling grant
(channel #1)
Temp ID #1
Allocated physical resource
Physical resource #1 is associated with channel indication #1, which includes channel #1
data
Allocated physical resource (UL or DL)
Second UE monitors channel(s) indicated by physical resource #2
Physical resource #2 is associated with channel indication #2, which includes channel #2
Scheduling grant
(channel #2)
Temp ID #1
Allocated physical resource
data
Allocated physical resource (UL or DL)

FIGURE 12

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NOTICE OF ALLOWANCE AND FEE(S) DUE

3624 7590 03/03/2014

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PHILADELPHIA, PA 19103

EXAMINER
YUEN, KAN

ART UNIT	PAPER NUMBER
2464	

DATE MAILED: 03/03/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	SIG-2-1853.01.US	2438

TITLE OF INVENTION: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/03/2014

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)

3624 7590 03/03/2014

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

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.
12/238,910	09/26/2008	Benoit Pelletier	SIG-2-1853.01.US	2438

TITLE OF INVENTION: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/03/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
YUEN, KAN	2464	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 credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

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

❑ Applicant asserting small entity status. See 37 CFR 1.27

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

❑ Applicant changing to regular undiscounted fee status.

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

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	SIG-2-1853.01.US	2438

3624 7590 03/03/2014

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER	
YUEN, KAN	

ART UNIT	PAPER NUMBER
2464	

DATE MAILED: 03/03/2014

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 349 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 349 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.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 12/238,910	Applicant(s) PELLETIER ET AL.	
	Examiner KAN YUEN	Art Unit 2464	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 *2/7/2014*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-7,30-32 (Renumbered 1-10 Respectively)*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

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

   * Certified copies not received: _____.

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

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

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

Attachment(s)

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

/KAN YUEN/
Primary Examiner, Art Unit 2464

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Robert Leonard on 11/1/2013.

The application has been amended as follows:

Claims 8-29 are now cancelled.

Conclusion

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KAN YUEN whose telephone number is (571)270-1413. The examiner can normally be reached on Monday-Friday 11:00a.m-6:00p.m EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky O. Ngo can be reached on 571-272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/KAN YUEN/
Primary Examiner, Art Unit 2464

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	Art Unit
	KAN YUEN	2464

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	02/18/2014								
1	1	=								
2	2	=								
3	3	=								
4	4	=								
5	5	=								
6	6	=								
7	7	=								
	8	-								
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	26	-								
	27	-								
	28	-								
	29	-								
8	30	=								
9	31	=								
10	32	=								
	33	-								
	34	-								

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

CPC						
Symbol					**Type**	**Version**
H04W		28	/	04	F	20130101
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CPC Combination Sets						
Symbol				**Type**	**Set**	**Ranking**	**Version**
			/				
			/				

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	10	
/KAN YUEN/ Primary Examiner.Art Unit 2464	02/18/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

U.S. Patent and Trademark Office — Part of Paper No. 20140218

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
370	329

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
370	338				
455	450				

INTERNATIONAL CLASSIFICATION										
CLAIMED					NON-CLAIMED					
H	0	4	W	4 / 00 (2009.0)						

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 10	
/KAN YUEN/ Primary Examiner.Art Unit 2464 (Primary Examiner)	02/18/2014 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6

U.S. Patent and Trademark Office — Part of Paper No. 20140218

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	**Art Unit**
	KAN YUEN	2464

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		17												
2	2		18												
3	3		19												
4	4		20												
5	5		21												
6	6		22												
7	7		23												
	8		24												
	9		25												
	10		26												
	11		27												
	12		28												
	13		29												
	14	8	30												
	15	9	31												
	16	10	32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 10	
/KAN YUEN/ Primary Examiner.Art Unit 2464	02/18/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	83	("20040052229" | "20040068505" | "20040117860" | "20050026623" | "20050053035" | "20050180371" | "20060039326" | "20060251027" | "20070115871" | "20080008152" | "20080049669" | "20080125043" | "20080192766" | "20080268852" | "20090086671" | "20090143074" | "20090168704" | "20090225709" | "20090225739" | "20100091652" | "20100215005" | "20100278143" | "20110164540" | "20120327833" | "6167248" | "6246692" | "6721566" | "6845238" | "7079489" | "7406314" | "7477609" | "7480269" | "7890094" | "7894390").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:51
L2	1785	(tebs or (buffer$4 near2 status)) with (zero or "0" or empt$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:51
L3	511	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:51
L4	3	1 2 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L5	29	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) same (buffer or tebs) near8 (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L6	511	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52

L7	4609	(tebs or ((buffer$4 or database or stor$4 or memory or queue) near3 status)) near7 (empt$4 or zero or "0" or vacant$4 or deplet$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L8	37	L6 L7	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L9	29	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) with (buffer$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L10	3	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-rach or (random$4 near2 access$4 near2 channel)) with (buffer$4 or queue)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L11	138	(tebs same (buffer$4 near2 status))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L12	1785	(tebs or (buffer$4 near2 status)) with (zero or "0" or empt$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L13	54	L11 L12	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L14	44027	(e-dch or (dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L15	54	L13 L14	US-PGPUB; USPAT; USOCR; FPRS; EPO;	AND	ON	2014/02/18 14:52

			DERWENT; IBM_TDB			
L16	5	("2009051502").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2014/02/18 14:52
L17	3	("20090086671").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2014/02/18 14:52
L18	441	(releas$4 near9 (e-dch or (enhanc$4 near4 dedicat$4 near4 channel)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L19	7979	interdigital$.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L20	41145	interdigital$	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L21	89	L18 L20	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L22	7	L21 L11	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L23	3	12/346631	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L24	589	(terminat$4 or releas$4 or disconnect$4 or teardown or tear-down or cancel$4) with (e-dch or	US-PGPUB; USPAT; USOCR;	AND	ON	2014/02/18 14:52

		(enhanc$4 near2 dedicat$4 near2 channel))	FPRS; EPO; DERWENT; IBM_TDB			
L25	671	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer$4 or queu$4 or database or memory or stor$4 or register)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L26	68	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer or queue) with (zero or empt$4 or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L27	98	(schedul$4 near2 information) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L28	148204	(tebs or buffer or queue) with (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L29	61	L27 L28	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L30	15280	((schedul$4 near2 information) or SI) with (tebs or buffer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L31	2399	L28 L30	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L32	291	((schedul$4 near2 information) or SI) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L33	119	L31 L32	US-PGPUB;	AND	ON	2014/02/18

			USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB			14:52
L34	697	(schedul$4 near2 information) with si	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L35	127	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (e-aich or aich or (acquisition near2 indication near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L36	95	(determin$7 or detect$6 or monitor$6) with (last near8 (harq))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
L43	2	("20090225709").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2014/02/18 14:52
L44	10	(releas$4 or cancel$5 or cancellation or clos$4 or disconnect$5 or terminat$5 or teardown or tear-down) with (e-dch or edch or dch or (dedicat$4 near2 channel)) with (harq) same (buffer$4 or stor$3 or memory) near4 (empty or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2014/02/18 14:52
S1	12	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) same (buffer or tebs) near8 (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 14:58
S2	334	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:21
S3	4153	(tebs or ((buffer$4 or database or stor$4 or memory or queue) near3 status)) near7 (empt$4 or zero or "0" or vacant$4 or deplet$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT;	AND	ON	2013/01/25 15:24

			IBM_TDB			
S4	18	S2 S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:25
S5	18	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-dch or (enchanc$4 near2 dedicat$4 near2 channel)) with (buffer$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:32
S6	3	(releas$4 or terminat$4 or disconnect$4 or cancel$4) with (e-rach or (random$4 near2 access$4 near2 channel)) with (buffer$4 or queue)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:38
S7	87	(tebs same (buffer$4 near2 status))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:44
S8	1579	(tebs or (buffer$4 near2 status)) with (zero or "0" or empt$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:45
S9	34	S7 S8	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:45
S10	34366	(e-dch or (dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
S11	34	S9 S10	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 15:46
S12	4	("2009051502").PN.	US-PGPUB; USPAT; USOCR; FPRS;	OR	OFF	2013/01/25 15:50

			EPO; DERWENT; IBM_TDB			
S13	2	("20090086671").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/01/25 15:53
S14	286	(releas$4 near9 (e-dch or (enhanc$4 near4 dedicat$4 near4 channel)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:00
S15	7329	interdigital$.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S16	21593	interdigital$	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S17	49	S14 S16	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S18	4	S17 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:01
S19	2	12/346631	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:03
S20	396	(terminat$4 or releas$4 or disconnect$4 or teardown or tear-down or cancel$4) with (e-dch or (enhanc$4 near2 dedicat$4 near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:09
S21	27105389	(@rlad<"20070928" or @ad<"20070928" or	US-PGPUB; USPAT;	AND	ON	2013/01/25 16:10

		@ptad<"20070928")	USOCR; FPRS; EPO; DERWENT; IBM_TDB			
S22	210	S20 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:11
S25	438	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer$4 or queu$4 or database or memory or stor$4 or register)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:13
S26	59	S22 S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:14
S27	37	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (tebs or buffer or queue) with (zero or empt$4 or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 16:40
S28	55	(schedul$4 near2 information) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:10
S29	132678	(tebs or buffer or queue) with (empt$4 or zero or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:12
S30	32	S28 S29	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:13
S31	13222	((schedul$4 near2 information) or SI) with (tebs or buffer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19

S32	2208	S29 S31	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S33	238	((schedul$4 near2 information) or SI) with (tebs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S34	86	S32 S33	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S35	9	S34 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:19
S36	1219	S21 S32	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:38
S37	451	(schedul$4 near2 information) with si	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
S38	14	S36 S37	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:39
S39	64	(e-dch or (enhanc$4 near2 dedicat$4 near2 channel)) with (e-aich or aich or (acquisition near2 indication near2 channel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 17:52
S40	4	S39 S21	US-PGPUB; USPAT; USOCR; FPRS; EPO;	AND	ON	2013/01/25 17:52

			DERWENT; IBM_TDB			
S41	59	(determin$7 or detect$6 or monitor$6) with (last near8 (harq))	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 18:00
S42	17	S21 S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/01/25 18:00
S51	2	("20090225709").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	OR	OFF	2013/10/28 15:59
S52	7	(releas$4 or cancel$5 or cancellation or clos$4 or disconnect$5 or terminat$5 or teardown or tear-down) with (e-dch or edch or dch or (dedicat$4 near2 channel)) with (harq) same (buffer$4 or stor$3 or memory) near4 (empty or "0")	US-PGPUB; USPAT; USOCR; FPRS; EPO; DERWENT; IBM_TDB	AND	ON	2013/10/28 16:04

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L37	19	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 14:52
L38	1721	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 14:52
L39	5	L37 L38	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 14:52
L40	1678	(buffer near2 empt$4).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 14:52
L41	2	L39 L40	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 14:52
L42	3	11/117579	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 14:52
L45	1721	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 15:02
L46	19	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 15:02
L47	5	45 46	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 15:02
L48	2579	(harq).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 15:02
L49	5	47 48	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 15:02
L50	1678	(buffer near2	US-PGPUB; USPAT;	AND	ON	2014/02/18

		empt$4).clm.	UPAD			15:03
L51	2	49 50	US-PGPUB; USPAT; UPAD	AND	ON	2014/02/18 15:03
S43	12	(releas$4 near5 e-dch).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:26
S44	1498	(buffer near2 status).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
S45	4	S43 S44	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:27
S46	1549	(buffer near2 empt$4).clm.	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
S47	2	S45 S46	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:28
S48	3	11/117579	US-PGPUB; USPAT; UPAD	AND	ON	2013/01/25 15:58

2/18/2014 3:06:21 PM
C:\Users\kyuen\Documents\EAST\Workspaces\12238910.wsp

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	12238910
	Filing Date	2008-09-26
	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6167248	B1	2000-12-26	Hamalainen et al.	
	2	6246692	B1	2001-06-12	Dai et al.	
	3	6721566	B2	2004-04-13	Longoni et al.	
	4	6845238	B1	2005-01-18	Muller	* Corresponds to JP 2003-509982
	5	7079489	B2	2006-07-18	Massie et al.	
	6	7406314	B2	2008-07-29	Sharma	
	7	7477609	B2	2009-01-13	Agin	
	8	7480269	B2	2009-01-20	Heo et al.	

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Receipt date: 02/07/2014	Application Number	12238910 12238910 - GAU: 2464
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(Not for submission under 37 CFR 1.99)	First Named Inventor	Pelletier et al.
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	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	9	7890094	B2	2011-02-15	Iwamure	* Corresponds to JP 2009-147920
	10	7894390	B2	2011-02-22	Nakamata	

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	1	20040052229	A1	2004-03-18	Terry et al.	
	2	20040068505	A1	2004-04-08	Lee et al.	
	3	20040117860	A1	2004-06-17	Yi et al.	
	4	20050026623	A1	2005-02-03	Fisher	
	5	20050053035	A1	2005-03-10	Kwak et al.	
	6	20050180371	A1	2005-08-18	Malkamaki et al.	
	7	20060039326	A1	2006-02-23	Jeong et al.	

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	8	20060251027	A1	2006-11-09	Chun et al.	
	9	20070115871	A1	2007-05-24	Zhang et al.	
	10	20080008152	A1	2008-01-10	Lohr et al.	
	11	20080049669	A1	2008-02-28	Lundby et al.	
	12	20080125043	A1	2008-05-29	Karmanenko et al.	
	13	20080192766	A1	2008-08-14	Ranta-Aho et al.	
	14	20080268852	A1	2008-10-30	Petrovic et al.	
	15	20090086671	A1	2009-04-02	Pelletier et al.	
	16	20090143074	A1	2009-06-04	Pelletier et al.	
	17	20090168704	A1	2009-07-02	Lee et al.	
	18	20090225709	A1	2009-09-10	Wager et al.	

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	19	20090225739	A1	2009-09-10	Yeo et al.	
	20	20100091652	A1	2010-04-15	Lin	
	21	20100215005	A1	2010-08-26	Pradas et al.	
	22	20100278143	A1	2010-11-04	Chun et al.	
	23	20110164540	A1	2011-07-07	Lee et al.	
	24	20120327833	A1	2012-12-27	Kim et al.	

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	1	04100598	WO	A1	2004-11-18	GRANZOW WOLFGANG		☐
	2	05006829	WO	A2	2005-01-27	SHARMA SANJEEV		☐
	3	05089050	WO	A2	2005-09-29	HWANG WOONHEE		☐

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	4	07048470	WO	A1	2007-05-03	SEIDEL EIKO		☐
	5	07077250	WO	A2	2007-07-12	ANDERSON NICHOLAS WILLIAM		☐
	6	08097489	WO	A2	2008-08-14	MARINIER PAUL		☐
	7	08137421	WO	A2	2008-11-13	MARINIER PAUL		☐

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	1	INFINEON TECHNOLOGIES, "Multiplexing option selection in case of E_DCH_TRANSMISSION equal FALSE," 3GPP TSG- RAN WG2 Meeting #58, R2-072054, Kobe, Japan, (May 7 – 11, 2007).	☐
	2	QUALCOMM EUROPE, "Layer 1/2 aspects for enhanced UL for CELL_FACH," 3GPP TSG-RAN WG2 #59bis, R2-074390 (Oct 8-12, 2007).	☐
	3	THIRD GENERATION PARTNERSHIP PROJECT WORK AREA, "Enhanced Uplink for CELL_FACH State In FDD", TSG-RAN #37 Meeting, RP-070677, (Riga, Latvia, September 11-14, 2007).	☐
	4	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 1999)," 3GPP TS 25.425 V3.8.0 (December 2003).	☐
	5	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 4)," 3GPP TS 25.425 V4.4.0 (December 2003).	☐

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	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	6	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iur interface user plane protocols for Common Transport Channel data streams (Release 5)," 3GPP TS 25.425 V5.8.0 (June 2005).	☐
	7	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 1999)," 3GPP TS 25.321 V3.17.0 (June 2004).	☐
	8	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 4)," 3GPP TS 25.321 V4.10.0 (June 2004).	☐
	9	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 5)," 3GPP TS 25.321 V5.13.0 (March 2007).	☐
	10	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 5)," 3GPP TS 25.321 V5.14.0 (September 2008).	☐
	11	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 6)," 3GPP TS 25.321 V6.13.0 (June 2007).	☐
	12	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification (Release 6)," 3GPP TS 25.321 V6.16.0 (September 2008).	☐
	13	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Medium Access Control (MAC) protocol specification(Release 7)," 3GPP TS 25.321 V7.10.0 (September 2008).	☐
	14	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 1999)," 3GPP TS 25.211 V3.12.0 (September 2002).	☐
	15	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 4)," 3GPP TS 25.211 V4.6.0 (September 2002).	☐
	16	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 5)," 3GPP TS 25.211 V5.8.0 (December 2005).	☐

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

Receipt date: 02/07/2014	Application Number	12238910 12238910 - GAU: 2464
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-09-26
	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

	17	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 6)," 3GPP TS 25.211 V6.8.0 (September 2007).	☐
	18	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 6)," 3GPP TS 25.211 V6.9.0 (November 2007).	☐
	19	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 7)," 3GPP TS 25.211 V7.6.0 (May 2008).	☐
	20	THIRD GENERATION PARTNERSHIP PROJECT, "Technical Specification Group Radio Access Network; Enhanced uplink; Overall description; Stage 2 (Release 7)," 3GPP TS 25.319 V7.6.0 (May 2008).	☐
	21	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 1999)," 3GPP TS 25.427 V3.11.0 (December 2003).	☐
	22	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 4)," 3GPP TS 25.427 V4.5.0 (December 2003).	☐
	23	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 5)," 3GPP TS 25.427 V5.5.0 (June 2005).	☐
	24	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 6)," 3GPP TS 25.427 V6.8.0 (December 2006).	☐
	25	THIRD GENERATION PARTNERSHIP PROJECT; "Technical Specification Group Radio Access Network; UTRAN Iub/Iur interface user plane protocol for DCH data streams (Release 7)," 3GPP TS 25.427 V7.5.0 (September 2007).	☐
	26		☐
	27		☐

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

Receipt date: 02/07/2014	Application Number	12238910 12238910 - GAU: 2464
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-09-26
	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

If you wish to add additional non-patent literature document citation information please click the Add button **Add**			
EXAMINER SIGNATURE			
Examiner Signature	/Kan Yuen/	Date Considered	02/18/2014

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

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

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

Receipt date: 02/07/2014	Application Number	12238910 12238910 - GAU: 2464
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Filing Date	2008-09-26
	First Named Inventor	Pelletier et al.
	Art Unit	2464
	Examiner Name	Kan Yuen
	Attorney Docket Number	SIG-2-1853.01.US

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	/Abhik A. Huq/	Date (YYYY-MM-DD)	2014-02-07
Name/Print	Abhik A. Huq	Registration Number	40656

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.**

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

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.

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12238910	PELLETIER ET AL.
	Examiner	Art Unit
	KAN YUEN	2464

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	328,329,338,341,348	2/18/2014	KY
455	450,464	2/18/2014	KY
709	226,229	2/18/2014	KY

SEARCH NOTES		
Search Notes	Date	Examiner
EAST SEARCH CONSULTED WITH SPE	2/18/2014	KY
MANUAL SEARCH CLASS 370 SUBCLASS 329	2/18/2014	KY
INVENTORSHIP SEARCH	2/18/2014	KY

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	INTERFERENCE SEARCH PRINTOUT	2/18/2014	KY

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:	
Pelletier et al.	
Application No.: 12/238,910	
Confirmation No.: 2438	Our File: SIG-2-1853.01.US
Filed: September 26, 2008	Date: May 15, 2014
For: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL	
Group: 2464	
Examiner: Kan Yuen	

AMENDMENT AFTER ALLOWANCE
PURSUANT TO 37 C.F.R. §1.312

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

Madam:

This amendment is submitted further to the Notice of Allowance dated March 3, 2013, to correct claim formalities.

Please amend the application without prejudice or disclaimer as follows:

Amendments to the Claims:

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

Listing of Claims:

1. (Currently Amended) A method for completing an enhanced dedicated channel (E-DCH) transmission in a cell forward access channel (CELL_FACH) state by a wireless transmit/receive unit (WTRU), the method comprising:

determining that a buffer is empty;

on a condition that the buffer is empty, triggering a transmission by the WTRU of scheduling information (SI) with a total enhanced dedicated channel (E-DCH) buffer status (TEBS) equal to zero;

determining a last hybrid automatic repeat request (HARQ) data transmission; and

on a condition that the buffer is empty and the last HARQ ~~hybrid automatic repeat request (HARQ)~~ data transmission has been determined, releasing an E-DCH resource.

2. (Original) The method as in claim 1, wherein an inactivity timer is started when the buffer is empty.

3. (Original) The method as in claim 2, wherein the transmission of the SI is triggered when the inactivity timer expires.

4. (Previously Presented) The method as in claim 1, wherein an E-DCH transmission occurs on a condition that a response is received on an E-DCH acquisition indication channel (E-AICH) to a preamble transmitted by the WTRU.

5. (Previously Presented) The method as in claim 1, further comprising completing the E-DCH transmission in case of cell reselection or radio link failure.

6. (Currently Amended) A wireless transmit/receive unit (WTRU) comprising:

a processor configured to:

determine that a buffer is empty;

on a condition that the buffer is empty, trigger a transmission of scheduling information (SI) with a total E-DCH buffer status (TEBS) equal to zero;

determine a last hybrid automatic repeat request (HARQ) data transmission; and

on a condition that the buffer is empty and the last HARQ ~~hybrid automatic repeat request (HARQ)~~ data transmission has been determined, release an E-DCH resource.

7. (Previously Presented) The WTRU as in claim 6, the processor further configured to complete the E-DCH transmission on a condition cell reselection or radio link failure.

8-29 Canceled

30. (Previously Presented) The WTRU as in claim 6, wherein the processor is further configured to start an inactivity timer when the buffer is empty.

31. (Previously Presented) The WTRU as in claim 30, wherein the transmission of the SI is triggered when the inactivity timer expires.

32. (Previously Presented) The WTRU as in claim 6, wherein an E-DCH transmission occurs on a condition that a response is received on an E-DCH acquisition indication channel (E-AICH) to a preamble transmitted by the WTRU.

33-34 Canceled

REMARKS

Claims 1-7 and 30-32 are currently pending in this application. Claims 1-7 and 30-32 were allowed in the March 3, 2013 Notice of Allowance. By the present amendment, claims 1 and 6 are amended to correct typographical or grammar errors. No substantive changes have been made to the claims and no new matter has been introduced into the claims by this amendment.

Entry of this 312 Amendment is respectfully requested as the application received a Notice of Allowance, and the change being made does not raise any substantive issues.

Accordingly, entry of this Rule 312 Amendment is respectfully requested.

Respectfully submitted,

Pelletier et al.

By /Abhik A. Huq/
Abhik A. Huq
Registration No. 40,656

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

AAH/say

Electronic Acknowledgement Receipt	
EFS ID:	19037134
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Abhik A. Huq/Sandy Yi
Filer Authorized By:	Abhik A. Huq
Attorney Docket Number:	SIG-2-1853.01.US
Receipt Date:	15-MAY-2014
Filing Date:	26-SEP-2008
Time Stamp:	17:40:50
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		20140515_SIG_2_1853_01_US_312_Amendment.pdf	65384 d035906234eba23a5c4722b61e9f8c4cf4efca96	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	4
	Applicant Arguments/Remarks Made in an Amendment	5	5
Warnings:			
Information:			
	Total Files Size (in bytes):	65384	

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

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

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	09/26/2008	Benoit Pelletier	SIG-2-1853.01.US	2438

3624 7590 05/22/2014

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER	
YUEN, KAN	
ART UNIT	**PAPER NUMBER**
2464	

NOTIFICATION DATE	DELIVERY MODE
05/22/2014	ELECTRONIC

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

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

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

eoffice@volpe-koenig.com

Response to Rule 312 Communication	Application No.	Applicant(s)
	12/238,910	PELLETIER ET AL.
	Examiner	Art Unit
	KAN YUEN	2464

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

1. ☒ The amendment filed on *15 May 2014* under 37 CFR 1.312 has been considered, and has been:

a) ☐ entered.

b) ☒ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/KAN YUEN/
Primary Examiner, Art Unit 2464

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)

3624 7590 03/03/2014

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

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.
12/238,910	09/26/2008	Benoit Pelletier	SIG-2-1853.01.US	2438

TITLE OF INVENTION: METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/03/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
YUEN, KAN	2464	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 Volpe and Koenig, P.C.

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: Signal Trust for Wireless Innovation

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Wilmington, Delaware

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.

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 220493 (enclose an extra copy of this form).

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

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

☐ Applicant asserting small entity status. See 37 CFR 1.27

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

☐ Applicant changing to regular undiscounted fee status.

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

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Abhik A. Huq/ Date June 3, 2014

Typed or printed name Abhik A. Huq Registration No. 40,656

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Patent Application Fee Transmittal

Application Number:	12238910
Filing Date:	26-Sep-2008
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Filer:	Abhik A. Huq/Sandy Yi
Attorney Docket Number:	SIG-2-1853.01.US

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	960	960
Publ. Fee- Early, Voluntary, or Normal	1504	1	0	0

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt	
EFS ID:	19197025
Application Number:	12238910
International Application Number:	
Confirmation Number:	2438
Title of Invention:	METHOD AND APPARATUS FOR TERMINATING TRANSMISSION OF A MESSAGE IN AN ENHANCED RANDOM ACCESS CHANNEL
First Named Inventor/Applicant Name:	Benoit Pelletier
Customer Number:	3624
Filer:	Abhik A. Huq/Sandy Yi
Filer Authorized By:	Abhik A. Huq
Attorney Docket Number:	SIG-2-1853.01.US
Receipt Date:	03-JUN-2014
Filing Date:	26-SEP-2008
Time Stamp:	14:53:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$960
RAM confirmation Number	1229
Deposit Account	220493
Authorized User	HUQ, ABHIK A.

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 1.20 (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)	SIG_2_1853_01_US_Issue_Fee_Trans.PDF	93610 17d608707732715c4612b28991ee5b0f39ada84e	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32213 c2f3c2ed09ef60374e1df26a67f8ceb8520fce35	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	125823		

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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.

<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.

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/238,910	07/08/2014	8774104	SIG-2-1853.01.US	2438

3624 7590 06/18/2014

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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 547 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.

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