To: eoffice@volpe-koenig.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 3624

May 20, 2021 03:45:18 AM

Dear PAIR Customer:

VOLPE KOENIG
30 SOUTH 17TH STREET, 18TH FLOOR
PHILADELPHIA, PA 19103
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 3624 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
16682854	ISSUE.NTF	05/19/2021	IPW2-USCN213316

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,854	06/08/2021	11032000	IPW2-USCN213316	1678

3624 7590 05/19/2021

VOLPE KOENIG
30 SOUTH 17TH STREET, 18TH FLOOR
PHILADELPHIA, PA 19103

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

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

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

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

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

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

Paul Howard, Bristol, UNITED KINGDOM;
Intellectual Ventures II LLC, Wilmington, DE;

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

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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 02/04/2021

Volpe Koenig
30 SOUTH 17TH STREET, 18TH FLOOR
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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

John D. Wilt	(Typed or printed name)
/John D. Wilt/	(Signature)
May 4, 2021	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

TITLE OF INVENTION: COMMUNICATIONS IN A WIRELESS NETWORK

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	05/04/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
ABELSON, RONALD B	2476	370-280000

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 03-09 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 Koenig
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Intellectual Ventures II LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Wilmington, DE

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

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

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

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 220493

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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.
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.
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 /John D. Wilt/ Date May 4, 2021

Typed or printed name John D. Wilt Registration No. 76,110

Electronic Patent Application Fee Transmittal

Application Number:	16682854
Filing Date:	13-Nov-2019
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Filer:	John D. Wilt/Caren Burgoon
Attorney Docket Number:	IPW2-USCN213316

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1200**

Electronic Acknowledgement Receipt

EFS ID:	42633961
Application Number:	16682854
International Application Number:	
Confirmation Number:	1678
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Customer Number:	3624
Filer:	John D. Wilt/Caren Burgoon
Filer Authorized By:	John D. Wilt
Attorney Docket Number:	IPW2-USCN213316
Receipt Date:	04-MAY-2021
Filing Date:	13-NOV-2019
Time Stamp:	16:20:42
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1200
RAM confirmation Number	E202154G22081878
Deposit Account	220493
Authorized User	Caren Burgoon

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IPW2_USCN213316_IssueFeePaymentTransmittal_20210504.pdf	117260 4fedd8f84f9024081b819ed29f63ef855c9238b0	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30509 185c96df912281a6562e59a4cff4d3fcf3eb57a3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	147769		

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.

To: eoffice@volpe-koenig.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 3624

Feb 04, 2021 04:01:58 AM

Dear PAIR Customer:

Volpe Koenig
30 SOUTH 17TH STREET, 18TH FLOOR
PHILADELPHIA, PA 19103
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 3624 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

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Application	Document	Mailroom Date	Attorney Docket No.
16682854	NOA	02/04/2021	IPW2-USCN213316

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

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

3624 7590 02/04/2021

Volpe Koenig
30 SOUTH 17TH STREET, 18TH FLOOR
PHILADELPHIA, PA 19103

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

DATE MAILED: 02/04/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

TITLE OF INVENTION: COMMUNICATIONS IN A WIRELESS NETWORK

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	05/04/2021

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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 02/04/2021

Volpe Koenig
30 SOUTH 17TH STREET, 18TH FLOOR
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

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

TITLE OF INVENTION: COMMUNICATIONS IN A WIRELESS NETWORK

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	05/04/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
ABELSON, RONALD B	2476	370-280000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

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

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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.
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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. _____

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.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

3624 7590 02/04/2021

Volpe Koenig
30 SOUTH 17TH STREET, 18TH FLOOR
PHILADELPHIA, PA 19103

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2476	

DATE MAILED: 02/04/2021

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

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/682,854	Applicant(s) Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	AIA (FITF) 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 1/20/21.
   ☐ 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 1-24 . 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 _____.

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

CPC - Searched*		
Symbol	**Date**	**Examiner**
h04b7/2643	01/27/2021	RA
h04j3/1694	01/27/2021	RA
h04l5/0053	01/27/2021	RA
h04w52/146 h04w72/0406 h04w72/042 h04w72/0446	01/27/2021	RA

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
CPC combined with limited text search in EAST	01/27/2021	RA

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
h04b	7/2643	01/27/2021	RA
h04j	3/1694	01/27/2021	RA
h04l	5/0053	01/27/2021	RA
h04w	52/146, 72/0406, 72/042, 72/0446	01/27/2021	RA

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	**Art Unit**
	RONALD B ABELSON	2476

CPC						
Symbol					**Type**	**Version**
H04B	/	7	/	2643	F	2013-01-01
H04W	/	72	/	0406	I	2013-01-01
H04J	/	3	/	1694	I	2013-01-01
H04L	/	5	/	0053	I	2013-01-01
H04W	/	52	/	146	I	2013-01-01
H04W	/	72	/	042	I	2013-01-01
H04W	/	72	/	0446	I	2013-01-01
H04W	/	52	/	54	A	2013-01-01

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	24	
/RONALD B ABELSON/ Primary Examiner, Art Unit 2476	27 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210121

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	**Art Unit**
	RONALD B ABELSON	2476

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04B	/	7	/	26
H04W	/	72	/	04
H04W	/	52	/	14
H04J	/	3	/	16
H04L	/	5	/	00

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	24	
/RONALD B ABELSON/ Primary Examiner, Art Unit 2476	27 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210121

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	**Art Unit**
	RONALD B ABELSON	2476

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

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10	19	19										
2	2	11	11	20	20										
3	3	12	12	21	21										
4	4	13	13	22	22										
5	5	14	14	23	23										
6	6	15	15	24	24										
7	7	16	16												
8	8	17	17												
9	9	18	18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	24	
/RONALD B ABELSON/ Primary Examiner, Art Unit 2476	27 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20210121

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

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

CLAIMS

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

CLAIM		DATE								
Final	Original	01/25/2020	06/25/2020	10/16/2020	01/27/2021					
1	1	✓	✓	✓	=					
2	2	✓	✓	✓	=					
3	3	✓	✓	✓	=					
4	4	✓	✓	✓	=					
5	5	✓	✓	✓	=					
6	6	✓	✓	✓	=					
7	7	✓	✓	✓	=					
8	8	✓	✓	✓	=					
9	9	✓	✓	✓	=					
10	10	✓	✓	✓	=					
11	11	✓	✓	✓	=					
12	12	✓	✓	✓	=					
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15	15	✓	✓	✓	=					
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20	20	✓	✓	✓	=					
21	21	✓	✓	✓	=					
22	22	✓	✓	✓	=					
23	23	✓	✓	✓	=					
24	24	✓	✓	✓	=					

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Did you mean: ***plc*** bit feedback

alainaleary.com › 2015/03/10 › review-pusheen-plush-...

Review: Pusheen Plush by Hey Chickadee (and learn a bit of ...

Mar 10, 2015 — For an early birthday gift, I got what every girl wants: a Pusheen plush! Yes, my girlfriend surprised me with this little cutie when we started ...

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Learn Your Rights as a Photographer with this Short and ...

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UMTS - ETSI

Feb 4, 2010 — Coding and Bit Scrambling of the MBMS Notification Indicator . ... PI. Paging Indicator (value calculated by higher layers). PLCCH . is performed by taking the tail bits from the shift register feedback after all information bits are.

books.google.com › books

WCDMA for UMTS: HSPA Evolution and LTE - Google Books Result

Physical Layer Common Control Channel (PLCCH) is used to carry power control ... no other information is carried on the PLCCH other than TPC and SS bits. ... (E-HICH) follows the WCDMA principle in carrying feedback whether a packet ...

Harri Holma, Antti Toskala · 2010 · Technology & Engineering

www.etsi.org › deliver › etsi_ts

3GPP TS 25.222 - ETSI

Coding and Bit Scrambling of the MBMS Notification Indicator ... PLCCH. Physical Layer Common Control Channel. Pq. Paging Indicator (indicator set by ... by taking the tail bits from the shift register feedback after all information bits are

www.youtube.com › watch

Five Nights at Freddy's 8-Bit Freddy Buildable Figure - FNAF ...

Our review of the 8-Bit Freddy buildable figure from McFarlane toys. This creepy building toy is based on the ...

Aug 12, 2016 · Uploaded by SEO Toy Review

Missing: plcch | Must include: plcch

scdn.rohde-schwarz.com › dl_common_library › pdf_1 PDF

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Realtime processing of HARQ feedback commands for closed-loop base station ... specifies the bit rate for serial transmission 115.2 kbps, 1.6 Mbps, 1.92 Mbps ...

dl.cdn-anritsu.com › Application-Notes › Application-Note PDF

TD-SCDMA Test

MICH. MBMS Indication Channel. – PLCCH. Physical Layer Common Control Channel ... HS-SICH carries the feedback signalling related to downlink HS- ... (bits). NSS & NTPC. (bits) Bits/slot. NData/Slot. (bits). Ndata/data field(1). (bits).

www.arib.or.jp › overview › doc › 5_Appendix › Rel8 PDF

3GPP TS 25.433

HS-DSCH Provided Bit Rate Value Information . ... CQI Feedback Cycle k . ... Power IE, the Node B shall reconfigure the power that the PLCCH shall use.

Fairfax County, Virginia - From your Internet address - Use precise location - Learn more

Help Send feedback Privacy Terms

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"16682854"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2021/01/27 07:38
L2	0	1 and (number field).clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2021/01/27 07:38
L3	1	1 and (number field)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2021/01/27 07:38
L4	6	plcch with (number field) with bit with feedback	US-PGPUB; USPAT; EPO; JPO	OR	ON	2021/01/27 07:40
L5	40,701	h04b7/2643 h04j3/1694 h04l5/0053 h04w52/146 h04w72/0406 h04w72/042 h04w72/0446	US-PGPUB; USPAT; EPO; JPO	OR	ON	2021/01/27 07:41
L6	40,701	L5	US-PGPUB; USPAT; EPO; JPO	OR	ON	2021/01/27 07:41
L7	2	6 and plcch with bit with feedback	US-PGPUB; USPAT; EPO; JPO	OR	ON	2021/01/27 07:41
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S2	4	11/646,692	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 16:39
S3	1	S2 and (time adj1 interval).clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 16:40
S4	0	S2 and (condition).clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 17:28
S5	4	S2 and (condition) with physical	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 17:28
S6	137	uplink adj2 control adj1 channel with channel adj1 condition	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 17:29

S7	7	uplink adj2 physical adj1 control adj1 channel with channel adj1 condition	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 17:30
S8	1	"20030022683".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:37
S9	0	S8 and multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:37
S10	1	S8 and tdd	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:37
S11	6,975	pdsch with multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:38
S12	0	pdsch with share near4 control with multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:39
S13	1,805	pdsch with channel near4 control with multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:39
S14	872,927	pdsch with control adj1 channelwith multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:39
S15	1,548	pdsch with control adj1 channel with multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:39
S16	1,548	pdsch with control adj1 channel with multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 18:39
S17	1	"20070077151".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 20:53
S18	1	"20070265017".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/24 20:53
S19	126	(ishii and hanaki).inv.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2020/01/25 08:29
S20	21	(ishii and hanaki).inv. and call.ti.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2020/01/25 08:31
S21	1	"2005346319".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/25 08:42

S22	1	"20080144600".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/25 09:14
S23	4	("20020077151" "20040022213" "20020172208" "20080144600").pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/25 09:30
S24	1	"20080090528".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:18
S25	0	S24 and (time adj1 multiplex$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:23
S26	1	S24 and (time multiplex$3)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:23
S27	0	S24 and (time multiplex$3) same (pusch puuch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:24
S28	1	S24 and (time multiplex$3 pusch puuch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:24
S29	1	S24 and (time multiplex$3 pusch pucch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:26
S30	1	S24 and (pusch same pucch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:27
S31	0	multiplex43 with (pusch with pucch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:29
S32	3,707	multiplex$3 with (pusch with pucch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:29
S33	999	time adj1 multiplex$3 same (pusch same pucch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:30
S34	6,756	multiplex$3 same (pusch same pucch)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:32
S35	5,757	S34 not S33	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:32
S36	6,745	multiplex$3 same (pusch same pucch)	US-PGPUB; USPAT	OR	ON	2020/01/26 08:33
S37	2,587	multiplex$3 same (pusch same pucch)	USPAT	OR	ON	2020/01/26 08:33

S38	4,158	multiplex$3 same (pusch same pucch)	US-PGPUB	OR	ON	2020/01/26 08:38
S39	2,324	multiplex$3 with (pusch with pucch)	US-PGPUB	OR	ON	2020/01/26 08:39
S40	3,731	multiplex$3 same (pusch with pucch)	US-PGPUB	OR	ON	2020/01/26 08:39
S41	1,407	S40 not S39	US-PGPUB	OR	ON	2020/01/26 08:39
S42	86	time adj1 multiplex$3 with (uplink with shared with control)	US-PGPUB	OR	ON	2020/01/26 08:45
S43	155	time adj1 multiplex$3 with (uplink with shared with control)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/26 08:45
S44	1	"20040028020".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/28 08:07
S45	0	S44 and header	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/28 08:08
S46	0	S44 and rv same tbs	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/28 08:08
S47	1	S44 and (rv redundancy) same (transport tbs)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/01/28 08:09
S48	31,861	h04b7/2643 h04j3/1694 h04l5/0053 h04w52/146 h04w72/0406 h04w72/042 h04w72/0446	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/02/04 08:35
S49	1,825	pdsch with channel near4 control with multiplex$3	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/02/04 08:35
S50	853	S48 and S49	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/02/04 08:35
S51	1	"20200083952".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 07:56
S52	1	"20070265017".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:05
S53	1	S52 and pdsch	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:05

S54	0	S51 and p-ccpch	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:07
S55	0	S51 and ccpch	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:07
S56	1	S51 and ("206" "208")	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:07
S57	14	downlink adj1 beacon with timeslot	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:08
S58	5,760	pdsch with (beacon timeslot slot)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:11
S59	2,211	pdsch with shar$3 with (beacon timeslot slot)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:11
S60	19	pdsch with shar$3 with (beacon)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:12
S61	449	pdsch with ccpch	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:22
S62	40	pdsch with ccpch with (slot timeslot)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 08:25
S63	1	"20040022213".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 09:18
S64	0	S63 and pdsch	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 09:38
S65	1	S63 and downlink with control	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 09:39
S66	0	"20070058595".pn. and pdsch	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 13:05
S67	1	"20070058595".pn. and downlink	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/06/20 13:05
S68	1	"20040170132".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/10/04 09:59

S69	2	beacon with pdsch with (timeslot time adj1 slot)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/10/04 10:02
S70	68	(identical "same") with pdsch with (timeslot time adj1 slot)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2020/10/04 10:07

1/27/2021 7:42:13 AM
C:\Users\rabelson\Documents\EAST\Workspaces\16682854.wsp

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of: Intellectual Ventures II LLC **Application No.:** 16/682,854 **Confirmation No.: 1678** **Filed:** November 13, 2019 For: COMMUNICATIONS IN A WIRELESS NETWORK Group: 2476 Examiner: Ronald B. Abelson	Our File: IPW2-USCN213316 Date: January 20, 2021

RESPONSE PURSUANT TO 37 C.F.R. §1.111

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

This Response is being timely filed in response to the Non-Final Office Action dated October 21, 2020.

Please amend the application without prejudice or disclaimer as follows:

6586645.1

Electronic Acknowledgement Receipt

EFS ID:	41693552
Application Number:	16682854
International Application Number:	
Confirmation Number:	1678
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Customer Number:	3624
Filer:	John D. Wilt/Caren Burgoon
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IPW2_USCN213316_NFOAReply_20210120.pdf	152574 a4ac4fc02e97bc9364ed0bdeac9c81978a8bd915	yes	17

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	10	17
	Claims	2	9
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	152574	

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

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

REMARKS/ARGUMENTS

After the foregoing Amendment, claims 1-24 are currently pending in this application. Claims 1, 7, 13, and 19 are amended.

Support for the amendments can be found throughout the specification, in particular, at least paragraphs [0028]–[0031] of the U.S. Patent Publication 2020/0083952 A1. No new matter has been added.

Applicant respectfully requests the entry of the amendments and reconsideration of the application in view of the amendments and the remarks below.

Claim Rejections - 35 U.S.C. §103

Claims 1, 2, 6-8, 12-14, 18-20, and 24 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over Japanese Patent Publication No. JP 2005-346319 (for translation see US Patent Publication No. 2007/0265017) to Ishii (hereinafter "Ishii") in view of U.S. Patent Publication No. 2002/0077151) to Matthews (hereinafter "Matthews"), U.S. Patent Publication No. 2004/0022213 to Choi (hereinafter "Choi"), and U.S. Patent Publication No. 2004/0170132 to Shin (hereinafter "Shin"), and U.S. Patent Publication No. 2005/0058103 to Jeong (hereinafter "Jeong").

Applicant respectfully traverses the §103 rejection and submits that independent claim 1 recites features not taught, suggested, or otherwise yielded by

any proper combination of the cited references. Accordingly, the Applicant submits that the amended claims are patentable for at least the following reasons:

For example, claim 1, as amended, herein recites, in part:

> ...wherein the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and
>
> the receiver and the processor are further configured to receive, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

None of the cited references teach or suggest that the uplink physical signal is used to determine channel conditions by a base station in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval and wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

Ishii discloses a call admission control device in a communication system for transmitting a packet to a plurality of mobile stations. Further, the call admission of a new mobile station is controlled based on at least one of a number and a ratio of mobile stations that cannot satisfy a predetermined minimum transmission data rate in the plurality of mobile stations. However, Ishii fails to disclose, teach, or suggest,

that the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval and wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

Matthew discloses a plurality of nanoCell base stations that provide radio connectivity among mobile stations. Further, the plurality of nanoCell base stations includes a plurality of transceivers that provides base station functionality via a controller for managing the transceivers, and determining the communications connectivity paths between base station and mobile station functions. However, Matthew fails to disclose, teach, or suggest the uplink physical signal is used to determine channel conditions by a base station in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval and wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

Choi discloses an apparatus for determining channel quality indicator (CQI) report cycles for user equipments (UEs). The Node B receives CQI information from the UEs receiving a high-speed downlink packet access (HSDPA) service. The Node B determines recommended CQI report cycles based on the number of UEs and the CQI information, and transmits the determined recommended CQI report cycles to the SRNC via the CRNC. The SRNC then determines CQI report cycles for the UEs

referring to the recommended CQI report cycles, and transmits the determined CQI report cycles to the UEs and the Node B. However, Choi fails to disclose, teach, or suggest that the uplink physical signal is used to determine channel conditions by a base station in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval and wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE. Determining and transmitting a CQI value to the Nobe B which then determines an MCS level is not the same as determining channel conditions by a base station in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval.

Shin discloses a method of determining uplink power requirements for a transceiver in a wireless communication system that includes obtaining measurements from a beacon signal occupying a first timeslot in a frame; obtaining measurements from at least one additional channel having a known transmitted signal strength and occupying a second timeslot in the frame; and utilizing the measurements to determine a path loss estimate. However, Shin fails to disclose, teach, or suggest the uplink physical signal is used to determine channel conditions by a base station in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval and wherein a number of bits sent over the physical control channel is based on a number

of fields of control information to be sent to the UE. Identifying physical channels in a time slot in a frame that does not include a physical control channel is not the same as wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

Jeong discloses a method for a UE to detect active channelization codes including channelization codes used by other UEs which are different from at least one channelization code assigned to the UE. Further, for transmission/reception to/from a Node B in an assigned time slot in a mobile communication system, where each of time slots of a radio channel frame is identified by a plurality of code channels, each having a unique channelization code. However, Jeong fails to disclose, teach, or suggest that the uplink physical signal is used to determine channel conditions by a base station in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval and wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE. The Examiner alleges on page 7 of the OA that, "Jeong teaches physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame (When one UE occupies all physical channels in one downlink time slot, or a plurality of UEs share all the physical channels in one downlink time slot, [0035])." We respectfully disagree with this assumption since we believe this is a

unicast transmission or a multicast transmission, respectfully. However, the claim was amended to include, "wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

Accordingly, Applicant's amended independent claim 1 is patentable over the Ishii, Matthew, Choi, Shins, and Jeong references, whether taken alone or in combination with one another. Although not identical, Applicant's amended and independent claims 7, 13, and 19 recite features similar to Applicant's amended independent claim 1, and are therefore patentable over the cited art of record for at least the same reasons provided above.

Claims 3, 9, 15, and 21 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of U.S. Patent Publication No. 2002/0172208 to Malkamaki (hereinafter "Malkamaki").

Malkamaki discloses a HARQ process with a modification that allows in-sequence delivery of protocol data units (PDUs) to the radio link control layer (RLC) of the receiving wireless terminal. However, Malkamaki fails to disclose, teach, or suggest the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a

plurality of UEs transmit uplink physical signals in the same time interval and wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

Claims 4, 5, 10, 11, 16, 17, 22, and 23 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of U.S. Patent Publication No. 2008/0144600 to Anderson (hereinafter "Anderson").

Anderson discloses a method of sending user equipment specific information to a plurality of user equipment to maximize channel efficiency. However, Anderson fails to disclose, teach, or suggest, wherein physical control channels that are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel. Therefore, Anderson does not cure the deficiencies of Ishii, Matthew, Choi, Shins, and Jeong. Based on the arguments presented above, withdrawal of the 35 U.S.C. §103 rejection of claims 4, 5, 10, 11, 16, 17, 22 and 23 is respectfully requested.

Claims 2-6, 8-12, 14-18, and 20-24 are dependent upon claims 1, 7, 13, and 19, and the Applicant believes that these claims are allowable over the cited references of record for the same reasons provided above.

Based on the arguments presented above, withdrawal of the 35 U.S.C. §103 rejections of claims 1-24 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, Applicant respectfully submits that the present application, including claim 1-24, is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

Intellectual Ventures II LLC

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JDW/cb

Amendments to the Claims:

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

1. (Currently Amended) A user equipment (UE) comprising:

a receiver and a processor are configured to receive resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals;

the transmitter and the processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and

the receiver and the processor are further configured to receive, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical

control channel is based on a number of fields of control information to be sent to the UE.

2. (Original) The UE of claim 1, wherein the receiver and the processor are further configured to receive data on a physical downlink shared channel.

3. (Previously Presented) The UE of claim 2, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

4. (Previously Presented) The UE of claim 1, wherein the receiver and the processor are further configured to receive, on the physical control channel, power control information.

5. (Previously Presented) The UE of claim 4, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

6. (Original) The UE of claim 1, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

7. (Currently Amended) A network device comprising:

a transmitter and a processor are configured to transmit resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a receiver and the processor are further configured to receive, over the physical uplink shared channel, data in assigned time intervals;

the receiver and the processor are further configured, in a time interval that it is not receiving information over the physical uplink shared channel, to receive the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and

the transmitter and the processor are further configured to transmit, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

8. (Original) The network device of claim 7, wherein the transmitter and the

processor are further configured to transmit data on a physical downlink shared channel.

9. (Previously Presented) The network device of claim 8, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

10. (Previously Presented) The network device of claim 7, wherein the transmitter and the processor are further configured to transmit, on the physical control channel, power control information.

11. (Previously Presented) The network device of claim 10, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

12. (Original) The network device of claim 7, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

13. (Currently Amended) A method performed by user equipment (UE), the method comprising:

receiving resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

sending, over the physical uplink shared channel, data in assigned time intervals;

sending, in a time interval that it is not sending information over the physical uplink shared channel, the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station and in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and

receiving, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

14. (Original) The method of claim 13 further comprising receiving data on a physical downlink shared channel.

15. (Previously Presented) The method of claim 14, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

16. (Previously Presented) The method of claim 13 further comprising receiving, on the physical control channel, power control information.

17. (Previously Presented) The method of claim 16, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

18. (Original) The method of claim 13, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

19. (Currently Amended) A method performed by a network device, the method comprising:

transmitting resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

receiving, over the physical uplink shared channel, data in assigned time intervals;

receiving, in a time interval that it is not receiving information over the physical uplink shared channel, the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device in the same time interval that the uplink physical signal is sent, a plurality of UEs transmit uplink physical signals in the same time interval; and

transmitting, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, wherein a number of bits sent over the physical control channel is based on a number of fields of control information to be sent to the UE.

20. (Original) The method of claim 19 further comprising transmitting data on a physical downlink shared channel.

21. (Previously Presented) The method of claim 20, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

22. (Previously Presented) The method of claim 19 further comprising transmitting, on the physical control channel, power control information.

23. (Previously Presented) The method of claim 22, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

24. (Original) The method of claim 19, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/682,854	Filing Date 11/13/2019	☐ 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	01/20/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 24	Minus	** 24	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	*** 4	= 0		x $480 =	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

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

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Application	Document	Mailroom Date	Attorney Docket No.
16682854	CTNF	10/21/2020	IPW2-USCN213316
	892	10/21/2020	IPW2-USCN213316

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

3624 7590 10/21/2020

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EXAMINER	
ABELSON, RONALD B	

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
10/21/2020	ELECTRONIC

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

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

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

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Office Action Summary	Application No. 16/682,854	Applicant(s) Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	AIA (FITF) Status No

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

Period for Reply

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

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

Status

1)☑ Responsive to communication(s) filed on 10/1/20.

☐ 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) 1-24 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) 1-24 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 11/13/19 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

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

Claim Rejections - 35 USC § 103

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

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

3. Claims 1, 2, 6-8, 12-14, 18-20, and 24 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ishii JP 2005-346319 (for translation see US 20070265017) in view of Matthews US 20020077151, Choi US 20040022213, and Shin US 20040170132, and Jeong US 20050058103.

Regarding claims 1, 7, 13, and 19, Ishii teaches a user equipment (UE) comprising:

a receiver and processor are configured to receive resource allocation information associated with an uplink physical control channel (uplink control channel, [0207]), wherein the

uplink physical control channel and a physical uplink shared channel / PUSCH have different resources;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

Although Ishii teaches time multiplexing the uplink physical control channel and a physical uplink shared channel / PUSCH, the reference is silent on the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information. The Examiner interprets this limitation to be dynamically allocating the time slots for transmitting the uplink physical control channel and a physical uplink shared channel based on received resource allocation information transmitted from the network.

Matthews teaches dynamically allocating control channels on uplink time slots (control channels dynamically allocated on uplink and downlink frequencies, time slots and code

channels, [0074]) based on received resource allocation information transmitted from the network (primary base station subsystem provides principle interface between base station controller and radio network, commands from base station controller interface used to configure primary base station, frequency, time slot and code channel allocation are based on commands received through the base station controller interface, [0084]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Ishii by the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, as suggested by Matthews. This modification would benefit the system by efficiently using bandwidth.

The combination is silent on wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information,

wherein the control information is based on the determined channel conditions.

Choi teaches wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions (It is possible to estimate a variation rate of a [redacted] by determining a Doppler frequency using a pilot signal of an [redacted] (UL DPCCH) or an HS-DPCCH signal received from a UE, [0126], Upon receiving a [redacted] channel signal, a UE must measure channel quality (CQ) of the received [redacted] channel signal, and report the measured channel quality to a Node B. The Node B then receives the channel quality information from the UE, determines an MCS level of an HS-DSCH over which data is actually transmitted to the UE according to the received channel quality information, and creates transport format and resource related information (TFRI), i.e., HS-DSCH [redacted] information, [0010]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the uplink physical signal is used to determine channel conditions by a base station; and the receiver and the processor are

further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions, as shown by Choi. This modification would benefit the system by providing a means for the UEs to receive control information based on the current channel conditions.

Although Ishii teaches a downlink physical control channel (HS-PDSCH, [0079], PDSCH, [0207], the reference is silent on wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

Shin teaches wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel (fig. 1, [0019, 0022]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, as shown by Shin.

This modification would benefit the system by simultaneously transmit the PDSCH and beacon.

The combination is silent on the physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame.

Jeong teaches the physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame (When one UE occupies all physical channels in one downlink [redacted] all physical channels in one downlink time slot, [0035]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, as shown by Jeong. This modification would benefit the system since using a single time slot to transmit information for a plurality of physical channels is an efficient use of the time slots.

Regarding claims 2, 8, 14, and 20, the processor is further configured to receive data on a physical downlink shared channel (Ishii: PDSCH, [0207]).

Regarding claims 6, 12, 18, and 24, in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval (Ishii: (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

4. Claims 3, 9, 15, and 21 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Malkamaki US 20020172208.

The combination is silent on the downlink control channel and the physical downlink shared channel are time multiplexed.

Malkamaki teaches the downlink control channel and the physical downlink shared channel are time multiplexed (The shared control channel could be sent as a separate code

channel (i.e. it could be code multiplexed) or could be sent using the same code channels as the HS-PDSCH (i.e. it could be time multiplexed with the HS-PDSCH, [0008]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the downlink control channel and the physical downlink shared channel are time multiplexed, as shown by Malkamaki. This modification would benefit the system by since time multiplexing allows for an efficient use of system resources.

5. Claims 4, 5, 10, 11, 16, 17, 22, and 23 rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Anderson US 20080144600.

Regarding claims 4, 10, 16, and 22, although Ishii teaches PLCCH, the reference is silent on the receiver and processor is further configured to receive, on the physical control channel, power control information.

Anderson teaches the receiver and processor is further configured to receive, on the physical control channel, power control information (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the receiver and processor is further configured to receive, on the physical control channel, power control information, as shown by Anderson. This modification would benefit the system by providing an proven, reliable method for sending power control information.

Regarding claims 5, 11, 17, and 23, the physical control channel includes power control information for a plurality of UEs using different bits (Anderson: PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD B ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F 8:00-4:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is

encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on 571-272-3795. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 16/682,854	Applicant(s)/Patent Under Reexamination Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
	A	20050058103	03-2005	Jeong	H04H 7/216	
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

CPC - Searched*		
Symbol	**Date**	**Examiner**
h04b7/2643	10/16/2020	RA
h04j3/1694	10/16/2020	RA
h04l5/0053	10/16/2020	RA
h04w52/146 h04w72/0406 h04w72/042 h04w72/0446	10/16/2020	RA

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
CPC combined with limited text search in EAST	10/16/2020	RA

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

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

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

CLAIMS

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

CLAIM		DATE								
Final	Original	01/25/2020	06/25/2020	10/16/2020						
	1	✓	✓	✓						
	2	✓	✓	✓						
	3	✓	✓	✓						
	4	✓	✓	✓						
	5	✓	✓	✓						
	6	✓	✓	✓						
	7	✓	✓	✓						
	8	✓	✓	✓						
	9	✓	✓	✓						
	10	✓	✓	✓						
	11	✓	✓	✓						
	12	✓	✓	✓						
	13	✓	✓	✓						
	14	✓	✓	✓						
	15	✓	✓	✓						
	16	✓	✓	✓						
	17	✓	✓	✓						
	18	✓	✓	✓						
	19	✓	✓	✓						
	20	✓	✓	✓						
	21	✓	✓	✓						
	22	✓	✓	✓						
	23	✓	✓	✓						
	24	✓	✓	✓						

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. 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	16/682,854	Filing Date	2019-11-13	Docket Number (if applicable)	IPW2-USCN213316	Art Unit	2476
First Named Inventor	Paul Howard			Examiner Name	Ronald B. Abelson		

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 _____

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 (02-18)
Approved for use through 11/30/2020. 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	/John D. Wilt/	Date (YYYY-MM-DD)	2020-10-01
Name	John D. Wilt	Registration Number	76110

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.

Electronic Patent Application Fee Transmittal

Application Number:	16682854
Filing Date:	13-Nov-2019
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Filer:	John D. Wilt/Caren Burgoon
Attorney Docket Number:	IPW2-USCN213316

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

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

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1300	1300
		Total in USD ($)		**1300**

Electronic Acknowledgement Receipt

EFS ID:	40735146
Application Number:	16682854
International Application Number:	
Confirmation Number:	1678
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Customer Number:	3624
Filer:	John D. Wilt/Caren Burgoon
Filer Authorized By:	John D. Wilt
Attorney Docket Number:	IPW2-USCN213316
Receipt Date:	01-OCT-2020
Filing Date:	13-NOV-2019
Time Stamp:	14:41:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1300
RAM confirmation Number	E202001E42520680
Deposit Account	220493
Authorized User	Caren Burgoon

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IPW2_USCN213316_FOAReply_20201001.pdf	141063 b31e10ba9ae475236a5dca5a6821a0fd718b231b	yes	14

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	14

Warnings:

Information:

2	Request for Continued Examination (RCE)	IPW2_USCN213316_RCE_20201001.pdf	45964 8622a930a5fe06eb8697b24a02c79d7275cfdd60	no	3

Warnings:

This is not a USPTO supplied RCE SB30 form.

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30461 7694e26635282a5de0ed4b4d3f9290b87428619e	no	2

Warnings:

Information:

Total Files Size (in bytes):	217488

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of: Intellectual Ventures II LLC **Application No.:** 16/682,854 **Confirmation No.:** 1678 **Filed:** November 13, 2019 For: COMMUNICATIONS IN A WIRELESS NETWORK Group: 2476 Examiner: Ronald B. Abelson	Our File: IPW2-USCN213316 Date: October 1, 2020

RESPONSE PURSUANT TO 37 C.F.R. § 1.114

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

This Response is being timely filed in response to the Final Office Action (hereinafter "FOA") dated July 1, 2020. A Request for Continued Examination (RCE) is filed concurrently herewith.

Please amend the application without prejudice or disclaimer as follows:

Amendments to the Claims:

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

1. (Currently Amended) A user equipment (UE) comprising:

a receiver and a processor are configured to receive resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals;

the transmitter and the processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

2. (Original) The UE of claim 1, wherein the receiver and the processor are further configured to receive data on a physical downlink shared channel.

3. (Previously Presented) The UE of claim 2, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

4. (Previously Presented) The UE of claim 1, wherein the receiver and the processor are further configured to receive, on the physical control channel, power control information.

5. (Previously Presented) The UE of claim 4, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

6. (Original) The UE of claim 1, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

7. (Currently Amended) A network device comprising:

a transmitter and a processor are configured to transmit resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a receiver and the processor are further configured to receive, over the physical uplink shared channel, data in assigned time intervals;

the receiver and the processor are further configured, in a time interval that it is not receiving information over the physical uplink shared channel, to receive the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device; and

the transmitter and the processor are further configured to transmit, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

8. (Original) The network device of claim 7, wherein the transmitter and the processor are further configured to transmit data on a physical downlink shared channel.

9. (Previously Presented) The network device of claim 8, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

10. (Previously Presented) The network device of claim 7, wherein the transmitter and the processor are further configured to transmit, on the physical control channel, power control information.

11. (Previously Presented) The network device of claim 10, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

12. (Original) The network device of claim 7, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

13. (Currently Amended) A method performed by user equipment (UE), the method comprising:

receiving resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

sending, over the physical uplink shared channel, data in assigned time intervals;

sending, in a time interval that it is not sending information over the physical uplink shared channel, the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station; and

receiving, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

14. (Original) The method of claim 13 further comprising receiving data on a physical downlink shared channel.

15. (Previously Presented) The method of claim 14, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

16. (Previously Presented) The method of claim 13 further comprising receiving, on the physical control channel, power control information.

17. (Previously Presented) The method of claim 16, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

18. (Original) The method of claim 13, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

19. (Currently Amended) A method performed by a network device, the method comprising:

transmitting resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

receiving, over the physical uplink shared channel, data in assigned time intervals;

receiving, in a time interval that it is not receiving information over the physical uplink shared channel, the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device; and

transmitting, on a physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical

control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

20. (Original) The method of claim 19 further comprising transmitting data on a physical downlink shared channel.

21. (Previously Presented) The method of claim 20, wherein the physical control channel and the physical downlink shared channel are time multiplexed.

22. (Previously Presented) The method of claim 19 further comprising transmitting, on the physical control channel, power control information.

23. (Previously Presented) The method of claim 22, wherein the physical control channel includes power control information for a plurality of UEs using different bits.

24. (Original) The method of claim 19, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

REMARKS/ARGUMENTS

After the foregoing Amendment, claims 1-24 are currently pending in this application. Claims 1, 7, 13, and 19 are amended.

Support for the amendments can be found in at least paragraph [0034] and FIG 2 shown below of the U.S. Patent Publication 2020/0083952 A1. No new matter has been added.

Applicant respectfully requests the entry of the amendments and reconsideration of the application in view of the amendments and the remarks below.

Claim Rejections - 35 U.S.C. § 103

Claims 1, 2, 6, 7, 8, 12, 13, 14, 18, 19, 20, and 24 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over JP Publication No. 2005-346319 (for translation US 2007-0265017) to Ishii et al. (hereinafter "Ishii") in view of U.S. Publication No. 2002-0077151 to Matthews (hereinafter "Matthews"), U.S. Publication No. 2004-0022213 to Choi (hereinafter "Choi") and U.S. Publication No. 2004-0170132 to Shin (hereinafter "Shin").

Applicant respectfully traverses the §103 rejections and submits that independent claim 1 recites features not taught, suggested, or otherwise yielded by any proper combination of the cited references. Accordingly, the Applicant submits that the amended claims are patentable for at least the following reasons:

For example, claim 1, as amended, herein recites, in part:

> ...wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

None of the cited references teach or suggest wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

Ishii discloses a call admission control device in a communication system for transmitting a packet to a plurality of mobile stations. Further, the call admission of a new mobile station is controlled based on at least one of a number and a ratio of mobile stations that cannot satisfy a predetermined minimum transmission data rate in the plurality of mobile stations. However, Ishii fails to disclose, teach, or suggest, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel. Ishii discloses only transmission time intervals (TTIs).

Matthew discloses a plurality of nanoCell base stations that provide radio connectivity among mobile stations. Further, the plurality of nanoCell base stations includes a plurality of transceivers that provides base station functionality via a controller for managing the transceivers, and determining the communications

connectivity paths between base station and mobile station functions. However, Matthew fails to disclose, teach, or suggest, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

Choi discloses an apparatus for determining channel quality indicator (CQI) report cycles for user equipments (UEs). The Node B receives CQI information from the UEs receiving a high-speed downlink packet access (HSDPA) service. The Node B determines recommended CQI report cycles based on the number of UEs and the CQI information, and transmits the determined recommended CQI report cycles to the SRNC via the CRNC. The SRNC then determines CQI report cycles for the UEs referring to the recommended CQI report cycles, and transmits the determined CQI report cycles to the UEs and the Node B. However, Choi fails to disclose, teach, or suggest, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

Shin discloses a method of determining uplink power requirements for a transceiver in a wireless communication system that includes obtaining measurements from a beacon signal occupying a first timeslot in a frame; obtaining measurements from at least one additional channel having a known transmitted

signal strength and occupying a second timeslot in the frame; and utilizing the measurements to determine a path loss estimate. However, Shin fails to disclose, teach, or suggest, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel. Shins discloses a dedicated timeslot. However, Shin does not disclose that it is used by other channels.

Accordingly, Applicant's amended independent claim 1 is patentable over the Ishii, Matthew, Choi and Shins references, whether taken alone or in combination with one another. Although not identical, Applicant's amended and independent claims 7, 13, and 19 recite features similar to Applicant's amended independent claim 1, and are therefore patentable over the cited art of record for at least the same reasons provided above.

Claims 3, 9, 15 and 21 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of U.S. Publication No. 2002-0172208 to Malkamaki (hereinafter "Malkamaki").

Malkamaki discloses a HARQ process with a modification that allows in-sequence delivery of protocol data units (PDUs) to the radio link control layer (RLC) of the receiving wireless terminal. However, Malkamaki fails to disclose, teach, or suggest, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink

frame, wherein other time slots of the downlink frame do not include a physical control channel. Therefore, Malkamaki does not cure the deficiencies of Ishii, Matthew, Choi, and Shins. Based on the arguments presented above, withdrawal of the 35 U.S.C. §103 rejection of claims 3, 9, 15 and 21 is respectfully requested.

Claims 4, 5, 10, 11, 16, 17, 22 and 23 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of U.S. Publication No. 2008-0144600 to Anderson (hereinafter "Anderson").

Anderson discloses a method of sending user equipment specific information to a plurality of user equipment to maximize channel efficiency. However, Anderson fails to disclose, teach, or suggest, wherein physical control channels are transmitted in a same time slot with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel. Therefore, Anderson does not cure the deficiencies of Ishii, Matthew, Choi, and Shins. Based on the arguments presented above, withdrawal of the 35 U.S.C. §103 rejection of claims 4, 5, 10, 11, 16, 17, 22 and 23 is respectfully requested.

Claims 2-6, 8-12, 14-18, and 20-24 are dependent upon claims 1, 7, 13, and 19, and the Applicant believes that these claims are allowable over the cited references of record for the same reasons provided above.

Based on the arguments presented above, withdrawal of the 35 U.S.C. §103 rejections of claims 1-24 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, Applicant respectfully submits that the present application, including claims 1-24, is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

Intellectual Ventures II LLC

By /John D. Wilt/
John D. Wilt
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JDW/JMG/cmb
Enc: Request for Continued Examination (RCE)

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/682,854	Filing Date 11/13/2019	☐ 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	10/01/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 24	Minus	** 24	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	*** 4	= 0		x $460 =	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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/DORIS M KING/
*** 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.	

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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Application	Document	Mailroom Date	Attorney Docket No.
16682854	CTFR	07/01/2020	IPW2-USCN213316
	892	07/01/2020	IPW2-USCN213316

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

3624 7590 07/01/2020

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EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
07/01/2020	ELECTRONIC

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

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

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

eoffice@volpe-koenig.com

Office Action Summary	Application No. 16/682,854	Applicant(s) Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	AIA (FITF) Status No

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

Period for Reply

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

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

Status

1)☑ Responsive to communication(s) filed on 6/19/20.

☐ 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) 1-24 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) 1-24 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 11/13/19 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

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

Claim Rejections - 35 USC § 103

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

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

3. Claims 1, 2, 6-8, 12-14, 18-20, and 24 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ishii JP 2005-346319 (for translation see US 20070265017) in view of Matthews US 20020077151, Choi US 20040022213, and Shin US 20040170132.

Regarding claims 1, 7, 13, and 19, Ishii teaches a user equipment (UE) comprising:

a receiver and processor are configured to receive resource allocation information associated with an uplink physical control channel (uplink control channel, [0207]), wherein the

uplink physical control channel and a physical uplink shared channel / PUSCH have different resources;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

Although Ishii teaches time multiplexing the uplink physical control channel and a physical uplink shared channel / PUSCH, the reference is silent on the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information. The Examiner interprets this limitation to be dynamically allocating the time slots for transmitting the uplink physical control channel and a physical uplink shared channel based on received resource allocation information transmitted from the network.

Matthews teaches dynamically allocating control channels on uplink time slots (control channels dynamically allocated on uplink and downlink frequencies, time slots and code

channels, [0074]) based on received resource allocation information transmitted from the network (primary base station subsystem provides principle interface between base station controller and radio network, commands from base station controller interface used to configure primary base station, frequency, time slot and code channel allocation are based on commands received through the base station controller interface, [0084]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Ishii by the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, as suggested by Matthews. This modification would benefit the system by efficiently using bandwidth.

The combination is silent on wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information,

wherein the control information is based on the determined channel conditions.

Choi teaches wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions (It is possible to estimate a variation rate of a [redacted] by determining a Doppler frequency using a pilot signal of an [redacted] (UL DPCCH) or an HS-DPCCH signal received from a UE, [0126], Upon receiving a [redacted] channel signal, a UE must measure channel quality (CQ) of the received [redacted] channel signal, and report the measured channel quality to a Node B. The Node B then receives the channel quality information from the UE, determines an MCS level of an HS-DSCH over which data is actually transmitted to the UE according to the received channel quality information, and creates transport format and resource related information (TFRI), i.e., HS-DSCH [redacted] information, [0010]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the uplink physical signal is used to determine channel conditions by a base station; and the receiver and the processor are

further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions, as shown by Choi. This modification would benefit the system by providing a means for the UEs to receive control information based on the current channel conditions.

Although Ishii teaches a downlink physical control channel (HS-PDSCH, [0079], PDSCH, [0207], the reference is silent on wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

Shin teaches wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel (fig. 1, [0019, 0022]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel, as shown by Shin.

This modification would benefit the system by simultaneously transmit the PDSCH and beacon.

Regarding claims 2, 8, 14, and 20, the processor is further configured to receive data on a physical downlink shared channel (Ishii: PDSCH, [0207]).

Regarding claims 6, 12, 18, and 24, in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval (Ishii: (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

4. Claims 3, 9, 15, and 21 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Malkamaki US 20020172208.

The combination is silent on the downlink control channel and the physical downlink shared channel are time multiplexed.

Malkamaki teaches the downlink control channel and the physical downlink shared channel are time multiplexed (The shared control channel could be sent as a separate code channel (i.e. it could be code multiplexed) or could be sent using the same code channels as the HS-PDSCH (i.e. it could be time multiplexed with the HS-PDSCH, [0008]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the downlink control channel and the physical downlink shared channel are time multiplexed, as shown by Malkamaki. This modification would benefit the system by since time multiplexing allows for an efficient use of system resources.

5. Claims 4, 5, 10, 11, 16, 17, 22, and 23 rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Anderson US 20080144600.

Regarding claims 4, 10, 16, and 22, although Ishii teaches PLCCH, the reference is silent on the receiver and processor is further configured to receive, on the physical control channel, power control information.

Anderson teaches the receiver and processor is further configured to receive, on the physical control channel, power

control information (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the receiver and processor is further configured to receive, on the physical control channel, power control information, as shown by Anderson. This modification would benefit the system by providing an proven, reliable method for sending power control information.

Regarding claims 5, 11, 17, and 23, the physical control channel includes power control information for a plurality of UEs using different bits (Anderson: PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Conclusion

6. 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 RONALD B ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F 8:00-4:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Ayaz Sheikh can be reached on 571-272-3795. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 16/682,854	Applicant(s)/Patent Under Reexamination Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
	A	20040170132	09-2004	Shin	H04L 5/14	
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

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

CLAIMS

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

CLAIM		DATE								
Final	Original	01/25/2020	06/25/2020							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							
	19	✓	✓							
	20	✓	✓							
	21	✓	✓							
	22	✓	✓							
	23	✓	✓							
	24	✓	✓							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

CPC - Searched*		
Symbol	**Date**	**Examiner**
h04b7/2643	06/25/2020	RA
h04j3/1694	06/25/2020	RA
h04l5/0053	06/25/2020	RA
h04w52/146 h04w72/0406 h04w72/042 h04w72/0446	06/25/2020	RA

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
CPC combined with limited text search in EAST	06/25/2020	RA

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

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of: Paul Howard **Application No.:** 16/682,854 **Confirmation No.:** 1678 **Filed:** November 13, 2019 For: COMMUNICATIONS IN A WIRELESS NETWORK Group: 2476 Examiner: Ronald B. Abelson	Our File: IPW2-USCN213316 Date: June 19, 2020

RESPONSE PURSUANT TO 37 C.F.R. § 1.111

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

This Response is being timely filed in response to the Non-Final Office Action (hereinafter "NFOA") dated February 7, 2020 and is submitted in conjunction with a Petition for a Two (2) Month Extension of Time.

Please amend the application without prejudice or disclaimer as follows:

PTO/AIA/22 (03-13)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): IPW2-USCN213316

Application Number: 16/682,854

Filed: 2019-11-13

For: COMMUNICATIONS IN A WIRELESS NETWORK

Art Unit: 2476

Examiner: Ronald B. Abelson

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
☐ 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 220493.

☑ 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 76110.

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

/John D. Wilt/ — Signature

2020-06-19 — Date

John D. Wilt — Typed or printed name

215.255.9187 — 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 _____ 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.

Privacy Act Statement

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

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

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

Electronic Patent Application Fee Transmittal

Application Number:	16682854
Filing Date:	13-Nov-2019
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Filer:	John D. Wilt/Caren Burgoon
Attorney Docket Number:	IPW2-USCN213316

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

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

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 2 months with $0 paid	1252	1	600	600
Miscellaneous:				
			Total in USD ($)	**600**

Electronic Acknowledgement Receipt

EFS ID:	39775142
Application Number:	16682854
International Application Number:	
Confirmation Number:	1678
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Customer Number:	3624
Filer:	John D. Wilt/Caren Burgoon
Filer Authorized By:	John D. Wilt
Attorney Docket Number:	IPW2-USCN213316
Receipt Date:	19-JUN-2020
Filing Date:	13-NOV-2019
Time Stamp:	16:10:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$600
RAM confirmation Number	E20206IG12234638
Deposit Account	220493
Authorized User	Caren Burgoon

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IPW2_USCN213316_NFOAReply_20200619.PDF	110226 ac064a229c200f18dca282bce442df4105b7bec8	yes	13

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Applicant Arguments/Remarks Made in an Amendment	10	13
Claims	2	9
Amendment/Req. Reconsideration-After Non-Final Reject	1	1

Warnings:

Information:

2	Extension of Time	IPW2_USCN213316_2MONEOT_20200619.PDF	127008 4565926abab98c8bef87d26e2a7feca7b4fa524f	no	2

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30961 a25a6852ebcefe34f94f4a97a61f410e074d648e	no	2

Warnings:

Information:

Total Files Size (in bytes):	268195

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.

REMARKS/ARGUMENTS

After the foregoing Amendment, claims 1-24 are currently pending in this application. Claims 1, 3, 4, 5, 7, 9, 10, 11, 13, 15, 16, 17, 19, 21, 22, and 23 are amended.

Support for the amendments can be found in at least paragraph [0032], [0034], [0037] and FIG 2 shown below of the U.S. Patent Publication 2020/0083952 A1. No new matter has been added.

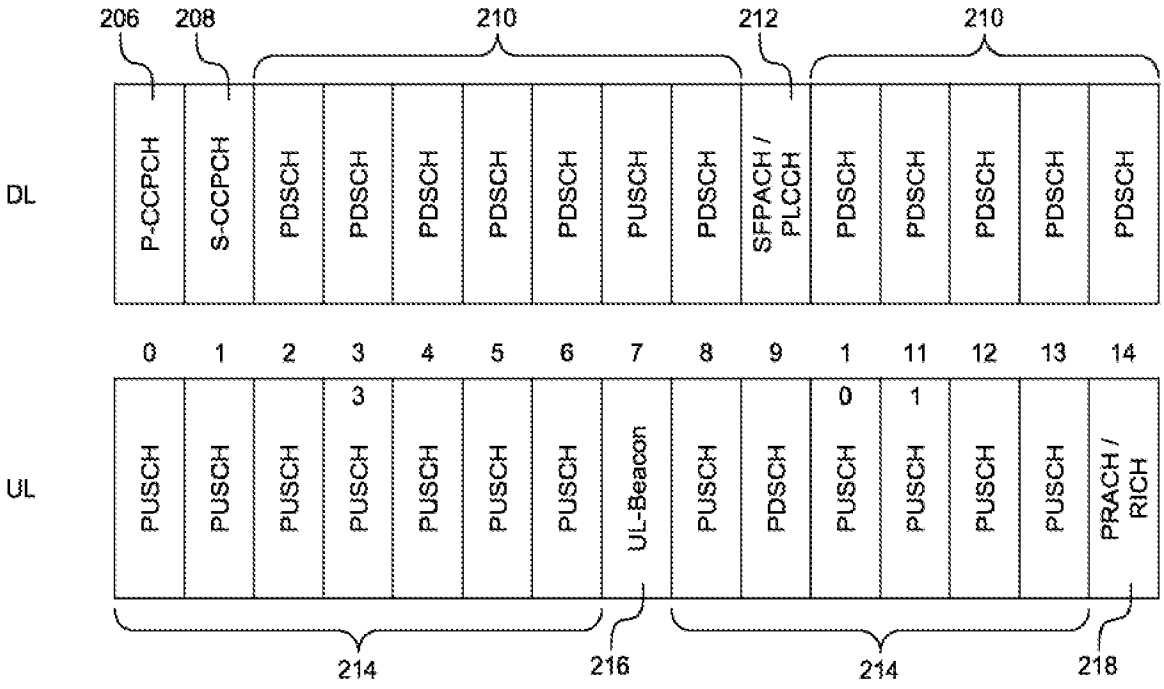


FIG. 2

Applicant respectfully requests the entry of the amendments and reconsideration of the application in view of the amendments and the remarks below.

Examiner Interview

Applicant thanks the Examiner for the telephonic interview with the Applicant's representative, Harry Vartanian, on 29 January 2020. During the telephonic interview, Ishii, Classon and Choi references were discussed.

Claim Rejections - 35 U.S.C. § 103

Claims 1, 2, 6, 7, 8, 12, 13, 14, 18, 19, 20, and 24 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over JP Publication No. 2005-346319 (for translation US 2007-0265017) to Ishii et al. (hereinafter "Ishii") in view of U.S. Publication No. 2002-0077151 to Matthews (hereinafter "Matthews") and U.S. Publication No. 2004-0022213 to Choi (hereinafter "Choi").

Claims 3, 9, 15 and 21 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of U.S. Publication No. 2002-0172208 to Malkamaki (hereinafter "Malkamaki").

Claims 4, 5, 10, 11, 16, 17, 22 and 23 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of U.S. Publication No. 2008-0144600 to Anderson (hereinafter "Anderson").

Claims 1, 2, 6, 7, 8, 12, 13, 14, 18, 19, 20 and 24 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over U.S. Publication No. 2007-0058595 to Classon (hereinafter "Classon") in view of Matthews and Choi.

Claims 3, 9, 15 and 21 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Malkamaki.

Claims 4, 5, 10, 11, 16, 17, 22, and 23 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Anderson.

Although applicant respectfully disagrees with the §103 rejections, the claims have been amended to advance prosecution. The current claims recite "wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel" None of the cited references alone or in combination disclose at least this feature of the claims.

Based on the arguments presented above, withdrawal of the 35 U.S.C. §103 rejections of claims 1-24 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, Applicant respectfully submits that the present application, including claims 1-24, is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

Intellectual Ventures II LLC

By /John D. Wilt/
John D. Wilt
Registration No. 76,110
(215) 568-6400

Volpe and Koenig, P.C.
United Plaza
30 South 17th Street
Philadelphia, PA 19103

JDW/JMG/cmb

Amendments to the Claims:

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

1. (Currently Amended) A user equipment (UE) comprising:

a receiver and a processor are configured to receive resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals;

the transmitter and the processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a ~~downlink~~ physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

2. (Original) The UE of claim 1, wherein the receiver and the processor are further configured to receive data on a physical downlink shared channel.

3. (Currently Amended) The UE of claim 2, wherein the ~~downlink~~ physical control channel and the physical downlink shared channel are time multiplexed.

4. (Currently Amended) The UE of claim 1, wherein the receiver and the processor are further configured to receive, on the ~~downlink~~ physical control channel, power control information.

5. (Currently Amended) The UE of claim 4, wherein the ~~downlink~~ physical control channel includes power control information for a plurality of UEs using different bits.

6. (Original) The UE of claim 1, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

7. (Currently Amended) A network device comprising:

a transmitter and a processor are configured to transmit resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a receiver and the processor are further configured to receive, over the physical uplink shared channel, data in assigned time intervals;

the receiver and the processor are further configured, in a time interval that it is not receiving information over the physical uplink shared channel, to receive the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device; and

the transmitter and the processor are further configured to transmit, on a ~~downlink~~ physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

8. (Original) The network device of claim 7, wherein the transmitter and the processor are further configured to transmit data on a physical downlink shared channel.

9. (Currently Amended) The network device of claim 8, wherein the ~~downlink~~ physical control channel and the physical downlink shared channel are time multiplexed.

10. (Currently Amended) The network device of claim 7, wherein the transmitter and the processor are further configured to transmit, on the ~~downlink~~ physical control channel, power control information.

11. (Currently Amended) The network device of claim 10, wherein the ~~downlink~~ physical control channel includes power control information for a plurality of UEs using different bits.

12. (Original) The network device of claim 7, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

13. (Currently Amended) A method performed by user equipment (UE), the method comprising:

receiving resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

sending, over the physical uplink shared channel, data in assigned time intervals;

sending, in a time interval that it is not sending information over the physical uplink shared channel, the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station; and

receiving, on a ~~downlink~~ physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

14. (Original) The method of claim 13 further comprising receiving data on a physical downlink shared channel.

15. (Currently Amended) The method of claim 14, wherein the ~~downlink~~ physical control channel and the physical downlink shared channel are time multiplexed.

16. (Currently Amended) The method of claim 13 further comprising receiving, on the ~~downlink~~ physical control channel, power control information.

17. (Currently Amended) The method of claim 16, wherein the ~~downlink~~ physical control channel includes power control information for a plurality of UEs using different bits.

18. (Original) The method of claim 13, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

19. (Currently Amended) A method performed by a network device, the method comprising:

transmitting resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

receiving, over the physical uplink shared channel, data in assigned time intervals;

receiving, in a time interval that it is not receiving information over the physical uplink shared channel, the uplink physical signal based on the transmitted

resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device; and

transmitting, on a ~~downlink~~ physical control channel, control information, wherein the control information is based on the determined channel conditions, wherein physical control channels are transmitted with other physical channels in a plurality of predetermined time slots in a downlink frame, wherein other time slots of the downlink frame do not include a physical control channel.

20. (Original) The method of claim 19 further comprising transmitting data on a physical downlink shared channel.

21. (Currently Amended) The method of claim 20, wherein the ~~downlink~~ physical control channel and the physical downlink shared channel are time multiplexed.

22. (Currently Amended) The method of claim 19 further comprising transmitting, on the ~~downlink~~ physical control channel, power control information.

23. (Currently Amended) The method of claim 22, wherein the ~~downlink~~ physical control channel includes power control information for a plurality of UEs using different bits.

24. (Original) The method of claim 19, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/682,854	Filing Date 11/13/2019	☐ 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 $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ 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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	06/19/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 24	Minus	** 24	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	*** 4	= 0		x $460 =	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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/KIM P DOZIER/
*** 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.	

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.

To: eoffice@volpe-koenig.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 3624

Mar 13, 2020 04:16:19 AM

Dear PAIR Customer:

VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 3624 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

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Application	Document	Mailroom Date	Attorney Docket No.
16682854	NTC.PUB	03/12/2020	IPW2-USCN213316

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

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PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316

CONFIRMATION NO. 1678

3624
VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

PUBLICATION NOTICE

OC000000115389481

Title:COMMUNICATIONS IN A WIRELESS NETWORK

Publication No.US-2020-0083952-A1
Publication Date:03/12/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

To: eoffice@volpe-koenig.com,,
From: PAIR_eOfficeAction@uspto.gov
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Feb 07, 2020 03:35:56 AM

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VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
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UNITED STATES

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Application	Document	Mailroom Date	Attorney Docket No.
16682854	CTNF	02/07/2020	IPW2-USCN213316
	INTV.SUM.EX	02/07/2020	IPW2-USCN213316
	892	02/07/2020	IPW2-USCN213316
	1449	02/07/2020	IPW2-USCN213316

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PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

3624 7590 02/07/2020

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

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
02/07/2020	ELECTRONIC

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

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

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

eoffice@volpe-koenig.com

Office Action Summary	Application No. 16/682,854	Applicant(s) Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	AIA (FITF) Status No

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

Period for Reply

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

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

Status

1)☑ Responsive to communication(s) filed on 1/8/20, 11/13/19.

☐ 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) 1-24 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) 1-24 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 11/13/19 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 1/8/20.

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

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

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

Claim Rejections - 35 USC § 103

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

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

3. Claims 1, 2, 6, 7, 8, 12, 13, 14, 18, 19, 20, and 24 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ishii JP 2005-346319 (for translation see US 20070265017) in view of Matthews US 20020077151 and Choi US 20040022213.

Regarding claims 1, 7, 13, and 19, Ishii teaches a user equipment (UE) comprising:

a receiver and processor are configured to receive resource allocation information associated with an uplink physical

control channel (uplink control channel, [0207]), wherein the uplink physical control channel and a physical uplink shared channel / PUSCH have different resources;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

Although Ishii teaches time multiplexing the uplink physical control channel and a physical uplink shared channel / PUSCH, the reference is silent on the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information. The Examiner interprets this limitation to be dynamically allocating the time slots for transmitting the uplink physical control channel and a physical uplink shared channel based on received resource allocation information transmitted from the network.

Matthews teaches dynamically allocating control channels on uplink time slots (control channels dynamically allocated

on uplink and downlink frequencies, time slots and code channels, [0074]) based on received resource allocation information transmitted from the network (primary base station subsystem provides principle interface between base station controller and radio network, commands from base station controller interface used to configure primary base station, frequency, time slot and code channel allocation are based on commands received through the base station controller interface, [0084]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Ishii by the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, as suggested by Matthews. This modification would benefit the system by efficiently using bandwidth.

The combination is silent on wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information,

wherein the control information is based on the determined channel conditions.

Choi teaches wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions (It is possible to estimate a variation rate of a [redacted] by determining a Doppler frequency using a pilot signal of an [redacted] (UL DPCCH) or an HS-DPCCH signal received from a UE, [0126]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of xxx by the uplink physical signal is used to determine channel conditions by a base station; and the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions, as shown by Choi. This modification would benefit the system by providing a means for the UEs to receive control information based on the current channel conditions.

Regarding claims 2, 8, 14, and 20, the processor is further configured to receive data on a physical downlink shared channel (Ishii: PDSCH, [0207]).

Regarding claims 6, 12, 18, and 24, in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval (Ishii: (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

4. Claims 3, 9, 15, and 21 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Malkamaki US 20020172208.

The combination is silent on the downlink control channel and the physical downlink shared channel are time multiplexed.

Malkamaki teaches the downlink control channel and the physical downlink shared channel are time multiplexed (The shared control channel could be sent as a separate code

channel (i.e. it could be code multiplexed) or could be sent using the same code channels as the HS-PDSCH (i.e. it could be time multiplexed with the HS-PDSCH, [0008]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the downlink control channel and the physical downlink shared channel are time multiplexed, as shown by Malkamaki. This modification would benefit the system by since time multiplexing allows for an efficient use of system resources.

5. Claims 4, 5, 10, 11, 16, 17, 22, and 23 rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Anderson US 20080144600.

Regarding claims 4, 10, 16, and 22, although Ishii teaches PLCCH, the reference is silent on the receiver and processor is further configured to receive, on the downlink control channel, power control information.

Anderson teaches the receiver and processor is further configured to receive, on the downlink control channel, power control information (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the receiver and processor is further configured to receive, on the downlink control channel, power control information, as shown by Anderson. This modification would benefit the system by providing an proven, reliable method for sending power control information.

Regarding claims 5, 11, 17, and 23, Anderson (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

6. Claims 1, 2, 6, 7, 8, 12, 13, 14, 18, 19, 20, and 24 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Classon US 20070058595 in view of Matthews US 20020077151 and Choi US 20040022213.

Regarding claims 1, 7, 13, and 19, Classon teaches a user equipment (UE) comprising:

a receiver and processor are configured to receive resource allocation information associated with an uplink physical

control channel, wherein the uplink physical control channel and a physical uplink shared channel;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals (uplink transmissions, control channels time multiplexed with shared data channel, [0040]).

Although Classon teaches time multiplexing the uplink physical control channel and a physical uplink shared channel, the reference is silent on the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information. The Examiner interprets this limitation to be dynamically allocating the time slots for transmitting the uplink physical control channel and a physical uplink shared channel based on received resource allocation information transmitted from the network.

Matthews teaches dynamically allocating control channels on uplink time slots (control channels dynamically allocated on uplink and downlink frequencies, time slots and code channels, [0074]) based on received resource allocation information transmitted from the network (primary base station

subsystem provides principle interface between base station controller and radio network, commands from base station controller interface used to configure primary base station, frequency, time slot and code channel allocation are based on commands received through the base station controller interface, [0084]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Ishii by the transmitter and processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, as suggested by Matthews. This modification would benefit the system by efficiently using bandwidth.

The combination is silent on wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions.

Choi teaches wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions (It is possible to estimate a variation rate of a [redacted] by determining a Doppler frequency using a pilot signal of an [redacted] (UL DPCCH) or an HS-DPCCH signal received from a UE, [0126]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of xxx by the uplink physical signal is used to determine channel conditions by a base station; and the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions, as shown by Choi. This modification would benefit the system by providing a means for the UEs to receive control information based on the current channel conditions.

Regarding claims 2, 8, 14, and 20, the processor is further configured to receive data on a physical downlink shared channel (Classon: [0040]).

Regarding claims 6, 12, 18, and 24, the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval (Classon: [0040]).

7. Claims 3, 9, 15, and 21 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Malkamaki US 20020172208.

The combination is silent on the downlink control channel and the physical downlink shared channel are time multiplexed.

Malkamaki teaches the downlink control channel and the physical downlink shared channel are time multiplexed (The shared control channel could be sent as a separate code channel (i.e. it could be code multiplexed) or could be sent using the same code channels as the HS-PDSCH (i.e. it could be time multiplexed with the HS-PDSCH, [0008]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the downlink control channel and the physical downlink shared channel are time multiplexed, as shown by Malkamaki. This modification would benefit the system by since time multiplexing allows for an efficient use of system resources.

8. Claims 4, 5, 10, 11, 16, 17, 22, and 23 rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination as applied to claim 1 above, and further in view of Anderson US 20080144600.

Regarding claims 4, 10, 16, and 22, although Ishii teaches PLCCH, the reference is silent on the receiver and processor is further configured to receive, on the downlink control channel, power control information.

Anderson teaches the receiver and processor is further configured to receive, on the downlink control channel, power control information (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the receiver and processor is further configured to receive, on the downlink control channel, power control information, as shown by Anderson. This modification would benefit the system by providing an proven, reliable method for sending power control information.

Regarding claims 5, 11, 17, and 23, Anderson (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD B ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F 8:00-4:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Ayaz Sheikh can be reached on 571-272-3795. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Examiner-Initiated Interview Summary	Application No. 16/682,854	Applicant(s) Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	AIA (FITF) Status No

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

(1) RONALD B. ABELSON. (3) _____.

(2) Harry Vartanian. (4) _____.

Date of Interview: 29 January 2020.

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: Ishii, Classon, Choi (see attached writeup),.

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...)

Applicant requested a formal office action be submitted even though this case is a Track 1 case..

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

/RONALD B ABELSON/ Primary Examiner, Art Unit 2476	

Notice of References Cited	Application/Control No. 16/682,854	Applicant(s)/Patent Under Reexamination Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
	A	20080144600	06-2008	Anderson	H04J 3/06	
	B	20040022213	02-2004	Choi	H04Q 7/00	
	C	20020172208	11-2002	Malkamaki	H04L 12/28	
	D	20020077151	06-2002	Matthews	H04Q 7/20	
	E	20070058595	03-2007	Classon	H04B 7/212	
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	JP 2005-346319	09-2006	Japan	Ishii	H04L 12/56
	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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/682,854	Howard, Paul
	Examiner	Art Unit
	RONALD B ABELSON	2476

CPC - Searched*		
Symbol	Date	Examiner
h04b7/2643		
h04j3/1694		
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CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	Examiner	Art Unit
	RONALD B ABELSON	2476

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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CLAIMS

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

CLAIM		DATE								
Final	Original	01/25/2020								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
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	6	✓								
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	19	✓								
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Application No: 16/682,854

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Verified and Acknowledged: /RONALD B ABELSON/ Examiner's Signature | Initials

Title: COMMUNICATIONS IN A WIRELESS NETWORK

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
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APPLICANTS

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CONTINUING DATA

This application is a CON of 14458693 08/13/2014

14458693 is a CON of 13176298 07/05/2011 PAT 8811356

13176298 is a CON of 11646692 12/27/2006 PAT 8009639

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

12/03/2019

STATE OR COUNTRY

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First Named Inventor	: Hiroyuki ISHII		
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Docket No.	: 010755.58429US		
Customer No.	: 23911		
Title	: Call Admission Control Device and Call Admission Control Method		

CLAIM OF PRIORITY UNDER 35 U.S.C. § 119

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

Sir:

The benefit of the filing date of prior foreign application No. 2005-346319, filed in Japan on November 30, 2005, is hereby requested and the right of priority under 35 U.S.C. § 119 is hereby claimed.

In support of this claim, filed herewith is a certified copy of the original foreign application.

Respectfully submitted,

November 29, 2006

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日本国特許庁
JAPAN PATENT OFFICE

別紙添付の書類に記載されている事項は下記の出願書類に記載されている事項と同一であることを証明する。
This is to certify that the annexed is a true copy of the following application as filed with this Office.

出願年月日
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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is ＪＰ２００５－３４６３１９

出願人
Applicant(s): 株式会社エヌ・ティ・ティ・ドコモ

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２００６年 ９月２７日

特許庁長官
Commissioner,
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出証番号 出証特２００６－３０７３４４５

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【整理番号】　2005P00430
【提出日】　平成17年11月30日
【あて先】　特許庁長官殿
【国際特許分類】　H04L 12/56
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【書類名】特許請求の範囲
【請求項１】
複数の無線端末に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、
前記複数の無線端末の内、所定の最低伝送速度を満たすことができない無線端末の数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御することを特徴とする呼受付制御装置。
【請求項２】
複数の無線端末に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、
前記無線端末の平均伝送速度を測定する伝送速度把握手段と、
最低伝送速度の値を設定する最低伝送速度設定手段と、
前記無線端末の平均伝送速度の値が、前記最低伝送速度の値よりも小さいか否かを判定する判定手段と、
前記平均伝送速度の値が前記最低伝送速度の値よりも小さいと判定された無線端末の数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御する新規無線端末受付手段と、
を有することを特徴とする呼受付制御装置。
【請求項３】
複数の無線端末に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、
前記無線端末の平均伝送速度を測定する伝送速度把握手段と、
最低伝送速度の値を設定する最低伝送速度設定手段と、
前記無線端末の平均伝送速度の値が、前記最低伝送速度の値よりも小さい場合に、前記無線端末の平均伝送速度の値を初期化する平均伝送速度初期化手段と、
前記平均伝送速度の値を初期化された無線端末の数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御する新規無線端末受付手段と、
を有することを特徴とする呼受付制御装置。
【請求項４】
複数の無線端末ｎ（ｎは無線端末の添え字）に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、
前記無線端末ｎの無線状態Ｒｎと、前記無線端末ｎの伝送速度avrgＲｎと、を把握する状態把握手段と、
最低伝送速度$_{target}$Ｒｎ及び伝送速度閾値Ｒ$_{threshold}$を設定する最低伝送速度設定手段と、
前記伝送速度avrgＲｎから前記最低伝送速度$_{target}$Ｒｎを引いたものが、前記伝送速度閾値Ｒ$_{threshold}$よりも小さい場合に、前記伝送速度avrgＲｎの値を初期化する伝送速度初期化手段と、
前記無線状態Ｒｎをべき乗する指数αと、前記伝送速度avrgＲｎから前記最低伝送送度$_{target}$Ｒｎを引いたものをべき乗する指数βと、を設定する設定手段と、
各無線端末ｎに対する評価関数Ｃｎを、
$Cn = Rn^{\alpha} / (avrgRn - {}_{target}Rn)^{\beta}$
に従って算出する評価関数算出手段と、
前記評価関数Ｃｎが最大となる無線端末を送信相手の無線端末として選択する無線端末選択手段と、
前記伝送速度avrgＲｎを初期化された無線端末ｎの数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御する新規無線端末受付手段と、
を有することを特徴とする呼受付制御装置。
【請求項５】
請求項４記載の呼受付制御装置であって、前記伝送速度初期化手段は、連続する所定の

時間間隔において、前記伝送速度avrgＲｎ－$_{target}$Ｒｎが、前記伝送速度閾値Ｒ$_{threshold}$よりも小さい場合に、前記伝送速度avrgＲｎの値を初期化することを特徴とする呼受付制御装置。

【請求項６】

請求項２から請求項４までのいずれか１項に記載の呼受付制御装置であって、

前記新規無線端末受付手段は、前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つが、所定の閾値よりも大きい場合に、新規の無線端末を受け付けないことを特徴とする呼受付制御装置。

【請求項７】

請求項２から請求項４までのいずれか１項に呼受付制御装置であって、

前記新規無線端末受付手段は、前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つに加えて、

通信を行っている無線端末の数に基づいて、新規の無線端末の受付を制御することを特徴とする呼受付制御装置。

【請求項８】

請求項７に記載の呼受付制御装置であって、

前記新規無線端末受付手段は、

前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つが、所定の閾値より大きく、かつ、前記通信を行っている無線端末の数とその割合との少なくとも一方が、別の所定の閾値よりも大きい場合に、新規の無線端末を受け付けないことを特徴とする呼受付制御装置。

【請求項９】

請求項２から請求項４までのいずれか１項に呼受付制御装置であって、

前記新規無線端末受付手段は、前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つを計算する際、サービス種別、契約種別、端末種別、ユーザ識別子、及び、Priority Classの少なくとも１つに応じて計算することを特徴とする呼受付制御装置。

【書類名】明細書
【発明の名称】呼受付制御装置
【技術分野】
【０００１】
本発明は呼受付制御装置に関し、特に移動体通信におけるパケット通信システムにおいて呼受付制御を行う呼受付制御装置に関する。
【背景技術】
【０００２】
移動通信システムは有限のリソース（周波数や電力）を用いて通信を行うシステムであり、その通信容量には上限が存在する。よって、上記通信容量に応じて、セル内の移動局の数を制限する必要がある。具体的には、新規の無線端末が当該セルにおいて通信を開始しようとした場合に、上記新規の無線端末が当該セルにおいて通信を開始してよいか否かを判定する必要があり、このような制御を呼受付制御という。また、新規の無線端末が当該セルにおいて通信を開始してはいけないと判定するような状況、すなわち、上記通信容量をほぼ１００％使用している状況を容量限界と呼ぶ。
【０００３】
従来の呼受付制御としては、例えば、当該セル内で通信中の移動局の総数が所定の閾値を超えていない場合に、新規の無線端末が通信を開始することを許可し、当該セル内で通信中の移動局の総数が所定の閾値を超えている場合に、新規の無線端末が通信を開始することを許可しないといった制御方法がある。
ところで、第３世代移動通信システム、いわゆるＩＭＴ（International Mobile Telecommunications）－２０００の標準化については、地域標準化機関等により組織された３ＧＰＰ／３ＧＰＰ２（Third-Generation Partnership Project／Third-Generation Partnership Project2）において、前者ではＷ－ＣＤＭＡ方式、後者ではｃｄｍａ２０００方式に係る標準仕様が規定されている。
【０００４】
３ＧＰＰでは、近年のインターネットの急速な普及に伴い、特に下りリンクにおいてデータベースやＷｅｂサイトからのダウンロード等による高速・大容量のトラヒックが増加するとの予測に基づき下り方向の高速パケット伝送方式である「ＨＳＤＰＡ（High Speed Downlink Packet Access）」の仕様が規定されている（例えば、非特許文献１参照）。また、３ＧＰＰ２でも、上記同様の観点から下り方向の高速データ専用の伝送方式「１ｘＥＶ－ＤＯ」の仕様が規定されている（例えば、非特許文献２参照）。なお、ｃｄｍａ２０００　１xＥＶ-ＤＯにおいて、ＤＯはＤａｔａ　ｏｎｌｙの意味である。
【０００５】
以下では、ＨＳＤＰＡに関して、さらに説明を行う。
ＨＳＤＰＡは、複数の移動局が１つの共有チャネルを共有して通信を行うシステムであり、無線基地局は、ＴＴＩ（Time Transmission Interval、ＨＳＤＰＡでは２ｍｓ）毎に上記複数の移動局の中から上記共有チャネルを使用する移動局を選択し、パケットの送信を行う。この場合、そのデータトラヒックの発生の仕方によって、容量限界に達した場合のセル内の移動局の数に差が生じることになる。例えば、全ての移動局がＦＴＰ（File Transfer Protocol）によるダウンロードを行った場合と、全ての移動局がWeb browsingを行った場合とでは、前者よりも後者の方が、容量限界に達した場合のセル内の移動局数が大きくなる。その理由は、ＦＴＰによるダウンロードでは、移動局に対して常に送信すべきパケットが存在するが、Web browsingの場合には、ユーザがＷｅｂページを閲覧するリーディングタイムが存在するため、移動局に対して送信すべきパケットが存在しない時間帯が存在するからである。すなわち、Web browsingの場合には、１台の移動局が共有チャネルを使用する頻度が小さいため、より多くの移動局が１つの共有チャネルを共有することができる。以上より、ＨＳＤＰＡにおいては、データトラヒックの発生の仕方によって、容量限界において収容可能な移動局の数は変動してしまう。
【０００６】

また、ＨＳＤＰＡでは、移動局と無線基地局との間の無線状態に応じて無線チャネルの変調方式や符号化率を制御する方式（ＨＳＤＰＡでは、適応変調・符号化ＡＭＣＳ（Adaptive Modulation and Coding Scheme）と呼ばれている）を採用しており、移動局と無線基地局との間の無線状態（ＳＩＲ）に応じて、伝送速度が変動する。一方、上記無線状態（ＳＩＲ）は屋外環境や屋外環境、市街地や郊外といったセルの形態によって、大きく異なる。すなわち、ＨＳＤＰＡにおいては、セルの形態によっても、容量限界において収容可能な移動局の数は変動してしまう。

【０００７】

このようなＨＳＤＰＡにおいては、上述した従来方法の呼受付制御、すなわち、セル内において通信を行っている移動局の数に基づいた呼受付制御を行った場合、容量限界におけるセル内において通信を行っている移動局の数は一定であるため、各移動局の位置やセル内の形態に依存して、容量限界における各移動局の伝送速度が異なることになる。例えば、屋内環境では他セルからの干渉が少なく、無線品質が良好であるため、容量限界における各移動局の伝送速度が高いが、屋外環境では他セルからの干渉が多く、無線品質が良好ではないため、容量限界における各移動局の伝送速度が低いということが考えられる。

しかしながら、容量限界における各移動局の伝送速度は、ＨＳＤＰＡを用いて提供する通信のサービス性によって決定されるべきものであり、セル形態や各移動局の位置に関係なく、一定であることが望ましい。

【０００８】

以下では、ＨＳＤＰＡにおけるスケジューリングに関して説明を行う。上述したように、ＨＳＤＰＡは、複数の移動局が１つの共有チャネルを共有して通信を行うシステムであり、無線基地局は、ＴＴＩ（Time Transmission Interval、ＨＳＤＰＡでは２ｍｓ）毎に上記複数の移動局の中から上記共有チャネルを使用する移動局を選択し、パケットの送信を行う。この基地局がＴＴＩ毎に上記共有チャネルを使用する移動局を選択することをスケジューリングと呼ぶ。

【０００９】

このスケジューリングのアルゴリズムとしては、無線基地局装置に属する移動局に順（例えば、移動局＃１→＃２→＃３→…）に下り共有チャネルの送信割り当てパケットの送信順序を制御するラウンドロビンスケジューラが良く知られている。また、各移動局の無線状態や各移動局の平均伝送速度に基づいて送信待ちパケットの送信順序を制御するProportional FairnessスケジューラやＭＡＸ　Ｃ／Ｉ（Maximum C/I）スケジューラが知られている。

例えば、Proportional Fairnessスケジューラは、評価関数

$Cn = Rn / avrgRn$

を各移動局に関して算出し、上記評価関数Ｃｎが最も大きい移動局に対してパケットを割り当てるというスケジューリングを行う。但し、Ｒｎは各移動局の瞬時の無線状態、avrgＲｎは各移動局の平均伝送速度である。

【００１０】

Proportional Fairnessスケジューラは、各々の移動局において、下り品質が比較的良い状況での送信割り当てが行われるため、ラウンドロビンスケジューラと比較して、高いスループットを得ることが期待できる。その上で、各移動局の平均伝送速度で除算することで、平均伝送速度が高い移動局の評価関数式の値を下げ、時間的な公平性の高い割り当てを実現することができる。

【００１１】

また、サービス性の観点から、最低伝送速度を考慮したProportional Fairnessスケジューリングを提供する方法が例えば特許文献１において提案されている。特許文献１では、評価関数Ｃｎとして、

$Cn = Rn / avrgRn$

の代わりに、

$Cn = Rn / (avrgRn - {}_{target}R)$

を用いることが提案されている。ここで、target Rは、上記最低伝送速度である。

【００１２】

その他、特許文献２では、呼を受け付けた場合における上り干渉量、下り総送信電力を推定し、その推定した上り干渉量が干渉量閾値以上であるか否か、下り総送信電力が送信電力閾値以上であるか否か、及び、使用されていない残りの拡散コード資源が拡散コード閾値以下であるか否かを判定し、その判定結果に応じて呼受付要求を認めるかどうか制御している。

【００１３】

また、特許文献３では、サービスの種別または優先度に応じて、新規の呼受付の規制を行っている。

さらに、特許文献４では、リソース使用状況やパケットユーザ数に応じて、新規の呼受付を規制している。

【特許文献１】特開２００５－１３００５３号公報
【特許文献２】特開２００２－２３２９４１号公報
【特許文献３】特開２００２－２２３２３９号公報
【特許文献４】特開２００２－２１７９５６号公報
【非特許文献１】３ＧＰＰ　TR25.848 v4.0.0
【非特許文献２】３ＧＰＰ２　C.S0024 Rev.1.0.0

【発明の開示】

【発明が解決しようとする課題】

【００１４】

上述したように、複数の移動局に対してパケットを送信する通信システムにおける呼受付制御方法として、当該セル内で通信を行っている移動局の総数が所定の閾値を超えた場合に新規の無線端末の受付を行わないという方法がある。

しかしながら、上記従来の呼受付制御方法では、パケットデータの生起の仕方やセルの形態に応じて適切に呼受付制御を行うことができない、という欠点がある、すなわち、従来の呼受付制御方法を行った場合、容量限界における移動局の伝送速度は、パケットデータの生起の仕方やセルの形態に応じて異なってしまう、という問題点が存在する。

本発明は上述した従来技術の問題点を解決するためになされたものであり、その目的はパケットデータの生起の仕方やセルの形態に対して適応的に呼受付制御を行い、新規呼の受け付けを効率良く制御することができる呼受付制御装置を提供することである。

【課題を解決するための手段】

【００１５】

本発明の請求項１による呼受付制御装置は、複数の無線端末に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、

前記複数の無線端末の内、所定の最低伝送速度を満たすことができない無線端末の数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御することを特徴とする。所定の最低伝送速度を満たすことができない無線端末の数とその割合とのいずれか一方に基づいてセル内の輻輳状態を推定し、呼受付制御を行うことにより、トラヒックの発生の仕方やセルの形態に関係無く適切に呼受付制御を行うことができる。

【００１６】

本発明の請求項２による呼受付制御装置は、複数の無線端末に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、

前記無線端末の平均伝送速度を測定する伝送速度把握手段と、

最低伝送速度の値を設定する最低伝送速度設定手段と、

前記無線端末の平均伝送速度の値が、前記最低伝送速度の値よりも小さいか否かを判定する判定手段と、

前記平均伝送速度の値が前記最低伝送速度の値よりも小さいと判定された無線端末の数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御する新規無線端末受付手段と、

を有することを特徴とする。平均伝送速度の値が最低伝送速度の値よりも小さいと判定された無線端末の数とその割合とのいずれか一方に基づいて、セル内の輻輳状態を推定し、呼受付制御を行うことにより、トラヒックの発生の仕方やセルの形態に関係無く適切に呼受付制御を行うことができる。

【００１７】

本発明の請求項３による呼受付制御装置は、複数の無線端末に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、

前記無線端末の平均伝送速度を測定する伝送速度把握手段と、

最低伝送速度の値を設定する最低伝送速度設定手段と、

前記無線端末の平均伝送速度の値が、前記最低伝送速度の値よりも小さい場合に、前記無線端末の平均伝送速度の値を初期化する平均伝送速度初期化手段と、

前記平均伝送速度の値を初期化された無線端末の数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御する新規無線端末受付手段と、

を有することを特徴とする。スケジューリングにおいて、平均伝送速度の値が初期化された無線端末の数及びその割合のいずれか一方に基づいてセル内の輻輳状態を推定し、呼受付制御を行うことにより、トラヒックの発生の仕方やセルの形態に関係無く適切に呼受付制御を行うことができる。

【００１８】

本発明の請求項４による呼受付制御装置は、複数の無線端末ｎ（ｎは無線端末の添え字）に対してパケットの送信を行う通信システムにおける呼受付制御装置であって、

前記無線端末ｎの無線状態Ｒｎと、前記無線端末ｎの伝送速度avrgＲｎと、を把握する状態把握手段と、

最低伝送速度$_{target}$Ｒｎ及び伝送速度閾値Ｒ$_{threshold}$を設定する最低伝送速度設定手段と、

前記伝送速度avrgＲｎから前記最低伝送速度$_{target}$Ｒｎを引いたものが、前記伝送速度閾値Ｒ$_{threshold}$よりも小さい場合に、前記伝送速度avrgＲｎの値を初期化する伝送速度初期化手段と、

前記無線状態Ｒｎをべき乗する指数αと、前記伝送速度avrgＲｎから前記最低伝送送度$_{target}$Ｒｎを引いたものをべき乗する指数βと、を設定する設定手段と、

各無線端末ｎに対する評価関数Ｃｎを、

$$Cn = Rn^{\alpha} / (avrgRn - {}_{target}Rn)^{\beta}$$

に従って算出する評価関数算出手段と、

前記評価関数Ｃｎが最大となる無線端末を送信相手の無線端末として選択する無線端末選択手段と、

前記伝送速度avrgＲｎを初期化された無線端末ｎの数とその割合との少なくとも一方に基づいて、新規の無線端末の受付を制御する新規無線端末受付手段と、

を有することを特徴とする。このように呼受付制御を行うことにより、トラヒックの発生の仕方やセルの形態に関係無く適切に呼受付制御を行うことができる。

【００１９】

本発明の請求項５による呼受付制御装置は、請求項４記載の呼受付制御装置であって、前記伝送速度初期化手段は、連続する所定の時間間隔において、前記伝送速度avrgＲｎ－$_{target}$Ｒｎが、前記伝送速度閾値Ｒ$_{threshold}$よりも小さい場合に、前記伝送速度avrgＲｎの値を初期化することを特徴とする。所定の時間間隔においてこのように呼受付制御を行うことにより、トラヒックの発生の仕方やセルの形態に関係無く適切に呼受付制御を行うことができる。

【００２０】

本発明の請求項６による呼受付制御装置は、請求項２から請求項４までのいずれか１項に記載の呼受付制御装置であって、

前記新規無線端末受付手段は、前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された

無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つが、所定の閾値よりも大きい場合に、新規の無線端末を受け付けないことを特徴とする。このように呼受付制御を行うことにより、トラヒックの発生の仕方やセルの形態に関係無く適切に呼受付制御を行うことができる。

【００２１】

本発明の請求項７による呼受付制御装置は、請求項２から請求項４までのいずれか１項に呼受付制御装置であって、

前記新規無線端末受付手段は、前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つに加えて、

通信を行っている無線端末の数に基づいて、新規の無線端末の受付を制御することを特徴とする。通信を行っている無線端末の数をも考慮した呼受付制御を行うことにより、より適切に呼受付制御を行うことができる。

【００２２】

本発明の請求項８による呼受付制御装置は、請求項７に記載の呼受付制御装置であって、

前記新規無線端末受付手段は、

前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つが、所定の閾値より大きく、かつ、前記通信を行っている無線端末の数とその割合との少なくとも一方が、別の所定の閾値よりも大きい場合に、新規の無線端末を受け付けないことを特徴とする。このように呼受付制御を行うことにより、より適切に呼受付制御を行うことができる。

【００２３】

本発明の請求項９による呼受付制御装置は、請求項２から請求項４までのいずれか１項に呼受付制御装置であって、

前記新規無線端末受付手段は、前記平均伝送速度が前記最低伝送速度よりも小さいと判定された無線端末の数と、その無線端末の数の割合と、前記平均伝送速度を初期化された無線端末の数と、その無線端末の数の割合とのうちの少なくとも１つを計算する際、サービス種別、契約種別、端末種別、ユーザ識別子、及び、Priority Classの少なくとも１つに応じて計算することを特徴とする。サービス種別、契約種別、端末種別、ユーザ識別子、Priority Classを考慮した呼受付制御を行うことにより、より適切に呼受付制御を行うことができる。

【発明の効果】

【００２４】

以上説明したように本発明は、平均伝送速度の値が初期化された移動局の数又はその割合に基づいて、当該セルの輻輳状態を推定し、呼受付制御を行うことにより、当該セルのセル形態、トラヒック状況に関係なく適切な呼受付制御を実現できるという効果がある。

【発明を実施するための最良の形態】

【００２５】

以下、本発明の実施の形態を、図面を参照して説明する。なお、以下の説明において参照する各図では、他の図と同等部分は同一符号によって示されている。

（実施形態１）

以下、本発明の実施形態１について、図面を参照して説明する。

（システム全体の構成例）

図１は、本発明の実施形態１に係る呼受付制御装置を用いた移動通信システムの構成例を示す図である。

【００２６】

同図において、この移動通信システムは、複数の移動局１０～１２及び２１と、呼受付制御装置である無線基地局１００と、それらを制御する無線制御装置３００とから構成さ

れ、前述したＨＳＤＰＡを適用した場合を示している。セル１０００は、基地局１００が通信を提供することのできるエリアを示す。ここで、移動局１０～１２はすでにセル１０００において基地局１００とＨＳＤＰＡを用いて通信を行っている状態にあり、移動局２１は、セル１０００において基地局１００とＨＳＤＰＡを用いた通信を新規に開始しようとしている状態にある、

以下、ＨＳＤＰＡを用いて通信を行っている移動局１０～１２に関しては、同一の構成、機能、状態を持つので、以下では特段の断りがない限り移動局ｎ（ｎは１以上の整数）として説明を進める。また、ＨＳＤＰＡを用いた通信を新規に開始しようとしている状態にある移動局の一例として、移動局２１を用いる。

【００２７】

ＨＳＤＰＡにおける通信チャネルに関する説明を行う。ＨＳＤＰＡにおける下りリンクにおいては、各移動局１０～１２で共有して使用される下り共有物理チャネルＨＳ－ＰＤＳＣＨ（High Speed－Physical Downlink Shared Channel、トランスポートチャネルで言えば、ＨＳ－ＤＳＣＨ：High Speed Downlink Shared Channel）と、各移動局で共有して使用される下り共有制御チャネルＨＳ－ＳＣＣＨ（High Speed-Shared Control Channel）と、各移動局に個別に割り当てられる、上記共有物理チャネルに付随する下りリンク付随個別チャネル（Ａ－ＤＰＣＨ：associated－Dedicated Physical Channel）とが用いられる。また、上りリンクにおいては、各移動局に個別に割り当てられる上りリンク付随個別チャネルＡ－ＤＰＣＨに加えて、各移動局に個別に割り当てられるＨＳＤＰＡ用の制御チャネルＨＳ－ＤＰＣＣＨ（High Speed－Dedicated Physical Control Channel）が用いられる。そして、下りリンクでは、上記下りリンク付随個別チャネルにより、上記上りリンク付随個別チャネルのための送信電力制御コマンド等が伝送され、上記共有物理チャネルによりユーザデータが伝送される。一方、上りリンクでは、上記上りリンク付随個別チャネルにより、ユーザデータ以外に、パイロットシンボル、下りリンク付随個別チャネル送信のための電力制御コマンド（ＴＰＣ　コマンド）が伝送され、上記ＨＳＤＰＡ用の個別制御チャネルにより、共有チャネルのスケジューリングや、ＡＭＣＳ（適応変調・符号化）に用いるための下り品質情報、及び、下りリンクの共有チャネルＨＳ－ＤＳＣＨの送達確認情報が伝送される。

【００２８】

（無線基地局の構成例）

図２は、図１に示す無線基地局１００の構成例を示す機能ブロック図である。

同図において、この無線基地局１００は、送受信アンテナ１０１と、アンプ部１０２と、送受信部１０３と、ベースバンド信号処理部１０４と、呼処理部１０５と、伝送路インターフェース１０６から構成される。下りリンクのパケットデータについては、無線基地局１００の上位に位置する無線制御装置３００から伝送路インターフェース１０６を介してベースバンド信号処理部１０４に入力される。ベースバンド信号処理部１０４では、再送制御（ＨＡＲＱ（Hybrid Automatic Repeat reQuest）の処理や、スケジューリング、伝送フォーマット選択、チャネル符号化、拡散処理が行われて送受信部１０３に転送される。送受信部１０３では、ベースバンド信号処理部１０４から出力されたベースバンド信号を無線周波数帯に変換する周波数変換処理が施され、その後、アンプ部１０２で増幅されて送受信アンテナ１０１より送信される。

【００２９】

一方、上りリンクのデータについては、送受信アンテナ１０１で受信された無線周波数信号がアンプ部１０２で増幅され、送受信部１０３で周波数変換されてベースバンド信号に変換される。このベースバンド信号は、ベースバンド信号処理部１０４で逆拡散やＲＡＫＥ合成、誤り訂正復号がなされた後、伝送路インターフェース１０６を介して無線制御装置に転送される。

また、呼処理部１０５では、無線制御装置と呼処理制御信号の送受信を行い、無線基地局１００の状態管理やリソース割り当てが行われる。

【００３０】

（ベースバンド信号処理部の構成例）
図３は、上記ベースバンド信号処理部１０４の機能構成を示す機能ブロック図である。同図において、ベースバンド信号処理部１０４は、レイヤー１処理部１１１と、ＭＡＣ－ｈｓ（Medium Access Control－ＨＳＤＰＡの略称）処理部１１２から構成される。ベースバンド信号処理部１０４におけるレイヤー１処理部１１１とＭＡＣ－ｈｓ処理部１１２はそれぞれ呼処理部１０５と接続される。レイヤー１処理部１１１では、下りデータのチャネル符号化や上りデータのチャネル復号化、上下の個別チャネルの送信電力制御や、ＲＡＫＥ合成、拡散・逆拡散処理が行われる。
また、レイヤー１処理部１１１では、各移動局からの上りＨＳＤＰＡ用個別物理チャネルに載せられて報告される下り無線状態を示す情報を受け取り、ＭＡＣ－ｈｓ処理部１１２に通知する。ＭＡＣ－ｈｓ処理部１１２では、ＨＳＤＰＡにおける下り共有チャネルのＨＡＲＱや送信待ちパケットに対するスケジューリングが行われる。また、ＭＡＣ－ｈｓ処理部１１２では、後述するように、移動局２１が当該セル１０００において新規にＨＳＤＰＡを用いた通信を開始することができるか否かを判定する呼受付判定も行われる。

【００３１】
（ＭＡＣ－ｈｓ処理部の構成例）
図４は、図３に示すＭＡＣ－ｈｓ処理部１１２の機能構成例を示す図である。同図において、ＭＡＣ－ｈｓ処理部１１２は、例えば、以下の機能ブロックを備えて構成される。
（１）フローコントロール部１２０
（２）ＭＡＣ－ｈｓリソース計算部１３０
（３）スケジューラ部１４０
（４）ＴＦＲ（Transport Format and Resource)選択部１５０
（５）移動局伝送速度初期化部１６０
（６）移動局伝送速度計算部１７０
（７）評価関数計算部１８０
（８）最低伝送速度設定部１９０
（９）ＨＳ呼受付判定部２００

【００３２】
（フローコントロール部）
上記（１）のフローコントロール部１２０は、無線制御装置から伝送路インターフェース１０６を介して受信される信号の伝送速度を、実装されているバッファの容量等に基づいて調整する機能を備える。各フローコントロール（＃１～＃Ｎ）１２$1_1$～１２$1_N$は、パケットの流通量を監視し、パケット流通量が増大し、キューバッファのメモリの空きが減少してくると送信パケット送出量を抑制する処理を行う。
（ＭＡＣ－ｈｓリソース計算部）
上記（２）のＭＡＣ－ｈｓリソース計算部１３０は、ＨＳ－ＤＳＣＨに割り当てる無線リソース（電力リソースや符号リソース、ハードウェアリソースなど）を計算するＨＳ－ＤＳＣＨパワーリソース計算部１３１とＨＳ－ＤＳＣＨコードリソース計算部１３２を備える。

【００３３】
（スケジューラ部）
上記（３）のスケジューラ部１４０は、Ｎ個のプライオリティキュー（＃１～＃Ｎ）１４$1_1$～１４$1_N$と、Ｎ個のリオーダリング部（＃１～＃Ｎ）１４$2_1$～１４$2_N$と、Ｎ個のＨＡＲＱ部（＃１～＃Ｎ）１４$3_1$～１４$3_N$とを有する。プライオリティキュー（＃１～＃Ｎ）１４$1_1$～１４$1_N$とは、コネクション毎のキューであり、通常は、１ユーザで１プライオリティキューを持つが、１ユーザが複数のコネクションを持つ場合には、１ユーザで複数のプライオリティキューを持つ。プライオリティキュー（＃１～＃Ｎ）１４$1_1$～１４$1_N$には、下りリンクのデータが入れられスケジューリングで選択されるまで蓄積される。リオーダリング部（＃１～＃Ｎ）１４$2_1$～１４$2_N$では、ＨＡＲＱにおける再送制御において、下りの受信順序制御を移動局ｎが行えるように、データに対してシーケンス

番号を付与し、移動局ｎの受信バッファがあふれないようにウィンドウ制御を行う。ＨＡＲＱ部（＃１～＃Ｎ）１４３$_1$～１４３$_N$では、Ｍプロセスのストップアンドウェイトプロトコルによって、上りＡｃｋ／Ｎａｃｋ（Acknowledgment/Negative Acknowledgment）フィードバックに基づいたＨＡＲＱの再送制御を行う。ここでは、Ｍはプロセスの数を示す。

【００３４】

（ＴＦＲ選択部）

上記（４）のＴＦＲ選択部１５０には、Ｎ個のＴＦＲSelect機能（＃１～＃Ｎ）１５１$_1$～１５１$_N$が備えられている。これらＮ個のＴＦＲSelect機能（＃１～＃Ｎ）１５１$_1$～１５１$_N$は、スケジューラ部１４０で選択されたユーザのデータについて、上りチャネルで受信する下り品質インジケータであるＣＱＩ（Channel Quality Indicator）や、ＭＡＣ－ｈｓリソース計算部で計算されたＨＳ－ＤＳＣＨに割り当てる無線リソース（電力リソース、符号リソース、ハードウェアリソース）などに基づいて、下り伝送チャネルの伝送フォーマット（コード変調、変調多値数、符号化率）及び送信電力を決定する。このＴＦＲ　Select機能で決定された下り伝送チャネルの伝送フォーマット及び送信電力はレイヤー１処理部へと通知される。

【００３５】

（移動局伝送速度初期化部）

上記（５）の移動局伝送速度初期化部１６０では、後述する移動局伝送速度計算部１７０から、移動局ｎの平均伝送速度（プライオリティキュー１４１$_1$～１４１$_N$毎に計算される平均伝送速度）avrgＲｎを受け取り、また、後述する最低伝送速度設定部１９０から、移動局ｎの最低伝送速度$_{target}$Ｒｎを受け取る。そして、上記平均伝送速度avrgＲｎを初期化するか否かを判定し、上記平均伝送速度avrgＲｎを初期化するべきだと判定した場合には、上記判定結果を、移動局伝送速度計算部１７０に通知する。さらに、移動局伝送速度初期化部１６０は上記平均伝送速度球を初期化するか否かの判定結果を、後述する呼受付判定部２００にも通知する。

【００３６】

ここで、以下に、上記平均伝送速度avrgＲｎを初期化するか否かの判定方法の例を記載する。

例えば、上記平均伝送速度avrgＲｎから上記最低伝送速度$_{target}$Ｒｎを引いたもの、すなわち、avrgＲｎ－$_{target}$Ｒｎが所定の伝送速度閾値Ｒ$_{threshold}$よりも小さい場合には、上記平均伝送速度avrgＲｎを初期化するべきだと判定する。

また、例えば、上記平均伝送速度avrgＲｎから上記最低伝送速度$_{target}$Ｒｎを引いたもの、すなわち、avrgＲｎ－$_{target}$Ｒｎが、連続する所定の時間間隔Ｔｉｍｅ$_{threshold}$において、所定伝送速度閾値Ｒ$_{threshold}$よりも小さい場合には、上記平均伝送速度avrgＲｎを初期化するべきだと判定する。

【００３７】

具体的な例をあげるならば、avrgＲｎ－$_{target}$Ｒｎが、連続する５０ＴＴＩ（１ＴＴＩ＝２[ｍｓ]であるため、１００[ｍｓ]）において、常に所定の伝送速度閾値Ｒ$_{threshold}$よりも小さい場合に、上記平均伝送速度avrgＲｎを初期化するべきだと判定してもよい。また、あるいは、avrgＲｎ－$_{target}$Ｒｎが、連続する５０ＴＴＩ（１ＴＴＩ＝２[ｍｓ]であるため、１００[ｍｓ]）において、所定の伝送速度閾値Ｒ$_{threshold}$よりも小さいＴＴＩが２０回以上存在した場合に、上記平均伝送速度avrgＲｎを初期化するべきだと判定してもよい。

【００３８】

なお、上記所定の伝送速度閾値Ｒ$_{threshold}$及び所定の時間間隔Ｔｉｍｅ$_{threshold}$は、上記例においては、全ての移動局に共通の値としているが、移動局毎に設定してもよい。また、上記所定の伝送速度閾値Ｒ$_{threshold}$及び所定の時間間隔Ｔｉｍｅ$_{threshold}$を、サービス種別毎、あるいは、契約種別毎、あるいは、端末種別毎、あるいは、ユーザ毎、あるいは、セル毎、あるいは、Priority Class毎に、設定してもよい。

【００３９】
（移動局伝送速度計算部）
上記（６）の移動局伝送速度計算部１７０では、移動局ｎ（平均伝送速度）が計算される。例えば、次式に基づき移動局ｎの伝送速度（平均伝送速度）が計算される。
avrgＲｎ（ｔ）＝δ・avrgＲｎ（ｔ－１）＋（１－δ）・ｒｎ　…（１）
ここで、式（１）において、δは、平均化区間を指定するパラメータ、言い換えれば、平均化のための忘却係数（０≦δ≦１）である。本パラメータδは、前記プライオリティキュー１４１$_1$～１４１$_N$内のデータに係るサービス種別や契約種別、受信器種別（ＲＡＫＥ受信器、等化器や受信ダイバーシチ、干渉キャンセラや、その他のＵＥ（User Equipment）のCapability（受信可能な変調方式や受信可能なコード数、ビット数等によってクラス分けされた指標）等）、セル種別、プライオリティクラス種別に基づいて設定されることができる。
【００４０】
また、式（１）において、ｒｎは瞬時伝送速度を示すものであり、ＭＡＣ－ｈｓ処理部１１２において
＜１＞送信されたデータの送達確認ができたデータのサイズ（データ量）、又は
＜２＞送信されたデータのサイズ（データ量）、又は
＜３＞移動局ｎから報告される下り瞬時の無線状態、あるいは、前記無線状態から推定される送信可能なデータのサイズ（データ量）
のいずれかを移動局ｎにおけるデータ伝送速度（瞬時のデータ伝送速度）とする。
【００４１】
上記式（１）に基づいて求められた移動局ｎの平均伝送速度の更新機会の組み合わせは、例えば、以下の式（２）に示すようなものが考えられる。

タイプ#	avrgＲｎの更新機会	ｒｎの計算方法
1	接続時間中の全てのＴＴＩ毎	上記＜１＞
2	接続時間中の全てのＴＴＩ毎	上記＜２＞
3	接続時間中の全てのＴＴＩ毎	上記＜３＞
4	スケジューリングの計算を行ったＴＴＩ毎	上記＜１＞
5	スケジューリングの計算を行ったＴＴＩ毎	上記＜２＞

…（２）

【００４２】
移動局伝送速度計算部１７０は、移動局伝送速度初期化部１６０から、平均伝送速度avrgＲｎを初期化するべきである、と通知された場合、上記平均伝送速度avrgＲｎを初期化する。具体的な初期化方法としては、例えば、平均伝送速度avrgＲｎを瞬時の無線状態Ｒｎと同一とする、といった方法が考えられる。ここで、瞬時の無線状態Ｒｎは、例えば、レイヤー１処理部１１１から出力される移動局ｎの下りリンクの瞬時の無線状態、あるいは、上記無線状態から推定される送信可能なデータのサイズ（データ量）である。
【００４３】
なお、移動局ｎの平均伝送速度avrgＲｎを求めるには、上記方法の他に、例えば、データリンク層でのデータの伝送速度を測定する機能がＭＡＣ－ｈｓ処理部１１２に備えられ、移動局ｎがデータ通信状態に入った後、ＭＡＣ－ｈｓ処理部１１２に流入したデータ量を一定時間毎に測定する。そして、その測定された一定時間毎のデータ量を移動局ｎにおける平均伝送速度avrgＲｎとする場合もある。
【００４４】
（評価関数計算部）
上記（７）の評価関数計算部１８０では、スケジューラ部１４０でのスケジューリングの際に用いられる移動局毎の評価関数が計算される。スケジューラ部１４０では、上記の評価関数計算部１８０で計算された移動局毎の評価関数のうち最大の評価関数を持つ移動局ｎを選択し、その移動局ｎに対し送信キューを割り当てる。すなわち、下りリンクの送信割り当てを行う。

【００４５】
（最低伝送速度設定部）
上記（８）の最低伝送速度設定部１９０は、プライオリティキュー１４１$_1$乃至１４１$_N$内の下りパケットについて考慮すべき最低伝送速度$_{target}$Ｒｎを設定し、上記最低伝送速度$_{target}$Ｒｎを、移動局伝送速度初期化部１６０及び評価関数計算部１８０に通知する。ここで、最低伝送速度設定部１９０は、呼処理部１０５を介して遠隔からの指定に応じて、最低伝送速度$_{target}$Ｒｎを設定するように構成されてもよい。
【００４６】
また、最低伝送速度設定部１９０は、サービス種別毎に、契約種別毎に、端末種別毎に、セル種別毎に、又は優先度クラス毎に、最低伝送速度$_{target}$Ｒｎを設定するように構成されてもよい。例えば、サービス種別は、下りパケットを伝送するサービスの種別を示すものであり、例えば、ＶｏＩＰ（Voice over Internet Protocol）サービスや音声サービスやストリーミングサービスやＦＴＰサービス等を含む。また、契約種別は、下りパケットの宛先移動局のユーザが加入している契約の種別を示すものであり、例えば、Low Class契約やHigh Class契約等を含む。また、端末種別は、下りパケットの宛先移動局の性能をクラス分けするものであり、移動局の識別情報に基づくクラスや、ＲＡＫＥ受信機能や等化器や受信ダイバーシチや干渉キャンセラ等の有無又は種別や、受信可能な変調方式やコード数やビット数等の端末能力等を含む。また、セル種別は、下りパケットの宛先移動局が在圏するセルの形態の種別を示すものであり、例えば、セルの識別情報に基づくクラスや、屋内又は屋外や、郊外又は市街地や、高トラヒック地帯又は低トラヒック地帯等を含む。さらには、優先度クラスは、下りパケットの送信に関わる優先度を示すものであり、例えば、第１の優先度の下りパケットは、第２の優先度の下りパケットよりも優先的に送信される。
【００４７】
また、最低伝送速度設定部１９０は、
$avrgRn - {}_{target}Rn \leqq {}_{minus}Rn$　　…（３）
の場合、評価関数Ｃｎの分母に設定すべき値$_{minus}$Ｒｎを、プライオリティキュー１４１$_1$乃至１４１$_N$毎に設定するように構成されている。なお、式（３）において、avrgＲｎは平均伝送速度、$_{target}$Ｒｎは最低伝送速度である。
ここで、最低伝送速度設定部１９０は、$_{target}$Ｒｎ＝０と設定してもよい。この場合、評価関数計算部１８０において用いられる評価関数Ｃｎは一般的なＰＦ（Proportional Fairness）スケジューリングを提供することになる。
【００４８】
（ＨＳ呼受付判定部）
上記（９）のＨＳ呼受付判定部２００は、移動局伝送速度初期化部１６０から、移動局ｎに関してその平均伝送速度avrgＲｎが初期化されたか否かの判定結果を受け取る。そして、上記平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行い、上記判定結果を、伝送路インターフェース１０６を介して、無線制御装置３００に通知する。
【００４９】
ここで、以下に、ＨＳ呼受付判定部２００が、その平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定する方法を記載する。
例えば、ＨＳ呼受付判定部２００は、平均伝送速度avrgＲｎが初期化された移動局の数を算出し、上記平均伝送速度avrgＲｎが初期化された移動局の数が１０よりも小さい場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができると判定し、平均伝送速度avrgＲｎが初期化された移動局の数が１０以上である場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができないと判定してもよい。

【００５０】
さらに例えば、ＨＳ呼受付判定部２００は、平均伝送速度avrgＲｎが初期化された移動局の割合を算出し、上記平均伝送速度avrgＲｎが初期化された移動局の割合が、セル１０００においてＨＳＤＰＡを用いた通信を行っている全移動局の２０％よりも小さい場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができると判定し、平均伝送速度avrgＲｎが初期化された移動局の割合が、セル１０００においてＨＳＤＰＡを用いた通信を行っている全移動局の２０％以上である場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができないと判定してもよい。ここで、上記セル１０００においてＨＳＤＰＡを用いた通信を行っている全移動局とは、プライオリティキューにデータが滞留している状態にある全ての移動局であってもよいし、あるいは、基地局１００との間でＡ－ＤＰＣＨが設定されている状態にある全ての移動局であってもよい。
【００５１】
また、上述した２つの例では、その平均伝送速度avrgＲｎが初期化された移動局の数に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定する方法と、その平均伝送速度avrgＲｎが初期化された移動局の割合に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定する方法と、を記載したが、その平均伝送速度avrgＲｎが初期化された移動局の数とその割合との両方に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定してもよい。
【００５２】
ここで、上記における平均伝送速度avrgＲｎが初期化された移動局の数または割合とは、例えば、所定の測定時間の間に平均伝送速度avrgＲｎが初期化された移動局の数または割合のことである。例えば、ＨＳ呼受付判定部２００が上記判定を行う時点から見た、過去の３分間に少なくとも１回、平均伝送速度avrgＲｎが初期化された移動局の数または割合のことである。あるいは、所定の測定時間の間に平均伝送速度avrgＲｎが初期化された回数が所定の閾値以上の移動局を、平均伝送速度avrgＲｎが初期化された移動局としてもよい。例えば、ＨＳ呼受付判定部２００が上記判定を行う時点から見た、過去の３分間に少なくとも３回以上、平均伝送速度avrgＲｎが初期化された移動局の数または割合のことである。
【００５３】
なお、上述した移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を、Priority Class毎に行ってもよい。この場合、Priority Class毎に平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合を算出して、上述したような判定を行う。
【００５４】
あるいは、複数のPriority Classに関する平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合の合計を用いて、上述したような判定を行ってもよい。この場合、平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合を、Priority Classに応じた重み付けを行って合計してもよい。例えば、優先度の高いPriority Classと、優先度の低いPriority Classとが存在する場合に、優先度の高いPriority Classの移動局に関しては、平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合に１．０を掛け算し、優先度の低いPriority Classの移動局に関しては、平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合に０．５を掛け算して、合計を行ってもよい。また、あるいは、優先度の低いPriority Classの移動局に関しては、平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合に０．０を掛け算して、合計を行ってもよい。
【００５５】
あるいは、上記した移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を、サービス種別毎、あるいは、契約種別毎、ある

いは、端末種別毎、あるいは、ユーザ毎、あるいは、セル毎に行ってもよい。この場合、サービス種別毎、あるいは、契約種別毎、あるいは、端末種別毎、あるいは、ユーザ毎、あるいは、セル毎に、平均伝送速度avrgＲｎが初期化された移動局の数あるいはその割合を算出して、上述したような判定を行う。

【００５６】

なお、上述した例では、初期化された移動局の数あるいは割合を用いて判定を行ったが、移動局が複数のプライオリティキューを持つ場合には、初期化された移動局のプライオリティキューの数あるいはその割合を用いて判定を行ってもよい。この場合、スケジューリングに関連する処理も移動局が持つプライオリティキュー毎に行われる。

【００５７】

なお、上述した例では、ＨＳ呼受付判定部２００は、平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ったが、より簡単に、各移動局ｎの伝送速度に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ってもよい。例えば、移動局伝送速度計算部１７０より各移動局ｎの伝送速度avrgＲｎを受け取り、上記各移動局ｎの伝送速度avrgＲｎに基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ってもよい。具体的には、伝送速度avrgＲｎが所定の閾値よりも小さい移動局の数、あるいは、割合に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ってもよい。

【００５８】

（無線制御装置の構成例）

図５は、無線制御装置３００の機能構成を示す機能ブロック図である。但し、本図においては、無線制御装置３００の機能のうち、新規の呼を設定する部分のみを記載しており、その他の機能に関しては省略している。無線制御装置３００は、新規呼設定部３１０を備えている。

【００５９】

新規呼設定部３１０は、無線基地局１００内のＨＳ呼受付判定部２００より、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定結果を受け取る。そして、新規呼設定部３１０は、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるという判定結果の場合には、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を開始するための処理を実行する。すなわち、通信を開始するための制御信号を無線基地局１００及び移動局２１に通知し、通信の設定を行う。一方、新規呼設定部３１０は、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができないという判定結果の場合には、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を開始するための処理を実行しない。この場合、例えば、新規呼設定部３１０は、ＨＳＤＰＡを用いた通信を開始するための処理を実行する代わりに、個別チャネルを用いた通信を開始するための処理を実行してもよい。この場合、移動局２１は、セル１０００において個別チャネルを用いた通信を行うことになる。あるいは、新規呼設定部３１０は、ＨＳＤＰＡを用いた通信を開始するための処理を実行する代わりに、移動局２１に、ＨＳＤＰＡの通信を行うことができないという情報を通知してもよい。この場合、移動局２１が開始しようとした通信は呼損となる。

【００６０】

なお、ここで、無線基地局１００内のＨＳ呼受付判定部２００においてＨＳＤＰＡの通信を開始することが可能か否かの判定を行い、無線制御装置３００内の新規呼設定部３１０において実際にＨＳＤＰＡの通信を設定するかしないかの呼受付制御を行ったが、本発明はこの一実施形態に限定されるものではない。すなわち、無線基地局１００においてＨＳＤＰＡの通信を開始することが可能か否かの判定とＨＳＤＰＡの通信の設定を行っても

よく、あるいは、無線制御装置３００においてＨＳＤＰＡの通信を開始することが可能か否かの判定と、ＨＳＤＰＡの通信の設定を行ってもよい。

【００６１】

次に、本発明に係る呼受付制御の動作について、図６に示すフローチャートを用いて説明する。なお、本発明に係る呼受付制御は、スケジューリング動作と関連しているため、図７を用いてスケジューリングの動作についても説明を行う。

（呼受付制御）

図６において、まずステップＳ１において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始しようとしているという情報を取得する。ステップＳ２において、ＨＳ呼受付判定部２００は、移動局伝送速度初期化部１６０より、平均伝送速度avrgＲｎが初期化された移動局の数を取得する。

【００６２】

ステップＳ３において、平均伝送速度avrgＲｎが初期化された移動局の数が所定の閾値、例えば「１０」よりも小さいか否かを判定する。そして、平均伝送速度avrgＲｎが初期化された移動局の数が所定の閾値よりも小さいと判定した場合にはステップＳ４に進み、平均伝送速度avrgＲｎが初期化された移動局の数が所定の閾値よりも小さくないと場合にはステップＳ６に進む。

【００６３】

ステップＳ４において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始することができると判定する。

ステップＳ５において、新規呼設定部３１０は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を行うための通信の設定を行う。

ステップＳ６において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始することができないと判定する。

【００６４】

ステップＳ７において、新規呼設定部３１０は、移動局２１がセル１０００において新規に個別チャネルを用いた通信を行うための通信の設定を行う。ここで、新規呼設定部３１０は、移動局２１がセル１０００において新規に個別チャネルを用いた通信を行うための通信の設定を行う代わりに、移動局２１はセル１０００において新規に通信を行うことができないと判断し、どのような通信の設定も行わないという処理を行ってもよい。この場合、移動局２１が行おうとした通信は呼損となる。

ところで、上記のステップＳ２、Ｓ３において、指標として平均伝送速度avrgＲｎが初期化された移動局の数を用いたが、代わりに、セル１０００において通信を行っている全ての移動局の数に対する、平均伝送速度avrgＲｎが初期化された移動局の数の割合を用いてもよい。

【００６５】

さらに、上記においては、ステップＳ２～Ｓ７の処理が、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始したタイミングで行われる場合を記載したが、予め決められた時間間隔でステップＳ２～Ｓ７の処理を行ってもよい。例えば、３秒を判定周期とし、３秒毎にステップＳ２～Ｓ７の処理を行ってもよい。この場合、セル１０００において新規に通信を行うことができると判定した場合には、新規呼設定部３１０は、その次の３秒間において、セル１０００においてＨＳＤＰＡを用いた通信を開始しようとした全ての移動局に対して、ＨＳＤＰＡを用いた通信を行うための通信の設定を行う。また、セル１０００において新規に通信を行うことができないと判定した場合には、新規呼設定部３１０は、その次の３秒間において、セル１０００においてＨＳＤＰＡを用いた通信を開始しようとした全ての移動局に対して、個別チャネルを用いた通信を行うための通信の設定を行う。

【００６６】

（スケジューリング動作）

次に、図７を用いて、本発明に係る呼受付制御と関連するスケジューリング動作につい

て説明を行う。
図７において、ＭＡＣ－ｈｓ処理部１１２の評価関数計算部１８０は、まず、ステップＳ１０１において、移動局ｎの評価関数を計算するための初期値設定を行う。
（初期値設定）
ｎ＝１
Ｃmax＝０
ｎmax＝０
ここで、ｎは移動局の添え字を表し、Ｃmaxは、評価関数の最大値を表し、ｎmaxは、評価関数が最大となる移動局の添え字を表す。
【００６７】
ステップＳ１０２～Ｓ１０４では、評価関数Ｃｎの計算に用いる下記の（１）～（３）の情報の取得が行われる。
（１）ステップＳ１０２：レイヤー１処理部１１１から出力される移動局ｎの下りリンクの瞬時の無線状態、あるいは、上記無線状態から推定される送信可能なデータのサイズ（データ量）の取得（但し、「無線状態から推定される送信可能なデータのサイズ」とは、下りの品質を示すＣＱＩ、或いは、下り伝送チャネルの瞬時ＳＩＲと、ＭＡＣ－ｈｓリソース計算部で計算されたＨＳ－ＤＳＣＨに割り当てる無線リソースとから、所定の誤り率で送信可能と推定されるデータのサイズのことを表す）
（２）ステップＳ１０３：移動局伝送速度計算部１７０から出力される移動局ｎの平均伝送速度$avrgR_n$の取得
（３）ステップＳ１０４：最低伝送速度設定部１９０から出力される移動局ｎの最低伝送速度$_{target}R_n$の取得
【００６８】
ステップＳ１０５では、上記（１）～（３）の情報が全て取得されたかどうかが判定され、上記（１）～（３）の情報が全て取得されたと判定されたとき（ステップＳ１０５でＹＥＳ）は、次ステップに移行し、そうでなければ（ステップＳ１０５でＮＯ）、上記（１）～（３）の情報のうち未取得情報の取得が行われる。
ステップＳ１０６では、平均伝送速度$avrgR_n$を初期化するか否かの判定を行う。例えば、連続する所定の時間間隔$Time_{threshold}$において、$avrgR_n - {}_{target}R_n$が、所定の伝送速度閾値$R_{threshold}$よりも小さい場合には（ステップＳ１０６でＹＥＳ）ステップＳ１０７に進み、そうでない場合には（ステップＳ１０６でＮＯ）、ステップＳ１０８に進む。
【００６９】
ステップＳ１０７では、ステップＳ１０６において、平均伝送速度$avrgR_n$を初期化すると判定されたため、平均伝送速度$avrgR_n$を初期化する。
ステップＳ１０８では、呼処理部１０５を介して遠隔から指定される指数パラメータ（α、β）を受け取り、ステップＳ１０９で次の式（４）に従って、評価関数（Ｃｎ）が計算される。

$(avrgR_n - {}_{target}R_n) > {}_{minus}R_n$　の時
$C_n = R_n{}^{\alpha} / (avrgR_n - {}_{target}R_n)^{\beta}$
$(avrgR_n - {}_{target}R_n) \leqq {}_{minus}R_n$　の時
$C_n = R_n{}^{\alpha} / {}_{minus}R_n{}^{\beta}$

…（４）

【００７０】
以下に、ステップＳ１０６、Ｓ１０７において、平均伝送速度$avrgR_n$を初期化することの作用効果を説明する。$avrgR_n - {}_{target}R_n$が、「０」に近づいた場合、当該移動局ｎに関する評価関数Ｃｎの値は増大する。この動作は、その平均伝送速度が考慮すべき最低伝送速度よりも小さくなった移動局ｎに対してパケット（ＨＳ－ＤＳＣＨ）を優先的に割り当てることとなり、本来であれば正しい動作であるが、逆に、そのような平均伝送速度が考慮すべき最低伝送速度よりも小さい移動局が多数存在した場合には、上記移動局に

必要以上にパケットを割り当てることとなり、他の移動局にパケットが割り当てられず、システム全体のスループットは劣化する。そこで、ある所定の時間間隔Ｔｉｍｅthresholdにおいて、上記移動局ｎのavrgＲｎ－targetＲｎが、所定の伝送速度閾値Ｒthresholdよりも小さい場合に、上記平均伝送速度avrgＲｎを初期化することにより、上記システム全体のスループットの劣化を回避することが可能となる。

【００７１】

また、上記のような平均伝送速度avrgＲｎが初期化される移動局の数または割合は、当該セルの輻輳状態を示す指標として用いることができる。すなわち、考慮すべき最低伝送速度を満たすことができない移動局が多数存在する場合には、当該セルは輻輳状態にあると判断することができる。一方で、考慮すべき最低伝送速度を満たすことができない移動局が多数存在しない場合には、当該セルは輻輳状態にないと判断することができる。

【００７２】

ここで、上記所定の時間間隔Ｔｉｍｅthresholdや、所定の伝送速度閾値Ｒthresholdは、遠隔、例えば、無線基地局１００の上位ノード（例：無線制御装置やコアネットワーク上のサーバ等）から指定する。例えば、呼処理制御信号に含められて上位ノードから無線基地局１００へと通知される。無線基地局１００は、上記呼処理制御信号に含まれる所定の時間間隔Ｔｉｍｅthresholdや、所定の伝送速度閾値Ｒthresholdを、呼処理部１０５で受け取り、ベースバンド信号処理部１０４内のＭＡＣ－ｈｓ処理部１１２の評価関数計算部１８０に転送する。また、あるいは、上記所定の時間間隔Ｔｉｍｅthresholdや、所定の伝送速度閾値Ｒthresholdは、無線基地局１００の局データとして保持され、ベースバンド信号処理部１０４内のＭＡＣ－ｈｓ処理部１１２の評価関数計算部１８０は、上記局データ内の上記所定の時間間隔Ｔｉｍｅthresholdや、所定の伝送速度閾値Ｒthresholdを参照してもよい。

【００７３】

なお、上記例において、α及びβの値を適切に設定することにより、いわゆる典型的なProportional Fairnessスケジューラ（$\alpha=1$、$\beta=1$）と、ＭＡＸ／Ｃｎスケジューラ（$\alpha=1$、$\beta\sim0$（但し、$\beta\neq0$））の中間のスケジューラを提供することが可能となる。

また、本発明は、上記発明に限定されることはなく、評価関数Ｃｎの式の一部が“$Rn^{\alpha}/(avrgRn-_{target}Rn)^{\beta}$”であるスケジューラの場合に適用することが可能である。例えば、評価関数の式が、

$$Cn=Rn^{\alpha}/(avrgRn-_{target}Rn)^{\beta}\cdot Wn^{\gamma} \quad \cdots(5)$$

というスケジューラの場合にも、本発明により、平均伝送速度avrgＲｎが、連続する所定の時間間隔Ｔｉｍｅthresholdにおいて、所定の伝送速度閾値Ｒthresholdよりも小さい場合には、上記平均伝送速度avrgＲｎを初期化する、という処理を加えてもよい。但し、式（５）において、α、β、γはパラメータ係数であり、０から１までのいずれかの値をとる。また、式（５）において、Ｗｎは移動局ｎに関する、無線基地局におけるパケットの滞留時間を表す。

【００７４】

上記のようにしてステップＳ１０９で評価関数Ｃｎが計算されると、その計算された評価関数Ｃｎが最大値であるかどうかの判定（ステップＳ１１０）が行われる。ここでは、Ｃmax＝０に設定（初期値）されているので、ステップＳ１０９で測定された評価関数ＣｎがＣmaxに設定され、そのＣmaxが与える移動局ｎが移動局ｎmaxとして設定される（ステップＳ１１１）。

【００７５】

ステップＳ１１２では、次の移動局の評価関数を計算するために移動局ｎを＋１インクリメントする。そして、移動局ｎが無線基地局と通信中の移動局数（ｍ）を超えると判断されなければ（ステップＳ１１３でＮＯ）、上記のステップＳ１０２以降のループ処理が移動局数（ｍ）を超えると判断されるまで繰り返し行われる。すなわち、無線基地局と通信中の移動局全ての評価関数Ｃｎが計算される。一方、ステップＳ１１３で移動局ｎが無

線基地局と通信中の移動局数（m）を超えると判断されたときは（ステップＳ１１３でＹＥＳ）、ステップＳ１１１で設定された移動局ｎmaxに対して送信キューの割り当てを行うようにスケジューラ部１４０に指示する（ステップＳ１１４）。

【００７６】

以上説明したような本実施形態によれば、平均伝送速度avrgＲｎの初期化を行うスケジューリングにおいて、上記平均伝送速度avrgＲｎの初期化が行われた移動局の数に基づいて輻輳状態を推定することにより、セルの形態、トラヒック状況に関係なく、呼受付制御を行うことが可能となる。

なお、ＭＡＣ－ｈｓ処理部１１２の評価関数計算部１８０は、例えば、ＣＰＵやデジタルシグナルプロセッサ（ＤＳＰ）、或いはＦＰＧＡ（Field Programmable Gate Array）等のプログラムの書き換えが可能なプログラマブルデバイスで構成され、所定のメモリ領域に上述した評価関数のプログラムが記憶され、パラメータ（α、β、δ、$Time_{threshold}$、$R_{threshold}$）をダウンロードして書き換える構成がとられる。この時、上記パラメータ（α、β、δ、$Time_{threshold}$、$R_{threshold}$）を無線基地局の上位ノードからダウンロードしてもよいし、評価関数計算部１８０に端末Ｉ／Ｆ（外部インターフェース機能）を設け、端末から直接上記パラメータ（α、β、δ、$Time_{threshold}$、$R_{threshold}$）を読み込ませるような形態であってもよい。

【００７７】

また、上述したＭＡＣ－ｈｓ処理部１１２の各機能ブロックは、ハードウェアで分割される場合もあるし、プロセッサ上のプログラムでソフトウェアとして分割されている場合もありうる。

また、上述した本発明に係る呼受付制御の動作では、平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ったが、より簡単に、各移動局ｎの伝送速度に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ってもよい。各移動局ｎの伝送速度に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行った場合の呼受付制御の動作を、図８に示すフローチャートを用いて説明する。

【００７８】

図８において、まずステップＳ２１において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始しようとしているという情報を取得する。

ステップＳ２２において、ＨＳ呼受付判定部２００は、移動局伝送速度計算部１７０より、各移動局ｎの平均伝送速度avrgＲｎを取得し、上記平均伝送速度avrgＲｎが所定の閾値ＴＨ１よりも小さい移動局の数を取得する。ここで、例えば、上記所定の閾値ＴＨ１を６４ｋｂｐｓと設定することができる。また、例えば、上記平均伝送速度avrgＲｎが、連続する所定の時間間隔$Time_{threshold}$において、所定の閾値ＴＨ１よりも小さい移動局の数を取得してもよい。

【００７９】

ステップＳ２３において、上記平均伝送速度avrgＲｎが所定の閾値ＴＨ１よりも小さい移動局の数が、所定の閾値ＴＨ２、例えば「１０」よりも小さいか否かを判定する。そして、平均伝送速度avrgＲｎが所定の閾値ＴＨ１よりも小さい移動局の数が所定の閾値ＴＨ２よりも小さいと判定した場合にはステップＳ２４に進み、平均伝送速度avrgＲｎが所定の閾値ＴＨ１よりも小さい移動局の数が所定の閾値ＴＨ２よりも小さくないと場合にはステップＳ２６に進む。

【００８０】

ステップＳ２４において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始することができると判定する。

ステップＳ２５において、新規呼設定部３１０は、移動局２１がセル１０００において

新規にＨＳＤＰＡを用いた通信を行うための通信の設定を行う。
ステップＳ２６において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始することができないと判定する。
【００８１】
ステップＳ２７において、新規呼設定部３１０は、移動局２１がセル１０００において新規に個別チャネルを用いた通信を行うための通信の設定を行う。ここで、新規呼設定部３１０は、移動局２１がセル１０００において新規に個別チャネルを用いた通信を行うための通信の設定を行う代わりに、移動局２１はセル１０００において新規に通信を行うことができないと判断し、どのような通信の設定も行わないという処理を行ってもよい。この場合、移動局２１が行おうとした通信は呼損となる。
ところで、上記のステップＳ２２、Ｓ２３において、指標として平均伝送速度avrgＲｎが所定の閾値ＴＨ１よりも小さい移動局の数を用いたが、代わりに、セル１０００において通信を行っている全ての移動局の数に対する、平均伝送速度avrgＲｎが所定の閾値ＴＨ１よりも小さい移動局の数の割合を用いてもよい。
【００８２】
さらに、上記においては、ステップＳ２２～Ｓ２７の処理が、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始したタイミングで行われる場合を記載したが、予め決められた時間間隔でステップＳ２２～Ｓ２７の処理を行ってもよい。例えば、３秒を判定周期とし、３秒毎にステップＳ２２～Ｓ２７の処理を行ってもよい。この場合、セル１０００において新規に通信を行うことができると判定した場合には、新規呼設定部３１０は、その次の３秒間において、セル１０００においてＨＳＤＰＡを用いた通信を開始しようとした全ての移動局に対して、ＨＳＤＰＡを用いた通信を行うための通信の設定を行う。また、セル１０００において新規に通信を行うことができないと判定した場合には、新規呼設定部３１０は、その次の３秒間において、セル１０００においてＨＳＤＰＡを用いた通信を開始しようとした全ての移動局に対して、個別チャネルを用いた通信を行うための通信の設定を行う。
【００８３】
また、上記実施例は、３ＧＰＰにおける高速パケット伝送方式ＨＳＤＰＡに関して記述したが、本発明は上記ＨＳＤＰＡに限定されるものではなく、その他の、移動通信システムにおける下りパケットの送信制御（スケジューリング）を行う高速パケット伝送方式に適用することが可能である。例えば、３ＧＰＰのＬＴＥ(Long Term Evolution)により提供される高速パケット伝送方式や、３ＧＰＰ２におけるｃｄｍａ２０００　１ｘＥＶ－ＤＯやＴＤＤ方式における高速パケット伝送方式など、がその他の高速パケット伝送方式としてあげられる。また、上記実施例では、本発明を下りリンクにおける高速パケット伝送方式に適用する場合を記載したが、本発明を上りリンクにおける高速パケット伝送方式に適用してもよい。ここで、上りリンクにおける高速パケット伝送方式とは、例えば、３ＧＰＰや３ＧＰＰ２、ＬＴＥにおける上りリンクの高速パケット伝送方式のことを指す。
【００８４】
上記実施例において、移動局伝送速度計算部１７０の機能が伝送速度把握手段、最低伝送速度設定部１９０の機能が最低伝送速度設定手段、ＨＳ呼受付判定部２００の機能が判定手段、新規呼設定部３１０が新規無線端末受付手段に対応する。
また、上記実施例において、無線基地局１００及び無線制御装置は、呼受付制御装置に対応し、移動局（＃１～＃３）１０～１２は無線端末に対応する。
【００８５】
（実施形態２）
以下、本発明の実施形態２について、図面を参照して説明する。
上述した実施形態１において、ＨＳ呼受付判定部２００は、平均伝送速度avrgＲｎが初期化された数あるいは割合に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行った。しかしながら、上記のような呼受付判定は、以下のような問題を抱えている。例えば、当該セルに２台の移動局

が通信を行っており、その内の１台が極めて無線品質の悪い環境に存在し、その平均伝送速度avrgＲｎが初期化されたとする。この場合、平均伝送速度avrgＲｎが初期化された割合は５０％となり、閾値を３０％に設定したとすると、セル内に２台の移動局しか存在しないにも関わらず、当該セルは輻輳状態にあると判断されてしまう。

【００８６】

以下に説明する実施の形態２においては、上記問題を克服するために、平均伝送速度avrgＲｎが初期化された数あるいは割合だけでなく、当該セルにおいて通信を行っている全移動局の数をも用いて呼受付判定を行う。

本実施の形態２に係る呼受付制御装置を用いた移動通信システムの構成は、上記実施の形態１とほぼ同様であり、異なる点は、ＨＳ呼受付判定部２００の機能のみである。よって、以下では、ＨＳ呼受付判定部２００の機能に関してのみ記載を行い、それ以外に関しては省略する。

【００８７】

ＨＳ呼受付判定部２００は、移動局伝送速度初期化部１６０から、移動局ｎに関してその平均伝送速度avrgＲｎが初期化されたか否かの判定結果を受け取る。そして、上記平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合と、当該セル１０００において通信を行っている移動局の数とに基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行い、上記判定結果を、伝送路インターフェース１０６を介して、無線制御装置３００に通知する。

ここで、以下に、ＨＳ呼受付判定部２００が、その平均伝送速度avrgＲｎが初期化された移動局の数とその割合とのいずれか一方と、当該セル１０００において通信を行っている移動局の数とに基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定する方法を記載する。

【００８８】

例えば、ＨＳ呼受付判定部２００は、平均伝送速度avrgＲｎが初期化された移動局の数と、当該セル１０００において通信を行っている移動局の数と、に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定してもよい。例えば、平均伝送速度avrgＲｎが初期化された移動局の数が「１０」よりも小さい場合、あるいは、当該セル１０００において通信を行っている移動局の数が「２０」よりも小さい場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができると判定し、平均伝送速度avrgＲｎが初期化された移動局の数が「１０」以上であり、かつ、当該セル１０００において通信を行っている移動局の数が「２０」よりも以上である場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができないと判定してもよい。

【００８９】

また、例えば、ＨＳ呼受付判定部２００は、平均伝送速度avrgＲｎが初期化された移動局の割合と、当該セル１０００において通信を行っている移動局の数と、に基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定してもよい。例えば、平均伝送速度avrgＲｎが初期化された移動局の割合が２０％よりも小さい場合、あるいは、当該セル１０００において通信を行っている移動局の数が「２０」よりも小さい場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができると判定し、平均伝送速度球が初期化された移動局の割合が２０％以上であり、かつ、当該セル１０００において通信を行っている移動局の数が「２０」よりも以上である場合に、移動局２１はセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができないと判定してもよい。

ここで、上記当該セル１０００において通信を行っている移動局の数とは、プライオリティキューにデータが滞留している状態の移動局の数であってもよいし、あるいは、基地局１００との間でＡ－ＤＰＣＨが設定されている状態の移動局の数であってもよい。

【００９０】

また、上記の例において、当該セル１０００において通信を行っている移動局の数が、

固定の閾値である「２０」よりも以上であるかそうでないかで、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かを判定したが、固定の閾値を用いる代わりに、適応的に変動する閾値を用いてもよい。例えば、セル内で通信を行うことのできる移動局の数は、ＨＳ－ＰＤＳＣＨに割り当てられるパワーリソース量に依存するため、ＨＳ－ＰＤＳＣＨに割り当てられるパワーリソース量に応じて上記閾値を適応的に変動させてもよい。すなわち、ＨＳ－ＰＤＳＣに割り当てられるパワーリソース量が全体のパワーリソース量の５０％である場合には、上記閾値を「２０」とし、ＨＳ－ＰＤＳＣに割り当てられるパワーリソース量が全体のパワーリソース量の２５％である場合には、上記閾値を「１０」としてもよい。あるいは、パワーリソースではなく、コードリソースを用いて同様の制御を行ってもよい。

【００９１】

次に、本実施の形態２に係る呼受付制御の動作について、図９に示すフローチャートを用いて説明する。なお、本発明に係る呼受付制御と関連するスケジューリング動作は、実施の形態におけるスケジューリング動作と同様であるため省略する。

図９において、まずステップＳ１１において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始しようとしているという情報を取得する。

【００９２】

ステップＳ１２において、ＨＳ呼受付判定部２００は、移動局伝送速度初期化部１６０より、平均伝送速度avrgＲｎが初期化された移動局の数を取得する。

ステップＳ１３において、平均伝送速度球が初期化された移動局の数が所定の閾値ＴＨ１、例えば「１０」よりも小さいか否かを判定し、平均伝送速度avrgＲｎが初期化された移動局の数が所定の閾値ＴＨ１よりも小さいと判定した場合にはステップＳ１４に進み、平均伝送速度avrgＲｎが初期化された移動局の数が所定の閾値ＴＨ１よりも小さくないと判定した場合にはステップＳ１６に進む、

ステップＳ１４において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始することができると判定する。

【００９３】

ステップＳ１５において、新規呼設定部３１０は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を行うための通信の設定を行う。

ステップＳ１６において、セル１０００において通信を行っている移動局の数が所定の閾値ＴＨ２、例えば「２０」よりも小さいか否かを判定し、セル１０００において通信を行っている移動局の数が所定の閾値ＴＨ２よりも小さいと判定した場合はステップＳ１４に進み、セル１０００において通信を行っている移動局の数が所定の閾値ＴＨ２よりも小さくないと判定した場合にはステップＳ１７に進む。

【００９４】

ステップＳ１７において、ＨＳ呼受付判定部２００は、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始することができないと判定する。

ステップＳ１８において、新規呼設定部３１０は、移動局２１がセル１０００において新規に個別チャネルを用いた通信を行うための通信の設定を行う。ここで、新規呼設定部３１０は、移動局２１はセル１０００において新規に通信を行うことができないと判断し、どのような通信の設定も行わないという処理を行ってもよい。この場合、移動局２１が行おうとした通信は呼損となる。

ここで、上記のステップＳ１２、Ｓ１３において、指標として平均伝送速度avrgＲｎが初期化された移動局の数を用いたが、代わりに、セル１０００において通信を行っている全ての移動局の数に対する、平均伝送速度avrgＲｎが初期化された移動局の数の割合を用いてもよい。

【００９５】

さらに、上記においては、ステップＳ１２～Ｓ１８の処理が、移動局２１がセル１０００において新規にＨＳＤＰＡを用いた通信を開始したタイミングで行われる場合を記載し

たが、予め決められた時間間隔でステップＳ１２～Ｓ１８の処理を行ってもよい。例えば、３秒を判定周期とし、３秒毎にＳ１２～Ｓ１８の処理を行ってもよい。この場合、セル１０００において新規に通信を行うことができると判定した場合には、新規呼設定部３１０は、その次の３秒間において、セル１０００においてＨＳＤＰＡを用いた通信を開始しようとした全ての移動局に対して、ＨＳＤＰＡを用いた通信を行うための通信の設定を行う。また、セル１０００において新規に通信を行うことができないと判定した場合には、新規呼設定部３１０は、その次の３秒間において、セル１０００においてＨＳＤＰＡを用いた通信を開始しようとした移動局全てに対して、個別チャネルを用いた通信を行うための通信の設定を行う。

【００９６】

なお、上述した例では、ＨＳ呼受付判定部２００は、平均伝送速度avrgＲｎが初期化された移動局の数あるいは割合と、当該セルにおいて通信を行っている全移動局の数あるいは割合とに基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ったが、より簡単に、各移動局ｎの伝送速度と、当該セルにおいて通信を行っている全移動局の数あるいは割合とに基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ってもよい。例えば、移動局伝送速度計算部１７０より各移動局ｎの伝送速度avrgＲｎを受け取り、上記各移動局ｎの伝送速度avrgＲｎと、当該セルにおいて通信を行っている全移動局の数あるいは割合とに基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ってもよい。具体的には、伝送速度avrgＲｎが所定の閾値よりも小さい移動局の数あるいは割合と、当該セルにおいて通信を行っている全移動局の数あるいは割合とに基づいて、移動局２１がセル１０００においてＨＳＤＰＡを用いた通信を新規に開始することができるか否かの判定を行ってもよい。

【産業上の利用可能性】

【００９７】

本発明は、移動体通信におけるパケット通信の呼受付制御に利用することができる。

【図面の簡単な説明】

【００９８】

【図１】本発明の実施形態に係る呼受付制御装置である無線基地局を用いた移動通信システムの構成例を示す図である。

【図２】図１中の無線基地局の構成例を示す機能ブロック図である。

【図３】図１中の無線基地局のベースバンド信号処理部の機能構成を示す機能ブロック図である。

【図４】図１中の無線基地局のＭＡＣ－ｈｓ処理部の機能構成を示す機能ブロック図である。

【図５】図１中の無線制御装置の機能構成を示す機能ブロック図である。

【図６】ＭＡＣ－ｈｓ処理部での呼受付判定動作を示すフローチャートである。

【図７】ＭＡＣ－ｈｓ処理部でのスケジューリング動作の一例を示すフローチャートである。

【図８】ＭＡＣ－ｈｓ処理部での呼受付判定動作の他の例を示すフローチャートである。

【図９】ＭＡＣ－ｈｓ処理部での呼受付判定動作を示すフローチャートである。

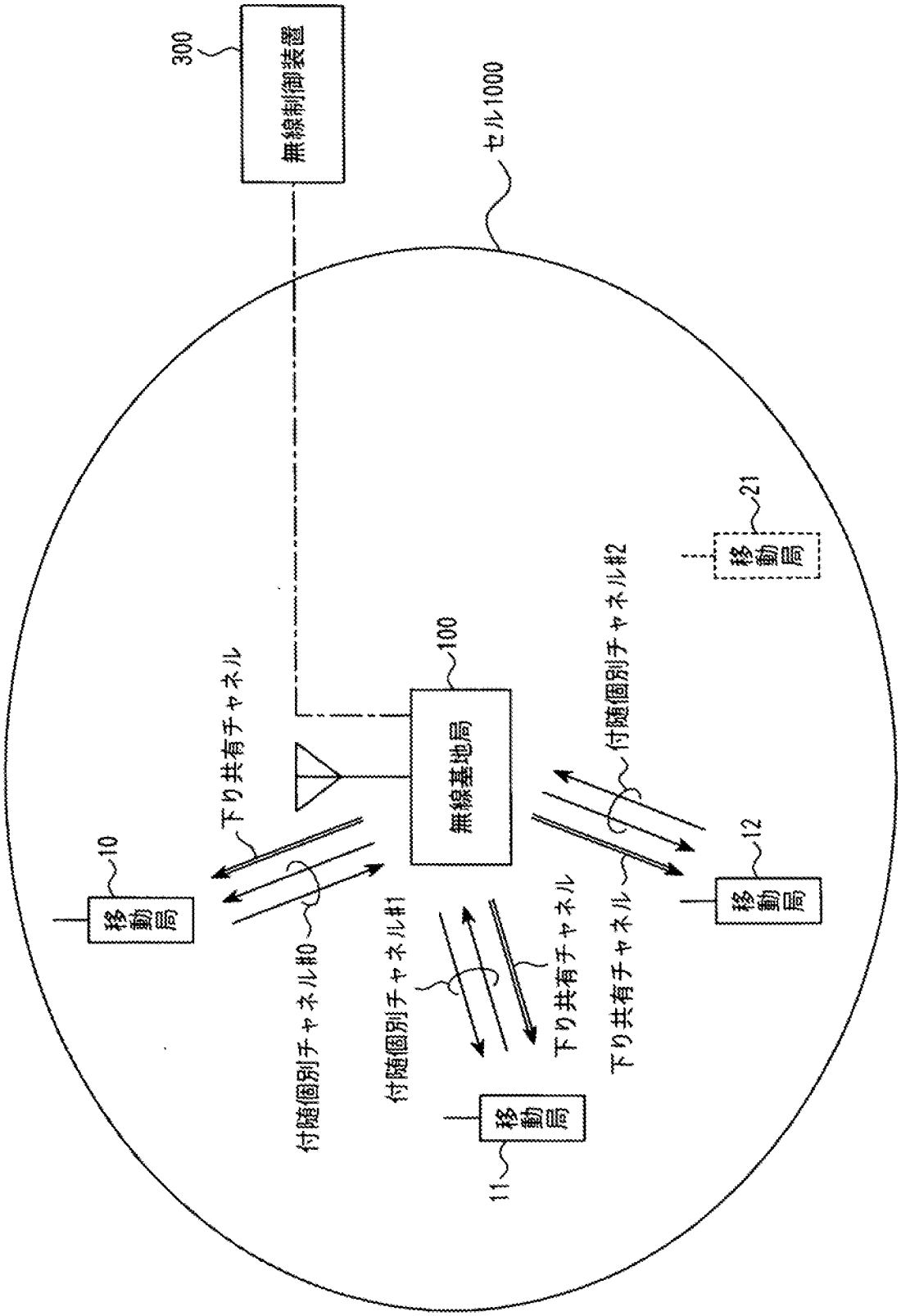
【符号の説明】

【００９９】

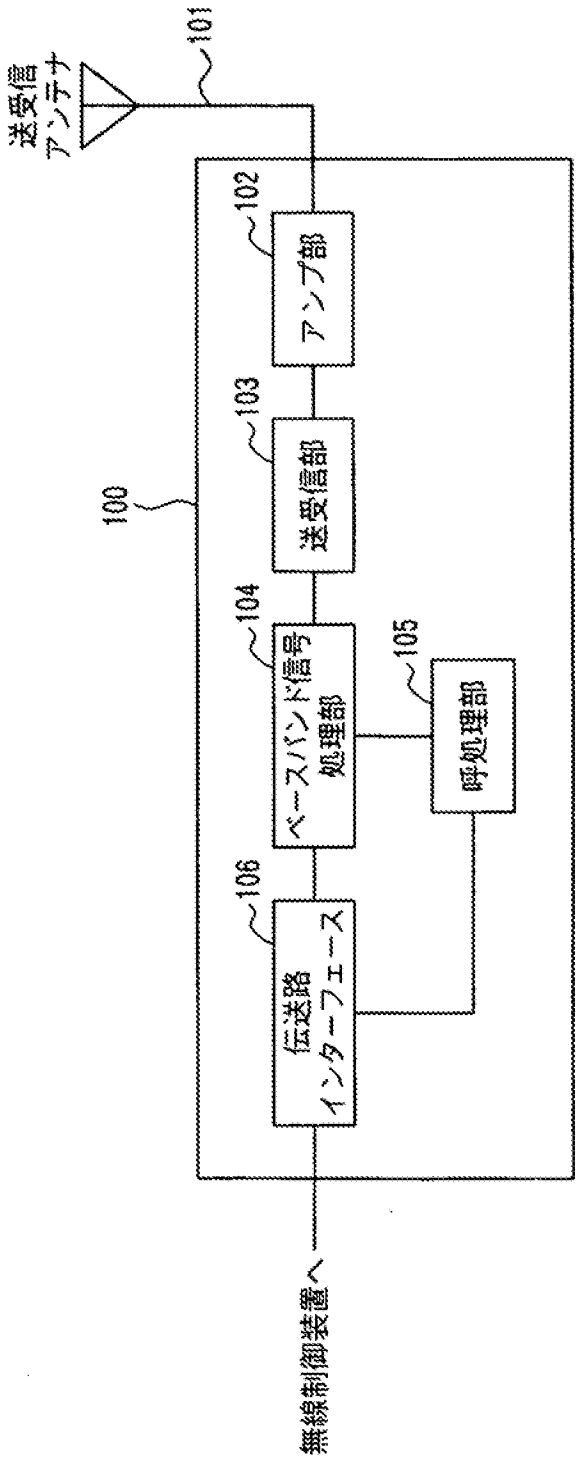
１０～１２、２１　移動局
１００　無線基地局
１０１　送受信アンテナ
１０２　アンプ部
１０３　送受信部

１０４　ベースバンド信号処理部
１０５　呼処理部
１０６　伝送路インターフェース
１１１　レイヤー１処理部
１１２　ＭＡＣ－ｈｓ処理部
１２０　フローコントロール部
121_1～121_N　フローコントロール
１３０　ＭＡＣ－ｈｓリソース計算部
１３１　ＨＳ－ＤＳＣＨパワーリソース計算部
１３２　ＨＳ－ＤＳＣＨコードリソース計算部
１４０　スケジューラ部
141_1～141_N　プライオリティキュー
142_1～142_N　リオーダリング部
143_1～143_N　ＨＡＲＱ部
１５０　ＴＦＲ選択部
151_1～151_N　ＴＦＲselect機能
１６０　移動局伝送速度初期化部
１７０　移動局伝送速度計算部
１８０　評価関数計算部
１９０　最低伝送速度設定部
２００　呼受付判定部
３００　無線制御装置
３１０　新規呼設定部
１０００　セル

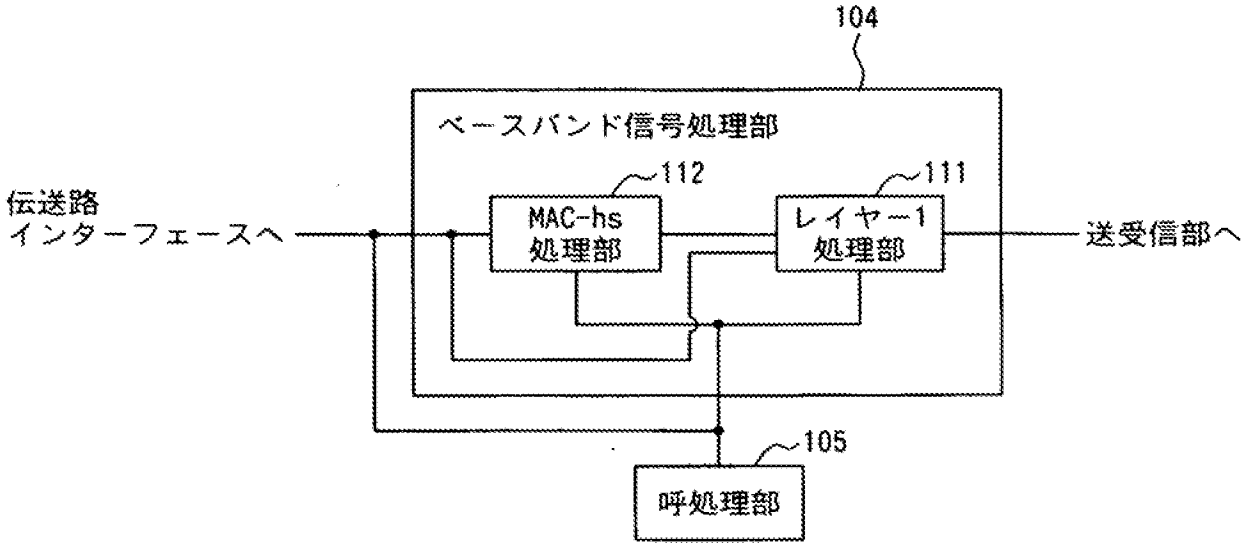
【書類名】図面
【図１】


300
無線制御装置
セル1000
100
無線基地局
10
移動局
11
移動局
12
移動局
21
移動局
下り共有チャネル
付随個別チャネル#0
付随個別チャネル#1
下り共有チャネル
付随個別チャネル#2
下り共有チャネル

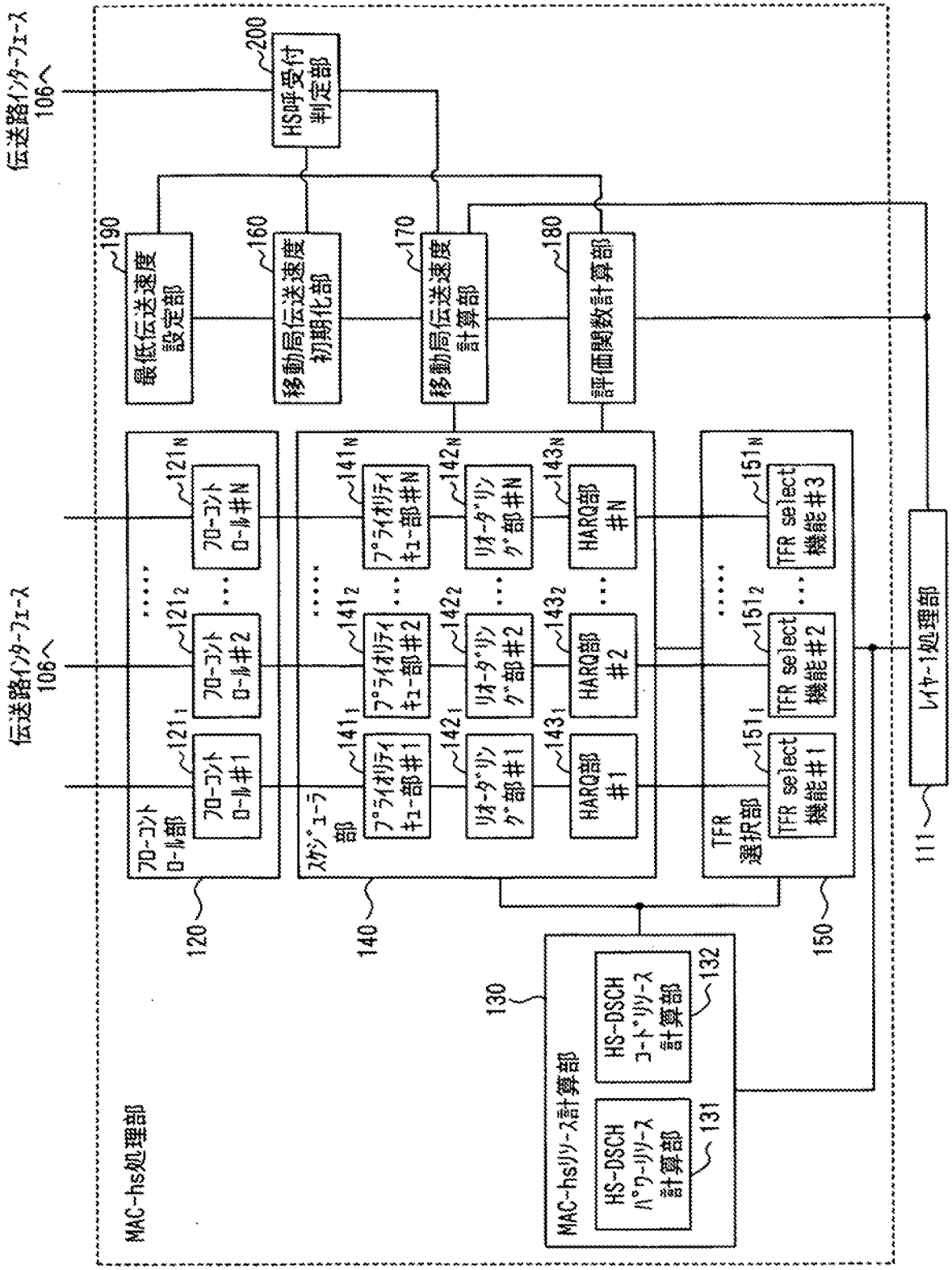
【図２】


送受信アンテナ
101
100
102
アンプ部
103
送受信部
104
ベースバンド信号処理部
105
呼処理部
106
伝送路インターフェース
無線制御装置へ

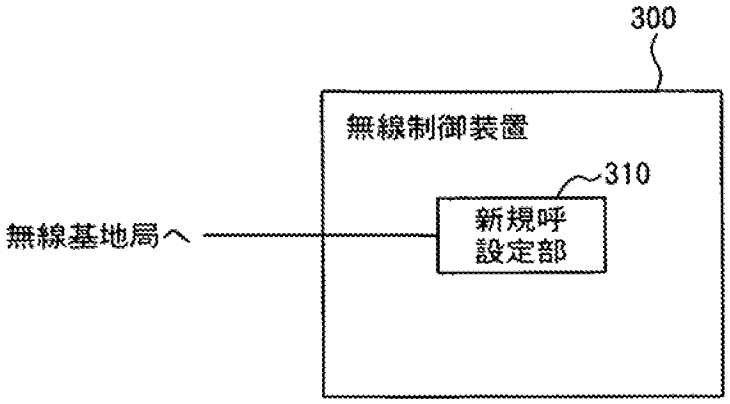
【図３】


104
ベースバンド信号処理部
112
111
伝送路
インターフェースへ
MAC-hs
処理部
レイヤー1
処理部
送受信部へ
105
呼処理部

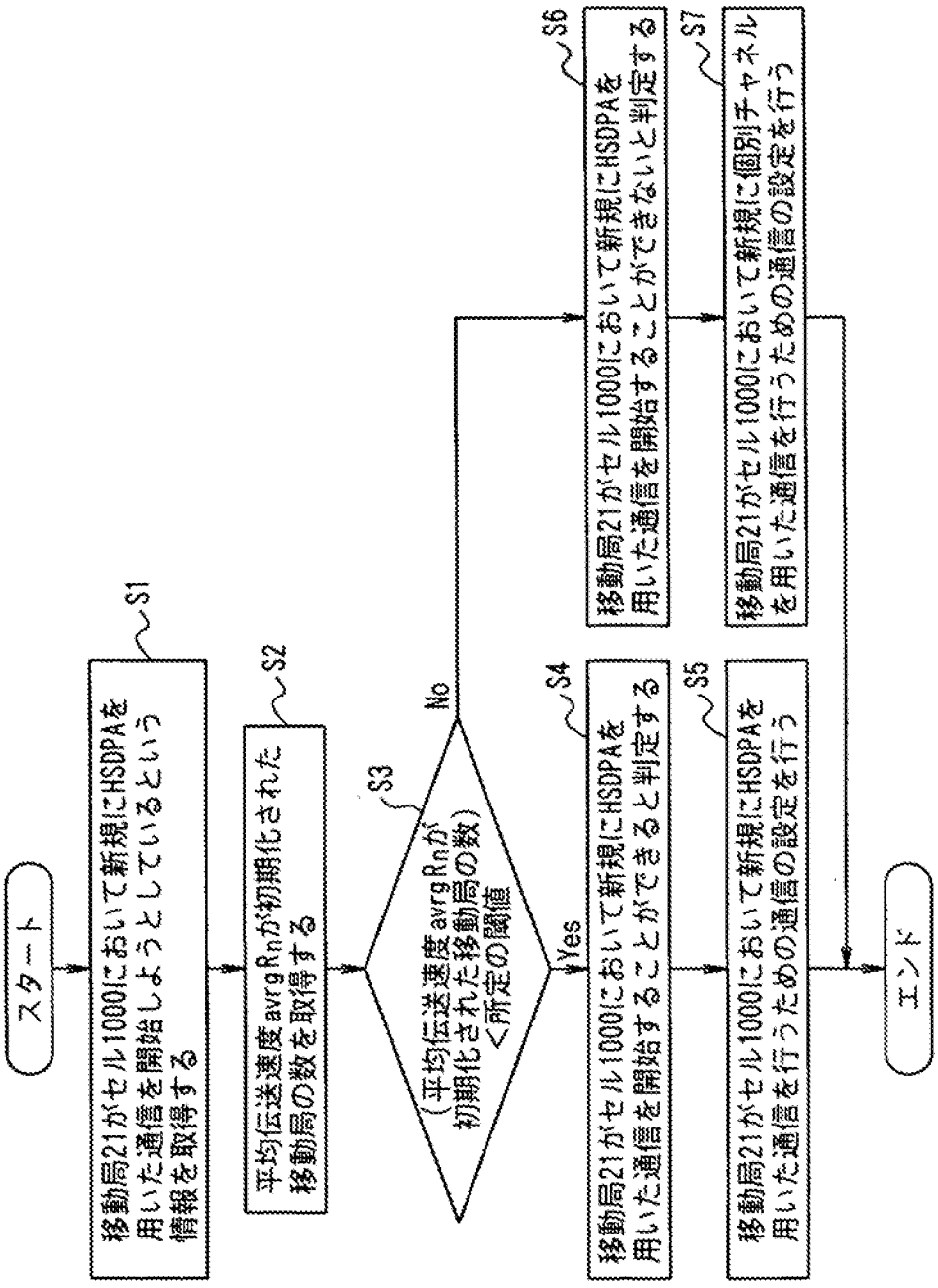
【図４】


伝送路インターフェース 106へ
伝送路インターフェース 106へ
MAC-hs処理部
200
HS呼受付判定部
190
最低伝送速度設定部
160
移動局伝送速度初期化部
170
移動局伝送速度計算部
180
評価関数計算部
フロー コントロール部
120
フロー コントロール #1
フロー コントロール #2
フロー コントロール #N
121 1
121 2
121 N
スケジューラ部
140
プライオリティキュー部 #1
プライオリティキュー部 #2
プライオリティキュー部 #N
141 1
141 2
141 N
リオーダリング部 #1
リオーダリング部 #2
リオーダリング部 #N
142 1
142 2
142 N
HARQ部 #1
HARQ部 #2
HARQ部 #N
143 1
143 2
143 N
TFR 選択部
150
TFR select 機能 #1
TFR select 機能 #2
TFR select 機能 #3
151 1
151 2
151 N
MAC-hsリソース計算部
130
HS-DSCH パワーリソース 計算部
131
HS-DSCH コードリソース 計算部
132
レイヤ-1処理部
111

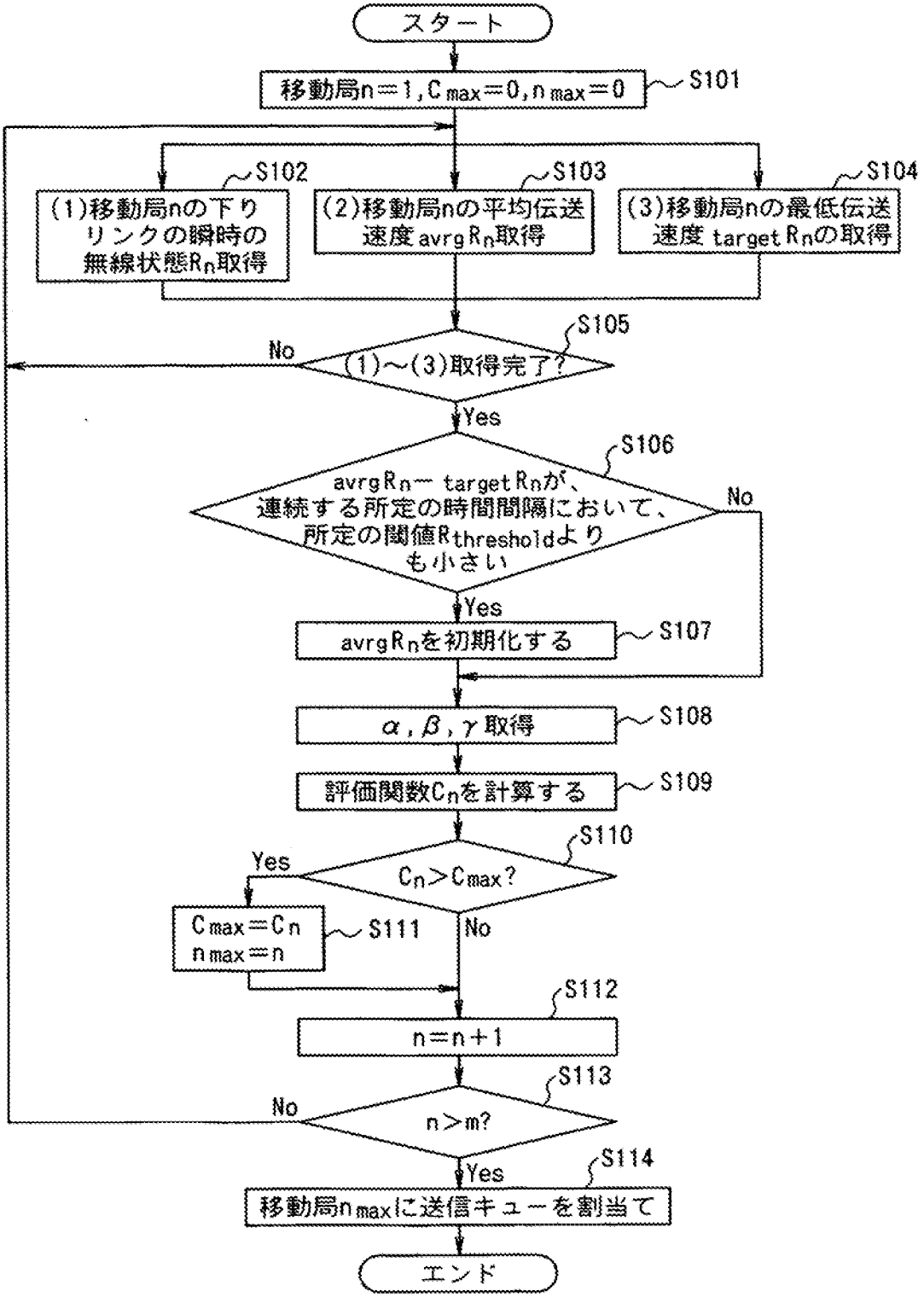
【図５】



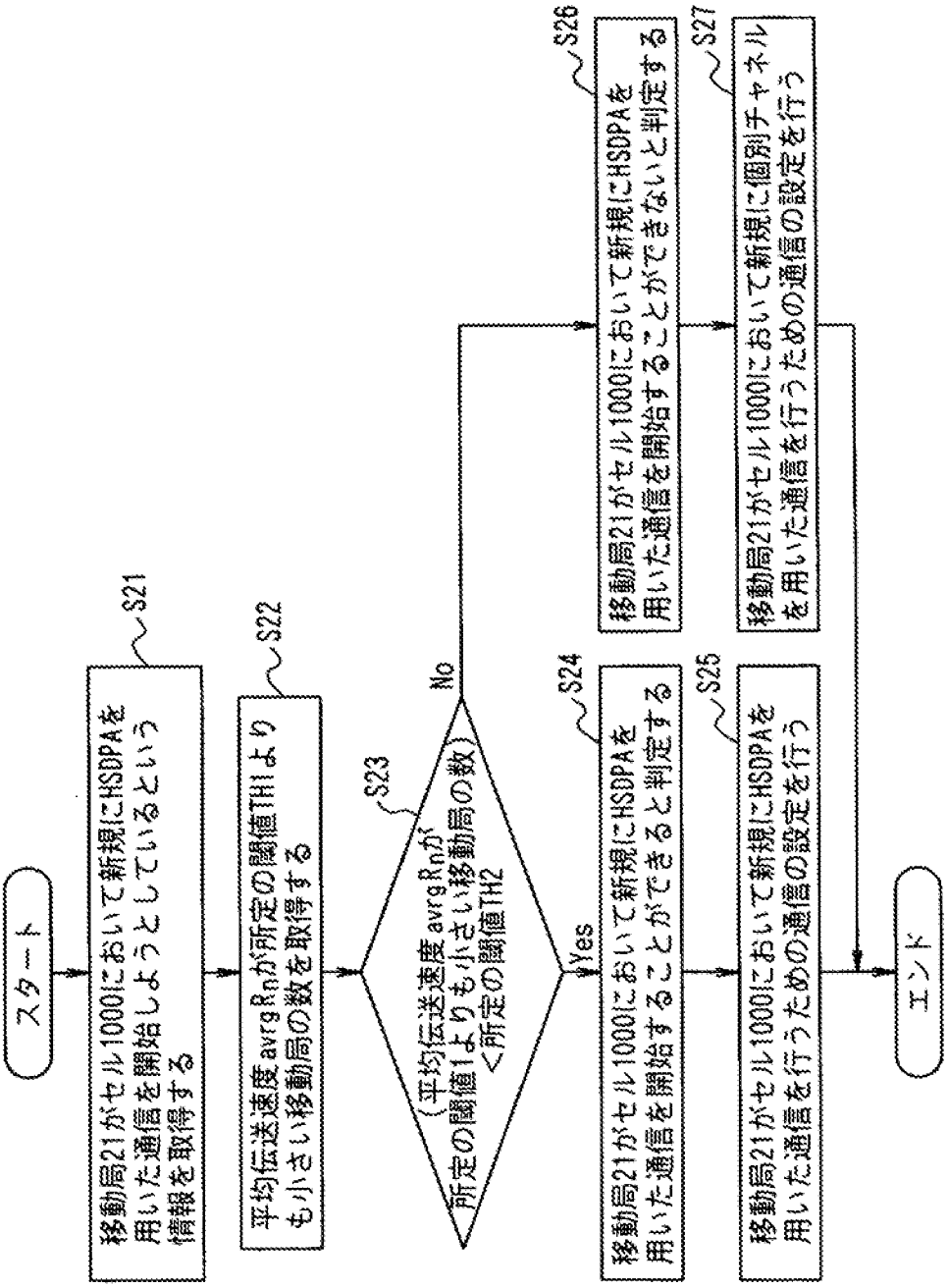
【図６】


スタート
S1
移動局21がセル1000において新規にHSDPAを用いた通信を開始しようとしているという情報を取得する
S2
平均伝送速度avrgRnが初期化された移動局の数を取得する
S3
(平均伝送速度avrgRnが初期化された移動局の数)<所定の閾値
No
Yes
S4
移動局21がセル1000において新規にHSDPAを用いた通信を開始することができると判定する
S5
移動局21がセル1000において新規にHSDPAを用いた通信を行うための通信の設定を行う
S6
移動局21がセル1000において新規にHSDPAを用いた通信を開始することができないと判定する
S7
移動局21がセル1000において新規に個別チャネルを用いた通信を行うための通信の設定を行う
エンド

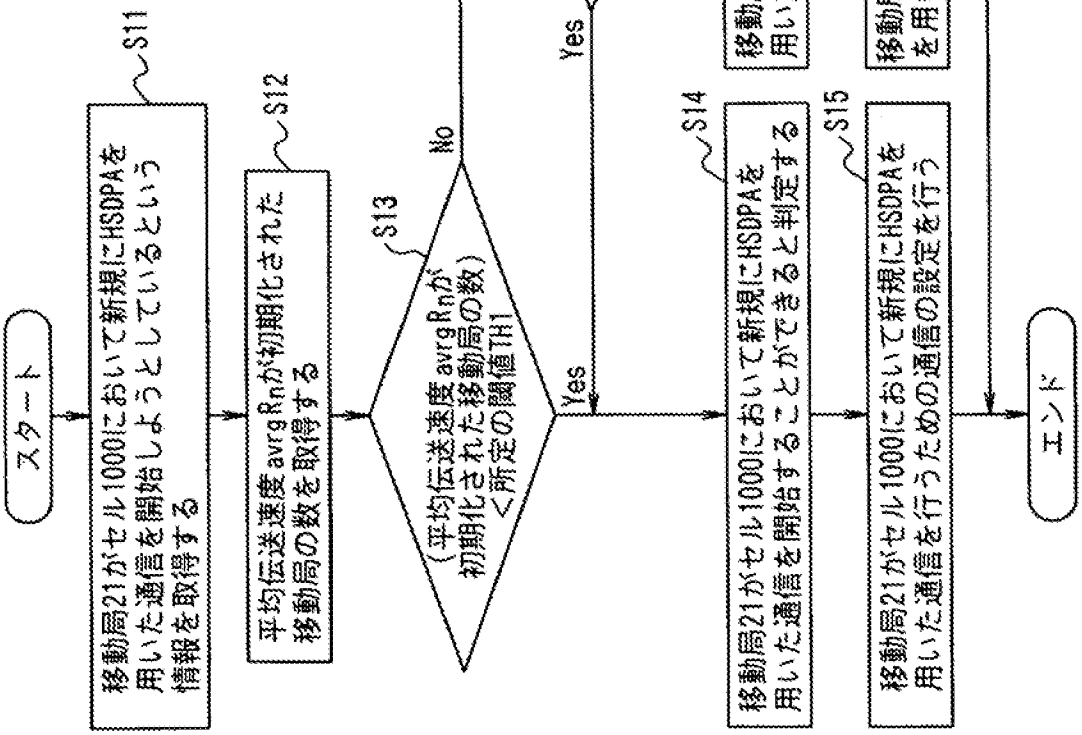
【図７】


スタート
移動局n＝1,C max＝0,n max＝0
S101
S102
(1)移動局nの下り
リンクの瞬時の
無線状態Rn取得
S103
(2)移動局nの平均伝送
速度avrgRn取得
S104
(3)移動局nの最低伝送
速度 targetRnの取得
S105
No
(1)～(3)取得完了?
Yes
S106
avrgRn－ targetRnが、
連続する所定の時間間隔において、
所定の閾値Rthresholdより
も小さい
No
Yes
avrgRnを初期化する
S107
α，β，γ取得
S108
評価関数Cnを計算する
S109
S110
Yes
Cn＞Cmax?
Cmax＝Cn
nmax＝n
S111
No
S112
n＝n＋1
S113
No
n＞m?
Yes
S114
移動局nmaxに送信キューを割当て
エンド

【図８】


スタート
移動局21がセル1000において新規にHSDPAを用いた通信を開始しようとしているという情報を取得する
S21
平均伝送速度avrgRnが所定の閾値TH1よりも小さい移動局の数を取得する
S22
S23
(平均伝送速度avrgRnが所定の閾値1よりも小さい移動局の数)<所定の閾値TH2
No
Yes
S24
移動局21がセル1000において新規にHSDPAを用いた通信を開始することができると判定する
S25
移動局21がセル1000において新規にHSDPAを用いた通信を行うための通信の設定を行う
S26
移動局21がセル1000において新規にHSDPAを用いた通信を開始することができないと判定する
S27
移動局21がセル1000において新規に個別チャネルを用いた通信を行うための通信の設定を行う
エンド

【図９】


スタート
移動局21がセル1000において新規にHSDPAを用いた通信を開始しようとしているという情報を取得する
S11
平均伝送速度 avrgRnが初期化された移動局の数を取得する
S12
(平均伝送速度 avrgRnが初期化された移動局の数)<所定の閾値TH1
S13
No
Yes
(当該セル1000において通信を行っている移動局の数)<所定の閾値TH2
S16
No
Yes
移動局21がセル1000において新規にHSDPAを用いた通信を開始することができると判定する
S14
移動局21がセル1000において新規にHSDPAを用いた通信を開始することができないと判定する
S17
移動局21がセル1000において新規にHSDPAを用いた通信を行うための通信の設定を行う
S15
移動局21がセル1000において新規に個別チャネルを用いた通信を行うための通信の設定を行う
S18
エンド

【書類名】要約書
【要約】
【課題】新規呼の受け付けを効率良く制御する。
【解決手段】スケジューリングにおいて、平均伝送速度が初期化された無線端末の数やその割合に基づいてセル内の輻輳状態を推定し、呼受付制御を行うことにより、トラヒックの発生の仕方やセルの形態に関係無く、適切に呼受付制御を行うことができる。
【選択図】　図６

特願２００５－３４６３１９

出願人履歴情報

識別番号　［３９２０２６６９３］

１．変更年月日　２０００年　５月１９日
［変更理由］　名称変更
住所変更
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Filing Date	2019-11-13
First Named Inventor	Paul Howard
Art Unit	2476
Examiner Name	Ayaz R. Sheikh
Attorney Docket Number	IPW2-USCN213316

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	9	7215657	B2	2007-05-08	Toshimitsu et al.	
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Name/Print	Harry Vartanian	Registration Number	56,787

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	1	10201270	DE	A1	2002-08-08	CHOI SUNG HO		

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	First Named Inventor	Paul Howard
	Art Unit	2476
	Examiner Name	Ayaz R. Sheikh
	Attorney Docket Number	IPW2-USCN213316

	2	1467582	EP	A1	2004-10-13	OLOFSSON PATRIK		
	3	1615384	EP	A1	2006-01-11	WALLACE MARK S		
	4	1681780	EP	A1	2006-07-19	DATEKI TAKASHI		
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	9	2006015984	WO	A1	2006-02-16	ANDERSON		
	10	2005083897	WO	A1	2005-09-09	YAMAKAWA MASAKI		

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	15	NON-FINAL REJECTION, U.S. Patent Application No. 13/176,298, dated July 24, 2013.	
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	Attorney Docket Number	IPW2-USCN213316

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

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

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Signature	/Harry Vartanian/	Date (YYYY-MM-DD)	2020-01-08
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3GPP TS 36.211 V0.2.1 (2006-11)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
Physical Channels and Modulation
(Release 8)



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Contents

Foreword 5
1 Scope 5
2 References 5
3 Definitions, symbols and abbreviations 6
3.1 Definitions 6
3.2 Symbols 6
3.3 Abbreviations 6
4 Frame Structure 6
4.1 Generic frame structure 7
4.2 Alternative frame structure 7
5 Downlink Physical Channels 8
5.1 Overview 8
5.1.1 Physical Channels 8
5.1.2 Physical Signals 8
5.2 Slot structure and physical resource elements 8
5.3 Physical Downlink Shared Channel 10
5.3.1 Modulation 10
5.3.2 Physical resource mapping 10
5.4 Physical Downlink Control Channel 10
5.4.1 Modulation 10
5.4.2 Physical resource mapping 10
5.5 Common Control Physical Channel 11
5.5.1 Modulation 11
5.5.2 Physical resource mapping 11
5.6 Reference signal 11
5.6.1 Sequence generation 11
5.6.1.1 Orthogonal sequence generation 11
5.6.1.2 Pseudo-random sequence generation 12
5.6.2 Physical resource mapping 12
5.7 Synchronization signals 14
5.7.1 Primary synchronization signal 14
5.7.1.1 Sequence generation 14
5.7.1.2 Physical resource mapping 14
5.7.2 Secondary synchronization signal 14
5.7.2.1 Sequence generation 14
5.7.2.2 Physical resource mapping 14
5.8 OFDM signal generation 15
5.9 Modulation and upconversion 15
6 Uplink Physical Channels 16
6.1 Overview 16
6.1.1 Physical Channels 16
6.1.2 Physical Signals 16
6.2 Slot structure and physical resources 17
6.3 Physical Uplink Shared Channel 17
6.3.1 Modulation 17
6.3.2 Mapping to physical resources 18
6.4 Reference signal 18
6.4.1 Demodulation reference signal 18
6.4.1.1 Sequence generation 18
6.4.1.2 Mapping to physical resources 18
6.4.2 Sounding reference signal 18
6.4.2.1 Sequence generation 18
6.4.2.2 Mapping to physical resources 18

6.5 Physical Uplink Control Channel 18
6.6 <Control channel 2> 19
6.7 SC-FDMA signal generation 19
6.8 Physical layer random access 20
6.8.1 Overview 20
6.8.2 Sequence generation 20
6.8.3 Mapping to physical resources 21
6.9 Modulation and upconversion 21

7 Modulation mapper 21
7.1 QPSK 21
7.2 16QAM 21
7.3 64QAM 22

8 Timing 24

Annex A (informative): Change history 24

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document describes the physical channels for evolved UTRA.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
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[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.201: "LTE Physical Layer – General Description ".

[3] 3GPP TS 36.212: "Multiplexing and channel coding".

[4] 3GPP TS 36.213: "Physical layer procedures".

[5] 3GPP TS 36.214: "Physical layer – Measurements".

[6] 3GPP TS xx.xxx: <RAN4 specification listing supported transmission bandwidths>

3 Definitions, symbols and abbreviations

Delete from the above heading those words which are not applicable.

Subclause numbering depends on applicability and should be renumbered accordingly.

3.1 Definitions

For the purposes of the present document, the [following] terms and definitions [given in ... and the following] apply.

Definition format

***<defined term>**: <definition>.*

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

$N_{\mathrm{BW}}^{\mathrm{DL}}$	Downlink bandwidth configuration, expressed as a number of subcarriers
$N_{\mathrm{BW}}^{\mathrm{UL}}$	Uplink bandwidth configuration, expressed as a number of virtual subcarriers
$N_{\mathrm{symb}}^{\mathrm{DL}}$	Number of OFDM symbols in a downlink slot
$N_{\mathrm{symb}}^{\mathrm{UL}}$	Number of SC-FDMA symbols in an uplink slot
$N_{\mathrm{BW}}^{\mathrm{RB}}$	Resource block size in the frequency domain, expressed as a number of subcarriers
N_{OS}	Number of orthogonal two-dimensional reference signal sequences
N_{PRS}	Number of pseudo-random two-dimensional reference signal sequences
N_{TX}	Scheduled bandwidth for uplink transmission, expressed as a number of virtual subcarriers
k_0	Scheduled starting frequency for uplink transmission, expressed as a virtual subcarrier number
T_{f}	Radio frame duration
T_{slot}	Slot duration
T_{s}	Basic time unit
Δf	Subcarrier spacing
N_{TA}	Timing offset between uplink and downlink radio frames at the UE, expressed as a number of time units T_{s}
N_{d}	Length of SC-FDMA symbol excluding cyclic prefix, expressed as a number of time units T_{s}

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

Abbreviation format

<ACRONYM> <Explanation>

4 Frame Structure

Downlink and uplink transmissions are organized into radio frames with $T_{\mathrm{f}} = 307200 \times T_{\mathrm{s}} = 10\,\mathrm{ms}$ duration. Two radio frame structures are supported:

- generic frame structure, applicable to both FDD and TDD transmissions,
- alternative frame structure, applicable to TDD only.

4.1 Generic frame structure

The generic frame structure is applicable to both FDD and TDD transmissions. Each radio frame is $T_f = 307200 \times T_s = 10$ ms long and consists of 20 slots of length $T_{slot} = 15360 \times T_s = 0.5$ ms, numbered from 0 to 19. A subframe is defined as two consecutive slots where subframe i consists of slots $2i$ and $2i+1$.

For FDD, 10 subframes are available for downlink transmission and 10 subframes are available for uplink transmissions in each 10 ms interval. Uplink and downlink transmissions are separated in the frequency domain.

For TDD, a subframe is either allocated to downlink or uplink transmission. The first subframe in a radio frame is always allocated for downlink transmission.

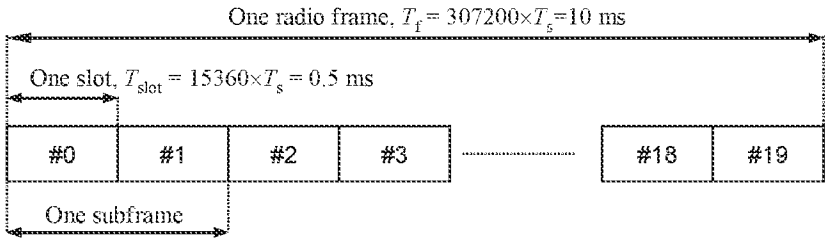


Figure 1: Generic frame structure.

4.2 Alternative frame structure

The alternative frame structure is only applicable to TDD. Each radio frame consists of two half-frames of length $T_f = 153600 \times T_s = 5$ ms each. The structure of each half-frame in a radio frame is identical. Each half-frame consists of seven slots, numbered from 0 to 6, and three special fields, DwPTS, GP, and UpPTS.

Slot #0 and DwPTS are always reserved for downlink transmission. UpPTS and slot #1 are always reserved for uplink transmission.

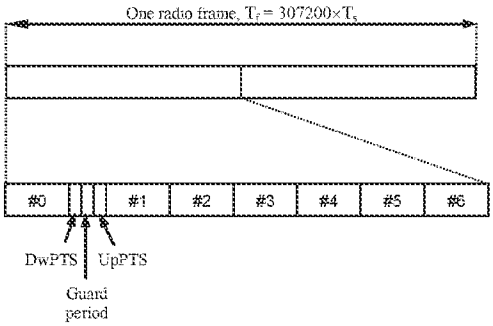


Figure 2: Alternative frame structure.

5 Downlink Physical Channels

5.1 Overview

The smallest time-frequency unit for downlink transmission is denoted a resource element and is defined in Section 5.2.

5.1.1 Physical Channels

A downlink physical channel corresponds to a set of resource elements carrying information originating from higher layers. The following downlink physical channels are defined:

- Physical Downlink Shared Channel, PDSCH
- Physical Downlink Control Channel, PDCCH
- Common Control Physical Channel, CCPCH

The following general steps can be identified for downlink transmission on a physical channel:

- scrambling
- modulation of scrambled bits to generate complex-valued modulation symbols
- mapping of complex-valued modulation symbols to resource elements
- generation of complex-valued time-domain OFDM signal for each layer

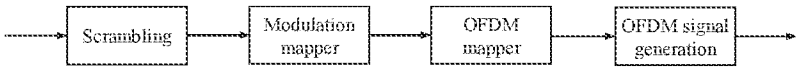


Figure 3: Overview of downlink signal generation.

5.1.2 Physical Signals

A downlink signal corresponds to a set of resource elements used by the physical layer but does not carry information originating from higher layers. The following downlink physical signals are defined:

- reference signal
- synchronization signal

5.2 Slot structure and physical resource elements

The transmitted signal in each slot is described by a resource grid of $N_{\mathrm{BW}}^{\mathrm{DL}}$ subcarriers and $N_{\mathrm{symb}}^{\mathrm{DL}}$ OFDM symbols. The resource grid and structure is illustrated in Figure 4.

In case of multi-layer transmission, there is one resource grid defined per layer. A layer is defined by a reference signal, unique within the cell.

Each element in the resource grid for layer p is called a resource element and is uniquely identified by the index triplet $\{p,k,l\}$ where p, k and l are the indices in the layer, frequency and time domains, respectively. One, two, or four layer transmission is supported, i.e., the index p shall fulfil $p=0$, $p\in\{0,1\}$, and $p\in\{0,1,2,3\}$, respectively. Each resource element $\{p,k,l\}$ corresponds to one complex-valued modulation symbol $a_{k,l}^{(p)}$ where $k=0,\ldots,N_{\mathrm{BW}}^{\mathrm{DL}}-1$ and

$l = 0,\ldots,N_{\text{symb}}^{\text{DL}} - 1$. Modulation symbols $a_{k,l}^{(p)}$ corresponding to resource elements not used for transmission of a physical channel or a physical signal in a slot shall be set to zero.

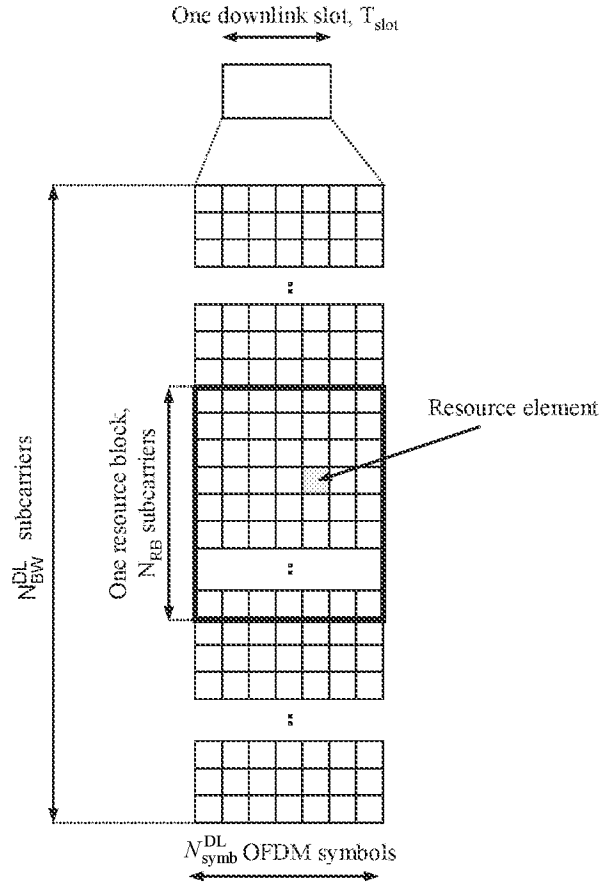


Figure 4: Downlink resource grid.

The value of $N_{\text{BW}}^{\text{DL}}$ depends on the transmission bandwidth configured in the cell and shall fulfil $[72] \le N_{\text{BW}}^{\text{DL}} \le 2048$. The set of allowed values for $N_{\text{BW}}^{\text{DL}}$ is given by [6]. Note that the value of $N_{\text{BW}}^{\text{DL}}$ does not include the DC subcarrier.

The number of OFDM symbols per slot, $N_{\text{symb}}^{\text{DL}}$, depends on the subcarrier spacing Δf and the cyclic prefix length configured by higher layers and is given by Table 1.

Table 1: Number of OFDM symbols per slot.

Configuration		N_{symb}	
		Generic frame structure	Alternative frame structure
Normal cyclic prefix	$\Delta f = 15$ kHz	7	9
Extended cyclic prefix	$\Delta f = 15$ kHz	6	8
	$\Delta f = 7.5$ kHz	3	4

A resource block is defined as $N_{\text{symb}}^{\text{DL}}$ consecutive OFDM symbols in the time domain and $N_{\text{BW}}^{\text{RB}} = 12$ consecutive subcarriers in the frequency domain. A resource block thus consists of $N_{\text{symb}}^{\text{DL}} \times N_{\text{BW}}^{\text{RB}}$ resource elements.

5.3 Physical Downlink Shared Channel

5.3.1 Scrambling

The block of bits $b(n)$, with the indexing starting at $n = 0$, to be transmitted on the physical downlink shared channel shall be scrambled prior to modulation, resulting in a block of scrambled bits $c(n)$.

5.3.2 Modulation

The block of scrambled bits $c(n)$ shall be modulated as described in Section 7, resulting in a block of complex-valued modulation symbols $d(n)$. Table 2 specifies the modulation mappings applicable for the physical downlink shared channel.

Table 2: PDSCH modulation schemes

Physical channel	Modulation schemes
PDSCH	QPSK, 16QAM, 64QAM

5.3.3 Physical resource mapping

The block of modulation symbols $d(n)$ shall be mapped to resource elements $\{k,l\}$ not used for other purposes in increasing order of first the index k and then the index l.

5.4 Physical Downlink Control Channel

Depending on future decisions, there may be multiple control channels, e.g., paging indicator, downlink scheduling control, uplink scheduling control, etc. In that case, a separate subsection per control channel will be needed.

5.4.1 Scrambling

The block of bits $b(n)$, with the indexing starting at $n = 0$, to be transmitted on the physical downlink control channel shall be scrambled prior to modulation, resulting in a block of scrambled bits $c(n)$.

5.4.2 Modulation

The block of scrambled bits $c(n)$ channel shall be modulated as described in Section 7, resulting in a block of complex-valued modulation symbols $d(n)$. Table 3 specifies the modulation mappings applicable for the physical downlink shared channel.

Table 3: PDCCH modulation schemes

Physical channel	Modulation schemes
PDCCH	

5.4.3 Physical resource mapping

The block of modulation symbols $d(n)$ shall be mapped to the first l OFDM symbols in a subframe, where $l \leq 3$.

5.5 Common Control Physical Channel

5.5.1 Scrambling

The block of bits $b(n)$, with the indexing starting at $n=0$, to be transmitted on the common control physical channel shall be scrambled prior to modulation, resulting in a block of scrambled bits $c(n)$.

5.5.2 Modulation

The block of scrambled bits $c(n)$ shall be modulated as described in Section 7, resulting in a sequence block of complex-valued modulation symbols $d(n)$. Table 4 specifies the modulation mappings applicable for the common control physical channel.

Table 4: CCPCH modulation schemes

Physical channel	Modulation schemes
CCPCH	QPSK

5.5.3 Physical resource mapping

The CCPCH is transmitted on 72 active subcarriers, centred around the DC subcarrier. The block of complex-valued modulation symbols $d(n)$ shall be mapped to the resource elements $\{k,l\}$ not reserved for reference signal transmission. The mapping of $d(n)$ to resource elements shall be in increasing order of first the index k and then the index l.

5.6 Reference signal

There is one reference signal transmitted per layer. The number of layers equals 1, 2, or 4.

5.6.1 Sequence generation

The two-dimensional reference signal sequence $r_{m,n}$ is generated as the symbol-by-symbol product $r_{m,n} = r_{m,n}^{\mathrm{OS}} \times r_{m,n}^{\mathrm{PRS}}$ of a two-dimensional orthogonal sequence $r_{m,n}^{\mathrm{OS}}$ and a two-dimensional pseudo-random sequence $r_{m,n}^{\mathrm{PRS}}$.

There are $N_{\mathrm{OS}} = 3$ different two-dimensional orthogonal sequences and $N_{\mathrm{PRS}} = [170]$ different two-dimensional pseudo-random sequences. Each cell identity corresponds to a unique combination of one orthogonal sequence and one pseudo-random sequence, thus allowing for $N_{\mathrm{OS}} \times N_{\mathrm{PRS}} = [510]$ unique cell identities.

5.6.1.1 Orthogonal sequence generation

The two-dimensional orthogonal sequence shall be generated according to

$$r_{m,n}^{OS} = s_{m,n}, \quad n = 0,1 \text{ and } m = 0,1,\ldots,N_r - 1$$

where $N_r = \left\lfloor \frac{N_{\mathrm{BW}}^{\mathrm{DL}}}{N_{\mathrm{BW}}^{\mathrm{RB}}/2} \right\rfloor$ is the number of resource elements used for the reference signal in the OFDM symbol. The quantity $s_{m,n}$ is the entry at the m:th row and the n:th column of the matrix S_i, defined as

$$S_i^T = \underbrace{\left[S_i^T \quad S_i^T \quad \ldots \quad S_i^T \right]}_{\left\lceil \frac{N_r}{3} \right\rceil \text{ repetitions}}, \quad i = 0,1,2$$

where

$$\overline{S}_0 = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{bmatrix}, \quad \overline{S}_1 = \begin{bmatrix} 1 & e^{j4\pi/3} \\ e^{j2\pi/3} & 1 \\ e^{j4\pi/3} & e^{j2\pi/3} \end{bmatrix}, \quad \overline{S}_2 = \begin{bmatrix} 1 & e^{j2\pi/3} \\ e^{j4\pi/3} & 1 \\ e^{j2\pi/3} & e^{j4\pi/3} \end{bmatrix}$$

for orthogonal sequence 0, 1, and 2, respectively. Which orthogonal sequence to use is configured by higher layers.

5.6.1.2 Pseudo-random sequence generation

5.6.2 Physical resource mapping

The two-dimensional reference signal sequence $r_{m,n}$ shall be mapped to complex-valued modulation symbols $a_{k,l}^{(p)}$ for each layer p according to

$$a_{k,l}^{(p)} = r_{m,n}$$

where

$$k = 6m + (q + x(i)) \bmod 6$$
$$l = \begin{cases} 0 & n = 0 \\ N_{\text{symb}} - 3 & n = 1 \end{cases}$$

and

$$m = 0,1,\ldots,\left\lfloor \frac{N_{\text{BW}}^{\text{DL}}}{N_{\text{BW}}^{\text{RB}}/2} \right\rfloor$$
$$n = \begin{cases} 0,\ldots,1 & \text{for } p = 0,1 \\ 0 & \text{for } p = 2,3 \end{cases}$$

The variable q defines a shift in the frequency domain for the different reference signals and is given by

$$q = \begin{cases} (0 + 3n) \bmod 6 & \text{for } p = 0 \\ (3 + 3n) \bmod 6 & \text{for } p = 1 \\ 1 & \text{for } p = 2 \\ 2 & \text{for } p = 3 \end{cases}$$

The variable $i \in \{0,1\}$ represents the slot number within a radio frame.

Resource elements $\{k,l\}$ used for reference signal transmission on any of the layers shall not be used for any transmission on any other layer.

Figures 5, 6, and 7 illustrate the resource elements used for reference symbol transmission.

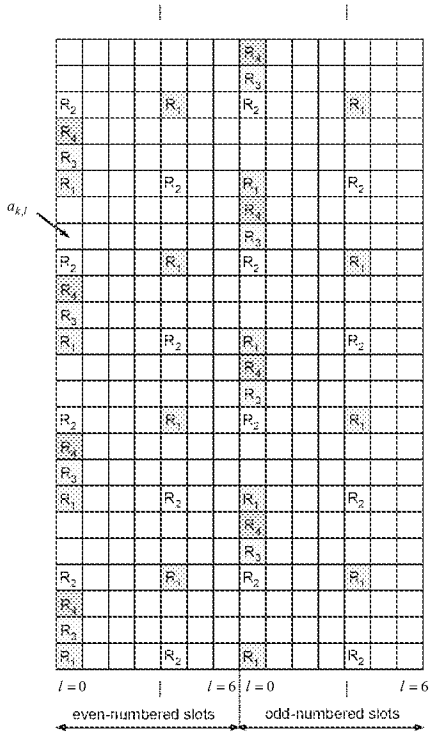


Figure 5. Mapping of downlink reference signals (generic frame structure, normal cyclic prefix).

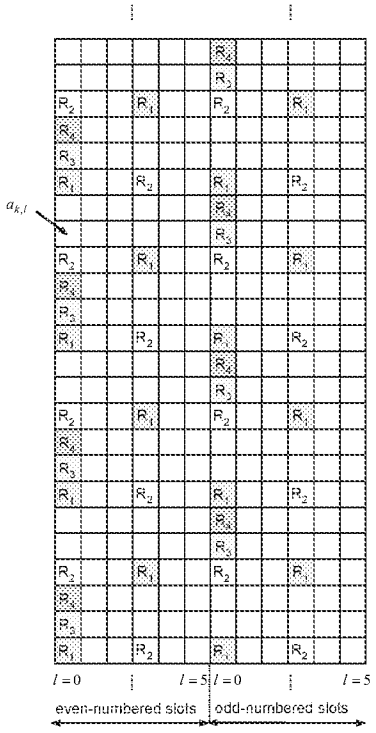


Figure 6. Mapping of downlink reference signals (generic frame structure, extended cyclic prefix).

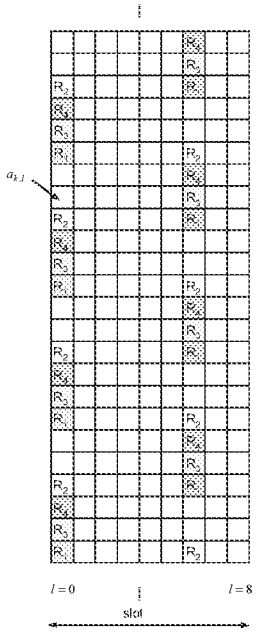


Figure 7. Mapping of downlink reference signals (alternative frame structure, normal cyclic prefix).

5.7 Synchronization signals

5.7.1 Primary synchronization signal

5.7.1.1 Sequence generation

5.7.1.2 Physical resource mapping

The primary synchronization signal is transmitted on 72 active subcarriers, centred around the DC subcarrier. The primary synchronization signal $d(n)$ shall be mapped to the resource elements according to

$$a_{k,l} = d(n), \quad k = n - 36 + \left\lfloor \frac{N_{\mathrm{BW}}^{\mathrm{DL}}}{2} \right\rfloor, \quad n = 0,...,71$$

where $l = [\mathrm{TBD}]$. The primary synchronization signal is only transmitted in slot [TBD].

5.7.2 Secondary synchronization signal

5.7.2.1 Sequence generation

5.7.2.2 Physical resource mapping

The secondary synchronization signal is transmitted on 72 active subcarriers, centred around the DC subcarrier. The secondary synchronization signal $d(n)$ shall be mapped to the resource elements according to

$$a_{k,l} = d(m), \quad k = m - 36 + \left\lfloor \frac{N_{\mathrm{BW}}^{\mathrm{DL}}}{2} \right\rfloor, \quad m = 0,...,71$$

where $l = [\text{TBD}]$. The secondary synchronization signal is transmitted in and only in slots where the primary synchronization signal is transmitted.

5.8 OFDM signal generation

The OFDM symbols in a slot shall be transmitted in increasing order of l. The time-continuous signal $s_l^{(p)}(t)$ on layer p in OFDM symbol l in a downlink slot is defined by

$$s_l^{(p)}(t) = \sum_{k=-\lfloor N_{\text{BW}}^{\text{DL}}/2 \rfloor}^{-1} a_{k^{(-)},l}^{(p)} \cdot e^{j\frac{2\pi k}{NT_s}(t-N_{\text{CP},l}T_s)} + \sum_{k=1}^{\lceil N_{\text{BW}}^{\text{DL}}/2 \rceil} a_{k^{(+)},l}^{(p)} \cdot e^{j\frac{2\pi k}{NT_s}(t-N_{\text{CP},l}T_s)}$$

for $0 \le t < (N_{\text{CP},l} + N) \times T_s$ where $k^{(-)} = k + \lfloor N_{BW}^{DL}/2 \rfloor$ and $k^{(+)} = k + \lfloor N_{BW}^{DL}/2 \rfloor - 1$.

Tables 5 and 6 list the value of $N_{\text{CP},l}$ that shall be used for the generic and alternative frame structure, respectively. Note that different OFDM symbols within a slot may have different cyclic prefix lengths.

Table 5: OFDM parameters for the generic frame structure.

Configuration		Cyclic prefix length $N_{\text{CP},l}$
Normal cyclic prefix	$\Delta f = 15$ kHz	160 for $l = 0$ 144 for $l = 1,\ldots,6$
Extended cyclic prefix	$\Delta f = 15$ kHz	512 for $l = 0,\ldots,5$
	$\Delta f = 7.5$ kHz	1024 for $l = 0,\ldots,2$

Table 6: OFDM parameters for the alternative frame structure.

Configuration		Cyclic prefix length $N_{\text{CP},l}$
Normal cyclic prefix	$\Delta f = 15$ kHz	224 for $l = 0,\ldots,8$
Extended cyclic prefix	$\Delta f = 15$ kHz	512 for $l = 0,\ldots,7$
	$\Delta f = 7.5$ kHz	1024 for $l = 0,\ldots,3$

5.9 Modulation and upconversion

Modulation and upconversion to the carrier frequency of the complex-valued OFDM signal for each layer is shown in Figure 8. The filtering required prior to transmission is defined by the requirements in [6].

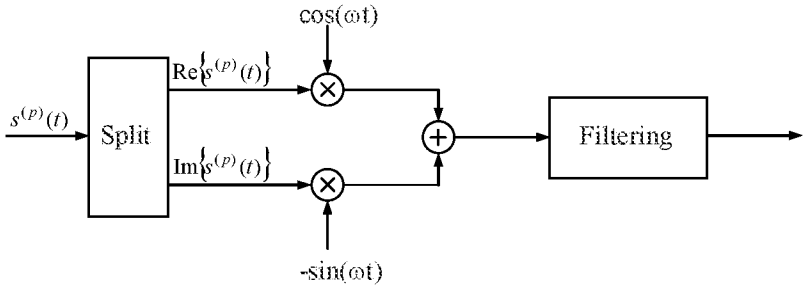


Figure 8: Downlink modulation.

6 Uplink Physical Channels

6.1 Overview

The smallest resource unit for uplink transmissions is denoted a resource element, defined in section 6.2.

6.1.1 Physical Channels

An uplink physical channel corresponds to a set of resource elements carrying information originating from higher layers. The following uplink physical channels are defined:

- Physical Uplink Shared Channel, PUSCH
- Physical Uplink Control Channel, PUCCH

The following general steps can be identified for uplink transmission on a physical channel:

- scrambling
- modulation of scrambled bits to generate complex-valued modulation symbols
- mapping of complex-valued modulation symbols to resource elements
- generation of complex-valued time-domain SC-FDMA signal for each layer

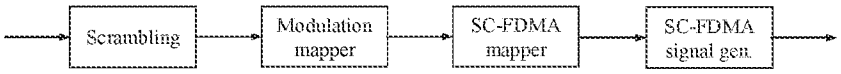


Figure 9: Overview of uplink signal generation.

6.1.2 Physical Signals

An uplink signal is used by the physical layer but does not carry information originating from higher layers. The following uplink physical signals are defined:

- reference signal
- random access preamble

6.2 Slot structure and physical resources

The transmitted signal in each slot is described by the contents of $N_{\text{symb}}^{\text{UL}}$ SC-FDMA symbols, numbered from 0 to $N_{\text{symb}}^{\text{UL}}-1$. Each SC-FDMA symbol carries multiple complex-valued modulation symbols $a_{u,l}$ where u is the time index within SC-FDMA symbol l. SC-FDMA symbol 1 and $N_{\text{symb}}^{\text{UL}}-2$ are denoted short SC-FDMA symbols, used to carry the uplink demodulation reference signal, while the remaining SC-FDMA symbols are denoted long SC-FDMA symbols. The uplink slot structure is illustrated in Figure 10.

The number of SC-FDMA symbols in a slot depends on the cyclic prefix length configured by higher layers and is given in Table 7.

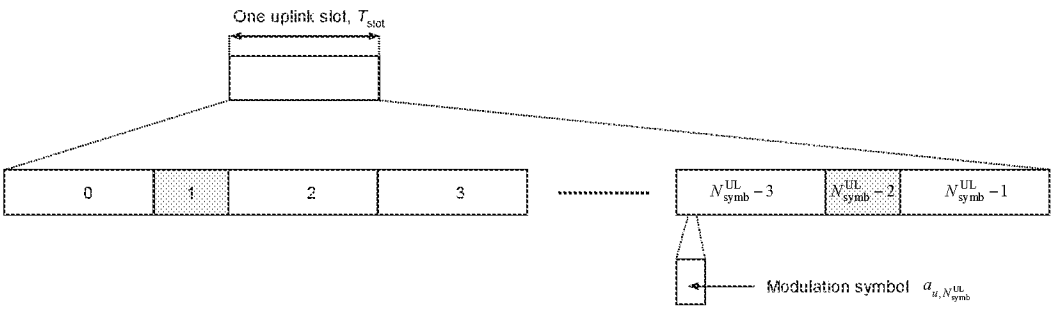


Figure 10: Uplink slot format.

Table 7: Number of SC-FDMA symbols per slot.

Configuration	$N_{\text{symb}}^{\text{UL}}$	
	Generic frame structure	Alternative frame structure
Normal cyclic prefix	8	10
Extended cyclic prefix	7	9

6.3 Physical Uplink Shared Channel

The physical uplink shared channel is defined by one subframe and the parameters N_{TX} and k_0, used in the generation of the SC-FDMA signal. The variables N_{TX} and k_0, determining the transmission bandwidth and the frequency hopping pattern, respectively, are under control of the uplink scheduler. and may vary on a per-subframe basis.

6.3.1 Scrambling

The block of bits $b(n)$, with the indexing starting at $n=0$, to be transmitted on the physical uplink shared channel shall be scrambled with a UE-specific scrambling sequence prior to modulation, resulting in a block of scrambled bits $c(n)$.

6.3.2 Modulation

The block of scrambled bits $c(n)$ shall be modulated as described in Section 7, resulting in a block of complex-valued modulation symbols $d(n)$. Table 8 specifies the modulation mappings applicable for the physical uplink shared channel.

Table 8: Uplink modulation schemes

Physical channel	Modulation schemes
PUSCH	QPSK, 16QAM

6.3.3 Mapping to physical resources

Each long SC-FDMA symbol l in a slot consists of N_{TX} complex-valued symbols $a_{u,l}$ where $u = 0,\ldots,N_{\text{TX}}-1$ and $l \in \{0,2,\ldots,N_{\text{symb}}^{\text{UL}}-3, N_{\text{symb}}^{\text{UL}}-1\}$. The block of modulation symbols $d(n)$ shall be mapped to the complex-valued symbols $a_{u,l}$ in SC-FDMA symbol l according to

$$a_{u,l} = \begin{cases} d(l' \times N_{\text{TX}} + u) & \text{for the first slot in a subframe} \\ d(\left[l' + N_{\text{symb}}^{\text{UL}} - 2\right] \times N_{\text{TX}} + u) & \text{for the second slot in a subframe} \end{cases}$$

where

$$l' = \begin{cases} l & \text{if } l = 0 \\ l-1 & \text{if } 2 \le l < N_{\text{symb}}^{\text{UL}} - 2 \\ l-2 & \text{if } l = N_{\text{symb}}^{\text{UL}} - 1 \end{cases}$$

6.4 Reference signal

Two types of uplink reference signals are supported:

- demodulation reference signal, associated with transmission of uplink data and/or control signalling
- sounding reference signal, not associated with uplink data transmission

6.4.1 Demodulation reference signal

6.4.1.1 Sequence generation

6.4.1.2 Mapping to physical resources

The demodulation reference signal is mapped to short SC-FDMA symbols. The same value of k_0 as for the PUSCH transmitted in the long SC-FDMA symbols in the subframe shall be used.

6.4.2 Sounding reference signal

6.4.2.1 Sequence generation

6.4.2.2 Mapping to physical resources

The sounding reference signal is mapped to a long SC-FDMA symbol. The bandwidth and location in frequency of the sounding reference signal is provided by higher layers.

6.5 Physical Uplink Control Channel

The physical uplink control channel, PUCCH, carries uplink control information. The PUCCH is never transmitted simultaneously with the PUSCH.

6.5.1 Scrambling

The block of bits $b(n)$, with the indexing starting at $n = 0$, to be transmitted on the physical uplink control channel shall be scrambled with a UE-specific scrambling sequence prior to modulation, resulting in a block of scrambled bits $c(n)$.

6.5.2 Modulation

The block of scrambled bits $c(n)$ shall be modulated as described in Section 7, resulting in a block of complex-valued modulation symbols $d(n)$.

6.5.3 Mapping to physical resources

The PUCCH shall be transmitted on a reserved frequency region in the uplink. Mapping of modulation symbols for the physical uplink control channel is illustrated in Figure 11.

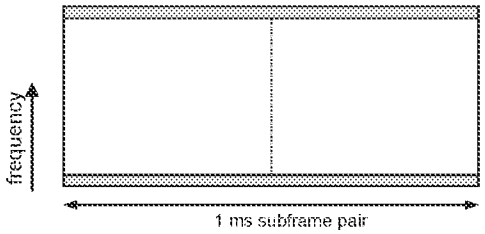


Figure 11: Physical uplink control channel

6.6 <Control channel 2>

6.7 SC-FDMA signal generation

This section does not apply to random access preamble transmission.

The SC-FDMA symbols in a slot shall be transmitted in increasing order of l. The time-continuous signal $s_l(t)$ in SC-FDMA symbol l in an uplink slot is defined by

$$s_l(t) = \sum_{k=0}^{N_{\mathrm{TX}}-1} \sum_{u=0}^{N_{TX}-1} a_{u,l} \cdot e^{-j\frac{2\pi uk}{N_{\mathrm{TX}}}} \cdot e^{j\frac{2\pi(k+f(k_0))}{N_{\mathrm{d}}T_{\mathrm{s}}}(t-N_{\mathrm{CP},l}T_{\mathrm{s}})}$$

for $0 \le t < (N_{\mathrm{CP},l} + N_{\mathrm{d}}) \times T_{\mathrm{s}}$.

The frequency hopping pattern used for uplink transmission is determined by the function $f(k_0)$, where k_0 is given by the scheduling decision.

Tables 9 and 10 list the values of $N_{\mathrm{CP},l}$ and N_{d} that shall be used for the generic and alternative frame structure, respectively. Note that different blocks within a slot may have different cyclic prefix lengths.

For the alternative frame structure, note that the last part of each slot is not transmitted.

Table 9: SC-FDMA parameters for the generic frame structure

l	Normal cyclic prefix						Extended cyclic prefix	
	$N_{BW}^{UL} \le 72$		$72 < N_{BW}^{UL} \le 144$		$144 < N_{BW}^{UL}$			
	$N_{CP,l}$	N_d	$N_{CP,l}$	N_d	$N_{CP,l}$	N_d	$N_{CP,l}$	N_d
0	240	2048	184	2048	156	2048	432	2048
1	112	1024	120	1024	124	1024	440	1024
2		2048		2048		2048		2048
3								
4								
5								1024
6		1024		1024		1024		2048
7		2048		2048		2048		

Table 10: SC-FDMA parameters for the alternative frame structure

l	Normal cyclic prefix				Extended cyclic prefix			
	$N_{BW}^{UL} \le 300$		$300 < N_{BW}^{UL}$		$N_{BW}^{UL} \le 300$		$300 < N_{BW}^{UL}$	
	$N_{CP,l}$	N_d	$N_{CP,l}$	N_d	$N_{CP,l}$	N_d	$N_{CP,l}$	N_d
0	320	2048	224	2048	560	2048	472	2048
1	192	1024	204	1024	423	1024	456	1024
2		2048		2048		2048		2048
3								
4								
5								
6								
7						1024		1024
8		1024		1024		2048		2048
9		2048		2048				

6.8 Physical layer random access

6.8.1 Overview

The physical layer random access preamble structure for the generic frame structure is illustrated in Figure 12. The preamble sequence occupies $T_{PRE} = 0.8$ ms and the cyclic prefix occupies $T_{CP} = 0.1$ ms, resulting in a guard period of $T_{GT} = 0.1$ ms in case one subframe is reserved for random access. The bandwidth of the random access preamble is 1.08 MHz. Higher layer signalling controls in which subframes random access preamble transmission is allowed.

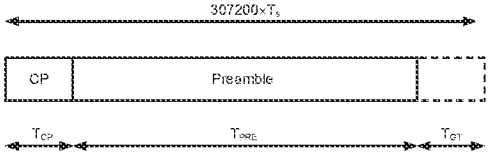


Figure 12: Random access preamble format (generic frame structure).

6.8.2 Sequence generation

The random access preambles are generated from Zadoff-Chu sequences with zero correlation zone, ZC-ZCZ, generated from one or several root Zadoff-Chu sequences. There are 64 different random access preambles in a cell.

The u : th root Zadoff-Chu sequence is defined by $x_u(n) = \exp(-j\pi un[n+1]/K)$. From the u : th root Zadoff-Chu sequence, $m-1$ additional random access preambles with zero correlation zone are obtained by cyclic shifts of multiples of $\lfloor K/m \rfloor$.

6.8.3 Mapping to physical resources

6.9 Modulation and upconversion

Modulation and upconversion to the carrier frequency of the complex-valued SC-FDMA signal for each layer is shown in Figure 13. The filtering required prior to transmission is defined by the requirements in [6].

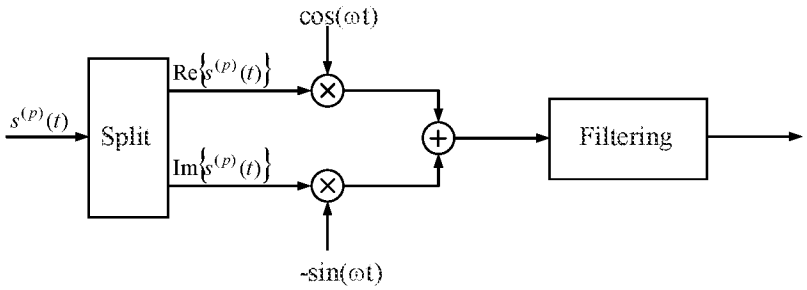


Figure 13: Uplink modulation.

7 Modulation mapper

The modulation mapper takes binary digits, 0 or 1, as input and produces complex-valued modulation symbols, $x=I+jQ$, as output.

7.1 QPSK

In case of QPSK modulation, pairs of bits, $b(n), b(n+1)$, are mapped to complex-valued modulation symbols $x=I+\mathrm{j}Q$ according to Table 11.

Table 11: QPSK modulation mapping

$b(n), b(n+1)$	*I*	*Q*
00	$1/\sqrt{2}$	$1/\sqrt{2}$
01	$1/\sqrt{2}$	$-1/\sqrt{2}$
10	$-1/\sqrt{2}$	$1/\sqrt{2}$
11	$-1/\sqrt{2}$	$-1/\sqrt{2}$

7.2 16QAM

In case of 16QAM modulation, quadruplets of bits, $b(n), b(n+1), b(n+2), b(n+3)$, are mapped to complex-valued modulation symbols $x=I+\mathrm{j}Q$ according to Table 12.

Table 12: 16QAM modulation mapping

$b(n),b(n+1),b(n+2),b(n+3)$	*I*	*Q*
0000	$1/\sqrt{10}$	$1/\sqrt{10}$
0001	$1/\sqrt{10}$	$3/\sqrt{10}$
0010	$3/\sqrt{10}$	$1/\sqrt{10}$
0011	$3/\sqrt{10}$	$3/\sqrt{10}$
0100	$1/\sqrt{10}$	$-1/\sqrt{10}$
0101	$1/\sqrt{10}$	$-3/\sqrt{10}$
0110	$3/\sqrt{10}$	$-1/\sqrt{10}$
0111	$3/\sqrt{10}$	$-3/\sqrt{10}$
1000	$-1/\sqrt{10}$	$1/\sqrt{10}$
1001	$-1/\sqrt{10}$	$3/\sqrt{10}$
1010	$-3/\sqrt{10}$	$1/\sqrt{10}$
1011	$-3/\sqrt{10}$	$3/\sqrt{10}$
1100	$-1/\sqrt{10}$	$-1/\sqrt{10}$
1101	$-1/\sqrt{10}$	$-3/\sqrt{10}$
1110	$-3/\sqrt{10}$	$-1/\sqrt{10}$
1111	$-3/\sqrt{10}$	$-3/\sqrt{10}$

7.3 64QAM

In case of 64QAM modulation, hextuplets of bits, $b(n),b(n+1),b(n+2),b(n+3),b(n+4),b(n+5)$, are mapped to complex-valued modulation symbols $x=I+jQ$ according to Table 13.

Table 13: 64QAM modulation mapping

$b(n),b(n+1),b(n+2),b(n+3),b(n+4),b(n+5)$	I	Q	$b(n),b(n+1),b(n+2),b(n+3),b(n+4),b(n+5)$	I	Q
000000	$3/\sqrt{42}$	$3/\sqrt{42}$	100000	$-3/\sqrt{42}$	$3/\sqrt{42}$
000001	$3/\sqrt{42}$	$1/\sqrt{42}$	100001	$-3/\sqrt{42}$	$1/\sqrt{42}$
000010	$1/\sqrt{42}$	$3/\sqrt{42}$	100010	$-1/\sqrt{42}$	$3/\sqrt{42}$
000011	$1/\sqrt{42}$	$1/\sqrt{42}$	100011	$-1/\sqrt{42}$	$1/\sqrt{42}$
000100	$3/\sqrt{42}$	$5/\sqrt{42}$	100100	$-3/\sqrt{42}$	$5/\sqrt{42}$
000101	$3/\sqrt{42}$	$7/\sqrt{42}$	100101	$-3/\sqrt{42}$	$7/\sqrt{42}$
000110	$1/\sqrt{42}$	$5/\sqrt{42}$	100110	$-1/\sqrt{42}$	$5/\sqrt{42}$
000111	$1/\sqrt{42}$	$7/\sqrt{42}$	100111	$-1/\sqrt{42}$	$7/\sqrt{42}$
001000	$5/\sqrt{42}$	$3/\sqrt{42}$	101000	$-5/\sqrt{42}$	$3/\sqrt{42}$
001001	$5/\sqrt{42}$	$1/\sqrt{42}$	101001	$-5/\sqrt{42}$	$1/\sqrt{42}$
001010	$7/\sqrt{42}$	$3/\sqrt{42}$	101010	$-7/\sqrt{42}$	$3/\sqrt{42}$
001011	$7/\sqrt{42}$	$1/\sqrt{42}$	101011	$-7/\sqrt{42}$	$1/\sqrt{42}$
001100	$5/\sqrt{42}$	$5/\sqrt{42}$	101100	$-5/\sqrt{42}$	$5/\sqrt{42}$
001101	$5/\sqrt{42}$	$7/\sqrt{42}$	101101	$-5/\sqrt{42}$	$7/\sqrt{42}$
001110	$7/\sqrt{42}$	$5/\sqrt{42}$	101110	$-7/\sqrt{42}$	$5/\sqrt{42}$
001111	$7/\sqrt{42}$	$7/\sqrt{42}$	101111	$-7/\sqrt{42}$	$7/\sqrt{42}$
010000	$3/\sqrt{42}$	$-3/\sqrt{42}$	110000	$-3/\sqrt{42}$	$-3/\sqrt{42}$
010001	$3/\sqrt{42}$	$-1/\sqrt{42}$	110001	$-3/\sqrt{42}$	$-1/\sqrt{42}$
010010	$1/\sqrt{42}$	$-3/\sqrt{42}$	110010	$-1/\sqrt{42}$	$-3/\sqrt{42}$
010011	$1/\sqrt{42}$	$-1/\sqrt{42}$	110011	$-1/\sqrt{42}$	$-1/\sqrt{42}$
010100	$3/\sqrt{42}$	$-5/\sqrt{42}$	110100	$-3/\sqrt{42}$	$-5/\sqrt{42}$
010101	$3/\sqrt{42}$	$-7/\sqrt{42}$	110101	$-3/\sqrt{42}$	$-7/\sqrt{42}$
010110	$1/\sqrt{42}$	$-5/\sqrt{42}$	110110	$-1/\sqrt{42}$	$-5/\sqrt{42}$
010111	$1/\sqrt{42}$	$-7/\sqrt{42}$	110111	$-1/\sqrt{42}$	$-7/\sqrt{42}$
011000	$5/\sqrt{42}$	$-3/\sqrt{42}$	111000	$-5/\sqrt{42}$	$-3/\sqrt{42}$
011001	$5/\sqrt{42}$	$-1/\sqrt{42}$	111001	$-5/\sqrt{42}$	$-1/\sqrt{42}$
011010	$7/\sqrt{42}$	$-3/\sqrt{42}$	111010	$-7/\sqrt{42}$	$-3/\sqrt{42}$
011011	$7/\sqrt{42}$	$-1/\sqrt{42}$	111011	$-7/\sqrt{42}$	$-1/\sqrt{42}$
011100	$5/\sqrt{42}$	$-5/\sqrt{42}$	111100	$-5/\sqrt{42}$	$-5/\sqrt{42}$
011101	$5/\sqrt{42}$	$-7/\sqrt{42}$	111101	$-5/\sqrt{42}$	$-7/\sqrt{42}$
011110	$7/\sqrt{42}$	$-5/\sqrt{42}$	111110	$-7/\sqrt{42}$	$-5/\sqrt{42}$
011111	$7/\sqrt{42}$	$-7/\sqrt{42}$	111111	$-7/\sqrt{42}$	$-7/\sqrt{42}$

8 Timing

Transmission of the uplink radio frame number i from the UE shall start $N_{TA} \times T_s$ time units before the start of the corresponding downlink radio frame at the UE. Note that not all slots in a radio frame may be transmitted. One example hereof is TDD, where only a subset of the slots in a radio frame is transmitted.

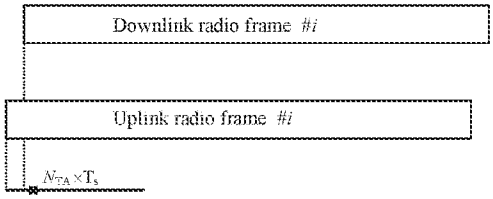


Figure 14: Uplink-downlink timing relation

Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
24/9/06	-	-	-		Draft version created	-	0.0.0
9/10/06	-	-	-		Updated skeleton	0.0.0	0.0.1
13/10/06	-	-	-		Endorsed by RAN1	0.0.1	0.1.0
23/10/06	-	-	-		Inclusion of decision from RAN1#46bis	0.1.0	0.1.1
6/11/06	-	-	-		Updated editor's version	0.1.1	0.1.2
9/11/06	-	-	-		Updated editor's version	0.1.2	0.1.3
10/11/06	-	-	-		Endorsed by RAN1#47	0.1.3	0.2.0
27/11/06	-	-	-		Editor's version, including decisions from RAN1#47	0.2.0	0.2.1

3GPP TS 36.212 V0.2.1 (2006-11)

Technical Specification

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3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
Multiplexing and channel coding
(Release 8)



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Keywords
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Contents

Foreword 4
Introduction 4
1 Scope 5
2 References 5
3 Definitions, symbols and abbreviations 5
3.1 Definitions 5
3.2 Symbols 5
3.3 Abbreviations 5
4 Mapping to Physical Channels 5
4.1 Uplink 6
4.2 Downlink 6
5 Channel Coding and Interleaving 6
5.1 Generic procedures 6
5.1.1 CRC 6
5.1.2 Channel Coding 6
5.1.2.1 Convolutional coding 7
5.1.2.2 Turbo coding 7
5.1.2.2.1 Turbo coder 7
5.1.2.2.2 Trellis termination for Turbo coder 8
5.1.2.2.3 Turbo code internal interleaver 9
5.1.3 Rate Matching 9
5.1.4 Channel interleaving 9
5.2 Uplink Shared Channel & Control 9
5.2.1 Uplink Shared Channel 9
5.2.1.1 CRC Attachment 9
5.2.1.2 Code Block Segmentation 9
5.2.1.3 Channel coding 9
5.2.1.4 HARQ functionality 9
5.2.1.5 Physical Resource Segmentation 9
5.2.1.6 Channel Interleaving 9
5.2.2 Coding for Control Y 9
5.3 Downlink Shared Channel & Control 9
5.3.1 Downlink Shared Channel 10
5.3.1.1 CRC Attachment 10
5.3.1.2 Code Block Segmentation 10
5.3.1.3 Channel coding 10
5.3.1.4 HARQ functionality 10
5.3.1.5 Physical Resource Segmentation 10
5.3.1.6 Channel Interleaving 10
5.3.2 Coding for Control X 10
Annex <X> (informative): Change history 10

Foreword

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Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

This clause is optional. If it exists, it is always the second unnumbered clause.

1 Scope

The present document specifies the coding, multiplexing and mapping to physical channels for E-UTRA.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

[1] 3GPP TS 21.103

[2] 3GPP TS LTE.302, L1 services

[3] 3GPP TS LTE.321, MAC

[4] 3GPP TS 36.211, Physical Channels and Modulation

3 Definitions, symbols and abbreviations

Delete from the above heading those words which are not applicable.

Subclause numbering depends on applicability and should be renumbered accordingly.

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [x] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [x].

Definition format

<defined term>: *<definition>.*

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Symbol format

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [x] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [x].

Abbreviation format

<ACRONYM> <Explanation>

4 Mapping to Physical Channels

4.1 Uplink

Table 4.1-1 specifies the mapping of uplink shared transport channel and related control information to physical channels as well as the set of possible resource allocations available for each physical channel.

Table 4.1-1

TrCH / Control information	Physical Channel
Uplink shared channel	Physical Uplink Shared Channel
<control data>	<physical control channel>

4.2 Downlink

Table 4.2.1 specifies the mapping of downlink shared transport channel and related control information to physical channels as well as the set of possible resource allocations available for each physical channel.

Table 4.2-1

TrCH / Control information	Physical Channel
Downlink shared channel	Physical Downlink Shared Channel
Broadcast channel	
Paging channel	Physical Downlink Shared Channel
MBMS channel	
<control data>	<physical control channel>

5 Channel Coding and Interleaving

Specifies the details of channel coding & interleaving of transport blocks and control bits received from higher layers.

5.1 Generic procedures

Captures coding procedures which are used for more than one channel/control.

5.1.1 CRC

Input x bits, output y bits.

5.1.2 Channel Coding

Code blocks are delivered to the channel coding block. They are denoted by $o_{ir1}, o_{ir2}, o_{ir3}, \ldots, o_{irK_i}$, where i is the TrCH number, r is the code block number, and K_i is the number of bits in each code block. The number of code blocks on TrCH i is denoted by C_i. After encoding the bits are denoted by $y_{ir1}, y_{ir2}, y_{ir3}, \ldots, y_{irY_i}$, where Y_i is the number of encoded bits. The relation between o_{irk} and y_{irk} and between K_i and Y_i is dependent on the channel coding scheme.

The following channel coding schemes can be applied to TrCHs:

- convolutional coding;
- turbo coding.

Usage of coding scheme and coding rate for the different types of TrCH is shown in table 1.

The values of Y_i in connection with each coding scheme:

- convolutional coding with rate 1/2: $Y_i = 2*K_i + 16$; rate 1/3: $Y_i = 3*K_i + 24$;

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- turbo coding with rate 1/3: $Y_i = 3*K_i + 12$.

Table 1: Usage of channel coding scheme and coding rate

TrCH / Control Information	Coding scheme	Coding rate
Uplink shared channel	Turbo coding	1/3
Downlink shared channel		
Broadcast channel		
Paging channel		
MBMS channel		
<control data for DL>	Convolutional coding	[FFS]
<control data for UL>		[FFS]

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5.1.2.1 Convolutional coding

Deleted: *Description of convolutional coding*

Convolutional codes with constraint length 9 and coding rates 1/3 and 1/2 are defined.

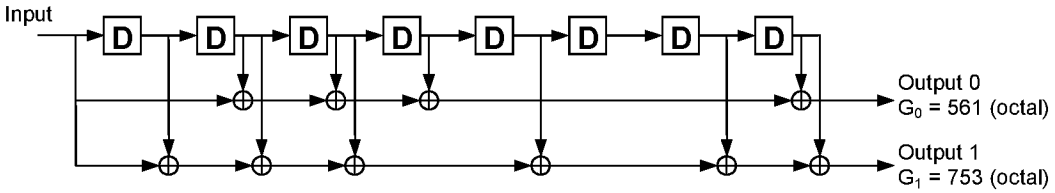
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The configuration of the convolutional coder is presented in figure [y].

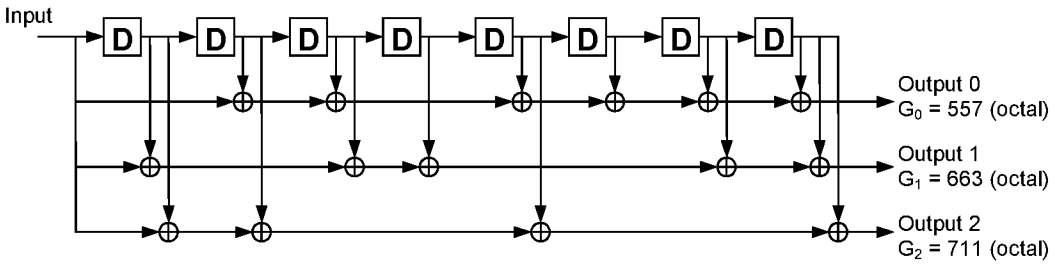
Output from the rate 1/3 convolutional coder shall be done in the order output0, output1, output2, output0, output1, output 2, output 0, ..., output2. Output from the rate 1/2 convolutional coder shall be done in the order output 0, output 1, output 0, output 1, output 0, ..., output 1.

8 tail bits with binary value 0 shall be added to the end of the code block before encoding.

The initial value of the shift register of the coder shall be "all 0" when starting to encode the input bits.



(a) Rate 1/2 convolutional coder



(b) Rate 1/3 convolutional coder

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Figure [y]: Rate 1/2 and rate 1/3 convolutional coders

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5.1.2.2 Turbo coding

5.1.2.2.1 Turbo coder

The scheme of Turbo coder is a Parallel Concatenated Convolutional Code (PCCC) with two 8-state constituent encoders and one Turbo code internal interleaver. The coding rate of Turbo coder is 1/3. The structure of Turbo coder is illustrated in figure [x].

The transfer function of the 8-state constituent code for PCCC is:

$$G(D) = \left[1, \frac{g_1(D)}{g_0(D)}\right],$$

where

$$g_0(D) = 1 + D^2 + D^3,$$

$$g_1(D) = 1 + D + D^3.$$

The initial value of the shift registers of the 8-state constituent encoders shall be all zeros when starting to encode the input bits.

Output from the Turbo coder is

$$x_1, z_1, z'_1, x_2, z_2, z'_2, \ldots, x_K, z_K, z'_K,$$

where $x_1, x_2, \ldots, x_K$ are the bits input to the Turbo coder i.e. both first 8-state constituent encoder and Turbo code internal interleaver, and K is the number of bits, and $z_1, z_2, \ldots, z_K$ and $z'_1, z'_2, \ldots, z'_K$ are the bits output from first and second 8-state constituent encoders, respectively.

The bits output from Turbo code internal interleaver are denoted by $x'_1, x'_2, \ldots, x'_K$, and these bits are to be input to the second 8-state constituent encoder.

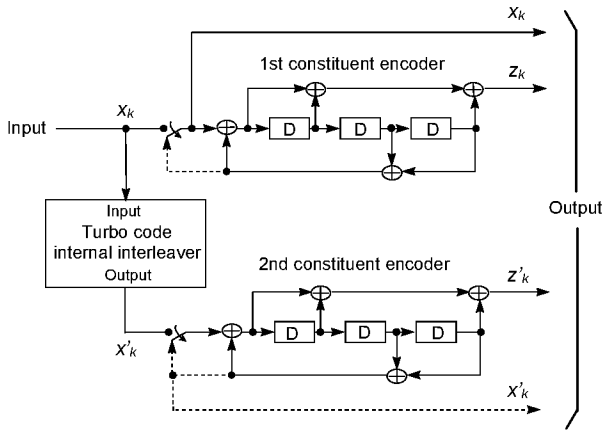


Figure [x]: Structure of rate 1/3 Turbo coder (dotted lines apply for trellis termination only)

5.1.2.2.2 Trellis termination for Turbo coder

Trellis termination is performed by taking the tail bits from the shift register feedback after all information bits are encoded. Tail bits are padded after the encoding of information bits.

The first three tail bits shall be used to terminate the first constituent encoder (upper switch of figure [x] in lower position) while the second constituent encoder is disabled. The last three tail bits shall be used to terminate the second constituent encoder (lower switch of figure [x] in lower position) while the first constituent encoder is disabled.

The transmitted bits for trellis termination shall then be:

$$x_{K+1}, z_{K+1}, x_{K+2}, z_{K+2}, x_{K+3}, z_{K+3}, x'_{K+1}, z'_{K+1}, x'_{K+2}, z'_{K+2}, x'_{K+3}, z'_{K+3}.$$

5.1.2.2.3 Turbo code internal interleaver

[…]

5.1.3 Rate Matching

Input x bits, output y bits

5.1.4 Channel interleaving

Input x bits, output y bits

5.2 Uplink Shared Channel & Control

Figure

5.2.1 Uplink Shared Channel

5.2.1.1 CRC Attachment

Input a bits, output b bits

5.2.1.2 Code Block Segmentation

Input b bits, output c bits

5.2.1.3 Channel coding

Input c bits, output d bits

5.2.1.4 HARQ functionality

Input d bits, output e bits

5.2.1.5 Physical Resource Segmentation

Segmentation per resource block

Input e bits, output f bits

5.2.1.6 Channel Interleaving

Input f bits, output g bits

5.2.2 Coding for Control Y

Figure and coding chain description for Control Y

5.3 Downlink Shared Channel & Control

Figure

5.3.1 Downlink Shared Channel

5.3.1.1 CRC Attachment

Input a bits, output b bits

5.3.1.2 Code Block Segmentation

Input b bits, output c bits

5.3.1.3 Channel coding

Input c bits, output d bits

5.3.1.4 HARQ functionality

Input d bits, output e bits

5.3.1.5 Physical Resource Segmentation

Segmentation per resource block

Input e bits, output f bits

5.3.1.6 Channel Interleaving

Input f bits, output g bits

5.3.2 Coding for Control X

Figure and coding chain description for Control X

Annex <X> (informative): Change history

It is usual to include an annex (usually the final annex of the document) for specifications under TSG change control which details the change history of the specification using a table as follows:

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2006-09					Skeleton		0.0.0
2006-10					Updated skeleton	0.0.0	0.0.1
2006-10					Endorsed skeleton	0.0.1	0.1.0
2006-11					Added TC. Added Broadcast, Paging and MBMS transport channels in Table 4.2-1.	0.1.0	0.1.1
2006-11					Endorsed v 0.2.0	0.1.1	0.2.0
2006-12					Added CC. Added type of coding for each transport channel or control information.	0.2.0	0.2.1

3GPP TS 36.213 V0.1.0 (2006-10)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Physical layer procedures (Release 8)



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Keywords
UMTS, radio, layer 1

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Contents

Foreword 5

1 Scope 6

2 References 6

3 Definitions, symbols, and abbreviations 6
3.1 Definitions 6
3.2 Symbols 6
3.3 Abbreviations 7

4 Synchronisation procedures 7
4.1 Cell search 7
4.1.1 Initial Cell search 7
4.1.2 Non-initial Cell search 7
4.4 Timing synchronisation 7
4.4.1 Synchronisation primitives 7
4.4.2 Radio link monitoring 7
4.4.3 Inter-cell synchronisation 7
4.4.4 Transmission timing adjustments 7

5 Power control 8
5.1 Uplink power control 8
5.1.1 Physical uplink shared channel 8
5.1.1.1 UE behaviour 8
5.1.1.2 eNodeB behaviour 8
5.1.2 Physical uplink shared control channel 8
5.1.2.1 UE behaviour 8
5.1.2.2 eNodeB behaviour 8
5.2 Downlink power allocation 8
5.2.1 eNodeB behaviour 8
5.2.2 Downlink channel subcarrier transmit power offset 8

6 Random access procedure 9
6.1 Physical random access procedure 9
6.1.1 Timing 9
6.1.1.1 Synchronized 9
6.1.1.2 Unsynchronized 9
6.1.2 Power Control 9
6.1.3 Sequence selection 9

7 Physical downlink shared channel related procedures 9
7.1. UE procedure for receiving physical downlink shared channel 9
7.2 UE procedure for reporting channel quality indication (CQI) 9
7.2.1 Channel quality indicator (CQI) definition 9
7.3 UE procedure for reporting MIMO feedback (MF) 9
7.3.1 MIMO feedback (MF) definition 9

8 Physical uplink shared channel related procedures 9
8.1 eNodeB procedure for receiving physical uplink shared channel 9
8.2 UE sounding procedure 10
8.2.1 Sounding definition 10
8.3 UE procedure for ACK/NACK detection 10

9 Physical shared control channel procedures 10
9.1 eNodeB procedure for physical uplink shared control channel assignment 10
9.2 UE procedure for determining physical uplink shared control channel assignment 10
9.3 eNodeB procedure for physical downlink shared control channel assignment 10
9.4 UE procedure for determining physical downlink shared control channel assignment 10

Annex A (informative): Change history 11

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies and establishes the characteristics of the physicals layer procedures in the FDD and TDD modes of [Evolved UTRA].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.201: "LTE Physical Layer – General Description ".

[3] 3GPP TS 36.211: "Physical channels and modulation".

[4] 3GPP TS 36.212: "Multiplexing and channel coding".

[5] 3GPP TS 36.214: "Physical layer – Measurements".

3 Definitions, symbols, and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Definition format

***<defined term>**: <definition>.*

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Symbol format

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ACK	Acknowledgement
BCH	Broadcast Channel
CQI	Channel Quality Indicator
CRC	Cyclic Redundancy Check
DL	Downlink
DTX	Discontinuous Transmission
NACK	Negative Acknowledgement
QoS	Quality of Service
RS	Reference Signal
SIR	Signal-to-Interference Ratio
SINR	Signal to Interference plus Noise Ratio
TTI	Transmission Time Interval
UE	User Equipment
UL	Uplink

4 Synchronisation procedures

4.1 Cell search

4.1.1 Initial Cell search

4.1.2 Non-initial Cell search

4.4 Timing synchronisation

4.4.1 Synchronisation primitives

4.4.2 Radio link monitoring

4.4.3 Inter-cell synchronisation

[For example, for cell sites with a multicast physical channel]

4.4.4 Transmission timing adjustments

5 Power control

5.1 Uplink power control

5.1.1 Physical uplink shared channel

5.1.1.1 UE behaviour

5.1.1.2 eNodeB behaviour

5.1.2 Physical uplink shared control channel

5.1.2.1 UE behaviour

5.1.2.2 eNodeB behaviour

5.2 Downlink power allocation

[The assumptions a UE can make on how power is distributed between subcarriers in the same OFDM symbol. Any restrictions on how total power is distributed between the subcarriers of different downlink channels in the same OFDM symbol. For example, do common reference symbols have priority to receive a certain fraction of total power in order to achieve a certain required or targeted transmit power per subcarrier level before other channels are allocated power? When and how often can common reference channel power be changed?]

5.2.1 eNodeB behaviour

5.2.2 Downlink channel subcarrier transmit power offset

[Definition of and restrictions on the subcarrier transmit power offset for each downlink channel type]

6 Random access procedure

6.1 Physical random access procedure

6.1.1 Timing

6.1.1.1 Synchronized

6.1.1.2 Unsynchronized

6.1.2 Power Control

6.1.3 Sequence selection

7 Physical downlink shared channel related procedures

7.1. UE procedure for receiving physical downlink shared channel

[For persistent and non-persistent scheduling, Includes pertinent aspects of downlink HARQ procedure and link adaptation procedure including any related signalled parameters to eNodeB and UE, ACK/NACK or CQI repetition procedure, eNodeB ACK/NACK detection procedure, handling of multiple HARQ processes for MIMO, etc]

7.2 UE procedure for reporting channel quality indication (CQI)

[Includes CQI reporting needed to support frequency domain scheduling at eNodeB, CQI bin bandwidth, selection of CQI MCS, repetition, etc]

7.2.1 Channel quality indicator (CQI) definition

[Includes definition of CQI information needed for frequency domain scheduling, may define different CQI MCS]

7.3 UE procedure for reporting MIMO feedback (MF)

7.3.1 MIMO feedback (MF) definition

[…]

8 Physical uplink shared channel related procedures

8.1 eNodeB procedure for receiving physical uplink shared channel

[For persistent and non-persistent scheduling, includes pertinent aspects of uplink HARQ and link adaptation procedure including any related signalled parameters to eNodeB and UE, repetition, SR procedure, and any uplink reference signal sequence assignment procedure]

8.2 UE sounding procedure

8.2.1 Sounding definition

8.3 UE procedure for ACK/NACK detection

9 Physical shared control channel procedures

9.1 eNodeB procedure for physical uplink shared control channel assignment

9.2 UE procedure for determining physical uplink shared control channel assignment

[includes determining ACK/NACK, CQI, SR physical uplink shared control channel assignments which maybe implicitly based on downlink L1/L2 control channel assignments or explicitly signalled]

9.3 eNodeB procedure for physical downlink shared control channel assignment

[includes UL ACK/NACK assignment, L1/L2 control channel assignment for persistent and non-persistent scheduling, possible control channel MCS assignment, control channel assignment when UE in different sleep modes]

9.4 UE procedure for determining physical downlink shared control channel assignment

[includes UL ACK/NACK physical downlink shared control channel assignment determination by UE, L1/L2 control channel assignment determination by UE for persistent and non-persistent scheduling, determination of DL control channel MCS, determining L1/L2 control signalling for Paging, control channel determination in different sleep modes]

Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2006-09					Draft version created		0.0.0
2006-10					Endorsed by RAN1	0.0.0	0.1.0

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Technical Specification

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Contents

Foreword 7

1 Scope 8

2 References 8

3 Definitions, symbols and abbreviations 8
3.1 Definitions 8
3.2 Symbols 9
3.3 Abbreviations 9

4 Overall architecture 10
4.1 Functional Split 11
4.2 Interfaces 13
4.2.1 S1 Interface 13
4.2.2 X2 Interface 13
4.3 Radio Protocol architecture 13
4.3.1 User plane 13
4.3.2 Control plane 13

5 Physical Layer for E-UTRA 15
5.1 Downlink Transmission Scheme 15
5.1.1 Basic transmission scheme based on OFDMA 15
5.1.1.1 Basic parameters 15
5.1.1.1.1 Modulation scheme 15
5.1.1.2 Multiplexing including reference-signal structure 15
5.1.1.2.1 Downlink data multiplexing 15
5.1.1.2.2 Downlink reference-signal structure 15
5.1.1.2.3 Downlink L1/L2 Control Signalling 15
5.1.1.3 MIMO and Transmit Diversity 15
5.1.1.4 MBMS 15
5.1.2 Physical layer procedure 15
5.1.2.1 Scheduling 15
5.1.2.2 Link adaptation 15
5.1.2.3 Cell search 15
5.1.2.4 Inter-cell interference mitigation 15
5.1.3 Physical layer measurements 15
5.2 Uplink Transmission Scheme 15
5.2.1 Basic transmission scheme 15
5.2.1.1 Modulation scheme 15
5.2.1.2 Multiplexing including reference signal structure 15
5.2.1.2.1 Uplink data multiplexing 15
5.2.1.2.2 Uplink reference-signal structure 15
5.2.1.2.3 Multiplexing of L1/L2 control signalling 15
5.2.1.2.4 Uplink L1/L2 Control Signalling 16
5.2.1.3 MIMO 16
5.2.1.4 Power De-rating Reduction 16
5.2.2 Physical channel procedure 16
5.2.2.1 Random access procedure 16
5.2.2.2 Scheduling 16
5.2.2.3 Link adaptation 16
5.2.2.4 Power control 16
5.2.2.5 Uplink timing control 16
5.2.2.6 Inter-cell interference mitigation 16
5.2.3 Physical layer measurements 16
5.3 Transport Channels 16
5.4 E-UTRA physical layer model 17
5.4.1 Physical-layer model of E-UTRA transport channels 18
5.4.1.1 Downlink-Shared Channel 18

5.4.1.2 Broadcast Channel 19
5.4.1.3 Paging Channel 20
5.4.1.4 Multicast Channel 21
5.4.1.5 Uplink Shared Channel 22
5.4.1.6 Random-access Channel 23
5.4.2 Physical-layer indications 23
5.4.2.1 Error indicators 23
5.4.2.2 Channel-quality indicators 24

6 Layer 2 24
6.1 MAC Sublayer 25
6.1.1 Services and Functions 25
6.1.2 Logical Channels 25
6.1.2.1 Control Channels 26
6.1.2.2 Traffic Channels 26
6.1.3 Mapping between logical channels and transport channels 26
6.1.3.1 Mapping in Uplink 27
6.1.3.2 Mapping in Downlink 27
6.2 RLC Sublayer 27
6.2.1 Services and Functions 28
6.2.2 PDU Structure 28
6.3 PDCP Sublayer 29
6.3.1 Services and Functions 29
6.3.2 PDU Structure 29
6.4 Data flows through Layer 2 30

7 RRC 30
7.1 Services and Functions 30
7.2 RRC protocol states & state transitions 30
7.3 Transport of NAS messages 31
7.4 System Information 31
7.5 RRC Procedures 32

8 E-UTRAN identities 32
8.1 E-UTRAN related UE identities 32
8.2 Network entity related Identities 32

9 ARQ and HARQ 33
9.1 HARQ principles 33
9.2 ARQ principles 33
9.3 HARQ/ARQ interactions 34

10 Mobility 34
10.1 Intra E-UTRAN 34
10.1.1 Mobility Management in LTE_IDLE 35
10.1.1.1 Cell selection 35
10.1.1.2 Cell reselection 35
10.1.1.3 Handling in eNB 36
10.1.1.4 Handling above eNB 36
10.1.1.5 Mobility Management Entity (MME) 36
10.1.2 Mobility Management in LTE_ACTIVE 36
10.1.2.1 Handover 36
10.1.2.2 Path Switch 38
10.1.2.3 Data forwarding 38
10.1.2.4 Handling in eNB 38
10.1.2.5 Handling above eNB 38
10.1.2.6 Mobility Management Entity (MME) 38
10.1.2.7 Timing Advance 38
10.1.3 Measurements 38
10.1.3.1 Neighbour cell measurements within the serving frequency layer 39
10.1.3.2 Neighbour cell measurements of other frequency layers 39
10.1.4 Paging and C-plane establishment 39
10.1.5 Random Access Procedure for Initial Access 39
10.1.6 Radio Link Failure 40

10.1.7 Radio Access Network Sharing 41
10.1.8 Handling of Roaming and Area Restrictions for UEs in LTE_ACTIVE 42
10.2 Inter RAT 42
10.2.1 Cell reselection 42
10.2.2 Handover 42
10.2.3 Measurements 42
10.2.3.1 Inter-RAT handovers from E-UTRAN 42
10.2.3.2 Inter-RAT handovers to E-UTRAN 42
10.2.3.3 Inter-RAT cell reselection from E-UTRAN 42
10.2.3.4 Limiting measurement load at UE 42
10.2.4 Network Aspects 43
10.3 Inter 3GPP access system mobility 43
10.3.1 Cell reselection 43
10.3.2 Handover 43
10.3.3 Measurements 43
10.4 Roaming Restrictions 43

11 Scheduling 43
11.1 Scheduler Operation 43
11.2 Signalling of Scheduler Decisions 44
11.3 Measurements to Support Scheduler Operation 44

12 QoS 45
12.1 QoS concept and bearer service architecture 45
12.2 Resource establishment and QoS signalling 45

13 Security 45
13.1 Overview and Principles 45
13.2 Security termination points 45

14 MBMS 45
14.1 MBMS control & functions 45
14.2 MBMS transmission 45

15 Radio Resource Management aspects 45
15.1 RRM functions 46
15.1.1 Radio Bearer Control (RBC) 46
15.1.2 Radio Admission Control (RAC) 46
15.1.3 Connection Mobility Control (CMC) 46
15.1.4 Dynamic Resource Allocation (DRA) - Packet Scheduling (PS) 46
15.1.5 Inter-cell Interference Coordination (ICIC) 46
15.1.6 Load Balancing (LB) 47
15.1.7 Inter-RAT Radio Resource Management 47
15.2 RRM architecture 47
15.2.1 Centralised Handling of certain RRM Functions 47
15.2.2 De-Centralised RRM 47
15.2.3 Load balancing control 47

16 RF aspects 47
16.1 Spectrum deployments 47

17 UE capabilities 47

18 S1 Interface 47
18.1 S1 User plane 47
18.2 S1 Control Plane 47
18.2.1 S1 Interface Functions 48
18.2.2 S1 Interface Signalling Procedures 48

19 X2 Interface 49
19.1 User Plane 49
19.2 Control Plane 49
19.2.1 X2-CP Functions 49
19.2.2 X2-CP Procedures 49

20 System and Terminal complexity 50
20.1 Overall System complexity 50
20.2 Physical layer complexity 50
20.3 UE complexity 50

21 Support for self-configuration and self-optimisation 50
21.1 Definitions 50

22 Others 52
22.1 Support for real time IMS services 52

Annex A (informative): NAS Overview 53

A.1 Services and Functions 53

A.2 NAS protocol states & state transitions 53

Annex B (informative): MAC and RRC Control 55

B.1 Difference between MAC and RRC control 55

B.2 Classification of MAC and RRC control functions 55

Annex C (informative): System Information 56

C.1 SI classification 56
C.1.1 Information valid across multiple cells 56
C.1.2 Information needed at cell/PLMN search 56
C.1.3 Information needed prior to cell camping 57
C.1.4 Information needed prior to cell access 57
C.1.5 Information needed while camping on a cell 58
C.1.6 Thoughts about category division 59

C.2 Division of SI between static and flexible parts 59
C.2.1 Static part 59
C.2.2 Flexible part 60
C.2.3 Information whose location is FFS 61
C.2.4 Dedicated part 61

Annex D (informative): MBMS Transmission 62
D.1 MBMS control & functions 62
D.2 MBMS transmission 62
D.3 Deployment Scenarios 63

Annex <X> (informative): Change history 64

Foreword

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1 Scope

The present document provides an overview and overall description of the E-UTRAN radio interface protocol architecture. Details of the radio interface protocols will be specified in companion specifications of the 36 series.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TR 25.913: "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)"

[2] 3GPP TS 36.201: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; General description".

[3] 3GPP TS 36.211 Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation .

[4] 3GPP TS 36.212 Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding .

[5] 3GPP TS 36.213 Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures .

[6] 3GPP TS 36.214 Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

Carrier frequency: center frequency of the cell.

MBMS-dedicated cell: cell dedicated to MBMS transmission.

Frequency layer: set of cells with the same carrier frequency.

Handover: procedure that changes the serving cell of a UE in RRC_CONNECTED.

Unicast/MBMS-mixed cell: cell supporting both unicast and MBMS transmissions.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Symbol format

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ACK	Acknowledgement
ACLR	Adjacent Channel Leakage Ratio
aGW	Access Gateway
AM	Acknowledge Mode
ARQ	Automatic Repeat Request
AS	Access Stratum
BCCH	Broadcast Control Channel
BCH	Broadcast Channel
C/I	Carrier-to-Interference Power Ratio
CAZAC	Constant Amplitude Zero Auto-Correlation
CMC	Connection Mobility Control
CP	Cyclic Prefix
C-plane	Control Plane
CQI	Channel Quality Indicator
CRC	Cyclic Redundancy Check
DCCH	Dedicated Control Channel
DL	Downlink
DRX	Discontinuous Reception
DTCH	Dedicated Traffic Channel
DTX	Discontinuous Transmission
eNB	E-UTRAN NodeB
EPC	Evolved Packet Core
E-UTRA	Evolved UTRA
E-UTRAN	Evolved UTRAN
FDD	Frequency Division Duplex
FDM	Frequency Division Multiplexing
GERAN	GSM EDGE Radio Access Network
GNSS	Global Navigation Satellite System
GSM	Global System for Mobile communication
HARQ	Hybrid ARQ
HO	Handover
HSDPA	High Speed Downlink Packet Access
ICIC	Inter-Cell Interference Coordination
IP	Internet Protocol
LB	Load Balancing
LCR	Low Chip Rate
LTE	Long Term Evolution
MAC	Medium Access Control
MBMS	Multimedia Broadcast Multicast Service
MCCH	Multicast Control Channel
MCS	Modulation and Coding Scheme
MIMO	Multiple Input Multiple Output
MME	Mobility Management Entity
MTCH	MBMS Traffic Channel
NACK	Non-Acknowledgement
NAS	Non-Access Stratum
OFDM	Orthogonal Frequency Division Multiplexing

OFDMA	Orthogonal Frequency Division Multiple Access
PA	Power Amplifier
PAPR	Peak-to-Average Power Ratio
PCCH	Paging Control Channel
PDCP	Packet Data Convergence Protocol
PDU	Packet Data Unit
PHY	Physical layer
PLMN	Public Land Mobile Network
PRB	Physical Resource Block
PSC	Packet Scheduling
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
RAC	Radio Admission Control
RACH	Random Access Channel
RAT	Radio Access Technology
RB	Radio Bearer
RBC	Radio Bearer Control
RF	Radio Frequency
RLC	Radio Link Control
RNL	Radio Network Layer
ROHC	Robust Header Compression
RRC	Radio Resource Control
RRM	Radio Resource Management
RU	Resource Unit
S1-C	S1-Control plane
S1-U	S1-User plane
SAE	System Architecture Evolution
SAP	Service Access Point
SC-FDMA	Single Carrier – Frequency Division Multiple Access
SCH	Synchronization Channel
SDMA	Spatial Division Multiple Access
SDU	Service Data Unit
SFN	Single Frequency Network
TA	Tracking Area
TB	Transport Block
TCP	Transmission Control Protocol
TDD	Time Division Duplex
TM	Transparent Mode
TNL	Transport Network Layer
TTI	Transmission Time Interval
UE	User Equipment
UL	Uplink
UM	Un-acknowledge Mode
UMTS	Universal Mobile Telecommunication System
UPE	User Plane Entity
U-plane	User plane
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network
VRB	Virtual Resource Block
X2-C	X2-Control plane
X2-U	X2-User plane

4 Overall architecture

The E-UTRAN consists of eNBs, providing the E-UTRA user plane (RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The eNBs are interconnected with each other by means of the X2 interface. The eNBs are also connected by means of the S1 interface to the EPC (Evolved Packet Core) more specifically to the MME (Mobility Management Entity) and the UPE (User Plane Entity). The S1 interface supports a many-to-many relation between MMEs/UPEs and eNBs. The S1 interface supports a functional split between the MME and the UPE.

NOTE: Some parts of the functional split between MME and UPE remain FFS.

There exists an X2 interface between the eNBs that need to communicate with each other. For exceptional cases (e.g. inter-PLMN handover), LTE_ACTIVE inter-eNB mobility is supported by means of MME/UPE relocation via the S1 interface.

The EUTRAN architecture is illustrated in Figure 4 below.

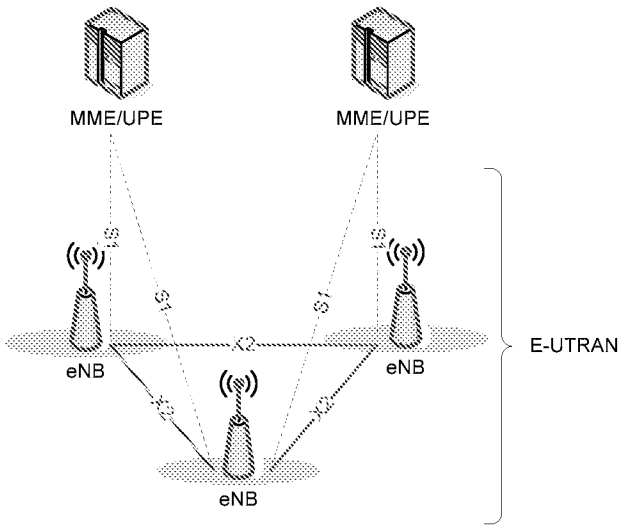


Figure 4: Overall Architecture

4.1 Functional Split

The eNB hosts the following functions:

- Functions for Radio Resource Management: Radio Bearer Control, Radio Admission Control, Connection Mobility Control, Dynamic allocation of resources to UEs in both uplink and downlink (scheduling);
- Selection of an MME at UE attachment;

NOTE: it is assumed, that at UE attachment, firstly the MME is involved, i.e. actually the MME is selected.

- Routing of User Plane data towards UPE;

NOTE: it is FFS which node actually establishes the User Plane tunnel.

NOTE: it is FFS whether User Plane tunnel establishment takes place together with the RRC activation.

- Scheduling and transmission of paging messages (originated from the MME);
- Scheduling and transmission of broadcast information (originated from the MME or O&M);
- Measurement and measurement reporting configuration for mobility and scheduling.

The MME/UPE hosts the following functions:

Note: Once the functional split between UPE and MME is decided, this list should be replaced by separate lists for MME and UPE.

- Distribution of paging messages to the eNBs;

NOTE: This function is assumed to reside in the MME.

- Security control;

- IP header compression and encryption of user data streams;

NOTE: This function is assumed to reside in the UPE.

- Termination of U-plane packets for paging reasons;

NOTE: This function is assumed to reside in the UPE.

- Switching of U-plane for support of UE mobility;

- Idle state mobility control;

NOTE: This function is assumed to reside in the MME.

- SAE bearer control;

- Ciphering and integrity protection of NAS signalling.

This is summarized on the figure below where yellow boxes depict the logical nodes, white boxes depict the functional entities of the control plane and blue boxes depict the radio protocol layers.

NOTE: it is assumed that a logical E-UTRAN node in addition to the eNB is not needed for RRM purposes. Moreover, due to the different usage of inter-cell RRM functionalities, each inter-cell RRM functionality should be considered separately in order to assess whether it should be handled in a centralised manner or in a distributed manner.

NOTE: MBMS related functions in E-UTRAN are described separately in subclause 14.

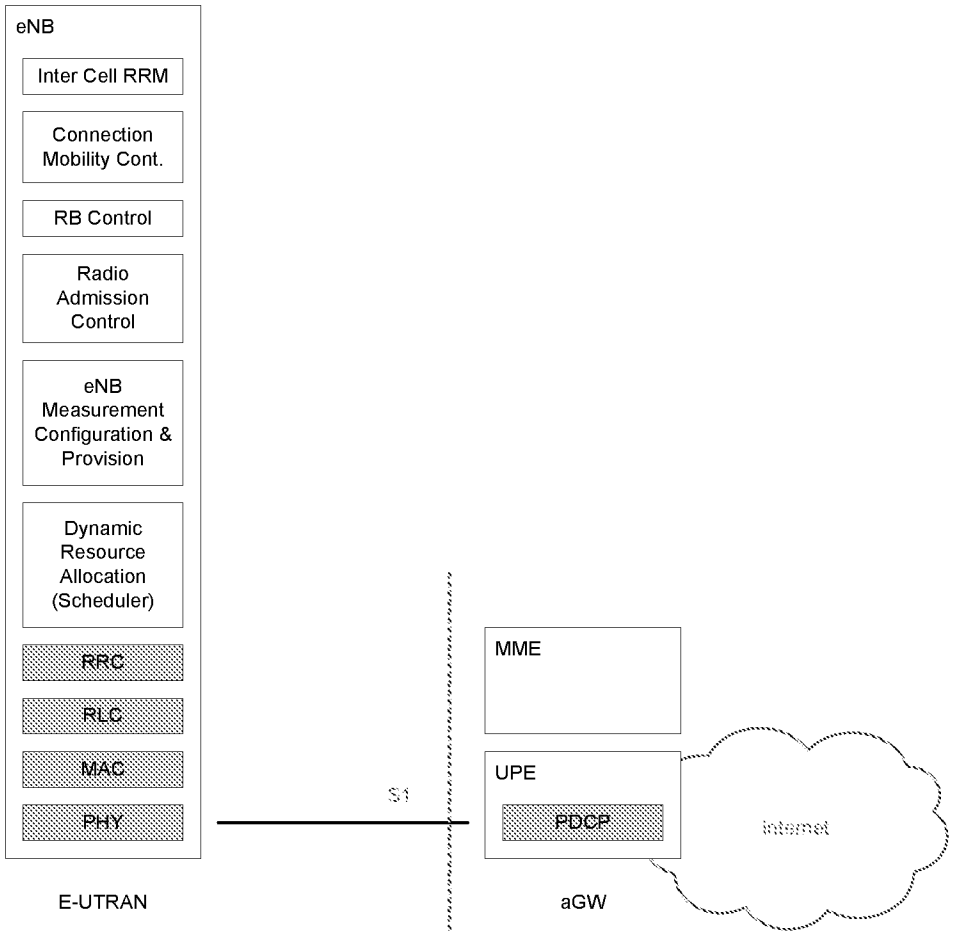


Figure 4.1: Functional Split between E-UTRAN and EPC

4.2 Interfaces

4.2.1 S1 Interface

4.2.2 X2 Interface

4.3 Radio Protocol architecture

In this subclause, the radio protocol architecture of E-UTRAN is given for the user plane and the control plane.

4.3.1 User plane

The figure below shows the protocol stack for the user-plane, where:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the functions listed in subclause 6, e.g. scheduling, ARQ and HARQ;
- PDCP sublayer (terminated in UPE on the network side) performs for the user plane the functions listed in subclause 6, e.g. header compression, integrity protection (FFS) and ciphering.

NOTE: even though the PDCP sublayer belongs to the EPC and not to E-UTRAN, it is still described in this specification.

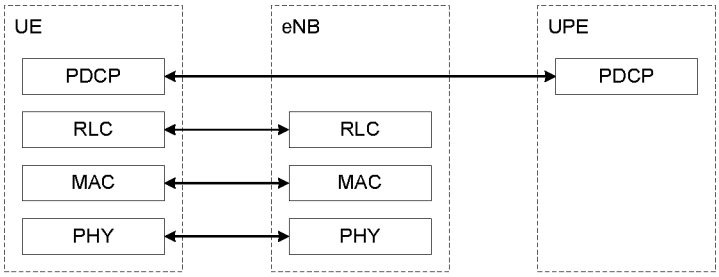


Figure 4.3.1: User-plane protocol stack

4.3.2 Control plane

The figure below shows the protocol stack for the control-plane, where:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the same functions as for the user plane;
- RRC (terminated in eNB on the network side) performs the functions listed in subclause 7, e.g.:
  - Broadcast;
  - Paging;
  - RRC connection management;
  - RB control;
  - Mobility functions;
  - UE measurement reporting and control.
- PDCP sublayer (terminated in MME on the network side) performs for the control plane the functions listed in subclause 6, e.g. integrity protection and ciphering;

NOTE: as for the user plane, even though the PDCP sublayer belongs to the EPC and not to E-UTRAN, it is still described in this specification for completeness.

- NAS control protocol (terminated in MME on the network side) performs among other things:
  - SAE bearer management;
  - Authentication;
  - LTE_IDLE mobility handling;
  - Paging origination in LTE_IDLE;
  - Security control for the signalling between MME and UE, and between UPE and UE.

NOTE: the NAS control protocol is not covered by the scope of this TS and is only mentioned for information.

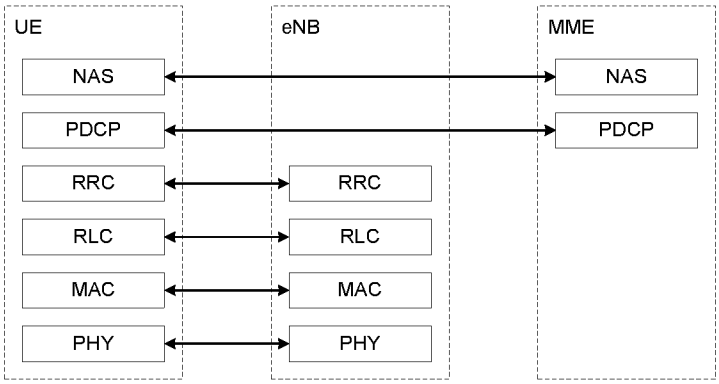


Figure 4.3.2: Control-plane protocol stack

5 Physical Layer for E-UTRA

5.1 Downlink Transmission Scheme

5.1.1 Basic transmission scheme based on OFDMA

5.1.1.1 Basic parameters

5.1.1.1.1 Modulation scheme

5.1.1.2 Multiplexing including reference-signal structure

5.1.1.2.1 Downlink data multiplexing

5.1.1.2.2 Downlink reference-signal structure

5.1.1.2.3 Downlink L1/L2 Control Signalling

5.1.1.3 MIMO and Transmit Diversity

5.1.1.4 MBMS

5.1.2 Physical layer procedure

5.1.2.1 Scheduling

5.1.2.2 Link adaptation

5.1.2.3 Cell search

5.1.2.4 Inter-cell interference mitigation

5.1.3 Physical layer measurements

5.2 Uplink Transmission Scheme

5.2.1 Basic transmission scheme

5.2.1.1 Modulation scheme

5.2.1.2 Multiplexing including reference signal structure

5.2.1.2.1 Uplink data multiplexing

5.2.1.2.2 Uplink reference-signal structure

5.2.1.2.3 Multiplexing of L1/L2 control signalling

5.2.1.2.4 Uplink L1/L2 Control Signalling

5.2.1.3 MIMO

5.2.1.4 Power De-rating Reduction

5.2.2 Physical channel procedure

5.2.2.1 Random access procedure

5.2.2.2 Scheduling

5.2.2.3 Link adaptation

5.2.2.4 Power control

5.2.2.5 Uplink timing control

The timing advance is a signal derived from the time synchronisation of the UL sequence and sent by the eNB to the UE which the UE uses to advance its timings of transmissions to the eNB so as to compensate for propagation delay and thus time align the transmissions from different UEs with the receiver window of the eNB. By avoiding the overlapping of uplink transmissions, timing advance allows time domain multiplexing in the uplink.

5.2.2.6 Inter-cell interference mitigation

5.2.3 Physical layer measurements

5.3 Transport Channels

The physical layer offers information transfer services to MAC and higher layers. The physical layer transport services are described by *how* and with what characteristics data are transferred over the radio interface. An adequate term for this is "Transport Channel".

NOTE: This should be clearly separated from the classification of *what* is transported, which relates to the concept of logical channels at MAC sublayer.

Downlink transport channel types are:

1. **Broadcast Channel (BCH)** characterised by:
   - fixed, pre-defined transport format;
   - requirement to be broadcast in the entire coverage area of the cell.
2. **Downlink Shared Channel (DL-SCH)** characterised by:
   - support for HARQ;
   - support for dynamic link adaptation by varying the modulation, coding and transmit power;
   - possibility to be broadcast in the entire cell;
   - possibility to use beamforming;
   - support for both dynamic and semi-static resource allocation;
   - support for UE discontinuous reception (DRX) to enable UE power saving;

- support for MBMS transmission (FFS).

NOTE: the possibility to use slow power control depends on the physical layer.

3. **Paging Channel (PCH)** characterised by:

   - support for UE discontinuous reception (DRX) to enable UE power saving (DRX cycle is indicated by the network to the UE);
   - requirement to be broadcast in the entire coverage area of the cell;
   - mapped to physical resources which can be used dynamically also for traffic/other control channels.

4. **Multicast Channel (MCH)** characterised by:

   - requirement to be broadcast in the entire coverage area of the cell;
   - support for SFN combining of MBMS transmission on multiple cells;
   - support for semi-static resource allocation e.g. with a time frame of a long cyclic prefix.

Uplink transport channel types are:

1. **Uplink Shared Channel (UL-SCH)** characterised by:

   - possibility to use beamforming; (likely no impact on specifications)
   - support for dynamic link adaptation by varying the transmit power and potentially modulation and coding;
   - support for HARQ;
   - support for both dynamic and semi-static resource allocation.

NOTE: the possibility to use uplink synchronisation and timing advance depend on the physical layer.

It is FFS, whether a RACH is included. If yes, it would be characterised by the following attributes:

2. **Random Access Channel(s) (RACH)** characterised by:

   - limited control information;
   - collision risk;

NOTE: the possibility to use open loop power control depends on the physical layer solution.

5.4 E-UTRA physical layer model

The E-UTRA physical-layer model captures those characteristics of the E-UTRA physical-layer that are relevant from the point-of-view of higher layers. More specifically, the physical-layer model captures:

- The structure of higher-layer data being passed down to or up from the physical layer;
- The means by which higher layers can configure the physical layer;
- The different indications (error indications, channel-quality indications, etc.) that are provided by the physical layer to higher layers;
- Other (non-transport-channel-based) higher-layer peer-to-peer signalling supported by the physical layer.

5.4.1 Physical-layer model of E-UTRA transport channels

5.4.1.1 Downlink-Shared Channel

The DL-SCH physical-layer model is described based on the corresponding DL-SCH physical-layer-processing chain, see Figure 5.4.1.1. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue on the figure.

- **Higher-layer data passed to/from the physical layer**
  - N (at least up to two) transport blocks of dynamic size delivered to the physical layer once every TTI.
- **CRC and transport-block-error indication**
  - Transport-block-error indication delivered to higher layers.
- **FEC and rate matching**
  - Channel coding rate is implicitly given by the combination of transport block size, modulation scheme and resource assignment;
  - Physical layer model support of HARQ: in case of Incremental Redundancy, the corresponding Layer 2 Hybrid-ARQ process controls what redundancy version is to be used for the physical layer transmission for each TTI.
- **Interleaving**
  - No control of interleaving by higher layers.
- **Data modulation**
  - Modulation scheme is decided by MAC Scheduler (QPSK, 16QAM and 64 QAM).
- **Mapping to resource blocks**
  - L2-controlled resource assignment.
- **Physical-layer processing Step 6: Multi-antenna processing**
  - MAC Scheduler partly configures mapping from assigned resource blocks (for each stream) to the available number of antenna ports.
- **Support for Hybrid-ARQ-related signalling**

  The model of Figure 5.4.1.1 also captures:
  - Transport via physical layer of Hybrid-ARQ related information (exact info is FFS) associated with the DL-SCH, to the peer HARQ process at the receiver side;
  - Transport via physical layer of corresponding HARQ acknowledgements to DL-SCH transmitter side.

NOTE: The signalling of transport-format and resource-allocation is not captured in the physical-layer model. At the transmitter side, this information can be directly derived from the configuration of the physical layer. The physical layer then transports this information over the radio interface to its peer physical layer, presumably multiplexed in one way or another with the HARQ-related information. On the receiver side, this information is, in contrast to the HARQ-related information, used directly within the physical layer for DL-SCH demodulation, decoding etc., without passing through higher layers.

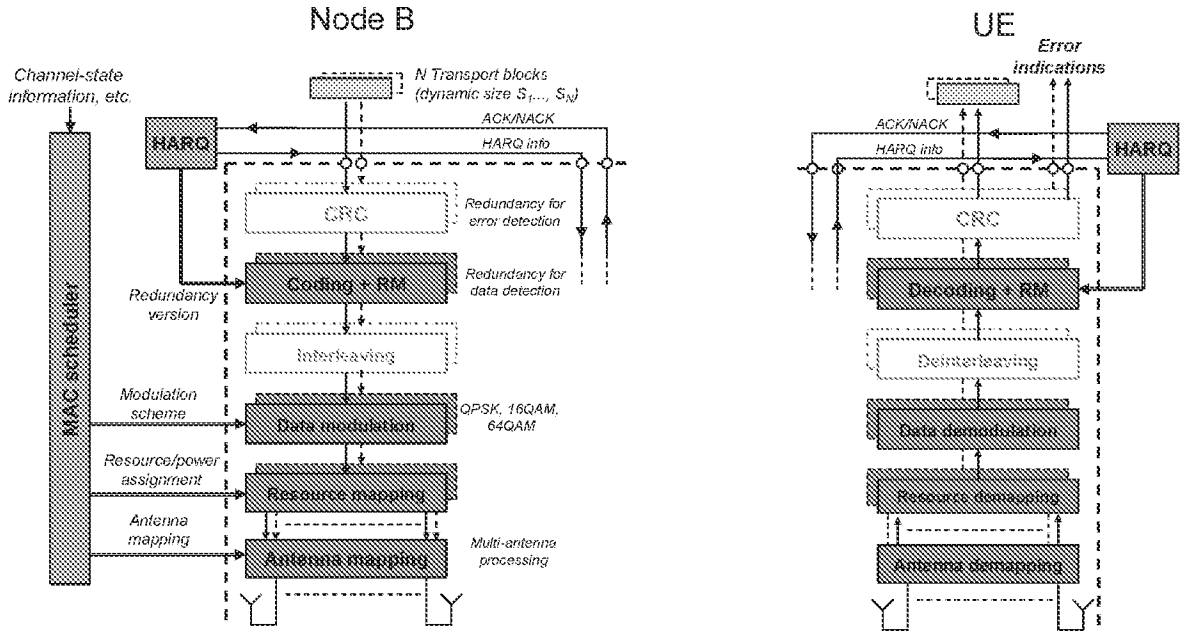


Figure 5.4.1.1: DL-SCH physical-layer model

5.4.1.2 Broadcast Channel

The BCH transport channel is characterized by a fixed pre-defined transport format. The BCH physical-layer model is described based on the corresponding BCH physical-layer-processing chain, see Figure 5.4.1.2:

- **Higher-layer data passed to/from the physical layer**
  - A single (fixed-size) transport block per TTI.
- **CRC and transport-block-error indication**
  - Transport-block-error indication delivered to higher layers.
- **FEC and rate matching**
  - Channel coding rate is implicitly given by the combination of transport block size, modulation scheme and resource assignment;
  - No BCH Hybrid ARQ, i.e. no higher-layer control of redundancy version.
- **Interleaving**
  - No control of interleaving by higher layers.
- **Data modulation**
  - Fixed modulation scheme (QPSK), i.e. not higher-layer control.
- **Mapping to resource blocks**
  - Fixed pre-determined transport format and resource allocation, i.e. no higher-layer control.
- **Physical-layer processing Step 6: Multi-antenna processing**
  - Fixed pre-determined processing, i.e. no higher-layer control.
- **Support for Hybrid-ARQ-related signalling**
  - No Hybrid ARQ.

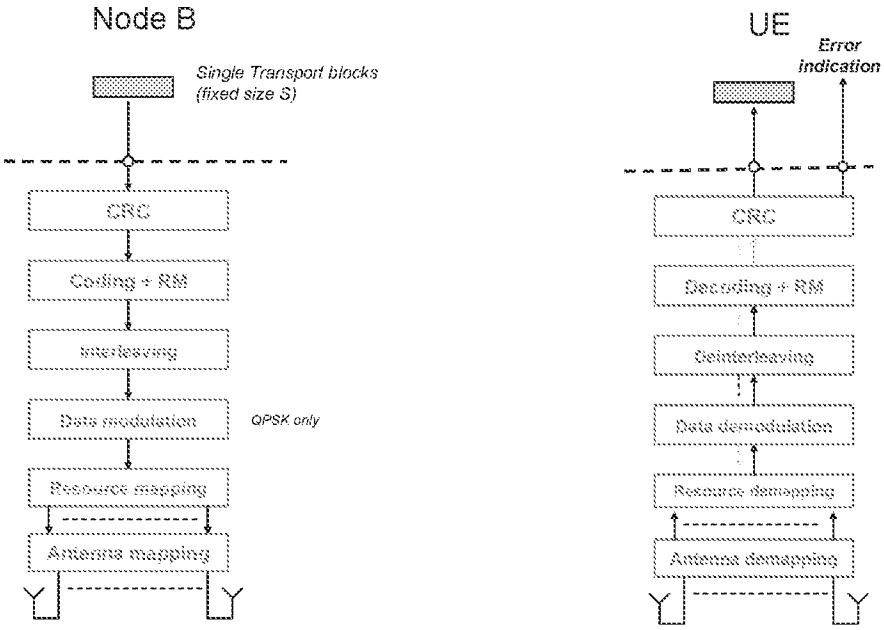


Figure 5.4.1.2: BCH physical-layer model

5.4.1.3 Paging Channel

The PCH physical-layer model is described based on the corresponding PCH physical-layer-processing chain, see Figure 5.4.1.3. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue on the figure.

- **Higher-layer data passed to/from the physical layer**
  - A single transport block per TTI.
- **CRC and transport-block-error indication**
  - Transport-block-error indication delivered to higher layers.
- **FEC and rate matching**
  - Channel coding rate is implicitly given by the combination of transport block size, modulation scheme and resource assignment;
  - No PCH Hybrid ARQ, i.e. no higher-layer control of redundancy version.
- **Interleaving**
  - No control of interleaving by higher layers.
- **Data modulation**
  - Modulation scheme is decided by MAC Scheduler.
- **Mapping to resource blocks**
  - L2 controlled resource assignment;
  - Possible support of dynamic transport format and resource allocation.
- **Physical-layer processing Step 6: Multi-antenna processing**
  - MAC Scheduler partly configures mapping from assigned resource blocks to the available number of antenna ports.

- **Support for Hybrid-ARQ-related signalling**

  No Hybrid ARQ.

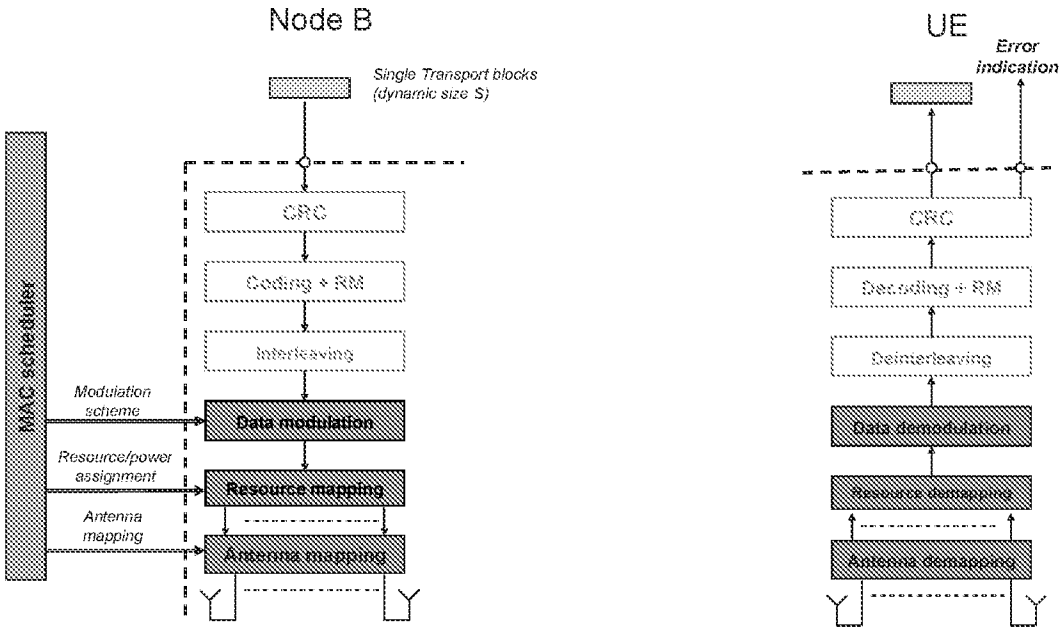


Figure 5.4.1.3: PCH physical-layer model

5.4.1.4 Multicast Channel

The MCH is characterized by the support for multi-cell reception at the UE (a.k.a. "SFN" transmission). This implies that only semi-static configuration of the MCH transport format and resource assignment is possible. The MCH physical-layer model is described based on the corresponding PCH physical-layer-processing chain, see Figure 5.4.1.4. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue.

- **Higher-layer data passed to/from the physical layer**
  - N (at least up to 2) transport blocks delivered to physical layer once every TTI.
- **CRC and transport-block-error indication**
  - Transport-block-error indication delivered to higher layers.
- **FEC and rate matching**
  - Channel coding rate is implicitly given by the combination of transport block size, modulation scheme and resource assignment;
  - No MCH Hybrid ARQ, i.e. no higher-layer control of redundancy version.
- **Interleaving**
  - No control of interleaving by higher layers.
- **Data modulation**
  - Modulation scheme is decided by MAC Scheduler.
- **Mapping to resource blocks**
  - L2 controlled semi–static resource assignment.
- **Physical-layer processing Step 6: Multi-antenna processing**

- MAC Scheduler partly configures mapping from assigned resource blocks (for each stream) to the available number of antenna ports.

- **Support for Hybrid-ARQ-related signalling**

  - No Hybrid ARQ.

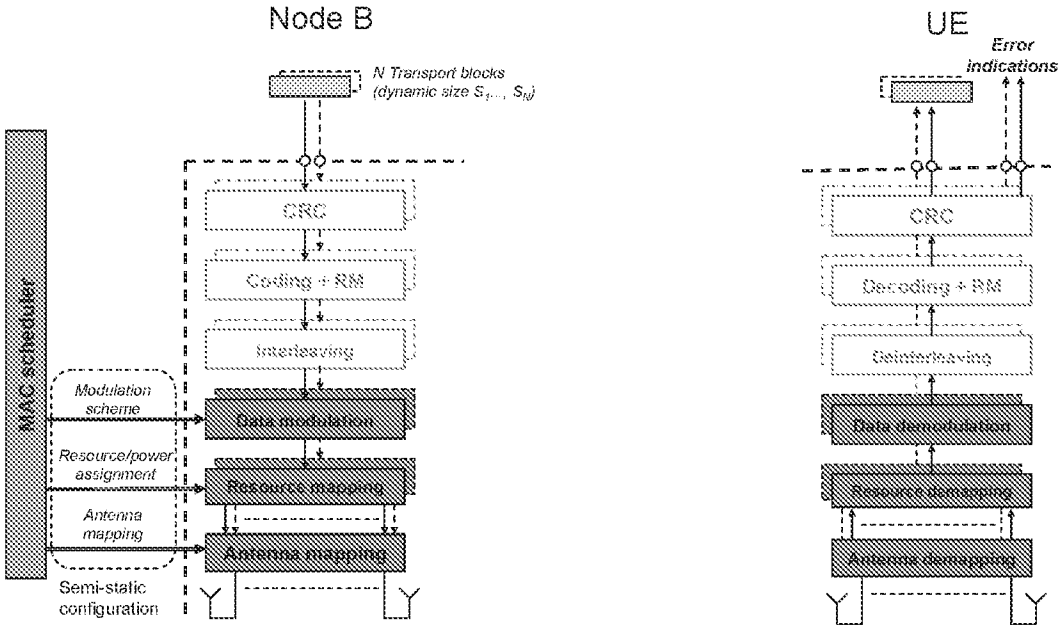


Figure 5.4.1.4: MCH physical-layer model

5.4.1.5 Uplink Shared Channel

The UL-SCH physical-layer model is described based on the corresponding PCH physical-layer-processing chain, see Figure 5.4.1.5. Processing steps that are relevant for the physical-layer model, e.g. in the sense that they are configurable by higher layers, are highlighted in blue. It should be noted that, in case UL-SCH, the scheduling decision is at least partly made at the network side. The uplink transmission control in the UE then configures the uplink physical-layer processing, based on uplink transport-format and resource-assignment information received on the downlink.

- **Higher-layer data passed to/from the physical layer**

  - N (N may be limited to one) transport blocks of dynamic size delivered to the physical layer once every TTI.

- **CRC and transport-block-error indication**

  - Transport-block-error indication delivered to higher layers.

- **FEC and rate matching**

  - Channel coding rate is implicitly given by the combination of transport block size, modulation scheme and resource assignment;

  - Physical layer model support of HARQ: in case of Incremental Redundancy, the corresponding Layer 2 Hybrid-ARQ process controls what redundancy version is to be used for the physical layer transmission for each TTI.

- **Interleaving**

  - No control of interleaving by higher layers.

- **Data modulation**

- Modulation scheme is decided by MAC Scheduler (at least QPSK and 16QAM).

- **Mapping to resource blocks**
  - L2-controlled resource assignment.
- **Physical-layer processing Step 6: Multi-antenna processing**
  - MAC Scheduler partly configures mapping from assigned resource blocks (for each stream) to the available number of antenna ports.
- **Support for Hybrid-ARQ-related signalling**

  The model of Figure 5.4.1.5 also captures
  - Transport via physical layer of Hybrid-ARQ related information (exact info is FFS) associated with the UL-SCH, to the peer HARQ process at the receiver side;
  - Transport via physical layer of corresponding HARQ acknowledgements to UL-SCH transmitter side.

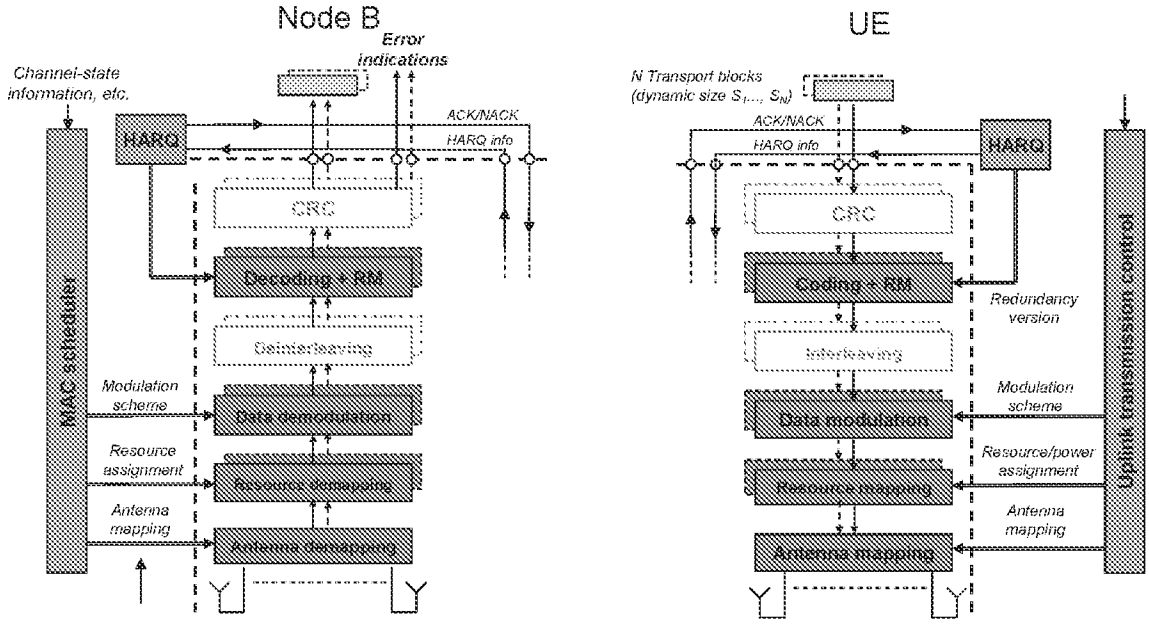


Figure 5.4.1.5: UL-SCH physical-layer model

5.4.1.6 Random-access Channel

5.4.2 Physical-layer indications

In addition to decoded transport blocks, the physical layer also provides higher layers with different indicators. The indicators delivered to higher layers may originate in the corresponding physical layer on in the physical layer of the peer entity (transported over the air by means of L1 signalling).

5.4.2.1 Error indicators

The error indicators (see Figures 5.4.1.1-5.4.1.5) are one type of indicators. An error indicator indicates whether or not the physical layer has correctly decoded a received transport block

5.4.2.2 Channel-quality indicators

Channel-quality indicators (CQI) indicate the downlink and uplink channel quality. The channel-quality indicators are delivered by the eNB physical layer to the eNB MAC layer. Exactly how the channel-quality indicators are generated within the physical layer is a physical-layer-internal issue and may e.g. depend on the duplex scheme (FDD or TDD).

6 Layer 2

Layer 2 is split into the following sublayers: Medium Access Control (MAC), Radio Link Control (RLC) and Packet Data Convergence Protocol (PDCP).

This subclause gives a high level description of the Layer 2 sub-layers in terms of services and functions. The two figures below depict the PDCP/RLC/MAC architecture for downlink and uplink, where:

- Service Access Points (SAP) for peer-to-peer communication are marked with circles at the interface between sublayers. The SAP between the physical layer and the MAC sublayer provides the transport channels. The SAPs between the MAC sublayer and the RLC sublayer provide the logical channels. The SAPs between the RLC sublayer and the PDCP sublayer provide the radio bearers.
- The multiplexing of several logical channels on the same transport channel is possible;
- The multiplexing of radio bearers with the same QoS onto the same priority queue is FFS. If there is no multiplexing of radio bearers onto priority queues, there is only one level of multiplexing in the RLC and MAC sublayers;
- In both uplink and downlink, only one transport block is generated per TTI in the non-MIMO case.

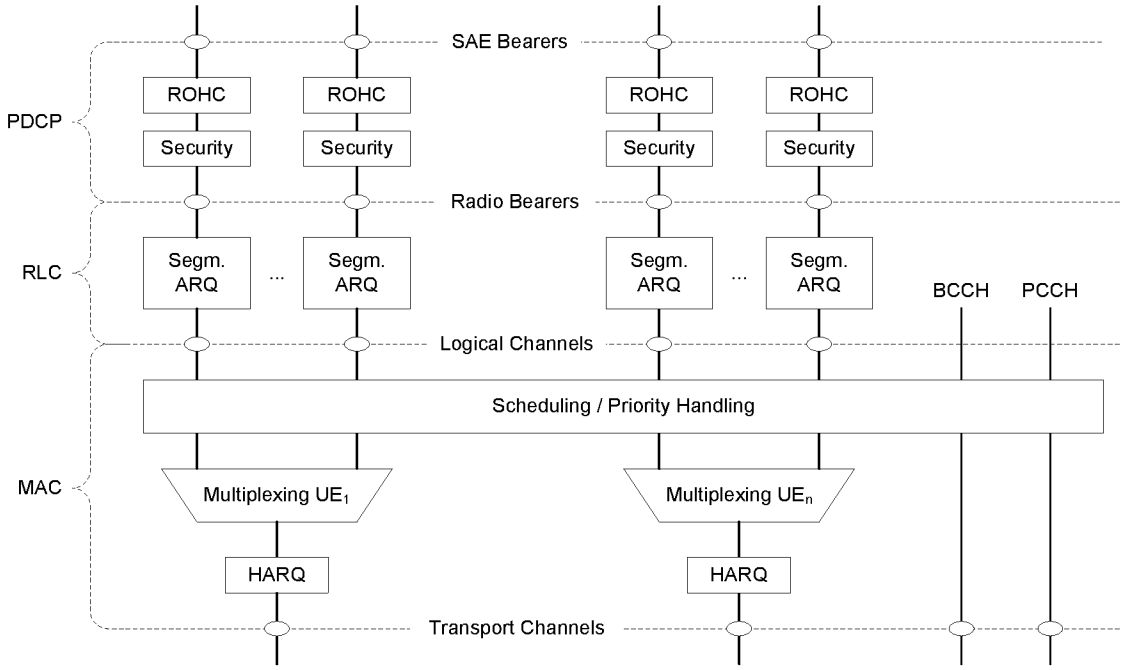


Figure 6a: Layer 2 Structure for DL

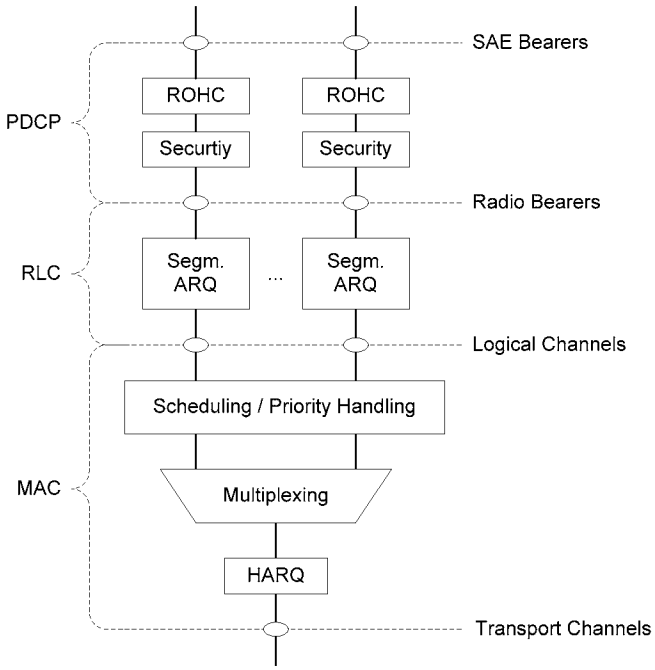


Figure 6b: Layer 2 Structure for UL

6.1 MAC Sublayer

This subclause provides an overview on services and functions provided by the MAC sublayer.

6.1.1 Services and Functions

The main services and functions of the MAC sublayer include:

- Mapping between logical channels and transport channels;
- Multiplexing/demultiplexing of RLC PDUs belonging to one or different radio bearers into/from transport blocks (TB) delivered to/from the physical layer on transport channels;
- Traffic volume measurement reporting;
- Error correction through HARQ;
- Priority handling between logical channels of one UE;
- Priority handling between UEs by means of dynamic scheduling;
- Transport format selection;
- Mapping of Access Classes to Access Service Classes (FFS for RACH);
- Padding (FFS).

NOTE: How the multiplexing relates to the QoS of the multiplexed logical channels is FFS.

6.1.2 Logical Channels

Different kinds of data transfer services as offered by MAC. Each logical channel type is defined by what type of information is transferred.

A general classification of logical channels is into two groups:

- Control Channels (for the transfer of control plane information);
- Traffic Channels (for the transfer of user plane information).

There is one MAC entity per cell. MAC generally consists of several function blocks (transmission scheduling functions, per UE functions, MBMS functions, MAC control functions, transport block generation…). Transparent Mode is only applied to BCCH and PCCH.

6.1.2.1 Control Channels

Control channels are used for transfer of control plane information only. The control channels offered by MAC are:

- **Broadcast Control Channel (BCCH)**

  A downlink channel for broadcasting system control information.

- **Paging Control Channel (PCCH)**

  A downlink channel that transfers paging information. This channel is used when the network does not know the location cell of the UE.

- **Common Control Channel (CCCH)**

  FFS: this channel is used by the UEs having no RRC connection with the network (need is FFS depending on whether the access mechanism is contained in L1. If RACH is visible as a transport channel, CCCH would be used by the UEs when accessing a new cell or after cell reselection).

- **Multicast Control Channel (MCCH)**

  A point-to-multipoint downlink channel used for transmitting MBMS control information from the network to the UE, for one or several MTCHs. This channel is only used by UEs that receive MBMS.

NOTE: It is FFS how MBMS scheduling is transmitted by either L2/3 signalling on MCCH or L1 signalling.

- **Dedicated Control Channel (DCCH)**

  A point-to-point bi-directional channel that transmits dedicated control information between a UE and the network. Used by UEs having an RRC connection.

6.1.2.2 Traffic Channels

Traffic channels are used for the transfer of user plane information only. The traffic channels offered by MAC are:

- **Dedicated Traffic Channel (DTCH)**

  A Dedicated Traffic Channel (DTCH) is a point-to-point channel, dedicated to one UE, for the transfer of user information. A DTCH can exist in both uplink and downlink.

- **Multicast Traffic Channel (MTCH)**

  A point-to-multipoint downlink channel for transmitting traffic data from the network to the UE. This channel is only used by UEs that receive MBMS.

6.1.3 Mapping between logical channels and transport channels

The figure below depicts the mapping between logical and transport channels (in grey the items for FFS):

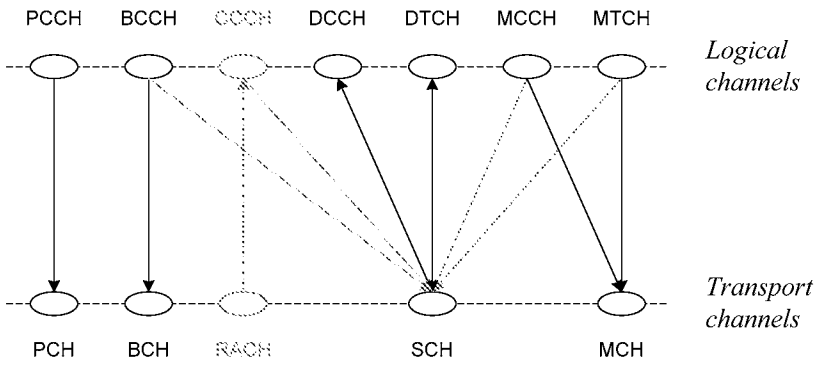


Figure 6.1.3: Mapping between logical channels and transport channels

6.1.3.1 Mapping in Uplink

In Uplink, the following connections between logical channels and transport channels exist:

- CCCH can be mapped to RACH: FFS if access procedure is not contained within L1;
- CCCH can be mapped to Uplink SCH: FFS if just a transient (random) ID is assigned for the resource request, the actual e.g. RRC Connection Request message has still to contain a UE identifier and therefore such message is considered to be a CCCH message, even if it's transported on the UL-SCH, since the UE is not in RRC_CONNECTED state at this stage;
- DCCH can be mapped to UL- SCH;
- DTCH can be mapped to UL-SCH.

6.1.3.2 Mapping in Downlink

In Downlink, the following connections between logical channels and transport channels exist:

- BCCH can be mapped to BCH;
- BCCH can be mapped to DL-SCH: FFS;
- PCCH can be mapped to PCH;
- CCCH can be mapped to DL-SCH: FFS if CCCH exists;
- DCCH can be mapped to DL-SCH;
- DTCH can be mapped to DL-SCH;
- MTCH can be mapped to DL-SCH: FFS;
- MTCH can be mapped to MCH;
- MCCH can be mapped to DL-SCH: FFS;
- MCCH can be mapped to MCH.

6.2 RLC Sublayer

This subclause provides an overview on services, functions and PDU structure provided by the RLC sublayer. Note that:

- The reliability of RLC is configurable: some radio bearers may tolerate rare losses (e.g. TCP traffic);

- Radio Bearers are not characterized by a fixed sized data unit (e.g. a fixed sized RLC PDU).

6.2.1 Services and Functions

The main services and functions of the RLC sublayer include:

- Transfer of upper layer PDUs supporting AM or UM;
- TM data transfer;
- Error Correction through ARQ (CRC check provided by the physical layer, in other words no CRC needed at RLC level);
- Segmentation according to the size of the TB: only if an RLC SDU does not fit entirely into the TB then the RLC SDU is segmented into variable sized RLC PDUs, which do not include any padding;
- Re-segmentation of PDUs that need to be retransmitted: if a retransmitted PDU does not fit entirely into the new TB used for retransmission then the RLC PDU is re-segmented;
- The number of re-segmentation is not limited;
- Concatenation of SDUs for the same radio bearer;
- In-sequence delivery of upper layer PDUs except at HO in the uplink;
- Duplicate Detection;
- Protocol error detection and recovery;
- Flow Control between eNB and UE (FFS);
- SDU discard;
- Reset.

6.2.2 PDU Structure

Figure 6.2.2 below depicts the RLC PDU structure where:

- The PDU sequence number carried by the RLC header is independent of the SDU sequence number (i.e. PDCP sequence number);
- A red dotted line indicates the occurrence of segmentation;
- Because segmentation only occurs when needed and concatenation is done in sequence, the content of an RLC PDU can generally be described by the following relations:
  - {0; 1} last segment of SDU_i + [0; n] complete SDUs + {0; 1} first segment of SDU_{i+n+1} ; or
  - 1 segment of SDU_i .

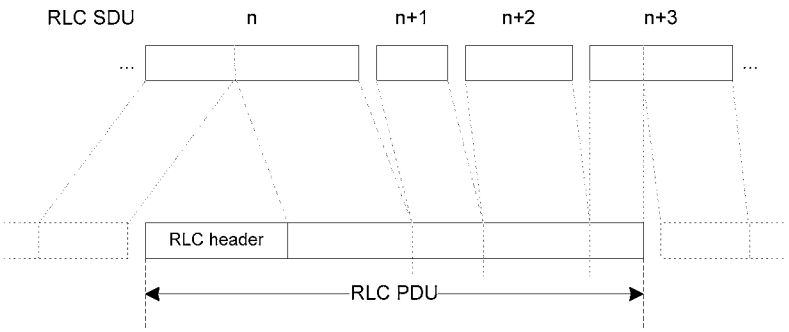


Figure 6.2.2: RLC PDU Structure

6.3 PDCP Sublayer

This subclause provides an overview on services, functions and PDU structure provided by the PDCP sublayer. A model of the PDCP sublayer is illustrated in the figure below.

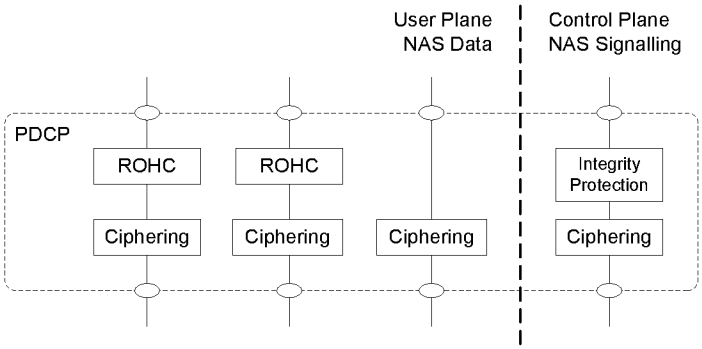


Figure 6.3: Model of PDCP sublayer

6.3.1 Services and Functions

The main services and functions of the PDCP sublayer include:

- Header compression and decompression: ROHC only;
- Transfer of user data: transmission of user data means that PDCP receives PDCP SDU from the NAS and forwards it to the RLC layer and vice versa;
- In-sequence delivery of upper layer PDUs at HO in the uplink (FFS);
- Ciphering of user plane data and control plane data (NAS Signalling);
- Integrity protection of control plane data (NAS signalling);- Integrity protection of user plane data is FFS.

NOTE: The UP and CP PDCP entities are located in the UPE and MME, respectively.

NOTE: When compared to UTRAN, the *lossless DL RLC PDU size change* is not required.

6.3.2 PDU Structure

Figure 6.3.2 below depicts the PDCP PDU structure where:

- PDCP PDU and PDCP header are octet-aligned;
- PDCP header can be either 1 or 2 bytes long.

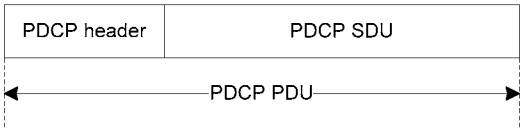


Figure 6.3.2: PDCP PDU Structure

6.4 Data flows through Layer 2

7 RRC

This subclause provides an overview on services and functions provided by the RRC sublayer.

7.1 Services and Functions

The main services and functions of the RRC sublayer include:

- Broadcast of System Information related to the non-access stratum (NAS);
- Broadcast of System Information related to the access stratum (AS);
- Paging;
- Establishment, maintenance and release of an RRC connection between the UE and E-UTRAN including:
  - Allocation of temporary identifiers between UE and E-UTRAN;
  - Configuration of signalling radio bearer(s) for RRC connection:
    - Low priority SRB and high priority SRB.
- Security functions including:
    - Integrity protection for RRC messages;
    - Ciphering for RRC messages.
- Establishment, configuration, maintenance and release of point to point Radio Bearers;
- Mobility functions including:
  - UE measurement reporting and control of the reporting for inter-cell and inter-RAT mobility;
  - Inter-cell handover;
  - UE cell selection and reselection and control of cell selection and reselection;
  - Context transfer between eNBs.
- Notification for MBMS services (FFS);
- Establishment, configuration, maintenance and release of Radio Bearers for MBMS services (FFS);
- QoS management functions;
- UE measurement reporting and control of the reporting;
- MBMS control (FFS);
- NAS direct message transfer to/from NAS from/to UE.

7.2 RRC protocol states & state transitions

RRC uses the following states:

- **RRC_IDLE**:
  - UE specific DRX configured by NAS;
  - Broadcast of system information;

- Paging;
- Cell re-selection mobility;
- The UE shall have been allocated an id which uniquely identifies the UE in a tracking area;
- No RRC context stored in the eNB.

- **RRC_CONNECTED**:
  - UE has an E-UTRAN-RRC connection;
  - UE has context in E-UTRAN;
  - E-UTRAN knows the cell which the UE belongs to;
  - Network can transmit and/or receive data to/from UE;
  - Network controlled mobility (handover);
  - Neighbour cell measurements;
  - At RLC/MAC level:
    - UE can transmit and/or receive data to/from network;
    - UE monitors control signalling channel for shared data channel to see if any transmission over the shared data channel has been allocated to the UE;
    - UE also reports channel quality information and feedback information to eNB;
    - DRX/DTX period can be configured according to UE activity level for UE power saving and efficient resource utilization. This is under control of the eNB.

7.3 Transport of NAS messages

In E-UTRAN, NAS messages are either concatenated with RRC messages or carried in RRC without concatenation:

- Concatenated messages:
  - Initial Direct Transfer is concatenated with RRC connection request;
  - Other NAS messages maybe concatenated with RRC messages i.e. for synchronised NAS/RRC procedure;
  - Integrity protection of the NAS messages from RRC is FFS as integrity protection is already applied in the MME.
- Non-concatenated messages:
  - No integrity protection from RRC;
- It is FFS if RRC Direct Transfer messages or RRC messages with concatenated NAS messages can use the same logical channel as the RRC only messages..

7.4 System Information

Common characteristics of system information sent on static (e.g. MIB) and flexible resources:

- Unicast system information sending possible at least for handover purposes;
- BCCH not continuously sent.

System information sent on static resources:

- Contains scheduling information for secondary system information;
- Contains information necessary for PLMN/Cell search procedures;
- Throughput not dependant on cell BW.

System information sent on flexible resources:

- Shares radio resources with DL-SCH.

7.5 RRC Procedures

8 E-UTRAN identities

8.1 E-UTRAN related UE identities

The following E-UTRAN related UE identities are used:

a) C-RNTI:

- The C-RNTI provides a unique UE identification at the cell level identifying RRC Connection;
- It is assumed that this identity is used for scheduling unless the cost would turn out to be too high and the introduction of a separate MAC identity would be required.

b) Random value for contention resolution:

- During some transient states, the UE is temporarily identified with a random value for contention resolution purposes.

8.2 Network entity related Identities

The following identities are used in E-UTRAN for identifying a specific network entity:

a) MME identity:

- It is agreed that a UE in LTE_IDLE establishing an RRC connection has to provide a unique identification of its current MME to the eNB when the connection establishment is initially related to NAS signalling, in order for the eNB to fetch the UE context from the MME;
- It is FFS whether this MME identity is also provided when the RRC connection is initially intended for user plane traffic;
- It is FFS whether this MME identity is provided by the UE to the eNB as a separate identity, or whether this MME identity is included in the TMSI for MME.

b) eNB identity or cell identity (FFS):

- The signalling sequence to be followed in case a UE in LTE_ACTIVE accesses a cell in which no UE context has been established yet (kind of “cell update”) is currently not agreed. Identified options are:
  1) In order to obtain the UE context/data from the old eNB, the new eNB directly contacts the old eNB without consulting the aGW;
  2) In order to obtain the UE context/data from the old eNB, the new eNB consults the aGW to obtain the identity of the old eNB;
  3) In order to obtain a UE context, the new eNB contacts the MME.
- If it is required for the new eNB to be able to contact the old eNB without involving the aGW (case 1 above), the UE has to provide a network entity related identification that enables the new eNB to contact the old

eNB, and that enables the old eNB to uniquely identify the UE for retrieving the correct UE context. For this purpose either an eNB identity or cell identity could be used.

c) UPE identity (FFS):

- The signalling sequence to be followed when a UE in LTE_IDLE wants to establish an RRC connection initially intended for user plane traffic is not agreed yet. If it is required to support user plane data transport before the UE context is retrieved from the aGW, the UE might have to provide a UPE identity to the eNB thus enabling the new eNB to contact the UPE directly.

d) Tracking Area identity (FFS):

- Unique identification of a Tracking Area in a PLMN.

The following identities are broadcast in every E-UTRAN cell:

a) Cell identity:

- Uniquely identifying the cell in the area (size of area is FFS).

b) One or more Tracking Area identities (FFS):

- Tracking Area (s) this cell belongs to.

c) One or more PLMNs:

- PLMN (s) for which this cell is providing radio access.

9 ARQ and HARQ

E-UTRAN provides ARQ and HARQ functionalities. The ARQ functionality provides error correction by retransmissions in acknowledged mode at Layer 2. The HARQ functionality ensures delivery between peer entities at Layer 1.

9.1 HARQ principles

The HARQ within the MAC sublayer has the following characteristics:

- N-process Stop-And-Wait HARQ is used;
- The HARQ is based on ACK/NACKs;
- In the downlink:
  - Asynchronous retransmissions with adaptive transmission parameters are supported;
  - Additional optimisations (e.g. less adaptive/synchronous) are FFS.
- In the uplink:
  - HARQ is based on synchronous retransmissions;
  - Whether resource allocation and modulation and coding scheme can be adapted for retransmissions is FFS.
- The HARQ transmits and retransmits TBs;

9.2 ARQ principles

The ARQ within the RLC sublayer has the following characteristics:

- ARQ retransmits RLC PDUs or RLC PDU segments;
- ARQ retransmissions are based on:

  - RLC status reports;
  - HARQ/ARQ interactions (see subclause 9.3).
- Polling for RLC status report is used when needed by RLC;
- Status reports can be triggered by upper layers;
- Means to discard a SDU not yet transmitted or under transmission should be supported;
- Means to reset and/or re-establish RLC should be supported.

9.3 HARQ/ARQ interactions

In HARQ assisted ARQ operation, ARQ uses knowledge obtained from the HARQ about the transmission/reception status of a TB e.g.:

- If the HARQ transmitter detects a failed delivery of a TB due to e.g. maximum retransmission limit is reached the relevant transmitting ARQ entities are notified and potential retransmissions and re-segmentation can be initiated;
- If the HARQ receiver is able to detect a NACK to ACK error it is FFS if the relevant transmitting ARQ entities are notified via explicit signalling;
- If the HARQ receiver is able to detect TB transmission failure it is FFS if the receiving ARQ entities are notified.

10 Mobility

E-UTRAN mobility in LTE_IDLE and LTE_ACTIVE should provide means for load balancing.

10.1 Intra E-UTRAN

In E-UTRAN RRC_CONNECTED state, network controlled UE assisted handovers are performed and various DRX/DTX cycles are supported:

- UE performs neighbour cell measurements based on measurement control and neighbour cell information from the network;
- Network signals reporting criteria for event-triggered and periodical reporting.

Following defines the handover support within E-UTRAN:

- The intra E-UTRAN HO in RRC_CONNECTED state is UE assisted NW controlled HO with HO preparation signalling in E-UTRAN:
  - Part of the HO command comes from the target eNB and is transparently forwarded to the UE by the source eNB;
  - The QoS profiles in use by the UE (SAE bearer attributes) are sent to the target eNB by the source eNB, and it is FFS if also the currently used AS configuration is sent (intra-MME case);
  - Both the source ENB and UE keep some context (e.g. C-RNTI) to enable the return of the UE in case of HO failure;
  - UE accesses the target cell via contention-based RACH (the use of dedicated resources for accessing the target cell in a contention-free manner is FFS).
- In E-UTRAN RRC_IDLE state, cell reselections are performed and DRX is supported.

10.1.1 Mobility Management in LTE_IDLE

10.1.1.1 Cell selection

The principles of PLMN selection in E-UTRA are based on the 3GPP PLMN selection principles. Cell selection is required on transition from LTE_DETACHED to LTE_IDLE or LTE_ACTIVE.

Cell selection:

- The UE NAS identifies a selected PLMN and equivalent PLMNs;
- The UE searches the E-UTRA frequency bands and for each carrier frequency identifies the strongest cell. It reads cell system information broadcast to identify its PLMN(s):
  - Details for the cell search are FFS;
  - The UE may search each carrier in turn ("initial cell selection") or make use of stored information to shorten the search ("stored information cell selection").
- The UE seeks to identify a suitable cell; if it is not able to identify a suitable cell it seeks to identify an acceptable cell. When a suitable cell is found or if only an acceptable cell is found it camps on that cell and commence the cell reselection procedure:
  - A suitable cell is one for which the measured cell attributes satisfy the cell selection criteria; the cell PLMN is the selected PLMN, registered or an equivalent PLMN; the cell is not barred or reserved and the cell is not part of a tracking area which is in the list of "forbidden tracking areas for roaming";

Note: the above text will be revised if it is agreed that a cell can be a member of more than one tracking area.

  - An acceptable cell is one for which the measured cell attributes satisfy the cell selection criteria and the cell is not barred;
  - The measurements made and the cell selection criteria to be applied are FFS.

Transition to RRC_IDLE:

On transition from RRC_CONNECTED to RRC_IDLE, a UE should camp on the last cell for which it was in RRC_CONNECTED or a cell/any cell of set of cells or frequency be assigned by RRC in the state transition message.

Recovery from out of coverage:

The UE should attempt to find a suitable cell in the manner described for stored information or initial cell selection above. If no suitable cell is found on any frequency or RAT the UE should attempt to find an acceptable cell.

10.1.1.2 Cell reselection

UE in RRC_IDLE performs cell reselection. The principles of the procedure are the following:

- Cell reselection takes place in a hierarchical or non hierarchical cell topology. The type of topology will be indicated in system information;
- The UE makes measurements of attributes of the serving and neighbour cells to enable the reselection process:
  - Cells listed in the serving cell system information broadcast are searched and measured by the UE; it is FFS whether the UE can search and measure cells that are not listed in system information;
  - The attributes to be measured for E-UTRAN cells are FFS;
- Measurements may be omitted if the serving cell attribute fulfils particular search or measurement criteria. The criteria and rules relating to which measurements may be omitted are FFS;

- Cell reselection identifies the cell that the UE should camp on. It is based on cell reselection criteria which involves measurements of the serving and neighbour cells. Details for cell reselection criteria are FFS (e.g. whether a cell specific offset is applied to measurements);
- Cell reselection parameters are applicable for all UEs in a cell, but it is possible to configure specific reselection parameters per UE group or per UE.

Cell access restrictions apply as for UTRAN, which consist of access class (AC) barring and cell reservation (e.g. for cells "reserved for operator use", other purpose are FFS) applicable for mobiles in RRC_IDLE mode.

10.1.1.3 Handling in eNB

10.1.1.4 Handling above eNB

10.1.1.5 Mobility Management Entity (MME)

10.1.2 Mobility Management in LTE_ACTIVE

10.1.2.1 Handover

The intra E-UTRAN HO in RRC_CONNECTED state is UE assisted NW controlled HO, with HO preparation signalling in E-UTRAN. The figure below depicts the basic handover scenario where neither MME nor UPE changes:

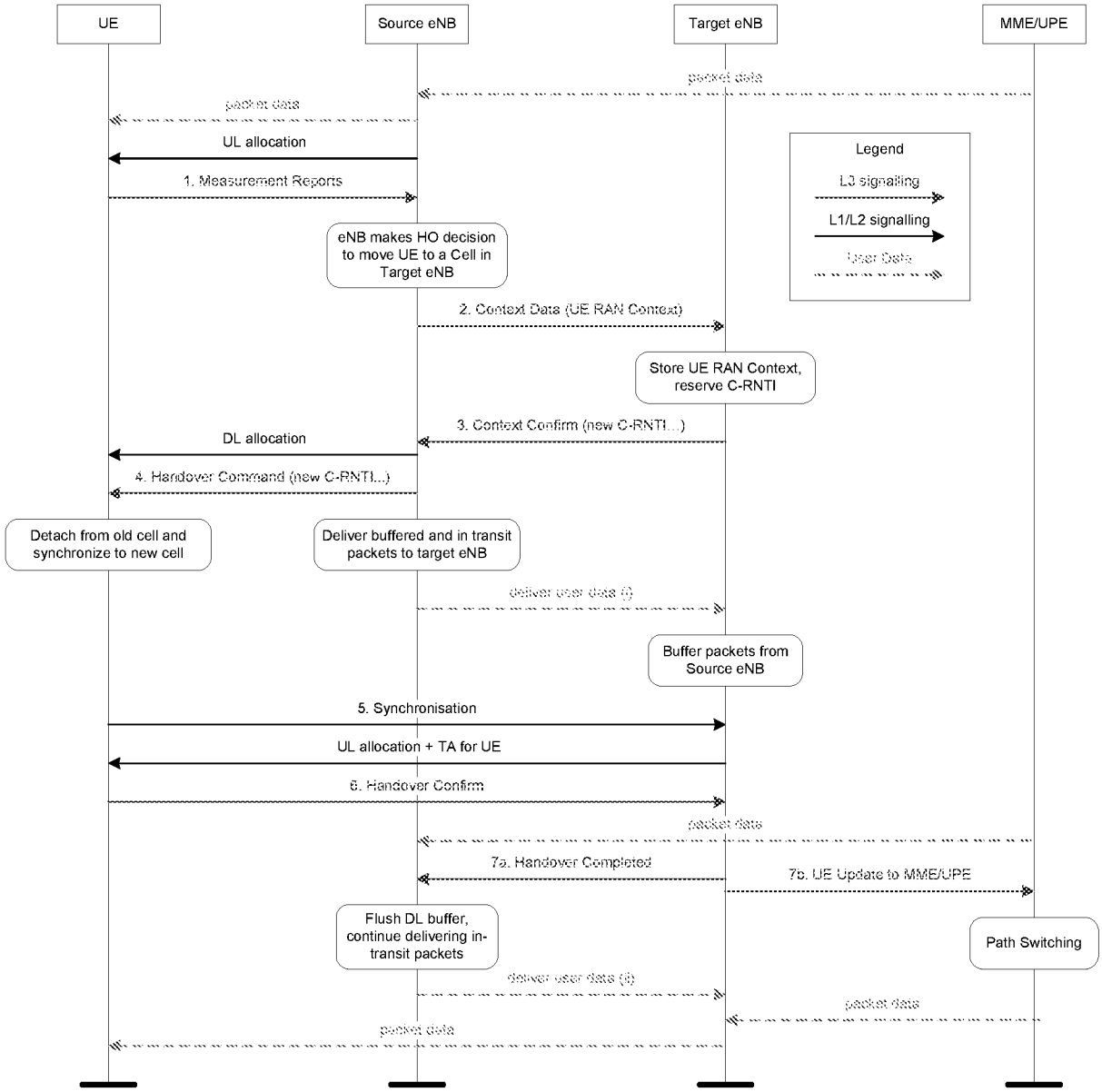


Figure 10.1.2.1: Intra-MME/UPE HO

Below is more detailed description of the intra-MME/UPE HO procedure:

1 UE is triggered to send MEASUREMENT REPORT by the rules set by i.e. system information, specification etc.

2 Source eNB makes decision based on MEASUREMENT REPORT and RRM information to hand off UE. The eNB prepares target eNB for handover and passes relevant information in the Handover Request. Relevant information includes the QoS profiles of the SAE bearers and possibly the AS configurations of these bearers (FFS).

3 Target eNB prepares HO with L1/L2 and responds to source eNB by providing new C-RNTI and possibly some other parameters i.e. access parameters, SIBs, etc. After reception of accepted preparation of HO, source eNB starts forwarding data packets to target eNB.

4 UE receives HANDOVER COMMAND with necessary parameters i.e. new C-RNTI, possible starting time, target eNB SIBs etc. It is probable that UE needs to acknowledge reception of the HO COMMAND with RLC acknowledgment procedure.

5 After expiry of starting time in HO COMMAND, UE performs synchronisation to target eNB and then starts acquiring UL timing advance.

6 Network responds with UL allocation and timing advance. These are used by UE to send HANDOVER CONFIRM to the target eNB, which completes handover procedure for the UE. It is probable that NW needs to acknowledge reception of the HO CONFIRM with RLC acknowledgment procedure.

7a Target eNB informs success of HO to source eNB, which can then clear already forwarded data from its buffers. Source eNB still continues forwarding UE data if it has some in its buffers or if UPE still forwards data to it.

7b UE location information is updated to MME/UPE in order to enable UPE to forward packets directly to target eNB

The handling of outstanding uplink and downlink data upon inter-eNB handover is described in 9.1.7.

10.1.2.2 Path Switch

10.1.2.3 Data forwarding

Upon handover, the source eNB forwards all downlink RLC SDUs, starting from the first SDU that has not been successfully received by the UE, to the target eNB. The source eNB discards any remaining downlink RLC PDUs. The target eNB re-transmits and prioritize all downlink RLC SDUs forwarded by the source eNB as soon as it obtains them. Correspondingly, the source eNB does not forward the downlink RLC context to the target eNB. Support of re-ordering of downlink RLC SDUs during handover, which either the target eNB or the UE could provide (e.g. based on PDCP sequence numbers), is FFS. The optimisation, to only re-transmit the downlink RLC SDUs not successfully received by the UE, is FFS.

Upon handover, the source eNB forwards all successfully received uplink RLC SDUs to the UPE and discards any remaining uplink RLC PDUs. The UE re-transmits the uplink RLC SDUs that have not been successfully received by the source eNB. Correspondingly, the source eNB neither forwards uplink RLC SDUs nor the uplink RLC context to the target eNB. If needed, the PDCP within UPE may support re-ordering of uplink RLC SDUs during handover (operator control).

10.1.2.4 Handling in eNB

10.1.2.5 Handling above eNB

During UPE relocation procedure, the header compression entity is restarted and no context related to header compression is transferred (FFS).

10.1.2.6 Mobility Management Entity (MME)

10.1.2.7 Timing Advance

In RRC_CONNECTED, it remains FFS whether the timing advance is permanently maintained or not. If not, MAC knows if the L1 is synchronised and which procedure to use to start transmitting in the uplink (FFS for RRC).

Cases where the UL synchronisation status may move from "synchronised" to "non-synchronised" include:

- Expiration of a timer;
- Non-synchronised handover;
- Explicit request by MAC or RRC in the eNB;

10.1.3 Measurements

Measurements to be performed by a UE for intra/inter-frequency mobility can be controlled by E-UTRAN, using broadcast or dedicated control. In RRC_IDLE state, a UE shall follow the measurement parameters defined for cell reselection specified by the E-UTRAN broadcast (as in UTRAN SIB). The use of dedicated measurement control for

RRC_IDLE state is FFS. In RRC_CONNECTED state, a UE shall follow the measurement configurations specified by RRC directed from the E-UTRAN (e.g. as in UTRAN MEASUREMENT_CONTROL).

Depending on whether the UE needs transmission/reception gaps to perform the relevant measurements, measurements are classified as gap assisted or non gap assisted. A non gap assisted measurement is a measurement on a cell that does not require transmission/reception gaps to allow the measurement to be performed. A gap assisted measurement is a measurement on a cell that does require transmission/reception gaps to allow the measurement to be performed.

Whether a measurement is non gap assisted or gap assisted depends on the UE's capability and current operating frequency. The UE determines whether a particular cell measurement needs to be performed in a transmission/reception gap and the scheduler needs to know whether gaps are needed. The exact scenarios that require gap assisted measurements are FFS (see subclause 9.1.1).

Measurement gaps are provided and controlled by the network.

10.1.3.1 Neighbour cell measurements within the serving frequency layer

In a system with frequency reuse = 1, mobility within the same frequency layer (i.e. between cells with the same carrier frequency) is predominant. Good neighbour cell measurements are needed for cells that have the same carrier frequency as the serving cell in order to ensure good mobility support and easy network deployment. Search for neighbour cells with the same carrier frequency as the serving cell, and measurements of the relevant quantities for identified cells are needed.

NOTE: To avoid UE activity outside the DRX/DTX cycle, the reporting criteria for neighbour cell measurements should match the used DRX/DTX cycle.

10.1.3.2 Neighbour cell measurements of other frequency layers

Regarding mobility between different frequency layers (i.e. between cells with a different carrier frequency), UE may need to perform neighbour cell measurements during DL/UL idle periods that are provided by DRX/DTX or packet scheduling (i.e. gap assisted measurements).

NOTE: How the gaps are controlled, as well as how the scheduler knows the gaps required by the UE, is FFS.

10.1.4 Paging and C-plane establishment

Paging groups (where multiple UEs can be addressed) are used on L1/L2 signalling channel:

- Precise UE identity is found on PCH;
- DRX is UE specific.

10.1.5 Random Access Procedure for Initial Access

The random access procedure for initial access is characterized by:

- FDD and TDD shall use same procedure;
- One procedure irrespective of cell size;
- Early contention resolution shall be used i.e. eNB does not wait for NAS reply before resolving contention.

The random access procedure for initial access is outlined on Figure 10.1.5 below:

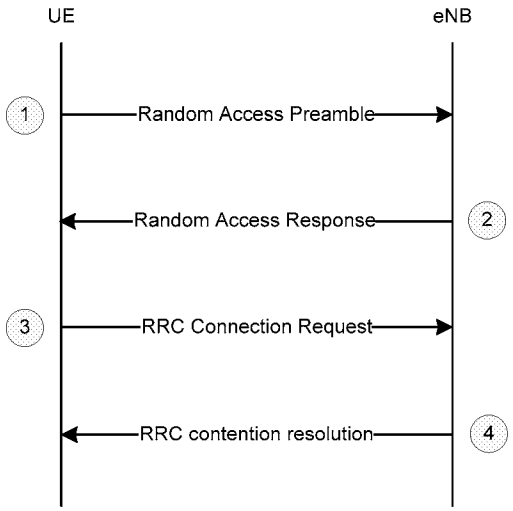


Figure 10.1.5: Random Access Procedure for Initial Access

The four steps of the random access procedures for initial access are:

1) Random Access Preamble on RACH in uplink:
   - 6 bits to carry a random ID, and possibly (FFS):
     - Cause or size, potentially with priority;
     - Pathloss or CQI to allocate UL resource appropriately.
2) Random Access Response in downlink:
   - Semi-synchronous (within a flexible window of which the size is one or more TTI) with message 1;
   - No HARQ;
   - Transmitted on L1/L2+DL-SCH;
   - Addressed through RA-RNTI;
   - Intended for one or multiple UEs in one DL-SCH message.
3) RRC Connection Request in uplink:
   - Uses HARQ;
   - RLC TM: no segmentation;
   - If the size of the message allows it, the initial NAS message (or something allowing to build the initial NAS message in eNB) can be included;
   - Size of the message is dynamic.
4) RRC Contention Resolution on DL-SCH:
   - Not synchronised with message 3;
   - Content of the message is FFS;
   - HARQ is FFS.

10.1.6 Radio Link Failure

Two phases governs the behaviour associated to radio link failure as shown on Figure 10.1.6:

- First phase:
  - started upon radio problem detection;
  - leads to radio link failure detection;
  - no UE-based mobility;
  - based on timer or other (e.g. counting) criteria (T_1).
- Second Phase:
  - started upon radio link failure detection;
  - leads to RRC_IDLE;
  - UE-based mobility;
  - Timer based (T_2).

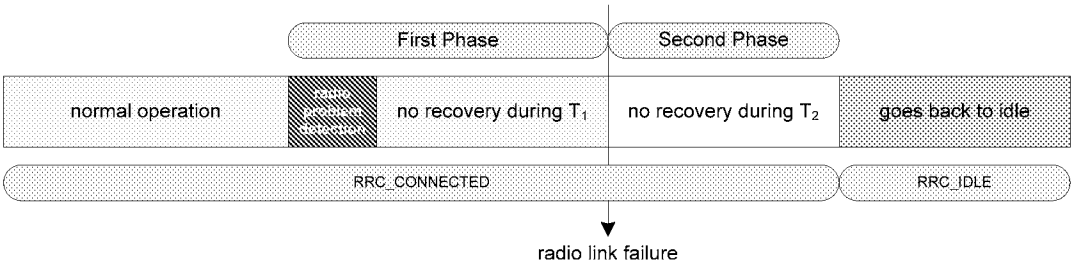


Figure 10.1.6: Radio Link Failure

Table 10.1.6 below describes how mobility is handled with respect to radio link failure:

Table 10.1.6: Mobility and Radio Link Failure

Cases	First Phase	Second Phase	T2 expired
UE returns to the same cell	Continue as if no radio problems occurred	Activity cannot be resumed without interaction between UE and eNB Procedure to be used is FFS Normally not via RRC_IDLE	Go via RRC_IDLE
UE selects a different cell from the same eNB	N/A	FFS	Go via RRC_IDLE
UE selects a cell of a different eNB	N/A	Go via RRC_IDLE	Go via RRC_IDLE

10.1.7 Radio Access Network Sharing

E-UTRAN shall support radio access network sharing based on support for multi-to-multi relationship between E-UTRAN nodes and EPC nodes (S1-flex).

If the E-UTRAN is shared by multiple operators respective system information is broadcasted in each cell of the E-UTRAN containing multiple PLMN-ids (one PLMN-id for each sharing operator).

The UE shall be able to read multiple PLMN-ids, to select one of the PLMN-ids at attachment and to indicate the selected PLMN-id to the E-UTRAN whenever it contacts the EPC. The E-UTRAN shall select the proper EPC node based on the PLMN-id indicated by the UE. Once attached to an EPC node, the E-UTRAN selects the EPC node based on routing information contained in the temporary UE id allocated by the EPC.

The E-UTRAN shall ensure that mobility of the UE in LTE_ACTIVE obeys roaming restrictions imposed by shared radio access network configurations.

10.1.8 Handling of Roaming and Area Restrictions for UEs in LTE_ACTIVE

Handling of roaming/area restrictions and handling of subscription specific preferences in LTE_ACTIVE is performed in the eNB based on information provided by the aGW over the S1 interface.

10.2 Inter RAT

10.2.1 Cell reselection

10.2.2 Handover

10.2.3 Measurements

10.2.3.1 Inter-RAT handovers from E-UTRAN

Measurements to be performed by a UE for inter-RAT mobility can be controlled by E-UTRAN, using broadcast or dedicated control. In RRC_CONNECTED state, a UE shall follow the measurement parameters specified by RRC or MAC commands (FFS) directed from the E-UTRAN (e.g. as in UTRAN MEASUREMENT_CONTROL).

UE performs inter-RAT neighbour cell measurements during DL/UL idle periods that are provided by the network through suitable DRX/DTX period or packet scheduling if necessary.

NOTE: How the gaps are controlled, as well as how the scheduler knows the gaps required by the UE, is FFS.

10.2.3.2 Inter-RAT handovers to E-UTRAN

From UTRAN, UE performs E-UTRAN measurements by using idle periods created by compressed mode (CELL_DCH), FACH measurement occasions (CELL_FACH - FFS), or DRX (other states).

From GERAN, E-UTRAN measurements are performed in the same way as WCDMA measurements for handover to UTRAN: E-UTRAN measurements are performed in GSM idle frames in a time multiplexed manner. However, it should be discussed with GERAN how to ensure that inter-RAT measurements do not take too much measurement time, while the requested 3GPP inter-RAT measurements can be performed well enough.

Design constraints of 3GPP inter-RAT measurements should be considered when L1 details of E-UTRAN concept are defined.

10.2.3.3 Inter-RAT cell reselection from E-UTRAN

In RRC_IDLE state, a UE shall follow the measurement parameters specified by the E-UTRAN broadcast (as in UTRAN SIB). The use of dedicated measurement control is FFS.

10.2.3.4 Limiting measurement load at UE

Introduction of E-UTRA implies co-existence of various UE capabilities. Each UE may support different combinations of RATs, e.g., E-UTRA, UTRA, GSM, and non-3GPP RATs, and different combinations of frequency bands, e.g., 800 MHz, 1.7 GHz, 2 GHZ, etc. Moreover, some UEs may support the full E-UTRA spectrum bandwidth of 20 MHz, whereas some UEs may support only a part of 20 MHz. Despite such heterogeneous environment, the measurement load at UE should be minimised. To limit the measurement load and the associated control load:

- E-UTRAN can configure the RATs to be measured by UE;
- The number of measurement criteria (event and periodic reporting criteria) should be limited (as in TS 25.133 subclause 8.3.2 [7]);
- E-UTRAN should be aware of the UE capabilities for efficient measurement control, to prevent unnecessary waking up of the measurement entity;

- The UE capabilities should be categorised to prevent diversion of capabilities and conformance test scenarios, FFS;
- Support for blind HO (i.e., HO without measurement reports from UE) is FFS.

10.2.4 Network Aspects

10.3 Inter 3GPP access system mobility

10.3.1 Cell reselection

10.3.2 Handover

10.3.3 Measurements

10.4 Roaming Restrictions

11 Scheduling

In order to utilise the SCH resources efficiently, a scheduling function is used in MAC. In this subclause, an overview of the scheduler is given in terms of scheduler operation, signalling of scheduler decisions, and measurements to support scheduler operation.

11.1 Scheduler Operation

MAC in eNB includes dynamic resource schedulers that allocate physical layer resources for the DL-SCH and UL-SCH transport channels. Different schedulers operate for the DL-SCH and UL-SCH.

Taking account the traffic volume and the QoS requirements of each UE and associated radio bearers, schedulers assign resources between UEs and potentially also between different radio bearers associated with a single UE (FFS).

Schedulers may assign resources taking account the radio conditions at the UE identified through measurements made at the eNB and/or reported by the UE.

Radio resource allocations can be valid for one or multiple TTIs.

Resource assignment consists of physical resource blocks (PRB) and MCS. Allocations for time periods longer than one TTI might also require additional information (allocation time, allocation repetition factor…).

A priority is associated to each radio bearer and the UE serves its radio bearer(s) in priority order.

NOTE: this has to be refined for e.g. starvation avoidance, “free ride”, better control of non-GBR RBs, etc…

The four possible types of allocation are:

- Short lived dynamic allocation: both PRB(s) and allowed MCS are allocated to a given UE for a defined number of TTIs;

NOTE: a UE may “operate” only during certain time periods of the radio frame (indicated from RRC).

- Short lived fixed allocation: PRB(s) are allocated to a given UE for a defined number of TTIs, and the allowed MCS is allocated for an undefined duration;

NOTE: a UE may “operate” only during certain time periods of the radio frame (indicated from RRC).

- Long lived dynamic allocation: PRB(s) are allocated to a given UE for an undefined duration, and the MCS is dynamically controlled by the network;

- Long lived fixed allocation: both PRB(s) and allowed MCS are allocated to a given UE for an undefined duration.

This is summarized on the figure below:

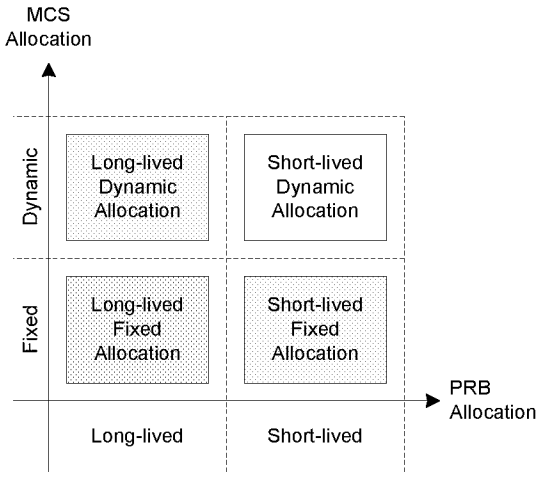


Figure 11.1: Allocation Types

For one UE, the allocation type can be different in UL and DL. Also there may be multiple simultaneous allocation types for the same UE.

Allocations are done one a per UE basis (i.e. not on a per radio bearer basis), but radio bearer restriction can apply for certain allocation type e.g. for long live allocation.

11.2 Signalling of Scheduler Decisions

UEs identify whether resources are assigned to them by receiving a L1/L2 control channel. There may be separate L1/L2 control channels for uplink and downlink resource assignment.

Scheduling decisions are signalled via MAC messages or L1/L2 control channel. It is FFS whether resources can be assigned by other means e.g. MAC headers or RRC signalling.

11.3 Measurements to Support Scheduler Operation

Measurement reports are required to enable the scheduler to operate in both uplink and downlink. These include transport volume and measurements of a UEs radio environment. The time and frequency granularity of the UE radio environment measurement reports is FFS.

Uplink buffer status reports are needed to provide support for QoS-aware packet scheduling. Uplink buffer status reports refer to the data that is buffered in the logical channel queues in the UE MAC. The uplink packet scheduler in the eNB is located at MAC level. Uplink buffer status reports may be transmitted using MAC signalling (e.g. as a specific type of MAC control PDU). A way to separately signal buffer status reports for different QoS classes may be used. To define the exact content of buffer status reports and the possible use of physical layer signalling are FFS.

The buffer reporting scheme used in uplink should be flexible in order to support different types of data services. The buffer reporting criteria are setup and reconfigured on a per user basis or per radio bearer basis (FFS) using RRC or MAC signalling (FFS). The use of System Information should also be considered for the initial setup of default buffer reporting criteria (on a per cell basis). Constraints on how often uplink buffer reports are signalled from the UEs can be specified by the network to limit the overhead from sending the reports in the uplink.

It is FFS whether additional measurement information is required to support the classification of UEs between localised and distributed resource allocation.

It is FFS whether additional measurement information is required to support cell center / cell-edge resource subdivision.

12 QoS

12.1 QoS concept and bearer service architecture

12.2 Resource establishment and QoS signalling

13 Security

13.1 Overview and Principles

13.2 Security termination points

The table below describes the security termination points.

Table 13.2 Security Termination Points

	Ciphering	Integrity Protection
NAS Signalling	Required and terminated in MME	Required and terminated in MME
U-Plane Data	Required and terminated in UPE (NOTE 1)	Need is FFS
RRC Signalling (AS)	Required and terminated in eNB (NOTE 2)	Required and terminated in eNB (NOTE 2)
MAC Signalling (AS)	Need is FFS	Need is FFS
NOTE 1: The protocol stack layer in which the ciphering takes place is FFS. The activation/deactivation of ciphering of the U-Plane is not controlled by the eNB NOTE 2: Key set for RRC protection cannot be used to derive NAS and user-plane keys.		

14 MBMS

14.1 MBMS control & functions

14.2 MBMS transmission

15 Radio Resource Management aspects

The purpose of radio resource management (RRM) is to ensure the efficient use the available radio resources and to provide mechanisms that enable E-UTRAN to meet radio resource related requirements identified in sub-clause 10 of 3GPP TR 25.913 [2]. In particular, RRM in E-UTRAN provides means to manage (e.g. assign, re-assign and release) radio resources taking into account single and multi-cell aspects.

15.1 RRM functions

15.1.1 Radio Bearer Control (RBC)

The establishment, maintenance and release of Radio Bearers involve the configuration of radio resources associated with them. When setting up a radio bearer for a service, radio bearer control (RBC) takes into account the overall resource situation in E-UTRAN, the QoS requirements of in-progress sessions and the QoS requirement for the new service. RBC is also concerned with the maintenance of radio bearers of in-progress sessions at the change of the radio resource situation due to mobility or other reasons. RBC is involved in the release of radio resources associated with radio bearers at session termination, handover or at other occasions.

RBC is located in the eNB.

15.1.2 Radio Admission Control (RAC)

The task of radio admission control (RAC) is to admit or reject the establishment requests for new radio bearers. In order to do this, RAC takes into account the overall resource situation in E-UTRAN, the QoS requirements, the priority levels and the provided QoS of in-progress sessions and the QoS requirement of the new radio bearer request. The goal of RAC is to ensure high radio resource utilization (by accepting radio bearer requests as long as radio resources available) and at the same time to ensure proper QoS for in-progress sessions (by rejecting radio bearer requests when they cannot be accommodated).

RAC is located in the eNB.

15.1.3 Connection Mobility Control (CMC)

Connection mobility control (CMC) is concerned with the management of radio resources in connection with idle or active mode mobility. In idle mode, the cell reselection algorithms are controlled by setting of parameters (thresholds and hysteresis values) that define the best cell and/or determine when the UE should select a new cell. Also, E-UTRAN broadcasts parameters that configure the UE measurement and reporting procedures. In active mode, the mobility of radio connections has to be supported. Handover decisions may be based on UE and eNB measurements. In addition, handover decisions may take other inputs, such as neighbour cell load, traffic distribution, transport and hardware resources and Operator defined policies into account.

CMC is located in the eNB.

15.1.4 Dynamic Resource Allocation (DRA) - Packet Scheduling (PS)

The task of dynamic resource allocation (DRA) or packet scheduling (PS) is to allocate and de-allocate resources (including buffer and processing resources and resource blocks (i.e. chunks)) to user and control plane packets. DRA involves several sub-tasks, including the selection of radio bearers whose packets are to be scheduled and managing the necessary resources (e.g. the power levels or the specific resource blocks used). PS typically takes into account the QoS requirements associated with the radio bearers, the channel quality information for UEs, buffer status, interference situation, etc. DRA may also take into account restrictions or preferences on some of the available resource blocks or resource block sets due to inter-cell interference coordination considerations.

DRA is located in the eNB.

15.1.5 Inter-cell Interference Coordination (ICIC)

Inter-cell interference coordination has the task to manage radio resources (notably the radio resource blocks) such that inter-cell interference is kept under control. ICIC is inherently a multi-cell RRM function that needs to take into account information (e.g. the resource usage status and traffic load situation) from multiple cells. The preferred ICIC method may be different in the uplink and downlink.

ICIC is located in the eNB.

15.1.6 Load Balancing (LB)

Load balancing has the task to handle uneven distribution of the traffic load over multiple cells. The purpose of LB is thus to influence the load distribution in such a manner that radio resources remain highly utilized and the QoS of in-progress sessions are maintained to the extent possible and call dropping probabilities are kept sufficiently small. LB algorithms may result in hand-over or cell reselection decisions with the purpose of redistribute traffic from highly loaded cells to underutilized cells.

LB is located in the eNB.

15.1.7 Inter-RAT Radio Resource Management

Inter-RAT RRM is primarily concerned with the management of radio resources in connection with inter-RAT mobility, notably inter-RAT handover. At inter-RAT handover, the handover decision may take into account the involved RATs resource situation as well as UE capabilities and Operator policies. The importance of Inter-RAT RRM may depend on the specific scenario in which E-UTRAN is deployed. Inter-RAT RRM may also include functionality for inter-RAT load balancing for idle and active mode UEs.

15.2 RRM architecture

15.2.1 Centralised Handling of certain RRM Functions

15.2.2 De-Centralised RRM

15.2.3 Load balancing control

16 RF aspects

16.1 Spectrum deployments

17 UE capabilities

RRC signalling carries RRC capability and NAS signalling carries NAS capability. Some capability information may be stored in the aGW. In the uplink, some capability information may be sent early in e.g. RRC_CONNECTION_REQUEST. In the downlink, inquiry procedure of the UE capability may be supported.

18 S1 Interface

18.1 S1 User plane

Note: Placeholder for S1 user plane protocol stack.

18.2 S1 Control Plane

Note: Placeholder for S1 control plane protocol stack

18.2.1 S1 Interface Functions

Note: The following list of S1 functions reflects the status of agreements in RAN3, might be extended in forthcoming meetings.

- SAE Bearer Service Management function:
  - Setup, release.
- Mobility Functions for UEs in LTE_ACTIVE:
  - Intra-LTE Handover;
  - Inter-3GPP-RAT Handover.
- S1 Paging function:
- NAS Signalling Transport function;
- S1-interface management functions:
  - Error indication.
- Network Sharing Function;
- Roaming and Area Restriction Support function;
- NAS Node Selection Function;

18.2.2 S1 Interface Signalling Procedures

Note: The following list of S1 procedures reflects the status of agreements in RAN3, might be extended in forthcoming meetings.

- SAE Bearer signalling procedures:
  - SAE Bearer Setup procedure;
  - SAE Bearer Release procedure (EPC initiated);
  - SAE Bearer Release procedure (eNB initiated).
- Handover signalling procedures;
- Paging procedure;
- NAS transport procedure:
  - UL direction (Initial UE);
  - DL direction (Direct Transfer).
- Error Indication procedure:
  - E-UTRAN initiated error indication procedure;
  - EPC initiated error indication procedure.

19 X2 Interface

19.1 User Plane

19.2 Control Plane

The X2 control plane interface (X2-CP) is defined between two neighbour eNBs. The control plane protocol stack of the X2 interface is shown on Figure 19.2 below. The transport network layer is built on SCTP on top of IP. The application layer signalling protocol is referred to as X2-AP (X2 Application Protocol).

Note: Exact naming of application protocol FFS.

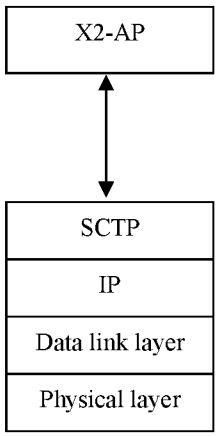


Figure 19.2: X2 Interface Control Plane

19.2.1 X2-CP Functions

The X2AP protocol supports the following functions:

- Intra LTE-Access-System Mobility Support for UE in LTE_ACTIVE:
  - Context transfer from source eNB to target eNB;
  - Control of user plane tunnels between source eNB and target eNB.
- General X2 management and error handling functions:
  - Error indication.

19.2.2 X2-CP Procedures

The elementary procedures supported by the X2AP protocol are listed in Table 19.2.2 below:

Table 19.2.2: X2-CP Procedures

Elementary Procedure	Initiating Message	Response Message of Successful Outcome	Response Message of Unsuccessful Outcome	Description & comments
Handover Preparation	HANDOVER REQUEST	HANDOVER SUCCESS	HANDOVER FAILURE	Used by source eNB to request a handover the target eNB
Release Resource	RELEASE RESOURCE	-	-	Used by the target eNB to signal to source eNB that control plane resources for the handed over UE context can be released.
Error Indication	ERROR INDICATION	-	-	Used by the eNB to report errors in a receiv message provided they cannot be reported an appropriate response message.

Note: this initial list might be extended.

20 System and Terminal complexity

20.1 Overall System complexity

20.2 Physical layer complexity

20.3 UE complexity

21 Support for self-configuration and self-optimisation

21.1 Definitions

This concept includes several different functions from eNB activation to radio parameter tuning. Figure 19.1 is a basic framework for all self-configuration /self-optimization functions.

Self-configuration process is defined as the process where newly deployed nodes are configured by automatic installation procedures to get the necessary basic configuration for system operation.

This process works in pre-operational state. Pre-operational state is understood as the state from when the eNB is powered up and has backbone connectivity until the RF transmitter is switched on.

As described in Figure 21.1, functions handled in the pre-operational state like:

- Basic Setup and
- Initial Radio Configuration

are covered by the Self Configuration process.

NOTE: depending on the final chosen functional distribution in RAN, the feasibility of following items should be studied e.g.:

- To obtain the necessary interface configuration;
- Automatic registration of nodes in the system can be provided by the network;
- Alternative possibilities for nodes to obtain a valid configuration;

- The required standardization scope.

Self-optimization process is defined as the process where UE & eNB measurements and performance measurements are used to auto-tune the network.

This process works in operational state. Operational state is understood as the state where the RF interface is additionally switched on.

As described in Figure 21.1, functions handled in the operational state like:

- Optimization / Adaptation

are covered by the Self Optimization process.

NOTE: depending on the final chosen functional distribution in RAN the feasibility of following items should be studied e.g.:

- The distribution of data and measurements over interfaces relevant to RAN3;
- Functions/entities/nodes in charge of data aggregation for optimization purpose;
- Dependencies with O&M and O&M interfaces, in the self optimization process;
- The required standardization scope.

The architecture of logical self-configuration/optimization functionality is FFS.

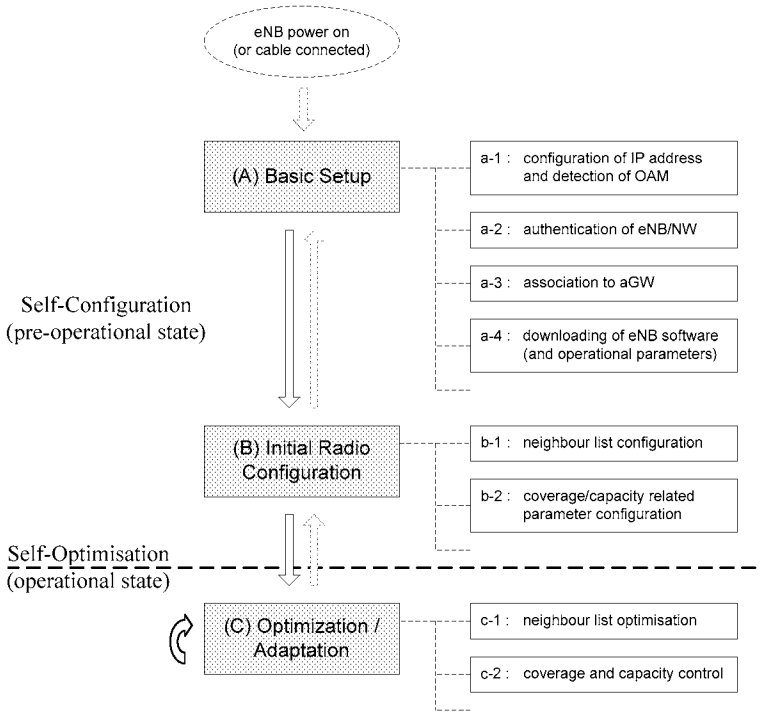


Figure 21.1: Ramifications of Self-Configuration /Self-Optimization functionality

22 Others

22.1 Support for real time IMS services

Annex A (informative): NAS Overview

This subclause provides for information an overview on services and functions provided by the NAS control protocol..

A.1 Services and Functions

The main services and functions of the NAS sublayer include:

- SAE Bearer control (see 3GPP TR 23.882 [6]);
- LTE_IDLE mobility handling;
- Paging origination;
- Configuration and control of PDCP;
- Configuration and control of Security.

A.2 NAS protocol states & state transitions

The NAS control protocol uses the following states:

- **LTE_DETACHED**:
  - No RRC entity.
- **LTE_IDLE**:
  - RRC_IDLE State;
  - Some information is stored in the UE and in the network:
    - IP address, etc;
    - Security association (keys, etc);
    - UE capability information (FFS);
    - Radio Bearers (FFS);
  - State transition decided in eNB or aGW (FFS);
- **LTE_ACTIVE**:
  - RRC_CONNECTED State;
  - State transition decided in eNB or aGW (FFS);

The following figure reflects how the NAS states relate to the RRC:

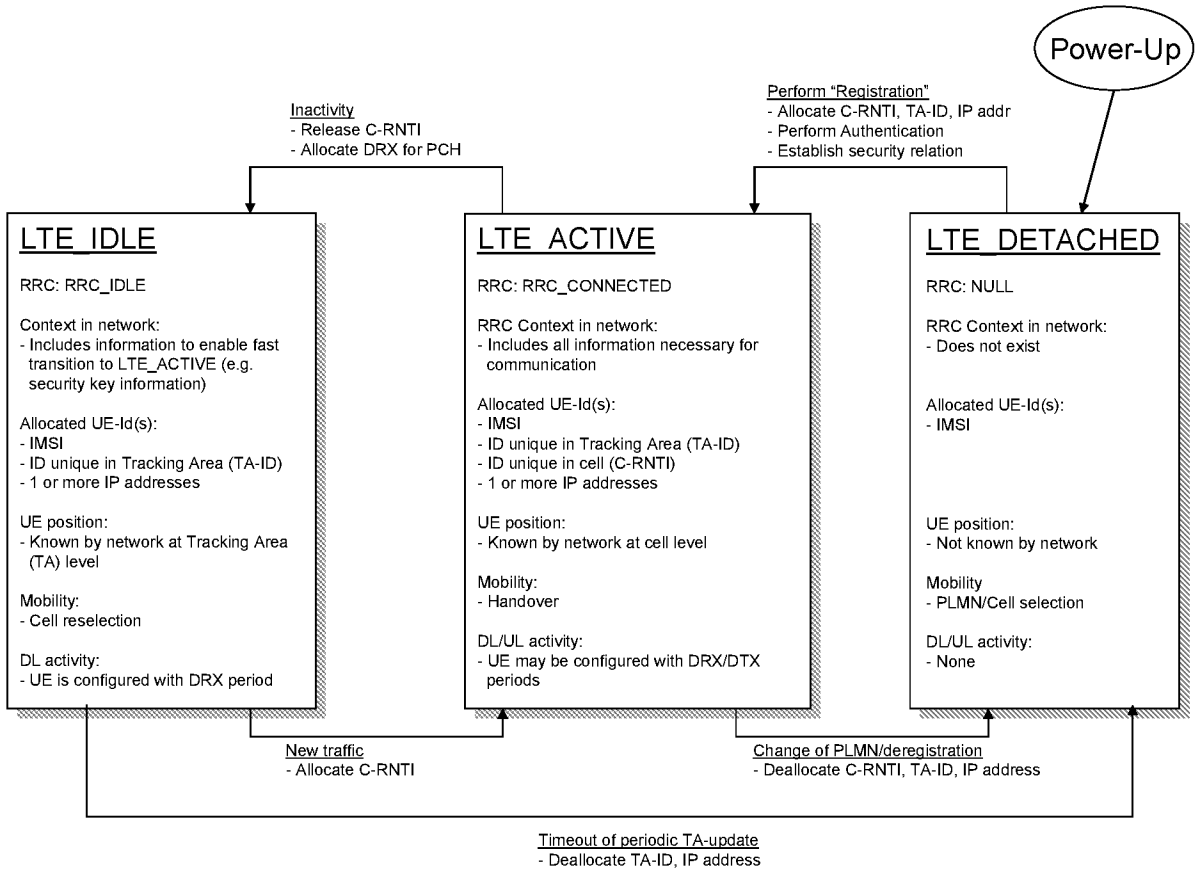


Figure A.2: E-UTRAN RRC protocol states

NOTE: The applicability of the ID unique in Tracking Area (TAID) in LTE_DETACHED is FFS.

The UE context in the aGW will discriminate the 3 states. The UE context in the eNB will only exist in the LTE_ACTIVE state.

Annex B (informative): MAC and RRC Control

The E-UTRA supports control signalling in terms of MAC control signalling (L1/L2 control channel and MAC control PDU) and RRC control signalling (RRC message).

B.1 Difference between MAC and RRC control

The different characteristics of MAC and RRC control are summarized in the table below.

Table B.1: Summary of the difference between MAC and RRC control

	MAC control		RRC control
Control entity	**MAC**		**RRC**
Signalling	L1/L2 control channel	MAC control PDU	RRC message
Signalling reliability	~ 10^{-2} (no retransmission)	~ 10^{-3} (after HARQ)	~ 10^{-6} (after ARQ)
Control delay	Very short	Short	Longer
Extensibility	None or very limited	Limited	High
Security	No integrity protection No ciphering	No integrity protection No ciphering	Integrity protected Ciphering (FFS)

The main difference between MAC and RRC control lies in the signalling reliability. Due to the signalling reliability, signalling involving state transitions and radio bearer configurations should be performed by RRC. Basically, all signalling performed by RRC in UTRA should also be performed by RRC also for E-UTRA.

B.2 Classification of MAC and RRC control functions

The table below illustrates the classification of MAC and RRC control functions for E-UTRAN.

Table B.2: Classification of MAC and RRC control functions

		Controlled configuration/parameters
MAC control signalling	**L1/L2 control channel**	Short-lived (PRB) and dynamic (MCS) allocation Long-lived (PRB) and fixed (MCS) allocation (FFS) Timing Advance (FFS)
	MAC control PDU	Timing Advance (FFS) RLC related control PDU (FFS)
RRC control signalling	**RRC message**	Long-lived (PRB) and fixed (MCS) allocation (FFS) Activation/deactivation of long-lived (PRB) and/or fixed (MCS) allocation (FFS) TTI configuration for variable TTI length control (FFS) Static parameter configuration for UE inactivity control within RRC_ACTIVE (e.g. DRX/DTX periods)

Annex C (informative): System Information

This annex provides an overview of the classification and division of system information between static and flexible parts. Considerations about dedicated distribution of system information are also included.

C.1 SI classification

Five categories are identified for system information classification:

1. Information valid across multiple cells;
2. Information needed at cell/PLMN search;
3. Information needed prior to cell camping;
4. Information needed before cell access;
5. Information needed while camping on a cell.

From UEs' point of view, the information that is needed at cell selection and prior to camping are very similar. Before a UE can camp on a cell, it needs to know if the access is allowed in that cell. Thus it would be very beneficial to know all access restrictions already at cell search phase.

C.1.1 Information valid across multiple cells

The pieces of information that can be valid across multiple cells are:

- A-GNSS assistance data;
- PLMN identity(ies);
- Tracking area identity;

Note: the above text will be revised if it is agreed that a cell can be a member of more than one tracking area.

- Predefined configuration information;
- System Frame Number if it does not change from cell to cell (in case of synchronized network);
- Some measurement/mobility information (FFS).

C.1.2 Information needed at cell/PLMN search

In order to support full mobility within the serving frequency layer, the UEs need to perform cell search rather often and thus it is seen very important that the information needed in cell search phase is readily available, thereby improving cell search times and minimizing UE power consumption. If system information decoding is needed for identifying a cell, fast system information reception is needed in order to avoid too long identification times. For optimising PLMN search and make PLMN search fast and non-complex, the information needed for PLMN search should be easily available. The pieces of information that are needed at cell/PLMN search are:

- PLMN identity(ies): in order to acquire information to which PLMN the cell belongs, UEs need to receive PLMN identity(ies);

NOTE: There may be multiple PLMN identities for one cell.

- Measurement cell identity (FFS): there needs to be a cell identity in the system information, in order to allow UEs to identify the cell reliably for measurement purposes.

NOTE: UEs may identify the cell also based on the reference sequence detection;
There is another cell identity that identifies the cell within e.g. PLMN.

NOTE: UEs may have to check possible cell access restrictions before selecting cell/PLMN;
For cell/PLMN search UEs might need some L1 parameters.

C.1.3 Information needed prior to cell camping

Before a UE can camp on a cell, it needs to know any access related parameters in order to avoid camping on cells where access is forbidden. Thus prior to camping on a cell, a UE needs to know the following information:

- Any cell access restriction parameters, e.g.:
  - Tracking area identity: if the forbidden TA concept is adopted from legacy systems, then the UE needs to know whether the cell belongs to such forbidden TA.

Note: the above text will be revised if it is agreed that a cell can be a member of more than one tracking area.

  - Cell barring status and cell reservation status (FFS if needed per PLMN): the UE needs to know whether the cell is barred or reserved in order to avoid camping on a barred cell. Possibly also barring time might be needed in order to avoid UE to poll barring time frequently from the system information. Another option is that barring status is indicated also in the neighbour cell list.
  - Radio access limitation parameters:
    - Any radio condition parameters that limit the access to the cell e.g. similar to GSM C1/S criteria;
    - It is FFS if we need to have some band information indication also, in order to allow UEs to check possible band support before camping on the cell.

NOTE: UE may need some L1 parameters prior to camping.

C.1.4 Information needed prior to cell access

Once a UE has camped on a cell, the information needed prior to cell access (transmission/reception) includes at least:

- System Frame Number (SFN) (FFS)
  - SFN is probably needed by the UE to understand the scheduling parameters (e.g. scheduling information for secondary SI, RACH, PCH, E-MBMS etc.)
- L1 information, example set of needed L1 parameters:

Note: RAN1 needs to define what parameters are needed at this phase.

  - Carrier Bandwidth: FFS if separate bandwidths for UL and DL are needed;
  - Carrier center frequency (FFS);
  - Cyclic Prefix parameters: in order to decode DL-SCH UE needs to know the CP length arrangements;
  - MIMO related parameters: in order to take advantage of the multi-antenna transmissions like MIMO, the UE needs to know parameters of number of TX antennas, DL/UL pre-coding matrices, etc...;
  - Band Information: may be needed if the same DL carrier frequency has variable UL carrier frequency;
  - L1/L2 signalling channel structure parameters: if L1/L2 signalling channel has variable configurations, the UE may need to know its channel structure at least partly. L1/L2 signalling is crucial to receive any allocation information. If Random Access Response is transmitted without L1/L2 signalling (e.g. synchronous transmission with Random Access Preamble), this information might not be required;
- RACH parameters (needed by the UE to start usage of RACH):

- RACH scheduling information: UE needs to know where in time (sub-frame) and frequency (Physical Resource Units) the RACH channel is located;
- RACH sequences: UE needs to know the RACH set of sequences to choose from. The sequences may not be fully of equal meaning (e.g. CQI can be classified for the sequences in a specific way);
- Access class restrictions: access class restrictions might be needed to limit the number of possible UEs using RACH;
- Persistence values: possible persistence value scheme parameters are needed for RACH usage;
- Other parameters related to RACH: UE needs to know the timers and parameters related to RACH e.g. how often the UE retransmits RACH and how many times the retransmission is allowed etc;
- RACH power control parameters: UE needs to know parameters related to UL power control.

C.1.5 Information needed while camping on a cell

When a UE has camped on a cell, it needs to continue measuring the neighbouring cells in order to stay camped. The pieces of information required for that are:

- Measurement parameters:
  - In order for the UE to start mobility procedures, it needs to receive parameters e.g. of reporting periods, reporting event parameters, time to trigger etc. UEs in RRC_IDLE state need cell reselection parameters. UEs in RRC_CONNECTED state need parameters of the neighbour cells e.g. for handover and for error recovery cases.
  - Neighbour cell lists are needed to start neighbour cell measurements. UEs in different states may use different sets of neighbour cell lists. Neighbour cell list may contain following parameters:
    - Some L1 parameters: FFS what parameters are needed in the neighbour cell list;
    - All information that is needed for camping: see sub-clauses C.2.2 and C.2.3 (FFS);
    - Synchronization information: indicating whether the neighbouring cell is synchronized to the current cell i.e. the cell sending the neighbour cell list (FFS);
    - PLMN identity(ies) & tracking area identity (FFS);

Note: the above text will be revised if it is agreed that a cell can be a member of more than one tracking area.

  - Other 3GPP RAT information: e.g. neighbour cell information of GERAN/UTRAN cells;
  - Information of non-3GPP access systems (e.g. WIMAX).
- Secondary NAS parameters:
  - Any NAS parameters that were not presented earlier e.g. cell identity uniquely identifying cell within wide area e.g. PLMN;
  - Cell identity (PLMN level) (FFS if this should be in category "Information needed prior to cell access").
- Secondary UE timer values: any timer values that affect UE's behaviour.
- Paging parameters: UEs in LTE_IDLE state need to receive paging parameters e.g. DRX periods and scheduling.
- Clock time (FFS): the network might send system clock in order to let UEs update their clock time e.g. in the user interface;
- MBMS service parameters: any parameters needed for MBMS reception e.g. MBMS multiplexing parameters, MBMS frequency;

NOTE: the presence of these parameters also indicate the presence of MBMS service in the cell (dedicated or mixed cell).

- Signalling Radio Bearer parameters: may be broadcasted unless they are standardized.

C.1.6 Thoughts about category division

From UEs' point of view the categories in sub-clauses C.1.2 and C.1.3 are very similar. Thus it is questionable whether we need to differentiate procedures between cell search/selection/camping and PLMN search.

From UEs' point of view, the difference between the procedure for cell search during RRC_CONNECTED and the procedure for cell search during RRC_IDLE state maybe small. When the UE is in RRC_CONNECTED state, it measures the neighbour cell and executes handovers commanded by the network.

C.2 Division of SI between static and flexible parts

System information distribution can be classified into two distinctive parts: static and flexible. Static part is sent more often, say once per frame, in the cell and has quite a limited capacity for information transfer. The flexible part has flexible amount of scheduled resources available and thus most of the SI information is contained there.

C.2.1 Static part

The static parts of the System Information are:

- L1 information in order to decode the rest of the information

Note: detailed information on the required information will be defined by RAN1;

- Measurement Cell identity (FFS): it may be possible that L1 channels do not identify the cell. Then some Cell identity needs to be sent on system information part;
- Any cell access restriction parameters e.g.:
  - Tracking area identity: if forbidden TA concept is adopted from legacy systems then UEs need to know whether the cell belongs to forbidden TA;

Note: the above text will be revised if it is agreed that a cell can be a member of more than one tracking area.

  - Cell barring and cell reservation status (FFS if needed per PLMN): UEs need to know whether cell is barred or reserved in order to avoid camping on barred cell. Possibly also barring time might be needed in order to avoid UEs to poll barring time frequently from the system information;
  - Radio access limitation parameters: any radio condition parameters that limit the access to the cell e.g. similar to GSM C1/S criteria;
  - PLMN identity(ies): in order to acquire information to which PLMN cell belongs, UEs need to receive PLMN identity(ies).

NOTE: there may be multiple PLMN identities for one cell.

- Scheduling parameters:
  - All of the scheduling information of flexible part or part of scheduling information (e.g. scheduling block) of flexible part. If static part consists of multiple SI blocks then it may be necessary to have scheduling information of those blocks in the static part.
    - Scheduling block defines, from where (time and frequency resources) to decode the SI blocks of the scheduled flexible part. It may be possible that scheduling of scheduling block is standardized, then this information can be omitted from the static part. If several types of scheduling blocks are defined , scheduling information might be sent for each scheduling block.
- Value_tag(s): informs whether the information transmitted on the flexible part has changed. This is needed in order to avoid UEs from reading any unchanged information repeatedly. Another possibility is to send this information in L1/L2 signalling channel, but possibly it would cause too much overhead.

NOTE: It also is possible to include Value_tag for SI on the flexible part indicating more precisely what changes have occurred in the system information.

NOTE: There may be a need for indicating changes in static part with value tag also, if static part consists of multiple SI blocks.

Table C.2.1 gives an estimate of the size of the elements mentioned above.

Table C.2.1: Initial rough estimates for static part capacity requirement

Information element	Bits
Cyclic Prefix (FFS)	2
Carrier BW (FFS)	3-8
MIMO parameters (FFS)	2 (+ 3)
Cell Id (FFS)	9
Tracking Area Id (+ FFS how many additional)	[16-28]
Cell Barring status+ possible Time of barring	1+4
Cell reservation status	[2]
Radio access limitation parameters	12
PLMN id(s) maximum of 5 (24 bits per one) - see Note	120
Scheduling parameters	(12-108)
Value Tag	4
SFN (FFS)	11

NOTE: It might not be necessary to send the Mobile Country Code part of the PLMN identity for each indicated PLMN to limit the number of bits.

C.2.2 Flexible part

The flexible part has different types of Information Elements which require independent scheduling in order to allow fast enough reception and not to waste transmission capacity. For example, the requirement to receive cell access parameters is very different than e.g. the clock time. Thus following flexible part division should be considered:

- Scheduling block: scheduling information of the secondary part of the System Information.
- Access parameters:
  - All parameters not present in the primary part (e.g. some L1 parameters);
  - RACH parameters;
  - Power control parameters;
  - Paging parameters;
  - Any timer values needed for operating in the cell and in the network.
- Measurement related parameters:
  - Neighbour cell lists;
  - Cell selection/reselection parameters;

NOTE: Some of these parameters are included in the static part element “Radio access limitation parameters.”

  - Measurement control information;
- Non vital information:
  - Clock time;
  - Positioning (A-GNSS etc.) information;

- Service parameters (e.g. MBMS parameters);
- Secondary NAS parameters.

C.2.3 Information whose location is FFS

The location of the following information is FFS:

- System Frame Number: SFN might be needed very fast i.e. for HO purposes. SFN might be needed also for decoding scheduling block parameters, but on the other hand it might be requested not to send often changing information on the static part in order to be able to make time soft combining. Further investigation on the SFN broadcasting is thus needed.

C.2.4 Dedicated part

The dedicated part is embedded in the RRC message that is meant for sending System Information Elements in unicast mode e.g. for HO purposes, positioning purposes …. The UE needs some information for the neighbouring cell to access it, this is needed to limit the interruption times caused by HO execution. When a UE receives a HO COMMAND it needs at least following information from the target cell:

- All information in the static part (see sub-clause C.2.1): may be received by the UE by itself;
- Most of the information from the access parameters (see sub-clause C.2.2): is favourably delivered by dedicated manner via the source cell, because the UE might not have time to get all the necessary secondary SI from the target cell;
- System Frame Number is needed to minimize the interruption times during the HO procedure. Most probably the UE needs to receive (at least confirm) the SFN directly by the neighbour cell SI reading, because giving the SFN via source cell may cause some inaccuracy to the SFN.

Annex D (informative): MBMS

D.1 MBMS control & functions

The E-UTRAN supporting MBMS comprises eNBs and co-ordinating functions.

The functions hosted by the eNB may be:

- Scheduling and transmission of MBMS control information;
- Scheduling of single-cell MBMS transmissions;
- Transmission of single-cell and multi-cell MBMS services;
- Radio bearer control for MBMS.

The co-ordinating functions may include:

- Distribution of MBMS services;
- Co-ordination of multi-cell MBMS transmissions;
- MBMS SAE bearer control.

It is FFS which node in E-UTRAN performs the co-ordination functions.

D.2 MBMS transmission

A point-to-multipoint radio bearer is used to carry MBMS traffic. It is FFS whether a point-to-point radio bearer is also used to carry MBMS traffic or not. Improvements for single-cell MBMS transmission (e.g. HARQ) and MCS that would enable potential removal of p-t-p transmissions for MBMS are FFS.

A frequency layer can be dedicated to MBMS transmissions:

- When a cell belongs to a frequency layer dedicated to MBMS transmissions (MBMS-dedicated cell):
  - The MBMS transmission (MTCH and MCCH) occurs on MCH or DL-SCH (FFS);
  - No uplink or counting mechanism supported;
  - No support for unicast data transfer in the cell;
  - The occurrence of paging messages on the frequency layer dedicated to MBMS transmission is FFS:
    - If paging messages were allowed, the UE could answer in a non-E-UTRA cell e.g. UTRA cell (FFS);
  - The possible multi-cell p-t-m transmission with SFN operation on the MCH of the SFN area is semi-statically configured e.g. by O&M.
  - Single-cell p-t-m transmission is possible.
- When a cell does not belong to a frequency layer dedicated to MBMS transmissions (MBMS/Unicast-mixed cell):
  - Transmission of both unicast and MBMS transmissions in the cell is done in a co-ordinated manner on DL-SCH and or MCH+DL-SCH (FFS);
  - The possible SFN operation on the MCH of the SFN area is semi-statically configured e.g. by O&M; or the SFN area is dynamic and may be based on counting mechanisms (FFS).
  - Counting is possible (FFS);

- P-t-p transmission on DL-SCH is FFS.

There are two types of MBMS transmissions in E-UTRA/E-UTRAN:

a) Single-cell transmission (no SFN operation):

- The MBMS service, e.g. message distribution, is transmitted only on the coverage of a specific cell;
- The MBMS service (MTCH and MCCH) may be transmitted on DL-SCH or MCH (FFS);
- Combining of MBMS transmission from multiple cells is not supported;
- Counting for switching between p-t-p and p-t-m radio bearer may be supported (FFS);
- The p-t-m/p-t-p switching points are either dynamically decided based on counting mechanism or semi-statically configured by O&M (FFS).

b) Multi-cell transmission (SFN operation):

- The MBMS service (MTCH and MCCH) is transmitted on MCH;
- Combining is supported with SFN;
- Synchronous transmission.

The BCCH indicates where the MCCH(s) are:

- One (or none) MCCH per cell for cell specific transmission;
- MCCH(s) sent in SFN area for non-cell specific transmission.

Having a feedback mechanism for MTCH transmission is FFS: statistical feedback, TTI based NACK or something else. Also is FFS if the re-transmission is a single cell transmission in all cases.

D.3 Deployment Scenarios

In terms of deployment scenarios of MBMS in E-UTRAN, the following alternatives can be listed:

- Carrier type: dedicated vs. mixed carrier;
- SFN transmission: multi-cell vs. single-cell transmission;
- Radio bearer type: p-t-m vs. p-t-p;
- Counting: yes or no;
- Audience measurement: yes or no;
- ON/OFF control of MBMS service delivery: yes or no;
- PTP / PTM radio bearer switching: yes or no;

Table D.3 below lists the combinations of the above alternatives that are supported in E-UTRAN:

Table D.3: MBMS Deployment Scenarios

#	Carrier	Transmission	RB	Counting	Comments
1	dedicated	multi-cell	p-t-m	no	From 1 to n cells Audience measurement (FFS)
2	mixed	multi-cell	p-t-m	no	Audience measurement (FFS)
...	...	...	...	...	...

Note: other deployment scenarios will be included once agreed.

Annex <X> (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2006-06	RAN2 Ad.	R2-062020			First version.		0.0.0
2006-06	RAN2 Ad.	R2-062026			RLC operation clarified; High priority and low priority SRBs listed in RRC; New section on RRC procedures; Organisation of paging groups explained; New section on Support for self-configuration and self-optimisation.	0.0.0	0.0.1
2006-06	RAN2 Ad.	R2-062036			Four possible types of allocation added to section 11; New section for the support for real time IMS services.	0.0.1	0.0.2
2006-08	RAN2#54	R2-062206			Annex B on RRC and MAC control added. Minor editorial clarifications.	0.0.2	0.0.3
2006-09	RAN#34	RP-060603			Section 4 on “Overall Architecture” reorganised; Details on RLC operation included (segmentation, PDU size); Overview of System Information and RACH procedure added.	0.0.3	0.0.4
2006-10	RAN2#55	R2-063012			Ciphering for RRC signalling required in eNB as agreed in SA3; Agreements on RLC operation included: concatenation, discard, polling and status reports; Agreed text proposal in R3-061428 on Self Configuration added to section 19; Context transfer of header compression at UPE relocation listed as FFS. Outline of the RACH procedure described.	0.0.4	0.0.5
2006-10	RAN2#55	R2-063039			Miscellaneous editorial corrections; Agreed text proposal R3-061606 on Current status of E-UTRAN Architecture description added to section 4; Agreed text proposal in R3-061613 on Support for self-configuration and self-optimisation added to section 19. Agreed Physical layer model R2-063031 added to section 5	0.0.5	0.1.0
2006-11	RAN2#56	R2-063656			Annex C on system information classification added (R2-063064); Integrity protection for the control plane only (SA3 agreement); Agreements on PDCP and RLC PDU structure/handling reflected; Decisions on mobility aspects such as load balancing, handover, radio link failure and random access procedure added; Agreed MBMS deployment scenarios listed together with MBMS transmissions and principles from 25.813; Agreed text proposal R3-061936 on Radio Resource Management added to section 15; Agreed text proposal R3-061940 on RAN Sharing added to section 10; Agreed text proposal R3-061943 on Roaming/Area Restrictions in SAE/LTE added to section 10; Agreed text proposal R3-062008 on S1 C-Plane Functions and procedures added to section 18; Agreed text proposal R3-062011 on X2 interface added to section 19.	0.1.0	0.2.0
2006-11	RAN2#56	R2-063xxx			Incorporation of RAN1 agreement regarding the mandatory support of 20Mhz DL bandwidth for UEs i.e. removal of sub-clause 16.1; Editorial corrections.	0.2.0	0.3.0
2006-11	RAN2#56	R2-063xxx			Removal of the SA3 agreement on integrity protection for the user plane; Addition of Annex D on MBMS Transmission; Editorial corrections	0.3.0	0.3.1

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14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 08/25/2016

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
08/25/2016	ELECTRONIC

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

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

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

eoffice@volpe-koenig.com

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

2. Claims 1, 5-9, 11, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of Anderson WO 2006015984 (see also US 20080144600) and Mazur US 20020114311.

Regarding claims 1 and 11, Malladi teaches a network device comprising:

in a CDMA/W-CDMA system ([0037]);

a transceiver is configured to send, to a user equipment (UE), resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different frequency resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned times (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no

control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B);

the network device is further configured to receive, at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B).

Although Malladi US 20080090528 teaches the limitations above and the provisional teaches the PUSCH and PUCCH being assigned time and frequency resources, the ***provisional*** is silent on the network device is configured to receive at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. However, sharing a time slot was well known in the art as a means for conserving time resources (see Mazur [0038]).

Malladi is silent on the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE.

Anderson teaches the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, pg. 29 lines 10-19).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi by the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE, as suggested by Anderson. This modification would benefit the system by providing a proven, reliable method for power control.

The combination is silent on wherein the single downlink control channel shares a time slot with a physical downlink

shared channel.

Mazur teaches sharing a timeslot between traffic channel and control channel transmissions ([0038]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the single downlink control channel shares a time slot with a physical downlink shared channel, as suggested by Mazur. This modification would benefit the system by conserving time resources.

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Anderson: PLCCH implement by including one TPC data bit and two SS data bits for each UE, pg. 29 lines 21-27).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network device, signals are received over other physical uplink control channels in the times from a plurality of UEs (as shown above, it was well known in the art at the time of the instant application to transmit over the physical uplink control channel and physical uplink shared control channel in defined time slots).

Regarding claims 7-9 and 17-19, the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or universal mobile telecommunication system (UMTS) physical channel (Malladi: CDMA [0037]).

Prior Art of Record

3. US 20050022098 [0041, 0046] teaches WCDMA HS-DPCCH (high speed uplink control channel)

US 20050013287 [0006] teaches WCDMA PUSCH (uplink shared channel)

RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 14/458,693	**Applicant(s)** HOWARD, PAUL	
	Examiner RONALD B. ABELSON	**Art Unit** 2476	**AIA (First Inventor to File) Status** No

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

THE REPLY FILED 10 August 2016 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☐ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance;

(2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:

a) ☒ The period for reply expires *3* months from the mailing date of the final rejection.

b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☒ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: *See attached PTO-892*. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☐ Applicant's reply has overcome the following rejection(s): _____.

6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

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

9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because:

_____.

13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____

14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: .
Claim(s) objected to: .
Claim(s) rejected: 1, 5-9, 11, and 15-19.
Claim(s) withdrawn from consideration: .

RONALD B ABELSON
Primary Examiner

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2002/0114311 A1	08-2002	Mazur, Sara	H04W72/1236	370/347
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

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3624 7590 11/23/2018

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Application Number: 14/458,693
Filing Date: 13 Aug 2014
Appellant(s): Howard, Paul,

Harry Vartanian
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 10/17/18.

(1) Grounds of Rejection to be Reviewed on Appeal

Every ground of rejection set forth in the Office action dated 05/17/2018 from which the appeal is taken is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

The following ground(s) of rejection are applicable to the appealed claims.

Claim Rejections - 35 USC § 103

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

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

2. Claims 1, 5-9, 11, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of

Tsunehara US 20010012276, Sato US 20050222948 and Mazur US 20020114311.

Regarding claims 1 and 11, Malladi teaches a network device comprising:

in a CDMA/W-CDMA system ([0037]);

a transceiver is configured to transmit, to a user equipment (UE), a first signal that includes resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different frequency resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned times (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B);

the network device is further configured to receive, at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information and wherein the physical uplink control channel is in a same

location in the time slot per frame (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B). Note, the Examiner maintains the teachings of Malladi entail the physical uplink control channel is in a same location in the time slot per frame given Malladi does not mention changing the location of the physical uplink control channel.

Although Malladi US 20080090528 teaches the limitations above and the provisional teaches the PUSCH and PUCCH being assigned time and frequency resources, the ***provisional*** is silent on the network device is configured to receive at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. However, sharing a time slot was well known in the art as a means for conserving time resources (see Mazur [0038]).

Malladi is silent on the transceiver is further configured to transmit, over a single downlink control channel to the UE, a second signal that includes a plurality of power commands for a plurality of UEs, wherein each power command controls a

transmission power level of the physical uplink control channel of a respective UE.

Tsunehara teaches the transceiver is further configured to transmit, over a single downlink control channel to a plurality of UEs, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE (common channel shared by the mobile terminals, base station can perform transmission power control of mobile terminals by transmitting power control signals via single common channel, [0072], CDMA, abstract).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi by the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE, as suggested by Tsunehara. This modification would benefit the system by providing a proven, reliable method for power control.

Although Tsunehara teaches the transceiver is further configured to transmit, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of a plurality of UEs, the

combination is silent on transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs.

Sato makes obvious transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs ([0001, radio transceiver Z11 transmits control signals to relay terminals, [0150], base station to transmit control signals to relay terminals, [0154], CDMA, [0102], fig. 1, 4, 9, 10). Note, power control signals are control signals.

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs, as suggested by Sato. This modification would benefit the system by when the UE is out of range of the destination base station.

Although Malladi teaches CDMA ([0005]) and transmitting downlink control channels and a physical downlink shared channel (see provisional [0024]) and it was well known in the art at the time of the instant application in CDMA networks to transmit in the downlink control channel information in a single timeslot (see 20010048711: each frame of the pilot channel consists of plural time slots, abstract and 20020085522: time slots of the dedicated physical channels can be shifted in time in relation

to the time slots (slot 0, slot 1, . . .) of the pilot channel (CPICH), abstract) and shared channel information in a single timeslot (see 20020105929: for each slot, transmitting a forward shared channel, [0017] and 20020136193: each time slot includes a high-speed downlink shared channel, [0029]), the combination is silent on wherein the single downlink control channel shares a time slot with a physical downlink shared channel.

Mazur teaches sharing a timeslot between traffic channel / “physical downlink shared channel” and control channel transmissions ([0038]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the single downlink control channel shares a time slot with a physical downlink shared channel, as suggested by Mazur. This modification would benefit the system by conserving time resources.

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Tsunehara: common channel shared by the mobile terminals, base station can perform transmission power control of mobile terminals by transmitting power control signals via single common channel, [0072], CDMA, abstract).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network device, signals are received over other physical uplink control channels in the times from a plurality of UEs (as shown above, it was well known in the art at the time of the instant application to transmit over the physical uplink control channel and physical uplink shared control channel in defined time slots).

Regarding claims 7-9 and 17-19, the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or universal mobile telecommunication system (UMTS) physical channel (Malladi: CDMA [0037]).

(2) Response to Argument

Appellant contends, "Since Tsunehara only relates to CDMA, the channels and timing described for the power control are structured differently than claim 1 such that "wherein the

single downlink control channel shares a time slot with a physical downlink shared channel" for the operation of transmitting "over a single downlink control channel to the UE, a second signal that includes a plurality of power commands for a plurality of UEs, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE." (pg. 9 last paragraph). However, as stated above, Malladi teaches CDMA ([0005]) and transmitting downlink control channels and a physical downlink shared channel (see provisional [0024]) and it was well known in the art at the time of the instant application in CDMA networks to transmit in the downlink control channel information in a single timeslot (see 20010048711: abstract and 20020085522: abstract) and shared channel information in a single timeslot (see 20020105929 [0017] and 20020136193 [0029]).

Appellant states Sato does not teach or suggest "wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE" (pg. 10 last paragraph). As shown above, the Examiner maintains Sato makes this limitation obvious since the base station in Sato is

transmitting control signals to the relay terminals and each relay terminal may forward control signals to multiple UEs. Furthermore, Appellant contends Sato does not state control signals for multiple terminals are sent to a relay terminal (pg. 11 1st paragraph). However, this is false (see Sato radio transceiver Z11 transmits control signals to relay terminals, [0150], base station to transmit control signals to relay terminals, [0154] fig. 1, 4, 9, 10). Appellant contends Sato does not state control signals are sent on a single downlink control channel (pg. 11 1st paragraph). However, Tsunehara teaches transmitting on a downlink control channel. Also, (pg. 11 1st paragraph) Appellant states control signals do not have to be power control signals. However, in every CDMA system power control is an integral component of the system.

Appellant contends "a substantial reconstruction or redesign at least of Malladi, Tsunehara, and Sato is needed to provide the basis for a prima facie case of obviousness" (pg. 11 last paragraph). For the reasons described above, the Examiner maintains this contention is false.

On pages 12 and 13 of the Appeal Brief the Appellant contends impermissible hindsight for combining the references Malladi, Tsunehara, Sato, and Mazur. The primary reference, Malladi, refers to a CDMA network. The Tsunehara reference, which also pertains to a CDMA network, teaches the limitation

"the transceiver is further configured to transmit, over a single downlink control channel to a plurality of UEs, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE". Furthermore, Sato teaches, in a CDMA environment, a base station transmitting control signals to relay terminals wherein each relay terminal may forward the control signals to a plurality of UEs. In addition, Mazur teaches sharing a timeslot between traffic channel / "physical downlink shared channel" and control channel transmissions was well known in the art at the time of the instant application. Therefore, the Examiner maintains the combination of the references would have been obvious to one of ordinary skill in the art at the time of the instant application.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Conferees:

/PHIRIN SAM/
Primary Examiner, Art Unit 2476

/AYAZ R SHEIKH/
Supervisory Patent Examiner, Art Unit 2476

Requirement to pay appeal forwarding fee. In order to avoid dismissal of the instant appeal in any application or ex parte reexamination proceeding, 37 CFR 41.45 requires payment of an appeal forwarding fee within the time permitted by 37 CFR 41.45(a), unless appellant had timely paid the fee for filing a brief required by 37 CFR 41.20(b) in effect on March 18, 2013.

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination Howard, Paul	
	Examiner RONALD B ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
	A	20010048711	12-2001	Sun	H04K 1/00	
	B	20020085522	07-2002	Huber	H04B 7/216	
	C	20020105929	08-2002	Chen	H04B 7/216	
	D	20020136193	09-2002	Chang	H04B 7/185	
	E					
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	I					
	J					
	K					
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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	U	
	V	
	W	
	X	

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

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eoffice@volpe-koenig.com

Office Action Summary	Application No. 14/458,693	Applicant(s) HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	AIA (First Inventor to File) Status No

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *3/30/16*.

☐ 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) *1,2,4-9,11,12 and 14-19* 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, 2, 4-9, 11, 12, and 14-19* 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 *8/13/14* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

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

2. Claims 1, 4-9, 11, and 14-19 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of Anderson WO 2006015984 (see also US 20080144600).

Regarding claims 1 and 11, Malladi teaches a network device comprising:

in a CDMA/W-CDMA system ([0037]);

a transceiver is configured to send, to a user equipment (UE), resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different frequency resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned frequencies;

the network device is further configured to receive, at frequencies that the physical uplink shared channel is not

received, a signal over the physical uplink control channel in relation to the sent resource allocation information (fig. 3, PUSCH, PUCCH, [0041, 0042], see also prov. 60/819,268 fig. 4A, 4B).

Although Malladi teaches W-CDMA and frequency multiplexing the PUSCH and PUCCH, the reference is silent on the network device is configured to receive at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. However, time slotting physical uplink control channels and physical uplink shared control channels was well known in the art at the time of the instant invention. Raaf US 7180902 col. 1 ln 66 – col. 2 ln 4 teaches time slots for a physical uplink control channel (DPCCH); Muraoka WO 2005083897 (for translation see US 20070177656 [0015, 0044] teaches time-slots shared uplink channel; and Masseroni US 20030054850 teaches time slots for physical uplink shared control channel, abstract, claim 1.

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi teaches by the network device is configured to receive at a time slot that

the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. This modification would benefit the system by decreasing the probability of interference by time multiplexing the PUSCH and PUCCH.

Malladi is silent on the transceiver is further configured to send, over a downlink control channel, feedback information.

Anderson teaches a processor in a UE configured to receive feedback information from a downlink control channel (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, pg. 29 lines 10-19).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi by the processor is further configured to receive feedback information from a downlink control channel, as suggested by Anderson. This modification would benefit the system by providing a proven, reliable method for the UEs to receive feedback data.

Regarding claims 4, 14, the feedback information includes power control information (Anderson: PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, pg. 29 lines 10-19).

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Anderson: PLCCH implement by including one TPC data bit and two SS data bits for each UE, pg. 29 lines 21-27).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network device, signals are received over other physical uplink control channels in the times from a plurality of UEs (as shown above, it was well known in the art at the time of the instant application to transmit over the physical uplink control channel and physical uplink shared control channel in defined time slots).

Regarding claims 7-9 and 17-19, the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division

multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or universal mobile telecommunication system (UMTS) physical channel (Malladi: CDMA [0037]).

3. Claims 2 and 12 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Malladi and Anderson as applied to claims 1 and 11 above, and further in view of Lamontagne US 20050002360.

The combination is silent on the processor is further configured to send data on a physical downlink shared channel.

Lamontagne teaches the processor is further configured to send data on a physical downlink shared channel ([0037]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the processor is further configured to send data on a physical downlink shared channel, as shown by Lamontagne. This modification would benefit the system by providing a proven, reliable method for transmitting downlink data.

Prior Art of Record

4. US 20050022098 [0041, 0046] teaches WCDMA HS-DPCCH (high speed uplink control channel)

US 20050013287 [0006] teaches WCDMA PUSCH (uplink shared channel)

Response to Arguments

5. Applicant’s arguments with respect to amended claims have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

Conclusion

6. 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 RONALD B. ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Ayaz Sheikh can be reached on (571) 272-3795. 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.

RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-7,180,902 B1	02-2007	Raaf; Bernhard	H04B7/2646	370/441
*	B	US-2003/0054850 A1	03-2003	Masseroni, Carlo	H04W52/367	455/522
*	C	US-2005/0002360 A1	01-2005	Lamontagne, Rene	H04L27/2608	370/335
*	D	US-2005/0022098 A1	01-2005	Vayanos, Alkinoos Hector	H04L1/1845	714/776
*	E	US-2005/0013287 A1	01-2005	Wallentin, Pontus	H04W28/16	370/352
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N	WO2006015984	02-2006	Great Britain	Anderson	H04Q 7/38
	O	WO2005083897	09-2005	Japan	Maruta	H04B 1/707
	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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 03/21/2017

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EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
03/21/2017	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

Office Action Summary	Application No. 14/458,693	Applicant(s) HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	AIA (First Inventor to File) Status No

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *3/10/17, 3/2/17*.

☐ 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) *1,5-9,11 and 15-19* 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, 5-9, 11, and 15-19* 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 *8/13/14* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *3/10/17*.

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

4) ☐ Other: _____.

IPR2025-00221 Exhibit 2009 Page 354 of 492

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

Claim Rejections - 35 USC § 103

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

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

3. Claims 1, 5-9, 11, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of Baker US 6754505, Sato US 20050222948 and Mazur US 20020114311.

Regarding claims 1 and 11, Malladi teaches a network device comprising:

in a CDMA/W-CDMA system ([0037]);

a transceiver is configured to send, to a user equipment (UE), resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different frequency resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned times (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B);

the network device is further configured to receive, at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B).

Although Malladi US 20080090528 teaches the limitations above and the provisional teaches the PUSCH and PUCCH being assigned time and frequency resources, the ***provisional*** is silent

on the network device is configured to receive at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. However, sharing a time slot was well known in the art as a means for conserving time resources (see Mazur [0038]).

Malladi is silent on the transceiver is further configured to transmit, over a single downlink control channel to the UE, a plurality of power commands, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE.

Baker teaches the transceiver is further configured to transmit, over a single downlink control channel to the UE, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE (col. 1 line 57 – col. 2 line 41, CDMA col. 7 lines 1-11).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi by the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the

physical uplink control channel of a respective UE, as suggested by Baker. This modification would benefit the system by providing a proven, reliable method for power control.

Although Baker teaches the transceiver is further configured to transmit, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE, the combination is silent on transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs.

Sato makes obvious transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs ([0001, radio transceiver Z11 transmits control signals to relay terminals, [0150], base station to transmit control signals to relay terminals, [0154] fig. 1, 4, 9). Note, power control signals are control signals.

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs, as suggested by Sato. This modification would benefit the system by when the UE is out of range of the destination base station.

The combination is silent on wherein the single downlink control channel shares a time slot with a physical downlink shared channel.

Mazur teaches sharing a timeslot between traffic channel / “physical shared channel” and control channel transmissions ([0038]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the single downlink control channel shares a time slot with a physical downlink shared channel, as suggested by Mazur. This modification would benefit the system by conserving time resources.

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Anderson: PLCCH implement by including one TPC data bit and two SS data bits for each UE, pg. 29 lines 21-27).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network

device, signals are received over other physical uplink control channels in the times from a plurality of UEs (as shown above, it was well known in the art at the time of the instant application to transmit over the physical uplink control channel and physical uplink shared control channel in defined time slots).

Regarding claims 7-9 and 17-19, the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or universal mobile telecommunication system (UMTS) physical channel (Malladi: CDMA [0037]).

Response to Arguments

4. Applicant's arguments with respect to the amended independent claims have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

Prior Art of Record

5. US 20050022098 [0041, 0046] teaches WCDMA HS-DPCCH (high speed uplink control channel)

US 20050013287 [0006] teaches WCDMA PUSCH (uplink shared channel)

Anderson WO 2006015984 (see also US 20080144600) (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, pg. 29 lines 10-19)

US 20020094834 [0042] teaches an MS adjusting the uplink physical control channel based on TPC commands. US 20010026543 [0228] downlink control channel used to send power control command.

Conclusion

6. 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.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Ayaz Sheikh can be reached on (571) 272-3795. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2005/0222948 A1	10-2005	Sato, Hijin	G06Q20/102	705/40
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 05/17/2018

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
05/17/2018	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

Office Action Summary	Application No. 14/458,693	Applicant(s) HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	AIA (First Inventor to File) Status No

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *4/23/18*.

☐ 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) *1,5-9,11 and 15-19* 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) *1,5-9,11 and 15-19* 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 *8/13/14* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

IPR2025-00221 Exhibit 2009 Page 366 of 492

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

Claim Rejections - 35 USC § 103

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

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

3. Claims 1, 5-9, 11, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of Tsunehara US 20010012276, Sato US 20050222948 and Mazur US 20020114311.

Regarding claims 1 and 11, Malladi teaches a network device comprising:

in a CDMA/W-CDMA system ([0037]);

a transceiver is configured to transmit, to a user equipment (UE), a first signal that includes resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different frequency resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned times (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B);

the network device is further configured to receive, at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information and wherein the physical uplink control channel is in a same location in the time slot per frame (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B). Note, the Examiner maintains the teachings of Malladi entail the physical uplink control channel is in a same location in the time slot per frame.

Although Malladi US 20080090528 teaches the limitations above and the provisional teaches the PUSCH and PUCCH being assigned time and frequency resources, the ***provisional*** is silent on the network device is configured to receive at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. However, sharing a time slot was well known in the art as a means for conserving time resources (see Mazur [0038]).

Malladi is silent on the transceiver is further configured to transmit, over a single downlink control channel to the UE, a second signal that includes a plurality of power commands for a plurality of UEs, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE.

Tsunehara teaches the transceiver is further configured to transmit, over a single downlink control channel to a plurality of UEs, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE (common channel shared by the mobile terminals, base station can perform transmission power control of mobile terminals by

transmitting power control signals via single common channel, [0072], CDMA, abstract).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi by the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE, as suggested by Tsunehara. This modification would benefit the system by providing a proven, reliable method for power control.

Although Tsunehara teaches the transceiver is further configured to transmit, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of a plurality of UEs, the combination is silent on transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs.

Sato makes obvious transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs ([0001, radio transceiver Z11 transmits control signals to relay terminals, [0150], base station to transmit control signals to relay terminals, [0154] fig. 1, 4, 9). Note, power

control signals are control signals.

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs, as suggested by Sato. This modification would benefit the system by when the UE is out of range of the destination base station.

The combination is silent on wherein the single downlink control channel shares a time slot with a physical downlink shared channel.

Mazur teaches sharing a timeslot between traffic channel / “physical downlink shared channel” and control channel transmissions ([0038]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the single downlink control channel shares a time slot with a physical downlink shared channel, as suggested by Mazur. This modification would benefit the system by conserving time resources.

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Tsunehara: common channel shared by the mobile terminals, base station can perform transmission power control of mobile terminals by transmitting power control signals via single common channel, [0072], CDMA, abstract).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network device, signals are received over other physical uplink control channels in the times from a plurality of UEs (as shown above, it was well known in the art at the time of the instant application to transmit over the physical uplink control channel and physical uplink shared control channel in defined time slots).

Regarding claims 7-9 and 17-19, the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division

multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or universal mobile telecommunication system (UMTS) physical channel (Malladi: CDMA [0037]).

Response to Arguments

4. Applicant's arguments filed 4/23/18 have been fully considered but they are not persuasive. The Examiner maintains with respect to the applicant's argument (pg. 8 last paragraph) Mazur makes "the single downlink control channel shares a time slot with a physical downlink shared channel" and (pg 10 1st paragraph) Malladi teaches "at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information and wherein the physical uplink control channel is in a same location in the time slot per frame".

Prior Art of Record

5. US 20050022098 [0041, 0046] teaches WCDMA HS-DPCCH (high

speed uplink control channel)

US 20050013287 [0006] teaches WCDMA PUSCH (uplink shared channel)

Anderson WO 2006015984 (see also US 20080144600) (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, pg. 29 lines 10-19)

US 20020094834 [0042] teaches an MS adjusting the uplink physical control channel based on TPC commands. US 20010026543 [0228] downlink control channel used to send power control command.

Conclusion

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

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

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD B. ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Ayaz Sheikh can be reached on (571) 272-3795. 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.

RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

/AYAZ SHEIKH/

Supervisory Patent Examiner, Art Unit 2476

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 05/20/2016

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
05/20/2016	ELECTRONIC

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

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

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

eoffice@volpe-koenig.com

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
14/458,693	13 August, 2014	HOWARD, PAUL	IPW2-USCN205928

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

EXAMINER	
RONALD B. ABELSON	
ART UNIT	PAPER
2476	20160512

DATE MAILED:

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

Commissioner for Patents

See attached PTO-892

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

PTO-90C (Rev.04-03)

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2007/0177656 A1	08-2007	Maruta; Yasushi	H04B1/712	375/148
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 12/30/2015

VOLPE AND KOENIG, P.C.
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EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
12/30/2015	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

Office Action Summary	Application No. 14/458,693	Applicant(s) HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	AIA (First Inventor to File) Status No

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *10/22/14 and 8/13/14*.

☐ 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) *1-20* 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) *1-20* 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 *8/13/14* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *10/22/14*.

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

4) ☐ Other: _____.

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

The Notice of Allowance sent on 11/16/15 is hereby removed.

Claim Rejections - 35 USC § 103

2. 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.

3. Claims 1, 2, 4-12, and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable Ishii US 20070265017 in view of Anderson US 20080144600.

Regarding claims 1 and 11, Ishii teaches a network device comprising:

a transceiver is configured to send, to a user equipment (UE), resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different resources (uplink control channel, PUSCH, [0207]);

the network device is configured to receive, over the physical uplink shared channel, data at assigned times (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]);

the network device is further configured to receive, at times that the physical uplink shared channel is not received, a signal over the physical uplink control channel in relation to the sent resource allocation information (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]); and

Ishii is silent on the transceiver is further configured to send, over a downlink control channel, feedback information.

Anderson teaches a processor in a UE configured to receive feedback information from a downlink control channel (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Ishii by the processor is further configured to receive feedback information from a downlink control channel, as suggested by Anderson. This modification would benefit the system by providing a proven, reliable method for the UEs to receive feedback data.

Regarding claims 2, 12, the processor is further configured to send data on a physical downlink shared channel (Ishii: PDSCH, [0207]).

Regarding claims 4, 14, the feedback information includes power control information (Anderson: PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Anderson: PLCCH implement by including one TPC data bit and two SS data bits for each UE, [0132], [0136]).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network device, signals are received over other physical uplink control channels in the times from a plurality of UEs (Ishii: uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

Regarding claims 7-10 and 17-20 , the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or universal mobile telecommunication system (UMTS) physical channel (Ishii: (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink

shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

4. Claims 3 and 13 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Ishii and Anderson as applied to claims 2 and 12 above, and further in view of Malkamaki US 20020172208.

The combination is silent on the downlink control channel and the physical downlink shared channel are time multiplexed.

Malkamaki teaches time multiplexing a physical downlink shared channel and another channel ([0008]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by having the downlink control channel and the physical downlink shared channel time multiplexed, as suggested by Malkamaki. This modification would benefit the system by providing a method of reducing interference between the two channels.

5. Claims 1 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of Anderson US 20080144600.

Regarding claims 1 and 11, Malladi teaches a network device comprising:

a transceiver is configured to send, to a user equipment (UE), resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned frequencies;

the network device is further configured to receive, at frequencies that the physical uplink shared channel is not received, a signal over the physical uplink control channel in relation to the sent resource allocation information (fig. 3, PUSCH, PUCCH, [0041, 0042], see also prov. 60/819,268 fig. 4A, 4B). Although Malladi teaches frequency multiplexing the PUSCH and PUCCH, time multiplexing the channels would have been

obvious to one of ordinary skill in the art at the time of the instant application.

Malladi is silent on the transceiver is further configured to send, over a downlink control channel, feedback information.

Anderson teaches a processor in a UE configured to receive feedback information from a downlink control channel (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi by the processor is further configured to receive feedback information from a downlink control channel, as suggested by Anderson. This modification would benefit the system by providing a proven, reliable method for the UEs to receive feedback data.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD B.

ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on (571) 272-3795. 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.

RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

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/RONALD B ABELSON/

Primary Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2007/0265017 A1	11-2007	Ishii; Hiroyuki	H04W28/16	455/453
*	B	US-2008/0144600 A1	06-2008	Anderson; Nicholas William	H04W28/06	370/350
*	C	US-2002/0172208 A1	11-2002	Malkamaki, Esa	H04L1/0083	370/400
*	D	US-2008/0090528 A1	04-2008	Malladi; Durga Prasad	H04L1/0004	455/70
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 12/02/2016

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PHILADELPHIA, PA 19103

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
12/02/2016	ELECTRONIC

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

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

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

eoffice@volpe-koenig.com

Office Action Summary	Application No. 14/458,693	Applicant(s) HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	AIA (First Inventor to File) Status No

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *10/31/16*.

☐ 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) *1,5-9,11 and 15-19* 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, 5-9, 11, 15-19* 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 *8/13/14* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

IPR2025-00221 Exhibit 2009 Page 394 of 492

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

Claim Rejections - 35 USC § 103

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

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

3. Claims 1, 5-9, 11, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of Baker US ***6754505*** and Mazur US 20020114311.

Regarding claims 1 and 11, Malladi teaches a network device comprising:

in a CDMA/W-CDMA system ([0037]);

a transceiver is configured to send, to a user equipment (UE), resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different frequency resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned times (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B);

the network device is further configured to receive, at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B).

Although Malladi US 20080090528 teaches the limitations above and the provisional teaches the PUSCH and PUCCH being assigned time and frequency resources, the ***provisional*** is silent

on the network device is configured to receive at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. However, sharing a time slot was well known in the art as a means for conserving time resources (see Mazur [0038]).

Malladi is silent on the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE.

Baker teaches the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE (***col. 1 line 57 – col. 2 line 41, CDMA col. 7 lines 1-11).***

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Malladi by the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the

physical uplink control channel of a respective UE, as suggested by Baker. This modification would benefit the system by providing a proven, reliable method for power control.

The combination is silent on wherein the single downlink control channel shares a time slot with a physical downlink shared channel.

Mazur teaches sharing a timeslot between traffic channel / “physical shared channel” and control channel transmissions ([0038]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the single downlink control channel shares a time slot with a physical downlink shared channel, as suggested by Mazur. This modification would benefit the system by conserving time resources.

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Anderson: PLCCH implement by including one TPC data bit and two SS data bits for each UE, pg. 29 lines 21-27).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network device, signals are received over other physical uplink control channels in the times from a plurality of UEs (as shown above, it was well known in the art at the time of the instant application to transmit over the physical uplink control channel and physical uplink shared control channel in defined time slots).

Regarding claims 7-9 and 17-19, the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or universal mobile telecommunication system (UMTS) physical channel (Malladi: CDMA [0037]).

Response to Arguments

4. Applicant's arguments filed 10/31/16 have been fully considered but they are not persuasive. Examiner has modified rejection to include Baker.

Prior Art of Record

5. US 20050022098 [0041, 0046] teaches WCDMA HS-DPCCH (high speed uplink control channel)

US 20050013287 [0006] teaches WCDMA PUSCH (uplink shared channel)

Anderson WO 2006015984 (see also US 20080144600) (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, pg. 29 lines 10-19)

US 20020094834 [0042] teaches an MS adjusting the uplink physical control channel based on TPC commands. US 20010026543 [0228] downlink control channel used to send power control command.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD B.

ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on (571) 272-3795. 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.

RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6,754,505 B1	06-2004	Baker; Matthew P. J.	H04W52/225	370/318
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 10/23/2017

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

NOTIFICATION DATE	DELIVERY MODE
10/23/2017	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

Office Action Summary	Application No. 14/458,693	Applicant(s) HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	AIA (First Inventor to File) Status No

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

Period for Reply

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

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

Status

1)☐ Responsive to communication(s) filed on *9/21/17*.

☐ 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) *1,5-9,11 and 15-19* 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, 5-9, 11, and 15-19* 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 *8* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

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

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

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

4) ☐ Other: _____.

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

Claim Rejections - 35 USC § 103

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

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

2. Claims 1, 5-9, 11, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable Malladi US 20080090528 in view of Tsunehara US 20010012276, Sato US 20050222948 and Mazur US 20020114311.

Regarding claims 1 and 11, Malladi teaches a network device comprising:

in a CDMA/W-CDMA system ([0037]);

a transceiver is configured to transmit, to a user equipment (UE), a first signal that includes resource allocation information associated with a physical uplink control channel, wherein the physical uplink control channel and a physical uplink shared channel have different frequency resources;

the network device is configured to receive, over the physical uplink shared channel, data at assigned times (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B);

the network device is further configured to receive, at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information (fig. 3, PUSCH, PUCCH, the UE may be assigned no data segment or no control segment in a given slot, [0041], 0042], see also prov. 60/819,268 fig. 4A, 4B).

Although Malladi US 20080090528 teaches the limitations above and the provisional teaches the PUSCH and PUCCH being assigned time and frequency resources, the ***provisional*** is silent

on the network device is configured to receive at a time slot that the physical uplink shared channel is not received, control information over the physical uplink control channel in relation to the sent resource allocation information. However, sharing a time slot was well known in the art as a means for conserving time resources (see Mazur [0038]).

Malladi is silent on the transceiver is further configured to transmit, over a single downlink control channel to the UE, a second signal that includes a plurality of power commands for a plurality of UEs, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE.

Tsunehara teaches the transceiver is further configured to transmit, over a single downlink control channel to a plurality of UEs, a plurality of power commands, wherein each power command controls a transmission power level of a respective UE (common channel shared by the mobile terminals, base station can perform transmission power control of mobile terminals by transmitting power control signals via single common channel, [0072], CDMA, abstract).

Therefore it would have been obvious to one of ordinary

skill in the art, to modify the system of Malladi by the transceiver is further configured to send, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of the physical uplink control channel of a respective UE, as suggested by Tsunehara. This modification would benefit the system by providing a proven, reliable method for power control.

Although Tsunehara teaches the transceiver is further configured to transmit, over a single downlink control channel, a plurality of power commands, wherein each power command controls a transmission power level of a plurality of UEs, the combination is silent on transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs.

Sato makes obvious transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs ([0001, radio transceiver Z11 transmits control signals to relay terminals, [0150], base station to transmit control signals to relay terminals, [0154] fig. 1, 4, 9). Note, power control signals are control signals.

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by

transmitting to the UE a second signal that includes a plurality of power commands for a plurality of UEs, as suggested by Sato. This modification would benefit the system by when the UE is out of range of the destination base station.

The combination is silent on wherein the single downlink control channel shares a time slot with a physical downlink shared channel.

Mazur teaches sharing a timeslot between traffic channel / “physical shared channel” and control channel transmissions ([0038]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by the single downlink control channel shares a time slot with a physical downlink shared channel, as suggested by Mazur. This modification would benefit the system by conserving time resources.

Regarding claims 5, 15, the downlink control channel includes power control information for a plurality of UEs using different bits (Tsunehara: common channel shared by the mobile terminals, base station can perform transmission power control of mobile terminals by transmitting power control signals via single common channel, [0072], CDMA, abstract).

Regarding claims 6 and 16, the times that the signal over the physical uplink control channel is received by the network device, signals are received over other physical uplink control channels in the times from a plurality of UEs (as shown above, it was well known in the art at the time of the instant application to transmit over the physical uplink control channel and physical uplink shared control channel in defined time slots).

Regarding claims 7-9 and 17-19, the uplink physical control channel, the respective uplink physical control channels, or the physical uplink shared channel is any one of a time division multiple access (TDMA), code division multiple access (CDMA), time division duplex (TDD), frequency division duplex (FDD), time division-code division multiple access (TD-CDMA), or

universal mobile telecommunication system (UMTS) physical channel (Malladi: CDMA [0037]).

Response to Arguments

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

Prior Art of Record

4. US 20050022098 [0041, 0046] teaches WCDMA HS-DPCCH (high speed uplink control channel)

US 20050013287 [0006] teaches WCDMA PUSCH (uplink shared channel)

Anderson WO 2006015984 (see also US 20080144600) (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, pg. 29 lines 10-19)

US 20020094834 [0042] teaches an MS adjusting the uplink physical control channel based on TPC commands. US 20010026543 [0228] downlink control channel used to send power control command.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD B. ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on (571) 272-3795. 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.

RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

/AYAZ SHEIKH/

Supervisory Patent Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2001/0012276 A1	08-2001	Tsunehara, Katsuhiko	H04W52/245	370/318
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

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NOTICE OF ALLOWANCE AND FEE(S) DUE

3624 7590 11/16/2015

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER
ABELSON, RONALD B

ART UNIT	PAPER NUMBER
2476	

DATE MAILED: 11/16/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

TITLE OF INVENTION: COMMUNICATIONS IN A WIRELESS NETWORK

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	02/16/2016

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 11/16/2015
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.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

TITLE OF INVENTION: COMMUNICATIONS IN A WIRELESS NETWORK

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	02/16/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
ABELSON, RONALD B	2476	370-280000

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.
14/458,693	08/13/2014	Paul Howard	IPW2-USCN205928	4825

3624 7590 11/16/2015

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2476	

DATE MAILED: 11/16/2015

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

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 14/458,693	Applicant(s) HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	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 *10/22/14 and 8/13/14*.
   ☐ 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 _____. 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 10/22/14
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 _____.

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Reasons for Allowance

Ishii US 20070265017 teaches a user equipment (UE) comprising:

a processor configured to receive resource allocation information associated with an uplink physical control channel (uplink control channel, [0207]), wherein the uplink physical control channel and a physical uplink shared channel / PUSCH have different resources;

the processor is further configured to send data over the physical uplink shared channel in assigned time intervals (uplink control channel can be one of two types, a channel to be time-multiplexed with physical uplink shared channel PUSCH and a channel to be frequency-multiplexed with it, [0207]).

Although Ishii teaches time multiplexing the uplink physical control channel and a physical uplink shared channel / PUSCH, the reference is silent on the processor is further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send a signal over the uplink physical control channel based on the

received resource allocation information. The Examiner interprets this limitation to be dynamically allocating the time slots for transmitting the uplink physical control channel and a physical uplink shared channel based on received resource allocation information transmitted from the network.

Matthews US 20020077151 teaches dynamically allocating control channels on uplink time slots (control channels dynamically allocated on uplink and downlink frequencies, time slots and code channels, [0074]) based on received resource allocation information transmitted from the network (primary base station subsystem provides principle interface between base station controller and radio network, commands from base station controller interface used to configure primary base station, frequency, time slot and code channel allocation are based on commands received through the base station controller interface, [0084]).

Although Ishii teaches PLCCH, the reference is silent on the processor is further configured to receive feedback information from a downlink control channel.

Anderson US 20080144600 teaches a processor in a UE configured to receive feedback information from a downlink

control channel (PLCCH implemented for communication of TPC and SS data, transmission comprising TPC and SS data bits for plurality of UEs, [0131]).

However, the independent claims are not obvious in view of the combination of the references.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD B. ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Ayaz Sheikh can be reached on (571) 272-3795. 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.

RONALD B ABELSON
Primary Examiner
Art Unit 2476

***

/RONALD B ABELSON/
Primary Examiner, Art Unit 2476

Notice of References Cited	Application/Control No. 14/458,693	Applicant(s)/Patent Under Reexamination HOWARD, PAUL	
	Examiner RONALD B. ABELSON	Art Unit 2476	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2007/0265017	11-2007	Ishii et al.	455/453
*	B	US-2002/0077151	06-2002	Matthews et al.	455/561
*	C	US-2008/0144600	06-2008	Anderson, Nicholas William	370/350
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of: Paul Howard	
Application No.: 16/682,854	Our File: IPW2-USCN213316
Confirmation No.: 1678	Date: January 8, 2020
Filed: November 13, 2019	
For: COMMUNICATIONS IN A WIRELESS NETWORK	
Group: 2476	
Examiner: Ayaz R. Sheikh	

INFORMATION DISCLOSURE STATEMENT

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

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

This Application is a continuation of U.S. Patent Application No. 14/458,693, filed August 13, 2014, which is a continuation of U.S. Patent Application No. 13/176,298, filed July 5, 2011, which issued August 19, 2014 as U.S. Patent No. 8,811,356, which is a continuation of U.S. Patent Application No. 11/646,692, filed December 27, 2006, which issued August 30, 2011 as U.S. Patent No. 8,009,639.

Pursuant to 37 C.F.R. §1.98(d) copies of documents cited in the parent application are not enclosed, but copies will be provided upon request. Documents that were not cited in the parent application are enclosed.

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

Respectfully submitted,

Intellectual Ventures II LLC

By /Harry Vartanian/
Harry Vartanian
Registration No. 56,787
(215) 568-6400

Volpe and Koenig, P.C.
United Plaza
30 South 17th Street
Philadelphia, PA 19103

HV/PCK
Enclosures

Electronic Acknowledgement Receipt

EFS ID:	38235577
Application Number:	16682854
International Application Number:	
Confirmation Number:	1678
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Customer Number:	3624
Filer:	Harry Vartanian/Carey Kulp
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN213316
Receipt Date:	08-JAN-2020
Filing Date:	13-NOV-2019
Time Stamp:	15:08:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IPW2-USCN213316-SB08-EFS.PDF	678529 7ee03351ce4a6f8364eaac59290a4e9fc2ddb018	no	12

Warnings:

Information:					
2	Non Patent Literature	36_211_V0_2_1.pdf	369795 62d84c0c4129c7ec69ab2e42f9e212472bc690c9	no	24
Warnings:					
Information:					
3	Non Patent Literature	36_212_V0_2_1.pdf	318138 4f010d55db77ac325f950c3e9f38a88163d73ed5	no	10
Warnings:					
Information:					
4	Non Patent Literature	36_213_V0_1_0.pdf	250571 26d7eb3d22bf2e1c72a03ce016e71f11780250eb	no	11
Warnings:					
Information:					
5	Non Patent Literature	36_300_V0_3_1.pdf	736268 7505809b7a05ecf976791c7742a5c27974b5595f	no	64
Warnings:					
Information:					
6	Other Reference-Patent/App/Search documents	Advisory_Action_20160825.pdf	263061 8cbacb891fec70827498aa8615f88aa91e782f0b	no	9
Warnings:					
Information:					
7	Other Reference-Patent/App/Search documents	Examiners_answer_to_Appeal_Brief_20181123.pdf	362125 99663a9e813e6fbda7b4453d432cc45eaf19c86a	no	14
Warnings:					
Information:					
8	Other Reference-Patent/App/Search documents	FR_20160510.pdf	313663 8409544609d7b4b324bedc1275cb845b1f3e3a56	no	11
Warnings:					
Information:					

9	Other Reference-Patent/App/Search documents	FR_20170321.pdf	338204 480ccf2044d2e0dbf3b61d897f959dd3d13fe0c5	no	12
Warnings:					
Information:					
10	Other Reference-Patent/App/Search documents	FR_20180517.pdf	344517 54c187cbb2def20a416b1e2a42a1cac56e31c2a7	no	13
Warnings:					
Information:					
11	Other Reference-Patent/App/Search documents	MiscellaneousCommunication_20160520.pdf	66258 6417ee5fd0396be5f039ba87e49d600d64e08fa4	no	3
Warnings:					
Information:					
12	Other Reference-Patent/App/Search documents	NFR_20151230.pdf	319880 c1c0051019c40cd4da5ab10ec3dc936f0c1a86e3	no	12
Warnings:					
Information:					
13	Other Reference-Patent/App/Search documents	NFR_20161202.pdf	290091 7e5af0e0fb1b853f85e4ab72bb2a1b2ff2313763	no	11
Warnings:					
Information:					
14	Other Reference-Patent/App/Search documents	NFR_20171023.pdf	327966 ec7dd1b3a6dedc0889ad9186686c89d44d453a0b	no	12
Warnings:					
Information:					
15	Other Reference-Patent/App/Search documents	NOA_20151116.pdf	470162 c97865ce075b6073f4a7fb1f67e4d376a41c72e1	no	10
Warnings:					
Information:					

16	Transmittal Letter	IPW2-USCN213316-IDS_transmittal-EFS.pdf	59620 5e88887858165 4e5bdef0a9c798090487b76ba6f	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	5508848

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.

To: eoffice@volpe-koenig.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 3624

Dec 12, 2019 03:44:23 AM

Dear PAIR Customer:

VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 3624 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:
The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
16682854	TRACK1.GRANT	12/11/2019	IPW2-USCN213316

To view your correspondence online or update your email addresses, please visit us anytime at https://sportal.uspto.gov/secure/myportal/privatepair.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

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.
16/682,854	11/13/2019	Paul Howard	IPW2-USCN213316	1678

3624 7590 12/11/2019

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

EXAMINER	
NGO, RICKY QUOC	

ART UNIT	PAPER NUMBER
2464	

NOTIFICATION DATE	DELIVERY MODE
12/11/2019	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

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 16/682,854	**Applicant(s)** Howard, Paul	
	Examiner BRIAN W BROWN	**Art Unit** OPET	**AIA (FITF) Status** No

1. THE REQUEST FILED 13 November 2019 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to BRIAN BROWN at (571)272-5338. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/BRIAN W BROWN/ Petitions Examiner, OPET	

To: eoffice@volpe-koenig.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 3624

Dec 04, 2019 03:44:07 AM

Dear PAIR Customer:

VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 3624 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

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Application	Document	Mailroom Date	Attorney Docket No.
16682854	APP.FILE.REC	12/04/2019	IPW2-USCN213316

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If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/682,854

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	24 minus 20 =	* 4			OR	x 100 =	400
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 460 =	460
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	2580

APPLICATION AS AMENDED - PART II

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

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

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

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

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/682,854	11/13/2019	2414	2580	IPW2-USCN213316	24	4

CONFIRMATION NO. 1678

3624
VOLPE AND KOENIG, P.C.
30 SOUTH 17TH STREET, 18th Floor
PHILADELPHIA, PA 19103

FILING RECEIPT

OC000000113059962

Date Mailed: 12/04/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Paul Howard, Bristol, UNITED KINGDOM;

Applicant(s)

Intellectual Ventures II LLC, Wilmington, DE;

Assignment For Published Patent Application

Intellectual Ventures II LLC, Wilmington, DE

Power of Attorney: The patent practitioners associated with Customer Number 3624

Domestic Priority data as claimed by applicant

This application is a CON of 14/458,693 08/13/2014
which is a CON of 13/176,298 07/05/2011 PAT 8811356
which is a CON of 11/646,692 12/27/2006 PAT 8009639

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 12/03/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/682,854**

Projected Publication Date: 03/12/2020

Non-Publication Request: No

Early Publication Request: No

Title

COMMUNICATIONS IN A WIRELESS NETWORK

Preliminary Class

370

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :C46575

Sale Accounting Date:12/03/2019

Sale Item Reference Number	Effective Date
16682854	11/13/2019

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I2019B3924248996	1202	CLAIMS IN EXCESS OF 20	$400.00	Deposit Account

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Not Yet Known
Filing Date	November 13, 2019
First Named Inventor	Paul Howard
Title	COMMUNICATIONS IN A WIRELESS NETWORK
Art Unit	Not Yet Known
Examiner Name	Not Yet Known
Attorney Docket Number	IPW2-USCN213316

SIGNATURE of Applicant or Patent Practitioner

Signature	/Harry Vartanian/	Date (Optional)	2019-11-13
Name	Harry Vartanian	Registration Number	56,787
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)	INTELLECTUAL VENTURES II LLC		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/AIA/80 (07-12)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

☒ Practitioners associated with Customer Number: 3624

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: 3624

OR

☐	Firm or Individual Name			
	Address			
	City		State	Zip
	Country			
	Telephone		Email	

Assignee Name and Address: Intellectual Ventures II LLC
2711 Centerville Road, Suite 400
Wilmington, DE 19808

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	Tracy Lemke	Date	4/18/16
Name	Tracy Lemke	Telephone	
Title	Authorized Person for Intellectual Ventures II LLC		

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

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PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	COMMUNICATIONS IN A WIRELESS NETWORK

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 14/458,693 filed on August 13, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

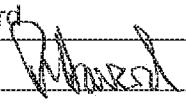
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Paul Howard Date (Optional): 22 October 2014

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Privacy Act Statement

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

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

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

Electronic Patent Application Fee Transmittal

Application Number:	14458693
Filing Date:	
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Filer:	Harry Vartanian/Amanda Lopez
Attorney Docket Number:	IPW2-USCN213316

Filed as Large Entity

Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
INDEPENDENT CLAIMS IN EXCESS OF 3	1201	1	460	460
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140

Petition:	
Patent-Appeals-and-Interference:	
Post-Allowance-and-Post-Issuance:	
Extension-of-Time:	
Miscellaneous:	
Total in USD ($)	**6320**

Electronic Acknowledgement Receipt

EFS ID:	37743445
Application Number:	16682854
International Application Number:	
Confirmation Number:	1678
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Paul Howard
Customer Number:	3624
Filer:	Harry Vartanian/Amanda Lopez
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN213316
Receipt Date:	13-NOV-2019
Filing Date:	
Time Stamp:	17:07:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$6320
RAM confirmation Number	E2019ACH09196504
Deposit Account	220493
Authorized User	Amanda Lopez

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	TrackOne Request	IPW2-USCN213316_Track_1_Request_20191113.PDF	136327 e0db7e13b017f52f690a03ef212ec2370ceb e30e	no	2
Warnings:					
Information:					
2		IPW2-USCN213316-Application-20191113.PDF	82060 6a420d8c677c47d336a48489dee2c1ebd5e 46d6f	yes	22

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	16
Claims	17	21
Abstract	22	22

Warnings:					
Information:					
3	Drawings-only black and white line drawings	IPW2-USCN213316_Drawings_20191113.PDF	563956 861d43262142019dc17769989c2093edec6 81d56	no	5
Warnings:					
Information:					
4	Application Data Sheet	IPW2-USCN213316_ADS_20191113.PDF	104156 6969d1cb21c828522a6f6318f3000e1f01be ea45	no	8
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5	Power of Attorney	IPW2-USCN213316_POA_20191113.PDF	336075 fd26e1016959c273d28b5a07c0ddb5908f8eaf0d	no	2
Warnings:					
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6	Oath or Declaration filed	IPW2-USCN213316_Signed_Declaration_20191113.PDF	2818700 484f5438bb56a659a5606bb504f639813cbfee95	no	2
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7	Miscellaneous Incoming Letter	IPW2-USCN213316_373_Statement_20191113.PDF	83063 377c77eff0e13f9de322e052e90875f16c0ac95b	no	3
Warnings:					
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8	Miscellaneous Incoming Letter	IPW2-USCN213316_373_Statement_continued_20191113.PDF	56830 9c317c1080972b235089eeb7b45f6c4b8074fabc	no	1
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	42126 51f097dc52aa68d7eb396bfe3dbe7af0ada55038	no	2
Warnings:					
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			Total Files Size (in bytes):	4223293	

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

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

Applicant/Patent Owner: Intellectual Ventures II LLC

Application No./Patent No.: _____ Filed/Issue Date: November 13, 2019

Titled: COMMUNICATIONS IN A WIRELESS NETWORK

Intellectual Ventures II LLC, a limited liability company

(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: Paul Howard To: IPWireless, Inc.

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

   Reel 027937, Frame 0788, or for which a copy thereof is attached.

2. From: IPWireless, Inc. To: Northrop Grumman Information Technology, Inc.

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

   Reel 027938, Frame 0301, or for which a copy thereof is attached.

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

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STATEMENT UNDER 37 CFR 3.73(c)

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5. From: Wireless Technology Solutions LLC To: IPWireless, Inc.

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6. From: IPWireless, Inc. To: Intellectual Ventures Holding 81 LLC

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

/Harry Vartanian/	2019-11-13
Signature	Date
Harry Vartanian	56,787
Printed or Typed Name	Title or Registration Number

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

STATEMENT UNDER 37 CFR 3.73(c) CONTINUED

Applicant/Patent Owner: Intellectual Ventures II LLC

Application No./Patent No.: _____

Filed/Issue Date: November 13, 2019

Titled: COMMUNICATIONS IN A WIRELESS NETWORK

7. **From:** Intellectual Ventures Holding 81 LLC **To:** Intellectual Ventures II LLC

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CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	Paul Howard	Nonprovisional Application Number (if known):	IPW2-USCN213316
Title of Invention:	COMMUNICATIONS IN A WIRELESS NETWORK		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

I. ☑ **Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **or** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ **Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Harry Vartanian/	Date 2019-11-13
Name (Print/Typed) Harry Vartanian	Practitioner Registration Number 56,787

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☐ *Total of _____ forms are submitted.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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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.

COMMUNICATIONS IN A WIRELESS NETWORK

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application Serial No. 14/458,693, filed August 13, 2014, which is a continuation of U.S. Patent Application Serial No. 13/176,298, filed July 5, 2011, which issued as 8,811,356 on August 19, 2014, which is a continuation of U.S. Patent Application Serial No. 11/646,692, filed December 27, 2006, which issued as 8,009,639 on August 30, 2011, which are all incorporated by reference as if fully set forth.

BACKGROUND OF THE INVENTION

[0002] Time division-code division multiple access (TD-CDMA) is an air interface technology that combines the benefits of the three elemental concepts in a universal mobile telecommunication system (UMTS): time division multiple access (TDMA); code division multiple access (CDMA); and time division duplex (TDD). TDD, in particular, uses the same radio channel for both uplink and downlink communications, and discriminates between signals by separating the transmissions in time. One of the benefits obtained by operating both links on the same frequency is the ability to exploit channel reciprocity.

[0003] Channel reciprocity gives equipment the ability to derive information about uplink channel conditions from downlink channel conditions based upon signals received by the user equipment (UE). Pathloss is one example of channel information that can be obtained from channel reciprocity. Knowledge of the uplink pathloss enables open-loop power control to be employed for uplink transmissions. For example, uplink power control is important for the operation of the CDMA element of TD-CDMA as it counteracts the near-far effect that would otherwise be encountered if all UEs transmitted at a fixed power regardless of the uplink pathloss.

[0004] The open-loop uplink power control feature provides a significant advantage when coupled with a multiple access data transmission system that is used for packet-based communication and/or shared channels. When access to a limited number of uplink channels is shared between a large population of terminals it is imperative that access to the channels can be switched between terminals with minimal latency. A data terminal that can derive information needed to access uplink channels from the downlink transmissions (beacon signals) has a significant advantage over a terminal that relies on the (lengthy) configuration of a dedicated channel in order to establish a feedback channel.

[0005] However, channel reciprocity cannot always be guaranteed. For example TDD transmissions may not be permitted in certain frequency spectrum allocations; this is a regulatory issue and may be used to protect other wireless equipment in the same or adjacent frequency bands. In these situations the correlation between uplink and downlink channels is lost because the channels are transported on carrier frequencies that are separated in frequency by an amount that is greater than the coherence bandwidth of the channel (usually, only a few MHz separation is sufficient to cause the uplink and downlink fading profiles to be independent).

[0006] In high speed mobile applications, the time delay between downlink and uplink transmissions may exceed the coherence time of the channel. The maximum time delay that can be tolerated is a function of the mobile speed and the RF carrier frequency used, with the coherence time reducing with increasing speed and RF carrier frequency. Also, the use of multiple transmit and/or receive antennas at the network and/or the mobile terminal can introduce unintentional decorrelation between the uplink and downlink channels.

[0007] If the TD-CDMA air interface is to be used in applications where the correlation between the uplink and downlink path loss is not guaranteed, then it would be advantageous to find a substitute for channel reciprocity.

BRIEF SUMMARY OF THE INVENTION

[0008] Although it is desirable to support air interfaces where the pathloss is not reciprocal, known conventional methods do not deal directly with the evolution or adaptation of an air interface that uses channel reciprocity to deliver key features and advantages where channel reciprocity is not guaranteed. The adaptation provided in embodiments of the invention introduces a new technique for uplink channel control that uses a feedback scheme as a substitute for the absence of channel reciprocity, with minimal impact on the ability of the air interface to support uplink shared channels.

[0009] Embodiments of the present invention enable active feedback control between a base station and user equipment (UE). In particular, the operation of a system designed for TDD, or unpaired operation, is expanded to operate in FDD, or paired, mode. For example, an uplink beacon function (for power control) and a modified random access process substitute for the information lost due to the lack of channel reciprocity in paired operation. Embodiments of the invention allow a terminal to transmit the uplink physical channel control signal (UL_Beacon) independently from the uplink physical channel. Therefore, the implementation of closed loop feedback may operate in the absence of an uplink physical channel. In one embodiment, a UE allocates a time slot for a beacon signal separated from the time slots for data in a frame. A second time slot is allocated within the frame for the base station to transmit a control signal in response to the beacon signal. The control signal instructs the UE to adjust a transmission parameter.

[0010] A UL_Beacon signal may be combined with a physical layer common control channel (PLCCH) to form a feedback system. A dedicated timeslot groups all of the UL_Beacon signals from multiple UEs in a specific uplink timeslot. By grouping the UL_Beacon signals together, embodiments obtain separation between the UL_Beacon signals and the standard uplink physical channels. Additionally, in a synchronous system embodiments of the invention detect and cancel the UL_Beacon signals from other cell sites (inter-cell interference). The PLCCH

carries feedback information to the UEs that are transmitting UL_Beacon signals. The PLCCH can share a timeslot with other physical channels by exploiting the CDMA aspect of the system.

[0011] In other embodiments, the number of supported UEs can be increased by fractionating the use of the UL_Beacon and PLCCH across a multiframe period. Fractionation may also prevent timeslot blocking where half duplex UEs have a long UL/DL switching time. Additionally, support for half duplex terminals is implicit due to the nature of the TDMA frame structure. The system may manage the allocation of resource across the population of terminals such that the full capacity of the base station can be utilized even when only half-duplex terminals are deployed. In embodiments of the invention, full-duplex terminals can be still be supported along with half duplex UEs.

[0012] Moreover, in other embodiments, a radio resource control (RRC) connected state covers the subset of terminals that are in cell forward access channel (Cell_FACH), which are also transmitting UL_Beacon and receiving PLCCH, thus creating an active control feedback channel. Management of the UEs that are in Cell_Active state may remove users that are less active, and may add users that are newly active while retaining users that may have on-going data transfer requirements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 illustrates a cellular communication system according to embodiments of the invention;

[0014] Figure 2 illustrates a timeslot arrangement for uplink and downlink messages supporting the UL_Beacon and its corresponding PLCCH within a TD-CDMA frame structure modified to support FDD according to embodiments of the invention;

[0015] Figure 3 illustrates fractionation in different frames at the base station according to embodiments of the invention;

[0016] Figure 4 illustrates UTRA RRC connected modes according to embodiments of the invention;

[0017] FIG. 5 illustrates a computer system that may be employed to implement embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Figure 1 illustrates an example of a cellular communication system according to embodiments of the invention. The network includes a user equipment (UE) domain, a radio access network (RAN) domain, and a core network domain. The UE domain includes user equipment 110 that communicate with at least one base station 112 in the RAN domain via a wireless interface. The RAN domain may also include a network controller (RNC) 118 (e.g., radio network controller), such as that used in UMTS systems. Alternatively, such functionality may be distributed between the Node Bs and an access gateway (AGW) (not shown) or other controller in the core network. FIG. 1 also illustrates an optional radio resource manager (RRM) 114. The RRM may perform functions otherwise performed by the Node Bs or an AGW in some embodiments.

[0019] The core network (CN) 116 includes, in this example, a serving GPRS support node (SGSN) 120, and a gateway GPRS support node (GGSN) 122. The core network is coupled to an external network 124. The SGSN 120 is responsible for session control, including keeping track of the location of the UEs. The GGSN 122 concentrates and tunnels user data within the core network 116 to the ultimate destination (e.g., an Internet service provider) in the external network 124. Further details may be found in the 3GPP UMTS technical specifications, such as TS23.246 v6.4.0 "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Multimedia Broadcast/Multicast Service (MBMS); Architecture and Functional Description (Release 6)," published by the 3GPP Support Office, 650 Route des Lucioles--Sophia Antipolis, Valbonne--FRANCE, which are incorporated by reference herein.

[0020] Further details regarding exemplary communications systems that may implement embodiments of the invention may be found in 3GPP UMTS technical specifications, such as TR 23.882, "3GPP System Architecture Evolution: Report on Technical Options and Conclusions"; TR 25.912, "Feasibility Study for Evolved UTRA and UTRAN"; TS 23.101, "General Universal Mobile Telecommunications System (UMTS) Architecture," all of which are incorporated by reference herein.

TDD to FDD Evolution

[0021] A system designed for operation in Time Division Duplex (TDD) mode has base stations and terminals that transmit and receive at orthogonal points in time. In normal operation terminals are in receive mode when the base station is transmitting, and base stations are in receive mode when terminals are transmitting. In conventional TDD implementations, neither base stations nor the terminals are able to transmit and receive at the same points in time because the same frequency is used for uplink and downlink communication.

[0022] Such a system can be adjusted to operate in Frequency Division Duplex (FDD) mode, where the uplink and downlink communications occur on different frequencies. According to embodiments of the invention, to make full and efficient use of the frequency spectrum resources, the base stations are adapted to transmit and receive at the same time. This is possible since the uplink and downlink communications now occur on different frequencies. The terminals, however, retain the restriction of transmitting and receiving at orthogonal points in time to retain the simplicity of not having to transmit and receive at the same time (e.g., no duplexer required). The full use of the frequency spectrum is then obtained by allocating the resource across a plurality of terminals.

[0023] Additional measures may be needed if there are aspects of the air interface that rely on the channel reciprocity that can be assumed for TDD systems.

In the case of TD-CDMA, modifications may be made for the correct operation of uplink power control and rate adaptation. This can be achieved by defining an uplink physical control channel used for estimating the uplink channel conditions and a downlink channel used to feed back control information to the terminal. These channels may not need an associated data physical channel to be operational.

[0024] Modifications may be made to the random access channel. This may be achieved by introducing an additional indicator step at the start of any physical random access. A new uplink physical channel carries the random access indicators. A new downlink physical channel carries the response to received uplink indicators.

Uplink Physical Channel Control Signal

[0025] When pathloss reciprocity is not available, the combination of an uplink physical channel control signal with a downlink feedback channel may be used to keep the terminal informed of the condition of the uplink channel. The uplink physical control signal is referred to herein as an "Uplink Beacon" (UL_Beacon).

[0026] In general, a system that supports shared channels may also support shared access to a large number of terminals. To extract the maximum benefit from the resulting trunking gain, shared channels can be quickly and efficiently re-allocated between the population of UEs. To obtain rapid access to the uplink shared channels, terminals can transmit at the correct power with their first transmission so that latency can be kept to a minimum.

[0027] According to embodiments of the invention, the RNC or other controller (e.g., other controller having its functionality in the core network) allocates resources so that the physical channel control signal is separate from the uplink (shared) physical channel. Thus, terminals are able to transmit an UL_Beacon independently of their access to the uplink shared channel. The system

may implement a closed loop control system, in which the base station detects the received power and/or other channel information from the UL_Beacon, and sends controlling commands back to each terminal to keep the terminal informed of the channel conditions observed at the base station.

[0028] In certain embodiments, the closed loop control system is simply based on the UL_Beacon power received at the base station. The base station may send power control commands on a shared downlink channel to each terminal based on the power received from the UL_Beacon signal. Each power control command may, for example, indicate whether terminal power should be increased or decreased by a predetermined amount. This downlink channel is referred to as the "Physical Layer Control Channel" (PLCCH). The capacity of the PLCCH may be matched to the number of bits required in the feedback field and the number of UL_Beacon signals that can be simultaneously supported. That is, each UL_Beacon may correspond to one bit of the PLLCH. All terminals transmitting UL_Beacon signals may receive this channel and extract the relevant feedback field.

[0029] It is possible to extend the complexity of the control loop by sending control commands based on other aspects of the UL_Beacon signal as received by the base station, such as time-of-arrival, and channel impulse response. The amount of resource that is required for the feedback channel increases with the size (in bits) of the feedback information to each UE.

[0030] For example, for air interface technologies with a TDMA element, it is possible to adapt the TDMA frame structure to provide separation between the UL_Beacon and the normal physical channels by dedicating at least one uplink time slot per frame (or at least one time slot per multi-frame) to carrying UL_Beacon signals.

[0031] By placing UL_Beacon signals in a dedicated timeslot, a dedicated detection scheme can be applied which may include performance enhancing features such as intra-cell cancelling (for alleviating the effects of cross-correlation interference between UL_Beacon signals transmitted by multiple terminals in the

same cell), or inter-cell cancelling (for reducing the interference from neighboring cells in the case where the UL_Beacon timeslots are time synchronized). Cross-interference between UL_Beacon and normal uplink bursts is avoided by the separation obtained from the use of separate time slots.

[0032] Those skilled in the art will recognize that there are a large number of possibilities for the arrangement of a UL_Beacon and its associated PLCCH within the frame structure according to embodiments of the invention. More than one UL_Beacon and PLCCH per frame could be supported if the feedback update rate is required to be faster than the frame rate (at the expense of system capacity). For system applications that can tolerate a slower feedback rate, embodiments may fractionate the use of the UL_Beacon timeslot (and the associated PLCCH).

[0033] When fractionation is employed, the RNC or other controller may allocate the UL_Beacon timeslot in a given frame to a group of terminals depending on the current fractionation phase, thus increasing the number of terminals that can be supported with active physical channel feedback control. The maximum fractionation cycle length may be determined by the feedback update rate that the system requires in order to meet its performance targets.

[0034] Figure 2 illustrates an example of a timeslot arrangement supporting the UL_Beacon and its corresponding PLCCH within a TD-CDMA frame structure modified to support FDD. In this example, the PLCCH 212 shares a timeslot with another downlink shared channel. This is possible since normal downlink physical channels are used to transmit the PLCCH. The downlink frame also comprises a downlink beacon timeslot 206, an access control timeslot 208, and normal traffic carrying timeslots 210. The uplink frame comprises a UL_Beacon control timeslot 216, an access control timeslot 218, and normal traffic carrying timeslots 214.

[0035] Figure 3 illustrates an example where fractionation is employed. The UL_Beacon and PLCCH timeslots are active in every frame at the base station 302. However, terminal 304, terminal 306, and terminal 308 have been assigned a different fractionation phase. Figure 3 illustrates the case where the fractionation

phase is 3. For example, the fractionation phase of terminal 304 occurs in frame #0 310, the fractionation phase of terminal 306 occurs in frame #1 312, and the fractionation phase of terminal 308 occurs in frame #2 314. Since the fractionation phase is 3, the phase for terminal 304 occurs again in frame #3 316.

Half Duplex Terminals

[0036] Embodiments of the invention enable terminals to operate in half duplex or full duplex mode. In a half duplex system, base stations and terminals do not transmit and receive simultaneously. When such a system is evolved to operate in paired spectrum, it becomes inefficient if base stations retain their half duplex operation. It is not necessarily inefficient for the terminals to do so, however, since half duplex operation may have some advantages in the design and implementation of the terminal.

[0037] Nonetheless, there are some points that should be considered. For example, a single terminal may not be able to access all transmit and all receive slots. Therefore, the system may have to manage resources across the population of terminals to ensure all the available resources at the base station are efficiently utilized. To prevent blocking of timeslots, half duplex terminals may be operated with a fractionation cycle of greater than one. In particular, this may also apply for the case where there are more than one UL_Beacon timeslot per, frame. There is a time delay for half duplex terminals to switch between transmit and receive functions. In some cases this delay exceeds the guard period inserted between consecutive timeslots. In the half duplex terminal case, the terminal is unable to transmit and receive on adjacent timeslots. This will affect the locations of the UL_Beacon, PLCCH, and other common channels. Accordingly, the timeslot arrangement may be adjusted when the system is configured.

Terminal Management

[0038] Embodiments of this invention separate uplink control from the uplink physical traffic. This allows the control feedback to operate even when the terminal does not have data to send, with the consequence that uplink shared channels can be used with maximum efficiency.

[0039] To use shared channels efficiently, a relatively large user base may be needed. At the same time, the network resources required to support the control feedback channels for these terminals need to be minimized. In general, the number of users that can be supported with active control feedback channels is smaller than the typical number of users per cell. Therefore, the terminals in this active state may be managed.

[0040] In UMTS terminology, embodiments of the invention provide a new Universal Terrestrial Radio Access-Radio Resource Control-Connected (UTRA RRC-Control) sub-state into the system. UTRA systems already support the idea of different RRC-Connected states (see, TS25.331 Radio Resource Control (RRC) Protocol Specification, which is incorporated herein by reference), e.g., CELL_DCH, CELL_FACH etc. This sub-state is referred to as the CELL_ACTIVE state. Figure 4 illustrates this sub-state in context with other UTRA RRC-connected states. A UE in a Cell_Active sub-state transmits the physical channel control part of the uplink physical channel only, and nothing else (i.e., no data).

[0041] As shown in Figure 4, CELL_ACTIVE sub-state is a sub-state of CELL_FACH state 404. In general, UEs in CELL_FACH state have an RRC connection, but they may not be actively transferring data. Out of the population of UEs in CELL_FACH state 404, a smaller number of UEs, determined by the network to be the most-active UEs, are supported in a CELL_ACTIVE state 406. In this state, the UEs transmit the physical channel control signal and listen to the associated feedback channel from the network. Because the UE is aware of the uplink pathloss conditions from the feedback channel, it can have instant access to

the uplink shared channels, and the resource allocator (controller) in the network can treat the UE accordingly.

[0042] The rules governing which UEs are maintained in CELL_ACTIVE state are decided by the network (e.g., through the RNC) and may be based on factors such as the volume of data transfer required by the UE, the data transfer rate required by a UE, the frequency of short bursts of data transfer, the total number of UEs in CELL_FACH state, the time since the last data transfer, the UE power saving requirements, etc.

[0043] Note that UEs in CELL_ACTIVE state have their transmitters active, therefore it is necessary for these UEs to monitor the status of the downlink and automatically come out of CELL_ACTIVE state if the downlink is deemed to be out-of-synchronization (for example, very high downlink errors or low received signal strength). This feature prevents UEs continuing to transmit in a state where the feedback channel may be unreliable and thus causing interference.

[0044] 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. Although embodiments of the present invention are described, in some instances, using UMTS terminology, those skilled in the art will recognize that such terms are also used in a generic sense herein, and that the present invention is not limited to such systems.

[0045] Those skilled in the art will recognize that the operations of the various embodiments may be implemented using hardware, software, firmware, or combinations thereof, as appropriate. For example, some processes can be carried out using processors or other digital circuitry under the control of software, firmware, or hard-wired logic. (The term "logic" herein refers to fixed hardware, programmable logic and/or an appropriate combination thereof, as would be recognized by one skilled in the art to carry out the recited functions.) Software and firmware can be stored on computer-readable media. Some other processes can be

implemented using analog circuitry, as is well known to one of ordinary skill in the art. Additionally, memory or other storage, as well as communication components, may be employed in embodiments of the invention.

[0046] Figure 5 illustrates a typical computing system 500 that may be employed to implement processing functionality in embodiments of the invention. Computing systems of this type may be used in the radio controllers, the base stations, and the UEs, for example. Those skilled in the relevant art will also recognize how to implement the invention using other computer systems or architectures. Computing system 500 may represent, for example, a desktop, laptop, or notebook computer, hand-held computing device (PDA, cell phone, palmtop, etc.), mainframe, server, client, or any other type of special or general purpose computing device as may be desirable or appropriate for a given application or environment. Computing system 500 can include one or more processors, such as a processor 504. Processor 504 can be implemented using a general or special purpose processing engine such as, for example, a microprocessor, microcontroller or other control logic. In this example, processor 504 is connected to a bus 502 or other communications medium.

[0047] Computing system 500 can also include a main memory 508, such as random access memory (RAM) or other dynamic memory, for storing information and instructions to be executed by processor 504. Main memory 508 also may be used for storing temporary variables or other intermediate information during execution of instructions to be executed by processor 504. Computing system 500 may likewise include a read only memory ("ROM") or other static storage device coupled to bus 502 for storing static information and instructions for processor 504.

[0048] The computing system 500 may also include information storage system 510, which may include, for example, a media drive 512 and a removable storage interface 520. The media drive 512 may include a drive or other mechanism to support fixed or removable storage media, such as a hard disk drive, a floppy disk drive, a magnetic tape drive, an optical disk drive, a CD or DVD drive (R or RW), or

other removable or fixed media drive. Storage media 518, may include, for example, a hard disk, floppy disk, magnetic tape, optical disk, CD or DVD, or other fixed or removable medium that is read by and written to by media drive 512. As these examples illustrate, the storage media 518 may include a computer-readable storage medium having stored therein particular computer software or data.

[0049] In alternative embodiments, information storage system 510 may include other similar components for allowing computer programs or other instructions or data to be loaded into computing system 500. Such components may include, for example, a removable storage unit 522 and an interface 520, such as a program cartridge and cartridge interface, a removable memory (for example, a flash memory or other removable memory module) and memory slot, and other removable storage units 522 and interfaces 520 that allow software and data to be transferred from the removable storage unit 522 to computing system 500.

[0050] Computing system 500 can also include a communications interface 524. Communications interface 524 can be used to allow software and data to be transferred between computing system 500 and external devices. Examples of communications interface 524 can include a modem, a network interface (such as an Ethernet or other NIC card), a communications port (such as for example, a USB port), a PCMCIA slot and card, etc. Software and data transferred via communications interface 524 are in the form of signals which can be electronic, electromagnetic, optical or other signals capable of being received by communications interface 524. These signals are provided to communications interface 524 via a channel 528. This channel 528 may carry signals and may be implemented using a wireless medium, wire or cable, fiber optics, or other communications medium. Some examples of a channel include a phone line, a cellular phone link, an RF link, a network interface, a local or wide area network, and other communications channels.

[0051] In this document, the terms "computer program product," "computer-readable medium" and the like may be used generally to refer to media such as, for

example, memory 508, storage device 518, or storage unit 522. These and other forms of computer-readable media may store one or more instructions for use by processor 504, to cause the processor to perform specified operations. Such instructions, generally referred to as "computer program code" (which may be grouped in the form of computer programs or other groupings), when executed, enable the computing system 500 to perform functions of embodiments of the present invention. Note that the code may directly cause the processor to perform specified operations, be compiled to do so, and/or be combined with other software, hardware, and/or firmware elements (e.g., libraries for performing standard functions) to do so.

[0052] In an embodiment where the elements are implemented using software, the software may be stored in a computer-readable medium and loaded into computing system 500 using, for example, removable storage drive 522, drive 512 or communications interface 524. The control logic (in this example, software instructions or computer program code), when executed by the processor 504, causes the processor 504 to perform the functions of the invention as described herein.

[0053] It will be appreciated that, for clarity purposes, the above description has described embodiments of the invention with reference to different functional units and processors. However, it will be apparent that any suitable distribution of functionality between different functional units, processors or domains may be used without detracting from the invention. For example, functionality illustrated to be performed by separate processors or controllers may be performed by the same processor or controller. Hence, references to specific functional units are only to be seen as references to suitable means for providing the described functionality, rather than indicative of a strict logical or physical structure or organization.

[0054] Although the present invention has been described in connection with some embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the scope of the present invention is limited only by the claims. Additionally, although a feature may appear to be described in connection with

particular embodiments, one skilled in the art would recognize that various features of the described embodiments may be combined in accordance with the invention.

[0055] Furthermore, although individually listed, a plurality of means, elements or method steps may be implemented by, for example, a single unit or processor. Additionally, although individual features may be included in different claims, these may possibly be advantageously combined, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. Also, the inclusion of a feature in one category of claims does not imply a limitation to this category, but rather the feature may be equally applicable to other claim categories, as appropriate.

* * *

CLAIMS

What is claimed is:

1. A user equipment (UE) comprising:

a receiver and a processor are configured to receive resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a transmitter and the processor are configured to send, over the physical uplink shared channel, data in assigned time intervals;

the transmitter and the processor are further configured, in a time interval that it is not sending information over the physical uplink shared channel, to send the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station; and

the receiver and the processor are further configured to receive, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions.

2. The UE of claim 1, wherein the receiver and the processor are further configured to receive data on a physical downlink shared channel.

3. The UE of claim 2, wherein the downlink control channel and the physical downlink shared channel are time multiplexed.

4. The UE of claim 1, wherein the receiver and the processor are further configured to receive, on the downlink control channel, power control information.

5. The UE of claim 4, wherein the downlink control channel includes power control information for a plurality of UEs using different bits.

6. The UE of claim 1, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

7. A network device comprising:

a transmitter and a processor are configured to transmit resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

a receiver and the processor are further configured to receive, over the physical uplink shared channel, data in assigned time intervals;

the receiver and the processor are further configured, in a time interval that it is not receiving information over the physical uplink shared channel, to receive the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device; and

the transmitter and the processor are further configured to transmit, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions.

8. The network device of claim 7, wherein the transmitter and the processor are further configured to transmit data on a physical downlink shared channel.

9. The network device of claim 8, wherein the downlink control channel and the physical downlink shared channel are time multiplexed.

10. The network device of claim 7, wherein the transmitter and the processor are further configured to transmit, on the downlink control channel, power control information.

11. The network device of claim 10, wherein the downlink control channel includes power control information for a plurality of UEs using different bits.

12. The network device of claim 7, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

13. A method performed by user equipment (UE), the method comprising:

receiving resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

sending, over the physical uplink shared channel, data in assigned time intervals;

sending, in a time interval that it is not sending information over the physical uplink shared channel, the uplink physical signal based on the received resource allocation information, wherein the uplink physical signal is used to determine channel conditions by a base station; and

receiving, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions.

14. The method of claim 13 further comprising receiving data on a physical downlink shared channel.

15. The method of claim 14, wherein the downlink control channel and the physical downlink shared channel are time multiplexed.

16. The method of claim 13 further comprising receiving, on the downlink control channel, power control information.

17. The method of claim 16, wherein the downlink control channel includes power control information for a plurality of UEs using different bits.

18. The method of claim 13, wherein in the time interval that the uplink physical signal is sent by the UE, a plurality of UEs each transmit on respective uplink physical control channels in the time interval.

19. A method performed by a network device, the method comprising:

transmitting resource allocation information associated with an uplink physical signal, wherein the uplink physical signal and a physical uplink shared channel have different resources;

receiving, over the physical uplink shared channel, data in assigned time intervals;

receiving, in a time interval that it is not receiving information over the physical uplink shared channel, the uplink physical signal based on the transmitted resource allocation information, wherein the uplink physical signal is used to determine channel conditions by the network device; and

transmitting, on a downlink control channel, control information, wherein the control information is based on the determined channel conditions.

20. The method of claim 19 further comprising transmitting data on a physical downlink shared channel.

21. The method of claim 20, wherein the downlink control channel and the physical downlink shared channel are time multiplexed.

22. The method of claim 19 further comprising transmitting, on the downlink control channel, power control information.

23. The method of claim 22, wherein the downlink control channel includes power control information for a plurality of UEs using different bits.

24. The method of claim 19, wherein in the time interval that the uplink physical signal is received by the network device, signals are received on other uplink physical control channels in the time interval from a plurality of UEs.

ABSTRACT

A user equipment (UE) may, in a time interval that it is not sending information over a physical uplink shared channel, send an uplink physical signal based on received resource allocation information. The uplink physical signal may be used to determine channel conditions by a base station. The UE may receive, on a downlink control channel, control information. The control information may be based on the determined channel conditions.

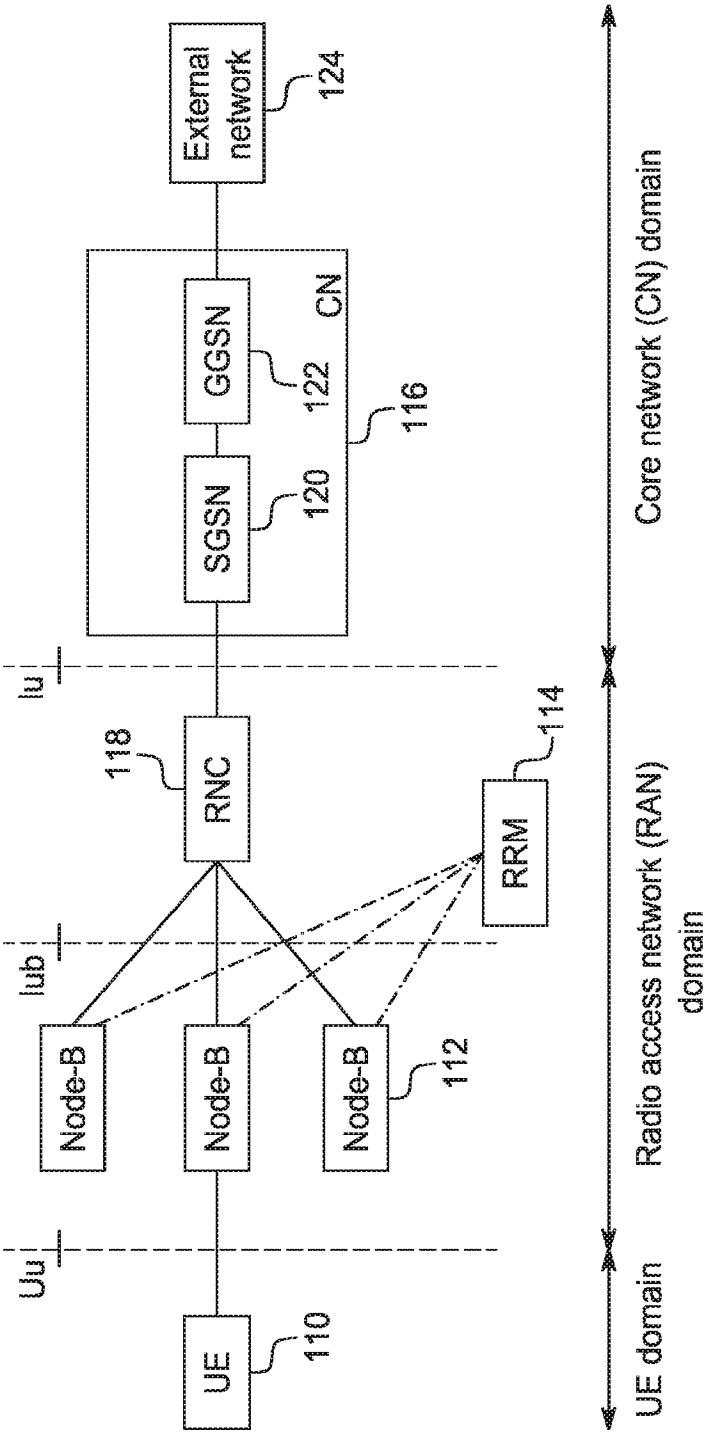

External network
124
GGSN
122
SGSN
120
CN
116
Core network (CN) domain
Iu
118
RNC
114
RRM
Iub
Node-B
Node-B
Node-B
112
Radio access network (RAN) domain
Uu
UE
110
UE domain

FIG. 1

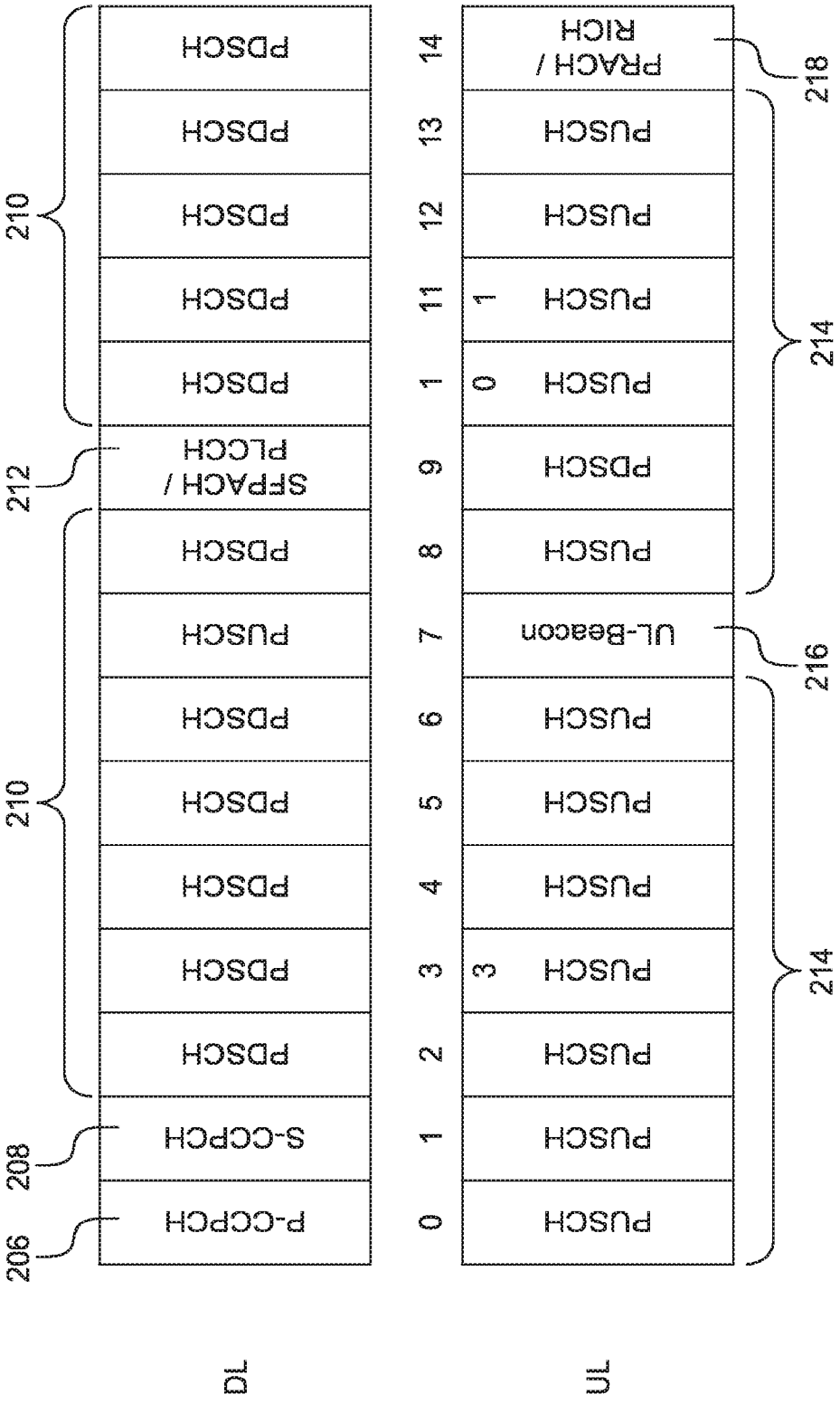

DL
UL
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208
210
212
210
214
216
214
218
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S-CCPCH
PDSCH
SFPACH / PLCCH
PUSCH
UL-Beacon
PRACH / RICH
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FIG. 2

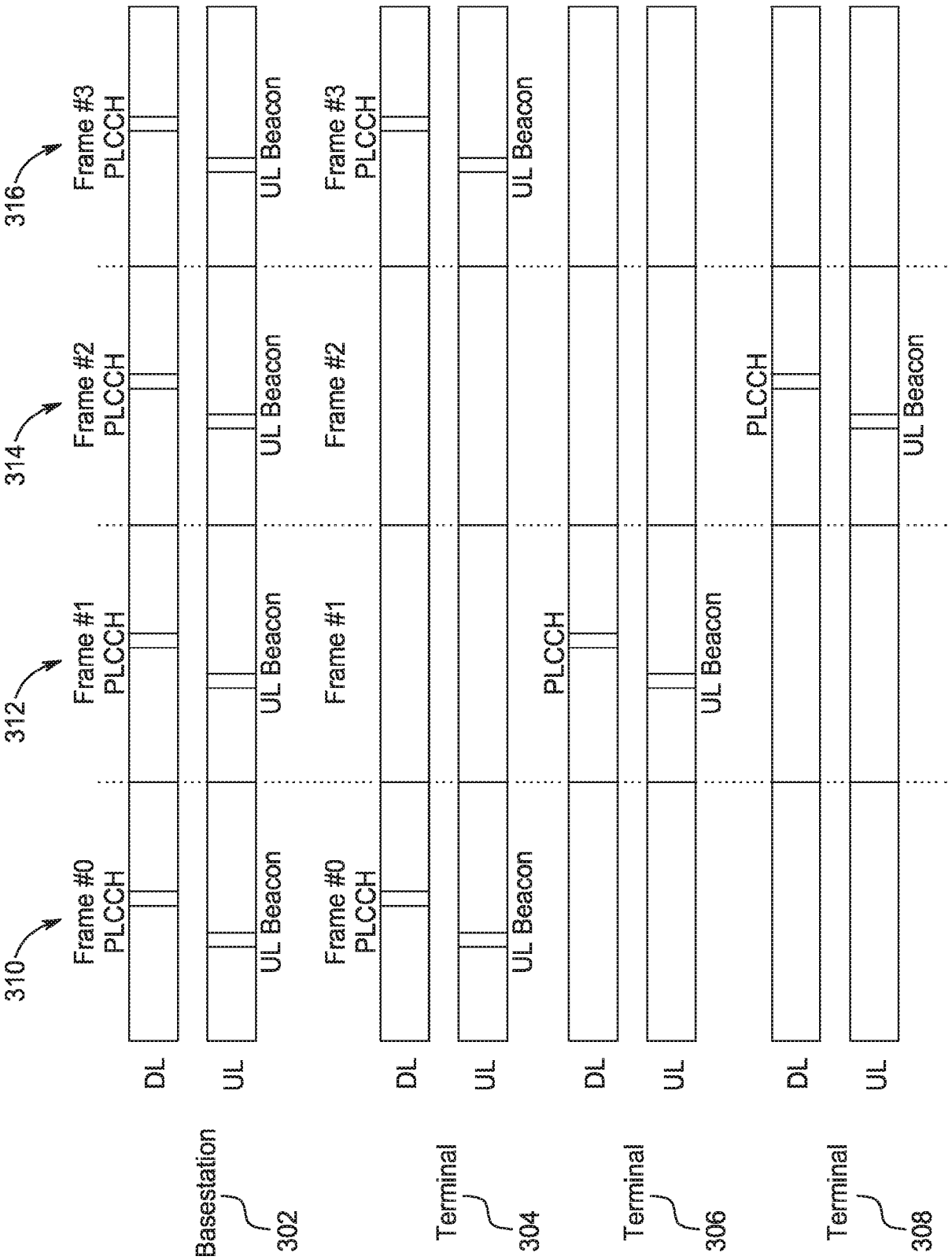

Basestation
302
Terminal
304
Terminal
306
Terminal
308
DL
UL
Frame #0
PLCCH
Frame #1
PLCCH
Frame #2
PLCCH
Frame #3
PLCCH
UL Beacon
310
312
314
316

FIG. 3

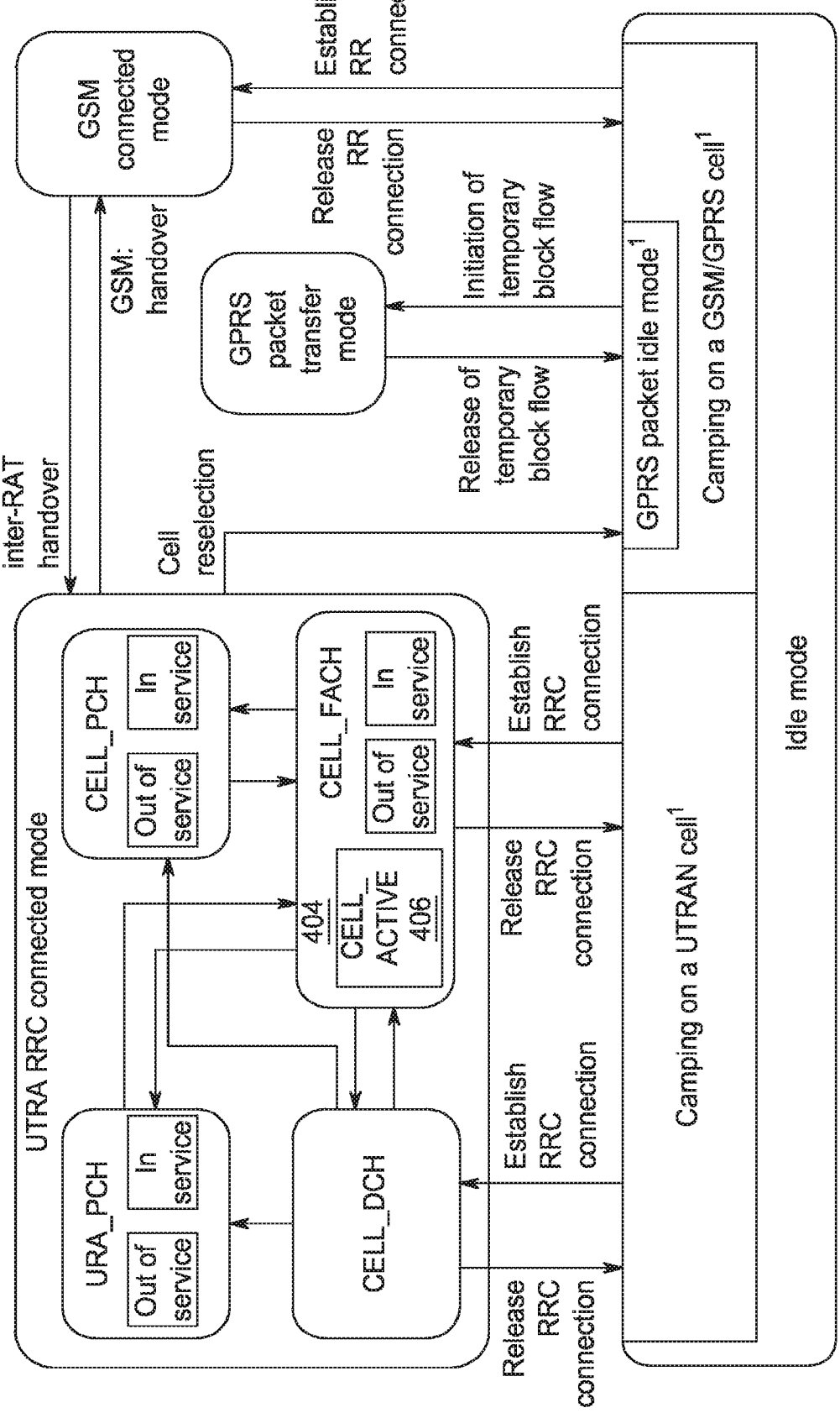

UTRA RRC connected mode
URA_PCH
Out of service
In service
CELL_PCH
Out of service
In service
CELL_DCH
CELL_FACH
Out of service
In service
404
CELL_ACTIVE 406
UTRA: inter-RAT handover
GSM: handover
Cell reselection
GSM connected mode
GPRS packet transfer mode
Establish RR connection
Release RR connection
Initiation of temporary block flow
Release of temporary block flow
Establish RRC connection
Release RRC connection
Establish RRC connection
Release RRC connection
GPRS packet idle mode[1]
Camping on a GSM/GPRS cell[1]
Camping on a UTRAN cell[1]
Idle mode

FIG. 4

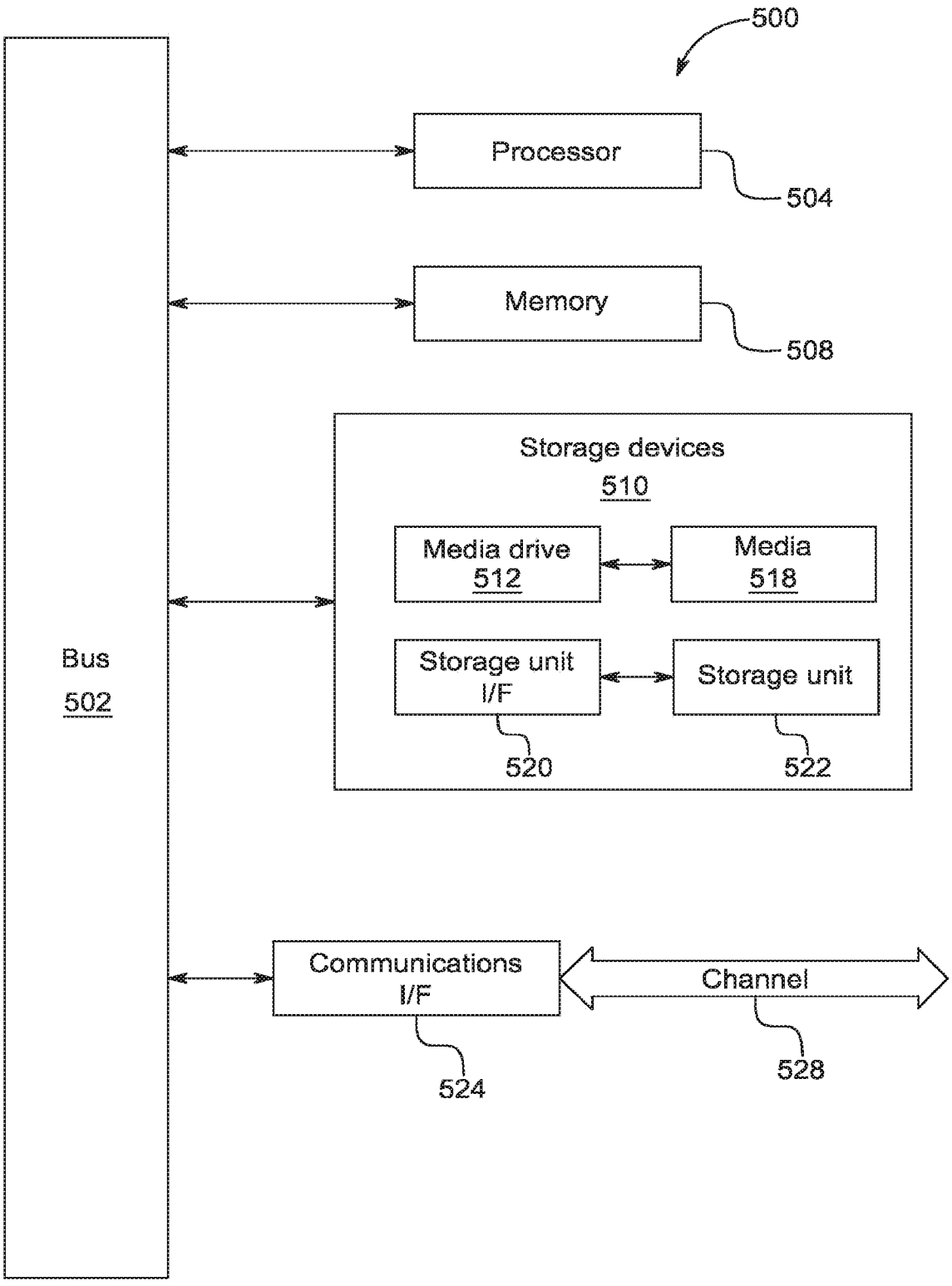

500
Processor
504
Memory
508
Storage devices
510
Media drive
512
Media
518
Storage unit
I/F
Storage unit
520
522
Bus
502
Communications
I/F
Channel
524
528

FIG. 5

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN213316
	Application Number	
Title of Invention	COMMUNICATIONS IN A WIRELESS NETWORK	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Paul		Howard	

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

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City	Bristol	**State/Province**	
Postal Code	BS7 8SB	**Country** [i]	UK

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	3624		
Email Address	eoffice@vklaw.com	Add Email	Remove Email

Application Information:

Title of the Invention	COMMUNICATIONS IN A WIRELESS NETWORK		
Attorney Docket Number	IPW2-USCN213316	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	**Suggested Figure for Publication (if any)**	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN213316
	Application Number	
Title of Invention	COMMUNICATIONS IN A WIRELESS NETWORK	

Filing By Reference:

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

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

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

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	3624		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	14458693	2014-08-13

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN213316
	Application Number	
Title of Invention	COMMUNICATIONS IN A WIRELESS NETWORK	

Prior Application Status	Patented			Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14458693	Continuation of	13176298	2011-07-05	8811356	2014-08-19
Prior Application Status	Patented			Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13176298	Continuation of	11646692	2006-12-27	8009639	2011-08-30

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

Foreign Priority Information:

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

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

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

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

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

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN213316
	Application Number	
Title of Invention	COMMUNICATIONS IN A WIRELESS NETWORK	

Authorization or Opt-Out of Authorization to Permit Access:

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

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

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

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

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

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

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

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

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

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

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

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Applicant Information:

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

Applicant 1

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

Clear

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

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

Name of the Deceased or Legally Incapacitated Inventor:	

If the Applicant is an Organization check here. ☒

Organization Name	Intellectual Ventures II LLC

Mailing Address Information For Applicant:

Address 1	2711 Centerville Road		
Address 2	Suite 400		
City	Wilmington	**State/Province**	DE
Country	US	Postal Code	19808
Phone Number		Fax Number	
Email Address			

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

Assignee Information including Non-Applicant Assignee Information:

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

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Assignee 1

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

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

Organization Name	Intellectual Ventures II LLC

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	2711 Centerville Road II LLC		
Address 2	Suite 400		
City	Wilmington	**State/Province**	DE
Country i	US	Postal Code	19808
Phone Number		Fax Number	
Email Address			

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

Signature:

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

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

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

Signature	/Harry Vartanian/			Date (YYYY-MM-DD)	2019-11-13
First Name	Harry	Last Name	Vartanian	Registration Number	56,787

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

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This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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

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

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

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

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

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

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

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

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

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

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