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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	08/09/2016	9414326	IPW2-USCN207446	3361

3624 7590 07/20/2016

VOLPE AND KOENIG, P.C.
UNITED PLAZA
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):

Nicholas W. Anderson, Exeter, UNITED KINGDOM;
Intellectual Ventures Holding 81 LLC, Las Vegas, NV;

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3624 7590 03/30/2016
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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.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

TITLE OF INVENTION: POWER CONTROL 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	06/30/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
REGO, DOMINIC E	2647	455-509000

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

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

1 Volpe and Koenig, P.C.
2
3

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

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

(A) NAME OF ASSIGNEE: Intellectual Ventures II LLC

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

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

4a. The following fee(s) are submitted:
- ☒ Issue Fee
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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 /Harry Vartanian/ Date June 30, 2016

Typed or printed name Harry Vartanian Registration No. 56,787

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Electronic Patent Application Fee Transmittal

Application Number:	14713719
Filing Date:	15-May-2015
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Filer:	Harry Vartanian/Elizabeth McGinty
Attorney Docket Number:	IPW2-USCN207446

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:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Utility Appl Issue Fee	1501	1	960	960
Publ. Fee- Early, Voluntary, or Normal	1504	1	0	0
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt	
EFS ID:	26222864
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Elizabeth McGinty
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	30-JUN-2016
Filing Date:	15-MAY-2015
Time Stamp:	16:59:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$960
RAM confirmation Number	3716
Deposit Account	220493
Authorized User	VARTANIAN, HARRY
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IPW2-USCN207446-Issue_Fee_Payment-20160630.PDF	1600197 5921023b548966202311d688fe82397de25d5d5c	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32268 92fc7a7f90a3451921e93d62238b2e614fac14d0	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1632465		

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

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

3624 7590 04/15/2016

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EXAMINER	
REGO, DOMINIC E	

ART UNIT	PAPER NUMBER
2647	

NOTIFICATION DATE	DELIVERY MODE
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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
14/713,719	15 May, 2015	ANDERSON, NICHOLAS W.	IPW2-USCN207446

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DOMINIC REGO	
ART UNIT	PAPER
2647	20160411

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IDS filed 03/25/2016 and 03/28/2016 have been considered fully.

/DOMINIC REGO/
Primary Examiner, Art Unit 2647

PTO-90C (Rev.04-03)

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
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Application Number	14713719
Filing Date	2015-05-15
First Named Inventor	Nicholas W. Anderson
Art Unit	2647
Examiner Name	Dominic E. Rego
Attorney Docket Number	IPW2-USCN207446

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6442398	B1	2002-08-27	Padovani et al.	
	2	6512931	B1	2003-01-28	Kim et al.	*English Equivalent of CN1128515

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	1	1128515	CN	C	2003-11-19	Samsung Electronics Co. Ltd.	English Abstract provided. *US6512931 is the English Equivalent	
	2	1343400	CN	A	2002-04-03	InterDigital Tech Corp	English Abstract provided. *WO00/57574 is the English Equivalent	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14713719
	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	3	00/57574	WO	A1	2000-09-28	Zeira et al.	*English Equivalent of CN1343400	

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Application Number	14713719
Filing Date	2015-05-15
First Named Inventor	Nicholas W. Anderson
Art Unit	2647
Examiner Name	Dominic E. Rego
Attorney Docket Number	IPW2-USCN207446

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8134994	B2	2012-03-13	Liu et al.	*English Equivalent of JP 2004-248247

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	1	20040190485	A1	2004-09-30	Khan	*English Equivalent of JP 2004-289842

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2004248247	JP	A	2004-02-09	Lucent Technol Inc.	*English Translation of Abstract. US 8134994 is the English Equivalent	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	14713719
Filing Date	2015-05-15
First Named Inventor	Nicholas W. Anderson
Art Unit	2647
Examiner Name	Dominic E. Rego
Attorney Docket Number	IPW2-USCN207446

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	OFFICE ACTION, Korean Patent Application No. 10-2007-7005478, dated December 21, 2011 with English Translation	
	2	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2007-7005478, dated June 7, 2012.	
	3	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2012-7004514, dated February 22, 2013.	
	4	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2012-7004519, dated December 26, 2012.	
	5	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2012-7004526, dated June 7, 2012.	
	6	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2012-7020771, dated January 30, 2013.	

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NOTICE OF ALLOWANCE AND FEE(S) DUE

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PHILADELPHIA, PA 19103

EXAMINER
REGO, DOMINIC E

ART UNIT	PAPER NUMBER
2647	

DATE MAILED: 03/30/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

TITLE OF INVENTION: POWER CONTROL 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	06/30/2016

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.

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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.

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

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

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

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

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

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

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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)

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(Depositor's name)
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(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

TITLE OF INVENTION: POWER CONTROL 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	06/30/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
REGO, DOMINIC E	2647	455-509000

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

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

3624 7590 03/30/2016

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

EXAMINER	
REGO, DOMINIC E	
ART UNIT	PAPER NUMBER
2647	

DATE MAILED: 03/30/2016

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. 14/713,719	Applicant(s) ANDERSON, NICHOLAS W.	
	Examiner DOMINIC REGO	Art Unit 2647	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 *03/17/2016*.
   ☐ 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 *1,2,4-6,8-10,12,13,15 and 16*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

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

   * Certified copies not received: _____.

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

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

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

Attachment(s)

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

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

DETAILED ACTION

Allowable Subject Matter

2. Claims 1, 2, 4-6, 8-10, 12, 13, 15, and 16 are allowed for the same reasons presented in the previous office action and updated further search report.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DOMINIC E. REGO whose telephone number is (571)272-8132. The examiner can normally be reached on Monday-Friday, 9:00 am-5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay A. Maung can be reached on 571-272-7882. 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.

/DOMINIC E REGO/
Primary Examiner, Art Unit 2647
Tel 571-272-8132

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	189	(nicholas near2 anderson).in.	US-PGPUB; USPAT	OR	ON	2016/03/20 22:12
L2	116	(intellectual near2 ventures near2 holding).as.	US-PGPUB; USPAT	OR	ON	2016/03/20 22:12
L3	4	((down$link forward$link forward near2 link) near5 (physical near2 channel) same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) with power near2 level same (path$loss path near2 loss)).clm.	US-PGPUB; USPAT	OR	ON	2016/03/20 22:12
L4	5	((down$link forward$link forward near2 link) with channel same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) same power near2 level same (path$loss path near2 loss)).clm.	US-PGPUB; USPAT	OR	ON	2016/03/20 22:12
L5	5	(resource with allocat$3 same power with command$3 same power with level same (path$loss path near2 loss)).clm.	US-PGPUB; USPAT	OR	ON	2016/03/20 22:13
L6	4	1 and 3	US-PGPUB; USPAT	OR	ON	2016/03/20 22:13
L7	5	1 and 4	US-PGPUB; USPAT	OR	ON	2016/03/20 22:13
L8	5	1 and 5	US-PGPUB; USPAT	OR	ON	2016/03/20 22:13
L9	4	2 and 3	US-PGPUB; USPAT	OR	ON	2016/03/20 22:13
L10	5	2 and 4	US-PGPUB; USPAT	OR	ON	2016/03/20 22:14
L11	5	2 and 5	US-PGPUB; USPAT	OR	ON	2016/03/20 22:14

3/20/2016 10:14:29 PM
C:\Users\drego\Documents\EAST\Workspaces\14713719.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	Art Unit
	DOMINIC E REGO	2647

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	522, 68, 69, 296, 135, 226.3, 277.2, 115.3, 126, 127.1, 127.2, 67.11, 434, 436	6/24/2015	DR
370	331, 320, 335, 342, 318, 392, 252, 276, 280	6/24/2015	DR
375	147, 130	6/24/2015	DR

SEARCH NOTES		
Search Notes	Date	Examiner
EAST, Inventor, and Assignee Search	6/24/2015	DR
Updated above search	12/13/2015	DR
Updated above search	3/20/2016	DR

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	PGPUB Text Search-See Interference Search History	12/13/2015	DR
	Updated above search	3/20/2016	DR

PTO/SB/08a (03-15)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14713719
Filing Date	2015-05-15
First Named Inventor	Nicholas W. Anderson
Art Unit	2647
Examiner Name	Dominic E. Rego
Attorney Docket Number	IPW2-USCN207446

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5257283	A	1993-10-26	Gilhousen et al.	

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

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1159720	CN	A	1997-09-17	Qualcomm, Inc.	*Abstract Translation provided	
	2	91/07037	WO	A1	1991-05-16	Qualcomm, Inc.	*English Equivalent of CN 1159720	

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

NON-PATENT LITERATURE DOCUMENTS Remove

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.E.R/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Application Number	14713719
	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

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

EXAMINER SIGNATURE

Examiner Signature	/DOMINIC E REGO/	Date Considered	03/20/2016

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

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.E.R/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L13	5	(down$link forward$link forward near2 link) with channel same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) same power near2 level same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:15
L14	14455	(down$link forward$link forward near2 link) near5 (physical near2 channel)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:15
L15	2977	L14 same resource near5 allocat$3	US-PGPUB; USPAT	OR	ON	2016/03/20 22:15
L16	624	L15 same (power near3 command$3 tpc)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:15
L17	4	L16 same (up$link reverse$link reverse near link) with power near2 level	US-PGPUB; USPAT	OR	ON	2016/03/20 22:15
L18	4	L16 same power near2 level	US-PGPUB; USPAT	OR	ON	2016/03/20 22:15
L19	4	(down$link forward$link forward near2 link) near5 (physical near2 channel) same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) with power near2 level same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:16
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L21	63212	(physical near2 channel)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:17
L22	2017	L21 same (up$link reverse$link reverse near link) with resource near3 allocat$3	US-PGPUB; USPAT	OR	ON	2016/03/20 22:17
L23	495	L22 same (power near3 command$3 tpc)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:17
L24	6	L23 same power near2 level	US-PGPUB;	OR	ON	2016/03/20 22:17

			USPAT			
L25	14455	(down$link forward$link forward near2 link) near5 (physical near2 channel)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:17
L26	3060	L25 same resource with allocat$3	US-PGPUB; USPAT	OR	ON	2016/03/20 22:17
L27	609	L26 same (power near4 control$4 with command$3 tpc)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:17
L28	2	L27 same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:17
L29	37410	455/522,68-70,115.3,126,135,226.3,277.2,422.1,450-453,456.2,464,509,510.ccls. 370/318.ccls.	US-PGPUB; USPAT	OR	ON	2016/03/20 22:18
L30	34	L29 and L27	US-PGPUB; USPAT	OR	ON	2016/03/20 22:18
L31	4	L30 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2016/03/20 22:18
L32	44	(different various multi$3 many several numerous variety pluralit$3 second third first fourth) near2 level near4 (tpc transmi$6 near2 power near2 control$4) near2 command$3	US-PGPUB; USPAT	OR	ON	2016/03/20 22:18
L33	32	L32 same power near2 level	US-PGPUB; USPAT	OR	ON	2016/03/20 22:18
L34	2	L33 same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:18
L35	12	multi$level near3 (tpc transmi$6 near2 power near2 command$3)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:19
L36	8	L35 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2016/03/20 22:19
L37	184	(transmi$6 send$3 forward$3 deliver$3 provid$3 broad$cast$3) near6 (tpc transmi$6 near2 power near2 command$3) near5 schedul$3 near2 information	US-PGPUB; USPAT	OR	ON	2016/03/20 22:19
L38	5	L37 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2016/03/20 22:19
L39	14455	(down$link forward$link forward near2 link) near5 (physical near2 channel)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:19
L40	3060	L39 same resource with allocat$3	US-PGPUB; USPAT	OR	ON	2016/03/20 22:19
L41	609	L40 same (power near4 control$4 with command$3 tpc)	US-PGPUB; USPAT	OR	ON	2016/03/20 22:19
L42	2	L41 same (path$loss path near2 loss)	US-PGPUB;	OR	ON	2016/03/20 22:19

			USPAT				

3/20/2016 10:22:36 PM
C:\Users\drego\Documents\EAST\Workspaces\14713719.wsp

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	**Art Unit**
	DOMINIC E REGO	2647

CPC						
Symbol					**Type**	**Version**
H04W		52	/	242	F	2013-01-01
H04W		52	/	06	I	2013-01-01
H04W		52	/	08	A	2013-01-01
H04W		52	/	10	A	2013-01-01
H04W		52	/	12	A	2013-01-01
H04W		52	/	221	I	2013-01-01
H04W		52	/	24	I	2013-01-01
H04W		52	/	243	A	2013-01-01
H04W		72	/	0473	I	2013-01-01
H04W		52	/	241	I	2013-01-01
H04W		72	/	1268	I	2013-01-01
H04W		72	/	1289	I	2013-01-01
			/			
			/			
			/			

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

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/DOMINIC E REGO/ Primary Examiner.Art Unit 2647	03/20/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	**Art Unit**
	DOMINIC E REGO	2647

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
455	522	H	0	4	B	7 / 00 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	68	69			

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/DOMINIC E REGO/ Primary Examiner.Art Unit 2647	03/20/2016	O.G. Print Claim(s)	O.G. Print Figure
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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	**Art Unit**
	DOMINIC E REGO	2647

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Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
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(Not for submission under 37 CFR 1.99)

Application Number	14713719
Filing Date	2015-05-15
First Named Inventor	Nicholas W. Anderson
Art Unit	2647
Examiner Name	Dominic E. Rego
Attorney Docket Number	IPW2-USCN207446

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6442398	B1	2002-08-27	Padovani et al.	
	2	6512931	B1	2003-01-28	Kim et al.	*English Equivalent of CN1128515

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	1	1128515	CN	C	2003-11-19	Samsung Electronics Co. Ltd.	English Abstract provided. *US6512931 is the English Equivalent	
	2	1343400	CN	A	2002-04-03	InterDigital Tech Corp	English Abstract provided. *WO00/57574 is the English Equivalent	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	3	00/57574	WO	A1	2000-09-28	Zeira et al.	*English Equivalent of CN1343400	

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	Application Number	14713719
	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry Vartanian/	Date (YYYY-MM-DD)	2016-03-28
Name/Print	Harry Vartanian	Registration Number	56787

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Power control device and method for reverse link common channel in mobile communication system

Application Number	99800994	**Application Date**	1999.07.13
Publication Number	1272987	**Publication Date**	2000.11.08
Priority Information	1998/7/13 KR 1998/28238; 1998/8/5 KR 1998/32351		
International Classification	H04B7/216		
Applicant(s) Name	Samsung Electronics Co., Ltd.		
Address			
Inventor(s) Name	Kim Young-Ky;Ahn Jae-Min;Park Chang-soo		
Patent Agency Code	11105	**Patent Agent**	ma ying

Abstract

A method for controlling the transmission power of the reverse common channel for a mobile station in a CDMA communication system. In the method, the mobile station transmits a preamble signal at predetermined periods with increasing transmission power. Upon receipt of an acknowledge signal from a base station, the mobile station accesses the reverse common channel. In order to avoid multiple mobile stations from simultaneously generating increasingly powerful and interfering transmissions, the method generates two transmission power control signals: one based on the measured strength of a signal received from the base station and the other based on an accumulated value of power control commands transmitted by the base station. These two signals are accumulated and used to control the preamble signal.

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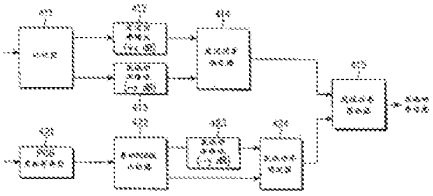
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权利要求书 3 页 说明书 8 页 附图 5 页

[54] 发明名称 移动通信系统中反向链路公共信道的功率控制装置和方法

[57] 摘要

一种在 CDMA 通信系统中控制移动台的反向公共信道的发送功率的方法。在该方法中，移动台通过以预定间隔增大发送功率来发送前同步信号。当从基站接收到确认信号时，移动台接入反向公共信道。为了避免多个移动台同时产生渐增的大功率和有干扰的发送，该方法产生两个发送功率控制信号：一个基于测量到的从基站接收的信号强度，另一个基于由基站发送的功率控制指令的累积值。这两个信号被累积，并用于控制前同步信号。



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1. 一种在码分多址(CDMA)通信系统中控制移动台的反向公共信道的发送功率的方法，包括下列步骤：

累积在预定时间内经前向公共信道接收到的功率控制信号，以产生一累积值；

将所述累积值与一门限值进行比较；

如果所述累积值小于所述门限值，则产生用于降低发送功率的指令；及

如果所述累积值大于所述门限值，则保持当前的发送功率。

2. 如权利要求 1 所述的方法，其中，所述移动台具有经所述反向公共信道发送的前同步信号，并且所述方法还包括如下步骤：当从基站接收到确认信号时，切断所述前同步信号的发送并接入所述反向公共信道。

3. 如权利要求 2 所述的方法，其中，所述前向公共信道是用于专门发送功率控制指令的前向公共子控制信道。

4. 如权利要求 2 所述的方法，其中，基站测量接收到的反向链路的功率，产生相应的功率控制比特，将所述功率控制比特插入所述前向公共控制信道中的预定位置，并发送所述前向公共控制信道。

5. 如权利要求 2 所述的方法，其中，所述前向公共信道是用于发送由基站对反向链路公共信道产生的功率控制指令的前向公共控制信道。

6. 一种在 CDMA 通信系统中控制移动台的反向公共信道的发送功率的方法，在所述 CDMA 通信系统中，所述移动台通过以预定间隔增大发送功率来发送前同步信号，并当从基站接收到确认信号时接入反向公共信道，所述方法包括下列步骤：

测量接收信号的强度，以产生所述前同步信号的第一发送功率控制信号；

累积在预定时间内经前向公共信道接收到的功率控制指令，以产生一累积值，将所述累积值与一门限值进行比较，当需要降低发送功率时产生用于降低发送功率的第二发送功率控制信号，而当需要增大发送功率时保持当前的发送功率；及

累积所述第一和第二发送功率控制信号，并根据所述累积的发送功率控制信号来控制所述前同步信号。

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7. 如权利要求 6 所述的方法，其中，用于确定所述第二发送功率控制信号的门限值是当根据功率控制指令增大发送功率时所允许的最大值，所述功率控制指令是由基站根据尝试以最高发送功率接入所述基站的移动台的发送功率产生的。

8. 如权利要求 7 所述的方法，还包括如下步骤：当从所述基站接收到确认信号时，切断所述前同步信号的发送，并接入所述反向公共信道。

9. 一种在 CDMA 通信系统中控制移动台的反向公共信道的发送功率的装置，所述装置包括：

累积器，用于累积在预定时间内经前向公共信道接收到的功率控制信号，所述累积器产生一累积值，以便控制所述反向公共信道的发送功率；及

功率控制器，包括将所述累积值与一门限值进行比较的比较器，当需要降低发送功率时所述功率控制器产生功率降低指令，而当需要增大发送功率时所述功率控制器保持当前的发送功率。

10. 如权利要求 9 所述的装置，其中，在所述反向公共信道上发送的信号是前同步信号。

11. 如权利要求 9 所述的装置，其中，所述前向公共信道是用于专门发送功率控制指令的前向公共子控制信道。

12. 一种在 CDMA 通信系统中控制移动台的反向公共信道的发送功率的装置，所述装置包括：

前同步信号发射机，用于通过以预定间隔增大发送功率来发送前同步信号；

开环功率控制器，用于测量接收信号的强度，以产生所述前同步信号的第一发送功率控制信号；

功率控制器，包括：累积在预定时间内经前向公共信道接收到的功率控制指令以产生一累积值的第一累积器，以及将所述累积值与一门限值进行比较的比较器；所述功率控制器产生第二发送功率控制信号，用于当需要降低发送功率时降低发送功率，或者当需要增大发送功率时保持当前的发送功率；及

第二累积器，用于累积所述第一和第二发送功率控制信号，并将所述累积的发送功率控制信号加到所述前同步发射机。

13. 如权利要求 12 所述的装置，其中，用于确定所述第二发送功率控

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制信号的门限值是当根据功率控制指令增大发送功率时所允许的最大值，所述功率控制指令是由基站根据尝试以最高发送功率接入所述基站的移动台的发送功率产生的。

移动通信系统中反向链路公共信道的功率控制装置和方法

本发明背景

1. 本发明领域

本发明涉及一种移动通信系统的功率控制装置和方法，尤其涉及一种反向链路公共信道的功率控制装置和方法。

2. 相关技术描述

通常，现有的码分多址(CDMA)移动通信系统基于 IS-95 标准，该标准主要支持话音服务。但是，在不远的将来，将根据 IMT-2000 标准来进行移动通信，IMT-2000 标准不仅支持话音服务，还支持高速数据传送服务。例如，IMT-2000 标准可支持高品质话音服务、运动图像服务、和因特网(Internet)搜索服务等。

在 CDMA 移动通信系统中，将基站和移动台之间的无线电链路分为前向链路和反向链路，其中前向链路用于将信号从基站发送到移动台，反向链路用于将信号从移动台发送到基站。

反向(链路)公共信道包括反向公共控制信道(R-CCCH)和反向接入信道(R-ACH)。通过在基站和移动台之间交换消息和确认(ACK)，反向公共控制信道和反向接入信道执行功率调节，但不执行如将后述的快速闭环功率控制。

下面将描述反向公共控制信道和反向接入信道的常规功率控制方法。

功率控制方法分为开环功率控制方法和闭环功率控制方法。在开环功率控制方法中，移动台测量经前向链路接收到的信号的强度，并将测量值与一门限值进行比较。当接收信号的强度小于门限值时，移动台增大发送功率；反之，当接收信号的强度大于门限值时，移动台降低发送功率。

在闭环功率控制方法中，移动台经反向链路向基站发送消息，然后确定是否从基站接收到确认(ACK)。如果未能接收到确认，则移动台以增大预定电平的发送功率再次发送消息，以接入基站。

反向公共控制信道和反向接入信道是基于争用的信道。当多个移动台试

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图同时通过各信道接入基站时，它们之间可能出现争用。在这种情况下，各移动台采用增大的功率再次尝试接入基站，使得移动通信系统的反向链路之间的干扰增大。这就导致其他移动台信道品质的性能恶化。通过下面的描述，该问题将变得更清楚。

图 1 表示反向链路公共信道的常规功率控制方法。参照图 1，移动台采用最小功率向基站发送前同步信号，以尝试接入基站。图 1 中，T_1 表示的是第一次尝试接入基站的时刻。在由于与其他移动台的争用而未能接入基站时，该移动台等待预定时间，然后在时刻 T_2，通过增大发送功率再次尝试接入基站。当再次未能接入基站时，移动台再次等待预定时间，然后在时刻 T_3，采用再次增大的发送功率尝试接入基站。这里，该预定时间是固定时间和随机时间之和。

在这种情况下，由于发送功率过度增大，因此多个移动台之间出现的争用可引起整个系统的干扰增大。因此，当经反向公共控制信道发送分组数据时，可能出现这种过大的发送功率的问题。因此，需要一种能够抑制过大的发送功率的快速功率控制方法。

一般来讲，反向业务信道的功率控制方法旨在保持从基站接收到的信号的信噪比(E_b/N_0)。但是，在反向公共信道的功率控制方法中，采用一个功率控制指令流来控制多个移动台，从而降低过大的反向发送功率。

本发明概述

本发明的一个目的是提供一种移动通信系统中用于降低反向公共信道的过大信号功率的功率控制装置和方法。

本发明的另一目的是提供一种移动通信系统中采用开环功率控制和闭环功率控制两者来控制反向公共信道的发送功率的装置和方法。

为了实现上述和其他目的，提供了一种 CDMA 通信系统中控制移动台的反向公共信道的发送功率的方法。在该方法中，移动台以预定间隔发送前同步信号，并且每次增大发送功率，直至从基站接收到确认信号，此时，移动台接入反向公共信道。该方法包括下列步骤：测量接收信号的强度，以产生前同步信号的第一发送功率控制信号；累积经前向公共信道在预定时间内接收到的功率控制指令，以产生一累积值，将该累积值与一门限值进行比较，当需要降低发送功率时产生用于降低发送功率的第二发送功率控制信号，而

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当需要增大发送功率时保持当前的发送功率；以及，累积第一和第二发送功率控制信号，并根据累积的发送功率控制信号来控制前同步信号。

为了实现上述和其他目的，提供了一种在 CDMA 通信系统中控制移动台的反向公共信道的发送功率的装置，所述装置包括：累积器，用于累积在预定时间内经前向公共信道接收到的功率控制信号，所述累积器产生一累积值，以便控制所述反向公共信道的发送功率；及功率控制器，包括将所述累积值与一门限值进行比较的比较器，当需要降低发送功率时所述功率控制器产生功率降低指令，而当需要增大发送功率时所述功率控制器保持当前的发送功率。

为了实现上述和其他目的，提供了一种在 CDMA 通信系统中控制移动台的反向公共信道的发送功率的装置，所述装置包括：前同步信号发射机，用于通过以预定间隔增大发送功率来发送前同步信号；开环功率控制器，用于测量接收信号的强度，以产生所述前同步信号的第一发送功率控制信号；功率控制器，包括：累积在预定时间内经前向公共信道接收到的功率控制指令以产生一累积值的第一累积器，以及将所述累积值与一门限值进行比较的比较器；所述功率控制器产生第二发送功率控制信号，用于当需要降低发送功率时降低发送功率，或者当需要增大发送功率时保持当前的发送功率；及第二累积器，用于累积所述第一和第二发送功率控制信号，并将所述累积的发送功率控制信号加到所述前同步发射机。

附图简述

通过参照附图的如下详细描述，本发明的上述和其他目的、特征和优点将变得更加清楚，附图中：

图 1 是 CDMA 移动通信系统中常规反向公共信道功率控制方法的示意图；

图 2 是表示 CDMA 移动通信系统的信道发送装置的框图；

图 3 是表示 CDMA 移动通信系统中用于反向公共信道的开环功率控制方法的流程图；

图 4 是表示根据本发明一实施例在 CDMA 移动通信系统中采用开环功率控制和闭环功率控制两者的反向公共信道功率控制方法的流程图；及

图 5 是表示根据本发明一实施例的功率控制确定器的框图。

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优选实施例的详细描述

下面将参照附图来描述本发明的优选实施例。

这里所采用的术语“功率控制比特(PCB)”是指为了控制另一方的发送功率而被发送以指令该另一方增大或降低发送功率的控制比特。

在本发明的一实施例中，为了控制反向链路公共信道的功率，同时采用开环功率控制方法和闭环功率控制方法。最好，在 CDMA 移动通信系统中采用反向链路公共信道而在基站和移动台之间交换第 3 层和 MAC(介质接入控制)消息。当采用开环功率控制方法时，根据接收信号的强度来控制反向链路公共信道的功率。当采用闭环功率控制方法时，采用从基站发送的功率控制信号来控制反向链路公共信道的功率。如果该功率控制信号是功率降低指令，则降低公共信道的发送功率；反之，保持当前的发送功率。以这种方式，降低了由于反向公共信道的过大信号功率而引起的干扰。

图 2 表示 CDMA 通信系统的信道发送装置。为了便于解释，这里假设输入数据是全速率的 20ms 帧数据。

参照图 2，将 172 比特的数据帧输入到循环冗余码(CRC)发生器 111，该 CRC 发生器附加 12 比特 CRC。CRC 发生器 111 的输出被输入到尾比特发生器 112，该尾比特发生器 112 产生 8 个尾比特，将其加到帧数据的终接点，以便使编码器 113 能够以帧为单位对数据进行初始化。因此，对于 172 比特的输入数据，尾比特发生器 112 输出 192 比特数据。然后，编码器 113 将从尾比特发生器 112 输出的帧数据编码成每帧 576 个符号，交织器 114 对从编码器 113 输出的编码数据进行交织。

比特选择器 117 对从长码发生器 116 输出的长码进行抽取，以将该长码的长度与交织过的编码数据的长度相匹配。异或(XOR)门 115 对交织过的编码数据和抽取的长码进行异或，以对交织过的编码数据进行加扰。接下来，信号转换器 118 对异或门 115 的输出进行多路复用，以将奇数编号的数据输出到第一信道(即 I 信道)，而将偶数编号的数据输出到第二信道(即 Q 信道)，其中这些输出信号被电平转换，其方式为将信号“0”转换为“+1”，而将信号“1”转换为“-1”。I 和 Q 信道的电平转换信号分别由信道增益控制器 119 和 121 进行增益控制。

控制比特发生器 120 产生要插入到反向公共信道中的控制比特。穿孔器

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-插入器(puncturer-inserter)122 和穿孔器-插入器 123 将从控制比特发生器 120 输出的控制比特插入到信道增益控制器 119 和 121 的输出数据中由比特选择器 117 指定的位置。乘法器 124 将穿孔器-插入器 122 的输出与一指定的 Walsh(沃尔什)码相乘，以产生扩频的 I 信道信号，而乘法器 125 将穿孔器-插入器 123 的输出与该指定的 Walsh 码相乘，以产生扩频的 Q 信道信号。

图 5 表示根据本发明一实施例用于控制反向公共信道的功率的功率控制确定器。该反向公共信道功率控制方法混合采用下列控制方法：(1)图 1 的功率控制方法，用于以预定时段增大发送功率，直至接入基站；(2)开环功率控制方法，用于测量接收信号强度以控制发送功率；和(3)快速闭环功率控制方法，用于采用功率控制指令来控制发送功率。这里，将不对图 1 的功率控制方法进行详细描述。相反，所进行的描述将集中在开环功率控制方法和快速闭环功率控制方法。

参照图 5，测量功率电平比较器 411 将从基站发送的信号强度与一门限值进行比较，并产生一比较结果，以确定如何控制反向公共信道的发送功率。当接收信号的强度大于该门限值时，则启动发送功率降低装置 413；反之，当接收信号的强度小于该门限值时，比较器 411 启动发送功率增大装置 412。然后，第一发送功率确定器 414 分析发送功率增大装置 412 和发送功率降低装置 413 的输出，以产生开环功率控制信号。

部件 411-414 构成开环功率控制器，它根据接收信号的强度来增大或降低反向公共信道的发送功率。

接下来，PCB 累积寄存器 421 累积从基站接收到的 PCB。累积 PCB 值比较器 422 将从 PCB 累积寄存器 421 输出的累积的 PCB 值与内部最大值进行比较，并产生一比较结果。当比较结果为需要降低发送功率时，比较器 422 启动发送功率降低装置 423。然而，当需要增大发送功率时，将反向公共信道的发送功率保持在当前发送功率电平不变。然后，第二发送功率确定器 424 分析发送功率降低装置 423 和比较器 422 的输出，以产生闭环功率控制信号。

部件 421-424 构成闭环功率控制器，它分析累积的 PCB 值，从而仅当需要降低发送功率时才降低反向公共信道的发送功率，而当需要增大发送功率时，保持当前的反向公共信道的发送功率。对于闭环功率控制，与累积的 PCB 值比较的最大值是可由试验确定的一系统参数，并且是当采用快速闭环功率控制增大发送功率时所允许的最大值。另外，对于快速闭环功率控制，基站

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可根据多个试图接入基站的移动台中具有最高发送功率的移动台来发送功率控制指令。因此，当尝试接入基站并具有最高发送功率的移动台的发送功率的降低量大时，尝试以较低发送功率接入基站的移动台可能不能接入基站。

发送功率累积器415累积从发送功率确定器414和424输出的开环功率控制信号和闭环功率控制信号，以输出发送功率控制信号。从发送功率累积器415输出的发送功率控制信号取决于接收信号强度和从基站发送的PCB的分析结果两者。该发送功率控制信号再次与以图1的功率控制方法产生的功率控制信号累积，然后被用作前同步信号的发送功率控制信号。

亦即，如图1所示，前同步发射机(未示出)以由加到随机时段的固定时段构成的预定间隔发送前同步信号，并在每个间隔上增大发送功率。然后，第一发送功率控制器(即，开环功率控制器)测量从基站接收到的信号强度，以产生第一发送功率控制信号，用于控制前同步信号的发送功率。此外，第二发送功率控制器(即，闭环功率控制器)累积在预定时间内经前向公共信道接收到的PCB，以产生累积的PCB值，并将累积的PCB值与一门限值进行比较。如果比较结果为需要降低发送功率，则第二发送功率控制器产生用于将发送功率降低预定值的第二发送功率控制信号。否则，第二发送功率控制器产生用于保持当前发送功率的第二发送功率控制信号。发送功率累积器415累积第一发送功率控制信号和第二发送功率控制信号，并将累积的信号加到前同步发射机，以控制前同步信号的发送功率。

如上所述，当闭环功率控制器确定第二发送功率控制信号时所使用的门限值为当响应于功率控制指令增大发送功率时所容许的最大值。基站根据具有最高发送功率的移动台来产生用于降低前同步信号发送功率的功率控制指令。当接收到该功率控制指令时，除产生以最高发送功率尝试接入基站的移动台之外的所有其他移动台将发送功率降低到最低限度。因此，可降低由于不能接入基站的移动台的过大的发送功率而引起的干扰。

图3表示的是在图5的开环功率控制部(411-414)中执行的开环功率控制方法。

参照图3，在步骤212，开环功率控制确定器测量从基站接收到的信号的强度RSSI。由于本领域中用于测量接收信号强度的方法为已知，因此，这里将不对其进行详细描述。在测量信号强度后，在步骤213，功率控制确定

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器将所测量到的信号强度与一门限值进行比较。如果比较结果为接收信号强度低于门限值，则在步骤 215 将移动台的发送功率增大预定值(x dB)；否则，如果接收信号强度高于门限值，则在步骤 214 将移动台的发送功率降低预定值(x dB)。

在步骤 214 或 215 控制发送功率后，在步骤 216，功率控制确定器将一前同步信号发送到基站，并在步骤 217 确定是否从基站接收到确认信号。一旦接收到确认信号，功率控制确定器便通过公共信道进行通信，并结束该过程。但是，如果未能接收到确认，则在步骤 218，功率控制确定器经历预定时间 T_w，然后返回到步骤 212。

图 4 表示在图 5 的功率控制确定器中执行的采用开环功率控制和闭环功率控制两者对反向公共信道的功率控制方法。

参照图 4，功率控制确定器将 PCB 累积寄存器值 PWR_ACC_REG 初始化为 “0”。这里，在步骤 330 执行图 3 的开环功率控制过程(211-214/5)。亦即，在步骤 330，移动台测量从基站发送的信号的强度，并将所测量到的信号强度与一门限值进行比较。当测量到的信号强度值低于门限值时，将前同步信号的发送功率增大预定值(x dB)；而当测量到的信号强度值高于门限值时，将前同步信号的发送功率降低预定值(x dB)。

对于闭环功率控制过程，在步骤 313，功率控制确定器接收从基站发送的功率控制指令(PCB)，并确定它是功率增大指令还是功率降低指令。例如，对于功率增大指令，该功率控制指令值可以是+1，而对于功率降低指令，该功率控制指令值可以是-1．然后，在步骤 314，功率控制确定器累积这些功率控制指令值。在步骤 315，将所累积的功率控制指令值与一最大值进行比较。这里，最大值可以是 0，或者可以是给出的系统参数。当累积的功率控制指令值大于最大值时，即当需要增大前同步信号的发送功率时，功率控制确定器跳转到步骤 317，以保持当前的发送功率。但是，当累积的功率控制指令值小于最大值时，即当需要降低前同步信号的发送功率时，功率控制确定器在步骤 316 将前同步信号的发送功率降低预定值(y dB)．在步骤 315 和 316 之后，功率控制确定器在步骤 317 对 PCB 累积寄存器值 PWR_ACC_REG 进行初始化，并在步骤 318 将变量 n 增大 “1”。

在步骤 319，功率控制确定器根据开环和闭环功率控制结果来增大或降低前同步信号的发送功率。亦即，功率控制确定器将由开环功率控制过程确

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定的信号与由闭环功率控制过程确定的信号进行组合，以确定反向公共信道的发送功率。

在步骤320，确定是否从基站接收到确认信号。一旦接收到该确认信号，则该过程进到步骤321，在此，通过公共信道进行通信。但是，当未能接收到该确认信号时，该过程返回到步骤313。以这种方式，当在多个移动台中出现争用时，能够降低可能在闭环功率控制方法期间出现的干扰，而不是增大该干扰。

与此同时，对于从基站向移动台发送功率控制指令的方法，除了可使用前向链路公共控制信道外，还可使用前向链路公共子控制信道。亦即，基站采用单独的子控制信道向移动台发送功率控制指令。作为向移动台发送功率控制指令的另一方法，基站可对寻呼信道或前向公共控制信道进行穿孔，以便通过将功率控制比特插入穿孔位置来发送该功率控制比特。作为向移动台发送功率控制指令的又一方法，基站可采用寻呼信道或前向公共控制信道发送功率控制指令，将其作为单独的消息。

如上所述，在移动通信系统中，本发明功率控制方法降低了在多个移动台基于争用同时尝试接入基站的情况下由于在反向公共信道上出现过大的信号功率引起的干扰。

尽管已参照本发明的确定优选实施例表示和描述了本发明，但本领域内的普通技术人员将理解的是，可在不背离由所附权利要求限定的本发明宗旨和范围的前提下对本发明进行各种形式或细节上的修改。

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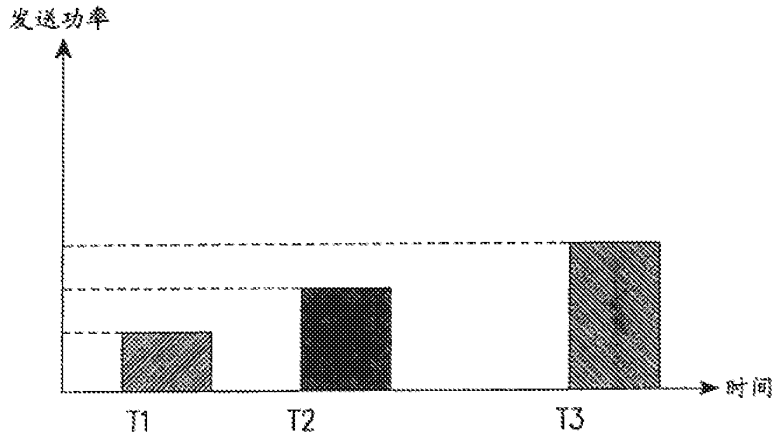


图 1

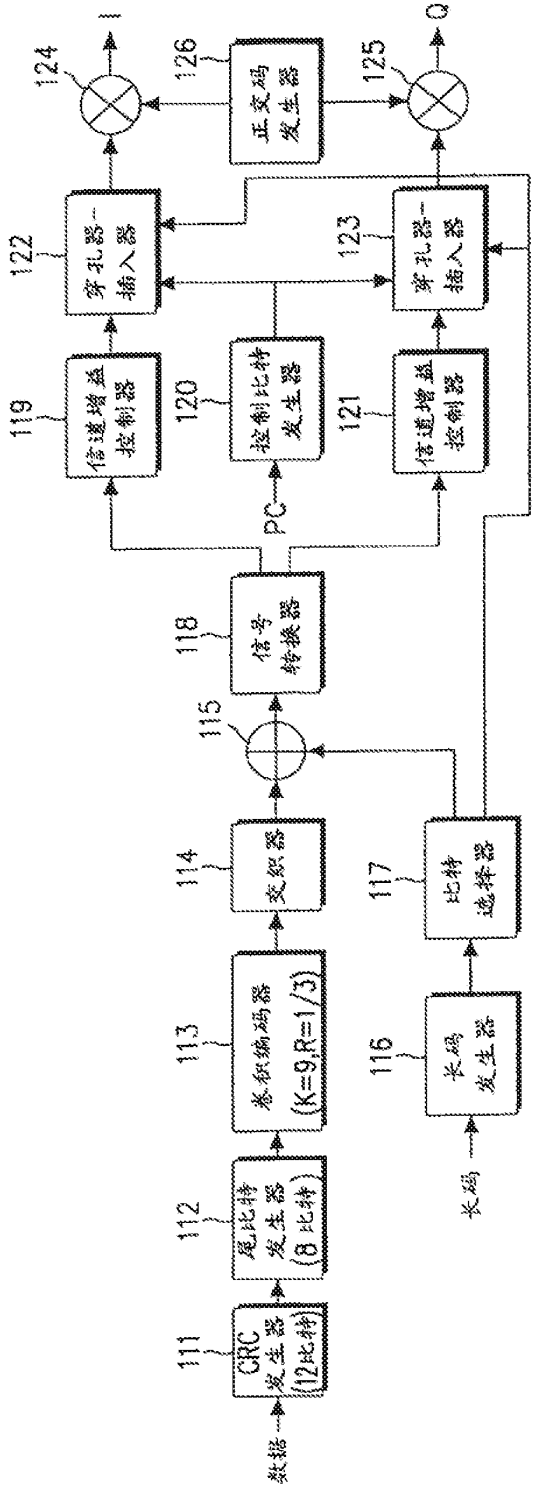

数据
CRC 发生器 (12比特)
111
尾比特 发生器 (8比特)
112
卷积编码器 (K=9,R=1/3)
113
交织器
114
信号 转换器
118
信道增益 控制器
119
控制比特 发生器
120
穿孔器- 插入器
122
信道增益 控制器
121
穿孔器- 插入器
123
PC
长码
长码 发生器
116
比特 选择器
117
115
正交码 发生器
126
124
125
I
Q

图 2

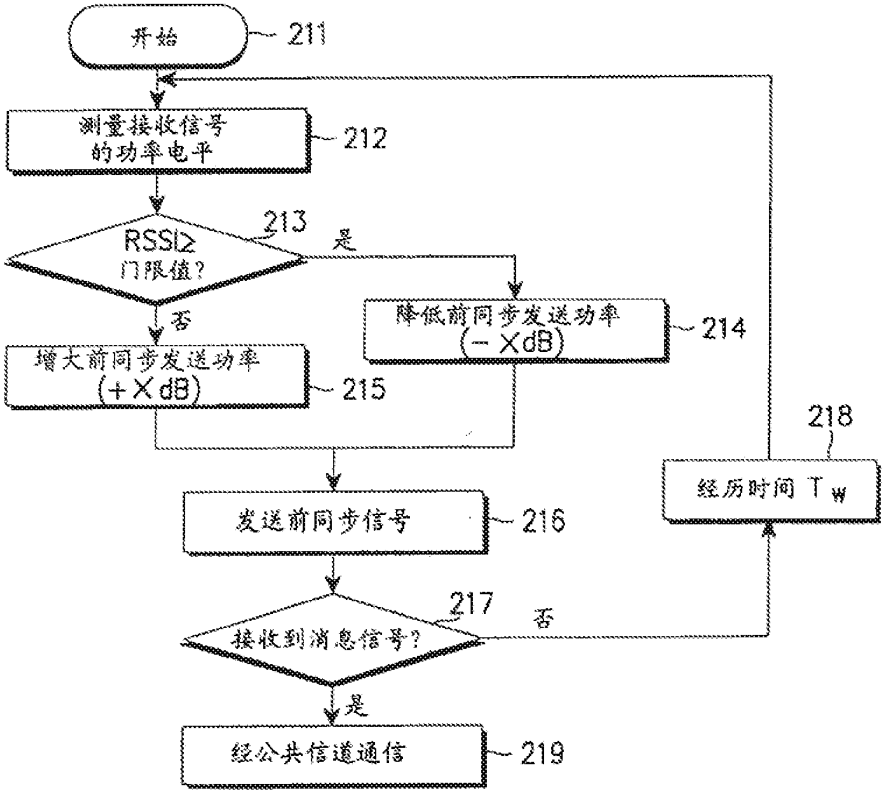

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RSSI≥门限值?
213
是
否
降低前同步发送功率(-XdB)
214
增大前同步发送功率(+XdB)
215
发送前同步信号
216
接收到消息信号?
217
否
是
经公共信道通信
219
经历时间 T_W
218

图 3

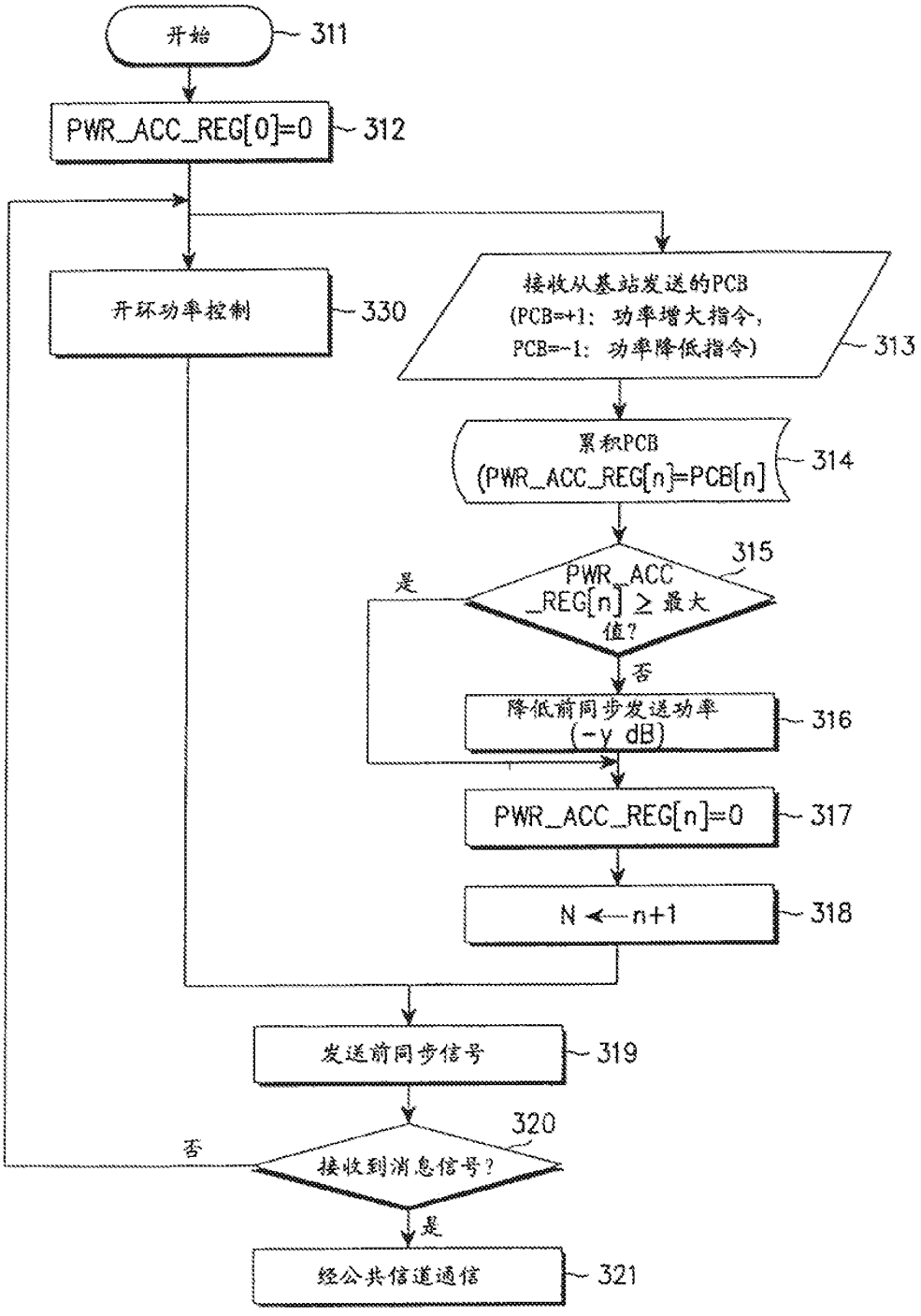

开始
311
PWR_ACC_REG[0]=0
312
开环功率控制
330
接收从基站发送的PCB
(PCB=+1：功率增大指令；
PCB=-1：功率降低指令)
313
累积PCB
(PWR_ACC_REG[n]=PCB[n]
314
PWR_ACC
_REG[n] ≥ 最大
值?
315
是
否
降低前同步发送功率
(-γ dB)
316
PWR_ACC_REG[n]=0
317
N ← n+1
318
发送前同步信号
319
接收到消息信号?
320
否
是
经公共信道通信
321

图 4

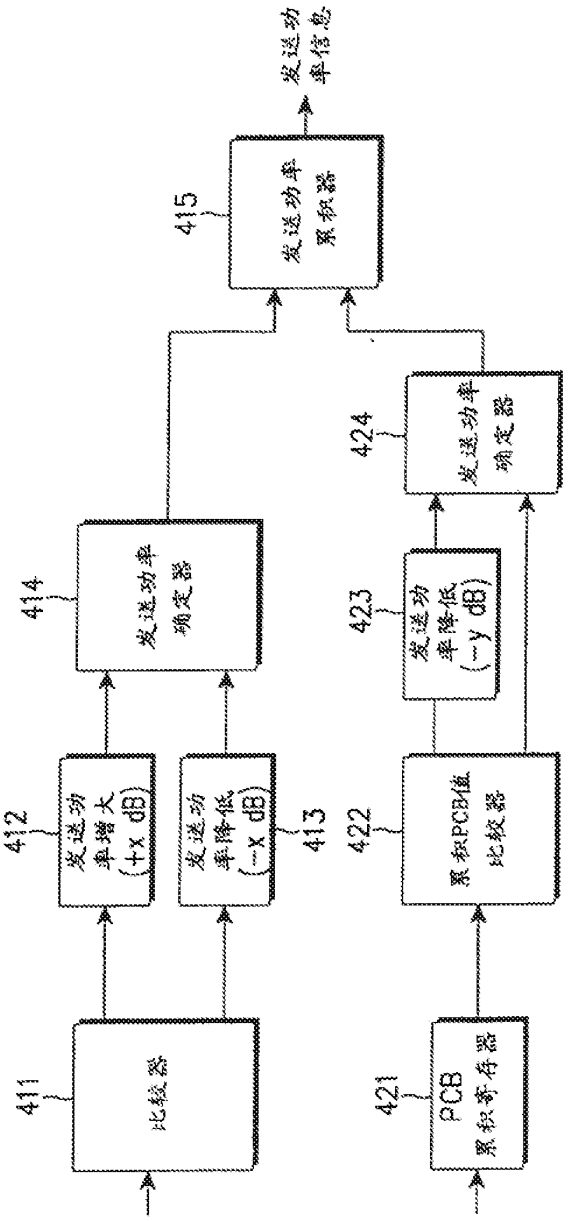

411
比较器
412
发送功率增大 (+x dB)
413
发送功率降低 (-x dB)
414
发送功率确定器
415
发送功率累积器
发送功率信息
421
PCB累积寄存器
422
累积PCB值比较器
423
发送功率降低 (-y dB)
424
发送功率确定器

图 5

Combined closed loop/open loop power control in time division duplex communication system

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Patent Agency Code	11219	**Patent Agent**	li hui

Abstract

Combined closed loop/open loop power control controls transmission power levels in a spread spectrum time division duplex communication station. A first communication station (50) receives communications from a second communication station (52). The first station transmits power commands based on in part a reception quality of the received communications. The first station transmits a first communication having a transmission power level in a first time slot. The second station receives the first communication and the power commands. A power level of the first communication as received is measured. A path loss estimate is determined based on in part the measured received second communication power level and the first communication transmission power level. The second station transmits a second communication to the first station in a second time slot. The second communication transmission power level is set based on in part the path loss estimate weighted by a factor and the power commands. The factor is a function of a time separation of the first and second time slots.

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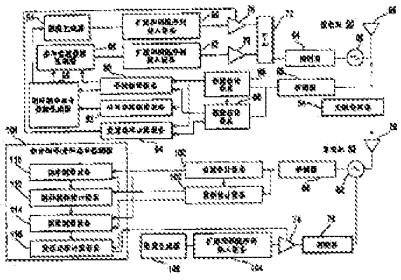
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[54]发明名称 在时分双工通信系统中的组合闭环/开环功率控制

[57]摘要

组合闭环/开环功率控制在一个扩频时分双工通信站中控制发送 功率电平。一个第一通信站(50)从一个第二通信站(52)接收通信。第一站部分地基于接收的通信的接收质量发送多个功率命令。第一站 在一个第一时隙中发送具有一个发送功率电平的第一通信。第二站接 收第一通信和多个功率命令。测量接收的第一通信的功率电平。部分 地基于测量的接收的第二通信功率电平和第一通信发送功率电平确定 路径损耗估计。第二站在一个第二时隙中向第一站发送一个第二通 信。部分地基于由一个因数加权的路径损耗估计和功率命令设置第二 通信发送功率电平。该因数是第一和第二时隙的时间分隔的函数。



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权 利 要 求 书

1. 一种用于在扩频时分双工通信系统中控制发送功率电平的方法，其中该通信系统中的帧具有用于通信的多个时隙，该方法包括：

在一个第一通信站接收来自一个第二通信站的通信，并部分地基于所接收的通信的接收质量从第一站发送功率命令；

从第一通信站在一个第一时隙中发送具有一个发送功率电平的第一通信；

在第二通信站接收第一通信和功率命令；

测量所接收的第一通信的功率电平；

部分地基于测量的接收的第一通信功率电平和第一通信发送功率电平确定路径损耗估计；

部分地基于由一个质量因数加权的路径损耗估计和所述功率命令，设置在第二时隙中从第二站向第一站发送的第二通信的发送功率电平，其中质量因数是第一和第二时隙的时间分隔的函数。

2. 根据权利要求 1 的方法，进一步包括：

部分地基于在第一和第二时隙之间的时隙数目 D，确定路径损耗估计的质量 α；和

其中质量因数是 α。

3. 根据权利要求 1 的方法，其中最大时隙延迟是 D_{MAX}，并且确定的质量 α 由 $\alpha = 1-(D-1)/D_{MAX}$ 确定。

4. 根据权利要求 1 的方法，其中设置的发送功率电平部分地基于在第一站的一个希望的接收功率电平、一个闭环因数和一个开环因数；其中闭环因数部分地基于接收的功率命令，并且开环因数部分地基于由质量因数加权的路径损耗估计。

5. 根据权利要求 1 的方法，其中设置的发送功率电平部分地基

于在第一站的一个希望的接收功率电平和一个组合闭环/开环因数；其中组合闭环/开环因数部分地基于接收的功率命令和由质量因数加权的路径损耗估计。

6. 根据权利要求 4 的方法，其中对每个接收的功率命令更新闭环因数。

7. 根据权利要求 5 的方法，其中对每个接收的功率命令更新组合因数。

8. 根据权利要求 4 的方法，其中希望的接收功率电平部分地基于一个目标信号对干扰的比率和一个在第一站测量的干扰电平。

9. 根据权利要求 5 的方法，其中希望的接收功率电平部分地基于一个目标信号对干扰的比率和一个在第一站测量的干扰电平。

10. 根据权利要求 1 的方法，其中第一站是一个基站，第二站是一个用户设备。

11. 根据权利要求 1 的方法，其中第一站是一个用户设备，第二站是一个基站。

12. 一种具有第一和第二通信站的扩频时分双工通信系统，该系统利用具有用于通信的时隙的帧，该系统包括：

第一站包括：

用于接收来自第二通信站的通信并部分地基于所接收的通信的接收质量发送功率命令的装置；和

用于在一个第一时隙中发送具有一个发送功率电平的一个第一通信的装置；和

第二站包括：

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用于接收第一通信和功率命令的装置；

用于测量所接收的第一通信的功率电平的装置；

部分地基于测量的接收的第一通信功率电平和第一通信发送功率电平确定路径损耗估计的装置；和

部分地基于由一个质量因数加权的路径损耗估计和所述功率命令，设置在第二时隙中从第二站向第一站发送的第二通信的发送功率电平的装置，其中质量因数是第一和第二时隙的时间分隔的函数。

13. 根据权利要求 12 的系统，其中：

第二站进一步包括用于部分地基于在第一和第二时隙之间的时隙数目 D 确定路径损耗估计的质量 α 的装置；和

质量因数是 α 。

14. 根据权利要求 12 的系统，其中最大时隙延迟是 D_{MAX}，并且确定的质量 α 由 $\alpha = 1 - (D-1) / D_{MAX}$ 确定。

15. 根据权利要求 1 的系统，其中设置装置部分地基于在第一站的一个希望的接收功率电平、一个闭环因数和一个开环因数，设置发送功率电平，闭环因数部分地基于接收的功率命令，并且开环因数部分地基于由质量因数加权的路径损耗估计。

16. 根据权利要求 1 的系统，其中设置装置部分地基于在第一站的一个希望的接收功率电平和一个组合闭环/开环因数设置发送功率电平，组合闭环/开环因数部分地基于接收的功率命令和由质量因数加权的路径损耗估计。

17. 根据权利要求 15 的系统，其中对每个接收的功率命令更新闭环因数。

18. 根据权利要求 16 的系统，其中对每个接收的功率命令更新

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组合因数。

19. 根据权利要求 15 的系统，其中希望的接收功率电平部分地基于一个目标信号对干扰的比率和一个在第一站测量的干扰电平。

20. 根据权利要求 16 的系统，其中希望的接收功率电平部分地基于一个目标信号对干扰的比率和一个在第一站测量的干扰电平。

21. 根据权利要求 12 的系统，其中第一站是一个基站，第二站是一个用户设备。

22. 根据权利要求 12 的系统，其中第一站是一个用户设备，第二站是一个基站。

23. 一个其发送功率电平在一个扩频时分双工通信系统中受控的通信站，该通信系统利用具有用于通信的时隙的帧，并有一个在一个第一时隙中发送一个通信和多个功率命令的第二通信站，该通信站包括：

至少一个天线，用于接收第一通信和功率命令并在一个第二时隙中发送一个放大的第二通信；

信道估计设置，具有一个被配置成接收所接收的第一通信的输入，用于产生信道信息；

数据估计设备，具有被配置成接收所接收的第一通信、功率命令和信道信息的输入，用于产生软码元和恢复功率命令；

功率测量设备，具有一个被配置成接收信道信息的输入，用于产生一个接收功率电平的测量以产生第一通信的路径损耗估计；

质量测量设备，至少部分地基于第一时隙和第二时隙的时间分隔产生一个质量测量；

发送功率计算设备，具有被配置成接收路径损耗估计、所恢复的功率命令和质量测量的输入，用于部分地基于由质量测量加权的路径

损耗估计和恢复的功率命令来产生一个功率控制信号；和

放大器，具有被配置成接收功率控制信号和一个要在第二时隙中被发送的第二通信的输入，用于响应功率控制信号放大第二通信以产生放大的第二通信。

说　明　书

在时分双工通信系统中的组合闭环/开环功率控制

本发明涉及扩频时分双工(TDD)通信系统。具体涉及用于在 TDD 通信系统中控制发送功率的系统和方法。

图 1 说明一个无线扩频时分双工（TDD）通信系统。该系统具有多个基站 30_1~30_7。每个基站 30_1 与在其操作区域中的用户设备（UE）32_1~32_3 进行通信。从基站 30_1 向 UE 32_1 发送的通信被称为下行链路通信，而从 UE 32_1 向基站 30_1 发送的通信被称为上行链路通信。

除了在不同频谱上通信，扩频 TDD 系统还在相同频谱上进行多个通信。多个信号由其各自的码片码序列（代码）来区分。而且，为了更有效地利用扩频，如图 2 所示的 TDD 系统利用被分成若干个时隙 36_1~36_n，比如 15 个时隙的重复帧(repeating frame)34。在那些系统中，利用选择的代码在选择的时隙 36_1~36_n 中发送一个通信。因此，一个帧 34 能够携带由时隙 36_1~36_n 和代码区分的多个通信。单个代码在单个时隙中的组合被称为一个资源单元。基于支持一个通信所要求的带宽，一个或多个通信单元被分配给那个通信。

大多数 TDD 系统自适应地控制发送功率电平。在一个 TDD 系统中，许多通信可能共享相同的时隙和频谱。当一个 UE 32_1 或基站 30_1 正在接收一个特定通信时，使用相同时隙和频谱的所有其他通信引起对该特定通信的干扰。增加一个通信的发送功率电平会降低在那个时隙和频谱中的所有其他通信的信号质量。但是，过快地降低发送功率电平会导致在接收机端的不希望的信噪比（SNR）和误码率（BER）。为了保持通信的信号质量和低的发送功率电平，使用发送功率控制。

控制发送功率电平的一种方法是开环功率控制。在开环功率控制

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中，典型地，一个基站 30_1 向 UE 32_1 发送一个参考下行链路通信和该通信的发送功率电平。UE 32_1 接收该参考通信，并测量其接收的功率电平。通过从发送功率电平中减去接收的功率电平，确定参考通信的路径损耗。为了确定上行链路的发送功率电平，在基站 30_1 将下行链路路径损耗添加到希望的接收功率电平上。UE 的发送功率电平被设置为所确定的上行链路发送功率电平。

控制发送功率电平的另一种方法是闭环功率控制。在闭环功率控制中，典型地，基站 30_1 确定从 UE 32_1 接收的通信的信号干扰比率（SIR）。把确定的 SIR 与目标 SIR（SIR_{TARGET}）进行比较。基于比较结果，基站 30_1 发送一个功率命令，b_{TPC}。在接收到功率命令之后，UE 32_1 基于接收的功率命令增加或减少发送功率电平。

闭环和开环功率控制都有缺点。在某些情况下，闭环系统的性能降低。比如，如果 UE 和基站之间发送的通信是在高度动态的环境中，比如由于 UE 的移动引起的，那些系统可能不能迅速地适应以补偿这些变化。TDD 中闭环功率控制的更新速率是每秒 100 周期，对于快衰落信道这种更新速率尚不足。开环功率控制对上行链路和下行链路增益链（gain chain）和干扰电平的不确定性敏感。

组合闭环和开环功率控制的一种方法由无线电工业和商业协会（ARIB）建议，其利用等式 1、2 和 3。

$$T_{UE}=P_{BS}(n)+L \qquad \text{等式 1}$$

$$P_{BS}(n)=P_{BS}(n-1)+b_{TPC}\,\Delta_{TPC} \qquad \text{等式 2}$$

$$b_{TPC}=\begin{cases}1: if & SIR_{BS} < SIR_{TARGET}\\ -1: if & SIR_{BS} > SIR_{TARGET}\end{cases} \qquad \text{等式 3}$$

T_{UE} 是 UE 32_1 的确定的发送功率电平。L 是估计的下行链路路径损耗。$P_{BS}(n)$是由等式 2 调整的基站 30_1 的希望的接收功率电平。对于每个接收的功率命令，b_{TPC}，把希望的接收功率电平增加或减少 Δ

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$_{TPC}$。Δ_{TPC} 通常为一分贝（dB）。当在基站 30 测量的 UE 的上行链路通信的 SIR，即 SIR_{BS} 小于目标 SIR，即 SIR_{TARGET} 时，功率命令 b_{TPC} 是一。相反地，当 SIR_{BS} 大于 SIR_{TARGET} 时，功率命令 b_{TPC} 是负一。

在某些情况下，这些系统的性能降低。例如，如果 UE 32 和基站 30 之间发送的通信是在一种高度动态的环境中，比如由于 UE 32 的移动引起，开环的路径损耗估计严重降低了系统的整体性能。因此，需要一些在所有的环境和情况下保持信号质量和低发送功率电平的方法。

发明内容

组合闭环/开环功率控制方法控制一个扩频时分双工通信站中的发送功率电平。一个第一通信站从一个第二通信站接收通信。第一站部分地基于接收的通信的接收质量发送功率命令。第一站在一个第一时隙中发送一个具有一个发送功率电平的第二通信。第二站接收第二通信和功率命令。测量所接收的第二通信的功率电平。部分地基于所测量的接收的第二通信功率电平和第一通信发送功率电平确定路径损耗估计。第二站在一个第二时隙中向第一站发送一个第二通信。部分地基于由一个因数加权的路径损耗估计和功率命令来设置第二通信发送功率电平。该因数是第一和第二时隙的时间分隔的函数。

附图简介

图 1 表示现有技术的 TDD 系统。

图 2 表示 TDD 系统的重复帧中的时隙。

图 3 是组合闭环/开环功率控制的流程图。

图 4 是利用组合闭环/开环功率控制的两个通信站的组件的图。

图 5-10 是描述闭环、ARIB 的协议和组合闭环/开环功率控制的两（2）个方案的曲线图。

优选实施例的详细描述

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下面将参考附图描述优选实施例，在所有附图中相同标号表示相同单元。将利用图 3 的流程图和如图 4 所示的两个简化的通信站 50、52 的组件来解释组合闭环/开环功率控制。对于下面的讨论，其发射机的功率受控的通信站被称为发送站 52，接收功率受控的通信的通信站被称为接收站 50。因为组合闭环/开环功率控制可以被用于上行链路、下行链路或者两种类型的通信，其功率受控的发射机可能位于基站 30_1、UE 32_1 或者两者。因此，如果同时使用上行链路和下行链路功率控制，接收和发送站的组件既位于基站 30_1，又位于 UE 32_1。

接收站 50 利用一个天线 56，或者另选地，一个天线阵，接收包括来自发送站 52 的通信的各种射频信号。接收的信号通过隔离器 60 被传到解调器 68 用来产生一个基带信号。该基带信号在各个时隙中利并用分配给发送站的通信的适当代码被处理，比如由一个信道估计设备 96 和一个数据估计设备 98 处理。信道估计设备 96 通常使用基带信号中的训练序列分量（training sequence component）来提供信道信息，比如信道脉冲响应。信道信息由数据估计设备 98、干扰测量设备 90、信号功率测量设备 92 和发送功率计算设备 94 来使用。数据估计设备 98 通过利用信道信息估计软码元（soft symbols）来从信道中恢复数据。利用软码元和信道信息，发送功率计算设备 94 通过控制放大器 76 的增益来控制接收站的发送功率电平。

信号功率测量设备 92 利用软码元或者信道信息、或者两者来以分贝（dB）为单位确定通信的接收信号功率。干扰测量设备 90 基于信道信息或者由数据估计设备 102 产生的软码元，或者这两者确定信道中的干扰电平 I_{RS}（以 dB 为单位）。

闭环功率命令生成器 88 利用测量的通信的接收功率电平和干扰电平 I_{RS} 来确定接收的通信的信号对干扰比率（SIR）。基于确定的 SIR 和目标 SIR（SIR_{TARGET}）的比较，生成闭环功率命令，即 b_{PTC}，比如一个功率命令比特，b_{PTC}，步骤 38。另选地，功率命令可能基于接收

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的信号的任何质量测量。

为了用于估计接收和发送站 50、52 之间的路径损耗和发送数据，接收站 50 向发送站 58 发送一个通信，步骤 40。该通信可能在这些不同信道的任何一个中被发送。典型地，在一个 TDD 系统中，用于估计路径损耗的信道被称为参考信道，尽管可以使用其他信道。如果接收站 50 是一个基站 30_1，优选地通过一个下行链路公用信道或一个公用控制物理信道（CCPCH）发送该通信。要通过参考信道向发送站 52 传送的数据被称为参考信道数据。参考数据可能包括，如示，干扰电平 I_{RS}，其与其他参考数据，比如参考信道的发送功率电平 T_{RS}，多路复用。干扰电平 I_{RS}，和参考信道功率电平 T_{RS} 可以在其他信道中发送，比如在信令信道中发送，步骤 40。闭环功率控制命令 b_{TPC}，典型地被通过一个专用信道发送，该专用信道专用于接收站 50 和发送站 52 之间的通信。

参考信道数据由参考信道数据生成器 86 生成。基于通信的带宽要求为参考数据分配一个或多个资源单元。一个扩展和训练序列插入设备 82 扩展参考信道数据，并使扩展的参考数据与训练序列在分配的资源单元的适当时隙和代码中时间多路复用。结果序列被称为一个通信脉冲串（communication burst）。之后，通信脉冲串被一个放大器 78 放大。一个加法设备 72 可以把放大的通信脉冲串与通过一些设备（比如数据生成器 84、扩展和训练序列插入设备 80 和放大器 76）所生成的任何其它通信脉冲串相加。

相加后的通信脉冲串由调制器 64 调制。调制的信号通过隔离器 60，并由如示的天线 56 或者，另选地，通过一个天线阵来辐射。通过一个无线电信道 54，辐射信号被传播给发送站 52 的天线 58。用于发送的通信的调制类型可以是本领域技术人员已知的任何类型，比如直接相移键控（DPSK）或者正交相移键控（QPSK）。

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发送站 52 的天线 58 或者，另选地，天线阵接收各种射频信号。接收的信号通过一个隔离器 62 被传播到一个解调器 66 用来产生一个基带信号。基带信号在时隙中并利用分配给接收站 50 的通信脉冲串的适当代码被处理，比如由一个信道估计设备 100 和一个数据估计设备 102 处理。信道估计设备 100 共同使用基带信号中的训练序列分量来提供信道信息，比如信道脉冲响应。信道信息由数据估计设备 102 和功率测量设备 110 来使用。

对应于参考信道的处理的通信的功率电平 R_{TS} 由功率测量设备 110 来测量，并被发送给一个路径损耗估计设备 112，步骤 42。信道估计设备 100 和数据估计设备 102 都能够把参考信道从所有其他信道中分离出来。如果使用一个自动增益控制设备或者放大器来处理所接收的信号，那么调整所测量的功率电平以便在功率测量设备 110 或者在路径损耗估计设备 112 校正这些设备的增益。功率测量设备 110 是组合闭环/开环控制器 108 的一个组件。如图 4 所示，组合闭环/开环功率控制器 108 包括功率测量设备 110、路径损耗估计设备 112、质量测量设备 114 和发送功率计算设备 116。

为了确定路径损耗 L，发送站 52 还需要该通信的发送功率电平 T_{RS}。发送功率电平 T_{RS} 可能和通信的数据一起或者在一个信令信道中发送。如果发送功率电平 T_{RS} 和通信的数据一起发送，数据估计设备 102 解译该功率电平，并把解译的功率电平发送给路径损耗估计设备 112。如果接收站 50 是一个基站 30_1，优选地通过广播信道（BCH）从基站 30_1 发送该发送功率电平 T_{RS}。通过从发送的通信的发送功率电平 T_{RS}（以 dB 为单位）中减去接收的通信的功率电平 R_{TS}（以 dB 为单位），路径损耗估计设备 112 估计两个站 50 和 52 之间的路径损耗 L，步骤 42。在某些情况下，接收站 50 可能不发送该发送功率电平 T_{RS}，而是发送一个该发送功率电平的参考值。在那种情况下，路径损耗估计设备 112 为路径损耗 L 提供参考电平。

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如果在估计的路径损耗和发送的通信之间存在一个时间延迟，发送的通信所经历的路径损耗可能不同于计算的损耗。在通信被在不同的时隙 36_1-36_n 发送的 TDD 系统中，接收的和发送的通信之间的时隙延迟可能降低开环功率控制系统的性能。组合闭环/开环功率控制利用闭环和开环功率控制信号特征（aspect）。如果路径损耗测量的质量高，系统主要作为一个开环系统。如果路径损耗测量的质量低，系统主要作为一个闭环系统。为了组合两种功率控制信号特征，系统基于路径损耗测量的质量对开环信号特征加权。

在一个加权开环功率控制器 108 中的质量测量设备 114 确定估计的路径损耗的质量，步骤 46。可以利用由信道估计设备 100 生成的信道信息、由数据估计设备 102 生成的软码元或者其他质量测量技术来确定质量。发送功率计算设备 116 利用估计的路径损耗质量对路径损耗估计加权。如果功率命令 b_{TPC} 在通信数据中被发送，数据估计设备 102 解译闭环功率命令 b_{TPC}。利用闭环功率命令 b_{TPC} 和加权的路径损耗，发送功率计算设备 116 设置接收站 50 的发送功率电平，步骤 48。

以下是优选的组合闭环/开环功率控制算法之一。发送站的功率电平 P_{TS}（以分贝为单位）由等式 4 和 6 确定。

$$P_{TS}=P_0+G(n)+\alpha L \qquad \text{等式 4}$$

P_0 是接收站 50 希望用来接收发送站的通信的功率电平（以 dB 为单位）。利用等式 5，由在接收站 50 的希望的 SIR，即 SIR_{TARGET} 和在接收站 50 的干扰电平 I_{RS} 来确定 P_0。

$$P_0=SIR_{TARGET}+I_{RS} \qquad \text{等式 5}$$

从接收站 50 到发送站 52 以信令或者广播方式发送 I_{RS}。对于下行链路功率控制，SIR_{TARGET} 在发送站 52 已知。对于上行链路功率控

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制，SIR_{TARGET} 被以信令方式从接收站 50 发送到发送站 52。G(n)是闭环功率控制因数。等式 6 是确定 G(n)的一个方程。

$$G(n)=G(n-1)+b_{TPC}\Delta_{TPC} \qquad \text{等式 6}$$

G(n-1)是前一个闭环功率控制因数。在等式 6 中使用的功率命令 b_{TPC} 或者为+1 或者为-1。确定功率命令 b_{TPC} 的一个方法是等式 3。典型地，功率命令 b_{TPC} 在一个 TDD 系统中以 100ms 的速率被更新，尽管也可以使用其他更新速率。Δ_{TPC} 是功率电平的变化。功率电平的变化典型地是 1dB，尽管可以使用其他值。结果，如果 b_{TPC} 为+1，闭环因数加 1，而如果 b_{TPC} 为-1，闭环因数减 1。

加权值 α 由质量测量设备 114 确定。α 是估计的路径损耗的质量的测量，优选地，它建立在由发送站 52 所发送的通信的最后一个路径损耗估计的时隙和第一个时隙之间的时隙数目 D 的基础上。α 值可以从 0 到 1。通常，如果时隙之间的时间差 D 很小，最近的路径损耗估计将相当精确，并且 α 被设置为一个接近 1 的值。相反，如果时间差很大，路径损耗估计可能不精确，闭环信号特征可能会更精确。因而，α 被设置为一个接近零的值。

等式 7 是用于确定 α 的一个等式，尽管可以利用其他的等式。

$$\alpha=1-(D-1)/D_{MAX} \qquad \text{等式 7}$$

D_{MAX} 是最大可能延迟。具有 15 个时隙的一个帧的典型值是六。如果延迟是 D_{MAX} 或更大值，α 接近零。利用由发送功率计算设备 116 所确定的计算的发送功率电平 P_{TS}，组合闭环/开环功率控制器 108 设置发送的通信的发送功率。

要在来自发送站 52 的通信中发送的数据由一个数据生成器 106

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来产生。通信数据由扩展和训练序列插入设备 104 扩展并在分配的资源单元的适当时隙和代码中与一个训练序列时间多路复用，产生一个通信脉冲串。扩展信号由放大器 74 放大，并由调制器 70 调制成射频。

组合闭环/开环功率控制器 108 控制放大器 74 的增益以获得用于通信的确定的发送功率电平 P_{TS}。功率受控的通信通过隔离器 62，由天线 58 辐射。

等式 8 和 9 是另一个优选的组合闭环/开环功率控制算法。

$$P_{TS}=P_0+K(n) \qquad \text{等式 8}$$

$$K(n)=K(n-1)+b_{TPC}\Delta_{TPC}+\alpha L \qquad \text{等式 9}$$

K(n)是组合闭环/开环因数。如示，该因数包括闭环和开环功率控制信号特征。等式 4 和等式 5 分开表示这两种信号特征。

尽管上述两种算法仅仅加权开环因数，加权可以被应用到闭环因数或者开环和闭环因数。两者在某些情况下，网络运营商可能希望使用只是开环或者只是闭环的功率控制。例如，运营商可能通过把 α 设置为 0 来使用只是闭环的功率控制。

图 5-10 描述曲线图 118-128，这些图说明组合闭环/开环功率控制系统的性能。这些曲线图 118-128 描述比较 ARIB 建议的系统、闭环系统、使用等式 4 和 6（方案 I）的组合开环/闭环系统和使用等式 8 和 9 的组合系统（方案 II）的性能的仿真结果。以码元速率执行仿真。对于上行链路和下行链路都使用扩展因数 16。上行链路和下行链路信道是国际电信同盟（ITU）信道模型[ITU-R M.1225，车辆的，类型 B]。对加性噪声以独立于具有单位方差（unity variance）的白高斯噪声的方式进行仿真。在发送站 52 估计路径损耗，发送站 52 是一个 UE 32_1，具体地说是一个移动站。BCH 信道被用于路径损耗估计。路径损耗每

帧被估计两次，以每秒 200 周期的速率进行估计。接收站 50，其为一个基站 30_1，通过 BCH 发送 BCH 发送功率电平。对 UE 32_1 和基站 30_1 使用 RAKE 组合。在基站 30_1 使用天线分集组合。

曲线图 118、122 和 126 描述在基站 30_1，UE 的功率受控通信的接收信噪比（SNR）的标准方差作为时隙延迟 D 的函数。曲线图 120、124 和 128 描述接收 SNR 的规格化偏差（normalized bias）作为延迟 D 的函数。规格化是针对希望的 SNR 执行的。曲线图 118-128 中的每个点代表 3000 个蒙特卡罗运算（Monte-Carlo runs）的平均值。

曲线图 118 和 120 描述将 α 设置为 1 的结果。对于低时隙延迟（D（4），方案 I 和 II 的性能优于闭环功率控制。对于更大的延迟（D≥4），闭环的性能优于方案 I 和 II，这显示出对开环和闭环信号特征加权的重要性。

曲线图 122 和 124 描述将 α 设置为 0.5 的结果。如示，对于不包括最大值的所有延迟，方案 I 和 II 的性能优于闭环功率控制。ARIB 建议仅仅在最低延迟（D=1）胜过其他方案。

曲线图 126 和 128 描述利用等式 7（其 D_{MAX} 等于 6）设置 α 的结果。如示，方案 I 和 II 在所有延迟 D 处都优于闭环和 ARIB 建议。

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说 明 书 附 图

图1

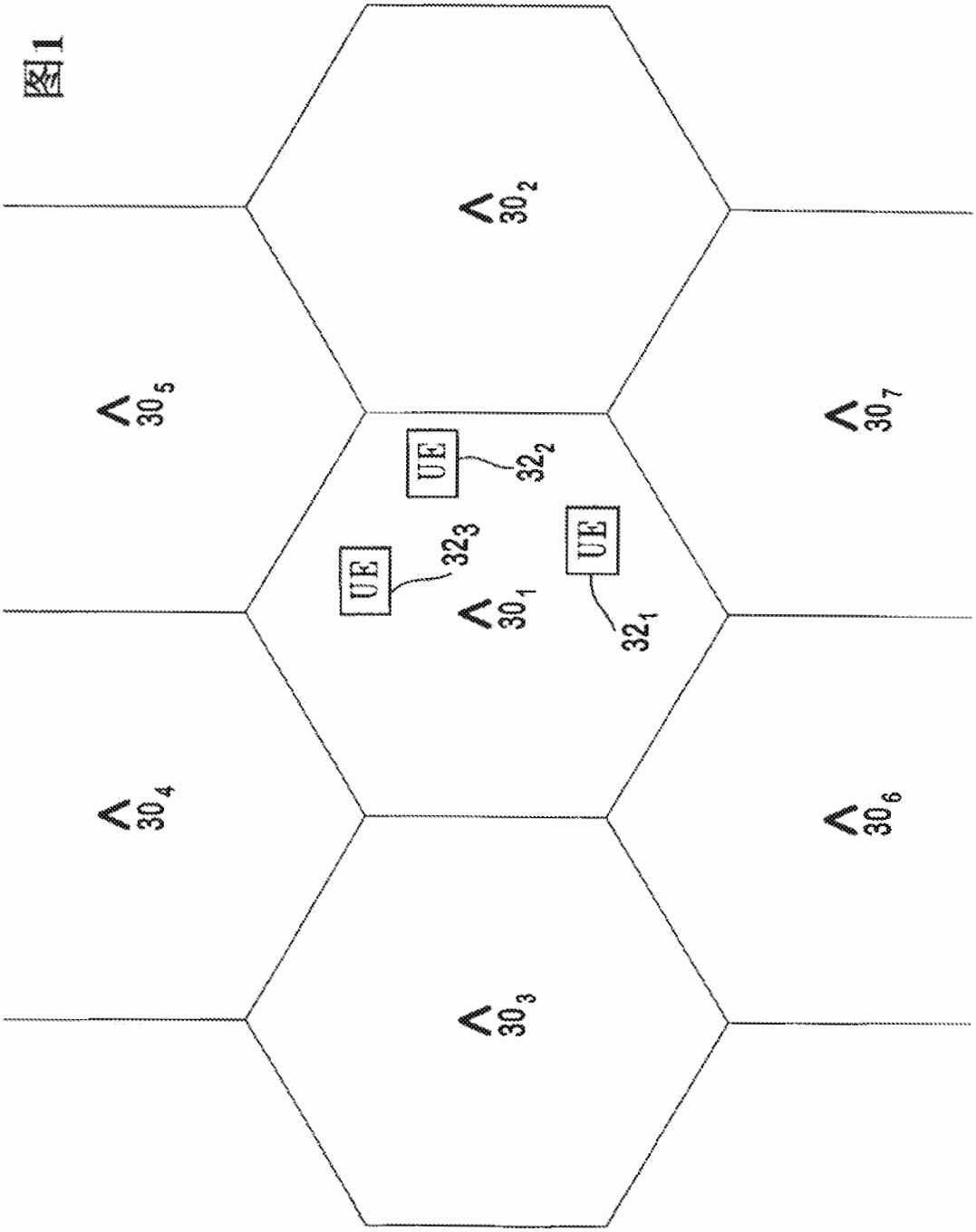


图2

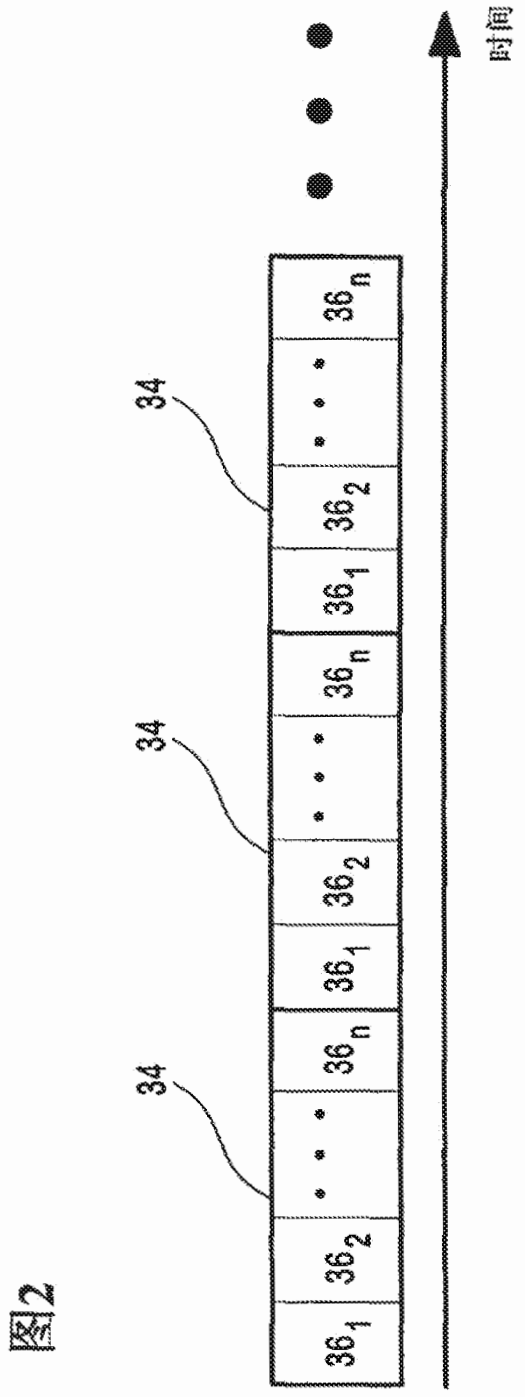
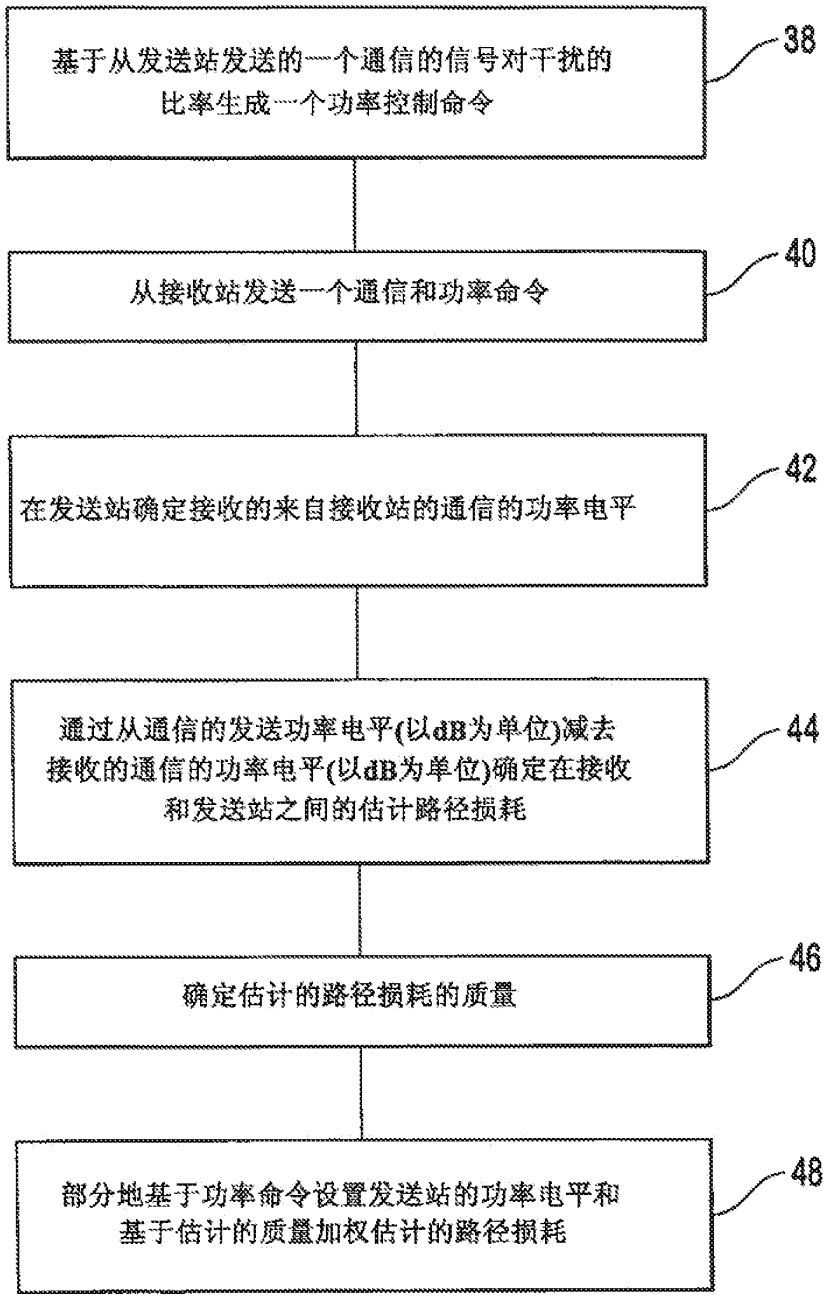


图3



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接收站 50
发送站 52
无线电信道
调制器
解调器
扩展和训练序列插入设备
数据生成器
参考信道数据生成器
闭环功率命令控制生成器
信道估计设备
数据估计设备
干扰测量设备
信号功率测量设备
发送功率计算设备
组合闭环/开环功率控制器
功率测量设备
路径损耗估计设备
质量测量设备
发送功率计算设备
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
100
102
104
106
108
110
112
114
116
54

图4

图5

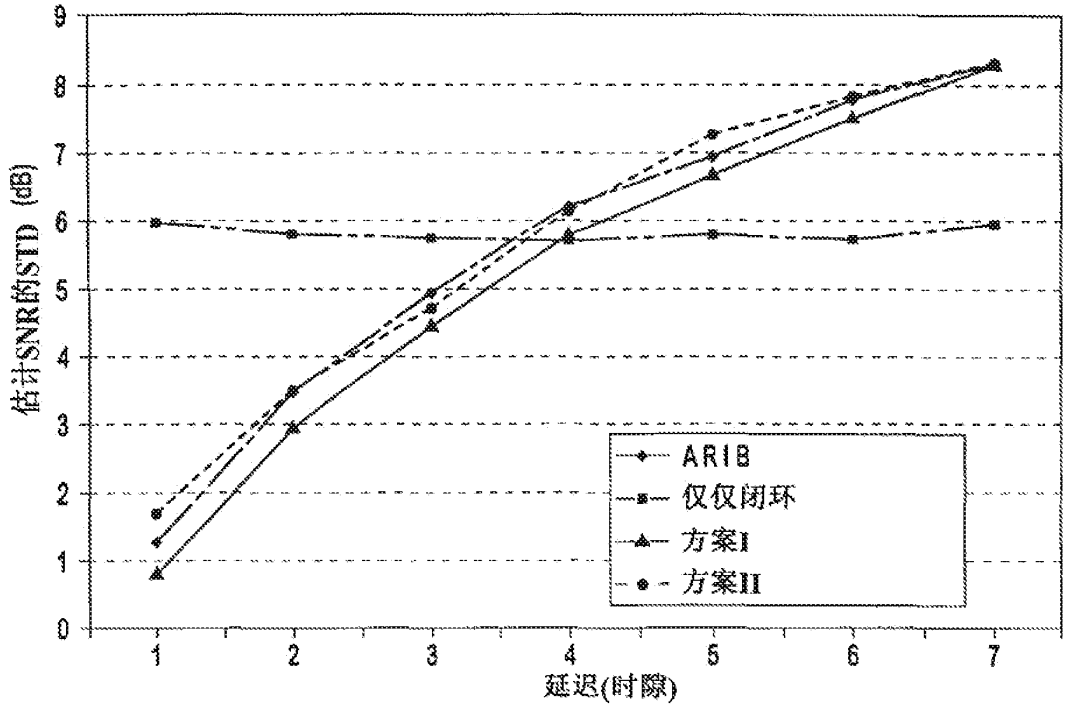

估计SNR的STD (dB)
延迟(时隙)
ARIB
仅仅闭环
方案I
方案II

图6

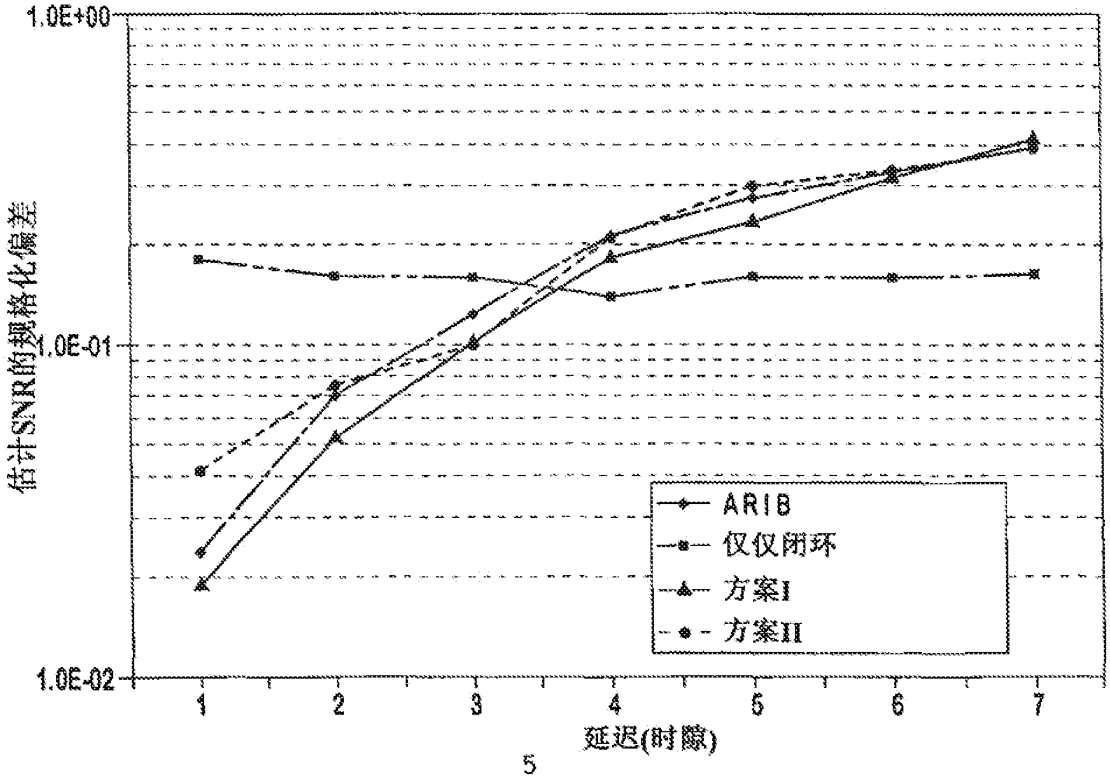

估计SNR的规格化偏差
1.0E+00
1.0E-01
1.0E-02
延迟(时隙)
ARIB
仅仅闭环
方案I
方案II

图7

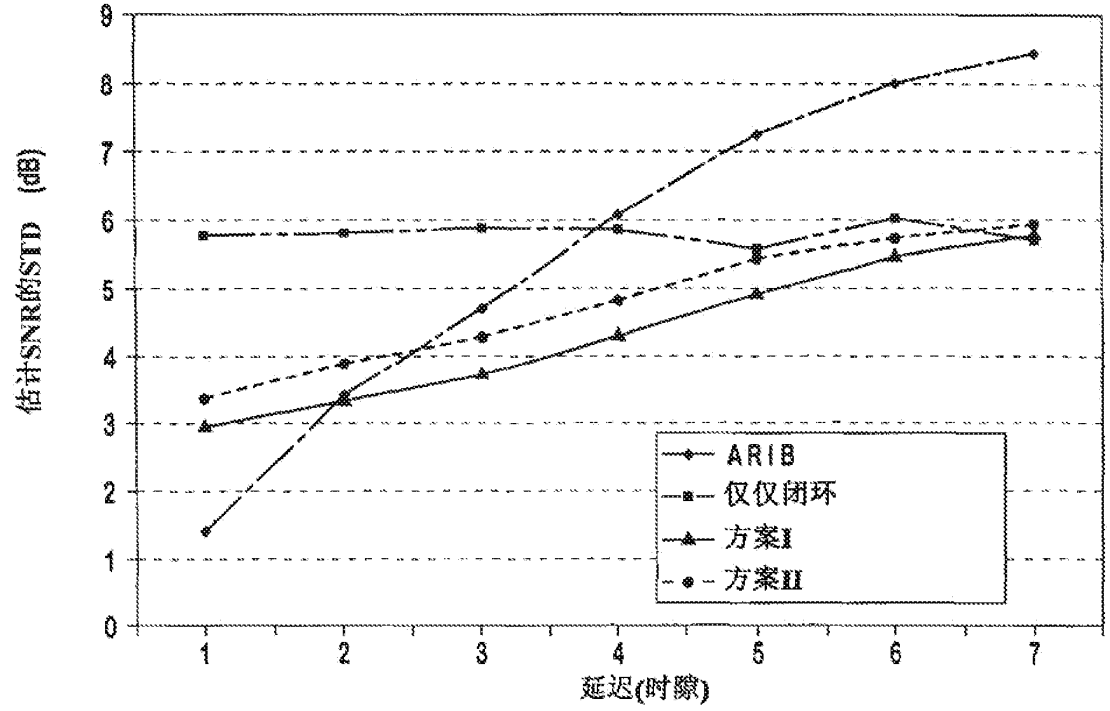

估计SNR的STD (dB)
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
延迟(时隙)
ARIB
仅仅闭环
方案I
方案II

图8

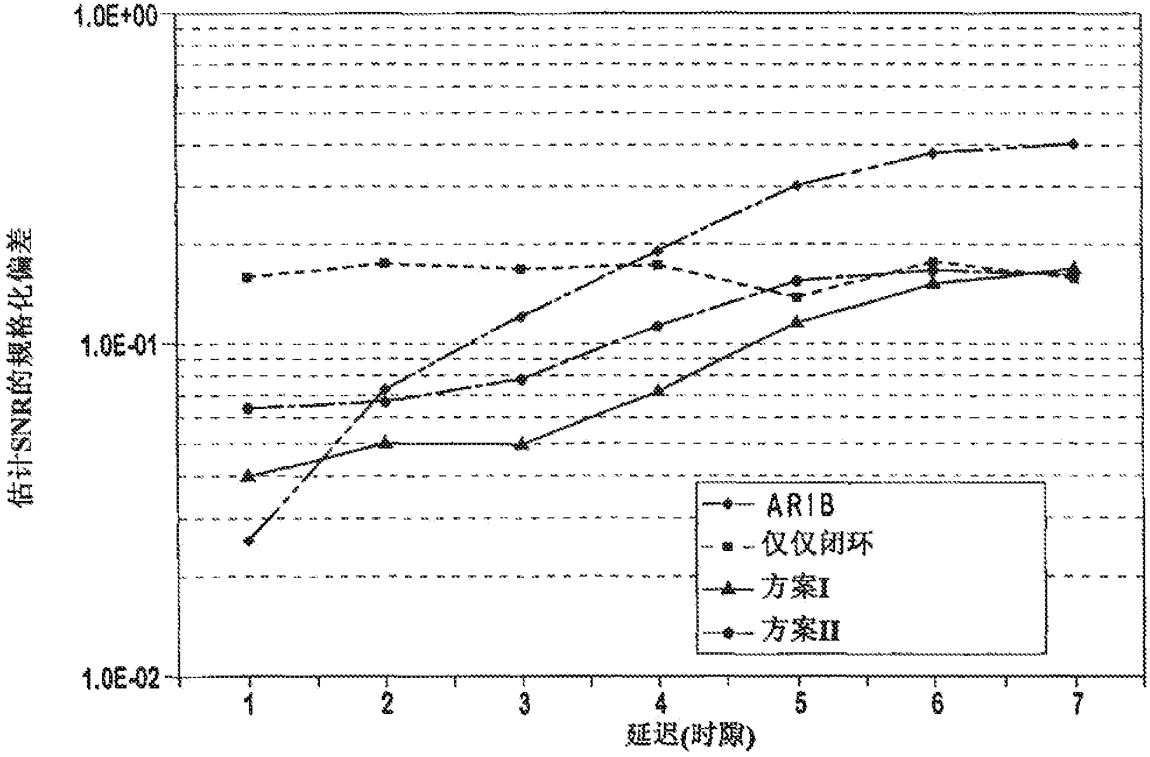

估计SNR的规格化偏差
1.0E+00
1.0E-01
1.0E-02
1
2
3
4
5
6
7
延迟(时隙)
ARIB
仅仅闭环
方案I
方案II

图9

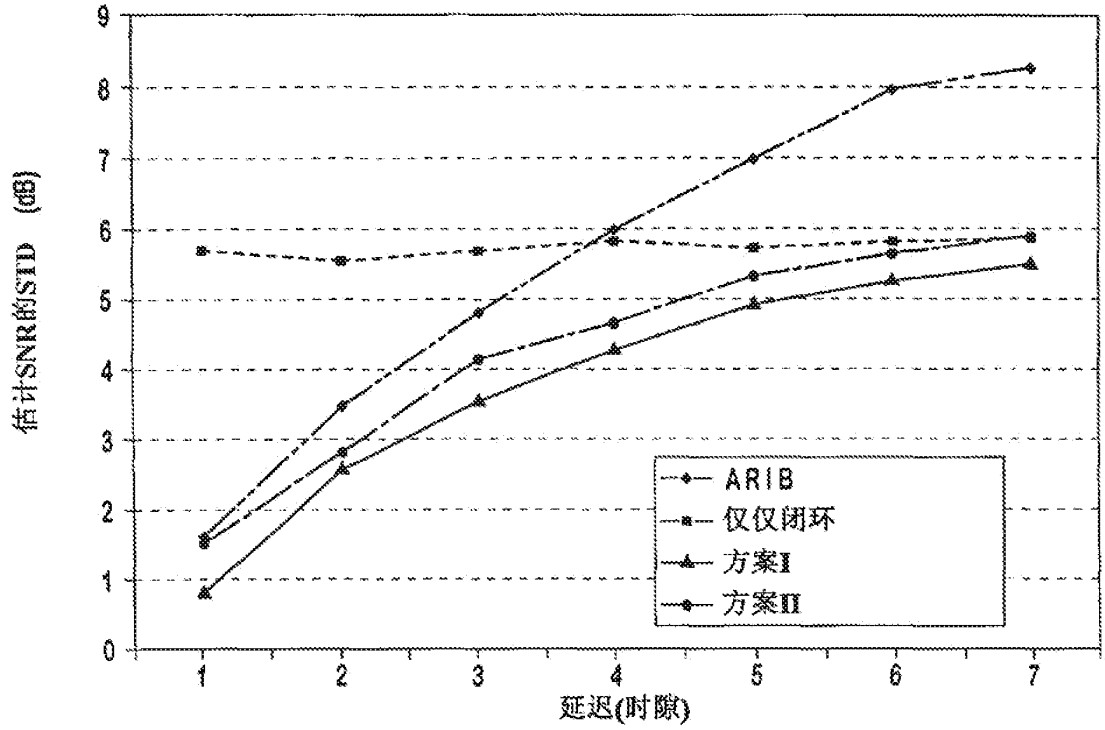
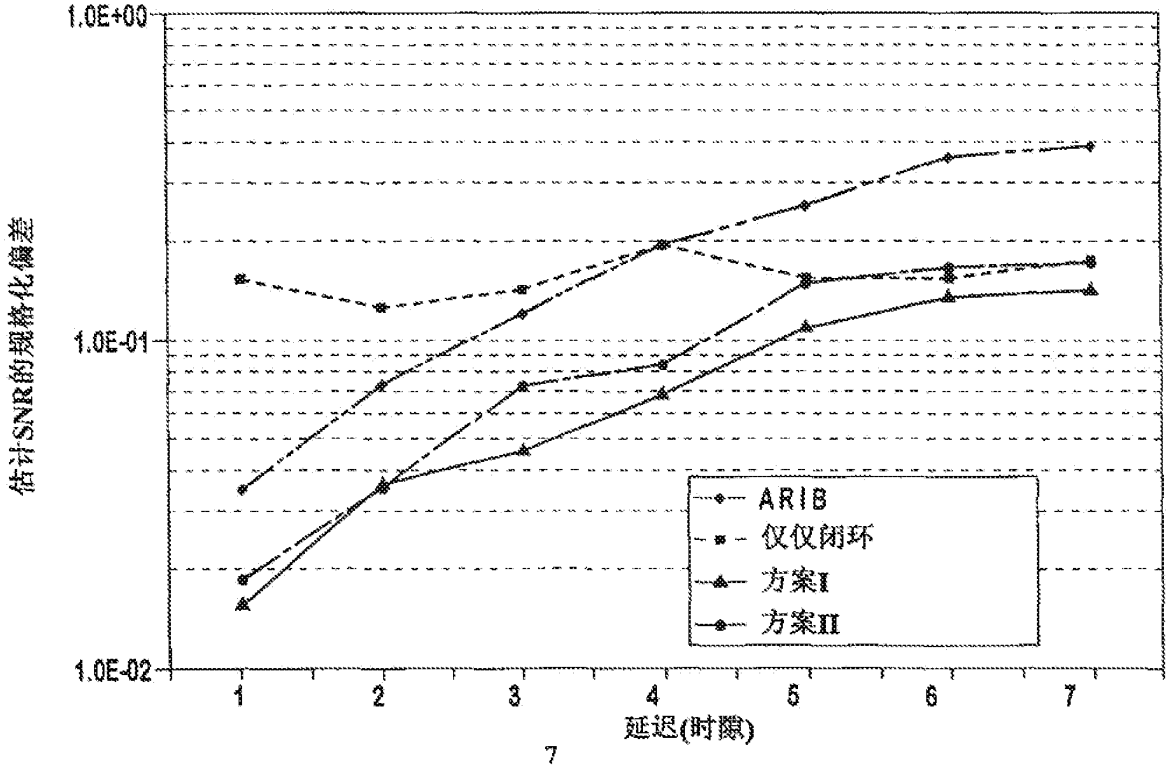

9
8
7
6
5
4
3
2
1
0
估计SNR的STD (dB)
1
2
3
4
5
6
7
延迟(时隙)
ARIB
仅仅闭环
方案I
方案II

图10


1.0E+00
1.0E-01
1.0E-02
估计SNR的规格化偏差
1
2
3
4
5
6
7
延迟(时隙)
ARIB
仅仅闭环
方案I
方案II

PCT

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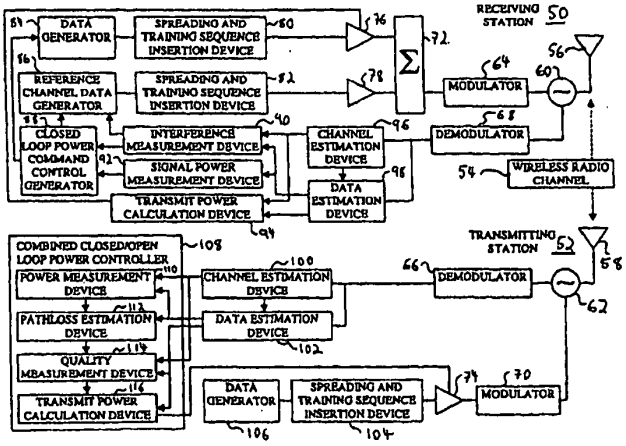
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(54) Title: COMBINED CLOSED LOOP/OPEN LOOP POWER CONTROL IN A TIME DIVISION DUPLEX COMMUNICATION SYSTEM



(57) Abstract

Combined closed loop/open loop power control controls transmission power levels in a spread spectrum time division duplex communication station. A first communication station (50) receives communications from a second communication station (52). The first station transmits power commands based on in part a reception quality of the received communications. The first station transmits a second communication having a transmission power level in a first time slot. The second station receives the second communication and the power commands. A power level of the second communication as received is measured. A path loss estimate is determined based on in part the measured received second communication power level and the first communication transmission power level. The second station transmits a second communication to the first station in a second time slot. The second communication transmission power level is set based on in part the path loss estimate weighted by a factor and the power commands. The factor is a function of a time separation of the first and second time slots.

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COMBINED CLOSED LOOP/OPEN LOOP POWER CONTROL IN A TIME DIVISION DUPLEX COMMUNICATION SYSTEM

BACKGROUND

This invention generally relates to spread spectrum time division duplex (TDD) communication systems. More particularly, the present invention relates to a system and method for controlling transmission power within TDD communication systems.

Figure 1 depicts a wireless spread spectrum time division duplex (TDD) communication system. The system has a plurality of base stations $\mathbf{30_1}$-$\mathbf{30_7}$. Each base station $\mathbf{30_1}$ communicates with user equipments (UEs) $\mathbf{32_1}$-$\mathbf{32_3}$ in its operating area. Communications transmitted from a base station $\mathbf{30_1}$ to a UE $\mathbf{32_1}$ are referred to as downlink communications and communications transmitted from a UE $\mathbf{32_1}$ to a base station $\mathbf{30_1}$ are referred to as uplink communications.

In addition to communicating over different frequency spectrums, spread spectrum TDD systems carry multiple communications over the same spectrum. The multiple signals are distinguished by their respective chip code sequences (codes). Also, to more efficiently use the spread spectrum, TDD systems as illustrated in **Figure 2** use repeating frames **34** divided into a number of time slots $\mathbf{36_1}$-$\mathbf{36_{n,}}$, such as fifteen time slots. In such systems, a communication is sent in selected time slots $\mathbf{36_1}$-$\mathbf{36_n}$ using selected codes. Accordingly, one frame **34** is capable of carrying multiple communications distinguished by both time slot $\mathbf{36_1}$-$\mathbf{36_n}$ and code. The

combination of a single code in a single time slot is referred to as a resource unit. Based on the bandwidth required to support a communication, one or multiple resource units are assigned to that communication.

Most TDD systems adaptively control transmission power levels. In a TDD system, many communications may share the same time slot and spectrum. When a UE 32_1 or base station 30_1 is receiving a specific communication, all the other communications using the same time slot and spectrum cause interference to the specific communication. Increasing the transmission power level of one communication degrades the signal quality of all other communications within that time slot and spectrum. However, reducing the transmission power level too far results in undesirable signal to noise ratios (SNRs) and bit error rates (BERs) at the receivers. To maintain both the signal quality of communications and low transmission power levels, transmission power control is used.

One approach to control transmission power levels is open loop power control. In open loop power control, typically a base station 30_1 transmits to a UE 32_1 a reference downlink communication and the transmission power level of that communication. The UE 32_1 receives the reference communication and measures its received power level. By subtracting the received power level from the transmission power level, a pathloss for the reference communication is determined. To determine a transmission power level for the uplink, the downlink pathloss is added to a desired received power level at the base station 30_1. The UE's transmission power level is set to the determined uplink transmission power level.

Another approach to control transmission power level is closed loop power control. In closed loop power control, typically the base station $\mathbf{30_1}$ determines the signal to interference ratio (SIR) of a communication received from the UE $\mathbf{32_1}$. The determined SIR is compared to a target SIR (SIR_{TARGET}). Based on the comparison, the base station $\mathbf{30_1}$ transmits a power command, b_{TPC}. After receiving the power command, the UE $\mathbf{32_1}$ increases or decreases its transmission power level based on the received power command.

Both closed loop and open loop power control have disadvantages. Under certain conditions, the performance of closed loop systems degrades. For instance, if communications sent between a UE and a base station are in a highly dynamic environment, such as due to the UE moving, such systems may not be able to adapt fast enough to compensate for the changes. The update rate of closed loop power control in TDD is 100 cycles per second which is not sufficient for fast fading channels. Open loop power control is sensitive to uncertainties in the uplink and downlink gain chains and interference levels.

One approach to combining closed loop and open loop power control was proposed by the Association of Radio Industries and Business (ARIB) and uses **Equations 1**, **2**, and **3**.

$$T_{UE} = P_{BS}(n) + L \qquad \textbf{Equation 1}$$

$$P_{BS}(n) = P_{BS}(n-1) + b_{TPC}\,\Delta_{TPC} \qquad \textbf{Equation 2}$$

$$b_{TPC} = \begin{cases} 1: \text{if } SIR_{BS} < SIR_{TARGET} \\ -1: \text{if } SIR_{BS} > SIR_{TARGET} \end{cases} \qquad \textbf{Equation 3}$$

T_{UE} is the determined transmission power level of the UE $\mathbf{32_1}$. L is the estimated downlink pathloss. $P_{BS}(n)$ is the desired received power level of the base station $\mathbf{30_1}$ as adjusted by **Equation 2**. For each received power command, b_{TPC}, the desired received power level is increased or decreased by Δ_{TPC}. Δ_{TPC} is typically one decibel (dB). The power command, b_{TPC}, is one, when the SIR of the UE's uplink communication as measured at the base station **30**, SIR_{BS}, is less than a target SIR, SIR_{TARGET}. Conversely, the power command is minus one, when SIR_{BS} is larger than SIR_{TARGET}.

Under certain conditions, the performance of these systems degrades. For instance, if communications sent between a UE **32** and a base station **30** are in a highly dynamic environment, such as due to the UE **32** moving, the path loss estimate for open loop severely degrades the overall system's performance. Accordingly, there is a need for alternate approaches to maintain signal quality and low transmission power levels for all environments and scenarios.

SUMMARY

Combined closed loop/open loop power control controls transmission power levels in a spread spectrum time division duplex communication station. A first communication station receives communications from a second communication station. The first station transmits power commands based on in part a reception quality of the received communications. The first station transmits a second communication having a transmission power level in a first time slot. The second

station receives the second communication and the power commands. A power level of the second communication as received is measured. A path loss estimate is determined based on in part the measured received second communication power level and the first communication transmission power level. The second station transmits a second communication to the first station in a second time slot. The second communication transmission power level is set based on in part the path loss estimate weighted by a factor and the power commands. The factor is a function of a time separation of the first and second time slots.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a prior art TDD system.

Figure 2 illustrates time slots in repeating frames of a TDD system.

Figure 3 is a flow chart of combine closed loop/open loop power control.

Figure 4 is a diagram of components of two communication stations using combined closed loop/open loop power control.

Figures 5-10 depict graphs of the performance of a closed loop, ARIB's proposal and two (2) schemes of combined closed loop/open loop power control.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments will be described with reference to the drawing figures where like numerals represent like elements throughout. Combined closed loop/open loop power control will be explained using the flow chart of **Figure 3** and

the components of two simplified communication stations **50**, **52** as shown in **Figure 4**. For the following discussion, the communication station having its transmitter's power controlled is referred to as the transmitting station **52** and the communication station receiving power controlled communications is referred to as the receiving station **50**. Since combined closed loop/open loop power control may be used for uplink, downlink or both types of communications, the transmitter having its power controlled may be located at a base station $\mathbf{30}_1$, UE $\mathbf{32}_1$ or both. Accordingly, if both uplink and downlink power control are used, the receiving and transmitting station's components are located at both the base station $\mathbf{30}_1$ and UE $\mathbf{32}_1$.

The receiving station **50** receives various radio frequency signals including communications from the transmitting station **52** using an antenna **56**, or alternately, an antenna array. The received signals are passed through an isolator **60** to a demodulator **68** to produce a baseband signal. The baseband signal is processed, such as by a channel estimation device **96** and a data estimation device **98**, in the time slots and with the appropriate codes assigned to the transmitting station's communication. The channel estimation device **96** commonly uses the training sequence component in the baseband signal to provide channel information, such as channel impulse responses. The channel information is used by the data estimation device **98**, the interference measurement device **90**, the signal power measurement device **92** and the transmit power calculation device **94**. The data estimation device **98** recovers data from the channel by estimating soft symbols using the channel information. Using the soft symbols and channel information, the transmit power

calculation device **94** controls the receiving station's transmission power level by controlling the gain of an amplifier **76**.

The signal power measurement device **92** uses either the soft symbols or the channel information, or both, to determine the received signal power of the communication in decibels (dB). The interference measurement device **90** determines the interference level in dB, I_{RS}, within the channel, based on either the channel information, or the soft symbols generated by the data estimation device **102**, or both.

The closed loop power command generator **88** uses the measured communication's received power level and the interference level, I_{RS}, to determine the Signal to Interference Ratio (SIR) of the received communication. Based on a comparison of the determined SIR with a target SIR (SIR_{TARGET}), a closed loop power command is generated, b_{TPC}, such as a power command bit, b_{TPC}, **step 38**. Alternately, the power command may be based on any quality measurement of the received signal.

For use in estimating the path loss between the receiving and transmitting stations **50, 52** and sending data, the receiving station **50** sends a communication to the transmitting station **58, step 40**. The communication may be sent on any one of various channels. Typically, in a TDD system, the channels used for estimating path loss are referred to as reference channels, although other channels may be used. If the receiving station **50** is a base station $\mathbf{30_1}$, the communication is preferably sent over a downlink common channel or a common control physical channel (CCPCH).

Data to be communicated to the transmitting station **52** over the reference channel is referred to as reference channel data. The reference data may include, as shown, the interference level, I_{RS}, multiplexed with other reference data, such as the transmission power level of the reference channel, T_{RS}. The interference level, I_{RS}, and reference channel power level, T_{RS}, may be sent in other channels, such as a signaling channel, **step 40**. The closed loop power control command, b_{TPC}, is typically sent in a dedicated channel, dedicated to the communication between the receiving station **50** and transmitting station **52**.

The reference channel data is generated by a reference channel data generator **86**. The reference data is assigned one or multiple resource units based on the communication's bandwidth requirements. A spreading and training sequence insertion device **82** spreads the reference channel data and makes the spread reference data time-multiplexed with a training sequence in the appropriate time slots and codes of the assigned resource units. The resulting sequence is referred to as a communication burst. The communication burst is subsequently amplified by an amplifier **78**. The amplified communication burst may be summed by a sum device **72** with any other communication burst created through devices, such as a data generator **84**, spreading and training sequence insertion device **80** and amplifier **76**.

The summed communication bursts are modulated by a modulator **64**. The modulated signal is passed through an isolator **60** and radiated by an antenna **56** as shown or, alternately, through an antenna array. The radiated signal is passed through a wireless radio channel **54** to an antenna **58** of the transmitting station **52**.

The type of modulation used for the transmitted communication can be any of the those known to those skilled in the art, such as direct phase shift keying (DPSK) or quadrature phase shift keying (QPSK).

The antenna **58** or, alternately, antenna array of the transmitting station **52** receives various radio frequency signals. The received signals are passed through an isolator **62** to a demodulator **66** to produce a baseband signal. The baseband signal is processed, such as by a channel estimation device **100** and a data estimation device **102**, in the time slots and with the appropriate codes assigned to the communication burst of the receiving station **50**. The channel estimation device **100** commonly uses the training sequence component in the baseband signal to provide channel information, such as channel impulse responses. The channel information is used by the data estimation device **102** and a power measurement device **110**.

The power level of the processed communication corresponding to the reference channel, R_{TS}, is measured by the power measurement device **110** and sent to a pathloss estimation device **112, step 42**. Both the channel estimation device **100** and the data estimation device **102** are capable of separating the reference channel from all other channels. If an automatic gain control device or amplifier is used for processing the received signals, the measured power level is adjusted to correct for the gain of these devices at either the power measurement device **110** or the pathloss estimation device **112**. The power measurement device **110** is a component of the combined closed loop/open loop controller **108**. As illustrated in **Figure 4**, the combined closed loop/open loop power controller **108** consists of the power

measurement device **110**, pathloss estimation device **112**, quality measurement device **114**, and transmit power calculation device **116**.

To determine the path loss, L, the transmitting station **52** also requires the communication's transmitted power level, T_{RS}. The transmitted power level, T_{RS}, may be sent along with the communication's data or in a signaling channel. If the power level, T_{RS}, is sent along with the communication's data, the data estimation device **102** interprets the power level and sends the interpreted power level to the pathloss estimation device **112**. If the receiving station **50** is a base station $\mathbf{30_1}$, preferably the transmitted power level, T_{RS}, is sent via the broadcast channel (BCH) from the base station $\mathbf{30_1}$. By subtracting the received communication's power level, R_{TS} in dB, from the sent communication's transmitted power level, T_{RS} in dB, the pathloss estimation device **112** estimates the path loss, L, between the two stations **50, 52, step 42**. In certain situations, instead of transmitting the transmitted power level, T_{RS}, the receiving station **50** may transmit a reference for the transmitted power level. In that case, the pathloss estimation device **112** provides reference levels for the path loss, L.

If a time delay exists between the estimated path loss and the transmitted communication, the path loss experienced by the transmitted communication may differ from the calculated loss. In TDD systems where communications are sent in differing time slots $\mathbf{36_1}$-$\mathbf{36_n}$, the time slot delay between received and transmitted communications may degrade the performance of an open loop power control system. Combined closed loop/open loop power control utilizes both closed loop

and open loop power control aspects. If the quality of the path loss measurement is high, the system primarily acts as an open loop system. If the quality of the path loss measurement is low, the system primarily acts as a closed loop system. To combine the two power control aspects, the system weights the open loop aspect based on the quality of the path loss measurement.

A quality measurement device **114** in a weighted open loop power controller **108** determines the quality of the estimated path loss, **step 46**. The quality may be determined using the channel information generated by the channel estimation device **100**, the soft symbols generated by the data estimation device **102** or other quality measurement techniques. The estimated path loss quality is used to weight the path loss estimate by the transmit power calculation device **116**. If the power command, b_{TPC}, was sent in the communication's data, the data estimation device **102** interprets the closed loop power command, b_{TPC}. Using the closed loop power command, b_{TPC}, and the weighted path loss, the transmit power calculation device **116** sets the transmit power level of the receiving station **50**, **step 48**.

The following is one of the preferred combined closed loop/open loop power control algorithms. The transmitting station's power level in decibels, P_{TS}, is determined using **Equations 4** and **6**.

$$P_{TS} = P_0 + G(n) + \alpha L \qquad \textbf{Equation 4}$$

P_0 is the power level that the receiving station **50** desires to receive the transmitting station's communication in dB. P_0 is determined by the desired SIR at the receiving station **50**, SIR_{TARGET}, and the interference level, I_{RS}, at the receiving

station **50** using **Equation 5**.

$$P_0 = SIR_{TARGET} + I_{RS} \qquad \textbf{Equation 5}$$

I_{RS} is either signaled or broadcasted from the receiving station **50** to the transmitting station **52**. For downlink power control, SIR_{TARGET} is known at the transmitting station **52**. For uplink power control, SIR_{TARGET} is signaled from the receiving station **50** to the transmitting station **52**. G(n) is the closed loop power control factor. **Equation 6** is one equation for determining G(n).

$$G(n) = G(n-1) + b_{TPC}\,\Delta_{TPC} \qquad \textbf{Equation 6}$$

G(n-1) is the previous closed loop power control factor. The power command, b_{TPC}, for use in **Equation 6** is either +1 or -1. One technique for determining the power command, b_{TPC}, is **Equation 3**. The power command, b_{TPC}, is typically updated at a rate of 100 ms in a TDD system, although other update rates may be used. Δ_{TPC} is the change in power level. The change in power level is typically 1 dB although other values may be used. As a result, the closed loop factor increases by 1 dB if b_{TPC} is +1 and decreases by 1 dB if b_{TPC} is -1.

The weighting value, α, is determined by the quality measurement device **114**. α is a measure of the quality of the estimated path loss and is, preferably, based on the number of time slots, D, between the time slot of the last path loss estimate and the first time slot of the communication transmitted by the transmitting station **52**. The value of α is from zero to one. Generally, if the time difference, D, between the time slots is small, the recent path loss estimate will be fairly accurate and α is set at a value close to one. By contrast, if the time difference is large, the path loss

estimate may not be accurate and the closed loop aspect is most likely more accurate. Accordingly, α is set at a value closer to zero.

Equation 7 is one equation for determining α, although others may be used.

$$\alpha = 1 - (D - 1)/D_{max} \qquad \textbf{Equation 7}$$

D_{max} is the maximum possible delay. A typical value for a frame having fifteen time slots is six. If the delay is D_{max} or greater, α approaches zero. Using the calculated transmit power level, P_{TS}, determined by a transmit power calculation device **116**, the combined closed loop/open loop power controller **108** sets the transmit power of the transmitted communication.

Data to be transmitted in a communication from the transmitting station **52** is produced by a data generator **106**. The communication data is spread and time-multiplexed with a training sequence by the spreading and training sequence insertion device **104** in the appropriate time slots and codes of the assigned resource units producing a communication burst. The spread signal is amplified by the amplifier **74** and modulated by the modulator **70** to radio frequency.

The combined closed loop/open loop power controller **108** controls the gain of the amplifier **74** to achieve the determined transmit power level, P_{TS}, for the communication. The power controlled communication is passed through the isolator **62** and radiated by the antenna **58**.

Equations 8 and **9** are another preferred combined closed loop/open loop power control algorithm.

$$P_{TS} = P_0 + K(n) \qquad \textbf{Equation 8}$$

$$K(n) = K(n-1) + b_{TPC}\,\Delta_{TPC} + \alpha L \qquad \textbf{Equation 9}$$

K(n) is the combined closed loop/open loop factor. As shown, this factor includes both the closed loop and open loop power control aspects. **Equations 4** and **5** segregate the two aspects.

Although the two above algorithms only weighted the open loop factor, the weighting may be applied to the closed loop factor or both the open and closed loop factors. Under certain conditions, the network operator may desire to use solely open loop or solely closed loop power control. For example, the operator may use solely closed loop power control by setting α to zero.

Figures 5-10 depict graphs **118-128** illustrating the performance of a combined closed-loop/open-loop power control system. These graphs **118-128** depict the results of simulations comparing the performance of the ARIB proposed system, a closed loop, a combined open loop/closed loop system using **Equations 4** and **6** (scheme I) and a combined system using **Equations 8** and **9** (scheme II). The simulations were performed at the symbol rate. A spreading factor of sixteen was used for both the uplink and downlink channels. The uplink and downlink channels are International Telecommunication Union (ITU) Channel model [ITU-R M.1225, vehicular, type B]. Additive noises were simulated as being independent of white Gaussian noises with unity variance. The path loss is estimated at the transmitting station **52** which is a UE $\mathbf{32_1}$ and in particular a mobile station. The BCH channel was used for the path loss estimate. The path loss was estimated two times per frame at a rate of 200 cycles per second. The receiving station **50**, which

was a base station 30_1, sent the BCH transmission power level over the BCH. RAKE combining was used for both the UE 32_1 and base station 30_1. Antenna diversity combining was used at the base station 30_1.

Graphs **118, 122, 126** depict the standard deviation of the received signal to noise ratio (SNR) at the base station 30_1 of the UE's power controlled communication as a function of the time slot delay, D. Graphs **120, 124, 128** depict the normalized bias of the received SNR as a function of the delay, D. The normalization was performed with respect to the desired SNR. Each point in the graphs **118-128** represents the average of 3000 Monte-Carlo runs.

Graphs **118, 120** depict the results for an α set at one. For low time slot delays ($D<4$), scheme I and II outperform closed loop power control. For larger delays ($D\geq 4$), closed loop outperforms both scheme I and II which demonstrates the importance of weighting the open loop and closed loop aspects.

Graphs **122, 124** depict the results for an α set at 0.5. As shown, for all delays excluding the maximum, schemes I and II outperform closed loop power control. The ARIB proposal only outperforms the others at the lowest delay ($D=1$).

Graphs **126, 128** depict the results for an α set using **Equation 7** with D_{max} equal to six. As shown, schemes I and II outperform both closed loop and the ARIB proposal at all delays, D.

* * *

CLAIMS

1. A method for controlling transmission power levels in a spread spectrum time division duplex communication system having frames with time slots for communication, the method comprising:

receiving at a first communication station communications from a second communication station and transmitting from the first station power commands based on in part a reception quality of the received communications;

transmitting from the first communication station a first communication having a transmission power level in a first time slot;

receiving at the second communication station the first communication and the power commands;

measuring a power level of the first communication as received;

determining a pathloss estimate based on in part the measured received first communication power level and the first communication transmission power level; and

setting a transmission power level for a second communication in a second time slot from the second station to the first station based on in part the pathloss estimate weighted by a quality factor and the power commands, wherein the quality factor is a function of a time separation of the first and second time slots.

2. The method of claim 1 further comprising:

determining a quality, α, of the pathloss estimate based on in part a number

of time slots, D, between the first and second time slot; and

wherein the quality factor is α.

3. The method of claim 1 wherein a maximum time slot delay is D_{max} and the determined quality, α, is determined by

$$\alpha = 1 - (D-1) / D_{max}.$$

4. The method of claim 1 wherein the set transmission power level is based on in part a desired received power level at the first station, a closed loop factor and an open loop factor; wherein the closed loop factor is based on in part the received power commands and the open loop factor is based on in part the pathloss estimate weighted by the quality factor.

5. The method of claim 1 wherein the set transmission power level is based on in part a desired received power level at the first station and a combined closed loop/open loop factor; wherein the combined closed loop/open loop factor is based on in part the received power commands and the pathloss estimate weighted by the quality factor.

6. The method of claim 4 wherein the closed loop factor is updated for each received power command.

7. The method of claim 5 wherein the combined factor is updated for each received power command.

8. The method of claim 4 wherein the desired received power level is based on in part a target signal to interference ratio and a measured interference level at the first station.

9. The method of claim 5 wherein the desired received power level is based on in part a target signal to interference ratio and a measured interference level at the first station.

10. The method of claim 1 wherein the first station is a base station and the second station is a user equipment.

11. The method of claim 1 wherein the first station is a user equipment and the second station is a base station.

12. A spread spectrum time division duplex communication system having a first and second communication station, the system using frames with time slots for communication, the system comprising:

the first station comprising:

means for receiving communications from the second communication

station and transmitting power commands based on in part a reception quality of the received communications; and

means for transmitting a first communication having a transmission power level in a first time slot; and

the second station comprising:

means for receiving the first communication and the power commands;

means for measuring a power level of the first communication as received;

means for determining a pathloss estimate based on in part the measured received first communication power level and the first communication transmission power level; and

means for setting a transmission power level for a second communication in a second time slot from the second station to the first station based on in part the pathloss estimate weighted by a quality factor and the power commands, wherein the quality factor is a function of a time separation of the first and second time slots.

13. The system of claim 12 wherein:

the second station further comprises means for determining a quality, α, of the pathloss estimate based on in part a number of time slots, D, between the first and second time slot; and

the quality factor is α.

14. The system of claim 12 wherein a maximum time slot delay is D_{max} and the determined quality, α, is determined by

$$\alpha = 1 - (D-1) / D_{max}.$$

15. The system of claim 1 wherein the setting means sets the transmission power level based on in part a desired received power level at the first station, a closed loop factor and an open loop factor, the closed loop factor is based on in part the received power commands and the open loop factor is based on in part the pathloss estimate weighted by the quality factor.

16. The system of claim 1 wherein the setting means sets the transmission power level based on in part a desired received power level at the first station and a combined closed loop/open loop factor, the combined closed loop/open loop factor is based on in part the received power commands and the path loss estimate weighted by the quality factor.

17. The system of claim 15 wherein the closed loop factor is updated for each received power command.

18. The system of claim 16 wherein the combined factor is updated for each received power command.

19. The system of claim 15 wherein the desired received power level is based on in part a target signal to interference ratio and a measured interference level at the first station.

20. The system of claim 16 wherein the desired received power level is based on in part a target signal to interference ratio and a measured interference level at the first station.

21. The system of claim 12 wherein the first station is a base station and the second station is a user equipment.

22. The system of claim 12 wherein the first station is a user equipment and the second station is a base station.

23. A communication station having its transmission power level controlled in a spread spectrum time division duplex communication system, the system using frames with time slots for communication and having a second communication station transmitting a first communication in a first time slot and power commands, the communication station comprising:

at least one antenna for receiving the first communication and the power commands and transmitting an amplified second communication in a second time slot;

a channel estimation device having an input configured to receive the received first communication for producing channel information;

a data estimation device having inputs configured to receive the received first communication, the power commands and the channel information for producing soft symbols and recovering the power commands;

a power measurement device having an input configured to receive the channel information for producing a measurement of a received power level for producing a pathloss estimate for the first communication;

a quality measurement device for producing a quality measurement based at least in part upon a time separation of the first time slot and a second time slot;

a transmit power calculation device having inputs configured to receive the pathloss estimation, the recovered power commands and the quality measurement for producing a power control signal based on in part the pathloss estimate weighted by the quality measurement and the recovered power commands; and

an amplifier having inputs configured to receive the power control signal and a second communication to be transmitted in the second time slot for amplifying the second communication in response to the power control signal to produce the amplified second communication.

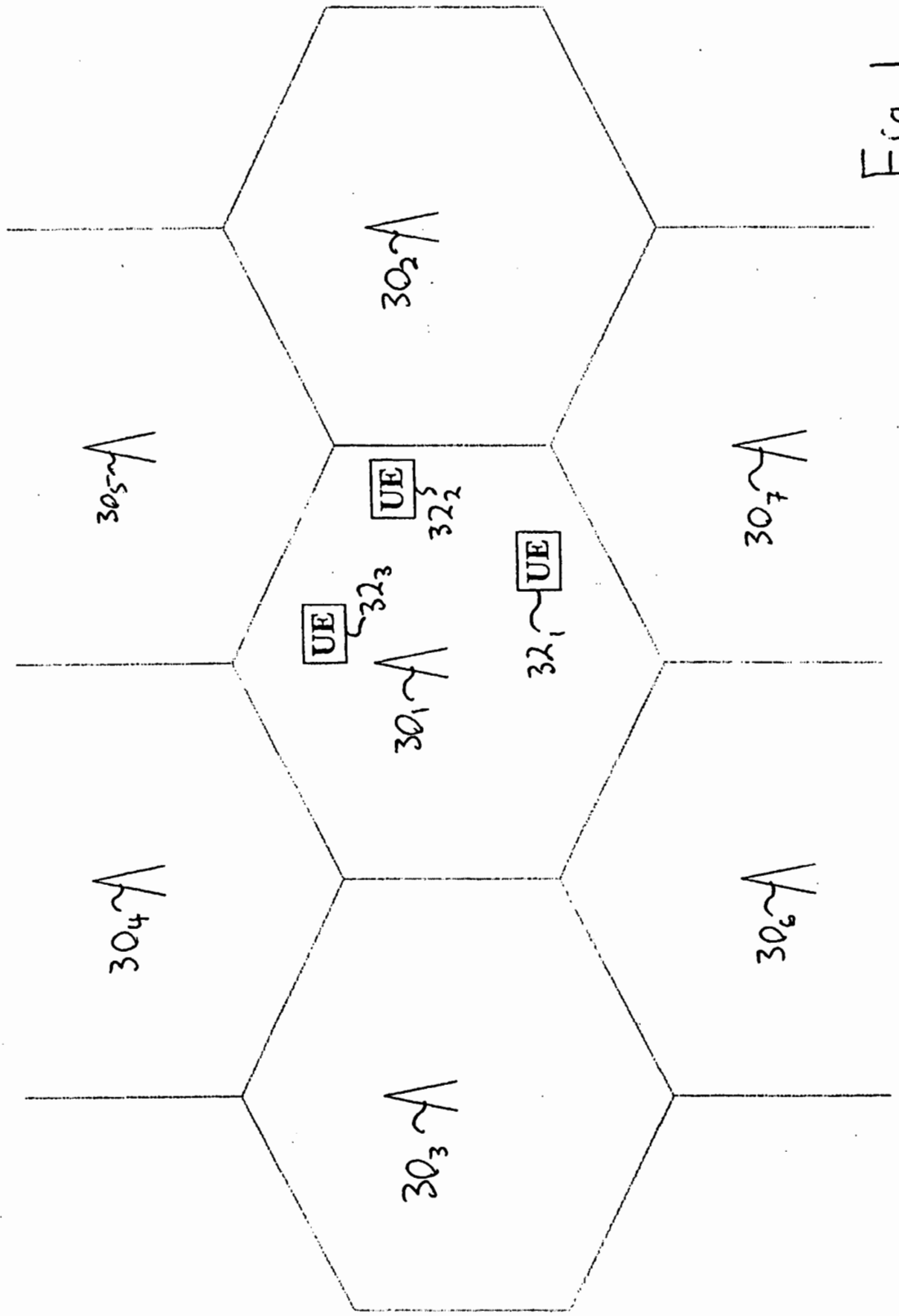


Fig. 1

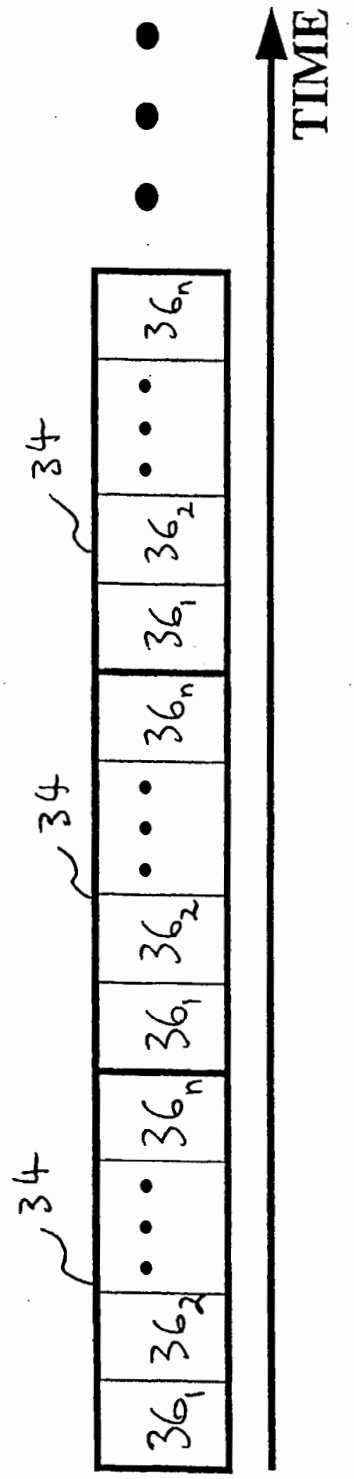


Fig. 2

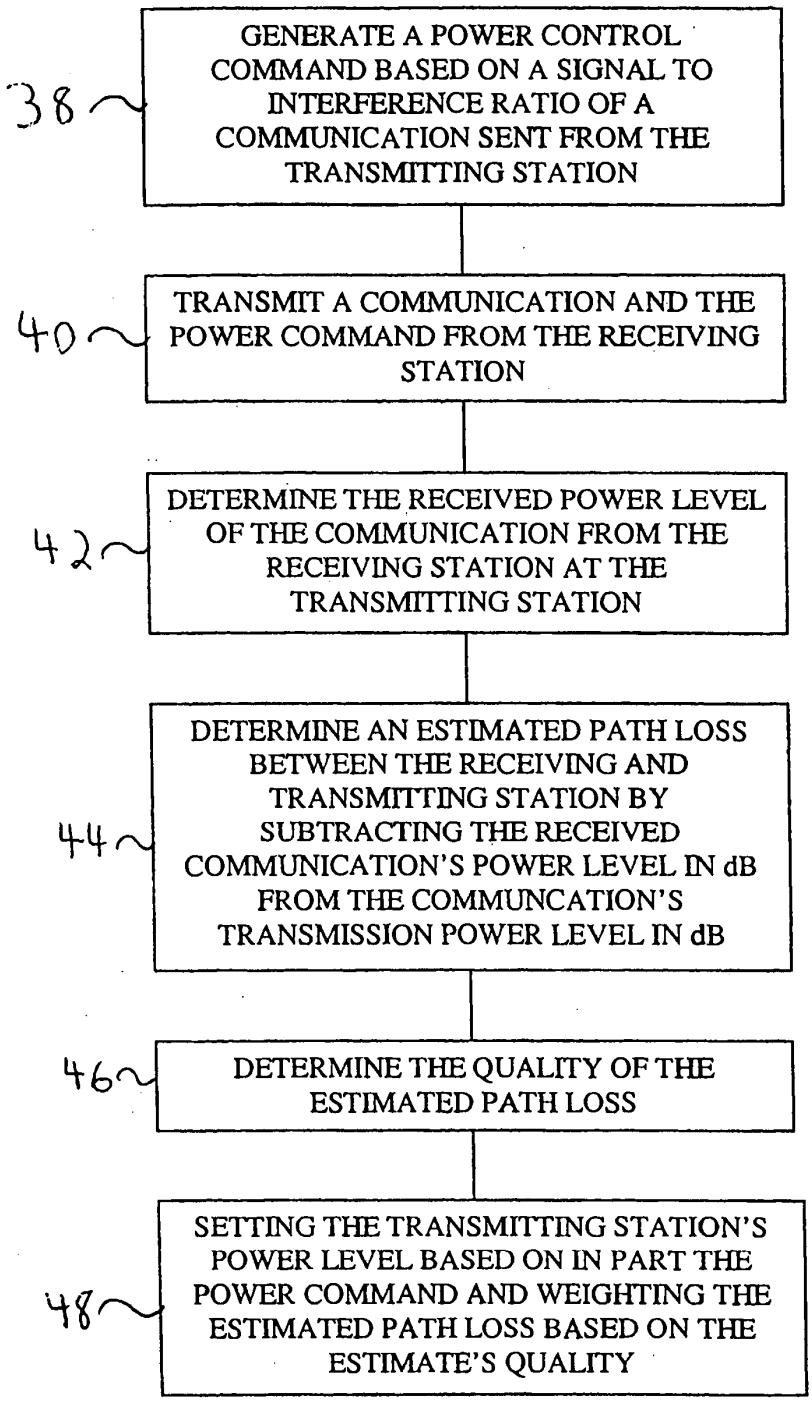

38
GENERATE A POWER CONTROL COMMAND BASED ON A SIGNAL TO INTERFERENCE RATIO OF A COMMUNICATION SENT FROM THE TRANSMITTING STATION
40
TRANSMIT A COMMUNICATION AND THE POWER COMMAND FROM THE RECEIVING STATION
42
DETERMINE THE RECEIVED POWER LEVEL OF THE COMMUNICATION FROM THE RECEIVING STATION AT THE TRANSMITTING STATION
44
DETERMINE AN ESTIMATED PATH LOSS BETWEEN THE RECEIVING AND TRANSMITTING STATION BY SUBTRACTING THE RECEIVED COMMUNICATION'S POWER LEVEL IN dB FROM THE COMMUNCATION'S TRANSMISSION POWER LEVEL IN dB
46
DETERMINE THE QUALITY OF THE ESTIMATED PATH LOSS
48
SETTING THE TRANSMITTING STATION'S POWER LEVEL BASED ON IN PART THE POWER COMMAND AND WEIGHTING THE ESTIMATED PATH LOSS BASED ON THE ESTIMATE'S QUALITY

Fig. 3

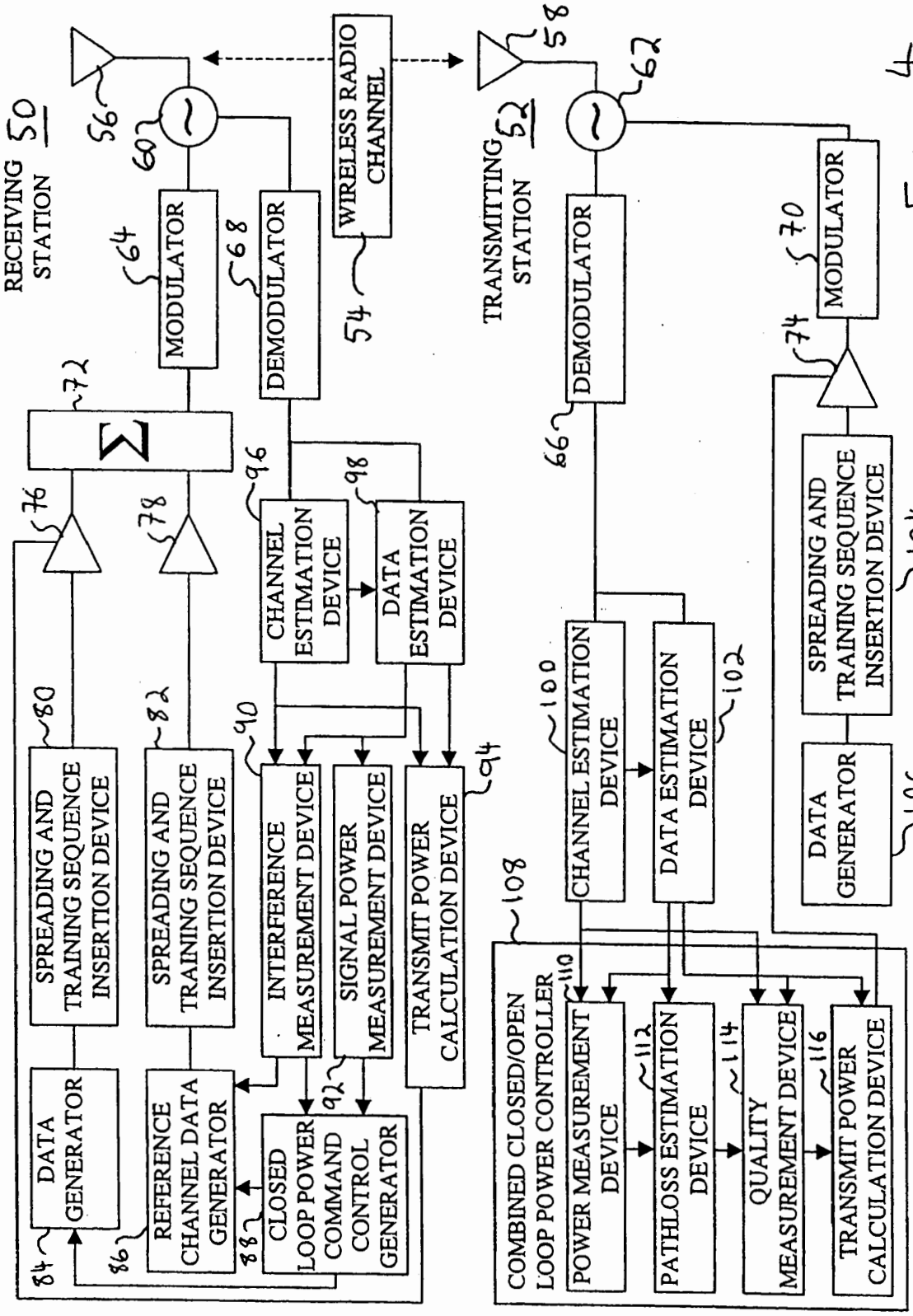

RECEIVING STATION 50
TRANSMITTING STATION 52
WIRELESS RADIO CHANNEL
54
56
58
60
62
64 MODULATOR
66 DEMODULATOR
68 DEMODULATOR
70 MODULATOR
72 Σ
74
76
78
80 SPREADING AND TRAINING SEQUENCE INSERTION DEVICE
82 SPREADING AND TRAINING SEQUENCE INSERTION DEVICE
84 DATA GENERATOR
86 REFERENCE CHANNEL DATA GENERATOR
88 CLOSED LOOP POWER COMMAND CONTROL GENERATOR
90 INTERFERENCE MEASUREMENT DEVICE
92 SIGNAL POWER MEASUREMENT DEVICE
94 TRANSMIT POWER CALCULATION DEVICE
96 CHANNEL ESTIMATION DEVICE
98 DATA ESTIMATION DEVICE
100 CHANNEL ESTIMATION DEVICE
102 DATA ESTIMATION DEVICE
104 SPREADING AND TRAINING SEQUENCE INSERTION DEVICE
106 DATA GENERATOR
108 COMBINED CLOSED/OPEN LOOP POWER CONTROLLER
110 POWER MEASUREMENT DEVICE
112 PATHLOSS ESTIMATION DEVICE
114 QUALITY MEASUREMENT DEVICE
116 TRANSMIT POWER CALCULATION DEVICE

Fig. 4

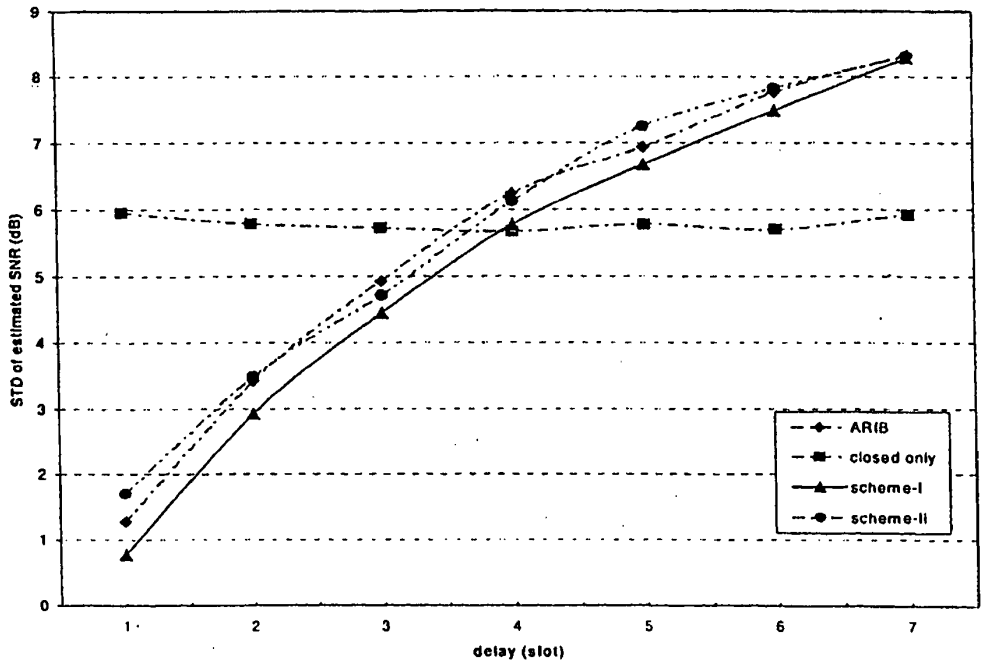

STD of estimated SNR (dB)
delay (slot)
ARIB
closed only
scheme-I
scheme-II

Fig. 5

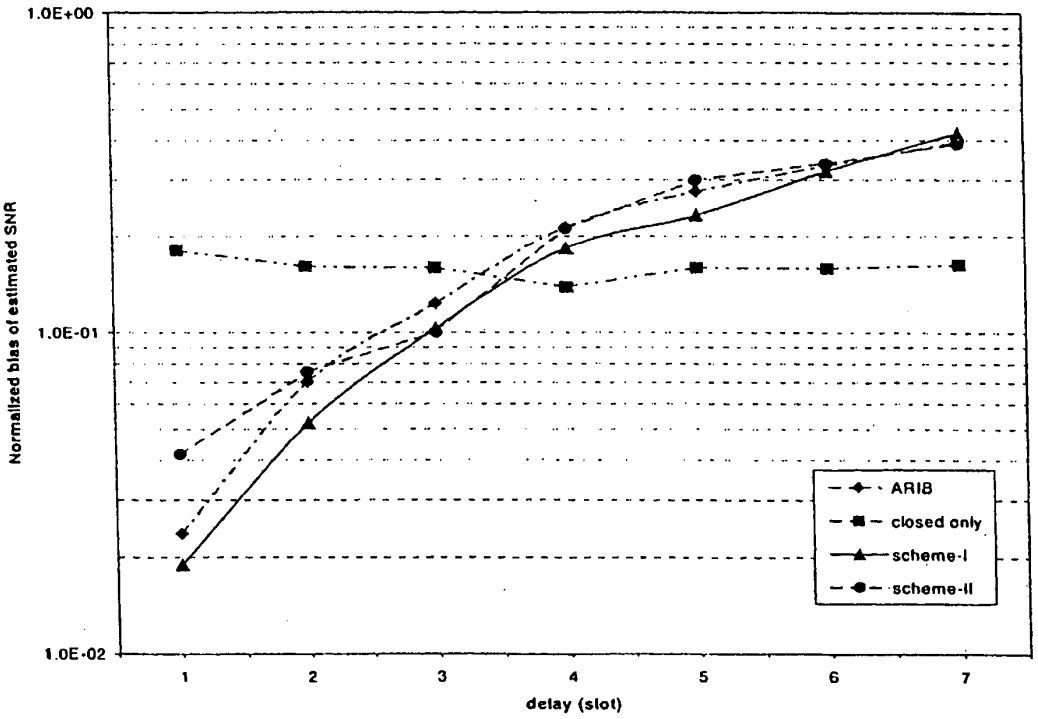

Normalized bias of estimated SNR
1.0E+00
1.0E-01
1.0E-02
delay (slot)
ARIB
closed only
scheme-I
scheme-II

Fig. 6

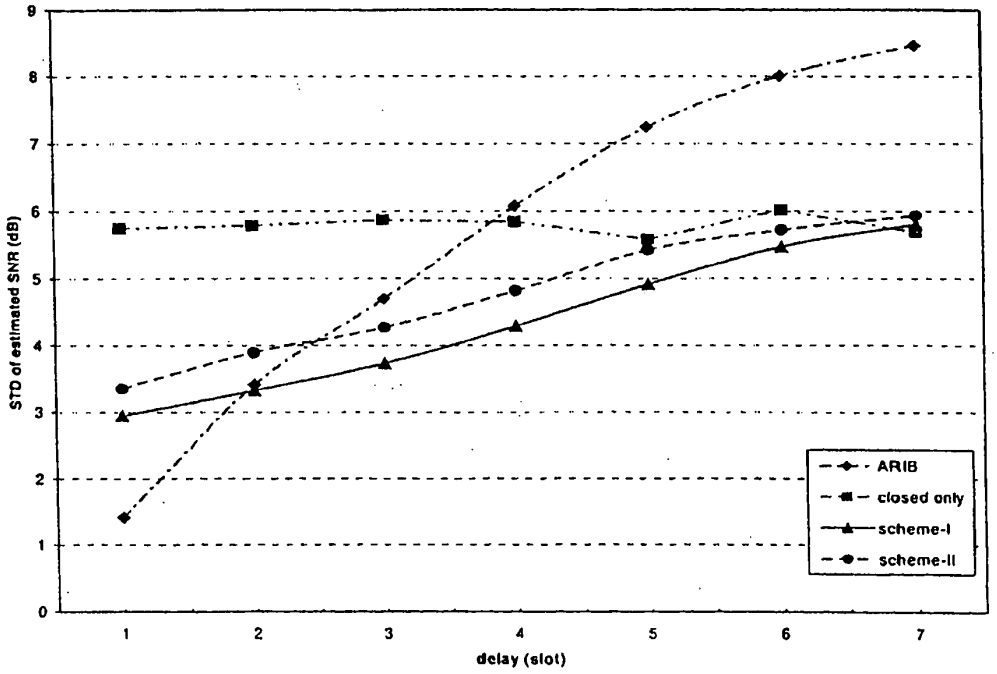

STD of estimated SNR (dB)
delay (slot)
ARIB
closed only
scheme-I
scheme-II

Fig. 7

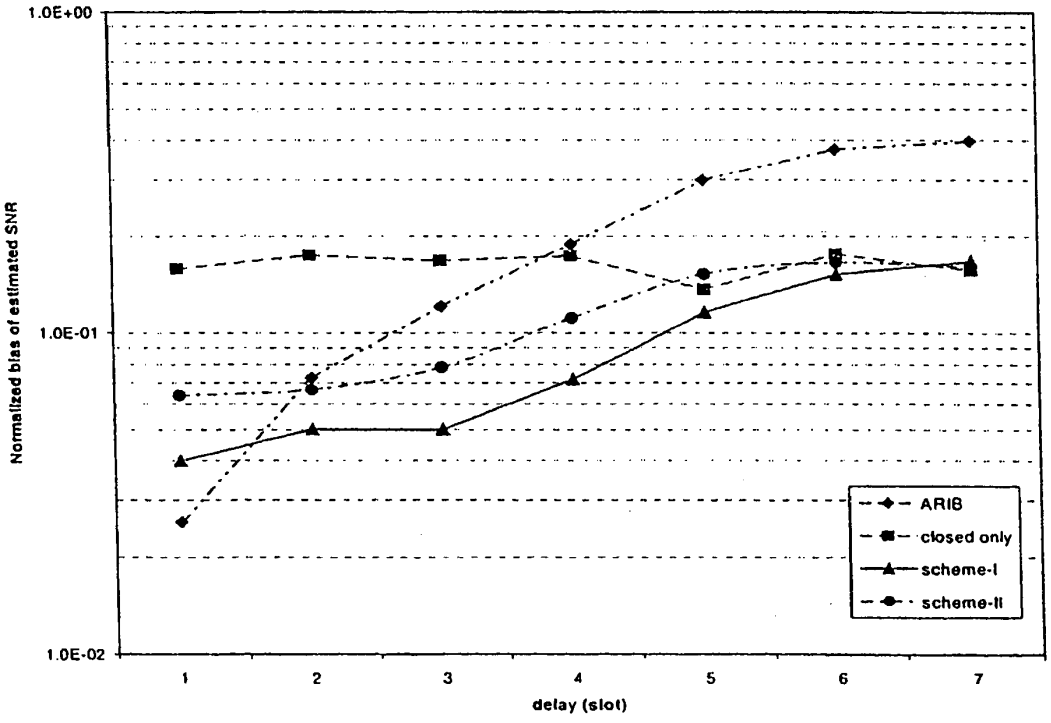

Normalized bias of estimated SNR
1.0E+00
1.0E-01
1.0E-02
delay (slot)
ARIB
closed only
scheme-I
scheme-II

Fig. 8

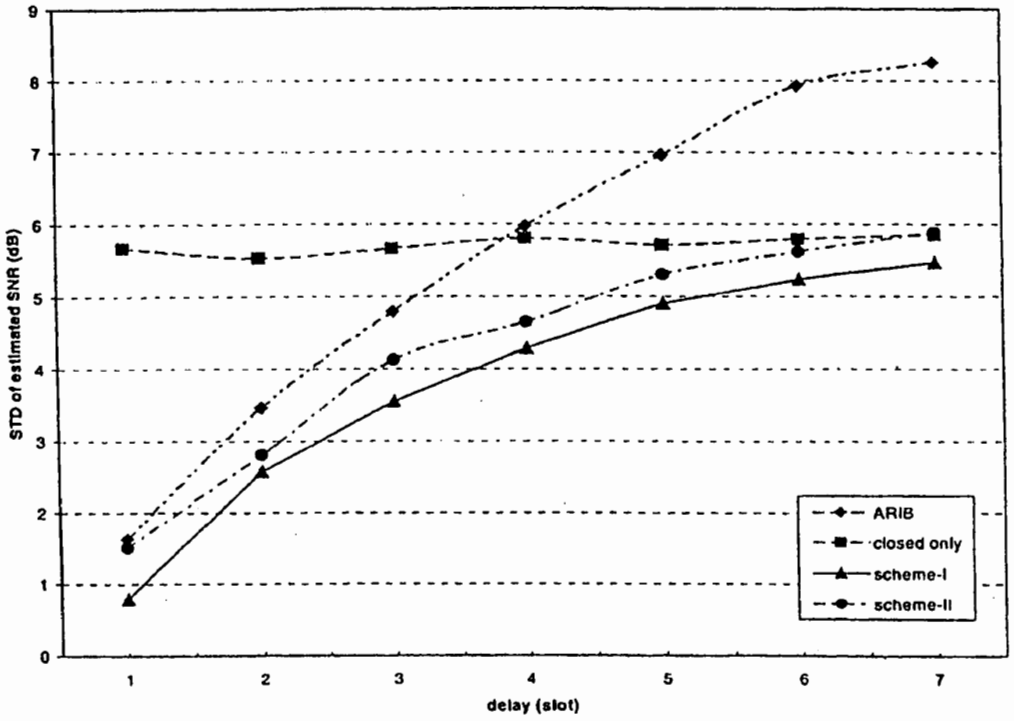

STD of estimated SNR (dB)
delay (slot)
ARIB
closed only
scheme-I
scheme-II

Fig. 9

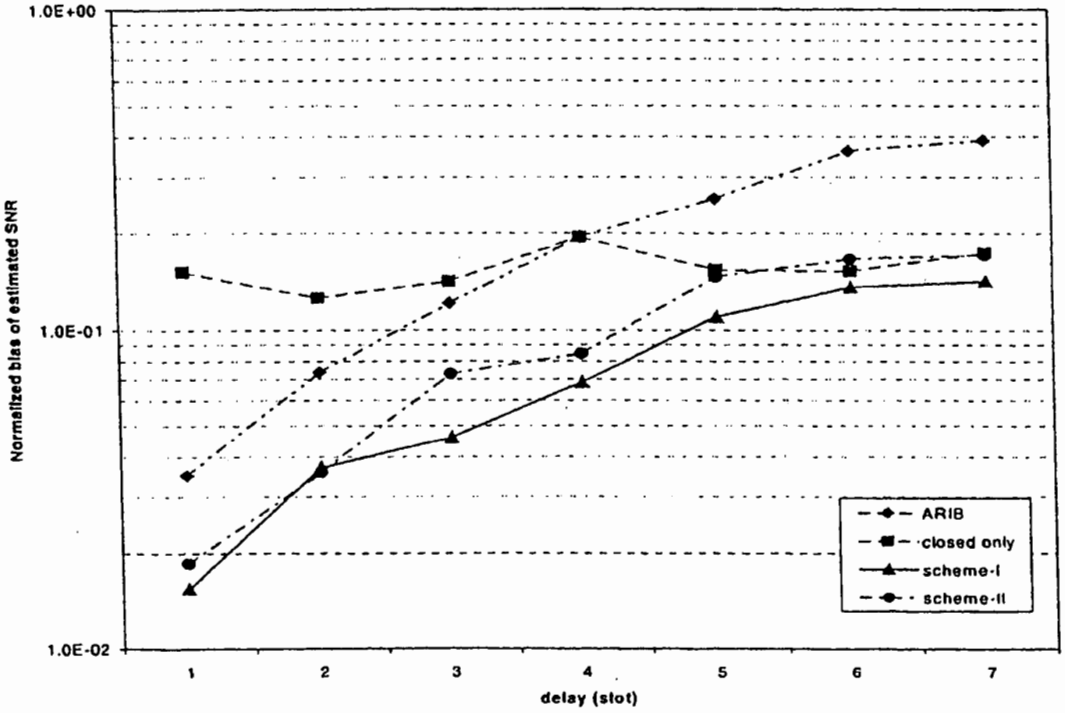

Normalized bias of estimated SNR
1.0E+00
1.0E-01
1.0E-02
delay (slot)
ARIB
closed only
scheme-I
scheme-II

Fig. 10

INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/US 00/07476

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B7/005

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 49197 A (HONKASALO ZHICHUN ;NOKIA MOBILE PHONES LTD (FI); JOKINEN HARRI (FI) 24 December 1997 (1997-12-24) abstract; figure 1 page 4, line 21 -page 5, line 11 page 6, line 13 -page 7, line 3 page 7, line 18 - line 29 page 11, line 18 -page 12, line 16 ---	1,2, 4-13, 15-23
A	EP 0 682 419 A (NIPPON TELEGRAPH & TELEPHONE) 15 November 1995 (1995-11-15) abstract; figures 4,6,7 column 8, line 13 - line 44 ---	1,4-12, 15-23

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 July 2000	13/07/2000

Name and mailing address of the ISA	Authorized officer
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Inte. ional Application No
PCT/US 00/07476

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 45962 A (ERICSSON GE MOBILE INC) 15 October 1998 (1998-10-15) abstract; figures 5,6,8 page 8, line 19 -page 10, line 9 page 12, line 14 -page 13, line 10 page 14, line 15 -page 15, line 12 page 17, line 13 -page 18, line 2	1,2, 4-13, 15-23
A	US 5 542 111 A (IVANOV KOLIO ET AL) 30 July 1996 (1996-07-30) abstract; figures 1,2 column 2, line 20 - line 43 column 2, line 58 - line 64 column 3, line 24 -column 4, line 61	1,4-12, 15-23
A	US 5 859 838 A (SOLIMAN SAMIR S) 12 January 1999 (1999-01-12) column 5, line 4 - line 19 column 8, line 1 - line 23; figure 2	1,4-12, 15-23

1

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INTERNATIONAL SEARCH REPORT

information on patent family members

Inter ional Application No
PCT/US 00/07476

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Electronic Acknowledgement Receipt	
EFS ID:	25321986
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Elizabeth McGinty
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	28-MAR-2016
Filing Date:	15-MAY-2015
Time Stamp:	16:52:54
Application Type:	Utility under 35 USC 111(a)

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Warnings:					
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2	Foreign Reference	CN1128515C-with_abstract.PDF	2615114 f723a12716dc3367d42abfe0d27f28ff6f03b89a	no	18
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Doc description: Information Disclosure Statement (IDS) Filed

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(Not for submission under 37 CFR 1.99)

Application Number	14713719
Filing Date	2015-05-15
First Named Inventor	Nicholas W. Anderson
Art Unit	2647
Examiner Name	Dominic E. Rego
Attorney Docket Number	IPW2-USCN207446

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	1	20040190485	A1	2004-09-30	Khan	*English Equivalent of JP 2004-289842

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	1	2004248247	JP	A	2004-02-09	Lucent Technol Inc.	*English Translation of Abstract. US 8134994 is the English Equivalent	
	2	2004289842	JP	A	2004-10-14	Lucent Technol Inc.	*English Translation of Abstract. US 20040190485 is the English Equivalent	

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	1	OFFICE ACTION, Korean Patent Application No. 10-2007-7005478, dated December 21, 2011 with English Translation	
	2	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2007-7005478, dated June 7, 2012.	
	3	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2012-7004514, dated February 22, 2013.	
	4	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2012-7004519, dated December 26, 2012.	
	5	NOTICE OF ALLOWANCE, Korean Patent Application No. 10-2012-7004526, dated June 7, 2012.	
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	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

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Signature	/Harry Vartanian/	Date (YYYY-MM-DD)	2016-03-25
Name/Print	Harry Vartanian	Registration Number	56787

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1	Non Patent Literature	10-2007-7005478-OfficeAction-20111221.PDF	644391 a95566a5b0cc8c064298ae45c695a48d31a43e75	no	11
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6	Non Patent Literature	10-2012-7020771-Notice_of_Allowance-20130130.PDF	1893014 9a3eabaa6db19a2c6d38fe9e114ae483da61f2d6	no	5
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New Applications Under 35 U.S.C. 111
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PATENT ABSTRACTS OF JAPAN

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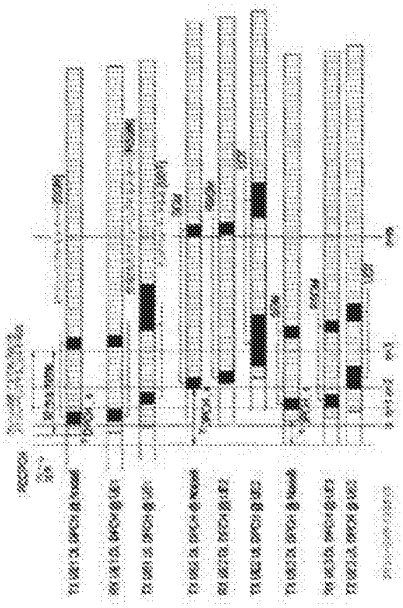
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(54) METHOD OF SCHEDULING DOWNLINK DEDICATED CHANNELS AND TRANSMITTING UPLINK DEDICATED CHANNELS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide the method for scheduling an uplink transmission on a high speed data dedicated channels, such as the EUDCH in UMTS.
SOLUTION: In the scheduling method of the present invention, scheduling grant messages for a user equipment are transmitted beginning in any time slot of a frame for a channel so long as the scheduling grant message does not exceed the frame. The scheduling grant message indicates user equipment is approved to transmit on an uplink dedicated channel. This down link transmission and subsequent uplink dedicated channel transmission have a timing relationship such that no more than one user equipment will begin transmitting on a respective uplink dedicated channel at a time.



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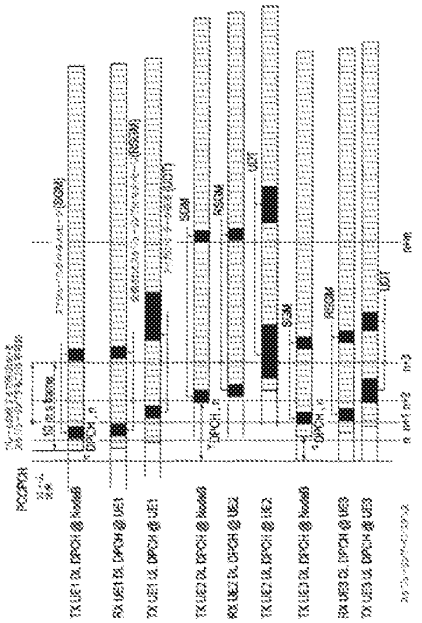
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最終頁に続く

(54)【発明の名称】ダウンリンク専用チャネル上でスケジューリングし、アップリンク専用チャネル上で伝送する方法

(57)【要約】
【課題】　本発明は、ＵＭＴＳにおけるＥＵＤＣＨ等の高速データ専用チャネル上でのアップリンク伝送をスケジューリングする方法を提供する。
【解決手段】　本発明のスケジューリング方法においては、スケジューリング付与メッセージがそのフレームを越えない限り、チャネルのためのフレームの任意のタイム・スロット内で開始する、ユーザ機器のためのスケジューリング付与メッセージが伝送される。スケジューリング付与メッセージは、ユーザ機器がアップリンク専用チャネル上で伝送することが承認されていることを示す。このダウンリンク伝送および後続のアップリンク専用チャネル伝送は、複数のユーザ機器が、各アップリンク専用チャネル上で一度に伝送を開始しないようなタイミング関係を有する。
【選択図】　図１



【特許請求の範囲】
【請求項１】
ワイヤレス・ネットワークでアップリンク専用チャネルをスケジューリングするための方法であって、
スケジューリング付与メッセージがフレームを越えないように、ダウンリンク・チャネルのためのフレームの任意のタイム・スロット内で開始するスケジューリング付与メッセージを伝送する工程を含む方法。
【請求項２】
伝送する工程が、ダウンリンク専用物理チャネル上でスケジューリング付与メッセージを伝送し、ダウンリンク専用物理チャネルのフレーム毎にせいぜい１つのスケジューリング付与メッセージを伝送する請求項１に記載の方法。
【請求項３】
伝送する工程が、スケジューリング付与メッセージの伝送がやがてオーバラップしないように、各ダウンリンク・チャネルを介して複数のユーザ機器のためのスケジューリング付与メッセージを伝送することを含み、
伝送する工程が、そのユーザ機器に関連付けられたダウンリンク専用物理チャネル上でそれぞれのユーザ機器のためのスケジューリング付与メッセージを伝送し、
伝送する工程が、それぞれのダウンリンク専用物理チャネルのフレーム毎にせいぜい１つのスケジューリング付与メッセージを伝送する請求項１に記載の方法。
【請求項４】
ワイヤレス・ネットワークでアップリンク専用チャネルをスケジューリングするための方法であって、
ダウンリンク共用チャネルを介して少なくとも１つのスケジューリング付与メッセージを伝送する工程を含む方法。
【請求項５】
伝送する工程が、ダウンリンク共用チャネルを介して複数のユーザ機器のためのスケジューリング付与メッセージを伝送し、
伝送する工程が、ダウンリンク共用チャネルのフレーム内で複数のスケジューリング付与メッセージを伝送する請求項４に記載の方法。
【請求項６】
ワイヤレス・ネットワークでアップリンク専用チャネルをスケジューリングするための方法であって、
複数のユーザ機器が各アップリンク専用チャネル上で一度に伝送を開始しないように、スケジューリング付与メッセージを伝送することを含む方法。
【請求項７】
ユーザ機器からのアップリンク専用チャネル上で伝送する方法であって、
スケジューリング付与メッセージの開始のブラインド検出を行うことと、
検出されたスケジューリング付与メッセージに応答してアップリンク専用チャネル上で伝送することとを含む方法。
【請求項８】
ユーザ機器からのアップリンク専用チャネル上で伝送する方法であって、
受信されたスケジューリング付与メッセージの終了後の所定の時間にアップリンク専用チャネル上で伝送することを含む方法。
【請求項９】
ユーザ機器からのアップリンク専用チャネル上で伝送する方法であって、
受信されたスケジューリング付与メッセージに応答してアップリンク専用チャネルのフレームの開始に同期された時点でアップリンク専用チャネル上で伝送することを含む方法。
【請求項１０】
アップリンク専用チャネルのフレームの開始に同期された時点が、受信されたスケジュ

ーリング付与メッセージの終了後の所定の時間より大きいかまたはそれに等しく、
所定の時間が、ユーザ機器がスケジューリング付与メッセージを処理する時間に少なくとも等しい請求項９に記載の方法。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、ワイヤレス通信システムに関し、具体的には、ＵＭＴＳなどの第３世代ワイヤレス通信システムに適用可能である。
【背景技術】
【０００２】
少なくとも１つのワイヤレス標準化団体が、アップリンク（すなわち、ユーザ機器とワイヤレス・ネットワークの間）上での高速データ伝送に対して専用のトランスポート・チャネルの使用を調査している。ＵＭＴＳにおいては、このアップリンク高速専用トランスポート・チャネルが、拡張アップリンク専用チャネル（ＥＵＤＣＨ）として知られるようになった。ＥＵＤＣＨなどのチャネルの使用を調査した結果として、ユーザ機器（ＵＥ）からネットワークへのデータの効率的な転送ができるようになることが望ましい。
【発明の開示】
【発明が解決しようとする課題】
【０００３】
以下に詳細に記載しているように、本発明は、とりわけ、背景技術の項で説明したＵＭＴＳにおけるＥＵＤＣＨなどの高速データ専用チャネル上でのアップリンク伝送をスケジューリングするための方法を提供することができる。その上、そのスケジューリングの方法は、データ転送が効率的な方法で実施されるように、ダウンリンク・スケジューリング・メッセージとそれに応答するアップリンク伝送の間のタイミング構造を提供することができる。
【課題を解決するための手段】
【０００４】
本発明の第１の実施形態では、既存のダウンリンク専用物理チャネルおよびアップリンク専用物理チャネルが使用される。しかし、スケジューリング付与メッセージを送信し、スケジューリング付与メッセージに応答するためのタイミング関係が定義される。スケジューリング付与メッセージを送信する際に、スケジューリング付与メッセージがフレームを越えないように、ダウンリンク専用物理チャネルのためのフレームの任意のタイム・スロット内で開始するスケジューリング付与メッセージが送信される。スケジューリング付与メッセージに応答して、伝送する際に、一実施形態ではスケジューリング付与メッセージを処理した後に、または別の実施形態では所定の時間後に、アップリンク専用チャネル上で伝送が行われる。他の実施形態では、スケジューリング付与メッセージを処理するのに必要な時間に対して、所定の時間が設定される。
【０００５】
本発明の第２の実施形態では、共用制御チャネルを使用して、スケジューリング付与メッセージを送信し、応答する際に、新しく定義された拡張アップリンク専用物理データ・チャネル（ＥＵＤＰＤＣＨ）が各ユーザ機器によって使用される。ＥＵＤＰＤＣＨを介して伝送する際には、一実施形態ではスケジューリング付与メッセージを処理した後に、または別の実施形態では所定の時間後に、アップリンク専用チャネル上での伝送が行われる。さらなる実施形態では、スケジューリング付与メッセージを受信した後の一定時間に等しいかまたはそれより大きいＥＵＤＰＤＣＨのフレームの開始から測定された（ｍ×２５６チップ）時点（ここで、ｍ＝０から１４９）で、ＥＵＤＰＤＣＨ上での伝送が行われる。
【０００６】
以下の詳細な説明および単に例示目的で示した添付図面から、本発明がより十分に理解されよう。なお、さまざまな図面において、同様の参照番号は対応する部分を表す。

【発明を実施するための最良の形態】
【０００７】
以下に詳細に記載しているように、本発明は、とりわけ、背景技術の項で説明したＵＭＴＳにおけるＥＵＤＣＨなどの高速データ専用チャネル上でのアップリンク伝送をスケジューリングするための方法を提供することができる。その上、そのスケジューリングの方法は、データ転送が効率的な方法で実施されるように、ダウンリンク・スケジューリング・メッセージとそれに応答するアップリンク伝送の間のタイミング構造を提供することができる。以下に記述する本発明の第１の実施形態では、本発明の原理が現在提案されているワイヤレス通信システム・トランスポートおよび物理チャネル・アーキテクチャに適用される。以下に記述する本発明の第２の実施形態では、本発明の原理が現在提案されているワイヤレス通信システム・トランスポートおよび物理チャネル・アーキテクチャを修正することによって適用される。したがって、これらの実施形態は、広範囲なワイヤレス通信システムへの本発明の適用可能性を実証する。
【０００８】
第１の実施形態
現在の第３世代ワイヤレス通信システムにおいては、たとえば基地局（「ノードＢ」とも呼ぶ）からユーザ機器（たとえば移動局）に伝送されるダウンリンク専用物理チャネルなどのダウンリンク・チャネルの伝送が、ある基準クロックに対して同期されている。たとえば、現在提案されている第３世代ワイヤレス通信システム（たとえば、ＵＭＴＳのＲｅｌ９９／４／５）においては、ダウンリンク専用物理チャネル（ＤＰＣＨ）のタイミングは、Ｐ－ＣＣＰＣＨ（一次共通制御物理チャネル）フレームのタイミングからオフセットされた$\tau_{DPCH,n}=T_0\times 256$チップ、$T_0\in\{0,1,\ldots,149\}$である。つまり、ダウンリンクＤＰＣＨは、それが２５６チップの倍数の整数である限り、Ｐ－ＣＣＰＣＨフレーム境界に対していつでもスタートできる。しかし、ダウンリンク専用チャネル上での伝送は、フレームの開始でスタートしなければならない。
【０００９】
ユーザ機器（ＵＥ）は、ＵＥから伝送すべきデータがある場合は常に、アップリンク専用チャネル上でアップリンク伝送をスタートする。しかし、この伝送は、アップリンク専用チャネルのフレームの開始でスタートする。ＵＭＴＳにおいては、アップリンク専用物理制御チャネル（ＤＰＣＣＨ）伝送および専用物理データ・チャネル（ＤＰＤＣＨ）伝送におけるフレームの開始のためのタイミングは、対応するダウンリンクＤＰＣＨフレームの（適時に）第１に検出される経路の受信後のおおよそ$T_0=1024$チップでスタートする。フレームのタイミングは，伝搬遅延がＵＥによって異なるために、正確に１０２４チップではない。しかし、伝搬遅延の差は、通常２，３チップ以内である。時間T_0は、一般に、ＵＥがダウンリンク・チャネルを処理するのに必要な処理時間を表す。したがって、アップリンクＤＰＣＣＨ／ＤＰＤＣＨのタイミングは、ダウンリンクＤＰＣＨのタイミングによって制限される。
【００１０】
新しい物理チャネルが作成されないという制限の下で、ＥＵＤＣＨなどの高速専用チャネルを介してデータを伝送する効率的な方法を構築する場合には、本実施形態では、たとえば、ＥＵＤＣＨおよびそれに関係する制御情報を両方向に運ぶために、アップリンク（ＵＬ）およびダウンリンク（ＤＬ）ＤＰＤＣＨ／ＤＰＣＣＨ（まとめて専用物理チャネル（ＤＰＣＨ）と呼ぶ）が使用される。ＵＭＴＳワイヤレス通信システムにおいてＥＵＤＣＨを伝送するための，本発明のこの実施形態の詳細な態様を以下に記述する。
【００１１】
この実施形態によれば、ＤＰＣＨを介するＥＵＤＣＨおよび関連するダウンリンク・シグナリングは、ＤＬとＵＬの両方のためのＥＵＤＣＨのために新しい無線構成を定義することによって達成される。新しい構成は、ＤＰＣＨがＥＵＤＣＨのために使用されていることを示すが、トランスポート・フォーマットまたは伝送情報は、構成に規定されていない。このような情報は、ＥＵＤＣＨシグナリングを通じて転送されていることが示されて

いるので、特定する必要はない。ＥＵＤＣＨのアップリンク伝送をスケジューリングする際の柔軟性を最大にするために、したがって、異なるＵＥによりＥＵＤＣＨ伝送をより効率的にスケジューリングするために、ノードＢは、スケジューリング付与メッセージを伝送して、ＵＥによりアップリンク伝送をトリガする。スケジューリング付与メッセージは、ＵＥがスケジューリングされているかどうかを示すビットと同じく簡単であり得る。しかし、符号化および変調、データ転送率、ハイブリッドＡＲＱ情報も伝送される場合は、より複雑な形式のスケジューリングが可能であることを理解されよう。スケジューリング付与メッセージの複雑さは、システム設計者によって決められる。ＤＬ　ＤＰＣＨ上でのスケジューリング付与メッセージの伝送は、スケジューリング付与メッセージがフレームを越えない限り、ＤＬ　ＤＰＤＣＨのフレーム内のどのようなスロットででも行うことができる。しかし、ＤＰＣＨのフレーム毎に、ただ１つのスケジューリング付与メッセージしか可能ではない。これは、ＤＰＣＨが、ＵＭＴＳのＲｅ１９９／４／５において少なくとも１０ｍｓで復号されるという事実による。この柔軟性があるために、ワイヤレス・ネットワークは、複数のＵＥが、ＵＥのためにオーバラップしていないスケジューリング付与メッセージを伝送することにより、実質的に同時に伝送を開始することを回避する助けとなるために、スケジューリング付与メッセージの伝送を制御できる。

【００１２】

この実施形態では、音声がＥＵＤＣＨを運ぶＤＰＣＨを介して伝送されておらず、かつＤＰＣＨを介して運ばれる帯域内シグナリングがＤＬ　ＥＵＤＣＨ制御シグナリングに対して優先権を有することが想定される。

【００１３】

ＤＰＣＨ上でのＥＵＤＣＨの複数のアップリンク伝送が、実質的に同時に開始しないことが、スケジューリング付与メッセージの受信とアップリンクＤＰＣＨ上の送信の間のＵＥで固定のタイミング関係を確立することによって確実となる。一実施形態の例では、スケジューリング付与メッセージの受信とアップリンクＤＰＣＨ上の後続の送信の間の時間は、ＵＥでスケジューリング付与メッセージを処理するための最悪の場合の時間に少なくとも等しいかまたはそれより大きい値で固定されている。しかし、この時間は、スケジューリング付与メッセージを処理するための予想平均時間などの他の可能な値で固定できる。スケジューリング付与メッセージがオーバラップしない方法で送信されるので、アップリンクＤＰＣＨを介する伝送におけるこの固定のタイミング関係を使用することにより、複数のＵＥがＤＰＣＨ上でアップリンク伝送を開始することが回避される。したがって、ＵＥのアップリンク伝送間の干渉が減少する。

【００１４】

さらに、スケジューリング付与メッセージがフレーム内の任意のタイム・スロットで送信できるので、ＵＥは、ブラインド検出を実施して、どのタイム・スロットを介してスケジューリング付与メッセージが伝送されるかを判断する。一実施形態の例では、スケジューリング付与メッセージの長さが固定されていない。その結果、ブラインド検出オペレーションでは、スケジューリング付与メッセージの開始および長さを検出する。しかし、別の実施形態の例では、スケジューリング付与メッセージの長さまたは持続時間が固定されている。その結果、スケジューリング付与メッセージの開始のブラインド検出のみが、必要となる。

【００１５】

図１は、本発明の第１の実施形態によるダウンリンク・シグナリングとアップリンク専用物理チャネルの間のタイミングの一例を示す図である。図１に示されるように、１０ｍｓフレームが終わる前に、ＵＥがＤＰＣＨを介して制御情報を復号できるようにすることにより、スケジューリングの最大の柔軟性が得られる。アップリンク・トランスポート・フォーマット、伝送時間間隔などを示すアップリンク伝送が、ダウンリンク・シグナリングの復号の直後またはその後の所定の時間にスタートする。現在のＤＰＣＨがＥＵＤＣＨシグナリングのために使用され、どのタイム・スロットでシグナリングが伝送されるかを判断するためにブラインド検出が実施されることを示すために新しい無線構成を追加する

ことにより、制御情報の早めの復号が可能になると想定される。

【００１６】

図１では、ＵＥ１のためのスケジューリング付与メッセージは、ＵＥ１のためのダウンリンクＤＰＣＨ内の第３および第４のスロットを使用してダウンリンク上で送信される（単にスケジューリング付与メッセージのための長さの一例として、２つのタイム・スロットが使用されている）。ＵＬ　ＤＰＤＣＨを介する伝送は、３タイム・スロットをとる。伝送後は、次の１０ｍｓフレーム境界まで、スケジューリング付与メッセージは送信できない。異なるパケットに対して異なる伝送時間間隔が可能である場合には、この非効率さを補償することができる。たとえば、図１では、ＵＥ２が、９タイム・スロットを使用して伝送するようスケジューリングされ、このことにより、１つの１０ｍｓ無線フレーム内の未使用のタイム・スロットの数が減少する。性能に影響を及ぼしかねない１つの他の問題が、スケジューリングが１０ｍｓフレームの終了間際に送信された場合に、１つの伝送がフレーム境界を越えることができるようにするかどうかである。図１では、ＵＥ２のための第２のスケジューリング付与が、このシナリオを示している。ＵＥ２がそのダウンリンク・シグナリングを受信すると、ＵＥ２は、アップリンクＤＰＣＨ内に残された３タイム・スロットしか有さない。しかし、バッファ・バックログ、ＵＥの使用可能パワー、経路損失情報などに基づいて、ノードＢでのスケジューラが、３を超えるタイム・スロットの伝送をスケジューリングすることを望むことがある。したがって、ＵＥ２は、現在のフレームの最後の３タイム・スロットおよび次のフレームの次の６タイム・スロットの間伝送する。ダウンリンク上では、ノードＢで伝送時間間隔と伝送スタート時間の両方が周知である場合は、１０ｍｓフレーム境界を介する伝送が可能である。一実施形態の例では、この場合ノードＢは、正しい段階でスケジューリングし、非常に多くのＵＥ伝送が同時にオーバラップするのを回避するために、$\tau_{DPCH,n} = T_n \times 256$チップ、$T_n \in \{0, 1, \ldots, 149\}$を追跡する。第３のＵＥ３の第３のスケジューリングも表されている。

【００１７】

ノードＢでのスケジューラが、たとえば、データの最も効率的な転送を可能にする異なるＵＥのＥＵＤＣＨのアップリンク伝送をトリガするための柔軟性を有することを理解されよう。つまり、図１に示されるようにＵＥ２をスケジューリングすることにより、スケジューリングのこの柔軟性により、より高いデータ転送率でのより長い伝送が可能となる。

【００１８】

第２の実施形態

本発明の第２の実施形態では、ＵＭＴＳにおける高速共用制御チャネル（ＨＳ－ＳＣＣＨ）などのダウンリンク制御チャネルを使用して、スケジューリング付与メッセージをＵＥに送信し、拡張アップリンク専用物理データ・チャネル（ＥＵＤＰＤＣＨ）と呼ぶ新しい物理データ・チャネルが、アップリンク上でのそれに応答する伝送のために確立される。この構造により、さらに柔軟性が得られ、したがって、伝送効率の可能性が増すこととなる。

【００１９】

ノードＢが、共用制御チャネルなどのＨＳ－ＳＣＣＨを使用して、スケジューリング付与メッセージを送信する。スケジューリング付与メッセージのための伝送時間間隔（ＴＴＩ）は、ある実施形態の例では固定であり得、別の実施形態の例では柔軟なままであり得る。特定のＵＥのためのスケジューリング付与メッセージが専用チャネルを介して送信される第１の実施形態とは異なり、この実施形態では、スケジューリング付与メッセージを送信するために共用チャネルが使用される。したがって、複数のＵＥのためのスケジューリング付与メッセージを単一のダウンリンク・チャネルを介して送信でき、スケジューリング付与メッセージを送信するために必要なチャネルの数を少なくすることができる。この構造により、スケジューリング付与メッセージ間にオーバラップが生じないことが確実となり、複数のスケジューリング付与メッセージが、ダウンリンク・チャネルの１フレー

ム内で送信されることを可能にする。また、スケジューリング付与メッセージは、そのスケジューリング付与メッセージがどのＵＥのためのものであるかを識別する，ＨＳ－ＳＣＣＨなどの共用チャネルで周知である識別情報を有する。

【００２０】

この実施形態では，ＵＥは、各識別情報を有するスケジューリング付与メッセージのための共用制御チャネルをモニタする。第１の実施形態の場合と同様に、スケジューリング付与メッセージの開始のブラインド検出が実施され、スケジューリング付与メッセージのＴＴＩが固定されていない場合には、スケジューリング付与メッセージの持続時間または長さも，ブラインドな方法で検出される。

【００２１】

ＵＥがそのＵＥのためのスケジューリング付与メッセージを受信すると，ＵＥは、アップリンクＥＵＤＰＤＣＨを介して伝送する。一実施形態の例では、ＥＵＤＰＤＣＨ上の伝送は、スケジューリング付与メッセージの受信に関連付けられた固定タイミングに基づいて実施される。一実施形態の例では、スケジューリング付与メッセージの受信とＥＵＤＰＤＣＨ上の後続の送信の間の時間は、ＵＥでスケジューリング付与メッセージを処理するための最悪の場合の時間に少なくとも等しいかまたはそれより大きい値で固定されている。しかし，この時間は、スケジューリング付与メッセージを処理するための予想平均時間などの他の可能な値で固定できる。スケジューリング付与メッセージがオーバラップしない方法で送信されるので、アップリンクＤＰＣＨを介する伝送におけるこの固定のタイミング関係を使用することにより、複数のＵＥが、ＤＰＣＨ上でアップリンク伝送を開始することが回避される。

【００２２】

別の実施形態の例では、ＥＵＤＰＤＣＨ上での伝送は、スケジューリング付与メッセージの受信およびＥＵＤＰＤＣＨのフレーム・タイミングに関連付けられた固定のタイミング関係に基づく。この実施形態の例では、スケジューリング付与メッセージに応答するＥＵＤＰＤＣＨ上での伝送が，スケジューリング付与メッセージの受信後の一定時間に等しいかまたはそれより大きいＥＵＤＰＤＣＨのフレームの開始から測定された（ｍ×２５６チップ）時点（ここで，ｍ＝０から１４９）で起きる。一実施形態の例では、スケジューリング付与メッセージの受信からのこの時間は、スケジューリング付与メッセージを処理するのに必要な時間である。別の実施形態では、この時間は，ＵＥでスケジューリング付与メッセージを処理するための最悪の場合の時間に少なくとも等しいかまたはそれより大きい値で固定されている。しかし，この時間は、スケジューリング付与メッセージを処理するための予想平均時間などの他の可能な値で固定できる。また、２５６チップ間隔に基づくのではなく、ＥＵＤＰＤＣＨフレームの開始に対するタイミング関係は、別のチップ間隔に基づくことができる。スケジューリング付与メッセージがオーバラップしない方法で送信されるので，ＥＵＤＰＤＣＨを介する伝送におけるこの固定のタイミング関係により、複数のＵＥが，同時にＥＵＤＰＤＣＨ上でアップリンク伝送を開始することが回避される。

【００２３】

図２は，ＨＳ－ＳＣＣＨのような制御チャネル上のダウンリンク・シグナリングとＥＵＤＰＤＣＨ伝送の間のタイミングの一例を示す図である。図２に示されるように，この例におけるスケジューリング付与メッセージのＴＴＩは、３スロット（すなわち、ＵＭＴＳにおいては３×２５６０チップ）で固定されている。伝送が固定ＴＴＩ値を使用すると想定すると、ダウンリンクＳＣＣＨのような制御チャネル上でスケジューリング付与を受信した後、ＵＥ伝送が，（ＥＵＤＰＤＣＨを介する伝送がＥＵＤＰＤＣＨフレームの開始から２５６チップの倍数に同期していることを確認するために，）所定の時間（たとえば、Ｔｏ＝１０２４チップ）＋おそらくいくつかのオフセットでスタートする。アップリンク上では，ノードＢは、順序だった方法で異なるＵＥからの伝送を受信するが，伝搬遅延のためにやや同期がずれている。

【００２４】

さらに、ＵＥのアップリンク制御チャネルは、ＥＵＤＰＤＣＨの１スロット前であり、ＥＵＤＰＤＣＨとオーバラップしていない場合がある。この場合は、アップリンク制御シグナリングが、ＥＵＤＰＤＣＨと同じチャネル化符号を共用できるが、このことは、チャネル化符号のより効率的な使用を可能にするためには必ずしも必要ではないが、ＵＥの増幅器の入力部へのピーク対平均値比（ＰＡＲ）を減少させる助けとなる。話をより明確にするために、アップリンク制御情報の３タイム・スロットおよびＥＵＤＰＤＣＨの３タイム・スロットがあると想定すると、ノードＢは、スケジューリング付与を送信した後およそ（Ｔｏ＋オフセット）秒でのアップリンク伝送を予想する。

【００２５】

図３は、アップリンク伝送を時分割多重化するための可能な方法を示す図である。制御スロット、Ｃ１、Ｃ２、Ｃ３は、そのスロット内で制御情報がどの程度クリティカルかにより、どのような位置でもあり得る。ＵＥの速度を判断する場合に、システム設計者が、ＴＦＣＩ（トランスポート・フォーマット制御インジケータ）をＣ１内に、バッファ・バックログ、パワー・マージンなどをＣ２およびＣ３内に入れたいと望むことがある。あるいは、ノードＢの速度を判断する場合に、単に、データの後にすべての制御情報を入れることもできる。しかし、ＰＡＲを減少させるためには、同時に制御およびデータを伝送しないことが有益である。

【００２６】

本発明をこのように記述してきたが、本発明を多くの方法で変えることができることは自明であろう。このような変形形態は本発明の趣旨および範囲から逸脱すると考えるべきではなく、すべてのこのような修正形態は本発明の範囲内に含まれるものとする。

【図面の簡単な説明】

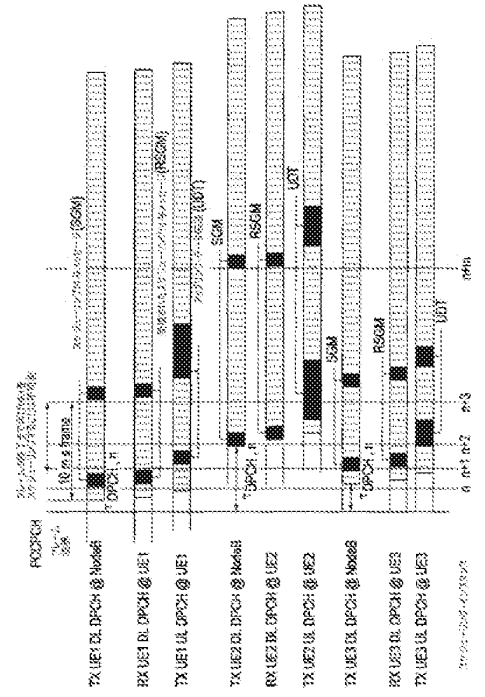
【００２７】

【図１】本発明の第１の実施形態によるダウンリンク・シグナリングとアップリンク専用物理チャネル伝送の間のタイミングの一例を示す図である。

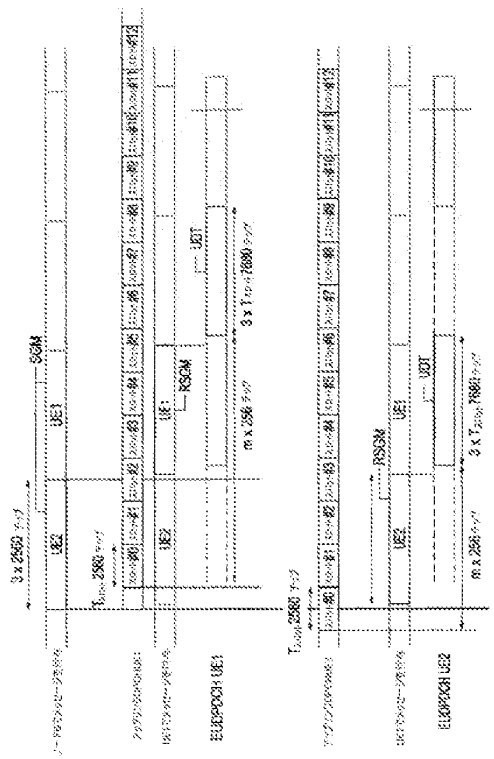
【図２】本発明の第２の実施形態によるダウンリンク・シグナリングとアップリンク専用物理チャネル伝送の間のタイミングの一例を示す図である。

【図３】アップリンク伝送を時分割多重化するための可能な方法を示す図である。

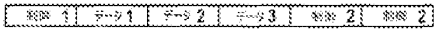
【図１】



【図２】



【図３】



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【手続補正書】
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【手続補正１】
【補正対象書類名】特許請求の範囲
【補正対象項目名】全文
【補正方法】変更
【補正の内容】
【特許請求の範囲】
【請求項１】
ワイヤレス・ネットワークでアップリンク専用チャネルをスケジューリングするための方法であって、
スケジューリング付与メッセージがフレームを越えないように、ダウンリンク・チャネルのためのフレームの任意のタイム・スロット内で開始する該スケジューリング付与メッセージを伝送するステップ
を含む方法。
【請求項２】
該伝送するステップが、ダウンリンク専用物理チャネル上でスケジューリング付与メッセージを伝送し、ダウンリンク専用物理チャネルのフレーム毎にせいぜい１つのスケジューリング付与メッセージを伝送する請求項１に記載の方法。
【請求項３】
該伝送するステップが、スケジューリング付与メッセージの伝送がやがてオーバラップしないように、各ダウンリンク・チャネルを介して複数のユーザ機器のためのスケジューリング付与メッセージを伝送することを含み、
該伝送するステップが、各ユーザ機器に関連付けられたダウンリンク専用物理チャネル上で各ユーザ機器のためのスケジューリング付与メッセージを伝送し、
該伝送するステップが、それぞれのダウンリンク専用物理チャネルのフレーム毎にせいぜい１つのスケジューリング付与メッセージを伝送する請求項１に記載の方法。
【請求項４】
ワイヤレス・ネットワークでアップリンク専用チャネルをスケジューリングするための方法であって、
ダウンリンク共用チャネルを介して少なくとも１つのスケジューリング付与メッセージを伝送するステップを含む方法。
【請求項５】
該伝送するステップが、ダウンリンク共用チャネルを介して複数のユーザ機器のためのスケジューリング付与メッセージを伝送し、

該伝送するステップが、ダウンリンク共用チャネルのフレーム内で複数のスケジューリング付与メッセージを伝送する請求項４に記載の方法。
【請求項６】
ワイヤレス・ネットワークでアップリンク専用チャネルをスケジューリングするための方法であって、
複数のユーザ機器が各アップリンク専用チャネル上で一度に伝送を開始しないように、スケジューリング付与メッセージを伝送するステップを含む方法。
【請求項７】
ユーザ機器からのアップリンク専用チャネル上で伝送する方法であって、
スケジューリング付与メッセージの開始のブラインド検出を行うステップ、及び
検出されたスケジューリング付与メッセージに応答して該アップリンク専用チャネル上で伝送するステップ
を含む方法。
【請求項８】
ユーザ機器からのアップリンク専用チャネル上で伝送する方法であって、
受信されたスケジューリング付与メッセージの終了後の所定の時間に該アップリンク専用チャネル上で伝送するステップを含む方法。
【請求項９】
ユーザ機器からのアップリンク専用チャネル上で伝送する方法であって、
受信されたスケジューリング付与メッセージに応答して該アップリンク専用チャネルのフレームの開始に同期された時点で該アップリンク専用チャネル上で伝送するステップを含む方法。
【請求項１０】
該アップリンク専用チャネルのフレームの開始に同期された時点が、該受信されたスケジューリング付与メッセージの終了後の所定の時間より大きいかまたはそれに等しく、
該所定の時間が、該ユーザ機器が該スケジューリング付与メッセージを処理する時間に少なくとも等しい請求項９に記載の方法。

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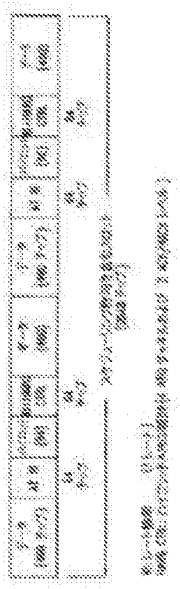
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(54) METHOD OF SCHEDULING PERMITTED TRANSMISSION IN WIRELESS COMMUNICATION SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method of transmitting a control information in a wireless communication system, such as for reverse link packet access transmission.
SOLUTION: The method includes transmission of a forward link data, having at least one time multiplexed scheduling grant. The method may also include receiving a forward link data, having at least one time-multiplexed scheduling permission and/or transmitting a packet, in response to receiving at least one time multiplexed scheduling grant. Here, the one or more scheduling permissions include at least one of user identification information, rate indication information, transmit power control information and HARQ (hybrid automatic repeat request) information.



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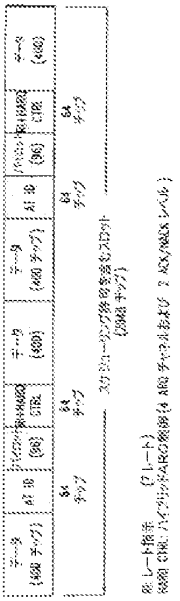
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最終頁に続く

(54)【発明の名称】無線通信システムにおける許可された送信のスケジューリング方法

(57)【要約】
【課題】リバース・リンク・パケット・アクセス送信に関するなど、無線通信システムにおける制御情報を送信する方法を提供する。
【解決手段】本方法は、少なくとも１つの時分割多重化されたスケジューリング許可を有する、フォワード・リンク・データを送信することを含む。本方法は、また、少なくとも１つの時分割多重化されたスケジューリング許可を有するフォワード・リンク・データを受信すること、および／または少なくとも１つの時分割多重化されたスケジューリング許可を受信することに応答してパケットを送信することを含むことができる。ここで、１つまたは複数のスケジューリング許可は、少なくとも１つのユーザ識別情報、レート指示情報、送信出力制御情報、およびＨＡＲＱ情報を含む。
【選択図】図４



【特許請求の範囲】
【請求項１】
無線通信方法であって、
少なくとも１つの時分割多重化されたスケジューリング許可を有するフォワード・リンク・データを送信する工程を含み、前記少なくとも１つの時分割多重化されたスケジューリング許可が、少なくとも１つのユーザ識別情報、レート指示情報、送信出力制御情報、およびＨＡＲＱ情報を含む無線通信方法。
【請求項２】
前記スケジューリング許可が、フォワード・リンク・スロットのＭＡＣフィールドで送信され、または前記スケジューリング許可が、前記フォワード・リンク・データに差し込まれる請求項１に記載の方法。
【請求項３】
前記スケジューリング許可が、符号化されかつインターリーブされ、フォワード・リンクＭＡＣフィールドで送信される請求項１に記載の方法。
【請求項４】
無線通信方法であって、
少なくとも１つの時分割多重化されたスケジューリング許可を有するフォワード・リンク・データを受信する工程を含み、前記少なくとも１つの時分割多重化されたスケジューリング許可が、少なくとも１つのユーザ識別情報、レート指示情報、送信出力制御情報、およびＨＡＲＱ情報を含む無線通信方法。
【請求項５】
前記スケジューリング許可が、フォワード・リンク・スロットのＭＡＣフィールドで受信され、または前記スケジューリング許可が、前記フォワード・リンク・データから抜かれる請求項４に記載の方法。
【請求項６】
前記スケジューリング許可が、複号化されかつデインターリーブされ、フォワード・リンクＭＡＣフィールドで受信される請求項４に記載の方法。
【請求項７】
無線通信方法であって、
少なくとも１つのスケジューリング許可の受信に応答してパケットを送信する工程を含み、前記少なくとも１つのスケジューリング許可が、少なくとも１つのユーザ識別情報、レート指示情報、送信出力制御情報、およびＨＡＲＱ情報を含む無線通信方法。
【請求項８】
前記パケットを送信する工程が、前記レート指示情報に応答してデータ・ブロックを符号化することを含む請求項７に記載の方法。
【請求項９】
前記パケットを送信する工程が、前記ＨＡＲＱ情報に応答して前記パケットを送信することを含む請求項７に記載の方法。
【請求項１０】
スケジューリング許可を受信する工程が、
Ｗａｌｓｈ符号のエネルギーを検出する工程と、
制御情報が、検出されたエネルギーに基づいてユーザに関するものであるかどうかを決定する工程とを含む請求項７に記載の方法。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、遠隔通信に関し、より詳細には無線通信に関する。
【背景技術】
【０００２】
無線通信システムは、多数の地理的に分散されたセルラ通信サイトすなわち基地局を用

いる。各基地局は、静止されたすなわち固定された無線通信デバイスまたはユニットへの通信信号の送信、および無線通信デバイスまたはユニットからの通信信号の受信をサポートする。各基地局は、セル／セクタと一般に呼ばれる特定の領域にわたる通信を処理する。無線通信システムに関する全体的なカバレージ領域は、用いられる基地局に関するセルの集まりによって画定される。ここで、隣接するまたは近接するセル・サイトに関するカバレージ領域は、互いに重なり合うことができ、ここでシステムの外側境界内の可能な連続する通信カバレージを確実にする。

【０００３】

アクティブであるとき、無線ユニットは、フォワード（順方向）・リンクすなわちダウンリンク上で少なくとも１つの基地局から信号を受信し、かつリバース（逆方向）・リンクすなわちアップリンク上で少なくとも１つの基地局へ信号を送信する。例えば、ＴＤＭＡ（ｔｉｍｅ－ｄｉｖｉｓｉｏｎ ｍｕｌｔｉｐｌｅ ａｃｃｅｓｓ、時分割多重アクセス）、ＦＤＭＡ（ｆｒｅｑｕｅｎｃｙ－ｄｉｖｉｓｉｏｎ ｍｕｌｔｉｐｌｅ ａｃｃｅｓｓ、周波数分割多重アクセス）、およびＣＤＭＡ（ｃｏｄｅ－ｄｉｖｉｓｉｏｎ ｍｕｌｔｉｐｌｅ ａｃｃｅｓｓ、符号分割多重アクセス）構成を含む、セルラ通信システムに関するリンクすなわちチャネルを規定するための多くの異なる構成が存在する。ＣＤＭＡ通信において、異なる無線チャネルは、異なる情報ストリームを符号化するために使用される異なるチャネル化符号またはシーケンスによって識別され、これらは、次に、同時の送信に関する１つまたは複数の異なる搬送周波数で変調されることができる。受信機は、受信した信号を復号化するために、適切な符号またはシーケンスを使用して受信した信号から特定のストリームを復元することができる。

【０００４】

音声通用に関しては、従来のセルラ通信システムは、無線ユニットと基地局との間の専用リンクを使用する。音声通信は，本質的に遅延を許容しない。したがって，無線セルラ通信システムにおける無線ユニットは、１つまたは複数の専用リンク上で信号を送受信する。ここで、それぞれアクティブな無線ユニットは，一般に、ダウンリンク上の専用リンク、ならびにアップリンク上の専用リンクの割り当てを必要とする。

【０００５】

インターネットの爆発的な普及およびデータに対する増大した要求とともに、リソース管理が、セルラ通信システムにおける増大する問題になった。しかしながら音声とは異なり、データ通信は、本質的に比較的遅延を許容し、かつ潜在的にバースト性であることができる。そのように、データ通信は、ダウンリンクまたはアップリンク上に専用リンクを必要とせず，むしろ１つまたは複数のチャネルを多数の無線ユニットによって共有できるようにする。この構成によって、アップリンク上の各無線ユニットは、利用可能なリソースを競合する。アップリンクで管理されるべきリソースは、基地局で受信される出力と、例えば、同一のセクタすなわちセル内の他のユーザ、ならびに他のセクタすなわち他のセル内のユーザに対する，各ユーザによって生成される干渉とを含む。これは、固定された送信出力設定を含むダウンリンク上で管理されるべきリソースとは対照的である。

【０００６】

データ通信は、本質的に比較的遅延を許容し、かつ潜在的にバースト性であることができるが，次世代の無線通信システムにおいて予想される１つの問題は、データ・ブロックまたはデータ・パケット送信に失敗することである。より詳細には、例えば基地局は、多数のパケットから１つまたは複数のデータ・パケットを、識別された無線ユニットへ送信することを失敗することがある。この失敗の結果として、基地局が，例えばハイブリッド自動繰り返し要求（ｈｙｂｒｉｄ ａｕｔｏｍａｔｉｃ ｒｅｐｅａｔ ｒｅｑｕｅｓｔ、ＨＡＲＱ）などの任意の数の再送信技術を使用して、無線ユニットによって十分に受信されないデータ・パケットを送ることができる。

【０００７】

ＨＡＲＱは、元々の送信を破棄することより、元々の送信に新たな送信を組み合わせることを可能にする。これは，パケットの復号を訂正する可能性を改善することができる。

ＨＡＲＱにおける用語「ハイブリッド」は、フォワード誤差訂正（Ｆｏｒｗａｒｄ Ｅｒｒｏｒ Ｃｏｒｒｅｃｔｉｏｎ，ＦＥＣ）技術が、ＡＲＱ技術に加えて使用されることを示す。ＨＡＲＱ組み合わせ構成は、再送信が、元々の成功しなかった送信と組み合わされることを意味する。したがって、ＨＡＲＱを試みることは、自体によって成功しなかった復号の結果となる送信が、破棄されることがないことを確実にする。

【０００８】

発展された努力は、ユニバーサル移動遠隔通信システム（Ｕｎｉｖｅｒｓａｌ Ｍｏｂｉｌｅ Ｔｅｌｅｃｏｍｍｕｎｉｃａｔｉｏｎｓ Ｓｙｓｔｅｍ、ＵＭＴＳ）およびＣＤＭＡ２０００ １ｘなどの第３世代（３Ｇ）無線通信システムの発展した展開のために進められている。これらのおよび以降の次世代の無線通信システムは、例えば、インターネット・アクセスおよびマルチメディア通信のサポートにおける、ＵＭＴＳでの高速ダウンリンク・パケット・アクセス（ｈｉｇｈ－ｓｐｅｅｄ ｄｏｗｎｌｉｎｋ ｐａｃｋｅｔ ａｃｃｅｓｓ、ＨＳＤＰＡ）仕様、およびＣＤＭＡ２０００での１ｘＥＶ－ＤＶ仕様などの高速データ・サービスを提供することが予想される。例えばＨＳＤＰＡおよび１ｘＥＶ－ＤＶなどのこれらの解決方法は、同一の搬送波で同時に音声および高速データの必要性を、反対方向でも適合できるように、別個にかつ潜在的な競合をサポートする取り組みに対処し始めた。

【０００９】

例えば無線インターネット適用などの無線適用に関連する急速に発展する必要性に合致するために、およびＨＳＤＰＡをサポートするために、これらの３Ｇシステムは、高速スケジューリング、適合変調および符号化（Ａｄａｐｔｉｖｅ Ｍｏｄｕｌａｔｉｏｎ ａｎｄ Ｃｏｄｉｎｇ、ＡＭＣ）、およびＨＡＲＱなどの性能を強化した技術を使用する。高速スケジューリングは、セクタ処理量を最大化するためのチャネル品質感受性スケジューリング技術であり、例えば、基地局は、チャネル品質に基づき所定の時間で１つまたは複数のユーザにリソースを割り当てる。ＡＭＣ技術は、スケージュールされたユーザの現在のチャネル状況に「適する」ことができる、データ・レートおよび送信フォーマット、例えば変調レベルおよびチャネル符号化レートの選択を可能にする。

【発明の開示】

【発明が解決しようとする課題】

【００１０】

遅延および測定誤差は、ＡＭＣからの劣化した性能を結果として生じることがある。例としてのシナリオにおいて、ビットまたはパケットのブロックは、誤って受信されても、ＱＰＳＫ変調および０．５の符号レートを使用して送ることができる。パケットは、次に、符号化されたビットの元々のセットからの少なくともいくつかの新たな「パリティ」ビットに加えて、新たな変調の適正な選択とともに再送信されることができる。ＨＡＲＱ技術は、劣化を最小化するための取り組みにおいて、物理層での高速再送信によってあるレベルの頑強性を提供するように使用されることができる。

【００１１】

３Ｇ標準のさらなる発展は、例えば無線ユニットから基地局へなど、高速リバース・リンクのパケット・アクセスを含むことがある。しかしながら、時分割多重化されたスロット構造は、リバース・リンク・パケット・アクセスをサポートする所定のシステムで使用されることができる。これらのシステムにおいて、スケジューリング許可チャネルは、所定の時分割多重化されたスロット構造を実現することが難しいことがある。したがって、リバース・リンク・パケット・アクセス送信に関して、スケジューリング許可などの制御情報を搬送する方法の必要性が存在する。

【課題を解決するための手段】

【００１２】

本発明は、無線通信システムにおけるリバース・リンクに関する制御情報を送信する方法を提供する。より詳細には、本発明は、リバース・リンク・パケット・アクセス送信に関する制御情報を送信する方法を提供する。本発明の目的のために、リバース・リンクに

関して送信された制御情報は、少なくとも１つのスケジューリング許可、および／または送信出力制御（Ｔｒａｎｓｍｉｔ　Ｐｏｗｅｒ　Ｃｏｎｔｒｏｌ、ＴＰＣ）情報、および／またはユーザ識別情報（例えば、ＡＴ　ＩＤ）、および／またはレート指示情報、および／またはＨＡＲＱ制御情報を含むことができる。

【００１３】

本発明の一実施形態において、本方法は、少なくとも１つの時分割多重化されたスケジューリング許可を有する、フォワード・リンク・データを送信することを含む。１つまたは複数の時分割多重化されたスケジューリング許可は、少なくとも１つのユーザ識別情報、レート指示情報、送信出力制御情報、およびＨＡＲＱ情報を含む。

【００１４】

他の実施形態において、本方法は、少なくとも１つの時分割多重化されたスケジューリング許可を有する、フォワード・リンク・データを受信することを含む。１つまたは複数の時分割多重化されたスケジューリング許可は、少なくとも１つのユーザ識別情報、レート指示情報、送信出力制御情報、およびＨＡＲＱ情報を含む。

【００１５】

さらに他の実施形態において、本方法は、少なくとも１つのスケジューリング許可の受信に応答してパケットを送信することを含む。１つまたは複数の時分割多重化されたスケジューリング許可は、少なくとも１つのユーザ識別情報、レート指示情報、送信出力制御情報、およびＨＡＲＱ情報を含む。

【００１６】

本発明は、添付の図面を参照して、非限定の実施形態の以下の記載を読むことからより理解されるであろう。

例示的な適用の図面は、同一の縮尺ではなく、単に概略的な例示であり、したがって、本明細書の開示の例を通して当業者によって決定されることができる本発明の特定の寸法を描写することを意図するものではない。

【発明の効果】

【００１７】

本発明により、リバース・リンク・パケット・アクセス送信に関するなど、無線通信システムにおける制御情報を送信する方法が提供される。

【発明を実施するための最良の形態】

【００１８】

図１２を参照すると、例示的な無線通信システム１００のブロック図が示される。システム１００は、基地局１１５と通信する１つまたは複数の無線ユニット（例えば、固定または移動電話）１０５を含むことができる。無線ユニット１０５は、パケット・データを、インターネット１２０、または例えば閉じられた企業ネットワーク（例えばイントラネット）などのいくつかの他のパケット・データ・ネットワーク１２５と交換するために、基地局１１５を介して通信することができる。パケット・データの例は、ウェブ・ページへのアクセスおよび電子メールの検索などの適用のために使用されるインターネット・プロトコル（Ｉｎｔｅｒｎｅｔ　Ｐｒｏｔｏｃｏｌ、ＩＰ）データグラムを含むことができる。そのようなパケット・データ適用は、無線ユニット１０５で実行することができる。代わりに、これらのパケット・データ適用は、無線モデムなどの無線ユニット１０５を使用する別個のコンピュータ・デバイスで実行することができる。例示的な実施形態において、無線ユニット１０５は、例えばフォワードおよびリバース・チャネルのセットであることができるエア・インタフェースで、無線ネットワーク１１５と通信することができる。これは、フォワード・リンク１０７およびリバース・リンク１１０として示されることができる。

【００１９】

基地局１１５は、単一の基地局および基地局コントローラからなることができ、または、複数の別個に配置された無線基地局（例えば、アクセス・ネットワーク）および集合基地局１１５としてともに接続された基地局コントローラを含むことができる。各基地局は

、データの無線ユニット１０５との交換に使用する所定数のトラフィック・チャネルを有することができる。１つのトラフィック・チャネルが，無線ユニット１０５に割り当てられると、その無線ユニット１０５は、アクティブ無線ユニット１０５と呼ばれることができる。少なくとも１つのトラフィック・チャネルは、次に、各アクティブ無線ユニット１０５に割り当てることができる。基地局１１５は、Ｔ１／Ｅ１、ＳＴＭ－ｘなどのバック・ホール設備、あるいは無線またはワイヤラインＴ１またはＴ３、ファイバ光接続、イーサネット（登録商標）などの任意の他の適切なタイプのネットワーク接続を使用するパケット・データ・ネットワーク１２０に接続されることができる。基地局１１５は、１つまたは複数のタイプを有するマルチ・パケット・データ・ネットワークに接続されることができる。例えば、イントラネットの代わりに、他のネットワーク１２５は、データ・サービス・インタワーキング機能（Ｉｎｔｅｒ－Ｗｏｒｋｉｎｇ　Ｆｕｎｃｔｉｏｎ、ＩＷＦ）を介して基地局１１５に接続された公共交換電話網（Ｐｕｂｌｉｃ　Ｓｗｉｔｃｈｅｄ　Ｔｅｌｅｐｈｏｎｅ　Ｎｅｔｗｏｒｋ、ＰＳＴＮ）であることができる。

【００２０】

本発明の目的のために、無線ユニットが、ユーザに音声および／またはデータ接続性を提供するデバイスとして特徴付けることができることに留意されたい。移動局は、ラップトップ，パーソナル・コンピュータ（ＰＣ）などの計算デバイスに接続されることができ、または，移動局は、携帯情報端末（Ｐｅｒｓｏｎａｌ　Ｄｉｇｉｔａｌ　Ａｓｓｉｓｔａｎｔ、ＰＤＡ）などのデータ内蔵デバイス、またはセルラ・ハンドセットすなわち電話であることができる。したがって、無線ユニットは，アクセス端末、無線移動体、移動局，遠隔局、ユーザ，ユーザ機器（Ｕｓｅｒ　Ｅｑｕｉｐｍｅｎｔ，ＵＥ）、加入者装置，または無線通信ネットワークにおける無線リソースの任意の他の遠隔のユーザに等しく、およびこのように呼ばれることができる。

【００２１】

無線データ・システムの発展において、フォワード・リンク（Ｆｏｒｗａｒｄ　Ｌｉｎｋ、ＦＬ）における、例えば基地局から無線ユニットへのスケジューリング機能は、ユーザからのチャネル品質フィードバックに基づく「高速」スケジューリングを提供するために、基地局コントローラから基地局へ移されることができる。さらに、適合変調および符号化（ＡＭＣ）およびハイブリッドＡＲＱ（ＨＡＲＱ）などの新たな技術は、全体システム容量を改善するために用いられることもできる。一般に、スケジューラが、所定の時間での送信に関するユーザを選択することができ、ＡＭＣは、ユーザによって見られる現在のチャネル状況に適したトランスポート・フォーマット（例えば、変調および符号化）の選択を可能にする。チャネル品質推定におけるエラーのために、高いエラー・レートは、結果として所定のレートで実行された送信（トランスポート・フォーマット）を生じる。ＨＡＲＱは、高速再送信を使用することができ、全体において著しい損失なしに送信エラーから復元するために、新たに受信した送信のコピーを前に受信したコピーと組み合わせる。

【００２２】

さらなる３Ｇ標準の発展は、無線ユニットから基地局への高速のリバース・リンク・パケット・アクセスを含む。ＦＬで使用されるほとんどの技術は、データ・レートおよびシステム容量を改善するためにリバース・リンクで使用されることもできる。これらの技術は、例えば、高速スケジューリング、ＡＭＣ、およびＨＡＲＱを含む。

【００２３】

リバース・リンク上のパケット・スケジューリングをサポートするために、無線ユニット識別に関する情報および他の制御情報を含むスケジューリング許可は、ＦＬ上に送られる必要がある。ＣＤＭＡ２０００において、フォワード・アップリンク・スケジューリング・チャネル（Ｆｏｒｗａｒｄ－Ｕｐｌｉｎｋ　Ｓｃｈｅｄｕｌｉｎｇ　Ｃｈａｎｎｅｌ、Ｆ－ＵＳＣＨ）と呼ばれる符合多重化制御チャネルは，Ｒ－ＳＣＨ（Ｒｅｖｅｒｓｅ　Ｓｕｐｐｌｅｍｅｎｔａｌ　Ｃｈａｎｎｅｌ）フレームで送信するようにスケジューリングされた無線ユニットに関して、ＦＬ上でスケジューリング許可を搬送することができる

。ＦＬスケジューリング許可チャネルは、ＦＬデータ送信に使用される符号に直交するＷａｌｓｈ符号で送信される。

【００２４】

図１を参照すると、フォワード・アップリンク・スケジューリング・チャネルおよびＲ－ＳＣＨフレーム送信タイミングが示される。ここで、無線ユニットは、ＲＬ上でＲ－ＳＣＨフレームにおけるパケットを送信する。パケットの送信は、ＦＬ上のスケジューリング許可メッセージに応答して実行される。

【００２５】

１ｘＥＶ－ＤＯとしても知られる、ＣＤＭＡ２０００ハイ・レート・パケット・データ（Ｈｉｇｈ Ｒａｔｅ Ｐａｃｋｅｔ Ｄａｔａ、ＨＲＰＤ）において、ＦＬは、時分割多重化構造を使用することができる。例えば、データおよび制御情報の両方は、同一のＷａｌｓｈ符号のセットを使用することができ、データおよび物理層制御情報の送信は、時間において直交して行われることができる。図２を参照すると、ＣＤＭＡ２０００ＨＲＰＤに関する例示的な構造が示される。示されるようにＨＲＰＤフォワード・チャネルは、以下の時分割多重化チャネルからなることができる。すなわち、パイロット・チャネル、フォワード媒体アクセス制御（ＭＡＣ）チャネル、およびフォワード・トラフィック・チャネルまたは制御チャネルである。トラフィック・チャネルは、ユーザ・データ・チャネルを搬送する。制御チャネルは，制御メッセージを搬送することができる。さらに、トラフィック・チャネルは、ユーザ・トラフィックを搬送することもできる。各チャネルは、さらに、符号分割多重化された直交位相Ｗａｌｓｈチャネルに分解されることもできる。

【００２６】

示されるように、フォワード・リンクは、長さ２０４８チップのスロット（１．６６．．．ｍｓ）からなることもできる。各スロット内で、パイロット、ＭＡＣ、およびトラフィックまたは制御チャネルは，時分割多重化される。全ての時分割多重化されたチャネルは、セクタの最大出力で送信されることができる。パイロット・チャネルは，Ｗａｌｓｈカバー０とともにＩチャネル上で送信される全て０の符号からなることができる。各スロットは、２つのハーフ・スロットに分割されることができ、各ハーフ・スロットは、パイロット・バーストを含むことができる。各パイロット・バーストは，９６チップの期間を有することができ，かつハーフ・スロットの中間点に中心合わせされることができる。

【００２７】

さらに、ＭＡＣチャネルは、３つのサブチャネルからなることができる。３つのサブチャネルは，リバース・パワー制御（Ｒｅｖｅｒｓｅ Ｐｏｗｅｒ Ｃｏｎｔｒｏｌ、ＲＰＣ）チャネル、リバース・アクティビティ（Ｒｅｖｅｒｓｅ Ａｃｔｉｖｉｔｙ、ＲＡ）チャネル、およびＤＲＣＬｏｃｋチャネルを含むことができる。ＲＡチャネルは、リバース・リンク・アクティビティ・ビット（Ｒｅｖｅｒｓｅ Ｌｉｎｋ Ａｃｔｉｖｉｔｙ Ｂｉｔ、ＲＡＢ）ストリームを送信する。

【００２８】

フォワードＭＡＣチャネルは、搬送波の特定の位相を直交して覆いかつＢＰＳＫ変調されたＷａｌｓｈチャネル（例えば、同位相または直交位相）を含むことができる。各Ｗａｌｓｈチャネルは、０と６３との間であるＭＡＣＩｎｄｅｘ値によって識別され、唯一の６４－ａｒｙのＷａｌｓｈカバーおよび唯一の変調位相を定義することができる。ＭＡＣＩｎｄｅｘ値に割り当てられたＷａｌｓｈ関数は，以下のようであることができる。

【数１】

$$W_{i/2}^{64} \text{ for } i = 0, 2, \ldots, 62$$

$$W_{(i-1)/2+32}^{64} \text{ for } i = 1, 3, \ldots, 63$$

ここで，ｉはＭＡＣＩｎｄｅｘ値である。偶数のＭＡＣＩｎｄｅｘ値を有するＭＡＣチャネルは、同位相（Ｉ）の変調位相に割り当てられることができ、一方、奇数のＭＡＣＩｎ

ｄｅｘ値を有するＭＡＣチャネルは、直角位相（Ｑ）の変調位相に割り当てることができる。ＭＡＣシンボルＷａｌｓｈカバーは、それぞれ６４チップ長さのバーストにスロット毎に４回送信されることができる。これらのバーストは、図２に示されるように、各スロットのパイロット・バーストの直前および直後に送信されることができる。ＭＡＣＩｎｄｅｘ値に対するＭＡＣチャネルの使用は、図３の例示的な表に示されるように行われることができる。

【００２９】

開放接続を有する各アクセス端末に関するＲＰＣチャネルは、利用可能なＭＡＣチャネルの１つに割り当てられる。それは、そのアクセス端末宛のＲＰＣビット・ストリームの送信に使用されることができる。ＲＰＣデータ・レートは６００ｂｐｓであることができる。各ＲＰＣシンボルは、それぞれ６４チップの２つのバーストのスロット毎に４回送信されることができる。２つのバーストは、スロットにおけるパイロット・バーストの直前および直後に送信されることができる。ＲＡチャネルは、ＭＡＣＩｎｄｅｘ４を有するＭＡＣチャネル上で、リバース・アクティビティ・ビット（ＲＡＢ）ストリームを送信することができる。

【００３０】

上述のように、いくつかの場合において、符号分割多重化されたスケジューリング許可チャネルは、ＣＤＭＡ２０００ＨＲＰＤで使用できないことがある。これは、ＦＬが、時分割多重化されたスロット構造を用いることがあるとの実現に帰することができる。したがって、少なくとも１つのスケジューリング許可、および／またはリバース・リンク・パケット送信に関する送信出力制御（ＴＰＣ）情報を含む制御情報を送信する方法が必要である。リバース・リンク・パケット送信に関する制御情報を送信するそのような方法は、例えば、ＲＬパケット送信に関するスケジューリング許可を搬送するフォワード・リンク・スロットにおけるＭＡＣフィールドの使用を含む、以下に詳細に記載する様々な異なる構成を組み込むことができる。

【００３１】

ＭＡＣＩｎｄｅｘを使用して搬送されるフォワード・リンク・スケジューリング許可

一実施形態において、開放接続を有する各アクティブ移動体は、特定の移動体が、ＲＬパケット送信に関してスケジュールされたか否かを示すために、ＡＴ　ＩＤとして使用される唯一のＭＡＣＩｎｄｅｘを割り当てることができる。ＡＴ　ＩＤは、パイロット・バーストの直前の２つの６４チップＭＡＣバーストで搬送されることができる。レート指示（ＲＩ）およびＨＡＲＱ制御情報（例えば５６個の組み合わせ）は、同様に、図４に示されるように、パイロット・バーストの直後の２つの６４チップＭＡＣバーストで搬送されることができる。

【００３２】

ＭＡＣＩｎｄｅｘは、６４チップ長さのＷａｌｓｈ符号バーストで送信されることができるので、制御情報の６ビット（例えばｌｏｇ。６４）は、６４チップ長さのＭＡＣＩｎｄｅｘで搬送されることができる。現在使用されていないＭＡＣＩｎｄｅｘと、また現在ＴＰＣビットに関して使用されているＭＡＣＩｎｄｅｘとが存在することは、スケジューリング許可を移動局へ搬送するために用いることができる。ＭＡＣＩｎｄｅｘの送信をより確実にするために、送信は、複数のスロット上で行われることができる。例えば、それぞれ６４チップ長さのバーストのスロット毎に４回である。

【００３３】

ＭＡＣＩｎｄｅｘ送信専用のＴＰＣビットおよびスケジューリング許可の両方を同時にサポートするために、直角位相Ｗａｌｓｈカバーが必要であることがある。しかしながら、ＴＰＣビットを時分割多重することも可能であり、スケジューリング許可ＭａｃＩｎｄｅｘまたはＭＡＣＩｎｄｅｘは、例えば、図５に示されるように、いくつかのスロットにおいてＴＰＣビットを搬送して、スケジューリング許可は、１つまたは複数の残りのスロットで搬送されることができる。これは、出力制御周波数の減少を犠牲にして達成されることができると考えられるが、より多くの数のアクティブな無線ユニットを同時にサポー

トする利点を提供することができる。ＦＬ上で搬送されるレート指示およびＨＡＲＱ制御情報の例は，図６のフィールドおよびビットを示す共通ＭＡＣＩｎｄｅｘフォーマット表に示される。制御情報の６ビットは、６４チップ長さのＷａｌｓｈ符号を使用して送ることができる。

【００３４】

スケジューリング許可を含むスロットのさらなる実施形態が、図７に示される。ＡＴ　ＩＤは、第１のハーフ・スロットにおけるパースト・パイロットの直前および直後の６４チップのパーストで送信されることができる。ＲＩおよびＨＡＲＱ制御は、第２のハーフ・スロットにおけるパースト・パイロットの直前および直後の６４チップのパーストで送信されることができる。この構造は、スケジュールされたＡＴだけが、スケジュールされていない（例えば、第１のハーフ・スロットでＡＴ　ＩＤの復号の後で知ることができる）アクティブ端末（例えばＡＴ）に関してバッテリ寿命を節約する可能性がある、ＲＩおよびＨＡＲＱ制御情報を含む第２のハーフ・スロットを復号しなければならないことがある。

【００３５】

ＴＤＭ制御チャネルを使用するスケジューリング許可送信

ＴＤＭ制御チャネルを使用するスケジューリング許可送信技術のさらなる実施形態が、図８に示される。ここで、ＡＴ　ＩＤ、レート指示、およびＨＡＲＱ制御などの制御情報は、まず、畳み込み符号またはブロック符号を使用してともに符号化されることができる。符号化された情報は、次にインターリーブされることができる。その後、符号化されかつインターリーブされた情報は、フォワード・リンク・スロットのＭＡＣフィールドで送信されることができるサブブロックに小分割されることができる。ＭＡＣフィールドにおける全ての利用可能なＷａｌｓｈ符号またはＷａｌｓｈ符号のサブセットは、サブブロック送信に使用されることができる。制御ブロック送信は，制御情報の信頼性を改善するために、複数のスロット上で実行されることもできる。

【００３６】

データ・フィールドに差し込まれた（ｐｕｎｃｔｕｒｅｄ）スケジューリング許可情報

データ・フィールドに差し込まれたスケジューリング許可情報技術のさらなる実施形態が、図９に示される。セル内の各ユーザは，唯一のＷａｌｓｈ符号に割り当てることができる。ＡＴ　ＩＤなどの制御情報、レート指示、およびＨＡＲＱ制御は、まず、ＣＲＣ保護され、符号化され、かつインターリーブされることができる。符号化されかつインターリーブされた情報は、次に、フォワード・リンク・スロットのデータ・フィールドにおけるユーザの特定のＷａｌｓｈ符号で搬送されることができる。全てのＷａｌｓｈ符号は、データ・フィールドにおけるデータ送信に既に使用されることがあるので、制御情報は、次に、データ・フィールドに差し込まれることができる。

【００３７】

ここで、各ユーザは，自身のＷａｌｓｈ符号を使用して制御情報を復号しようとすることができる。この方法論は、図１０のフロー図に示される。ＣＲＣチェックが、これが問題ないと判定するなら、次に、ユーザは，制御チャネルにおけるレート指示およびＨＡＲＱ制御情報を使用して、リバース・リンク上でパケットを処理しかつ送信することができる。しかしながら、ＣＲＣチェックが、これが問題であると判定するなら、制御チャネルは再び復号化される。

【００３８】

スケジューリング許可情報技術のさらなる実施形態が、図１１に示される。ここで、制御チャネルが差し込まれることができる。この差込工程が、データ・フィールドおよびＭＡＣフィールドの両方で制御チャネルを搬送する。

【００３９】

特定の発明が、例示的な実施形態を参照して記載されたが、この記載は、意味を限定するものと解釈されることを意味するものではない。本発明が記載されたが，例示的な実施形態，ならびに本発明のさらなる実施形態の様々な変形形態が、本発明の精神から逸脱す

ることなく、本明細書に添付された請求項に言及されるように、本記載を参照して、当業者には明らかであることが理解される。したがって、それらの、ならびに記載された方法およびシステムの方法、システム、および部分は、無線ユニット、基地局、基地局コントローラ、および／または移動スイッチング・センタなどの異なる場所で実施されることができる。さらに、記載されたシステムを実施しかつ使用するために必要な処理回路は、本開示を享受する当業者には理解されるように、特定の集積回路、ソフトウエアで駆動される処理回路、ファームウエア、プログラム可能な論理回路、ハードウエア、ディスクリート構成部品、または上述の構成部品の構成の適用で実施されることができる。これらおよび様々な他の変形形態、構成、および方法は、本発明の精神および範囲から逸脱することなく、本明細書に示されかつ記載される例示的な適用に厳密に従うことなく、本発明になされることができることは、当業者には容易に理解される。したがって、添付の請求項は、本発明の範囲内にあるように任意のそのような変形形態または実施形態を含むことが考えられる。

【図面の簡単な説明】

【００４０】

【図１】例示的なフォワード・アップリンク・スケジューリング・チャネルおよびＲ－ＳＣＨフレーム送信タイミングを示す図である。

【図２】例示的なＣＤＭＡ２０００高速パケット・データ（ＨＲＰＤ）スロット構造を示す図である。

【図３】ＭＡＣＩｎｄｅｘに対する、媒体アクセス制御（ＭＡＣ）チャネル使用の例示的な表である。

【図４】例示的なフォワード・リンク・スロットを示す図である。

【図５】フォワード・リンク上のＴＰＣビットおよびスケジューリング許可の例示的な時分割多重化構造を示す図である。

【図６】共通ＭＡＣＩｎｄｅｘフォーマットを示す例示的な表である。

【図７】スケジューリング許可を含む例示的なフォワード・リンク・スロットを示す図である。

【図８】スケジューリング許可を含む他の例示的なフォワード・リンク・スロットを示す図である。

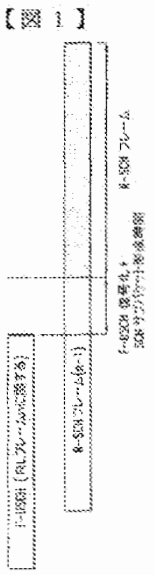
【図９】スケジューリング許可を含むさらに他の例示的なフォワード・リンク・スロットを示す図である。

【図１０】スケジューリング許可の受信および処理を示すフロー・チャートを示す図である。

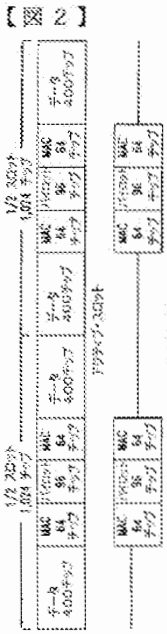
【図１１】スケジューリング許可を含むさらに他の例示的なフォワード・リンク・スロットを示す図である。

【図１２】例示的な無線通信システムのブロック図を示す図である。

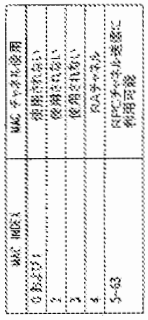
【図１】



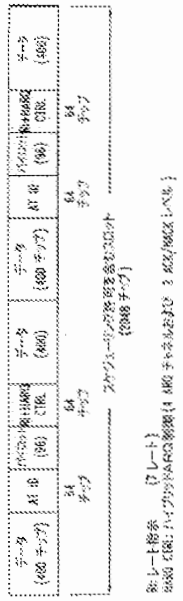
【図２】



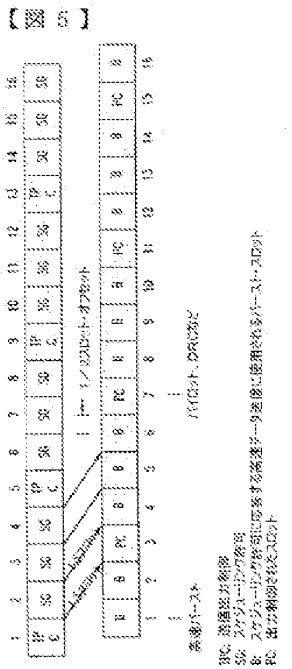
【図３】



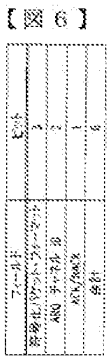
【図４】



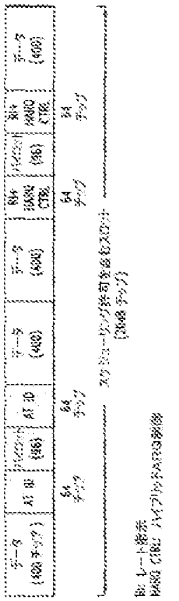
【図５】



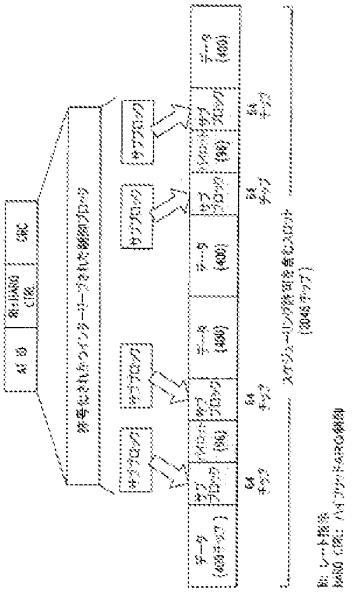
【図６】



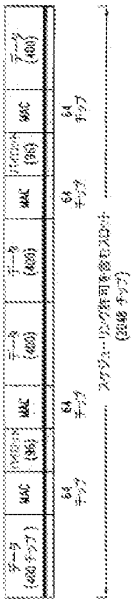
【図７】



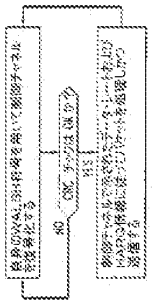
【図８】



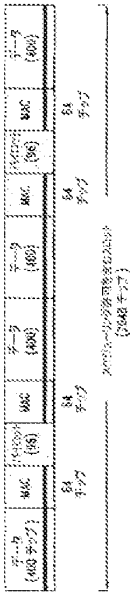
【図９】



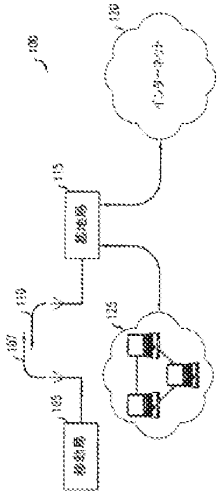
【図１０】



【図１１】



【図１２】



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Ｆターム(参考) 5K022 EE02 EE14 EE21 EE31
5K067 BB21 CC04 CC10 EE02 EE10 GG08 HH28

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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	14/713,719	Filing Date	2015-05-15	Docket Number (if applicable)	IPW2-USCN207446	Art Unit	2647
First Named Inventor	Nicholas W. Anderson			Examiner Name	Dominic E. Rego		

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, to any international application that does not comply with the requirements of 35 U.S.C. 371, 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

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Signature of Registered U.S. Patent Practitioner			
Signature	/Harry Vartanian/	Date (YYYY-MM-DD)	2016-03-17
Name	Harry Vartanian	Registration Number	56787

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.

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

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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.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14713719
	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5257283	A	1993-10-26	Gilhousen et al.	

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	1	1159720	CN	A	1997-09-17	Qualcomm, Inc.	*Abstract Translation provided	
	2	91/07037	WO	A1	1991-05-16	Qualcomm, Inc.	*English Equivalent of CN 1159720	

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	Application Number	14713719
	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry Vartanian/	Date (YYYY-MM-DD)	2016-03-17
Name/Print	Harry Vartanian	Registration Number	56787

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ABSTRACT WO9107037

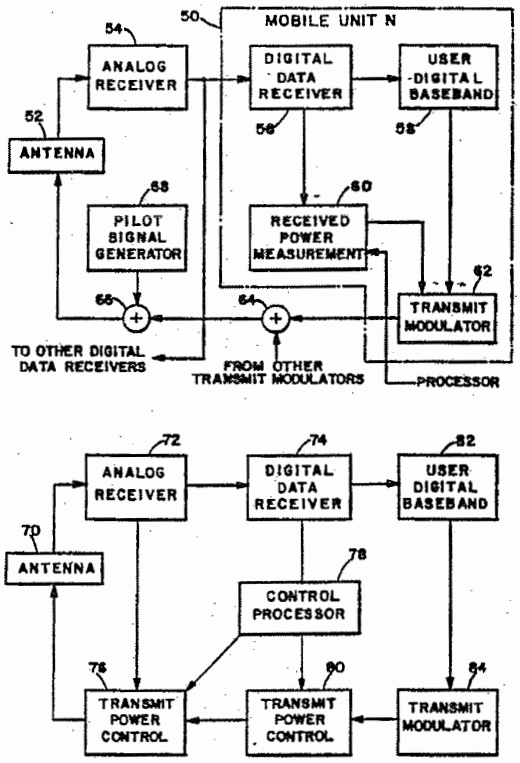
the power control system for a cellular mobile telephone system in which users communicate information signals between one another via at least one cell location and by means of spread spectrum communication signals and multiple access Unlike code. The control system of the power control the power of the transmission signals for each cellular mobile telephone in the cellular mobile telephone system wherein each cellular mobile telephone has an antenna (70), an emitter (84) and a receiver (72, 74), and each cell site also has an antenna (52), an emitter (62) and a receiver (54, 56). The power of the signal transmitted by the cell site is measured as received by the mobile unit. ; The power transmitted by the mobile unit is regulated by regulatory subunits of the power transmission (76, 80) inversely in relation to increases and decreases in received signal power.

Système de commande de la puissance pour un système téléphonique mobile cellulaire dans lequel les utilisateurs communiquent des signaux d'information entre eux par l'intermédiaire d'au moins un emplacement cellulaire et au moyen de signaux de communication à spectre dispersé et à accès multiple par différence de code. Le système de commande de la puissance commande la puissance des signaux de transmission pour chaque téléphone mobile cellulaire dans le système à téléphones mobiles cellulaires dans lequel chaque téléphone mobile cellulaire possède une antenne (70), un émetteur (84) et un récepteur (72, 74), et chaque emplacement cellulaire possède également une antenne (52), un émetteur (62) et un récepteur (54, 56). La puissance du signal transmis par l'emplacement cellulaire est mesurée telle qu'elle est reçue par l'unité mobile. ; La puissance transmise par l'unité mobile est réglée par des unités régulatrices de la puissance de transmission (76, 80) de manière inverse par rapport aux augmentations et aux diminutions de la puissance du signal reçu.

a feedback system can also be used controlling the power. In cell location communicating with the mobile unit, the power transmitted by the latter is measured by the unit measuring the received

power (60). A control signal is created and transmitted to the mobile unit for further adjusting the transmission power of the mobile unit to correspond to the excursions of the signal power received by the cell site. ; The feedback system is used to further adjust the transmitter power of the mobile unit so that the signals transmitted by the mobile unit reaches the cell location with a desired power level.

On peut également utiliser un système à réaction commandant la puissance. Dans l'emplacement cellulaire communiquant avec l'unité mobile, la puissance transmise par cette dernière est mesurée par l'unité de mesure de la puissance reçue (60). Un signal de commande y est créé et transmis à l'unité mobile pour un réglage supplémentaire par la puissance de transmission de l'unité mobile afin qu'il corresponde aux excursions de la puissance du signal reçu par l'emplacement cellulaire. ; Le système à réaction sert au réglage supplémentaire de la puissance de l'émetteur de l'unité mobile afin que les signaux transmis par l'unité mobile atteignent l'emplacement cellulaire avec un niveau de puissance souhaité.


MOBILE UNIT N
50
54
ANALOG RECEIVER
DIGITAL DATA RECEIVER
USER DIGITAL BASEBAND
52
ANTENNA
56
58
68
PILOT SIGNAL GENERATOR
60
RECEIVED POWER MEASUREMENT
62
TRANSMIT MODULATOR
66
64
TO OTHER DIGITAL DATA RECEIVERS
FROM OTHER TRANSMIT MODULATORS
PROCESSOR
72
ANALOG RECEIVER
74
DIGITAL DATA RECEIVER
82
USER DIGITAL BASEBAND
70
ANTENNA
78
CONTROL PROCESSOR
76
80
84
TRANSMIT POWER CONTROL
TRANSMIT POWER CONTROL
TRANSMIT MODULATOR

[19]中华人民共和国专利局

[51]Int.Cl[6]
H04Q 7/20

[12] 发明专利申请公开说明书

[21] 申请号 96120301.3

[43]公开日 1997 年 9 月 17 日

[11] 公开号 CN 1159720A

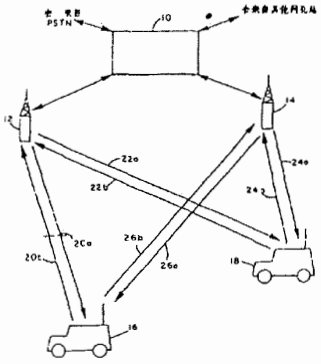
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[30]优先权
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[74]专利代理机构 上海专利商标事务所
代理人 沈昭坤

权利要求书 2 页 说明书 16 页 附图页数 5 页

[54]发明名称 在蜂窝状移动电话系统中用于控制传输功率的方法和装置

[57]摘要

蜂窝状移动电话系统中的一种功率控制系统。网孔发送的作为在移动单元接收的信号功率被测量，以相应于被接收信号功率增加和减少的相反方式，在移动单元调整发射机功率，还可以使用一个功率控制反馈方案；在网孔与移动单元通话的状态下，移动单元发送的作为在网孔接收的功率被测量，相应于网孔站接收的信号功率的偏差，在网孔站产生一个命令信号，并发送给移动单元，用于进一步调整移动单元的发射机功率。



(BJ)第 1456 号

权 利 要 求 书

1. 一种无线收发信机，它具有一个接收机(72,74)，用于接收和解调作为由一个网孔台(12,14)发送到一个特定用户的包含扩频信号(20a,22a,24a,26a)的出界信息和一个发射机(84)，用于发送一个包含扩频信号的入界(20b,22b,24b,26b)信息到所说的网孔站(12,14)，以便转送给另一个被要求的用户，所说的无线收发信机具有一个功率控制系统，对于所说的作为在所说的网孔台(12,14)接收的入界(20b,22b,24b,26b)扩频信号，用于控制发射机(84)信号功率在一个预定的电平，其特征在于，所说的功率控制系统包括：

耦合到所说的接收机(72,74)的控制处理器装置(78)，用于从所说的接收机(72,74)接收在所说的出界扩频信号(20a,22a,24a,26a)中传送的功率调整命令；相应于每个所说的功率调整命令，存储相对于一个预定的闭环功率电平值的数值；产生一个相应的闭环功率电平控制信号，所说的控制处理器(78)根据一个预定的开环功率电平值进一步用于产生一个开环功率电平信号；

有效地耦合到所说的发射机(84)的第一放大器装置(102)，用于接收所说的闭环功率电平控制信号，和以由所说的闭环功率电平控制信号决定的一个第一增益，放大入界扩频信号；

耦合到所说的接收机(72,74)的自动增益控制装置(96)，用于测量一个由所说的接收机(72,74)接收的信号的组合信号功率，并且提供一个相应的功率测量信号；

比较器装置(98)，用于接收和比较所说的功率测量信号和所说的开环功率电平信号，并且提供一个相应的比较信号；

滤波器装置(100)，用于接收所说的比较信号，非线性地限制所说的被接收的比较信号的变化率，并且提供一个相应的开环功率电平控制信号；和

有效地耦合到所说的发射机(84)的第二放大器装置(104)，用于接收所说的开环功率电平控制信号，和以由所说的开环功率电平控制信号决定的一个第二增益放大所说的入界扩频信号。

2. 如权利要求 1 的无线收发信机，其特征在于，所说的接收机具有一个模拟接收机部分(72)和一个数字接收机部分(74)，耦合到所说的模拟接收机部分(72)的自动增益控制装置(96)用于测量所有被接收的出界扩频信号的宽带信号功率。

3. 如权利要求 1 的无线收发信机，其特征在于，所说的滤波器装置(100)提供一个所说的比较信号增加的变化率，该增加的变化率大于所说的比较信号的减少变化率。

4. 如权利要求 1 的无线收发信机，其特征在于，被测量信号功率的增加相当于所说的比较信号和相应的开环功率控制电平信号的增加，所说的第二放大器装置(104)对此作出响应，从而减少所说的第二增益；并且被测量信号功率的减少相当于所说的比较信号和相应的开环功率控制电平信号的减少，所说的第二放大器装置(104)对此作出响应，从而增加所说的第二增益。

5. 如权利要求 2 的无线收发信机，其特征在于，所说的数字接收机部分(74)从所说的出界扩频信号(20a，22a，24a，26a)中提取所说的功率调整命令，并且所说的控制处理器装置(78)被耦合到所说的数字接收机部分(74)，用于接收所说的功率调整命令，以便产生所说的闭环功率电平控制信号，其中每个功率调整命令影响着一个所说的闭环功率电平控制信号的变化，所说的第一放大器装置(102)响应每一个所说的闭环功率电平控制信号的变化，以便提供一个相应的所说的第一增益的变化。

6. 如权利要求 5 的无线收发信机，其特征在于，每个所说的第一增益的变化都相当于所说发射机(84)增益的一个预定分贝值的变化。

Ex.1022 / Page 159 of 383
TESLA, INC.

说　明　书

在蜂窝状移动电话系统中
用于控制传输功率的方法和装置

本申请是申请日为90年11月7日、申请号为93119710.4、与本申请相同发明名称的发明专利申请的分案申请。

本发明涉及电话系统，特别是涉及一种新的和改进的在码分多址(CDMA)蜂窝状移动电话系统中用于控制传输功率的方法和装置。

使用码分多址(CDMA)调制技术是便于在通信中出现大量系统用户的通信技术手段之一。虽然已经知道一些其它技术，如时分多址(TDMA)、频分多址(FDMA)和幅度调制(AM)方案，如幅度压缩单边带(ACSSB)技术，但是CDMA技术大大地优于上述其它技术。在美国专利申请No.06/921261中公开了一种在多址通信系统中使用CDMA技术，该申请的申请日为1986年10月17日，题目为"使用卫星或陆地中继器的扩频多址通信系统"，现在的美国专利号No.4901307转让给本发明的受让人，该公开一并作为参考。

在刚才提到的专利中，公开了一种多址技术，这里有大量的移动电话系统用户，每一个用户有一个收发信机，它使用码分多址(CDMA)扩频通信信号，通过卫星中继器或陆地基站(也象熟知的网孔站或用作短的网孔)进行通信。在使用CDMA通信中，频谱能够重用多次，这样可以增加系统内用户容量。使用CDMA比使用其他多址技术能获得多得多的特殊效益。在CDMA系统中，用控制每个移动用户发射机的功率，可以实现增加系统容量，以便降低对其他系统用户的干扰。

在CDMA通信技术的卫星应用中，移动单元的收发信机测量经卫星中继器接收到的信号功率电平，利用该功率测量，并根据卫星转发器下行发送功率电平和移动单元接收机灵敏度的情况，移动单元收发信机能够估计移动单元和卫星之间信道的通路衰耗。然后，根据通路衰耗测量的大小、发送数据速率和卫星接收的灵敏度，移动电台收发信机确定合适的发射功率，用于移动单元和卫星之间的信号传输。

由移动单元发送到卫星的信号，由卫星转发到中心控制系统地面站。中心站测量接收的信号功率，该信号是由每个有源移动单元收发信机发送的信号。然

后，中心站确定接收的功率电平与需要维持希望通信的功率电平之间的编差。最好是所希望的功率电平是需要维持通信质量的最低功率电平，以便降低系统干扰。

然后，中心站发送一个功率控制指令信号至每个移动用户，以便调整或"微调"移动单元的发射功率。移动单元使用该指令信号来改变发射功率电平至要求维持希望通信的最低电平。因为信道条件的改变，典型地，由于移动单元的移动，根据移动单元接收机功率测量和从主站的功率控制反馈，连续地重新调整发送功率电平，以便维持合适的功率电平。从中心站来的功率控制反馈一般是很慢的，由于通过卫星需要有约 1/2 秒传播时间的往返时延。

卫星或陆地基站系统之间的一个重要差别是分离移动单元和卫星或网孔站的相对距离。卫星与陆地系统比较，它的另一个重要差别是出现在这些信道中的衰减类型。因此，在研究陆地的系统功率控制中，这些差别要求非常精细。

在卫星/移动单元信道中，如卫星信道，通常卫星中继器被安置在地理同步的地球轨道。由于所有的移动单元距卫星中继器接近相同的距离，因此，它们经历了几乎相同的传播衰耗。而且，卫星信道有这样的传播衰耗特性，它近似遵循反平方律，即传播衰耗反比于所使用的移动单元和卫星中继器之间距离的平方。因此，由于距离变化使卫星信道通路衰耗的偏差，典型地约为 1－2dB。

与卫星信道对比，陆地的/移动单元信道，即陆地信道，移动单元和网孔站之间的距离能有可观地变化。例如，一个移动单元可能放置在距网孔站 5 英里的距离，而另一个移动单元可能放置在距网孔站几英尺的距离。其距离的变化可超过一百比一。陆地信道经受的传播衰耗特性象卫星信道一样。但是，在陆地信道传播衰耗特性反比于四次方律，即通路的衰耗反比例于通路距离的四次方。因此，在一个具有半径为 5 公里的网孔中，通路衰耗变化可能达到约超过 80dB。

卫星信道典型地所经受衰减呈现瑞桑(Rician)特性。因此，接收的信号包括一个直接的分量和具有雷利(Rayleigh)衰落统计多次反射分量之和。直接分量和反射分量之间的功率比典型地约为 6－10dB，它取决于移动单元的特性和移动单元周围的环境。

卫星信道与陆地信道相对比，陆地信道经受的信号衰落，典型地，包括雷利衰落分量，无直接分量。因此，陆地信道比卫星信道呈现更严重的衰落环境，而卫星信道中瑞桑衰落是一种具有支配地位的衰落特性。

在陆地信道信号中的雷利衰落特性是由来自实际环境许多不同特征的反射而产生的。因而，一个信号从许多方向，具有不同的时延，几乎同时到达一个移动

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单元接收机。通常，把甚高频(UHF)频带用于移动无线电通信，包括那些蜂窝状移动电话系统，在不同通路上传播的信号可能会出现有效的相位差，有出现信号破坏性相加的可能性，有时出现深衰落。

陆地信道衰落是移动单元实际位置很强的函数，移动单元位置小的变化就能改变所有信号传播通路的实际时延，其位置的变化进一步对每个通路产生不同的相位。这样，通过环境，移动单元的位置能够产生很迅速的衰落过程。例如，在850MHz蜂窝无线频带中，这种衰落典型地可快至汽车速度的每小时每公里每秒一个衰落(fade)，该量级的衰落可以强烈地损害陆地信道中的信号，产生差的通信质量。然而，附加的发射机功率能够用于克服衰落问题。

陆地的蜂窝状电话系统典型地需要一个全双工信道，为了能够使双向的电话谈话同时工作，如像传统的有线电话系统一样，这种全双工无线信道通常使用一个频带，作为出界链路，也就是从网孔发射机至移动单元接收机的传输。对于入界链路使用不同的频带，也就是从移动单元发射机至网孔接收机的传输。因此，该频带分离能够使一个移动单元发射机和接收机同时工作，而没有来自发射机对接收机的反馈或干扰。

使用不同的频带具有的重要意义在于对网孔站和移动单元发射机的功率控制。使用不同的频带产生多经衰落，对入界和出界信道单独处理。移动单元不能简单测量出界信道通路衰耗，及假定入界信道呈现相同的通路衰减。

因此，本发明的目的是提供一种用于控制陆地信道发射机功率的新的和改进的方法和装置，以便克服有害的衰落，不产生无需的系统干扰，因为该干扰有害地影响整个系统容量。

在陆地CDMA蜂窝状电话系统中，总是希望控制移动单元的发射机功率，以便在网孔接收机处得到来自每个网孔和在网孔内工作的每个移动单元发射机的正常的接收信号功率。应该控制在网孔复盖区域内的所有移动单元发射机的发射功率，因此，在网孔站处接收的总信号功率应当等于网孔内大量发射的移动单元复用在一起的移动单元发射信号的正常接收机功率。该功率还要加上在该网孔处接收来自临近网孔中移动单元的杂音功率。

网孔站的CDMA接收机分别地工作，用变换来自相应于其中一个单元发射机的宽带CDMA信号成为载有信号的窄带数字信息。同时，另一个接收的CDMA信号没有被选择，保持其宽带杂音信号。网孔接收机的比特误码率性能这样来确定，即用希望信号的功率与在网孔接收机上收到的不希望的信号功率之比来确定，也就是，由所选择的移动单元发射机发射的希望信号的接收信号功

率与由另一个移动单元发射机发射的不希望信号的接收信号功率之比。带宽减小处理，相关处理，结果产生通常所称的“处理增益”，会增加信号杂音干扰比，从一个负值增到一个正值，这样在可接受的比特误码率之内就能够工作。

在陆地CDMA蜂窝状移动电话系统中，从同时的电话呼叫的数量来看，特别希望系统达到最大容量，电话呼叫是指在给定系统带宽之内可以处理的电话呼叫。如果控制每个移动单元发射机的功率，使得发送信号以最小的信号杂音干扰比（该比值能允许可接受的数据恢复）到达网孔接收机，则系统容量可为最大。如果由移动单元发送的信号以太低的功率电平到达网孔接收机，则比特误码率太高，而不允许高质量的通信。另一方面，如果移动单元发射的信号以太高的功率电平被网孔接收机接收，而与该特定的移动单元通信将是可接受的。但是，该高功率信号干扰其他移动单元发射的信号，而这些信号共用相同的信道，即带宽。这些干扰反过来可能影响同其他移动单元的通信，除非减少通信移动单元的总数量。

在蜂窝状移动电话信道UHF频带内，信号的通路衰耗可用两个独立的现象，平均通路衰耗和衰落来表征。平均通路衰耗可用对数正态分布统计地来描述，它的平均值正比于通路距离四次平方的倒数，而且，它的标准偏差近似等于8dB。第二个现象是衰落过程，是由信号的多经传播产生的，它用雷利分布来表征。平均通路衰耗是一个对数分布，可以认为其出界和入界频带是一样的，对于传统的蜂窝状移动电话系统是这样的。但是，如上所述，对于入界和出界链路频带而言，雷利衰落是独立的现象。平均通路衰耗的对数正态分布是相对于位置慢变化的函数，相反，雷利分布为位置的函数，其变化相对地快。

在本发明中，在一个蜂窝状移动电话系统上，实现了用CDMA方法使多个用户接入。在这样的一个系统中，在一个区域内的所有网孔发送一个相同频率和码的“导频”信号。在CDMA系统中使用导频信号已熟知了。在这种特殊应用中，由移动单元使用的导频信号用于移动单元接收机的初始同步。导频信号也用于作为相位和频率和时间基准，用于解调由网孔站发射的数字话音信号。

在本发明中，每一个移动单元估计从网孔站到移动单元发送信号的通路衰耗。为了获得该信号通路衰耗估计，应该测量在移动单元收到的网孔站发送的信号功率电平。这样移动单元测量从正在与移动单元通信的那个网孔站接收的导频信号功率。移动单元还测量在移动单元处接收的所有网孔站发射信号的功率电平和。功率电平和测量如像后面进一步详细描述的那样，需要处理这样的一种情况，即移动单元可能临时地获得比较好的通路，比较远的网孔比通常优先选用

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的最近的网孔还好。

出界链路通路衰耗估计使用非线性滤波器滤波。在估计过程中非线性的目的是允许快速地响应信道的突然改善，而允许慢得多的响应信道的突然降级。移动单元响应信道的突然改善，这样突然降低移动单元发射机的发射功率。如果一个移动单元的信道突然改善，那么网孔站从该移动单元接收的信号将突然地增加功率。这种突然地增加功率将产生对共用相同带宽信道的所有信号的附加干扰。快速响应突然的改善，将降低系统的干扰。

信道突然改善的一个典型例子出现在，当运动着的一个移动单元通过由大的建筑物或其他障碍物遮蔽的区域，并且然后移出遮蔽区的时候。由于汽车移动使信道的改善能够在约几十毫秒中发生信道改善。由于移动单元驶出遮蔽区，由移动单元接收的出界链路信号将突然地增加强度。

在移动单元处出界链路通路衰耗估计是为了使移动单元调整移动单元发射机功率。这样，接收的信号越强，移动单元发射机的功率将越低。从网孔站接收的强信号表示移动单元或是靠近网孔站，或者是有至网孔站的特别好的通路。强信号的接收意味着，对于网孔移动单元正常的接收功率而言，需要相对小的移动单元发射机功率电平。

在临时的情况下，信道已经突然地降级，则希望移动单元发射机功率允许很慢地增加，这种慢慢增加移动单元发射机功率也是所希望的，以便阻止移动单元发射机功率无必要地迅速增加。因为，这种功率增加对所有其他移动单元会有干扰。因此，为了避免所有移动单元信道的降级，一个移动单元信道临时降级是能容忍的。

在信道突然降级的情况下，非线性滤波器避免移动的发射机功率以高速率的增加，去响应移动单元接收信号的信号功率的突然降低。移动单元发射机发射功率增加的速率，一般必须限制至从网孔站发送闭环功率调整指令的速率，(如下所述)能够降低移动单元发射机发射的功率的速率。利用产生功率调整指令的网孔站，将避免增加的电平大大地高于通信所需要的电平，特别是，仅在出界链路通路而不在入界链路通路中出现突然地信道降级时。

应当注意到，不希望简单地使用慢速响应移动单元发射机功率的控制，试图从由于距离和地形产生的慢速衰落中分离出快的雷利衰落。在移动单元发射机的功率控制中的慢速响应是不希望的，因为，突然改善和衰减的可能性同等地影响入界和出界信道。如果响应突然改善，使用滤波器，它将慢慢地下降，然后，当移动单元发射机功率出现极度变化并对其他移动用户产生干扰时，将会频繁出

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现上述情况。因此，本发明在估计通路衰耗中使用了两个时间常数和非线性法。

除了测量移动单元的接收的信号强度之外，为了用于移动单元的处理器，还希望知道网孔站发射机的功率和天线增益(EIRP)，网孔站的G/T(接收天线增益G被接收机杂音电平T除)，移动单元天线增益和与该网孔站有效的呼叫数目。该信息允许移动单元处理器适当地计算对于本地功率设定函数的参考功率电平。这种计算是用计算网孔站至移动链路功率预算来完成的，并求解出通路衰耗。然后，该通路衰耗估计用于移动的网孔链路预算方程，求解出为产生希望的信号电平而需要的移动单元发射的功率。这种能力允许系统具有相应于网孔大小的不同EIRP电平的网孔站。例如，一个小半径网孔不需要发射像一个大半径网孔那样高的功率电平。但是，当移动单元距一个低功率网孔为一定的距离时，它将接收一个比来自高功率网孔更弱的信号。该移动单元对短距离的必要性来说更能响应较高的发射功率。因此，具有每个网孔发送信息的需要性，正是其功率控制的特性。

网孔站发送的信息有，网孔站的EIRP，G/T和在一个网孔建立信道的有效呼叫数。当首先获得系统同步时，移动单元接收该信息，当来自公共电话交换网的呼叫打算用移动单元寻呼而空闲时，继续监视该信道。移动单元天线增益存储在移动单元的存储器中，这时该移动单元安装在汽车里。

如上所述，移动单元发射机的功率还受来自网孔站信号的控制。每一个网孔站接收机测量在网孔站接收到的来自与该网孔通信的每一个移动单元的信号强度。测得的信号强度同作为特殊移动单元所希望的信号强度相比较。产生一个功率调整指令，以出界链路数据或话音信道发送至移动单元，寻址至相应的移动单元。响应于网孔站功率调整指令，移动单元以预定量，通常1dB，增加或减少移动单元发射机的功率。

网孔发射机以相对高的速率，典型地为每毫秒约1个指令，发送功率调整指令。功率调整指令的传输速率必须是高的，足以允许跟踪入界链路通路的雷利衰落。进一步地希望出界链路通路雷利衰落加在被跟踪的入界链路通路信号上。每毫秒1个指令，对于850MHz频带的移动通信，每小时25—50英里范围的车速，跟踪衰落过程是合适的。重要的是，确定功率调整指令的等待时间和使其传输减至最小，以便在移动单元接收和响应信号之前，信道条件将没有多大变化。

总之，由于两个雷利衰落(入界和出界)通路的独立性，移动单元发射机功率受来自网孔站功率调整指令的控制。每一网孔接受机测量从每个移动单元接收的信号强度。测得的信号强度同作为特定移动单元的希望的信号强度相比较，并

且产生一个功率调整信号。该功率调整信号以出界数据或话音信道，发送至移动单元，并寻址至上述移动单元。该功率调整指令与移动单元向估计值组合，得到移动单元发射机功率的最后值。

以一个实施例为例，用每毫秒重写一个或多个用户数据比特的方法，发送功率调整指令信号。在CDMA系统中利用的调制系统能够为用户数据比特提供校正编码。用功率调整指令重写，作为信道比特误码或消除来处理，并且用误码校正来校正，如象移动单元接收机中的解码。对功率调整指令比特进行误码校正编码，在许多情况下，不可能是所希望的，因为在接收中产生了增加等待时间并响应于功率调整指令。也可以想象到，不对用户数据信道符号重写，而使用时分复用来传输功率调整指令比特。

网孔控制器或处理器可用于确定所希望的信号强度，该信号为由每个移动单元发射，在网孔站接收的信号。所希望的信号强度电平值供给每一个网孔接收机。该希望的信号强度值用于同测得的信号强度值相比较，用于产生功率调整指令。

利用一个系统控制器来指挥每个网孔处理器，达到所使用的希望的信号强度值。正常的功率电平可以上下调整，以适应网孔平均条件的变化。例如，放置在异常的杂音位置或地理区域的网孔可能能够使用比正常入界功率电平较高的电平。但是，这种在网孔内工作的较高的功率电平，将产生较高的干扰电平，对该网孔最临近的网孔干扰。这种干扰可用允许临近网孔小的增加入界链路功率的办法来补偿。这样，在临近网孔中增加的入界功率将小于由于移动用户在高杂音环境网孔通信所增加的功率。进一步明白，网孔处理器可以监视平均比特误码率。系统控制器可使用该数据，来指挥网孔处理器建立一个合适的入界链路功率电平保证可接受的优质通信。

还希望提供一种装置，用于控制由网孔发射的每个数据信号中使用的相对功率，响应由每个移动单元发送的控制信息。提供这种控制的主要原因是适应这样的现实，即在一定的位置，从网孔至移动单元出界信道链路可能是特别有缺陷的。如果不增加发送到该移动单元的功率，通信质量可能变为不可接受的。这种位置的一个例子是这样的一个地点，即到一个或两个邻近的网孔的通路衰耗是近似相同于与移动单元通信的网孔的通路衰耗。在这样的一个位置，总的干扰由移动单元在相对接近其网孔的位置产生的干扰增加三倍。此外，来自这些邻近网孔的干扰将不衰落，与所希望的信号相一致，如像来自希望的网孔的干扰的情况一样。这种情况可能需要3—4dB的附加信号功率，以便获得合适的性能。

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另一种情况，移动单元可能是放置在一些强的多通路信号到达的地方，产生比正常干扰更大的干扰。在这种情况下，相对于干扰增加希望信号的功率，可以允许可接受的性能。平时，移动单元可放置在信号/干扰比异常好的地方。在这种情况下，网孔站可使用比正常发射机功率低的功率发射希望的信号，以便降低对由系统发射的其他信号的干扰。

为了达到上述目的，最佳的实施例包括在移动单元接收机具有信号/干扰测量能力。这种测量通过把希望的信号功率同总的干扰和杂音功率进行比较来实现。如果测量的比值低于预定值，移动单元发送一个请求至网孔站，请求网孔站发送附加的功率。如果测量的比值超过了预定值，移动单元发送一个请求用于降低发射功率。

网孔站从每个移动单元接收功率调整请求信号，并且用调整功率来响应，即用预定的量值分配给相应的网孔发射信号。其调整量通常是小的，约 0.5dB，或 12%。功率变化速率可能稍微低于从移动单元至网孔入界链路上使用的值。大概每声码器帧一次，或通常每 15 毫秒一次。调整量的动态范围也限制在低于正常值 4dB 至高于正常值 6dB。

网通站还必须考虑所有移动单元产生的功率需求，以决定是否响应任何特殊移动单元的请求。例如，如果网孔站承载的容量对附加功率的请求可以答应，但仅 6%或更低，而不是 12%。在这种情况下，功率降低的请求仍应答应在正常的 12%变化。

通过下面连同附图及整个相应的参考符号详细的描述，本发明的特征和优点将变得更为明显，其中：

图 1 是一个举例性移动蜂窝状电话系统概况示意图；

图 2A－2D 表示一组曲线图，表示移动单元接收的信号强度和发射的功率为距离的函数；

图 3 是一个特别涉及具有本发明的功率控制特征的网孔站的方框图；

图 4 是一个特别涉及具有本发明的功率控制特征的移动单元的方框图；

图 5 是一个进一步详细说明图 4 的移动单元功率控制特征的方框图；和

图 6 是一个进一步详细说明图 3 的网孔站功率控制特征的方框图。

图 1 说明了一种包含有本发明的举例性蜂窝状移动电话系统。图 1 所说明的系统，该系统利用了在系统移动用户和网孔之间通信的 CDMA 调制技术。大城市的蜂窝状系统可能有几千个网孔站，为几十万个移动电话服务。使用 CDMA 技术，在同样大小的一个系统中，与现行的 FM 调制蜂窝状系统相对比，确

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实便于增加用户容量。

在图 1 中，系统控制器和开关 10，典型地包括合适的接口和用于向网孔站提供系统控制信息的处理硬件。控制器 10 控制从公共交换电话网(PSTN)至合适的网孔站的电话呼叫路由，用于传输到合适的移动单元。控制器 10 还控制从移动单元来经过一个网孔站到 PSTN 的呼叫路由。控制器 10 可以经过合适的网孔站指挥移动用户之间的呼叫，因为这种移动单元典型地不能直接地与另一个移动单元通信。

控制器 10 可经各种装置，如象专用电话线，光纤链路或无线频率通信，连接至网孔站。在图 1 中，说明了两个举例性的网孔站 12 和 14，以及两个举例性的移动单元 16 和 18，这些移动单元含有蜂窝状电话。箭头 20a－20b 和 22a－22b 分别规定为网孔站 12 和移动单元 16 和 18 之间可能的通信链路。类似地，箭头 24a－24b 和箭头 26a－26b 分别规定为网孔站 14 和移动单元 18 和 16 之间可能的通信链路。网孔站 12 和 14 通常用等功率发射。

移动单元 16 测量在通路 20a 和 26a 上由网孔站 12 和 14 发射的导频信号的总接收功率。同样，移动单元 18 测量在通路 22a 和 24a 上由网孔站 12 和 14 发射的导频信号的总接收功率。移动单元 16 和 18 的每一个移动单元，在接收机中测量导频信号的功率，这里的信号为宽带信号。因此，该功率的测量是在具有伪噪声扩频信号的接收信号校正之前进行的。

当移动单元 16 更靠近于网孔站 12 时，接收的信号功率将由传播通路 20a 上的信号来控制。当移动单元 16 更靠近网孔站 14 时，接收的信号功率将由传播通路 26a 上的信号来控制。类似地，当移动单元 18 更靠近于网孔站 14 时，接收的信号功率将由传播支路 24a 上的信号来控制。当移动单元 18 更靠近于网孔站 12 时，接收的信号功率将由传播通路 22a 上的信号来控制。

移动单元 16 和 18 的每一个移动单元使用合成的测量，与网孔发射机功率和移动单元天线增益消息一起，来估计至最近网孔站的通路衰耗。估计的通路衰耗，与移动天线增益和网孔站 G/T 的消息一起，用于确定正常的发射机功率，该功率是为了在网孔接收机中得到希望的载波/杂音比而需要的。移动单元和网孔参数的消息或是固定在存储器中或是用网孔信息广播信号发送出去，建立信道，来指示一个特殊网孔站的其它标称状态。

由于移动单元正常发射功率确定的结果，不存在雷利衰落，并假定正确的测量，移动单元发射的信号以精确的所希望的载波/杂音比到达最近的网孔。这样以最小量的移动单元发射功率，将获得所希望的性能。移动单元发射功率的最小

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化，在CDMA系统中是重要的，因为，每一个移动单元产生的干扰，会干扰系统中每一个其他的移动单元。在最小的移动单元发射功率的系统中，系统干扰将处于最小，这样，允许附加的移动用户来共用频带。因此，系统容量和特殊的效率为最大。

图2A说明了雷利衰落为距离的函数，及对在移动单元接收的网孔发射信号的强度影响。平均通路衰耗用曲线30表示，该衰耗主要由网孔站与移动单元之间的距离的四次方和它们之间的地形形状来决定。随着移动单元和网孔站之间距离的增加，对于固定功率发射网孔信号而言，则在移动单元处接收的信号功率减少。对于链路的两个方向来说，其平均通路衰耗是相同的，典型地，平均通路衰耗呈现对数正态分布。

除了慢变化的对数正态平均通路衰耗之外，由于多通路信号传播的存在，产生了围线平均通路衰耗迅速衰落的上升或下降。这些信号以随机的相位和幅度从这些多通路到达，结果呈雷利衰落特性。图2A所示的曲线32表示由于雷利衰落而产生的信号通路衰耗的变化。雷利衰落对网孔/移动单元通信链路的两个方向(即出界和入界)来说，典型地是独立的。例如，当出界信道是衰落的时候，在同一时间，入界信道不是必须在衰落。

图2B表示移动单元发射机的功率调整到相应于图2A的链路通路信号强度。在图2B中曲线34表示相应于图2A曲线30的平均通路衰耗所希望的平均发射功率。类似地，曲线36为响应图2A曲线32表示的雷利衰落相应的移动单元发射机功率。当雷利衰落信号，图2A的曲线32所示，信号的强度而减小时，发射功率产生迅速的增加。这种发射机功率迅速向上偏移对整个系统性能产生有害的影响。因此，本发明预想使用非线性滤波器来控制迅速向上偏移或增加，而且还控制发射机的功率，本发明还利用来自网孔的闭环功率调整反馈，来调整移动单元的发射机功率。

图2C表示没有考虑网孔闭环功率调整反馈时，相应于图2A的移动单元的发射机功率。在图2C中，希望的平均发射功率用曲线34表示，相应于图2A的曲线30的移动单元接收信号的强度。曲线38表示在本发明的功率控制中利用非线性滤波器的发射机功率。

发射机功率迅速向上偏移，如象图2C的虚线所示，并且相应于图2B的曲线36的向上偏移都大大地降低了。在曲线38中，通过设定发射机功率与固定值增加的比率，而大大地降低了向上的偏移。发射机功率相对于希望的发射功率产生的变化受动态范围和变化速率两种因素的限制。该限制允许闭环功率调整反

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馈处理以低得多的控制数据速率更容易地实现，而且更有效。曲线 38 所示的发射功率允许以比增加速率大得多的速率而降低。

随着距离的增加，从标记点 D_1—D_3 发射机功率稍微快地降低，相应于信道的迅速改善。标记点 D_2—D_3 距离之间的信道降级，相应于发射机功率增加。降级的变化不是那么有效，因为，非线性滤波器的最大速率限制了发射机功率增加的速率。

随着距离的增加，从距离标记点 D_3—D_4，信道降级比非线性滤波器将允许发射机功率的增加要快得多。在此期间，发射机功率以非线性滤波器允许的最大速率增加。在由标记 D_4—D_5 指示的距离变化期间，信道开始改善。但是，随着信道质量的改善，发射机功率继续以最大速率增加，直至发射机功率足以满足如标记 D_5 处所希望的电平。

希望消除发射机功率的向上偏移，这种偏移可能产生不少要的系统干扰。如果出现一个比较好的通路至另一个网孔站，它将在系统中产生不必要的干扰，因此用限制发射机功率增加的速率可保持通信质量。

图 2D 是一个说明网孔接收的信号功率强度相对于移动单元传输距离的曲线图，移动单元离开网孔站移动。曲线 40 表示在网孔站接收来自移动单元发射的信号所希望的平均接收的信号功率。希望平均的接收信号功率为固定电平，及最少需要保证与一个移动单元的优质通信链路。在移动单元处进行校正，校正在网孔发射信号中的雷利衰落。

移动单元发射的信号在到达网孔接收机之前经受了雷利衰落。因而，在网孔接收的信号是一个固定平均接收功率电平的信号，但是，仍具有入界信道的雷利衰落加到上面。曲线 42 代表在入界信号上出现的雷利衰落。

此外，有这样一种可能性，即在链路没有衰落，但是入界链路有严重衰落的地方，移动单元进入休息状态。这样的条件将中断通信，除非利用附加的机器补偿入界信道的雷利衰落。在网孔站利用闭环功率调整指令处理是这样的一种机器，用于调整移动单元的发射功率，以便补偿入界信道的雷利衰落。在图 2D 中，曲线 44 表示当补偿入界和出界信道的平均支路衰减和雷利衰落时，在网孔站接收的移动单元发射的信号功率。从图 2D 可以看出，除了用闭环控制使衰落过程减至最小的严重衰落之外，曲线 44 很接近于曲线 40。

在图 3 中，天线 52 用于接收多个移动单元发送的信号，然后，把该信号供给模拟接收机 54 进行放大，频率下变换和接收的 RF 信号的 IF 处理。从接收机 54 输出的模拟信号供给多个接收机模块，提取指导用户的信息信号，产生功率调整

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指令和用于传输的用户输入信息信号的调制。通信中使用的这样一个模块有一个特殊的移动单元，如移动单元N，该移动单元是模块50。这样，接收机54的输出供给包括模块50的多个这样的模块。

模块50包括数字数据接收机56，用户数字基带电路58，接收功率测量电路60和发射调制器62。数字数据接收机56接收宽带扩频信号，用于校正和去扩展，移动单元N发送的信号为窄带信号，用于转移到一个与移动单元N通信的指定的接收者。数字数据接收机56提供窄带数字信号至用户数字基带电路58。数字数据接收机56还提供窄带信号至接收功率测量电路60。

接收功率测量电路60测量从移动单元N接收的信号电平。接收功率测量电路60响应测量的功率电平产生一个功率调指命令，该指令输入到发射调制器62，用于传输到移动单元N。如上所述，功率调整指令的数据比特由移动单元N在调整移动单元的发射功率中使用。

当接收的功率测量值大于由网孔站处理器(未画出)提供的预置电平时，产生一个合适的功率调整指令。如果接收的功率测量值低于预置电平，产生功率调整指令数据比特，并指出需要增加的移动单元发射机功率。类似地，如果接收的测量值大于预置电平，产生功率调整指令，这样就降低移动单元的发射机功率。利用功率调整指令来维持网孔站正常的接收功率电平。

从数字数据接收机56来的输出信号供给用户数字基带电路58，该电路是用于经系统控制器和开关连接到指定的接收者的接口。类似地，基带电路58接收指定为移动单元N的用户信息信号，并把它供给发射调制器62。

发射调制器62扩频调制，用于传输至移动单元N的用户可寻址的信息信号。发射调制器62还从接收功率测量电路60接收功率调整指令数据比特。该功率调整指令数据比特也由发射调制器62进行扩频调制，用于传输到移动单元N。发射调制器62提供扩频调制信号至加法器64，该加法器把扩频信号与在网孔站中的其它模块发射调制器混合。

混合的扩频信号输入到加法器66，在加法器66该信号同导频信号发生器68提供的导频信号混合。然后，把这些混合信号提供给用于把IF频带变到RF频带的频率上变换的电路(未画出)并放大。然后，把RF信号提供用于传输的天线52。虽然没有示出，但发射功率控制电路可配置在加法器66和天线52之间。该电路在网孔处理器的控制下响应由移动单元发射的功率调整指令信号，该信号在网孔接收机被解调，并提供给网孔控制处理器，连接至该电路。

在图4中，移动单元，如移动单元N，包括一个天线70，用于收集网孔站发

射的信号和辐射移动单元产生的CDMA信号，移动单元N利用天线70，模拟接收机72和数字数据接收机74，接收导频信号，建立信道信号和移动单元N的寻地信号。接收机72放大并且频率下变换接收的射频CDMA信号为IF信号并对中频IF信号滤波。IF信号输出到数字数据接收机74，用于数字处理。接收机72还包括对接收信号混合功率进行模拟测量的电路。该功率测量用于产生一个反馈信号，该信号给发射功率控制电路76，用于控制发射的功率。

数字数据接收机74用于解除扩频并将相关的接收信号寻址至移动单元N。接收机74还从由网孔产生的功率调整指令中分离数字数据。该功率调整指令数据比特发送到控制处理器78。处理器78响应功率调整指令数据比特产生一个发射功率控制指令，该指令供给发射功率控制电路80。处理器78还提供一个电平设定指令给发射功率控制电路76。进一步地有关接收机72，发射功率控制电路76和80，和处理器的相互作用的详细情况，参见图5的进一步详细描述。

接收机74还提供如数字编码话音数据给用于解码的用户数字基带电路82和与用户的接口。基带电路82包括用于连接接收机74和发射调制器84至用户手机(未画出)的接口硬件。

被发射的数据通过基带电路82提供，在那编码并送给发射调制器84。该数据根据指定的扩展码由发射调制器84扩频调制。扩频信号从发射调制器84输出到发射功率控制电路80。根据由控制处理器78提供的发射功率控制指令，调整信号的功率。该功率调整信号从发射功率控制电路80供给发射功率控制电路76，该电路根据模拟测量控制信号调整该信号。虽然图中示出了两个分离的单元用于控制发射功率，但是，功率电平可用单个可变增益的放大器来调整，该放大器具有两个输入控制信号，它们在加到可变增益放大器之前被混合。但是，在图示的实施例中，以分离的元件表示两个控制功能。

在图4所示的功率控制电路的工作中，接收机72测量从所有网孔站接收的所有信号的组合功率电平。这些功率电平测量结果用于控制功率电平，它由发射功率控制电路76来设置。发射功率控制电路76包括这样的电路，在该电路中，如前面所述，用非线性滤波器限制增加发射功率的速率。所设置的增加的速率不应快于这样的速率，即发射功率控制电路80能响应自网孔站的一系列下降指令，扭转功率下降，如接收机74和处理器78处理的那样。

图5进一步更详细地表示出了参照图4所讨论的移动单元N的功率控制方法。在图5中，从天线上接收的RF信号供给频率下变换器90，该变换器把接收的RF信号变换为IF频率。IF频率信号连接到带通滤波器92，该滤波器把出

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界的频率分量从信号中除去。

滤波后的信号从滤波器92输出到可变增益IF放大器，该放大器把信号放大。放大的信号从放大器94输出到模拟/数字(A/D)变换器(未画出)，对该信号进行数字信号处理操作。放大器94的输出还连接到自动增益控制(AGC)检测器电路96。

AGC检测器电路96产生一个增益控制信号，该信号连接至放大器94的增益控制输入端。该增益控制信号用于控制放大器94的增益，以便维持固定的平均功率电平，作为从放大器94至A/D变换器的输出。

AGC检测器电路96还提供一个输出到比较器98的一个输入端。比较器98的另一个输入端由从移动单元处理器(未画出)来的电平设置信号来提供。该电平设置信号表示希望的发射机基准功率电平。用比较器98把这些输入信号比较，产生的比较信号提供给一个非线性滤波器电路100。该比较信号相应于接收的功率测量值与希望的移动单元发射机功率电平之间的偏差。

滤波器100可能配置成简单的电阻—二极管—电容电路。例如，输入端电路是一个由两个电阻共用的公共结点，每个电阻的另一端分别连接到二极管。二极管在它们同电阻的连接中反向连接，并且每个二极管的另一端连接在一起，以一个公共的结点作为滤波器的输出。一个电容连接在二极管的公共结点与地之间。设计的滤波器电路限制功率增加速率，使其低于每毫秒1dB。功率下降的速率典型地设置为比功率增加速率约快10倍，即每毫秒10dB。滤波器100的输出作为功率电平控制信号输入到可变增益IF放电器102的增益控制输入端。

AGC检测器电路96，比较器98和滤波器100估计接收的移动单元的信号功率和需用于移动单元发射机的功率校正。该校正是用于在出界信道衰落的条件下维持希望的发射机功率电平，衰落条件对入界信道是共同的。

图4的发射调制器电路84提供低功率的IF频率扩频信号至变增益IF放大器104的一个输入端，放大器104的增益由来自处理器78(图4)的功率电平控制信号来控制。该功率电平控制信号来自闭环功率调整指令信号，该指令信号由网孔站发射，并由移动单元处理，如参照图4所描述的那样。

功率调整指令信号包括被存储在移动单元处理器中的一系列增加功率和降低功率的命令。移动单元控制处理器从增加控制电平设置开始到达一个正常值。每个功率上升命令增加的增益控制命令值，相应于放大器增益大约增加1dB。每个功率下降命令减少的增益控制命令值，相应于放大器增益大约减少1dB。增益控制命令作为功率电平控制信号在加到放大器104之前通过一个数/模(D/A)

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变换器(未示出)转换成模拟的形式。

移动单元参考功率电平可以存在控制处理器的存贮器中。在可供选择的方案中,移动单元参考功率电平可以包含在发送给移动单元的信号之内,该信号命令数据被数字数据接收器分离,并且被控制处理器译成设置电平。作为从控制处理器提供的该信号,在输入到比较器 98 之前,由一个数/模(D/A)变换器(未示出)进行变换。

放大器 104 的输出作为一个输入提供给放大器 102。如前所述,放大器 102 也是一个具有按照来自滤波器 100 的功率电平控制信号确定增益的可变增益 IF 放大器。这样,用于发送的信号根据由功率电平控制信号设置的增益被放大。来自放大器 102 的被放大的信号输出进一步被放大并且频率被转换成用于发送的射频频率。然后该射频频率馈送到发送天线。

图 6 更详细地示出了如图 3 所示的网孔的功率控制原理图。在图 6 中,网孔接收由移动单元发送的信号。被接收的信号由网孔模拟接收器和相应于移动单元 N 的网孔处理。

在数字数据接收器(图 3 中的接收器 56)中,被接收的模拟信号通过 A/D 转换器 110 从模拟转换成数字形式。来自 A/D 转换器的数字信号输出被提供到伪随机噪声(PN)相关器 112,在相关器 112 中信号与 PN 发生器 114 提供的一个 PN 信号相关处理。PN 相关器 112 的输出提供给一个快速 Hadamard 变换数字滤波器 114,在该滤波器中信号被滤波。滤波器 114 的输出被提供给一个用户数据解码电路 116,该电路 116 把用户数据提供给用户数字基带电路。解码器 116 提供最大的变换滤波器符号(Symbols)给功率平均器电路 118。功率平均器电路利用公知的数字技术对超过一毫秒间隔的最大变换输出进行平均。

每个平均功率电平的指示信号是来自功率平均器 118 的输出,该指示信号提供给比较器 120。该比较器 120 还接收一个指示期望的接收功率电平的功率电平设置信号。该期望的接收功率电平由网孔的控制处理器设置。比较器 120 比较这两个输入信号,并且提供一个指示平均功率电平与期望的功率电平的偏差的输出信号。该信号被输出给增加功率/降低功率命令发生器 122。发生器 122 响应该比较结果,产生一个增加功率或降低功率的命令。功率命令发生器 122 提供该功率控制命令给网孔发送调制器,用于移动单元 N 的发射机功率的发送和控制。

如果在网孔接收的功率高于移动单元 N 期望的功率,那么就产生一个降低功率的命令并发送到移动单元 N。但是,如果在网孔接收的功率太低,那么就产

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生一个增加功率的命令并且被发送。增加/降低的命令以高速率传送，在实施例中，通常每秒 1，000 条命令。以每个命令一比特，功率命令的整理操作(overhead)同一个高质量数字话音信号的比特率相比是不重要的。

功率调整命令反馈补偿入界信道的变化，这种变化是独立于出界信道的。这种独立的入界信道变化在出界信道是测量不到的。因而，基于出界信道的通路损耗估计和相应的发送器功率调整不能反映入界信道的变化。这样，功率调整命令反馈被用于补偿基于入界信道通路损耗的移动单元发送器功率的调整，这种入界信道损耗在出界信道是不存在。

在情况大大地改变之前，对于到达移动单元的命令最好的是使用闭环控制处理。本发明在网孔中提供了一种新颖和独特的功率控制电路，用于把测量和发送的延迟和等待时间减至最小。在移动单元中的功率控制电路(模拟控制并且数字命令响应)，在蜂窝状移动电话系统中提供了一种大大改进了的功率控制处理。

上述最佳实施例的提供能使技术熟练的人制造和使用本发明。对于技术熟练的人来说，上述实施例的各种改进将是不困难的，并且它的一般原理可以被应用到其他的方案中而无需进行创造。因此，本发明不受这里所示实施例限制的，但是，本发明能被应用到更广的范围，而与这里公开的原理和新颖的特征是不矛盾的。

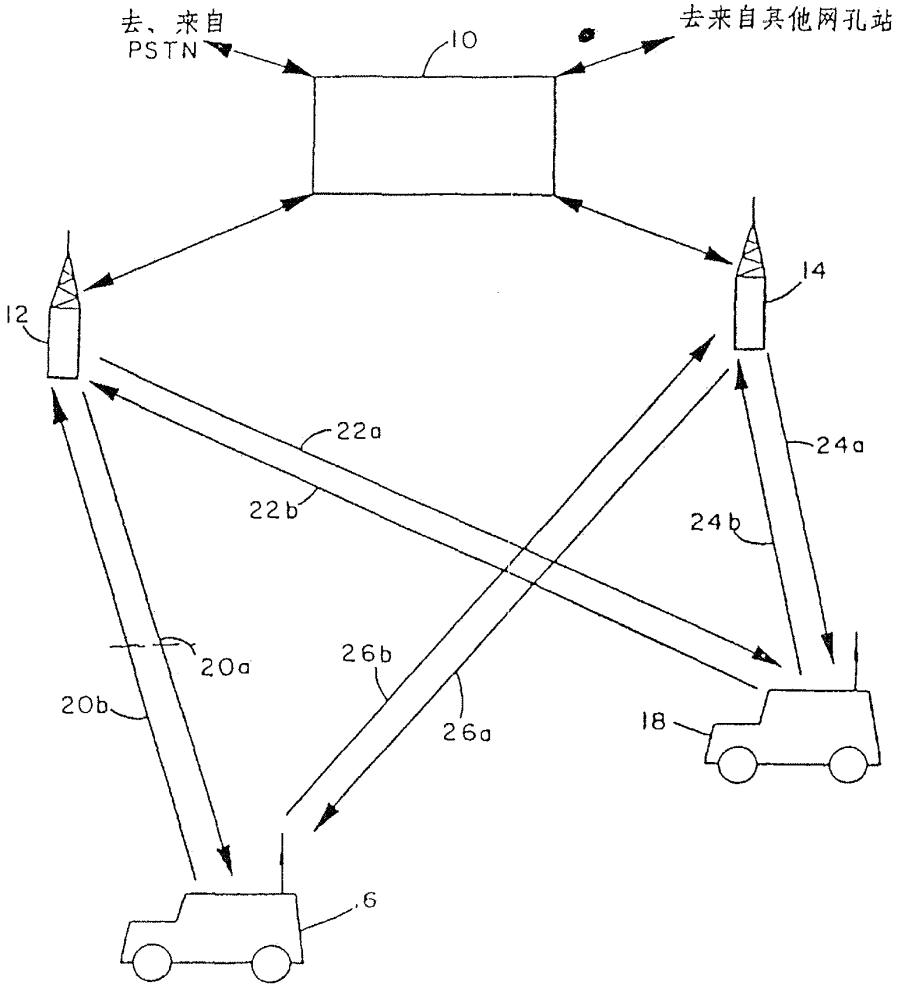


图 1

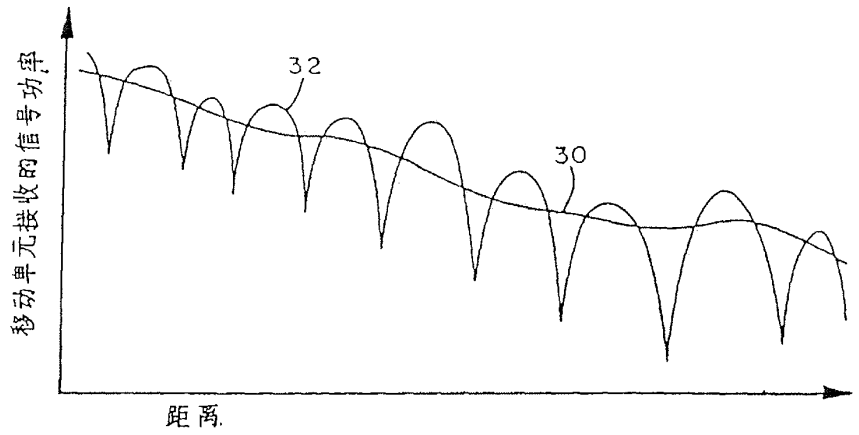


图 2A

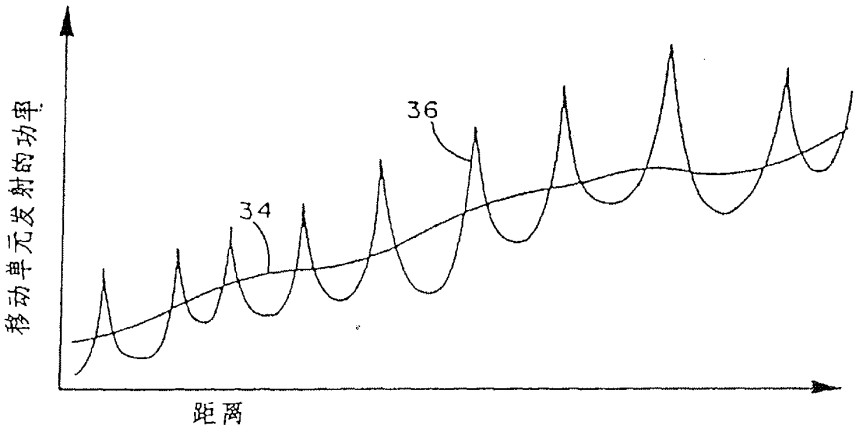


图 2B

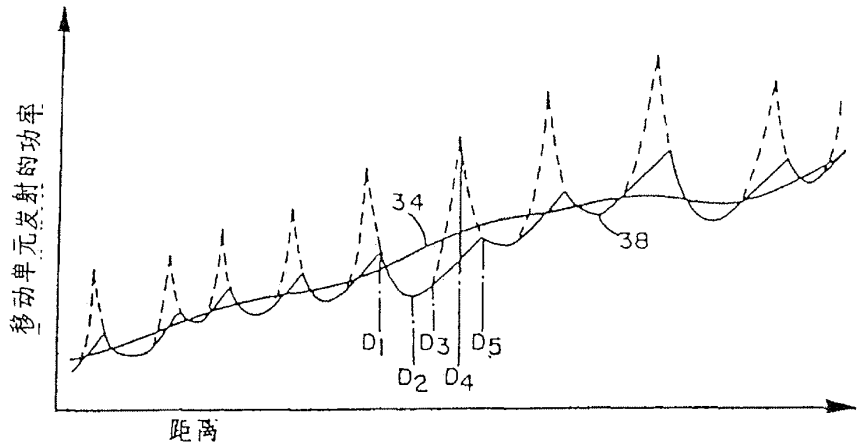


图 2C

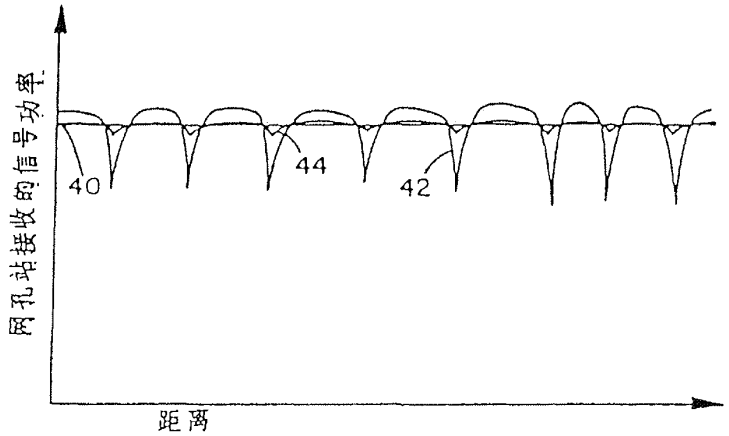


图 2D

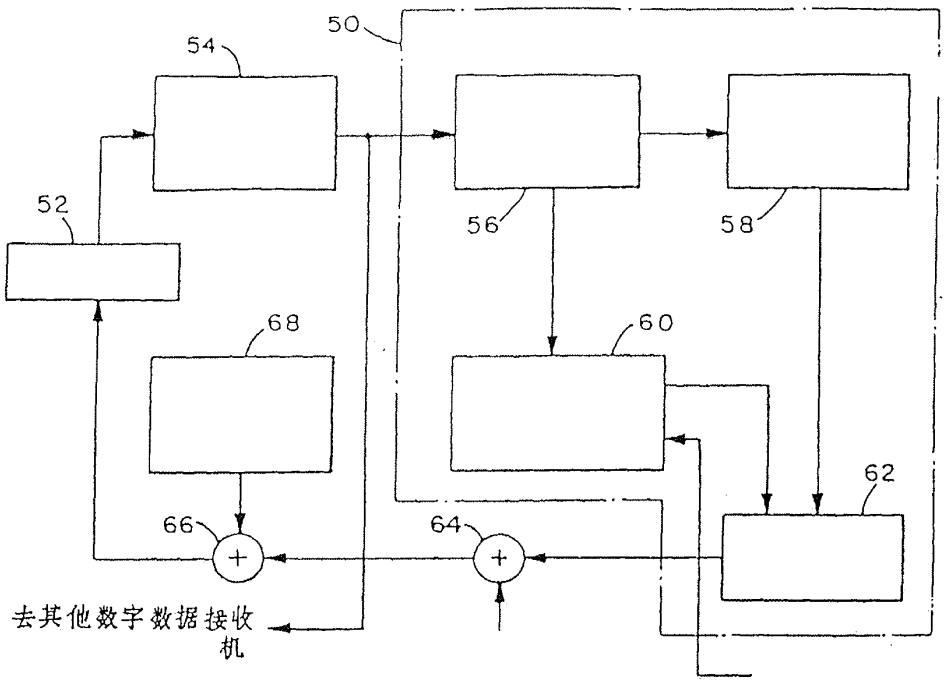


图-3

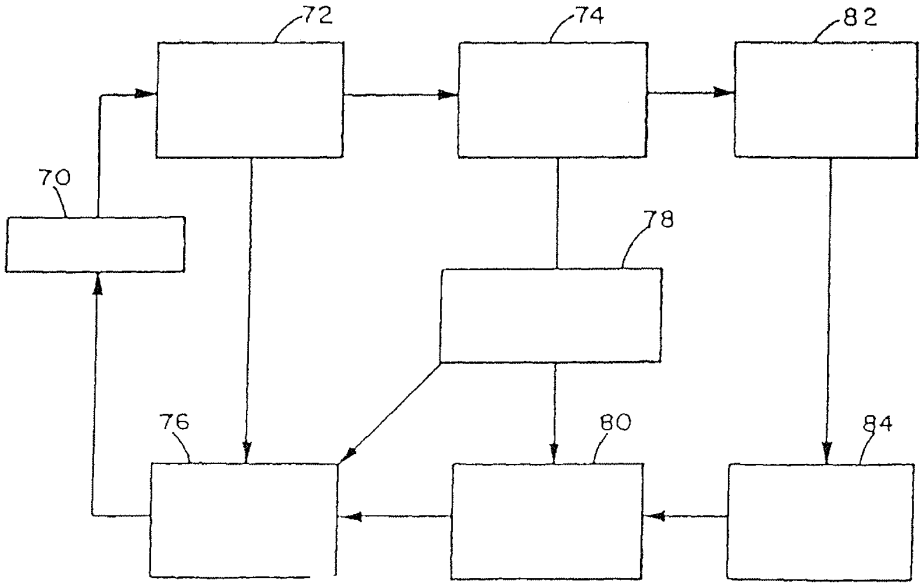


图 4

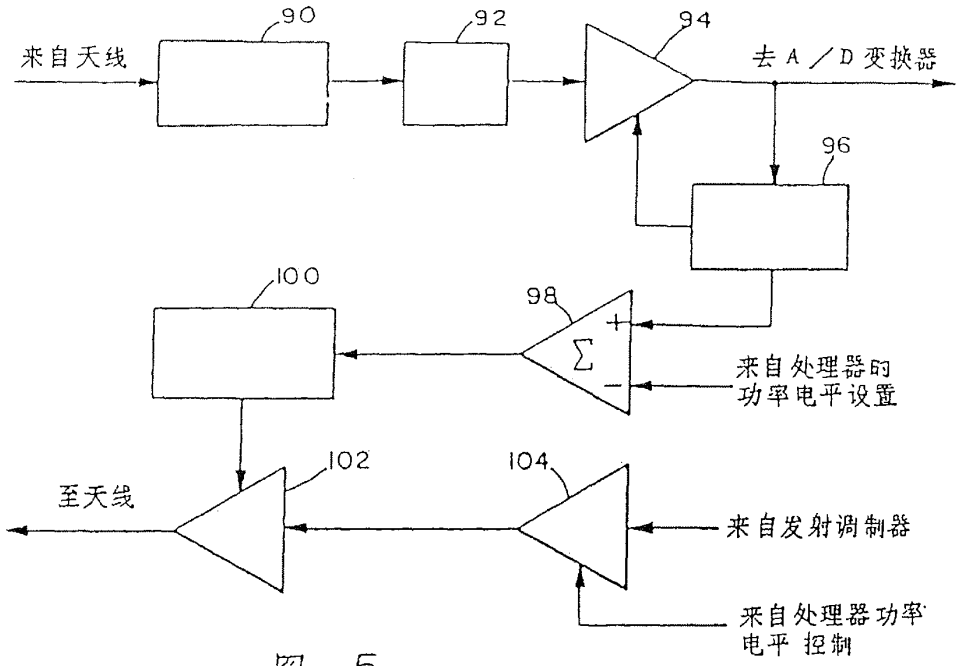

来自天线
90
92
94
去A／D变换器
96
100
98
Σ
+
−
来自处理器的
功率电平设置
至天线
102
104
来自发射调制器
来自处理器功率
电平 控制

图 5

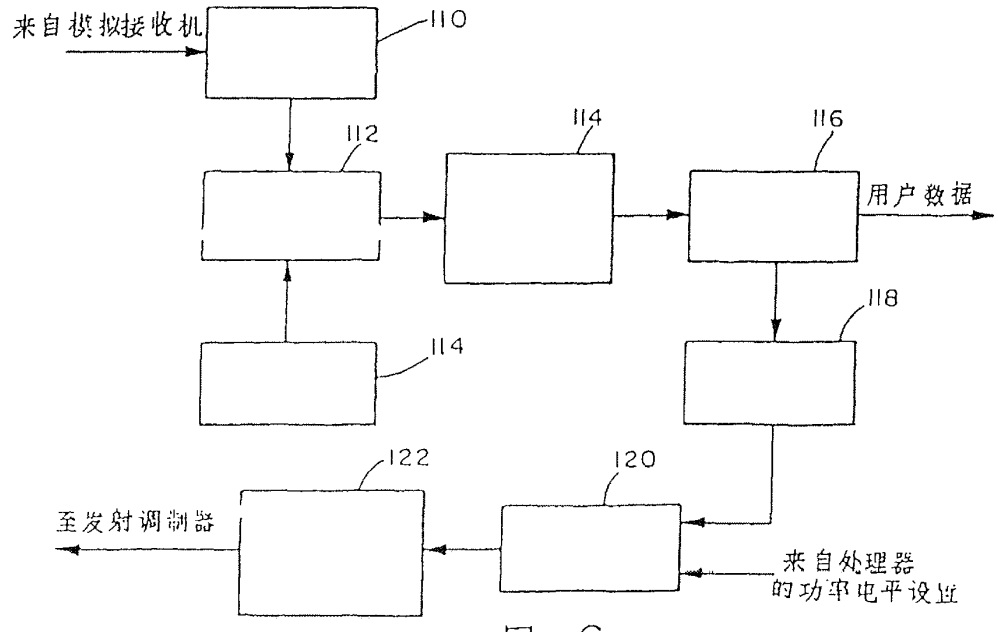

来自模拟接收机
110
112
114
116
用户数据
118
114
122
120
至发射调制器
来自处理器
的功率电平设置

图 6

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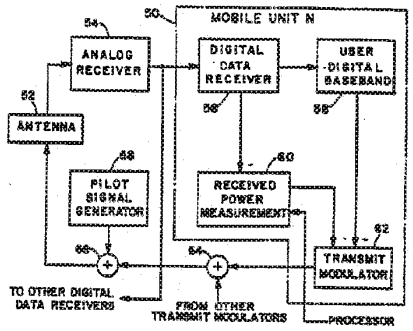
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(54) Title: METHOD AND APPARATUS FOR CONTROLLING TRANSMISSION POWER IN A CDMA CELLULAR MOBILE TELEPHONE SYSTEM

(57) Abstract

A power control system for a cellular mobile telephone system in which system users communicate information signals between one another via at least one cell-site using code division multiple access spread spectrum communication signals. The power control system controls transmission signal power for each cellular mobile telephone in the cellular mobile telephone system wherein each cellular mobile telephone has an antenna (70), a transmitter (84), and a receiver (72, 74) and each cell-site also has an antenna (52), a transmitter (62), and a receiver (54, 56). Cell-site transmitted signal power is measured as received at the mobile unit. Transmitted power at the mobile unit is adjusted by transmit power control units (76, 80) in an opposite manner with respect to increases and decreases in received signal power. A power control feedback scheme may also be utilized. At the cell-site communicating with the mobile unit, the mobile unit transmitted power is measured by the received power measurement unit (60) at the cell-site. A command signal is generated at the cell-site and transmitted to the mobile unit for further adjusting mobile unit transmitter power corresponding to deviations in the cell-site received signal power. The feedback scheme is used to further adjust the mobile unit transmitter power so that mobile unit transmitted signals arrive at the cell-site at a desired power level.



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METHOD AND APPARATUS FOR CONTROLLING TRANSMISSION POWER IN A CDMA CELLULAR MOBILE TELEPHONE SYSTEM

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates telephone systems. More specifically, the present invention relates to a novel and improved method and apparatus for controlling transmitter power in a code division multiple access (CDMA) cellular mobile telephone system.

II. Description of the Related Art

The use of code division multiple access (CDMA) modulation techniques is one of several techniques for facilitating communications in which a large number of system users are present. Although other techniques such as time division multiple access (TDMA) frequency division multiple access (FDMA) and AM modulation schemes such as amplitude companded single sideband (ACSSB) are known, CDMA has significant advantages over these other techniques. The use of CDMA techniques in a multiple access communication system is disclosed in U.S. Patent application Serial No. 06/921,261, filed October 17, 1986, entitled "SPREAD SPECTRUM MULTIPLE ACCESS COMMUNICATION SYSTEM USING SATELLITE OR TERRESTRIAL REPEATERS", now U.S. Patent No. 4,901,307 assigned to the assignee of the present invention, the disclosure thereof incorporated by reference.

In the just mentioned patent, a multiple access technique is disclosed where a large number of mobile telephone system users each having a transceiver communicate through satellite repeaters or terrestrial base stations (also known as cell-sites stations, or for short cell-sites) using code division multiple access (CDMA) spread spectrum communication signals. In using CDMA communications, the frequency spectrum can be reused multiple times thus permitting an increase in system user capacity. The use of CDMA results in a much higher spectral efficiency than can be achieved using other multiple access techniques. In a CDMA system,

increases in system capacity may be realized by controlling the transmitter power of each mobile user so as to reduce interference to other system users.

In the satellite application of the CDMA communication techniques, the mobile unit transceiver measures the power level of a signal received via a satellite repeater. Using this power measurement, along with knowledge of the satellite transponder downlink transmit power level and the sensitivity of the mobile unit receiver, the mobile unit transceiver can estimate the path loss of the channel between the mobile unit and the satellite. The mobile unit transceiver then determines the appropriate transmitter power to be used for signal transmissions between the mobile unit and the satellite, taking into account the path loss measurement, the transmitted data rate and the satellite receiver sensitivity.

The signals transmitted by the mobile unit to the satellite are relayed by the satellite to a Hub control system earth station. The Hub measures the received signal power from signals transmitted by each active mobile unit transceiver. The Hub then determines the deviation in the received power level from that which is necessary to maintain the desired communications. Preferably the desired power level is a minimum power level necessary to maintain quality communications so as to result in a reduction in system interference.

The Hub then transmits a power control command signal to each mobile user so as to adjust or "fine tune" the transmit power of the mobile unit. This command signal is used by the mobile unit to change the transmit power level closer to a minimum level required to maintain the desired communications. As channel conditions change, typically due to motion of the mobile unit, both the mobile unit receiver power measurement and the power control feedback from the Hub continually readjust the transmit power level so as to maintain a proper power level. The power control feedback from the Hub is generally quite slow due to round trip delays through the satellite requiring approximately 1/2 of a second of propagation time.

One important difference between satellite or terrestrial base stations systems are the relative distances separating the mobile units and

the satellite or cell-site. Another important different in the satellite versus the terrestrial system is the type of fading that occurs in these channels. Thus, these differences require various refinements in the approach to system power control for the terrestrial system.

In the satellite/mobile unit channel, i.e. the satellite channel, the satellite repeaters are normally located in a geosynchronous earth orbit. As such, the mobile units are all at approximately the same distance from the satellite repeaters and therefore experience nearly the same propagation loss. Furthermore, the satellite channel has a propagation loss characteristic that follows approximately the inverse square law, i.e. the propagation loss is inversely proportional to the square of the distance between the mobile unit and the satellite repeater in use. Accordingly, in the satellite channel the variation in path loss due to distance variation is typically on the order of only 1-2 dB.

In contrast to the satellite channel, the terrestrial/mobile unit channel, i.e. the terrestrial channel, the distance between the mobile units and the cell sites can vary considerably. For example, one mobile unit may be located at a distance of five miles from the cell site while another mobile unit may be located only a few feet away. The variation in distance may exceed a factor of one hundred to one. The terrestrial channel experiences a propagation loss characteristic as did the satellite channel. However, in the terrestrial channel the propagation loss characteristic corresponds to an inverse fourth-power law, i.e. the path loss is proportional to the inverse of the path distance raised to the fourth power. Accordingly, path loss variations may be encountered which are on the order of over 80 dB in a cell having a radius of five miles.

The satellite channel typically experiences fading that is characterized as Rician. Accordingly the received signal consists of a direct component summed with a multiply reflected component having Rayleigh fading statistics. The power ratio between the direct and reflected component is typically on the order of 6-10 dB, depending upon the characteristics of the mobile unit antenna and the environment about the mobile unit.

Contrasting the satellite channel with the terrestrial channel, the terrestrial channel experiences signal fading that typically consists of the

Rayleigh faded component without a direct component. Thus, the terrestrial channel presents a more severe fading environment than the satellite channel where Rician fading is the dominant fading characteristic.

The Rayleigh fading characteristics in the terrestrial channel signal is caused by the signal being reflected from many different features of the physical environment. As a result, a signal arrives almost simultaneously at a mobile unit receiver from many directions with different transmission delays. At the UHF frequency bands usually employed for mobile radio communications, including those of cellular mobile telephone systems, significant phase differences in signals traveling on different paths may occur. The possibility for destructive summation of the signals may result, with on occasion deep fades occurring.

Terrestrial channel fading is a very strong function of the physical position of the mobile unit. A small change in position of the mobile unit changes the physical delays of all the signal propagation paths, which further results in a different phase for each path. Thus, the motion of the mobile unit through the environment can result in a quite rapid fading process. For Example, in the 850 MHz cellular radio frequency band, this fading can typically be fast as one fade per second per mile per hour of vehicle speed. Fading on this order can be extremely disruptive to signals in the terrestrial channel resulting in poor communication quality. However, additional transmitter power can be used to overcome the problem of fading.

The terrestrial cellular mobile telephone system typically requires a full-duplex channel to be provided in order to allow both directions of the telephone conversation to be simultaneously active such as provided by the conventional wired telephone system. This full-duplex radio channel is normally provided by using one frequency band for the outbound link, i.e. transmissions from the cell-site transmitter to the mobile unit receivers. A different frequency band is utilized for the inbound link, i.e. transmissions from the mobile unit transmitters to the cell-site receivers. According, this frequency band separation allows a mobile unit transmitter and receiver to be active simultaneously without feedback or interference from the transmitter into the receiver.

The use of different frequency bands has significant implications in

the power control of the cell-site and mobile unit transmitters. Use of different frequency bands causes the multipath fading to be independent processes for the inbound and outbound channels. A mobile unit cannot simply measure the outbound channel path loss and assume that the same path loss is present on the inbound channel.

It is therefore, an object of the present invention to provide a novel and improved method and apparatus for controlling in the terrestrial channel transmitter power so as to overcome deleterious fading without causing unnecessary system interference which can adversely affect overall system capacity.

SUMMARY OF THE INVENTION

In a terrestrial CDMA cellular mobile telephone system, it is desirable that the transmitter power of the mobile units be controlled so as to produce at the cell site receiver a nominal received signal power from each and every mobile unit transmitter operating within the cell. Should all of the mobile unit transmitters within an area of coverage of the cell-site have transmitter power controlled accordingly the total signal power received at the cell-site would be equal to the nominal receiver power of the mobile unit transmitted signal multiplied by the number of mobile units transmitting within the cell. To this is added the noise power received at the cell-site from mobile units in adjacent cells.

The CDMA receivers of the cell-site respectively operate by converting a wideband CDMA signal from a corresponding one of the mobile unit transmitters into a narrowband digital information carrying signal. At the same time, other received CDMA signals that are not selected remain as wideband noise signals. The bit-error-rate performance of the cell-site receiver is thus determined by the ratio of the power of the desired signal to that of the undesired signals received at the cell-site, i.e., the received signal power in the desired signal transmitted by the selected mobile unit transmitter to that of the received signal power in undesired signals transmitted by the other mobile unit transmitters. The bandwidth reduction processing, a correlation process which results in what is commonly called "processing gain", increases the signal to noise

interference ratio from a negative value to a positive value thus allowing operation within an acceptable bit-error-rate.

In a terrestrial CDMA cellular mobile telephone system it is extremely desirable to maximize the capacity in terms of the number of simultaneous telephone calls that may be handled in a given system bandwidth. System capacity can be maximized if the transmitter power of each mobile unit is controlled such that the transmitted signal arrives at the cell-site receive at the minimal signal to noise interference ratio which allows acceptable data recovery. If a signal transmitted by a mobile unit arrives at the cell-site receiver at a power level that is too low, the bit-error-rate may be too high to permit high quality communications. On the other hand if the mobile unit transmitted signal is at a power level that is too high when received at the cell site receiver, communication with this particular mobile unit will be acceptable. However, this high power signal acts as interference to other mobile unit transmitted signals that are sharing the same channel, i.e. bandwidth. This interference may adversely affect communications with other mobile units unless the total number of communicating mobile units is reduced.

The path loss of signals in the UHF frequency band of the cellular mobile telephone channel can be characterized by two separate phenomena, average path loss and fading. The average path loss can be described statistically by a log-normal distribution whose mean is proportional to the inverse fourth- power of the path distance, and whose standard deviation is approximately equal to 8 dB. The second phenomena is a fading process caused by multipath propagation of the signals which is characterized by a Rayleigh distribution. The average path loss, which is a log-normal distribution, can be considered to be the same for both the inbound and outbound frequency bands, as is for the conventional cellular mobile telephone systems. However, as mentioned previously Rayleigh fading is an independent phenomena for the inbound and outbound link frequency bands. The log-normal distribution of the average path loss is a relatively slow varying function of position. In contrast, the Rayleigh distribution varies relatively fast as a function of position.

In the present invention, a CDMA approach to multiple user access

in a cellular mobile telephone system is implemented. In such a system all the cell-sites in a region transmit a "pilot" signal of the same frequency and code. The use of a pilot signal in CDMA systems is well known. In this particular application, the pilot signal is used by the mobile units for initial synchronization of the mobile unit receiver. The pilot signal is also used as a phase and frequency reference, and a time reference for demodulation of the digital speech signals transmitted by the cell-site.

In the present invention, each mobile unit estimates the path loss in signals transmitted from the cell-site to the mobile unit. In order to make this signal path loss estimate, the power level of the cell-site transmitted signals, as received at the mobile unit, are measured. The mobile unit thus measures the pilot signal power as received from the cell-site to which the mobile unit is communicating. The mobile unit also measures the power level sum of all cell-site transmitted signals as received at the mobile unit. The power level sum measurement as described in further detail later herein, is necessary to handle cases in which the mobile unit might temporarily obtain a better path to a more distant cell-site than to a normally preferred closest cell-site.

The outbound link path loss estimate is filtered using a non-linear filter. The purpose of the non-linearity in the estimation process is to permit a rapid response to a sudden improvement in the channel while only allowing a much slower response to a sudden degradation in the channel. The mobile unit in response to a sudden improvement in the channel thus suddenly reduces mobile unit transmitter transmit power.

Should the channel for one mobile unit suddenly improve, then the signal as received at the cell-site from this mobile unit will suddenly increase in power. This sudden increase in power causes additional interference to all signals sharing the same wideband channel. A rapid response to the sudden improvement will thus reduce system interference.

A typical example of a sudden improvement in the channel occurs when a mobile unit is moving through an area that is shadowed by a large building or other obstruction and then drives out of the shadow. The channel improvement, as a result of the vehicle movement, can take place on the order of a few tens of milliseconds. As the mobile unit drives

out of the shadow, the outbound link signal as received by the mobile unit will suddenly increase in strength.

The outbound link path loss estimate at the mobile unit is used by the mobile unit to adjust the mobile unit transmitter power. Thus, the stronger the received signal, the lower the mobile unit transmitter power will be. Reception of a strong signal from the cell-site indicates that the mobile unit is either close to the cell-site or else an unusually good path to the cell-site exists. Reception of a strong signal means that a relatively smaller mobile unit transmitter power level is required in nominal received power at the cell-site the mobile unit.

In the case where there is a temporary but yet sudden degradation in the channel it is desirable that a much slower increase in mobile unit transmitter power be permitted. This slow increase in mobile unit transmitter power is desired so as to prohibit an unnecessarily rapid increase in mobile unit transmit power which increases the interference to all other mobile units. Thus a temporary degradation in one mobile unit channel will be tolerated in order to prevent a degradation of all mobile unit channels.

In the case of a sudden degradation in the channel, the non-linear filter prevents the mobile transmitter power from being increased at a high rate in response to the sudden decrease in signal power in signals received at the mobile unit. The rate of increase of the mobile unit transmitter transmit power must generally be limited to the rate of a closed loop power adjustment command transmitted from the cell-site, as described below, can reduce the mobile unit transmitter transmit power. Using the cell-site generated power adjustment commands, the mobile unit transmitter power will be prevented from being increased to a level significantly higher than the level required for communications, particularly when a sudden channel degradation occurs in only the outbound link path and not in the inbound link path.

It should be noted that it is undesirable to simply use a slow response on the mobile unit transmitter power control in an attempt to separate the fast Rayleigh fading from the slow fading due to distance and terrain. A slow response in the mobile unit transmitter power control is undesirable because the possibility of sudden improvements and fades

that affect the inbound and outbound channels equally. If the response to a sudden improvement were to be slowed down by a filter, then there would be frequent occasions when the mobile unit transmitter power would be quite excessive and cause interference to all other mobile users. Thus the present invention uses a two-time constant, non-linear approach in estimating the path loss.

In addition to measuring the received signal strength in the mobile unit, it is also desirable for the processor in the mobile unit to know the cell-site transmitter power and antenna gain (EIRP), the cell-site G/T (receive antenna gain G divided by receiver noise level T) the mobile unit antenna gain, and the number of calls active at this cell-site. This information allows the mobile unit processor to properly compute the reference power level for the local power setting function. This computation is done by calculating the cell- site to mobile link power budget, solving for the path loss. This path loss estimate is then used in the mobile cell-site link budget equation, solving for the mobile unit transmit power required to produce a desired signal level. This capability allows the system to have cell-sites with differing EIRP levels to correspond to the size of the cells. For example, a small radius cell need not transmit with as high a power level as a large radius cell. However, when the mobile unit is a certain distance from a low power cell, it would receive a weaker signal than from a high power cell. The mobile unit would respond with a higher transmit power than would be necessary for the short range. Hence, the desirability of having each cell-site transmit information as to its characteristics for power control.

The cell-site transmits information such as cell-site EIRP, G/T and number of active calls on a cell-site setup channel. The mobile unit receives this information when first obtaining system synchronization and continues to monitor this channel when idle for pages for calls originated within the public telephone switching network intended for the mobile unit. The mobile unit antenna gain is stored in a memory in the mobile unit at the time the mobile unit is installed in the vehicle.

As mentioned previously, mobile unit transmitter power is also controlled by a signal from the cell-site. Each cell-site receiver measures the strength of the signal, as received at the cell-site, from each mobile

unit to which the cell-site is in communication with. The measured signal strength is compared to a desired signal strength level for that particular mobile unit. A power adjustment command is generated and sent to the mobile unit in the outbound link data, or voice channel, addressed to that mobile unit. In response to the cell-site power adjustment command, the mobile unit increases or decreases the mobile unit transmitter power by a predetermined amount, nominally 1 dB.

The power adjustment command is transmitted by the cell-site transmitter at a relatively high rate, typically on the order of about one command every millisecond. The rate of transmission of the power adjustment command must be high enough to permit Rayleigh fading on the inbound link path to be tracked. It is further desirable for the outbound link path Rayleigh fading impressed on the inbound link path signal to be tracked. One command per millisecond is adequate to track the fading processes for vehicle speeds in the range of 25-50 miles per hour for 850 MHz band mobile communications. It is important that the latency in determining the power adjustment command and the transmission thereof be minimized so that channel conditions will not change significantly before the mobile unit receives and responds to the signal.

In summary, to account for the independence of the two Rayleigh fading paths (inbound and outbound), the mobile unit transmitter power is controlled by the power adjustment command from the cell-site. Each cell-site receiver measures the received signal strength from each mobile unit. The measured signal strength is compared to the desired signal strength for that mobile unit and a power adjustment command is generated. The power adjustment command is sent to the mobile unit in the outbound data or voice channel addressed to that mobile unit. This power adjustment command is combined with the mobile unit one way estimate to obtain the final value of the mobile unit transmitter power.

The power adjustment command signal is transmitted, in an exemplary embodiment, by overwriting one or more user data bits every millisecond. The modulation system employed in CDMA systems is capable of providing correction coding for user data bits. The overwrite by the power adjustment command is treated as a channel bit error or erasure

and corrected by the error correction as decoded in the mobile unit receiver. Error correction coding on the power adjustment command bits in many cases may not be desirable because of the resulting increased latency in reception and response to the power adjustment command. It is also envisioned that time division multiplexing for transmission of the power adjustment command bits may be used without overwriting user data channel symbols.

The cell-site controller or processor can be used to determine the desired signal strength, as received at the cell-site, for signals transmitted by each mobile unit. The desired signal strength level values are provided to each of the cell-site receivers. The desired signal strength value is used for comparing with a measured signal strength value for generating the power adjustment command.

A system controller is utilized to command each cell-site processor as to the value of desired signal strength to use. The nominal power level can be adjusted up or down to accommodate variations in the average conditions of the cell. For example, a cell-site positioned in an unusually noisy location or geographic region might be allowed to use a higher than normal inbound power level. However, such a higher power level for in-cell operation will result in higher levels of interference to immediate neighbors of this cell. This interference can be compensated for by allowing the neighbor cells a small increase in inbound link power. Such an increase in inbound power in neighboring cells would be smaller than that of the increase given to the mobile users communicating in the high noise environment cell. It is further understood that the cell-site processor may monitor the average bit-error-rate. This data may be used by the system controller to command the cell-site processor to set an appropriate inbound link power level to assure acceptable quality communications.

It is also desirable to provide a means for controlling the relative power used in each data signal transmitted by the cell-site in response to control information transmitted by each mobile unit. The primary reason for providing such control is to accommodate the fact that in certain locations, the outbound channel link from the cell-site to the mobile unit may be unusually disadvantaged. Unless the power being transmitted to

this mobile is increased, the quality may become unacceptable. An example of such a location is a point where the path loss to one or two neighboring cells is nearly the same as the path loss to the cell-site communicating with the mobile unit. In such a location, the total interference would be increased by three times over the interference seen by the mobile unit at a point relatively close to its cell- site. In addition, the interference coming from these neighboring cell-sites will not fade in unison with the desired signal as would be the case for interference coming from the desired cell-site. This situation may required 3-4 dB additional signal power to achieve adequate performance.

In another situation, the mobile unit may be located where several strong multi-path signals arrive, resulting in larger than normal interference. In such a situation, increasing the power of the desired signal relative to the interference may allow acceptable performance. At other times, the mobile unit may be located where the signal-to-interference ratio is unusually good. In such a case, the cell-site could transmit the desired signal using a lower than normal transmitter power, reducing interference to other signals being transmitted by the system.

To achieve the above objectives, the preferred embodiment includes a signal-to-interference measurement capability within the mobile unit receiver. This measurement is performed by comparing the power of the desired signal to the total interference and noise power. If the measured ratio is less than a predetermined value, the mobile transmits a request to the cell-site for additional power in cell-site transmissions. If the ratio exceeds the predetermined value the mobile unit transmits a request for a reduction in power.

The cell-site receives the power adjustment requests from each mobile and responds by adjusting the power allocated to the corresponding cell-site transmitted signal by a predetermined amount. The adjustment would usually be small, on the order of 0.5 dB, or 12% . The rate of change of power may be somewhat slower than that used for the inbound link from the mobile unit to cell-site, perhaps once per vocoder frame, or nominally once per 15 milliseconds. The dynamic range of the adjustment would also be limited to 4 dB less than nominal to about 6 dB greater than nominal.

The cell-site must also consider the power demands being made on it by all the mobiles in deciding whether to comply with the requests of any particular mobile. For example, if the cell-site is loaded to capacity, requests for additional power might be granted but only by 6% or less, instead of the normal 12%. In this regime, a request for a reduction in power would still be granted at the normal 12% change.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters correspond throughout and wherein:

Figure 1 is a schematic overview of an exemplary mobile cellular telephone system;

Figures 2A-2D illustrate, in a series of graphs, mobile unit received signal strength and transmit power as a function of distance;

Figure 3 is a block diagram of a cell-site with particular reference to the power control features of the present invention;

Figure 4 is a block diagram of the mobile unit with particular reference to the power control features of the present invention;

Figure 5 is a block diagram illustrating in further detail the power control features of the mobile unit of Figure 4; and

Figure 6 is a block diagram illustrating in further detail the power control features of the cell-site of Figure 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An exemplary terrestrial cellular mobile telephone system in which the present invention is embodied is illustrated in Figure 1. The system illustrated in Figure 1 utilizes CDMA modulation techniques in communications between the system mobile user, and the cell-sites. Cellular systems in large cities may have hundreds of cell-site stations serving hundreds of thousands of mobile telephones. The use of CDMA

techniques readily facilitates increases in user capacity in systems of this size as compared to conventional FM modulation cellular systems.

In Figure 1, system controller and switch 10, typically includes appropriate interface and processing hardware for providing system control information to the cell-sites. Controller 10 controls the routing of telephone calls from the public switched telephone network (PSTN) to the appropriate cell-site for transmission to the appropriate mobile unit. Controller 10 also controls the routing of calls from the mobile units via at least one cell-site to the PSTN. Controller 10 may direct calls between mobile users via the appropriate cell-site stations since such mobile units do not typically communicate directly with one another.

Controller 10 may be coupled to the cell-sites by various means such as dedicated telephone lines, optical fiber links or by radio frequency communications. In Figure 1, two exemplary cell-sites, 12 and 14, along with two exemplary mobile units 16 and 18 which include cellular telephones are illustrated. Arrows 20a-20b and 22a-22b respectively define the possible communication links between cell-site 12 and mobile units 16 and 18. Similarly, arrows 24a-24b and arrows 26a-26b respectively define the possible communication links between cell-site 14 and mobile units 18 and 16. Cell-sites 12 and 14 normally transmit using equal power.

Mobile unit 16 measures the total received power in pilot signals transmitted by cell-sites 12 and 14 upon path 20a and 26a. Similarly, mobile unit 18 measures the total received power in pilot signal as transmitted by cell-sites 12 and 14 upon paths 22a and 24a. In each of mobile units 16 and 18, pilot signal power is measured in the receiver where the signal is a wideband signal. Accordingly, this power measurement is made prior to correlation of the received signal with a pseudonoise (PN) spectrum spreading signal.

When mobile unit 16 is closer to cell-site 12, the received signal power will be dominated by the signal traveling path 20a. When mobile unit 16 is nearer to cell-site 14, the received power will be dominated by the signal traveling on path 26a. Similarly, when mobile unit 18 is closer to cell-site 14, the received power will be dominated by the signal on path 24a. When mobile unit 18 is closer to cell-site 12, the received power will be dominated by the signal traveling on path 22a.

Each of mobile units 16 and 18 uses the resultant measurement, together with knowledge of the cell-site transmitter power and the mobile unit antenna gain to estimate the path loss to the closest cell-site. The estimated path loss, together with knowledge of the mobile antenna gain and the cell-site G/T is used to determine the nominal transmitter power required to obtain the desired carrier-to-noise ratio in the cell-site receiver. The knowledge by the mobile units of the cell-site parameters may be either fixed in memory or transmitted in cell-site information broadcast signals, setup channel, to indicate other than nominal conditions for a particular cell-site.

As a result of the determination of the mobile unit nominal transmit power, in the absence of Rayleigh fading and assuming perfect measurements, the mobile unit transmitted signals will arrive at the nearest cell-site precisely at the desired carrier-to-noise ratio. Thus the desired performance will be obtained with the minimum amount of mobile unit transmitter power. The minimization of the mobile unit transmitted power is important in a CDMA system because each mobile unit causes interference to every other mobile unit in the system. In minimizing the mobile unit transmitter power, system interference will be held to a minimum, thus allowing additional mobile users to share the frequency band. Accordingly, system capacity and spectral efficiency is maximized.

Figure 2A illustrates the effect of both Rayleigh fading as a function of distance on the strength of the cell-site transmitted signal as received at a mobile unit. The average path loss, indicated by curve 30, is determined primarily by the fourth-power of the distance between the cell-site and the mobile unit, and by the shape of the terrain between them. As distance increases between the mobile unit and the cell-site, signal power decreases as received at the mobile unit for a constant power transmitted cell-site signal. The average path loss is the same for both directions of the link, and typically exhibits a log-normal distribution about the average path loss.

In addition to the slowly varying log-normal average path loss, the rapid fading up and down around the average path loss is caused by the existence of multiple path signal propagation. The signals arrive from

these multiple paths in random phase and amplitude, resulting in the characteristic Rayleigh fading. Curve 32, as illustrated in Figure 2A, represents the variation in signal path loss as a result of Rayleigh fading. The Rayleigh fading is typically independent for the two directions of the cell-site/mobile unit communication link, i.e. outbound and inbound channels. For example, when the outbound channel is fading, the inbound channel is not necessarily fading at the same time.

Figure 2B illustrates the mobile unit transmitter power adjusted to correspond to the link path signal strength of Figure 2A. In Figure 2B, curve 34 represents the desired average transmit power corresponding to the average path loss of curve 30 of Figure 2A. Similarly, curve 36 corresponds to the mobile unit transmitter power responding to the Rayleigh fading as represented by curve 32 of Figure 2A. As the Rayleigh faded signal, curve 32 of Figure 2A, decreases in signal strength, rapid increases in transmitter power result. These rapid upward excursions of transmitter power can result in deleterious effects in overall system performance. Therefore, the present invention envisions the use of a nonlinear filter to control rapid upward excursions, or increases, in transmitter power Furthermore, the present invention also utilizes closed loop power adjustment feedback from the cell-site to adjust mobile unit transmitter power.

Figure 2C illustrates the mobile unit transmitter power corresponding to Figure 2A without taking into consideration the cell-site closed loop power adjustment feedback. In Figure 2C the desired average transmit power, as represented by curve 34', corresponds to the mobile unit received signal strength of curve 30 of Figure 2A. Curve 38 illustrates the transmitter power utilizing the non-linear filter in power control of the present invention.

The rapid upward excursions in transmitter power, as indicated by the dashed lines of Figure 2C and correspond to the upward excursions in curve 36 of Figure 2B, are significantly reduced. In curve 38, the upward excursions are significantly reduced by setting the rate of increase in transmit power to a fixed value. The resulting variation in transmitter power relative to the desired transmit power is both limited in dynamic range and in rate of change. This limitation allows the closed loop power

adjustment feedback process to be easier to implement and to be more effective at a much lower control data rate. Transmit power, as indicated by curve 38, is permitted to decrease at a much greater rate than an increase.

As distance increases from the points marked D_1-D_2, transmitter power decreases rather quickly corresponding to a sudden improvement in the channel. Between the distance points marked D_2-D_3 the channel degrades with a corresponding increase in transmitter power. The change in degradation is not so significant such that the non-linear filter maximum rate limits the rate of increase in transmitter power.

As distance increases as from the distance points marked D_3-D_4, the channel degrades much more rapidly than the nonlinear filter will permit an increase in transmitter power. During this period, transmitter power increases at the maximum rate permitted by the non-linear filter. During the distance change indicated by marks D_4-D_5, the channel begins improving. However, as the quality of the channel improves the transmitter power continues to increase at the maximum rate until transmitter power is sufficient to meet the desired level such as at mark D_5.

It is desirable to eliminate the upward excursions in transmitter power which may cause unnecessary system interference. Should a better path to another cell-site occur, which would result in unnecessary interference in the system, quality communications in the system may be maintained by limiting the rate of increase in transmitter power.

Figure 2D is a graph illustrating the cell-site received signal power strength with respect to transmissions of the mobile unit as it travels from the cell-site. Curve 40 indicates the desired average received signal power at the cell-site for a signal transmitted from a mobile unit. It is desirable that the average received signal power be at a constant level, yet a minimum necessary to assure a quality communication link with the mobile unit. Corrections are made at the mobile unit to correct for Rayleigh fading in the cell-site transmitted signal.

The mobile unit transmitted signal experiences Rayleigh fading before arriving at the cell-site receiver. The signal received at the cell-site is therefore a signal of constant average received power level but still with

the Rayleigh fading of the inbound channel impressed thereupon. Curve 42 represents the Rayleigh fading that occurs on the inbound signal.

Additionally, there is the possibility that the mobile unit may come to rest at a place where the outbound link is not faded but yet the inbound link is severely faded. Such a condition would disrupt communications unless an additional mechanism is employed to compensate for the inbound channel Rayleigh fading. The closed loop power adjustment command process employed at the cell-site is such a mechanism for adjusting the mobile unit transmitter power, so as to compensate for the Rayleigh fading on the inbound channel. In Figure 2D, curve 44 illustrates the mobile unit transmitted signal power as received at the cell-site when compensating for average path loss and Rayleigh fading on both the inbound and outbound channels. As can be seen in Figure 2D curve 44 follows close to curve 40 except for instances of severe fading where the fading process is minimized by the closed loop control.

In Figure 3, antenna 52 is provided for receiving multiple mobile unit transmitted signals which are then provided to analog receiver 54 for amplification, frequency downconversion and IF processing of the received RF signal. The analog signals output from receiver 54 are provided to a plurality of receiver modules for, extraction of user directed information signals, generation of power adjustment commands, and modulation of user input information signals for transmission. One such module used in communications with a particular mobile unit, such as mobile unit N, is module 50. Thus the output of receiver 54 is provided to a plurality of these modules including module 50.

Module 50 comprises digital data receiver 56, user digital baseband circuit 58, received power measurement circuitry 60 and transmit modulator 62. Digital data receiver 56 receives the wideband spread spectrum signals for correlating and despreading the mobile unit N transmitted signal to a narrowband signal for transfer to an intended recipient communicating with mobile unit N. Digital data receiver 56 provides the narrowband digital signals to user digital baseband circuitry 58. Digital data receiver 56 also provides the narrowband signal to received power measurement circuitry 60.

Received power measurement circuitry 60 measures the power

level in the received signal from mobile unit N. Received power measurement circuitry 60 in response to the measured level of power generates a power adjustment command which is input to transmit modulator 62 for transmission to mobile unit N. As previously discussed, the data bits in the power adjustment command are used by mobile unit N in adjusting mobile unit transmitter power.

When the received power measurement is greater than the preset level provided by a cell-site processor (not shown), an appropriate power adjustment command is generated. Should the received power measurement be less than the preset level, the power adjustment command data bits are generated and indicate that an increase in mobile unit transmitter power is necessary. Similarly, if the received measurement is greater than the preset level, the power adjustment command is generated such that the mobile unit transmitter power is reduced. The power adjustment command is utilized to maintain a nominal received power level at the cell-site.

The signal output from digital data receiver 56 is provided to user digital baseband circuitry 58 where it is interfaced for coupling to the intended recipient via the system controller and switch. Similarly, baseband circuitry 58 receives user information signals intended for mobile unit N and provides them to transmit modulator 62.

Transmit modulator 62 spread spectrum modulates the user addressable information signals for transmission to mobile unit N. Transmit modulator 62 also receives the power adjustment command data bits from received power measurement circuitry 60. The power adjustment command data bits are also spread spectrum modulated by transmit modulator 62 for transmission to mobile unit N. Transmit modulator 62 provides the spread spectrum modulated signal to summer 64 where combined with spread spectrum signals from other module transmit modulators also located at the cell-site.

The combined spread spectrum signals are input to summer 66 where they are combined with a pilot signal provided by pilot signal generator 68. These combined signals are then provided to circuitry (not shown) for frequency upconversion from the IF frequency band to the RF frequency band and amplified. The RF signals are then provided to

antenna 52 for transmission. Although not illustrated, transmit power control circuitry may be disposed between summer 66 and antenna 52. This circuitry, under control of the cell-site processor, is responsive to power adjustment command signals transmitted by the mobile unit which are demodulated at the cell-site receiver and provided to the cell-site control processor for coupling to the circuitry.

In Figure 4, the mobile unit, such as mobile unit N, includes an antenna 70 for collecting cell site transmitted signals and radiating mobile unit generated CDMA signals. Mobile unit N receives the pilot signal, setup channel signals and the mobile unit N addressed signals using antenna 70, analog receiver 72 and digital data receiver 74. Receiver 72 amplifies and frequency downconverts the received RF CDMA signals to IF, and filters the IF signals. The IF signals are output to digital data receiver 74 for digital processing. Receiver 72 also includes circuitry for performing an analog measurement of the combined power of the received signals. This power measurement is used to generate a feedback signal that is provided to transmit power control circuitry 76 for controlling transmit power.

Digital data receiver 74 is used for despreading and correlating the received signals addressed to mobile unit N. Receiver 74 also separates the digital data from the power adjustment commands generated by the cell site. The power adjustment command data bits are sent to control processor 78. Processor 78 in response to the power adjustment command data bits generates a transmit power control command that is provided to transmit power control circuitry 80. Processor 78 also provides a level set command to transmit power control circuitry 76. Further details on the interaction of receiver 72, transmit power control 76 and 80, and processor are described in further detail with reference to Figure 5.

Receiver 74 also provides data such as digitized encoded speech to user digital baseband circuitry 82 for decoding and interface with the user. Baseband circuitry 82 includes interface hardware for coupling receiver 74 and transmit modulator 82 to the user handset (not shown).

Data to be transmitted is provided through baseband circuitry 82 where it is encoded and provided to transmit modulator 84. The data is spread spectrum modulated by transmit modulator 84 according to an

assigned spreading code. The spread spectrum signals are output from transmit modulator 84 to transmit power control circuitry 80. The signal power is adjusted in accordance with the transmit power control command provided by control processor 78. This power adjusted signal is provided from transmit power control circuitry 80 to transmit power control circuitry 76 where the signal is adjusted in accordance with the analog measurement control signal. Although illustrated as two separate units for controlling the transmit power, the power level could be adjusted by a single variable gain amplifier with two input control signals combined before being applied to the variable gain amplifier. However in the illustrated exemplary embodiment the two control functions are shown as separate elements.

In the operation of the power control circuitry illustrated in Figure 4, receiver 72 measures the combined power level of all signals received from all cell-sites. These power level measurement results are used in controlling the power level as set by transmit power control circuitry 76. Transmit power control circuitry 76 includes circuitry in which the rate of increase transmitter power is limited by a non-linear filter as previously discussed. The rate of increase is set to be no faster than the rate at which transmit power control circuitry 80 can turn the power down in response to a series of downward commands from the cell-site as processed by receiver 74 and processor 78.

Figure 5 illustrates in further detail the power control aspect of mobile unit N discussed with reference to Figure 4. In Figure 5, received RF signals from the antenna are provided to frequency downconverter 90 where the received RF signals are converted to an IF frequency. The IF frequency signals are coupled to bandpass filter 92 where out of band frequency components are removed from the signals.

The filtered signals are output from filter 92 to variable gain IF amplifier 94 where the signals are amplified. The amplified signals are output from amplifier 94 to an analog to digital (A/D) converter (not shown) for digital signal processing operations on the signals. The output of amplifier 94 is also coupled to automatic gain control (AGC) detector circuit 96.

AGC detector circuit 96 generates a gain control signal which is

coupled to a gain control input of amplifier 94. This gain control signal is used to control the gain of the amplifier 94 so as to maintain a constant average power level as output from amplifier 94 to the A/D converter.

AGC detector circuit 96 also provides an output to one input of comparator 98. The other input of comparator 98 is provided with a level set signal from the mobile unit processor (not shown). This level set signal is indicative of a desired transmitter reference power level. These input signals are compared by comparator 98 with the comparison signal provided to a non-linear filter circuit 100. This comparison signal corresponds to a deviation in the received power measurement from a desired mobile unit transmitter power level.

Filter 100 may be configured as a simple resistor-diode-capacitor circuit. For example, the input to the circuit is a common node shared by two resistors. The other end of each resistor is coupled to a respective diode. The diodes are reversed in their connection to the resistors and the other end of each diode coupled together at a common node as an output of the filter. A capacitor is coupled between the diode common node and ground. The filter circuit is designed to limit the rate of power increase to less than 1 dB per millisecond. The rate of power decrease is typically set to be about ten times faster than the rate of power increase, i.e. 10 dB per millisecond. The output of filter 100 is provided as a power level control signal input to the gain control input of variable gain IF amplifier 102.

AGC detector circuit 96, comparator 98 and filter 100 estimate received mobile unit signal power and the power correction necessary for the mobile unit transmitter. This correction is used to maintain a desired transmitter power level in conditions of fading on the outbound channel that are common to the inbound channel.

Transmit modulator circuit 84 of Figure 4, provides a low power, IF frequency spread spectrum signal to an input of variable gain IF amplifier 104. Amplifier 104 is gain controlled by a power level control signal from processor 78 (Figure 4). This power level control signal is derived from the closed loop power adjustment command signal transmitted by the cell-site and processed by the mobile unit as discussed with reference to Figure 4.

The power adjustment command signal consists of a sequence of

power-up and power-down commands that are accumulated in the mobile unit processor. The mobile unit control processor starts with the gain control level set to a nominal value. Each power-up command increases the value of a gain control command corresponding to a resultant approximate 1 dB increase in amplifier gain. Each power-down command decreases the value of the gain control command, corresponding to a resultant approximate 1 dB decrease in amplifier gain. The gain control command is converted to analog form by a digital to analog (D/A) converter (not shown) before applied to amplifier 104 as the power level control signal.

The mobile unit reference power level may be stored in the memory of the control processor. In the alternative, the mobile unit reference power level may be contained within a signal sent to the mobile unit. This signal command data is separated by the digital data receiver and interpreted by the control processor in setting the level. This signal as provided from the control processor is converted by a digital to analog (D/A) converter (not shown) before input to comparator 98.

The output of amplifier 104 is provided as an input to amplifier 102. Amplifier 102 as previously mentioned is also a variable gain IF amplifier with the gain determined according to the power level control signal output from filter 100. The signal for transmission is thus amplified in accordance with the gain set by the power level control signal. The amplified signal output from amplifier 102 and is further amplified and frequency translated to the RF frequency for transmission. The RF signal is then fed to the antenna for transmission.

Figure 6 illustrates in further detail the power control scheme of the cell-site as illustrated in Figure 3. In Figure 6, a mobile unit transmitted signal is received at the cell-site. The received signal is processed by the cell-site analog receiver and cell-site corresponding to mobile unit N.

In the digital data receiver, receiver 56 of Figure 3, the received analog signal is converted from analog to digital form by A/D converter 110. The digital signal output from A/D converter is provided to pseudorandom noise (PN) correlator 112 where the signal undergoes a correlation process with a PN signal provided from PN generator 114. The output of PN correlator 112 is provided to a fast Hadamard transform

digital filter 114 where the signal is filtered. The output of filter 114 is provided to a user data decoder circuit 116 which provides user data to the user digital baseband circuitry. Decoder 116 provides the largest transform filter symbols to power averager circuit 118. Power averager circuit 118 averages the largest transform outputs over a one millisecond interval using well known digital techniques.

A signal indicative of each average power level is output from power averager 118 to comparator 120. Comparator 120 also receives a power level set signal indicative of the desired received power level. This desired received power level is set by the control processor for the cell-site. Comparator 120 compares the two input signals and provides an output signal indicative of the deviation of the average power level from the desired power level. This signal is provided output to power up/down command generator 122. Generator 122 in response to the comparison generates either a power-up or a power-down command. Power command generator 122 provides the power control commands to the cell-site transmit modulator for transmission and control of the transmitter power of mobile unit N.

If the received power at the cell-site is higher than that desired of mobile unit N, then a power-down command is generated and transmitted to mobile unit N. However, if the received power level at the cell-site is too low, then a power-up command is generated and transmitted. The up/down commands are transmitted at a high rate, nominally 1,000 commands per second in the exemplary embodiment. At one bit per command, the overhead of the power command is insignificant compared to the bit rate of a high quality digital voice signal.

The power adjustment command feedback compensates for changes in the inbound channel that are independent of the outbound channel. These independent inbound channel changes are not measured in the outbound channel signal. Therefore the path loss estimate based upon then outbound channel and the corresponding transmitter power adjustment do not reflect the changes in the inbound channel. Thus, the power adjustment command feedback is used to compensate for adjustments in the mobile unit transmitter power based on the inbound channel path losses that do not exist in the outbound channel.

In using a closed loop control process it is highly desirable for the command to arrive at the mobile unit before conditions change significantly. The present invention provides a novel and unique power control circuitry at the cell-site for minimizing delay and latency of measurement and transmission. The power control circuitry at the mobile unit, analog control and digital command response, provides a vastly improved power control process in the cellular mobile telephone system.

The previous description of the preferred embodiments are provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principals defined herein may be applied to other embodiments without the use of the inventive faculty. Thus, the present invention is not intended to be limited to the embodiments shown herein, but is to be accorded the widest scope consistent with the principals and novel features disclosed herein.

WE CLAIM:

CLAIMS

1. In a cellular mobile telephone system in which system users communicate information signals between one another via at least one cell-site using code division multiple access (CDMA) spread spectrum communication signals, a power control system for controlling transmission signal power for each mobile telephone in said cellular mobile telephone system, wherein each mobile telephone has an antenna, transmitter and receiver and each cell-site has an antenna, at least one transmitter and at least one receiver, said power control system comprising:

at least one first power measurement means, each coupled to a respective mobile telephone receiver, for measuring signal power in CDMA communication signals received by said respective mobile telephone receiver;

at least one first power adjustment means, each coupled to a respective mobile telephone transmitter and corresponding first power measurement means, said first power adjustment means responsive to decreases and increases in power measurements of said corresponding first power measurement means with respect to a first predetermined power level, for respectively increasing and decreasing transmission signal power of said corresponding mobile telephone transmitter;

at least one second power measurement means, each coupled to a respective cell-site receiver, for measuring signal power in each CDMA communication signal directed to said respective cell-site receiver from a corresponding mobile telephone transmitter in communication therewith;

at least one power adjustment command generator means, each coupled to a respective cell-site transmitter and corresponding second power measurement means for, generating power adjustment commands corresponding to deviations in power measurements of said corresponding second power measurement means from a second predetermined power level, said respective cell-site transmitter transmitting said power adjustment commands; and

at least one second power adjustment means, each coupled to a

respective mobile telephone receiver and corresponding transmitter, said second power adjustment means responsive to said power adjustment commands directed to said respective mobile telephone receiver, for adjusting transmission signal power of said corresponding mobile telephone transmitter.

2. The power control system of Claim 1 wherein said first power adjustment means provided increase in transmission signal power is at a rate less than said first power adjustment means provided decrease in transmission signal power.

3. The power control system of Claim 1 wherein said first power measurement means power measurements correspond to a sum of all contemporaneously received CDMA communication signals within a predetermined frequency band, and said first power measurement means is further for generating and providing a corresponding first power measurement signal to said corresponding first power adjustment means.

4. The power control system of Claim 3 wherein said first power adjustment means comprises:

comparator means for receiving said first power measurement signal and a first power level set signal, said first power level set signal corresponding to a desired mobile telephone transmitter power level, for comparing said first power measurement signal with said first power level set signal, and for providing a corresponding comparator output signal; and

variable gain amplification means operatively coupled to said mobile telephone transmitter for receiving said comparator output signal and responsive thereto for varying transmission signal power of said corresponding mobile telephone transmitter.

5. The power control system of Claim 4 further comprising filter means disposed between said comparator means and said variable gain amplification means for receiving said comparator output signal, for unequally limiting a rate of change in increases and decreases in said

received comparator output signal and for providing a corresponding limited comparator output signal to said variable gain amplification means.

6. An apparatus for controlling transmission signal power in a cellular mobile telephone in communications with at least one cell-site station using code division multiple access (CDMA) spread spectrum communication signals, said cellular mobile telephone having an antenna coupled to a transmitter and a receiver, said transmitter for generating and transmitting a CDMA carrier signal according to an assigned spreading function modulated by a mobile user input information signal, said receiver for receiving CDMA communication signals and spectrum processing said received CDMA communication signals according to an assigned spreading function so as to recover a mobile user output information signal intended for a user of said cellular mobile telephone, said cell-site station communicating power control commands in CDMA communication signals intended for said cellular mobile telephone with said receiver providing an output of said power control commands, said apparatus comprising:

measurement means for, operatively coupling to said receiver, measuring combined signal power in contemporaneously received CDMA communication signals and providing a measurement signal indicative of measured signal power;

adjustment means for, operatively coupling to said transmitter, receiving said measurement signal, varying transmitter signal power in opposite correspondence to variations in measured signal power about a predetermined power level; and

additional adjustment means for, operatively coupling to said receiver and transmitter, receiving said power adjustment commands, and varying transmitter signal power in correspondence thereto.

7. The apparatus of Claim 6 wherein said adjustment means is responsive to said measurement signal for, increasing transmitter signal power in response to decreases in measured signal power with respect to said predetermined power level, and decreasing transmitter signal power

in response to increases in measured signal power with respect to said predetermined power level.

8. The apparatus of Claim 7 wherein said adjustment means rate of increase in transmitter signal transmission power is less than a rate of decrease in transmitter signal transmission power.

9. The apparatus of Claim 6 wherein said cell-site station measures signal power of said cellular mobile telephone transmitted CDMA communication signals and generates for transmission said power adjustment commands indicative of one of an increase and a decrease in said cellular mobile telephone signal power so as to maintain a predetermined power level for cell-site station received CDMA communication signals from said cellular mobile telephone.

10. The apparatus of Claim 6 wherein said adjustment means comprises:

comparator means for receiving measurement signal and a first power level set signal, said first power level set signal corresponding to a desired cellular mobile telephone transmitter power level, for comparing said first power measurement signal with said first power level set signal, and for providing a corresponding comparator output signal;

filter means for, receiving said comparator output signal, limiting a rate of change in variations in said comparator output signal, and providing an output of a corresponding limited comparator output signal; and

variable gain amplification means, operatively coupled to said transmitter, for receiving said limited comparator output signal and responsive thereto for varying signal power of said transmitter.

11. The apparatus of Claim 10 wherein said additional adjustment means comprises:

processor means for, receiving said power adjustment commands, accumulating said power adjustment commands with a predetermined gain control level setting, and providing a corresponding power

adjustment signal; and

additional variable gain amplification means, operatively coupled to said transmitter, for receiving said power adjustment signal and responsive thereto for varying signal power of said transmitter.

12. A transceiver having a receiver for receiving and demodulating an outbound information containing spread spectrum signal as transmitted by a base station to an intended user, and a transmitter for transmitting an inbound information containing spread spectrum signal to said base station for transfer to another intended user, said transceiver having a power control system for controlling transmitter signal power at a predetermined level for said inbound spread spectrum signal as received at said base station, said power control system comprising:

control processor means coupled to said receiver for, receiving from said receiver power adjustment commands transmitted in said outbound spread spectrum signal, accumulating values corresponding to each of said power adjustment commands with respect to a predetermined closed loop power level value, and generating a corresponding closed loop power level control signal, said control processor further for generating an open loop power level signal in accordance with a predetermined open loop power level value;

first amplifier means operatively coupled to said transmitter for, receiving said closed loop power level control signal, and amplifying said inbound spread spectrum signal at a first gain determined by said closed loop power level control signal;

automatic gain control means coupled to said receiver for, measuring a combined signal power of signals received by said receiver, and providing a corresponding power measurement signal;

comparator means for, receiving and comparing said power measurement signal and said open loop power level signal, and providing a corresponding comparison signal;

filter means for, receiving said comparison signal, non-linearly limiting a rate of change in said received comparison signal, and providing a corresponding open loop power level control signal; and

second amplifier means operatively coupled to said transmitter for, receiving said open loop power level control signal, and amplifying said inbound spread spectrum signal at a second gain determined by said open loop power level control signal.

13. The transceiver of Claim 12 wherein said receiver has an analog receiver portion and a digital receiver portion, said automatic gain control means coupled to said analog receiver portion for measuring wideband signal power of all received outbound spread spectrum signals.

14. The transceiver of Claim 12 wherein said filter means provides a rate of change in increases of said comparison signal that is greater than a rate of change in decreases in said comparison signal.

15. The transceiver of Claim 12 wherein an increase in measured signal power corresponds to an increase in said comparison signal and corresponding open loop power control level signal with said second amplifier means responsive thereto for decreasing said second gain, and a decrease in measured signal power corresponds to a decrease in said comparison signal and corresponding open loop power control level signal with said second amplifier means responsive thereto for increasing said second gain.

16. The transceiver of Claim 13 wherein said digital receiver portion extracts said power adjustment commands from said outbound spread spectrum signal and said control processor means is coupled to said digital receiver portion for receiving said power adjustment commands so as to generate said closed loop power level control signal, wherein each power adjustment command affects a change in said closed loop power level control signal with said first amplifier means responsive to each change in said closed loop power level control signal so as to provide a corresponding change in said first gain.

17. The transceiver of Claim 16 wherein each change in said first gain corresponds to a predetermined dB change in gain of said transmitter.

18. A system for controlling transmission power of a first transceiver capable of transmitting information signals of a first user, using spread spectrum communication signals, to a second transceiver for transfer to a second user, and capable of extracting information signals of a second user transmitted to said first transceiver by said second transceiver, also using spread spectrum communication signals, said system comprising:

open loop power control means operatively coupled to said first transceiver for controlling signal power of said first transceiver transmitted spread spectrum communication signals in opposite correspondence to variations in signal power of first transceiver received spread spectrum communication signals; and

closed loop power control means operatively coupled to said first and second transceiver for further controlling signal power of said first transceiver transmitted spread spectrum communication signals in opposite correspondence to variations in signal power of second transceiver received spread spectrum communication signals.

19. The system of Claim 18 wherein said open loop power control means provides increases in signal power at a rate less than decreases in signal power.

20. The system of Claim 18 wherein said open loop power control means provides increases in signal power at a rate less than said closed loop power control means provides decreases in signal power.

21. The system of Claim 18 wherein said open loop power control means compensates for variations in channel conditions affecting signal power in a second transceiver to first transceiver communication channel.

22. The system of Claim 18 wherein said closed loop power control means compensates for variations in channel conditions affecting signal power in a first transceiver to second transceiver communication

channel.

23. The system of Claim 18 wherein said open loop power control means comprises:

means for measuring signal power of first transceiver received spread spectrum communication signals; and

means for adjusting signal power, of said first transceiver transmitted spread spectrum communication signals, in opposite correspondence to deviations in said first transceiver measured signal power with respect to a predetermined transmission power level.

24. The system of Claim 18 wherein said closed loop power control means comprises:

means for measuring signal power of second transceiver received spread spectrum communication signals transmitted by said first transceiver;

means for generating power adjustment commands in opposite correspondence to deviations in said second transceiver measured signal power with respect to a desired reception power level;

means for inserting said power adjustment commands in said spread spectrum communication signals as transmitted by said second transceiver to said first transceiver ; and

means for further adjusting signal power of said first transceiver transmitted spread spectrum communication signals in correspondence with said power adjustment commands as received by said first transceiver.

25. The system of Claim 23 wherein said closed loop power control means comprises:

means for measuring signal power of second transceiver received spread spectrum communication signals transmitted by said first transceiver;

means for generating power adjustment commands in opposite correspondence to deviations in said second transceiver measured signal power with respect to a desired reception power level;

means for inserting said power adjustment commands in said spread spectrum communication signals as transmitted by said second transceiver to said first transceiver ; and

means for further adjusting signal power of said first transceiver transmitted spread spectrum communication signals in correspondence with said power adjustment commands as received by said first transceiver.

26. The system of Claim 25 wherein said means for measuring signal power of first transceiver received spread spectrum communication signals measures wideband signal power, and said means for measuring signal power of second transceiver received spread spectrum communication signals transmitted by said first transceiver digitally measures narrowband signal power.

27. The system of Claim 18 further comprising additional closed loop power control means operatively coupled to said first and second transceiver for controlling signal power of said second transceiver transmitted spread spectrum communication signals in opposite correspondence to variations of a measured ratio, of signal power of first transceiver received spread spectrum communication signals to a signal power of interfering signals, with respect to a desired ratio.

28. The system of Claim 27 wherein said additional closed loop power control means comprises:

means for, measuring signal power of all first transceiver received spread spectrum communication signals including other transceiver transmitted spread spectrum communication signals and multipath signals of said spread spectrum communication signals transmitted by said second transceiver, measuring signal power of first transceiver received spread spectrum communication signals as transmitted by said second transceiver, comparing said measured signal power of first transceiver received spread spectrum communication signals as transmitted by said second transceiver with said measured signal power of all first transceiver received spread spectrum communication signals so as to provide a

signal-to-interference ratio value, generating power adjustment requests in opposite correspondence to deviations in said signal-to-interference ratio value with respect to a desired predetermined signal-to-interference ratio value, and inserting said power adjustment requests in said spread spectrum communication signals as transmitted by said first transceiver to said second transceiver; and

means for adjusting signal power of said second transceiver transmitted spread spectrum communication signals in correspondence with said power adjustment requests as received by said second transceiver.

29. A method for controlling transmission power of a first transceiver capable of communicating information signals of a first user, using spread spectrum communication signals, to a second transceiver for transfer to a second user and capable of extracting information signals of a second user communicated to said first transceiver by said second transceiver using said spread spectrum communication signals, said method comprising the steps of:

controlling signal power of said first transceiver transmitted spread spectrum communication signals in opposite correspondence to variations in signal power of first transceiver received spread spectrum communication signals ; and

controlling signal power of said first transceiver transmitted spread spectrum communication signals in opposite correspondence to variations in signal power of second transceiver received spread spectrum communication signals.

30. The method of Claim 29 wherein said step of controlling signal power of said first transceiver transmitted spread spectrum communication signals in opposite correspondence to variations in signal power of first transceiver received spread spectrum communication signals comprises the steps of :

measuring signal power of first transceiver received spread spectrum communication signals; and

adjusting signal power, of said first transceiver transmitted spread

spectrum communication signals, in opposite correspondence to deviations in said first transceiver measured signal power with respect to a predetermined transmission power level.

31. The system of Claim 29 wherein said step of controlling signal power of said first transceiver transmitted spread spectrum communication signals in opposite correspondence to variations in signal power of second transceiver received spread spectrum communication signals comprises the steps of:

measuring signal power of second transceiver received spread spectrum communication signals transmitted by said first transceiver;

generating power adjustment commands in opposite correspondence to deviations in said second transceiver measured signal power with respect to a desired reception power level;

inserting said power adjustment commands in said spread spectrum communication signals as transmitted by said second transceiver to said first transceiver ; and

adjusting signal power of said first transceiver transmitted spread spectrum communication signals in correspondence with said power adjustment commands as received by said first transceiver.

32. The system of Claim 30 wherein said step of controlling signal power of said first transceiver transmitted spread spectrum communication signals in opposite correspondence to variations in signal power of second transceiver received spread spectrum communication signals comprises the steps of:

measuring signal power of second transceiver received spread spectrum communication signals transmitted by said first transceiver;

generating power adjustment commands in opposite correspondence to deviations in said second transceiver measured signal power with respect to a desired reception power level;

inserting said power adjustment commands in said spread spectrum communication signals as transmitted by said second transceiver to said first transceiver; and

adjusting signal power of said first transceiver transmitted spread

spectrum communication signals in correspondence with said power adjustment commands as received by said first transceiver.

33. The method of Claim 29 further comprising the step of controlling signal power of said second transceiver transmitted spread spectrum communication signals in opposite correspondence to variations of a measured ratio, of signal power of first transceiver received spread spectrum communication signals to a signal power of interfering signals, with respect to a desired ratio.

34. The system of Claim 33 wherein said step of controlling signal power of said second transceiver transmitted spread spectrum communication signals comprises the steps of:

measuring signal power of all first transceiver received spread spectrum communication signals including other transceiver transmitted spread spectrum communication signals and multipath signals of said spread spectrum communication signals transmitted by said second transceiver;

measuring signal power of first transceiver received spread spectrum communication signals as transmitted by said second transceiver;

comparing said measured signal power of first transceiver received spread spectrum communication signals as transmitted by said second transceiver with said measured signal power of all first transceiver received spread spectrum communication signals so as to provide a signal-to-interference ratio value;

generating power adjustment requests in opposite correspondence to deviations in said signal-to-interference ratio value with respect to a desired signal-to-interference ratio value;

inserting said power adjustment requests in said spread spectrum communication signals as transmitted by said first transceiver to said second transceiver; and

adjusting signal power of said second transceiver transmitted spread spectrum communication signals in correspondence with said power adjustment requests as received by said second transceiver.

35. In a cellular mobile telephone system in which system users communicate information signals between one another via at least one cell-site using code division multiple access (CDMA) spread spectrum communication signals, a method for controlling transmission signal power for each mobile telephone in said cellular mobile telephone system, wherein each mobile telephone has an antenna, transmitter and receiver, and each cell-site has an antenna, at least one transmitter and at least one receiver, said method comprising the steps of:

measuring signal power in CDMA communication signals received by each respective mobile telephone receiver;

varying transmission signal power of each corresponding mobile telephone transmitter in opposite correspondence to variations in corresponding mobile telephone power measurements with respect to a first predetermined power level;

measuring signal power in each CDMA communication signal received at each respective cell-site receiver as transmitted from a corresponding mobile telephone transmitter in communication therewith;

generating power adjustment commands corresponding to deviations in corresponding cell-site power measurements from a second predetermined power level;

transmitting said power adjustment commands along with said information signals from each respective cell-site to a corresponding mobile telephone in communication therewith;

receiving at each respective mobile telephone receiver said power adjustment commands corresponding thereto; and

adjusting transmission signal power of each corresponding mobile telephone transmitter in correspondence to said power adjustment commands directed to said respective mobile telephone receiver.

36. The method of Claim 35 wherein said step of varying transmission signal power of each corresponding mobile telephone transmitter in opposite correspondence to variations in corresponding mobile telephone power measurements with respect to a first

predetermined power level further comprises the step of:

limiting a rate of increase in transmission signal power of each corresponding mobile telephone transmitter less than a rate of decrease in transmission signal power of each corresponding mobile telephone transmitter.

37. The method of Claim 35 wherein said step of varying transmission signal power of each corresponding mobile telephone transmitter in opposite correspondence to variations in corresponding mobile telephone power measurements with respect to a first predetermined power level comprises the steps of:

providing an increase in transmission signal power of each corresponding mobile telephone transmitter in response to a decrease in a corresponding mobile telephone power measurement with respect to said first predetermined power level; and

providing an decrease in transmission signal power of each corresponding mobile telephone transmitter in response to an increase in a corresponding mobile telephone power measurement with respect to said first predetermined power level.

38. The method of Claim 35 wherein said step of generating power adjustment commands corresponding to deviations in corresponding cell-site power measurements from a second predetermined power level comprises the steps of:

generating a power-up command in response to a decrease in a corresponding cell-site power measurement from said second predetermined power level; and

generating a power-down command in response to an increase in a corresponding cell-site power measurement from said second predetermined power level.

39. The method of Claim 38 wherein said step of adjusting transmission signal power of each corresponding mobile telephone transmitter in correspondence to said power adjustment commands directed to said respective mobile telephone receiver comprises the steps

of:

increasing mobile telephone transmitter signal in response to each power-up command; and

decreasing mobile telephone transmitter signal in response to each power-down command.

40. The method of Claim 37 wherein said step of generating power adjustment commands corresponding to deviations in corresponding cell-site power measurements from a second predetermined power level comprises the steps of:

generating a power-up command in response to a decrease in a corresponding cell-site power measurement from said second predetermined power level; and

generating a power-down command in response to an increase in a corresponding cell-site power measurement from said second predetermined power level.

41. The method of Claim 40 wherein said step of adjusting transmission signal power of each corresponding mobile telephone transmitter in correspondence to said power adjustment commands directed to said respective mobile telephone receiver comprises the steps of:

increasing mobile telephone transmitter signal in response to each power-up command; and

decreasing mobile telephone transmitter signal in response to each power-down command.

42. The method of Claim 35 wherein in said step of measuring signal power in CDMA communication signals received by each respective mobile telephone receiver, measured signal power corresponds to a sum of all contemporaneously received CDMA communication signals within a predetermined frequency band.

43. The method of Claim 35 further comprising the step of generating a first power measurement signal corresponding to said

measured signal power in CDMA communication signals received by each respective mobile telephone receiver.

44. The method of Claim 43 wherein said step of varying transmission signal power of each corresponding mobile telephone transmitter in opposite correspondence to variations in corresponding mobile telephone power measurements with respect to a first predetermined power level comprises the steps of:

comparing said first power measurement signal with a first power level set signal, said first power level set signal corresponding to a desired mobile telephone transmitter power level;

providing a comparator output signal corresponding to a difference between said first power measurement signal and said first power level set signal; and

varying mobile telephone transmitter gain according to said comparator output signal.

45. A method for controlling transmission signal power in a cellular mobile telephone in communications with at least one cell-site station using code division multiple access (CDMA) spread spectrum communication signals, said cellular mobile telephone having an antenna coupled to a transmitter and a receiver, said transmitter for generating and transmitting a CDMA carrier signal according to an assigned spreading function modulated by a mobile user input information signal, said receiver for receiving CDMA communication signals and spectrum processing said received CDMA communication signals according to an assigned spreading function so as to recover a mobile user output information signal intended for a user of said cellular mobile telephone, said cell-site station communicating power control commands in CDMA communication signals intended for said cellular mobile telephone with said receiver processing said received power control commands and providing an output of said power control commands, said method comprising the steps of:

measuring combined signal power in contemporaneously received CDMA communication signals;

varying transmitter signal power in opposite correspondence to variations in measured signal power about a predetermined power level; and

varying transmitter signal power in correspondence to received power adjustment commands.

46. The method of Claim 45 wherein said step of varying transmitter signal power in opposite correspondence to variations in measured signal power about a predetermined power level comprises the steps of:

increasing transmitter signal power in response to decreases in measured signal power with respect to said predetermined power level; and

decreasing transmitter signal power in response to increases in measured signal power with respect to said predetermined power level.

47. The method of Claim 46 wherein increases in transmitter signal power are at a rate less than decreases in transmitter signal power.

48. The method of Claim 45 wherein said cell-site station measures signal power of said cellular mobile telephone transmitted CDMA communication signals and generates for transmission said power adjustment commands indicative of one of an increase and a decrease in said cellular mobile telephone signal power so as to maintain a predetermined power level for cell-site station received CDMA communication signals from said cellular mobile telephone.

49. The apparatus of Claim 45 wherein said step of measuring combined signal power in contemporaneously received CDMA communication signals further comprises the step of generating a measurement signal indicative of measured signal power, and wherein said step of varying transmitter signal power in opposite correspondence to variations in measured signal power about a predetermined power level comprises the steps of:

generating a first power level set signal corresponding to a desired

cellular mobile telephone transmitter power level;

comparing said first power measurement signal with said first power level set signal;

providing a comparator output signal corresponding to a difference between said desired cellular mobile telephone transmitter power level and said measured signal power;

limiting a rate of change in variations in said comparator output signal;

providing a corresponding limited comparator output signal; and

varying signal power of said transmitter in response to said limited comparator output signal.

50. The apparatus of Claim 49 wherein said step of varying transmitter signal power in correspondence to received power adjustment commands comprises the steps of:

accumulating said processed power adjustment commands with a predetermined gain control level setting;

providing a power adjustment signal corresponding to said accumulation of said processed power adjustment commands with said predetermined gain control level setting; and

varying signal power of said transmitter in response to said power adjustment signal.

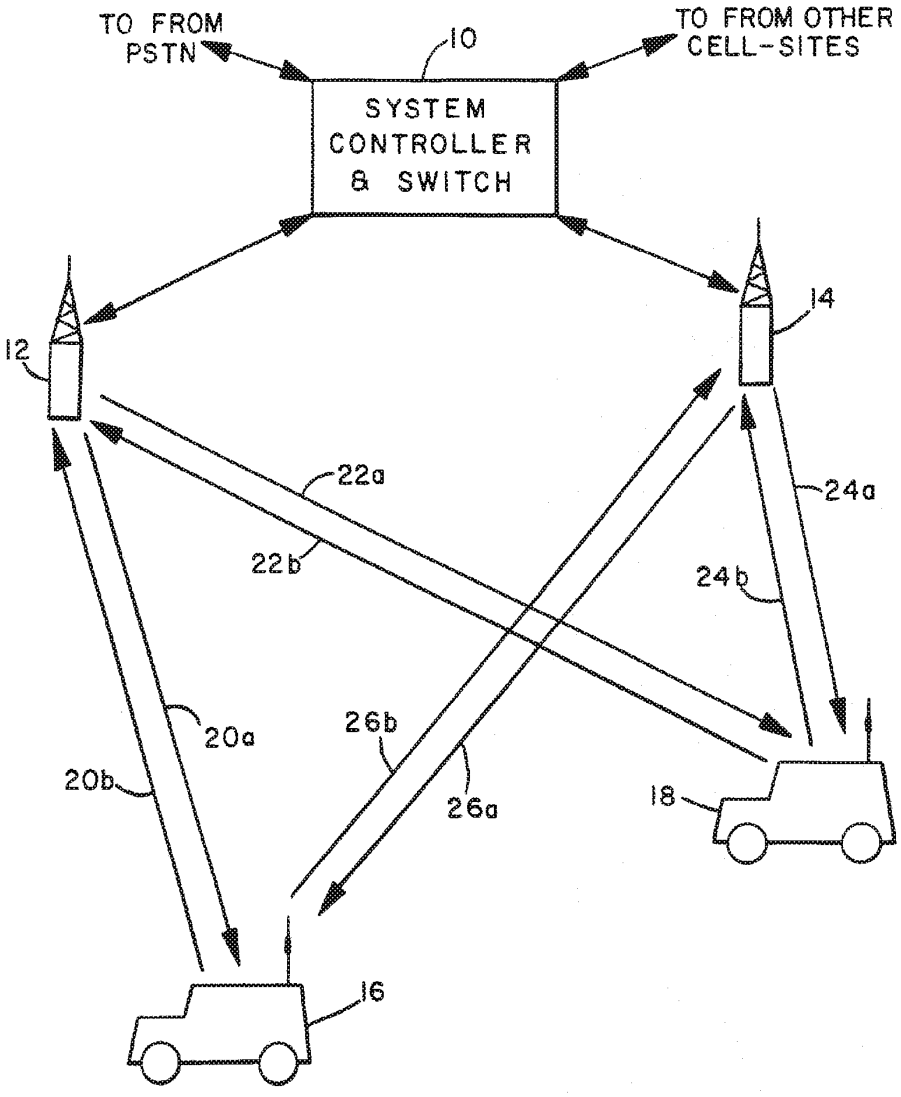

TO FROM PSTN
10
TO FROM OTHER CELL-SITES
SYSTEM CONTROLLER & SWITCH
12
14
22a
22b
24a
24b
20a
20b
26b
26a
18
16

FIG. 1

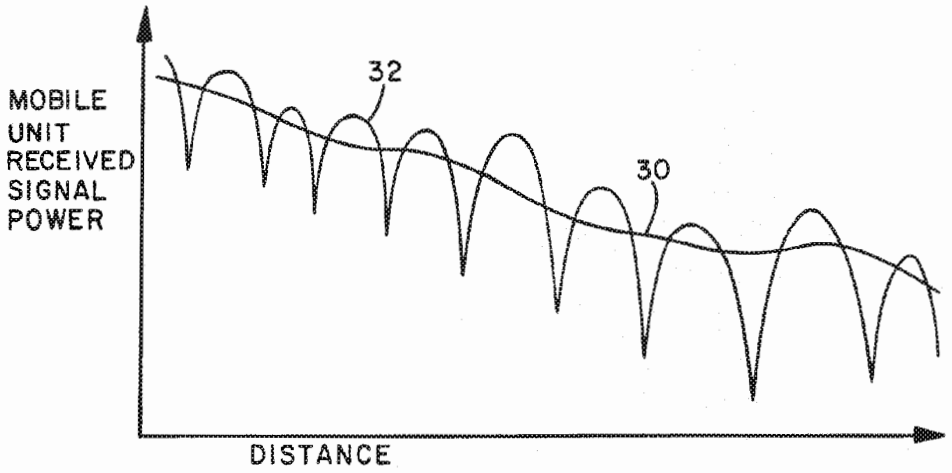

MOBILE
UNIT
RECEIVED
SIGNAL
POWER
32
30
DISTANCE

FIG. 2A

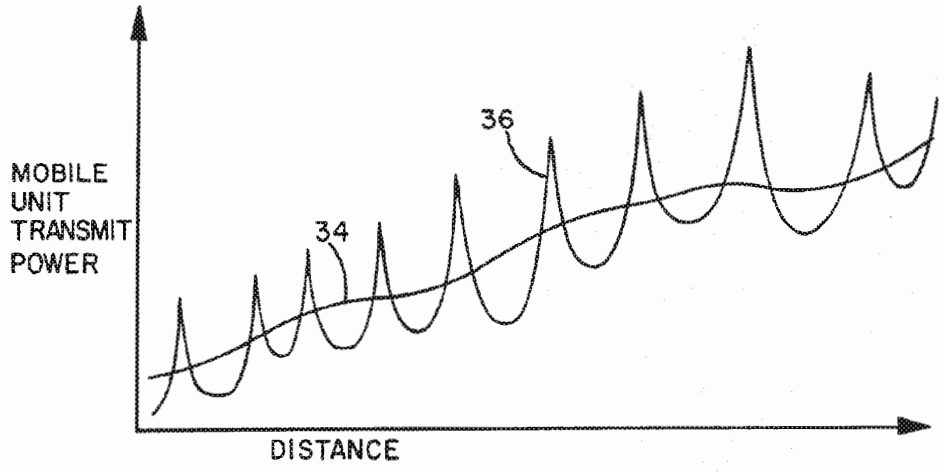

MOBILE
UNIT
TRANSMIT
POWER
36
34
DISTANCE

FIG. 2B

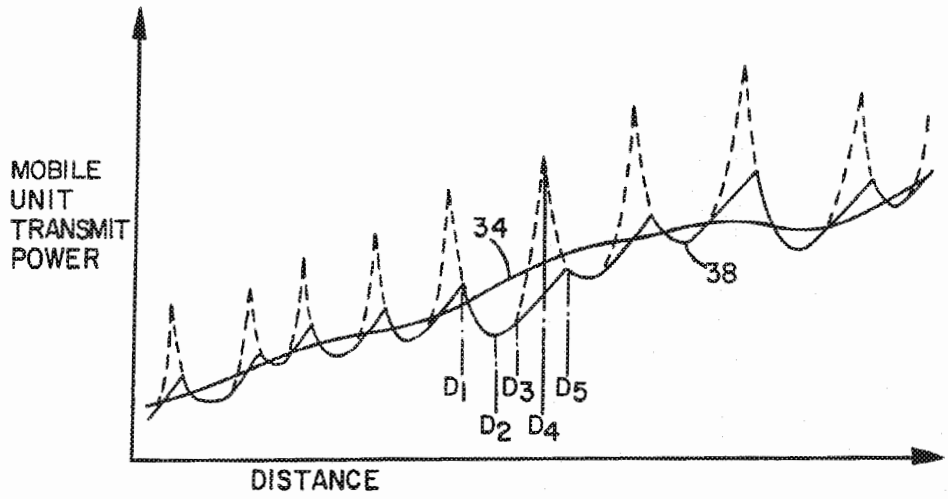

MOBILE
UNIT
TRANSMIT
POWER
34
38
D1
D2
D3
D4
D5
DISTANCE

FIG. 2C

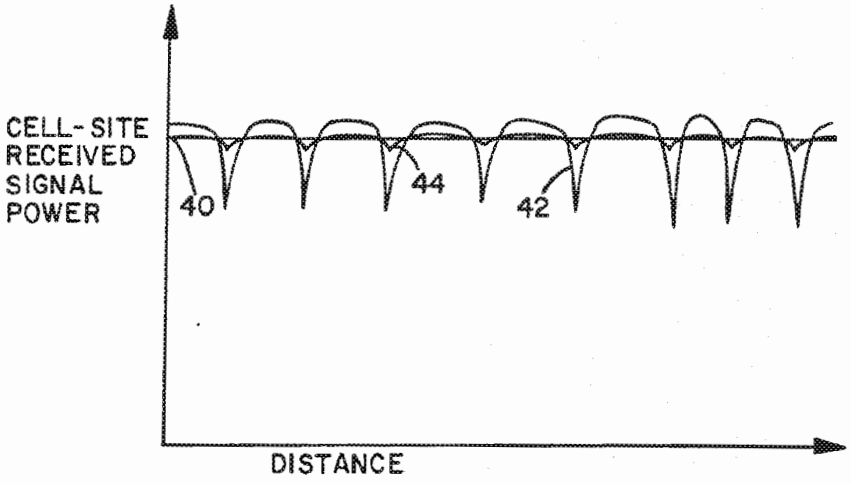

CELL-SITE
RECEIVED
SIGNAL
POWER
40
44
42
DISTANCE

FIG. 2D

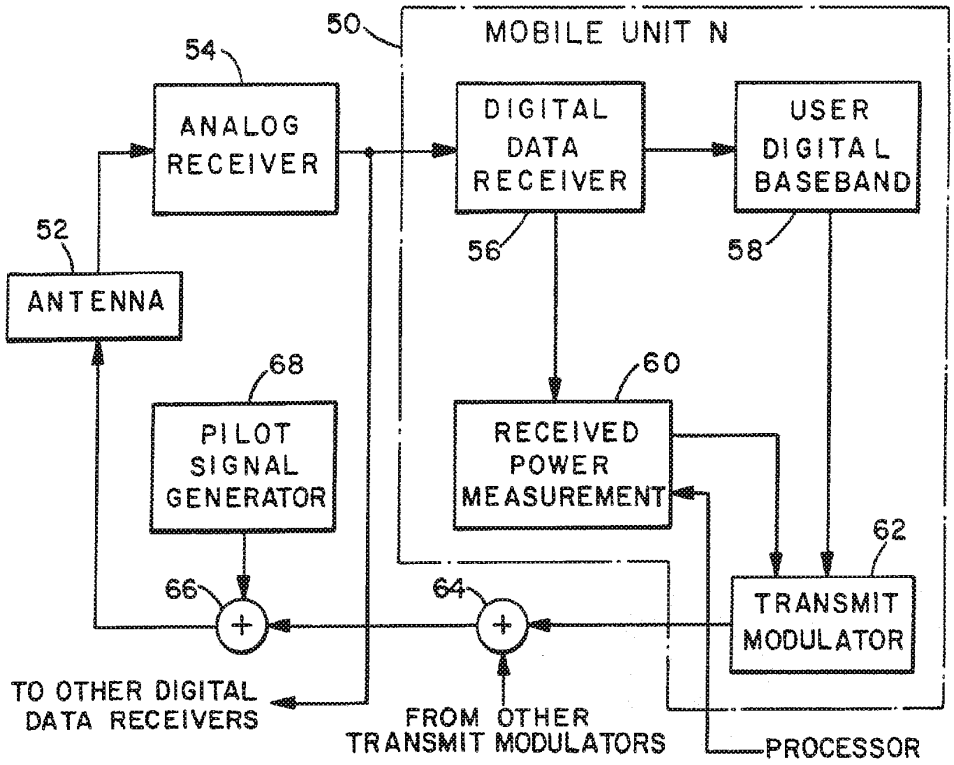

50
MOBILE UNIT N
54
ANALOG RECEIVER
DIGITAL DATA RECEIVER
USER DIGITAL BASEBAND
52
ANTENNA
56
58
68
PILOT SIGNAL GENERATOR
60
RECEIVED POWER MEASUREMENT
62
66
64
TRANSMIT MODULATOR
TO OTHER DIGITAL DATA RECEIVERS
FROM OTHER TRANSMIT MODULATORS
PROCESSOR

FIG. 3

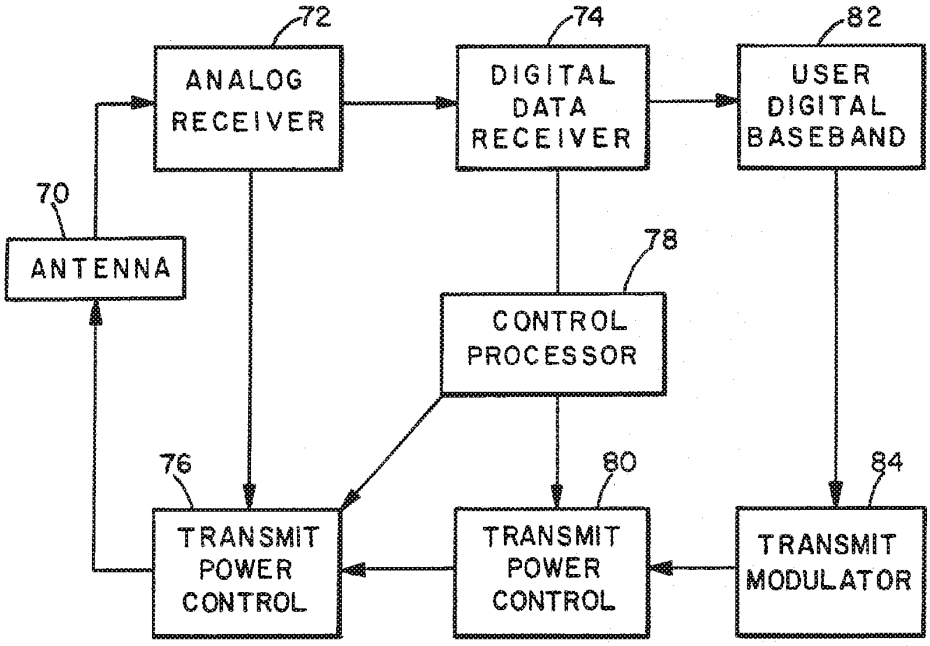

72
74
82
ANALOG RECEIVER
DIGITAL DATA RECEIVER
USER DIGITAL BASEBAND
70
ANTENNA
78
CONTROL PROCESSOR
76
80
84
TRANSMIT POWER CONTROL
TRANSMIT POWER CONTROL
TRANSMIT MODULATOR

FIG. 4

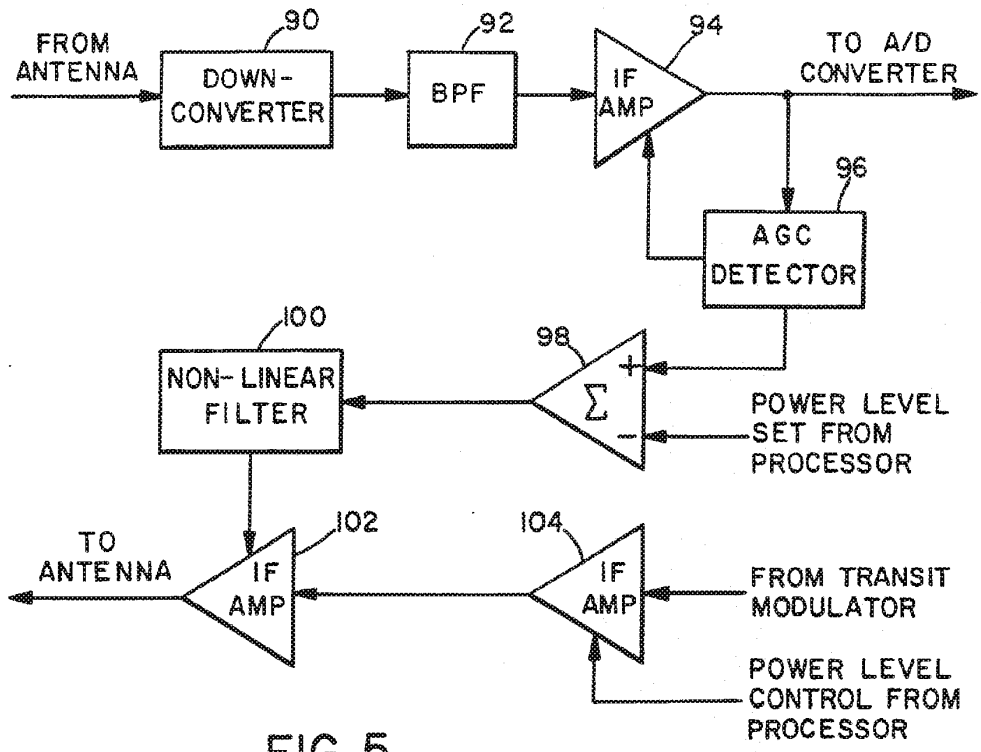

FROM ANTENNA
90
DOWN-CONVERTER
92
BPF
94
IF AMP
TO A/D CONVERTER
96
AGC DETECTOR
100
NON-LINEAR FILTER
98
Σ
+
-
POWER LEVEL SET FROM PROCESSOR
TO ANTENNA
102
IF AMP
104
IF AMP
FROM TRANSIT MODULATOR
POWER LEVEL CONTROL FROM PROCESSOR

FIG. 5

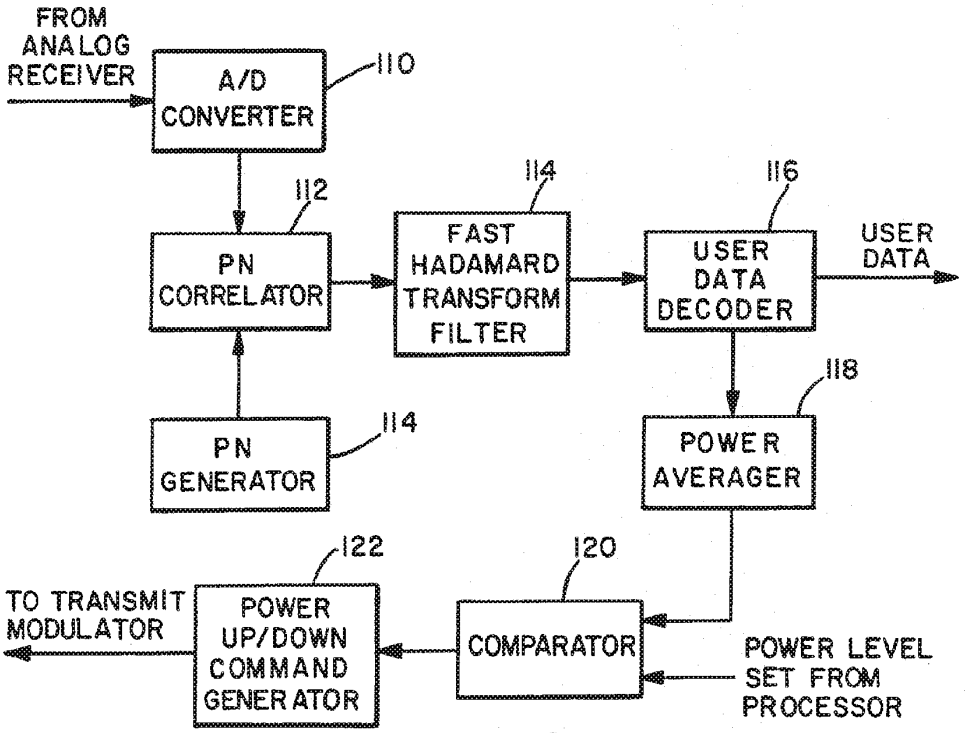

FROM ANALOG RECEIVER
A/D CONVERTER
110
112
PN CORRELATOR
114
FAST HADAMARD TRANSFORM FILTER
116
USER DATA DECODER
USER DATA
PN GENERATOR
114
118
POWER AVERAGER
122
120
TO TRANSMIT MODULATOR
POWER UP/DOWN COMMAND GENERATOR
COMPARATOR
POWER LEVEL SET FROM PROCESSOR

FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US90/06418

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): H04L 27/30
U.S. Cl. 375/1

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	375/1 380/33,34 455/33,54,56,59 370/18,50 379/58,59

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4,641,322 Published 03 February 1987, HASEGAWA	1-50
X	US, A, 4,811,421 Published 07 March 1989, HAVEL et al.	12-34

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
07 January 1991	12 FEB 1991
International Searching Authority	Signature of Authorized Officer
ISA/US	Bernarr Earl Gregory

Form PCT/ISA/210 (second sheet) (Rev. 11-87)

Electronic Patent Application Fee Transmittal

Application Number:	14713719
Filing Date:	15-May-2015
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Filer:	Harry Vartanian/Elizabeth McGinty
Attorney Docket Number:	IPW2-USCN207446

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($)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt	
EFS ID:	25229510
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Elizabeth McGinty
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	17-MAR-2016
Filing Date:	15-MAY-2015
Time Stamp:	16:28:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1200
RAM confirmation Number	3303
Deposit Account	220493
Authorized User	VARTANIAN, HARRY
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 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	Request for Continued Examination (RCE)	IPW2-USCN207446-RCE_Transmittal-20160317.PDF	1364575 a98bbb28679d306c7c3f821cc68e4fce5f7c201b	no	3
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	IPW2-USCN207446-IDS_SB08-20160317.PDF	1035311 85fb20acb085428d4fd315f97570f227aec43af3	no	4
Warnings:					
Information:					
3	Foreign Reference	CN1159720A.PDF	1571798 03c9d552a921220b3deeb6a990269190908adc9e	no	27
Warnings:					
Information:					
4	Foreign Reference	WO9107037A1.PDF	6649618 592fba5398da69fac56aefe2f711c745f93288ee	no	51
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30806 5a7fedcda51692ba757e7f1be46d2f97cdd04d57	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	10652108		

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

3624 7590 12/17/2015

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER
REGO, DOMINIC E

ART UNIT	PAPER NUMBER
2647	

DATE MAILED: 12/17/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

TITLE OF INVENTION: POWER CONTROL 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	03/17/2016

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.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

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

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

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

3624 7590 12/17/2015
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.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

TITLE OF INVENTION: POWER CONTROL 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	03/17/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
REGO, DOMINIC E	2647	455-509000

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.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

3624 7590 12/17/2015

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER	
REGO, DOMINIC E	
ART UNIT	PAPER NUMBER
2647	

DATE MAILED: 12/17/2015

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. 14/713,719	Applicant(s) ANDERSON, NICHOLAS W.	
	Examiner DOMINIC E. REGO	Art Unit 2647	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 *10/30/2015*.
   ☐ 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 *1,2,4-6,8-10,12,13.15 and 16*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

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

   * Certified copies not received: _____.

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

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

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

Attachment(s)

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

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

DETAILED ACTION

Allowable Subject Matter

2. Claims 1, 2, 4-6, 8-10, 12, 13, 15, and 16 are allowed for the same reasons presented in the Patented Application #10/917,968, Patent No. 8,897,828 and updated search report.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DOMINIC E. REGO whose telephone number is (571)272-8132. The examiner can normally be reached on Monday-Friday, 9:00 am-5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay A. Maung can be reached on 571-272-7882. 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.

/DOMINIC E REGO/
Primary Examiner, Art Unit 2647
Tel 571-272-8132

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14713719
Filing Date	2015-05-15
First Named Inventor	Nicholas W. Anderson
Art Unit	2647
Examiner Name	Dominic E. Rego
Attorney Docket Number	IPW2-USCN207446

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5719583	B1	1998-02-17	Kanai	
	2	5887245	B1	1999-03-23	Lindroth et al.	
	3	6085106	B1	2000-07-04	Sedonaris et al.	
	4	6137993	B1	2000-10-24	Almgren et al.	
	5	6442398	B1	2002-08-27	Padovani et al.	
	6	6512931	B1	2003-01-28	Kim et al.	
	7	6597723	B1	2003-07-22	Zeira et al.	
	8	6628956	B2	2003-09-30	Bark et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.R./

Ets Web2.1-rz

Receipt date: 09/24/2015	Application Number	14713719 14713719 - GAU: 2647
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2015-05-15
(Not for submission under 37 CFR 1.99)	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	9	6823194	B2	2004-11-23	Haim	
	10	6983166	B2	2006-01-03	Shiu et al.	
	11	7190688	B1	2007-03-13	Kamel et al.	
	12	7277721	B2	2007-10-02	Okumura et al.	* Corresponds to
	13	8134994	B2	2012-03-13	Liu et al.	* Corresponds to

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

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010036823	A1	2001-11-01	Van Lieshout et al.	
	2	20030032411	A1	2003-02-13	Kim et al.	
	3	20030103530	A1	2003-06-05	Durastante	
	4	20030134655	A1	2003-07-17	Chen et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.R./

Ets-web2-fr

Receipt date: 09/24/2015	Application Number	14713719 14713719 - GAU: 2647
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2015-05-15
(Not for submission under 37 CFR 1.99)	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	5	20040137860	A1	2004-07-15	Oh et al.	
	6	20040141483	A1	2004-07-22	Zeira et al.	
	7	20040162093	A1	2004-08-19	Bevan et al.	
	8	20040171387	A1	2004-09-02	Miyoshi et al.	
	9	20040190485	A1	2004-09-30	Khan	* Corresponds to
	10	20040203987	A1	2004-10-14	Butala	
	11	20050003846	A1	2005-01-06	Anderson	
	12	20050025056	A1	2005-02-03	Chen et al.	
	13	20050041673	A1	2005-02-24	Jiang et al.	
	14	20050130690	A1	2005-06-16	Shinozaki	
	15	20050136961	A1	2005-06-23	Simonsson et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.R./

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TESLA, INC.

Receipt date: 09/24/2015	Application Number	14713719 14713719 - GAU: 2647
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2015-05-15
(Not for submission under 37 CFR 1.99)	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	16	20050176455	A1	2005-08-11	Krishnan et al.	
	17	20050207359	A1	2005-09-22	Hwang et al.	
	18	20070081492	A1	2007-04-12	Petrovic et al.	
	19	20090028111	A1	2009-01-29	Chao et al.	
	20	20050073973	A1	2005-04-07	LaRoia et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1071227	EP	A2	2001-01-24	Usuda et al.		☐
	2	1176739	EP	A1	2002-01-30	Hayashi et al.		☐
	3	1367740	EP	A1	2003-12-03	Zeira et al.		☐
	4	2350522	GB	A1	2000-11-29	Hulbert et al.		☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.R./

Ets-web2-fr

Receipt date: 09/24/2015	Application Number	14713719 14713719 - GAU: 2647
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	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	5	2004040187	JP	A2	2004-02-05	Miya et al.		☐
	6	199631009	WO	A1	1996-10-03	Otten		☐
	7	199907105	WO	A2	1999-02-11	Larsen et al.		☐
	8	200057574	WO	A1	2000-09-28	Zeira et al.		☐
	9	200108322	WO	A1	2001-02-01	Simonsson et al.		☐
	10	200184740	WO	A2	2001-11-08	Zeira et al.		☐
	11	2003010903	WO	A1	2003-02-06	Okumura et al.		☐
	12	2003036816	WO	A1	2003-05-01	Anderson		☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	"Recommendation ITU-R M.1225: Guidelines for Evaluation of Radio Transmission Technologies for IMT-2000," International Telecommunication Union/ITU Radiocommunication Sector, January 1, 1997, Rec. ITU-R M.1225, pp. 1-61.	☐

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/Dominic E. Rego/ Examiner, Art Unit 2647

Receipt date: 09/24/2015	Application Number	14713719 14713719 - GAU: 2647
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
(Not for submission under 37 CFR 1.99)	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	2	Communication pursuant to Article 94(3) EPC from European Patent Application No. 05 801 370.7-1246 dated December 30. 2009.	☐
	3	European Search Report Dated December 2, 2010 from European Application No. 10185576.5- 1246.	☐
	4	Great Britain Search Report mailed May 14, 2002, for Great Britain Application No. 0125504.1 filed October 24, 2001, 1 page.	☐
	5	International Search Report mailed December 22, 2005, for PCT Application No. PCT/EP2005/053931 filed August 10, 2005, 4 pages.	☐
	6	International Search Report mailed January 21, 2003, for PCT Application No. PCT/GB02/04811 filed October 24, 2002, 3 pages.	☐
	7	Office Action for Japanese Application No. 2007-525302, issued March 13, 2012 (A copy of the office action and its English machine translation have been provided).	☐
	8	THIRD GENERATION PARTNERSHIP PROJECT, Technical Specification Group Radio Access Network; Feasibility Study on Uplink Enhancements for UTRA TDD; (Release 6); 3GPP TR 25.804 V6.0.0 (2005-03)	☐
	9	NON-FINAL REJECTION, U.S. Patent Application No. 13/726,976, dated May 22, 2014.	☐
	10	OFFICE ACTION, Japanese Patent Application No. 2011-234218, dated December 6, 2012.	☐
	11	OFFICE ACTION, Japanese Patent Application No. 2011-234218, dated December 6, 2012.	☐
	12	NON-FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated June 18, 2014.	☐

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TESLA, INC.

Receipt date: 09/24/2015	Application Number	14713719 14713719 - GAU: 2647
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2015-05-15
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	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	13	FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated January 8, 2010.	☐
	14	NON-FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated March 31, 2009.	☐
	15	FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated August 1, 2008.	☐
	16	REQUIREMENT FOR RESTRICTION/ELECTION, U.S. Patent Application No. 10/917,968, dated March 19, 2008.	☐
	17	NON-FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated July 2, 2007.	☐
	18	NON-FINAL REJECTION, U.S. Patent Application No. 13/727,153, dated May 22, 2014.	☐
	19	NOTICE OF ALLOWANCE, U.S. Patent Application No. 13/727,153, dated September 10, 2014.	☐
	20	NOTICE OF ALLOWANCE, U.S. Patent Application No. 13/727,153, dated February 6, 2015.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Dominic Rego/	Date Considered	12/13/2015

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

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.R./

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TESLA, INC.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L10	5	(resource with allocat$3 same power with command$3 same power with level same (path$loss path near2 loss)).clm.	US-PGPUB; USPAT	OR	ON	2015/12/13 13:51
L11	4	(down$link forward$link forward near2 link) near5 (physical near2 channel) same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) with power near2 level same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:54
L12	4	11 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/12/13 13:55
L13	4	12 AND ((H04W52/06 OR H04W52/08 OR H04W52/10 OR H04W52/12 OR H04W52/221 OR H04W52/24 OR H04W52/241 OR H04W52/242 OR H04W52/243 OR H04W72/0473 OR H04W72/1268 OR H04W72/1289).CPC.)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:56
L14	5	(down$link forward$link forward near2 link) with channel same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) same power near2 level same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:56
L15	13535	(down$link forward$link forward near2 link) near5 (physical near2 channel)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:56
L16	2691	L15 same resource near5 allocat$3	US-PGPUB; USPAT	OR	ON	2015/12/13 13:56
L17	546	L16 same (power near3 command$3 tpc)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:56
L18	4	L17 same (up$link reverse$link reverse near link) with power near2 level	US-PGPUB; USPAT	OR	ON	2015/12/13 13:56
L19	4	L17 same power near2 level	US-PGPUB; USPAT	OR	ON	2015/12/13 13:57
L20	60600	(physical near2 channel)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:57
L21	1870	L20 same (up$link reverse$link reverse near link) with resource near3 allocat$3	US-PGPUB; USPAT	OR	ON	2015/12/13 13:57
L22	443	L21 same (power near3 command$3 tpc)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:57
L23	6	L22 same power near2 level	US-	OR	ON	2015/12/13

			PGPUB; USPAT			13:57
L24	7	L22 same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:57
L25	5	24 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/12/13 13:57
L26	4	(down$link forward$link forward near2 link) near5 (physical near2 channel) same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) with power near2 level same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:58
L27	5	(down$link forward$link forward near2 link) with channel same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) same power near2 level same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:58
L28	13535	(down$link forward$link forward near2 link) near5 (physical near2 channel)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:58
L29	2691	L28 same resource near5 allocat$3	US-PGPUB; USPAT	OR	ON	2015/12/13 13:58
L30	546	L29 same (power near3 command$3 tpc)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:58
L31	4	L30 same (up$link reverse$link reverse near link) with power near2 level	US-PGPUB; USPAT	OR	ON	2015/12/13 13:58
L32	4	L30 same power near2 level	US-PGPUB; USPAT	OR	ON	2015/12/13 13:58
L33	60600	(physical near2 channel)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L34	1870	L33 same (up$link reverse$link reverse near link) with resource near3 allocat$3	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L35	443	L34 same (power near3 command$3 tpc)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L36	6	L35 same power near2 level	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L37	13535	(down$link forward$link forward near2 link) near5 (physical near2 channel)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L38	2766	L37 same resource with allocat$3	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L39	534	L38 same (power near4 control$4 with command$3 tpc)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L40	2	L39 same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59

L41	37208	455/522,68-70,115.3,126,135,226.3,277.2,422.1,450-453,456.2,464,509,510.ccls. 370/318.ccls.	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L42	32	L41 and L39	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L43	23	L42 and (@ad <= "20101020" @rlad <= "20101020" @pd <= "20101020")	US-PGPUB; USPAT	OR	ON	2015/12/13 13:59
L44	171	(transmi$6 send$3 forward$3 deliver$3 provid$3 broad$cast$3) near6 (tpc transmi$6 near2 power near2 command$3) near5 schedul$3 near2 information	US-PGPUB; USPAT	OR	ON	2015/12/13 14:00
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L46	12	multi$level near3 (tpc transmi$6 near2 power near2 command$3)	US-PGPUB; USPAT	OR	ON	2015/12/13 14:00
L47	8	L46 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/12/13 14:00
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L49	32	48 same power near2 level	US-PGPUB; USPAT	OR	ON	2015/12/13 14:01
L50	2	49 same (path$loss path near2 loss)	US-PGPUB; USPAT	OR	ON	2015/12/13 14:01

12/ 13/ 2015 2:02:33 PM
C:\ Users\ drego\ Documents\ EAST\ Workspaces\ 13727153.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	Art Unit
	DOMINIC E REGO	2647

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	522, 68, 69, 296, 135, 226.3, 277.2, 115.3, 126, 127.1, 127.2, 67.11, 434, 436	6/24/2015	DR
370	331, 320, 335, 342, 318, 392, 252, 276, 280	6/24/2015	DR
375	147, 130	6/24/2015	DR

SEARCH NOTES		
Search Notes	Date	Examiner
EAST, Inventor, and Assignee Search	6/24/2015	DR
Updated above search	12/13/2015	DR

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	PGPUB Text Search-See Interference Search History	12/13/2015	DR

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	**Art Unit**
	DOMINIC E REGO	2647

CPC						
Symbol					**Type**	**Version**
H04W		52	/	242	F	2013-01-01
H04W		52	/	06	I	2013-01-01
H04W		52	/	08	A	2013-01-01
H04W		52	/	10	A	2013-01-01
H04W		52	/	12	A	2013-01-01
H04W		52	/	221	I	2013-01-01
H04W		52	/	24	I	2013-01-01
H04W		52	/	243	A	2013-01-01
H04W		72	/	0473	I	2013-01-01
H04W		52	/	241	I	2013-01-01
H04W		72	/	1268	I	2013-01-01
H04W		72	/	1289	I	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
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			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/DOMINIC E REGO/ Primary Examiner.Art Unit 2647	12/13/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	**Art Unit**
	DOMINIC E REGO	2647

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
455	522	H	0	4	B	7 / 00 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	68	69			

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	12	
/DOMINIC E REGO/ Primary Examiner.Art Unit 2647	12/13/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	**Art Unit**
	DOMINIC E REGO	2647

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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12	13														
	14														
4	15														
8	16														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	12	
/DOMINIC E REGO/ Primary Examiner.Art Unit 2647	12/13/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	180	(nicholas near2 anderson).in.	US-PGPUB; USPAT	OR	ON	2015/12/13 13:50
L4	110	(intellectual near2 ventures near2 holding).as.	US-PGPUB; USPAT	OR	ON	2015/12/13 13:50
L5	4	((down$link forward$link forward near2 link) near5 (physical near2 channel) same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) with power near2 level same (path$loss path near2 loss)).clm.	US-PGPUB; USPAT	OR	ON	2015/12/13 13:50
L6	5	((down$link forward$link forward near2 link) with channel same resource near5 allocat$3 same power with command$3 same (up$link reverse$link reverse near link) same power near2 level same (path$loss path near2 loss)).clm.	US-PGPUB; USPAT	OR	ON	2015/12/13 13:50
L7	4	3 and 5	US-PGPUB; USPAT	OR	ON	2015/12/13 13:51
L8	4	4 and 5	US-PGPUB; USPAT	OR	ON	2015/12/13 13:51
L9	5	3 and 6	US-PGPUB; USPAT	OR	ON	2015/12/13 13:51
L10	5	(resource with allocat$3 same power with command$3 same power with level same (path$loss path near2 loss)).clm.	US-PGPUB; USPAT	OR	ON	2015/12/13 13:51

12/13/2015 1:52:27 PM
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Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	14713719
Filing Date	15-May-2015
First Named Inventor	Nicholas Anderson
Attorney Docket Number	IPW2-USCN207446
Title of Invention	POWER CONTROL IN A WIRELESS NETWORK

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

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Owner	Percent Interest
Intellectual Ventures II LLC	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

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In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
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- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ○ Small Entity ○ Micro Entity ◉ Regular Undiscounted I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 56787 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this request	
Signature	/Harry Vartanian/
Name	Harry Vartanian

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	14713719
Filing Date:	15-May-2015
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Filer:	Harry Vartanian/Elizabeth McGinty
Attorney Docket Number:	IPW2-USCN207446

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Statutory or Terminal Disclaimer	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 14713719

Filing Date: 15-May-2015

Applicant/Patent under Reexamination: Anderson et al.

Electronic Terminal Disclaimer filed on December 8, 2015

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	24293622
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Elizabeth McGinty
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	08-DEC-2015
Filing Date:	15-MAY-2015
Time Stamp:	14:50:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$160
RAM confirmation Number	13059
Deposit Account	220493
Authorized User	VARTANIAN, HARRY
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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

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

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	33560 305d59d32b6865023f85c5161112d4c3f4215b3b	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30700 b423160b4cba3188aa3fea94b60e431bb642fd06	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	64260		

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:	
Nicholas W. Anderson	
Application No.: 14/713,719	
Confirmation No.: 3361	
Filed: May 15, 2015	
For: POWER CONTROL IN A WIRELESS NETWORK	
Group: 2647	
Examiner: Dominic E. Rego	

Our File: IPW2-USCN207446

Date: October 30, 2015

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 filed in response to the Non-Final Office Action dated June 30, 2015 and is submitted in conjunction with an appropriate petition for extension of time.

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 method comprising:

transmitting, by a first network device, ~~a first~~ an indication of a transmission power level of the first network device so that a user equipment (UE) can determine a path loss ~~pathloss~~;

transmitting, by the first network device to the UE, ~~a second~~ an indication of whether accumulation of transmit power control (TPC) commands is enabled;

transmitting, by the first network device on a single channel to the UE, a multilevel TPC command and scheduling information related to a shared uplink channel;

receiving, by the first network device from the UE on the shared uplink channel, an uplink signal, wherein transmission power level of the uplink signal is based on the multilevel TPC command and the path loss determined with the indication of the transmission power level of the first network device; and

~~receiving, by~~ transmitting, by the first network device to a second network device ~~from the first network device~~, data of the uplink signal.

2. (Currently Amended) The method of claim 1[[,]] further comprising:

accumulating, by the UE, TPC commands if the ~~second~~ indication of whether accumulation of TPC commands is enabled indicates accumulation is enabled ~~or does not accumulate TPC commands if the second indication indicates accumulation is not enabled~~.

3. (CANCELED)

4. (Currently Amended) The method of claim 1[[,]] further comprising:

setting, by the UE, uplink transmission power level of the uplink signal based on the multilevel TPC command, a determined path loss ~~pathloss~~, and a format of the uplink signal.

5. (Currently Amended) A wireless system comprising:

a first network device configured to transmit ~~a first~~ an indication of a transmission power level of the first network device so that a user equipment (UE) can determine a path loss ~~pathloss~~;

the first network device is further configured to transmit, to the UE, ~~a second~~ an indication of whether accumulation of transmit power control (TPC) commands is enabled;

the first network device is further configured to transmit, on a single channel to the UE, a multilevel TPC command and scheduling information related to a shared uplink channel;

the first network device is further configured to receive, from the UE on the shared uplink channel, an uplink signal, wherein transmission power level of the uplink signal is based on the multilevel TPC command and the path loss determined with the indication of the transmission power level of the first network device; and

~~a second~~ the first network device is configured to transmit ~~receive~~, ~~from the first~~ to a second network device, data of the uplink signal.

6. (Currently Amended) The wireless system of claim 5 further comprising:

the UE configured to accumulate TPC commands if the ~~second~~ indication of whether accumulation of TPC commands is enabled indicates accumulation is enabled ~~or does not accumulate TPC commands if the second indication indicates accumulation is not enabled~~.

7. (CANCELED)

8. (Currently Amended) The wireless system of claim 5[[,]] further comprising:

the UE is configured to set uplink transmission power level of the uplink signal based on the multilevel TPC command, a determined path loss ~~pathloss~~, and a format of the uplink signal.

9. (Currently Amended) A network device comprising:

~~circuitry~~ a transmitter configured to transmit ~~a first~~ an indication of a transmission power level of the network device so that a user equipment (UE) can determine a path loss ~~pathloss~~;

the ~~circuitry~~ transmitter is further configured to transmit, to the UE, ~~a second~~ an indication of whether accumulation of transmit power control (TPC) commands is enabled;

the ~~circuitry~~ transmitter is further configured to transmit, on a single channel to the UE, a multilevel TPC command and scheduling information related to a shared uplink channel; and

~~the circuitry is further~~ a receiver configured to receive, from the UE on the shared uplink channel, an uplink signal, wherein transmission power level of the uplink signal is based on the multilevel TPC command and the path loss determined with the indication of the transmission power level of the network device.

10. (Currently Amended) The network device of claim 9 further comprising:

the ~~circuitry~~ transmitter is further configured to transmit, to a second network device, data of the uplink signal.

11. (CANCELED)

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

transmitting, by the network device, ~~a first~~ an indication of a transmission power level of the network device so that a user equipment (UE) can determine a path loss ~~pathloss~~;

transmitting, by the network device to the UE, ~~a second~~ an indication of whether accumulation of transmit power control (TPC) commands is enabled;

transmitting, on a single channel to the UE, a multilevel TPC command and scheduling information related to a shared uplink channel; and

receiving, from the UE on the shared uplink channel, an uplink signal, wherein transmission power level of the uplink signal is based on the multilevel TPC command and the path loss determined with the indication of the transmission power level of the network device.

13. (Original) The method of claim 12 further comprising:

transmitting, to a second network device, data of the uplink signal.

14. (CANCELED)

15. (NEW) The method of claim 1, wherein the first network device is any one of a Node-B or a base station and the second network device is any one of a controller, a radio network controller (RNC), or a base station controller.

16. (NEW) The wireless system of claim 5, wherein the first network device is any one of a Node-B or a base station and the second network device is any one of a controller, a radio network controller (RNC), or a base station controller.

REMARKS/ARGUMENTS

After the foregoing Amendment, claims 1, 2, 4-6, 8-10, 12, 13, 15, and 16 are currently pending in this application. Claims 3, 7, 11, and 14 are canceled. Claims 1, 2, 4-6, 8-10 and 12 are amended. New claims 15 and 16 are added.

Examiner Interview

Applicant thanks the Examiner for granting a telephonic interview with the Applicant's representative on August 18, 2015. During the telephonic interview, the 35 U.S.C. 112 and 35 U.S.C. 103 rejections were discussed for the pending and proposed claims. Allowable subject matter from family counterparts was also discussed. No agreement was reached.

Double Patenting Rejection

Claims 1-14 are rejected under the judicially created doctrine of non-statutory obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 8,862,079. Applicant believes that this rejection is an error since U.S. Patent No. 8,862,079 or U.S. App. No. 13/829,992 is owned by LG Electronics Inc. and has claims different than those referenced in the outstanding Office Action. Accordingly, withdrawal of the non-statutory obviousness-type double patenting rejection is respectfully requested.

Claim Rejections - 35 U.S.C. § 112

Claims 1 and 5 are rejected under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The Office Action alleges that "receiving, by a second network device from the first network device, data of the uplink signal" in claim 1 is not found in the specification. Claim 5 was rejected for a similarly recited feature.

Examples of this feature for claims 1 and 5 may be found at least in paragraph [0026] of the specification of the present application filed on May 15, 2015:

> FIGURE 1 shows a block diagram of a wireless communication system. A network 100 may include one or more base station controllers 110, such as a radio network controller (RNC), and one or more base stations 120 and 130, such as a Node-B, wherein each Node-B is connected to an RNC. The network 100 communicates with one or more users 140, 150 through a channel 160, also referred to as a radio link, created between a base station and a user.

Nevertheless, without conceding the propriety of the invention, and in an effort to advance prosecution, claim 1 is amended to read "transmitting, by the first network device to a second network device, data of the uplink signal." Claim 5 is also similarly amended.

Based on the arguments presented above, withdrawal of the 35 U.S.C. § 112 rejection of claims 1 and 5 is respectfully requested.

Claim Rejections - 35 U.S.C. § 103(a)

Claims 1, 2, 4-6, 8, 10, and 13 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over International Publication No. WO 00/57574 to Zeira et al. (hereinafter "Zeira") in view of U.S. Publication No. 2004/0190485 to Khan (hereinafter "Khan") in view of U.S. Publication No. 2001/0036823 to Van Lieshout et al. (hereinafter "Van Lieshout") and further in view of U.S. Publication No. 2012/0113808 to Washburn (hereinafter "Washburn"). Without conceding the propriety of the rejection, and in an effort to advance prosecution, claims 1 and 5 are amended in view of the interview on August 18, 2015. Ziera in view of Khan in view of Van Lieshout and further in view of Washburn, alone or in combination, at least do not teach or suggest "transmitting...an indication of whether accumulation of transmit power control (TPC) commands is enabled; transmitting, by the first network device on a single channel to the UE, a multilevel TPC command and scheduling information related to a shared uplink channel; receiving, by the first network device from the UE on the shared uplink channel, an uplink signal, wherein transmission power level of the uplink signal is based on the multilevel TPC command and the path loss determined with the indication of the transmission power level of the first network device" of amended claim 1.

Amended or previously presented claims 2, 4-6, 8, 10, and 13, although different, are allowable over the cited references for at least the same reasons as

amended claim 1. Based on the arguments presented above, withdrawal of the 35 U.S.C. § 103(a) rejection of claims 1, 2, 4-6, 8, 10, and 13 is respectfully requested.

Claims 3, 7, 11, and 14 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Zeira in view of Khan in view of Van Lieshout in view of Washburn, and further in view of U.S. Patent No. 6,804,512 to Baker et al. (hereinafter "Baker"). Without conceding the propriety of the rejection, and in an effort to advance prosecution, claims 3, 7, 11, and 14 are canceled. Based on the arguments presented above, withdrawal of the 35 U.S.C. § 103(a) rejection of claims 3, 7, 11, and 14 is respectfully requested.

Claims 9 and 12 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Zeira in view of Khan, and further in view of Van Lieshout. Without conceding the propriety of the rejection, and in an effort to advance prosecution, claims 9 and 12 are amended in view of the interview on August 18, 2015. Ziera in view of Khan and further in view of Van Lieshout, alone or in combination, at least do not teach or suggest to "transmit, to the UE, an indication of whether accumulation of transmit power control (TPC) commands is enabled...transmit, on a single channel to the UE, a multilevel TPC command and scheduling information related to a shared uplink channel; and...receive, from the UE on the shared uplink channel, an uplink signal, wherein transmission power level of the uplink signal is based on the multilevel TPC command and the path loss

determined with the indication of the transmission power level of the network device" of amended claim 9.

Amended or previously presented claim 12, although different, is allowable over the cited references for at least the same reasons as amended claim 9. Based on the arguments presented above, withdrawal of the 35 U.S.C. § 103(a) rejection of claims 1, 2, 4-6, 8, 10, and 13 is respectfully requested.

Conclusion

It should also be noted that although arguments have been presented with respect to certain claims herein, the recited subject matter as well as various other subject matter and/or combinations of subject matter may be patentable for other reasons. Further, the failure to address any statement by the Examiner herein should not be interpreted as acquiescence or agreement with such statement. The Applicant expressly reserves the right to set forth additional and/or alternative reasons for patentability and/or allowance with the present application or in any other future proceeding, and to rebut any statement presented by the Examiner in this or other papers during prosecution of the present application.

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, 2, 4-6, 8-10, 12, 13, 15, and 16, is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

Intellectual Ventures Holding 81 LLC

By: /Harry Vartanian/
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Registration No. 56,787

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Facsimile: (215) 568-6499

HV/JMG/eam

Electronic Patent Application Fee Transmittal

Application Number:	14713719
Filing Date:	15-May-2015
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Filer:	Harry Vartanian/Elizabeth McGinty
Attorney Docket Number:	IPW2-USCN207446

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 - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
		Total in USD ($)		**200**

Electronic Acknowledgement Receipt	
EFS ID:	23948844
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Elizabeth McGinty
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	30-OCT-2015
Filing Date:	15-MAY-2015
Time Stamp:	17:04:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$200
RAM confirmation Number	4270
Deposit Account	220493
Authorized User	VARTANIAN, HARRY
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees) Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees) Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Extension of Time	IPW2-USCN207446-EOT-20151030.PDF	163473 4a2fe9a8a8786b5369bfc00c65770b8fdc07ecd3	no	2
Warnings:					
Information:					
2		IPW2-USCN207446-ResponsetoNonFinal-20151030.PDF	94965 c33effde866eb5e8656f24fc81636c2c67c8d111	yes	13

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	13

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30811 96c93aa62934c739b7ed3d2d9bfc305ae12f52ca	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	289249		

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

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

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

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

PTO/AIA/22 (03-13)
Approved for use through 7/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) IPW2-USCN207446
Application Number 14/713,719	Filed May 15, 2015
For POWER CONTROL IN A WIRELESS NETWORK	
Art Unit 2647	Examiner Dominic E. Rego

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	$ 200
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☐	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 56,787.

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

/Harry Vartanian/ — Signature

October 30, 2015 — Date

Harry Vartanian — Typed or printed name

215-568-6400 — Telephone Number

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

☑ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Privacy Act Statement

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

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

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

PTO/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
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/713,719	Filing Date 05/15/2015	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

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

APPLICATION AS AMENDED – PART II

AMENDMENT	10/30/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 12	Minus	** 20	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

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

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

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

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

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

LIE
/LORRAINE E. WALDEN/

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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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14713719
	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5719583	B1	1998-02-17	Kanai	
	2	5887245	B1	1999-03-23	Lindroth et al.	
	3	6085106	B1	2000-07-04	Sedonaris et al.	
	4	6137993	B1	2000-10-24	Almgren et al.	
	5	6442398	B1	2002-08-27	Padovani et al.	
	6	6512931	B1	2003-01-28	Kim et al.	
	7	6597723	B1	2003-07-22	Zeira et al.	
	8	6628956	B2	2003-09-30	Bark et al.	

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	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	9	6823194	B2	2004-11-23	Haim	
	10	6983166	B2	2006-01-03	Shiu et al.	
	11	7190688	B1	2007-03-13	Kamel et al.	
	12	7277721	B2	2007-10-02	Okumura et al.	* Corresponds to
	13	8134994	B2	2012-03-13	Liu et al.	* Corresponds to

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010036823	A1	2001-11-01	Van Lieshout et al.	
	2	20030032411	A1	2003-02-13	Kim et al.	
	3	20030103530	A1	2003-06-05	Durastante	
	4	20030134655	A1	2003-07-17	Chen et al.	

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	5	20040137860	A1	2004-07-15	Oh et al.	
	6	20040141483	A1	2004-07-22	Zeira et al.	
	7	20040162093	A1	2004-08-19	Bevan et al.	
	8	20040171387	A1	2004-09-02	Miyoshi et al.	
	9	20040190485	A1	2004-09-30	Khan	* Corresponds to
	10	20040203987	A1	2004-10-14	Butala	
	11	20050003846	A1	2005-01-06	Anderson	
	12	20050025056	A1	2005-02-03	Chen et al.	
	13	20050041673	A1	2005-02-24	Jiang et al.	
	14	20050130690	A1	2005-06-16	Shinozaki	
	15	20050136961	A1	2005-06-23	Simonsson et al.	

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	Attorney Docket Number	IPW2-USCN207446

	16	20050176455	A1	2005-08-11	Krishnan et al.	
	17	20050207359	A1	2005-09-22	Hwang et al.	
	18	20070081492	A1	2007-04-12	Petrovic et al.	
	19	20090028111	A1	2009-01-29	Chao et al.	
	20	20050073973	A1	2005-04-07	LaRoia et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1071227	EP	A2	2001-01-24	Usuda et al.		☐
	2	1176739	EP	A1	2002-01-30	Hayashi et al.		☐
	3	1367740	EP	A1	2003-12-03	Zeira et al.		☐
	4	2350522	GB	A1	2000-11-29	Hulbert et al.		☐

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	Attorney Docket Number	IPW2-USCN207446

	5	2004040187	JP	A2	2004-02-05	Miya et al.		☐
	6	199631009	WO	A1	1996-10-03	Otten		☐
	7	199907105	WO	A2	1999-02-11	Larsen et al.		☐
	8	200057574	WO	A1	2000-09-28	Zeira et al.		☐
	9	200108322	WO	A1	2001-02-01	Simonsson et al.		☐
	10	200184740	WO	A2	2001-11-08	Zeira et al.		☐
	11	2003010903	WO	A1	2003-02-06	Okumura et al.		☐
	12	2003036816	WO	A1	2003-05-01	Anderson		☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	"Recommendation ITU-R M.1225: Guidelines for Evaluation of Radio Transmission Technologies for IMT-2000," International Telecommunication Union/ITU Radiocommunication Sector, January 1, 1997, Rec. ITU-R M.1225, pp. 1-61.	☐

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	2	Communication pursuant to Article 94(3) EPC from European Patent Application No. 05 801 370.7-1246 dated December 30. 2009.	☐
	3	European Search Report Dated December 2, 2010 from European Application No. 10185576.5- 1246.	☐
	4	Great Britain Search Report mailed May 14, 2002, for Great Britain Application No. 0125504.1 filed October 24, 2001, 1 page.	☐
	5	International Search Report mailed December 22, 2005, for PCT Application No. PCT/EP2005/053931 filed August 10, 2005, 4 pages.	☐
	6	International Search Report mailed January 21, 2003, for PCT Application No. PCT/GB02/04811 filed October 24, 2002, 3 paqes.	☐
	7	Office Action for Japanese Application No. 2007-525302, issued March 13, 2012 (A copy of the office action and its English machine translation have been provided).	☐
	8	THIRD GENERATION PARTNERSHIP PROJECT, Technical Specification Group Radio Access Network; Feasibility Study on Uplink Enhancements for UTRA TDD; (Release 6); 3GPP TR 25.804 V6.0.0 (2005-03)	☐
	9	NON-FINAL REJECTION, U.S. Patent Application No. 13/726,976, dated May 22, 2014.	☐
	10	OFFICE ACTION, Japanese Patent Application No. 2011-234218, dated December 6, 2012.	☐
	11	OFFICE ACTION, Japanese Patent Application No. 2011-234218, dated December 6, 2012.	☐
	12	NON-FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated June 18, 2014.	☐

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	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

	13	FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated January 8, 2010.	☐
	14	NON-FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated March 31, 2009.	☐
	15	FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated August 1, 2008.	☐
	16	REQUIREMENT FOR RESTRICTION/ELECTION, U.S. Patent Application No. 10/917,968, dated March 19, 2008.	☐
	17	NON-FINAL REJECTION, U.S. Patent Application No. 10/917,968, dated July 2, 2007.	☐
	18	NON-FINAL REJECTION, U.S. Patent Application No. 13/727,153, dated May 22, 2014.	☐
	19	NOTICE OF ALLOWANCE, U.S. Patent Application No. 13/727,153, dated September 10, 2014.	☐
	20	NOTICE OF ALLOWANCE, U.S. Patent Application No. 13/727,153, dated February 6, 2015.	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14713719
	Filing Date	2015-05-15
	First Named Inventor	Nicholas W. Anderson
	Art Unit	2647
	Examiner Name	Dominic E. Rego
	Attorney Docket Number	IPW2-USCN207446

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry Vartanian/	Date (YYYY-MM-DD)	2015-09-24
Name/Print	Harry Vartanian	Registration Number	56,787

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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

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

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

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

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

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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.

Electronic Patent Application Fee Transmittal

Application Number:	14713719
Filing Date:	15-May-2015
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Filer:	Harry Vartanian/Carey Kulp
Attorney Docket Number:	IPW2-USCN207446

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

Electronic Acknowledgement Receipt	
EFS ID:	23589614
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Carey Kulp
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	24-SEP-2015
Filing Date:	15-MAY-2015
Time Stamp:	15:00:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	2033
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDS.pdf	60085 eb038779c75fb1615c1ada7e87a60fb246d2ffbd	no	2
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	SB08.pdf	680691 490e40fc6d1cda7ad9a16dd09288e0df48d35c60	no	9
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	NFR_May_22_2014.pdf	259310 0ddabec4a7059a40ab473a310c9be7facb1fab8e	no	7
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	NOA_Feb_6_2015.pdf	398214 40a87c1a945a115de1252f40bd0a3910019276f8	no	7
Warnings:					
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5	Other Reference-Patent/App/Search documents	NOA_Sep_10_2014.pdf	428793 c97cd5ad453f0fac4a553b81208a6c0bb07cd242	no	8
Warnings:					
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6	Fee Worksheet (SB06)	fee-info.pdf	30728 7f04694271936f330009a0523d03e38a57400c44	no	2
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New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the **PATENT APPLICATION** of:	
Nicholas W. Anderson	
Application No.: 14/713,719	
Confirmation No.: 3361	
Filed: May 15, 2015	
For: POWER CONTROL IN A WIRELESS NETWORK	
Group: 2647	
Examiner: Dominic E. Rego	

Our File: IPW2-USCN207446
Date: September 24, 2015

INFORMATION DISCLOSURE STATEMENT

Mail Stop Amendment
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 Information Disclosure Statement Form.

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 indicated by an asterisk (*) on the enclosed Information Disclosure Statement Form. Copies of the cited references are enclosed.

This Information Disclosure Statement is being filed with the fee required by 37 C.F.R. § 1.17(p).

It is respectfully requested that the Examiner consider these documents and return an initialed copy of the Information Disclosure Statement Form indicating consideration of the cited materials.

Respectfully submitted,

Intellectual Ventures Holding 81 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 (4)

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446

CONFIRMATION NO. 3361

3624
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

PUBLICATION NOTICE

OC000000077498551

Title:POWER CONTROL IN A WIRELESS NETWORK

Publication No.US-2015-0264653-A1
Publication Date:09/17/2015

NOTICE OF PUBLICATION OF APPLICATION

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

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

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

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

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

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

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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

3624 7590 08/21/2015

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER
REGO, DOMINIC E

ART UNIT	PAPER NUMBER
2647	

NOTIFICATION DATE	DELIVERY MODE
08/21/2015	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

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	14/713,719	ANDERSON, NICHOLAS W.	
	Examiner	Art Unit	
	DOMINIC E. REGO	2647	

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

(1) *DOMINIC E. REGO*. (3)_____.

(2) *Harry Vartanian,Atorney, Reg. No. 56,787*. (4)_____.

Date of Interview: *18 August 2015*.

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

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

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

Claim(s) discussed: *1*.

Identification of prior art discussed: *N/A*.

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

Applicant will amend above claim in such away in order to overcome the prior arts that were used to reject above claim. Further,based on 112 1st rejection, applicant will clearly pointout where in spec.recited limitation can be found.

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

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

☐ Attachment

/DOMINIC E REGO/ Primary Examiner, Art Unit 2647	

Summary of Record of Interview Requirements

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

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

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

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

———

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

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

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

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

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

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

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

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

Examiner to Check for Accuracy

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446

CONFIRMATION NO. 3361

3624
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

POA ACCEPTANCE LETTER

OC00000076870795

Date Mailed: 08/14/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/06/2015.

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

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

/zabraha/

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

[X] Practitioners associated with the 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 assignment documents attached to this form in accordance with 37 CFR 3.73(c).

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

[X] The address associated with Customer Number: **3624**

OR

[ ] Firm or Individual Name					
Address					
City		State		Zip	
Country		Telephone		Email	

Assignee Name and Address:

Intellectual Ventures Holding 81 LLC
7251 W Lake Mead Blvd
Ste 200
Las Vegas, NV 89128

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(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	8/4/15
Name	Tracy Lemke	Telephone	
Title	Authorized Person for Intellectual Ventures Holding 81 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.**

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

DECLARATION REGARDING AUTHORITY TO SIGN
ON BEHALF OF A LEGAL ENTITY
37 C.F.R. 3.73(c)(1)

I, Tracy Lemke (whose title is supplied below), hereby declare that I am authorized to sign documents on behalf of Intellectual Ventures Holding 81 LLC

Authorized Person for Intellectual Ventures Holding 81 LLC

2/9/15
Date

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office;U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of1995, no persons arerequired to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Intellectual Ventures Holding 81 LLC

Application No./Patent No.: 14/713,719 Filed/Issue Date: May 15, 2015

Titled: POWER CONTROL IN A WIRELESS NETWORK

Intellectual Ventures Holding 81 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: Nicholas William Anderson To: IPWireless, Inc.

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

   Reel 015474, Frame 0248, 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 022102, Frame 0891, or for which a copy thereof is attached.

This collection of information is required by37 CFR3.73(b). The information is required toobtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentialityis governed by35 U.S.C. 122and 37 CFR1.11 and1.14. Thiscollection is estimated to take 12 minutes to complete, including gathering, preparing, and submittingthe 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 tothe Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.**SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**

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

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

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Northrop Grumman Information Technology, Inc. To: IPWireless, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 024006, Frame 0144, or for which a copy thereof is attached.

4. From: IPWireless, Inc. To: Wireless Technology Solutions LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 024305, Frame 0492, or for which a copy thereof is attached.

5. From: Wireless Technology Solutions LLC To: IPWireless, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 027910, Frame 649, or for which a copy thereof is attached.

6. From: IPWireless, Inc. To: Intellectual Ventures Holding 81 LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 036159, Frame 0531, or for which a copy thereof is attached.

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

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

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

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

/Harry Vartanian/	August 6, 2015
Signature	Date
Harry Vartanian	Agent, Reg. No. 56,787
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

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

The informationprovided 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 informationin 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 InternationalApplication filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
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, arecord 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 thissystem of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	23067222
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Elizabeth McGinty
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	06-AUG-2015
Filing Date:	15-MAY-2015
Time Stamp:	17:01:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	IPW2-USCN207446-AIA-POA-20150806.PDF	1274812 ea4e365151bd386f64307fc430644c9f5798bd19	no	1
Warnings:					
Information:					

2	Assignee showing of ownership per 37 CFR 3.73	IPW2-USCN207446-AIA-DRATS-20150806.PDF	429222 3014f64f5b4d8d859662ed065844bf5d06a75680	no	1
Warnings:					
Information:					
3	Assignee showing of ownership per 37 CFR 3.73	IPW2-USCN207446-373cStatement-20150806.PDF	125133 652e953b0c1607eb9c0dfb351b5851485edbf25e	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	1829167		

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

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

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/713,719	05/15/2015	Nicholas W. Anderson	IPW2-USCN207446	3361

3624 7590 06/30/2015

VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

EXAMINER
REGO, DOMINIC E

ART UNIT	PAPER NUMBER
2647	

NOTIFICATION DATE	DELIVERY MODE
06/30/2015	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. 14/713,719	Applicant(s) ANDERSON, NICHOLAS W.	
	Examiner DOMINIC E. REGO	Art Unit 2647	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 *05/15/2015*.

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

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

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

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

Disposition of Claims*

5)☒ Claim(s) *1-14* 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) *1-14* 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 *05/15/2015* 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.

DETAILED ACTION

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1 and 5 rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. Regarding claims 1 and 5, recites, “receiving, by a second network device from the first network device, data of the uplink signal". The underlying part is not found in the specification.

Double Patenting

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 1-14 rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 8,862,079 since the claims, if allowed, would improperly extend the "right to exclude" already granted in the patent.

6. The subject matter claimed in the instant application is fully disclosed in the patent and is covered by the patent since the patent and the application are claiming common subject matter, as follows, and the difference of the limitations are wordings differently..

Instant Application	Patent 8,862,079, Application #13/829,992
1. A method comprising: transmitting, by a first network device, a first indication of a transmission power level of the first network device so that a user equipment (UE) can determine a pathloss; transmitting, by the first network device to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled; transmitting, by the first network device on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel; receiving, by the first network device from the UE on the shared uplink channel, an uplink signal; and receiving, by a second network device from the first network device, data of the uplink signal.	1. A method performed by user equipment (UE), the method comprising: receiving, by the UE, an indication of whether accumulation of transmit power control (TPC) commands is enabled; determining, by the UE, a path loss of a downlink channel; receiving, on a single physical channel by the UE if accumulation is enabled, an allocation of a scheduled uplink resource and a TPC command, wherein the TPC command is accumulated with other received TPC commands; calculating, by the UE if accumulation is enabled, transmit power in association with an uplink communication based on both the path loss and the accumulated TPC commands; and receiving, on the single physical channel by the UE if accumulation is not enabled, an allocation of a scheduled

	uplink resource to transmit data at a power level calculated by the UE based on the path loss.
For claims 2-9	See claims 2-10
For claims 10-20	See claims 1-10 or 11-20

Claim Rejections - 35 USC § 103

7. 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 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.

8. Claims 1, 2, 4-6, 8, 10, and 13 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Zeira et al. (International Publication Number #WO 00/57574) in view of Khan (US 2004/0190485) in view of Van Lieshout et al. (US Pub. No. 2001/0036823), and further in view of Washburn (US 2012/0113808).

Regarding claims 1 and 5, Zeira teaches a method comprising:

transmitting, by a first network device, a first indication of a transmission power level of the first network device so that a user equipment (UE) can determine a pathloss *(Page 2, lines 14-21; Page 4, line 17-page 5, line 8, Zeira teaches one approach to*

control transmission power levels is open loop power 15 control. In open loop power control, typically a base station 30~ transmits to a UE 321 a reference downlink communication and the transmission power level of that communication. The UE 321 receives the reference communication and measures its received power level. By subtracting the received power level from the transmission power level, a pathloss for the reference communication is determined);

transmitting, by the first network device to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled *(Page 4, line 17-page 5, line 8, teaches the first station (base station) transmits power commands based on in part a reception quality of the received communications),* but does not specifically teach transmitting, by the first network device on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel; receiving, by the first network device from the UE on the shared uplink channel, an uplink signal; and receiving, by a second network device from the first network device, data of the uplink signal.

However, in related art, Khan teaches transmitting, by the first network device on a single channel to the UE, a TPC command and scheduling information related to a uplink channel; receiving, by the first network device from the UE on the uplink channel, an uplink signal *(Paragraphs 0012 and 0043, especially Paragraph 0012, Khan teaches a method of transmitting control information for reverse link packet access transmission. For the purposes of the present invention, the control information transmitted for the reverse link may include at least one scheduling grant(s), and/or transmit power control*

("TPC") information and/or user identification information (e.g., AT ID) and/or rate indication information and/or HARQ control information). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of Khan to Zeira in order to perform the efficient scheduling processing and to allocate radio resources efficiently in the uplink high-speed packet communications method.

The combination of Zeira and Khan do not specifically teach a shared uplink channel used to carry scheduling information and transmission power control (TPC).

However, Van Lieshout teaches a shared uplink channel used to carry scheduling information and transmission power control (TPC) (*Para. 0006, Van Lieshout teaches since the DRNC is in charge of scheduling how data is multiplexed in a frame on the shared radio channel and allocating particular radio resources, such as channelization codes and associated spreading factors, the DRNC can convey to the mobile radio, using the transport format indicator, these types of specific details to allow the mobile radio unit to decode information sent over the shared radio channel).* Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of van Lieshout to Zeira and Khan so that the mobile unit can find out the available resources that it can use from the base station.

The combination of Zeira, Khan, and Lieshout do not specifically teach receiving, by a second network device from the first network device, data of the uplink signal.

However, in related art, Washburn teaches receiving, by a second network device from the first network device, data of the uplink signal *(See Abstract and*

Paragraph 0010 teaches a first network device and a second network device for forwarding data units are included in a network. The second network device is configured to receive data units from the first network device via an output interface from the first network device). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of Washburn to Zeira, Khan, and van Lieshout so that the mobile unit can find out the available resources that it can use from the base station.

Regarding claims 2 and 6, the combination of Zeira, Khan, Van Lieshout, and Washburn teach all the claimed elements in claim 1. In addition, Zeira teaches the method of claim 1, further comprising: accumulating, by the UE, TPC commands if the second indication indicates accumulation is enabled *(Page 4, line 17-page 5, line 8, teaches the first station (base station) transmits power commands based on in part a reception quality of the received communications)* or does not accumulate TPC commands if the second indication indicates accumulation is not enabled.

Regarding claims 4 and 8, the combination of Zeira, Khan, Van Lieshout, and Washburn teach all the claimed elements in claim 1. In addition, Zeira teaches the method of claim 1, further comprising:

setting, by the UE, uplink transmission power level of the uplink signal based on the TPC command, a determined pathloss, and a format of the uplink signal pathloss *(Page 2, lines 14-21, Zeira teaches one approach to control transmission power levels is open loop power 15 control. In open loop power control, typically a base station 30~ transmits to a UE 321 a reference downlink communication and the transmission power*

level of that communication. The UE 321 receives the reference communication and measures its received power level. By subtracting the received power level from the transmission power level, a pathloss for the reference communication is determined. Page 4, line 17-page 5, line 8, teaches the first station (base station) transmits power commands based on in part a reception quality of the received communications. The first station transmits a second communication having a transmission power level in a first time slot. The second station receives the second communication and the power commands. A power level of the second communication as received is measured. A path loss estimate is determined based on in part the measured received second communication power level and the first communication transmission power level).

Regarding claims 10 and 13, the combination of Zeira, Khan, and Lieshout do not specifically teach the network device of claim 9 further comprising: the circuitry is further configured to transmit, to a second network device, data of the uplink signal.

However, in related art, Washburn teaches the network device of claim 9 further comprising: the circuitry is further configured to transmit, to a second network device, data of the uplink signal *(See Abstract and Paragraph 0010 teaches a first network device and a second network device for forwarding data units are included in a network. The second network device is configured to receive data units from the first network device via an output interface from the first network device).* Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of Washburn to Zeira, Khan, and van Lieshout so that the mobile unit

can find out the available resources that it can use from the base station.

9. Claims 3, 7, 11, and 14 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Zeira et al. (International Publication Number #WO 00/57574) in view of Khan (US 2004/0190485) in view of Van Lieshout et al. (US Pub. No. 2001/0036823) in view of Washburn (US 2012/0113808), and further in view of Baker et al. (US Patent #6,804,512).

Regarding claims 3 and 7, the combination of Zeira, Khan, Van Lieshout, and Washburn do not specifically teach the method of claim 1, wherein the TPC command is a multi-level TPC command.

However, in related art, Baker teaches the method of claim 1, wherein the TPC command is a multi-level TPC command *(Col 4, lines 16-18, the acceptable value of P could be set at different levels for different sets or groups of sets of TPC commands).* Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of Baker to Zeira, Khan, Van Lieshout, and Washburn in order to adjust transmission power level in communication system.

Regarding claims 11 and 14, the combination of Zeira, Khan, Van Lieshout, and Washburn do not specifically teach the network device of claim 9, wherein the TPC command is a multi\- level TPC command.

However, in related art, Baker teaches the network device of claim 9, wherein the TPC command is a multi- level TPC command *(Col 4, lines 16-18, the acceptable value of P could be set at different levels for different sets or groups of sets of TPC*

commands). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of Baker to Zeira, Khan, Van Lieshout, and Washburn in order to adjust transmission power level in communication system.

10. Claims 9 and 12 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Zeira et al. (International Publication Number #WO 00/57574) in view of Khan (US 2004/0190485), and further in view of Van Lieshout et al. (US Pub. No. 2001/0036823).

Regarding claims 9 and 12, Zeira teaches a method performed by a network device, the method comprising:

transmitting, by the network device, a first indication of a transmission power level of the network device so that a user equipment (UE) can determine a pathloss *(Page 2, lines 14-21; Page 4, line 17-page 5, line 8, Zeira teaches one approach to control transmission power levels is open loop power 15 control. In open loop power control, typically a base station 30~ transmits to a UE 321 a reference downlink communication and the transmission power level of that communication. The UE 321 receives the reference communication and measures its received power level. By subtracting the received power level from the transmission power level, a pathloss for the reference communication is determined)*;

transmitting, by the network device to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled *(Page 4, line 17-*

page 5, line 8, teaches the first station (base station) transmits power commands based on in part a reception quality of the received communications), but does not specifically teach transmitting, on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel; and receiving, from the UE on the shared uplink channel, an uplink signal.

However, in related art, Khan teaches transmitting, on a single channel to the UE, a TPC command and scheduling information related to a uplink channel; and receiving, from the UE on the uplink channel, an uplink signal *(Paragraphs 0012 and 0043, especially Paragraph 0012, Khan teaches a method of transmitting control information for reverse link packet access transmission. For the purposes of the present invention, the control information transmitted for the reverse link may include at least one scheduling grant(s), and/or transmit power control ("TPC") information and/or user identification information (e.g., AT ID) and/or rate indication information and/or HARQ control information).* Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of Khan to Zeira in order to perform the efficient scheduling processing and to allocate radio resources efficiently in the uplink high-speed packet communications method.

The combination of Zeira and Khan do not specifically teach a shared uplink channel used to carry scheduling information and transmission power control (TPC).

However, Van Lieshout teaches a shared uplink channel used to carry scheduling information and transmission power control (TPC) (*Para. 0006, Van Lieshout teaches since the DRNC is in charge of scheduling how data is multiplexed in a frame*

on the shared radio channel and allocating particular radio resources, such as channelization codes and associated spreading factors, the DRNC can convey to the mobile radio, using the transport format indicator, these types of specific details to allow the mobile radio unit to decode information sent over the shared radio channel).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the above teaching of van Lieshout to Zeira and Khan so that the mobile unit can find out the available resources that it can use from the base station.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DOMINIC E. REGO whose telephone number is (571)272-8132. The examiner can normally be reached on Monday-Friday, 9:00 am-5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay A. Maung can be reached on 571-272-7882. 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.

/DOMINIC E REGO/
Primary Examiner, Art Unit 2647
Tel 571-272-8132

Notice of References Cited	Application/Control No. 14/713,719	Applicant(s)/Patent Under Reexamination ANDERSON, NICHOLAS W.	
	Examiner DOMINIC E. REGO	Art Unit 2647	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2013/0142217	06-2013	Lomp, Gary R.	375/130
*	B	US-2012/0113808	05-2012	WASHBURN, James	370/230
*	C	US-2004/0190485	09-2004	Khan, Farooq Ullah	370/349
*	D	US-6,804,512	10-2004	Baker et al.	455/423
	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.

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BIB DATA SHEET

CONFIRMATION NO. 3361

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/713,719	05/15/2015 RULE	455	2647	IPW2-USCN207446

APPLICANTS
Intellectual Ventures Holding 81 LLC, Las Vegas, NV;

INVENTORS
Nicholas W. Anderson, Exeter, UNITED KINGDOM;

**** CONTINUING DATA **************************
This application is a CON of 13/727,153 12/26/2012 PAT 9055586
which is a CON of 10/917,968 08/12/2004 PAT 8897828

**** FOREIGN APPLICATIONS **************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
06/11/2015

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/DOMINIC E REGO/ Examiner's Signature	☐ Initials	UNITED KINGDOM	4	14	4

ADDRESS

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

TITLE

POWER CONTROL IN A WIRELESS NETWORK

FILING FEE RECEIVED		
2020	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	Art Unit
	DOMINIC E REGO	2647

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	522, 68, 69, 296, 135, 226.3, 277.2, 115.3, 126, 127.1, 127.2, 67.11, 434, 436	6/24/2015	DR
370	331, 320, 335, 342, 318, 392, 252, 276, 280	6/24/2015	DR
375	147, 130	6/24/2015	DR

SEARCH NOTES		
Search Notes	Date	Examiner
EAST, Inventor, and Assignee Search	6/24/2015	DR

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	205	1 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/06/25 17:01
L4	10	multi$level near3 (tpc transmi$6 near2 power near2 command$3)	US-PGPUB; USPAT	OR	ON	2015/06/25 17:16
L5	7	4 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/06/25 17:16
L6	104	(different various multi$3 many several numerous variety pluralit$3 second third first fourth) near2 level near4 (tpc transmi$6 near2 power near2 command$3)	US-PGPUB; USPAT	OR	ON	2015/06/25 17:19
L7	73	6 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/06/25 17:19
L8	43	(different various multi$3 many several numerous variety pluralit$3 second third first fourth) near2 level near4 (tpc transmi$6 near2 power near2 control$4) near2 command$3	US-PGPUB; USPAT	OR	ON	2015/06/25 17:21
L9	35	8 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/06/25 17:21
S52	139	(transmi$6 send$3 forward$3 deliver$3 provid$3 broad$cast$3) near6 (tpc transmi$6 near2 power near2 command$3) near5 schedul$3 near2 information	US-PGPUB; USPAT	OR	ON	2015/06/25 12:48
S53	4	S52 and (@ad <= "20040812" @rlad <= "20040812" @pd <= "20040812")	US-PGPUB; USPAT	OR	ON	2015/06/25 12:56

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14713719	ANDERSON, NICHOLAS W.
	Examiner	**Art Unit**
	DOMINIC E REGO	2647

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

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

CLAIM		DATE								
Final	Original	06/24/2015								
	1	✓								
	2	✓								
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/713,719	05/15/2015	2649	2020	IPW2-USCN207446	14	4

CONFIRMATION NO. 3361

FILING RECEIPT

3624
VOLPE AND KOENIG, P.C.
UNITED PLAZA
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103

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Date Mailed: 06/12/2015

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Assignment For Published Patent Application
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Power of Attorney: None

Domestic Priority data as claimed by applicant
This application is a CON of 13/727,153 12/26/2012 PAT 9055586
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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.

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/713,719**
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Title

POWER CONTROL IN A WIRELESS NETWORK

Preliminary Class

455

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 14/713,719

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	14 minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 420 =	420
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	2020

APPLICATION AS AMENDED - PART II

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

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

POWER CONTROL IN A WIRELESS NETWORK

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of U.S. Patent Application Serial No. 13/727,153, filed December 26, 2012, which is a continuation of U.S. Patent Application Serial No. 10/917,968, filed August 12, 2004, which issued as U.S. Patent No. 8,897,828 on November 25, 2014, which are both incorporated by reference as if fully set forth.

[0002] This application is related to U.S. Patent Application Serial No. 13/726,976, filed December 26, 2012, which issued as U.S. Patent No. 8,983,522 on March 17, 2015.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0003] This invention relates to power control in a mobile radio system or wireless communication system, and more particularly, to controlling received power levels in a code division multiple access (CDMA) radio system.

2. Description of the Prior Art

[0004] Typically, radio signals transmitted with increased power result in fewer errors when received than signals transmitted with decreased power. Unfortunately, signals transmitted with excessive power may interfere with the reception of other signals sharing the radio link. Wireless communication systems employ power control schemes to maintain a target error rate of a signal received on a radio link.

[0005] If a received signal includes a rate of errors far above a target error rate, the received signal may result in an undesirable effect on a delivered service. For example, excessive errors may lead to broken voice during voice calls, low

throughput over data links, and glitches in displayed video signals. On the other hand, if the received signal includes a rate of errors well below the target error rate, the mobile radio system is not efficiently using its radio resources. A very low error rate may mean that a signal is transmitted with an excessive level of power and that user could be provided a higher data rate. Alternatively, if the power level of a signal is sufficiently reduced, additional users may be serviced. If data rates are increased, a user may receive a higher level of service. Therefore, if a target error rate for each user is met within a tolerance threshold, a radio resource may be more optimally used.

[0006] A wireless communication system often employ one of either an open loop scheme or a closed loop scheme to control uplink transmit power of a mobile radio. Uplink typically refers to the radio link from a mobile radio to a base station, where as the downlink typically refers to the link from the base station to the mobile radio. A mobile radio is not necessarily mobile and may also be referred to as a mobile, a user, user equipment (UE), a terminal or terminal equipment. A base station may also be referred to as a Node-B.

[0007] The error rate is related to a received signal to noise-plus-interference ratio (SNIR); a higher SNIR generally results in a lower error rate; and conversely, a lower SNIR generally results in a higher error rate. The exact relationship between SNIR and error rate, however, is often a function of several factors including radio channel type and the speed at which a mobile is travelling.

[0008] A target error rate is often reached using a two stage process, which includes an outer loop and an inner loop. A first process may operate as an outer loop and may be tasked to adjust a target received SNIR (SNIR Target). This first process tracks changes in the relationship between SNIR and error rate. The outer loop sets an SNIR Target that is generally used several times by the inner loop. Periodically, the outer loop may adjust or update this SNIR Target used by the inner loop. For example, if an actual error rate exceeds a desired error rate, the outer loop may increase the value of the SNIR Target.

[0009] A second process operates as an inner loop and tries to force the link to exhibit the SNIR Target determined by the outer loop. The inner loop may operate by closed loop or by open loop means.

[0010] In the open loop method of the inner loop process, a UE uses an SNIR Target value that is derived by the network and signalled to the UE. The inner loop running in the UE attempts to maintain the SNIR Target. The UE uses the information signalled to it and monitors the received strength of signals it receives to determine a power level at which it will transmit. Advantageously, this open loop method compensates for fast channel fading by determining the path loss on a per frame bases and by adjusting the transmit power accordingly. Unfortunately, this open loop method is relatively slow at compensating for changes due to interfering signals from other transmitters.

[0011] In the closed loop method of the inner loop process, a closed loop scheme operates to match an SNIR Target. A received SNIR measurement is made by the network on an uplink signal. The SNIR measurement is compared within the network to the SNIR Target value. The inner loop drives the system to match the SNIR Target by issuing transmit power control commands from the network to a UE. The commands instruct the UE to increase or decrease its transmitted power by a predetermined step dB amount. Unfortunately, such closed loop methods demand a very high command update rate to adequately compensate for fast channel fading because of the single-dB-step commands used. At slower update rates, fast channel fading is not tracked adequately since a large number of iterations and long delays are needed to compensate for a change in power that is substantially larger than the dB-step value.

[0012] Both the closed loop scheme and the open loop scheme have their disadvantages. Therefore, an improved method and system are needed that better balances the conflicting goals of reducing errors in a received signal while also reducing interference imposed on signals received at other receivers. An improved

method and system are also needed to better reduce the overall residual SNIR fluctuations experienced by each users signal at a receiver.

BRIEF SUMMARY OF THE INVENTION

[0013] Some embodiments provide a method of power control in a radio communications system, the method comprising: determining a path loss of a radio channel between a base station and a remote transceiver; receiving a transmit power control (TPC) command transmitted to the remote transceiver from the base station; and calculating a transmit power level for the remote transceiver based on the path loss and the TPC command.

[0014] Some embodiments provide a method of power control in a radio communications system, the method comprising: receiving a signal at a second transceiver transmitted from a first transceiver; measuring a power level of the received signal; receiving a transmit power control (TPC) command at the second transceiver transmitted from the first transceiver; and calculating a transmit power level for the second transceiver based on the power level of the received signal and the TPC command.

[0015] Some embodiments provide a method of uplink power control in a CDMA radio communications system, the method comprising: receiving an uplink signal; determining an error metric of the uplink signal; updating an SNIR target based on the error metric; measuring a received SNIR of the uplink signal; comparing the measured received SNIR with the SNIR target; assigning a first value to a step indicator if the measured received SNIR is greater than the SNIR target, and assigning a second value to a step indicator if the measured received SNIR is less than the SNIR target; transmitting a transmit power control (TPC) command instructing a transmitter to adjust an uplink transmit power level based on the step indicator; receiving the TPC command including the step indicator; accumulating the step indicator value; broadcasting a downlink signal including an indication of a downlink power level, wherein the signal is transmitted at the

downlink power level; measuring the received power of the downlink signal; and setting a transmit power level base on the received power level, the indication of the downlink power level, and the accumulated step indicator value.

[0016] Some embodiments provide a method comprising: measuring a power level of a received signal; receiving a transmit power control (TPC) command; and calculating a transmit power level based on the power level of the received signal and the TPC command.

[0017] Some embodiments provide a radio comprising: a receiver including an output to provide a measured received power level; an accumulator having an input for accepting step increase and decrease instructions and an output providing a sum of past step instructions; a power level setting circuit coupled to the accumulator output and coupled to the receiver output, wherein the power level setting circuit sets a transmit power bases on the accumulator output and the measured received power level; and a transmitter, wherein the transmitter transmits a signal at the set transmit power.

[0018] Other features and aspects of the invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings which illustrate, by way of example, the features in accordance with embodiments of the invention. The summary is not intended to limit the scope of the invention, which is defined solely by the claims attached hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIGURE 1 shows a block diagram of a wireless communication system.

[0020] FIGURE 2 illustrates a wireless communication system using an open loop scheme.

[0021] FIGURE 3 illustrates a wireless communication system using a closed loop scheme.

[0022] FIGURE 4 illustrates a wireless communication system using elements of both open loop and closed loop schemes, in accordance with the present invention.

[0023] FIGURES 5A, 5B and 5C each illustrate a simulated probability density function of the received SNIR in the network.

DETAILED DESCRIPTION OF THE INVENTION

[0024] In the following description, reference is made to the accompanying drawings which illustrate several embodiments of the present invention. It is understood that other embodiments may be utilized and mechanical, compositional, structural, electrical and operational changes may be made without departing from the spirit and scope of the present disclosure. The following detailed description is not to be taken in a limiting sense, and the scope of the embodiments of the present invention is defined by the claims of the issued patent.

[0025] Some portions of the detailed description which follows are presented in terms of procedures, steps, logic blocks, processing, and other symbolic representations of operations on data bits that can be performed on computer memory. A procedure, computer executed step, logic block, process etc., are here conceived to be a self-consistent sequence of steps or instructions leading to a desired result. The steps are those utilizing physical manipulations of physical quantities. These quantities can take the form of electrical, magnetic, or radio signals capable of being stored, transferred, combined, compared, and otherwise manipulated in a computer system. These signals may be referred to at times as bits, values, elements, symbols, characters, terms, numbers, or the like. Each step may be performed by hardware, software, firmware, or combinations thereof.

[0026] FIGURE 1 shows a block diagram of a wireless communication system. A network 100 may include one or more base station controllers 110, such as a radio network controller (RNC), and one or more base stations 120 and 130, such as a Node-B, wherein each Node-B is connected to an RNC. The network 100 communicates with one or more users 140, 150 through a channel 160, also referred to as a radio link, created between a base station and a user.

[0027] Two mechanisms are primarily responsible for changes in the SNIR of a signal travelling through a radio link.

[0028] First, changes in the channel affect the SNIR. The instantaneous path loss between a base station and a user may vary as the user changes position or the user's environment changes. Rapid changes may occur as a result of a transmitted signal combining constructively and destructively as the signal travels along multiple paths from a base station and to the user. Additionally, slower changes may occur due to attenuation of the radio waves with increased distance between the base station and the user. Slower changes may also occur due to signal obstruction by buildings, vehicles and hills.

[0029] Second, signals from other transmitters affect the SNIR. For example, signals intended for other mobile radios or other base stations may increase interference in the radio link and thus reduce a received signal's SNIR.

[0030] In Time Division Duplex (TDD) systems, both uplink and downlink share the same carrier frequency. Due to this reciprocity in the links, path loss measurements made on the downlink by a mobile radio may be used estimate the path loss on the uplink. That is, a measured downlink path loss may be used to estimate the uplink path loss. The estimated uplink path loss will be less reliable with the passing of time but may be adequate within a frame period. Therefore, a mobile radio may determine a transmit power level for an uplink transition that compensates for an estimated uplink path loss, thereby providing a received signal to a base station at an expected input power level.

[0031] Downlink path loss measurements may be facilitated by a beacon channel, which is transmitted from a base station at a reference power level. A mobile radio is informed of the actual transmit power level being used by the base station for the beacon channel. In addition to knowing the actual transmit power level of a beacon channel, the mobile radio may measure a received signal power level. By measuring the received signal power level, the mobile radio can compute a downlink path loss as the difference between the actual transmit power level and

the received signal power level. Thus, the mobile radio is able to estimate the uplink path loss in a channel between the base station and the mobile radio and properly set its uplink transmit power level.

[0032] The path loss calculation may be updated as often as a beacon signal is transmitted and received. In a UTRA TDD system in compliance with the third generation partnership project (3GPP) specifications, a beacon signal is transmitted either once or twice every 10 milliseconds (ms). If an uplink transmission follows a beacon transmission within a relatively short period of time, a mobile radio can compensate for the fast fluctuations (fast-fading) in a radio channel. Such is the case for mobiles travelling at slow to moderate speeds if a beacon signal is transmitted either once or twice every 10 ms and the uplink transmissions occur in the intervening
period.

[0033] Additionally, a radio channel may be adversely affected by changes in interference levels over time. These temporal interference changes may be accommodated by a base station, measuring and communicating interference levels seen in each uplink timeslot. In a UTRA TDD system, a table having values of the measured interference for each timeslot may be broadcast to all users via a Broadcast Channel (BCH). The broadcasted information may be updated approximately every 16 frames (160 ms) depending upon the system configuration. In other embodiments, a mobile radio may receive this interference table as a signalled message directed to the individual mobile radio.

[0034] The 3GPP specifications describe two separate schemes for power control of uplink channels: an open loop scheme and a closed loop scheme. For example, in 3GPP 3.84 Megachips per second (Mcps) TDD systems, open loop power control is specified for all uplink channels. In 3GPP 1.28 Mcps TDD systems, open loop power control is specified only for physical random access channels (PRACH). Also defined by 3GPP is an implementation of a closed loop power control scheme.

For example, see 3GPP recommendations for UTRA TDD systems operating at 1.28 Mcps for non-PRACH uplink channels.

[0035] In a wireless communication system using an open loop scheme, a network and UE use an outer loop to update and signal to the UE an SNIR Target value, thereby influencing the UE's transmit power. The network updates the SNIR Target value to be signalled based upon an observed error rate on the uplink. Once received, the mobile radio takes into account the signalled SNIR Target value when deriving a transmit power level that it will apply to the next uplink signal transmitted.

[0036] In a 3GPP 3.84 Mcps system incorporating an open loop scheme, a network instructs the UE with an SNIR Target value. The network also signals its beacon transmit power level and may also provide a measure of uplink interference for each timeslot as measured by the network. The UE receives an input signal that is typically a combination of attenuated versions of the network signal, which passed through a radio channel, along with interfering signals from other transmitters. The UE measures the received power level of the attenuated network signal and determines a path loss of the radio channel. The UE also decodes the signalled SNIR Target value from the network signal. The UE computes a transmit power level based on the SNIR Target value, the determined path loss and, if available, the uplink interference measurements.

[0037] FIGURE 2 illustrates a wireless communication system using an open loop scheme. A UE transmits 200 user data at a determined transmit power level. An uplink signal 202, which includes user data 204, propagates through the radio link. The network receives an attenuated version of the transmitted signal. The network measures 207 an uplink interference value and determines 206 an error metric of the uplink signal. The network may use the measured uplink interference value to update 208 an interference measurement table. The interference measurement table may include average measured interference levels for each uplink timeslot.

[0038] The network also uses the error metric to update 210 an SNIR Target value. The network transmits 212 SNIR Target in a signalling message on the downlink 214, which includes the SNIR Target 216. The UE receives and saves 220 the SNIR Target. The network also broadcasts 222 a beacon signal on the downlink 224. The downlink 224 propagates the signal, which includes an indication of the beacon power level 226, over the radio link. The network may also broadcast the interference measurements 228. The UE measures 230 the received power level and saves 232 the interference measurements for later processing.

[0039] With the measured power level and the signalled beacon power level, the UE may determine a path loss. The UE may use the saved received SNIR Target 216, the saved received interference measurements 228 and the computed path loss to set 234 a transmit power level. This transmit power level may be used by transmitter 200 to set the power level of transmitted user data 204 on the uplink 202.

[0040] The 3GPP specifications also define a closed loop scheme. For example, a 3GPP 1.28 Mcps system employs a closed loop scheme using an outer loop and an inner loop. The closed loop TPC scheme is the primary power control mechanism used for all non-PRACH channels in a 1.28 Mcps TDD system. The closed loop TPC scheme is not currently employed for the uplink of 3.84 Mcps TDD systems.

[0041] The outer loop determines an SNIR Target value and the inner loop uses the SNIR Target value. The outer loop includes network components that determine an error metric, such as a bit error rate, a block error rate or a CRC error count, on uplink traffic from UEs. This error metric is used to set and update an SNIR Target value. An inner loop includes network components that use the SNIR Target value computed and set by the outer loop. The network measures a received SNIR value of the uplink signal.

[0042] Next, a comparator determines whether the measured SNIR value is greater than or less than the SNIR Target value. If the measured SNIR value is

greater than the SNIR Target value, the network signals a transmit power control (TPC) command on the downlink instructing the UE to reduce its current transmitter power by a step value (e.g., 1 dB). On the other hand, if the measured SNIR value is less than the SNIR Target value, the network signals a TPC command instructing the UE to increase its current transmitter power by the step dB value.

[0043] In a system employing only a closed loop power control scheme, several TPC commands may be necessary to properly bring the UE's transmitted power in line with the SNIR Target value. For example, if a path loss increases from one frame to the next by 15 dB, the system will take 15 TPC commands to compensate for the 15 dB fade. A UE accumulates the increase and decrease TPC commands to determine a proper uplink transmit power level. By increasing and decrease uplink power levels of each UE, a network attempts to control the power level of each UE such that the ratio of the received uplink energy level per transmitted bit to the spectral density of the noise and interference signals is a constant value. This TPC command adjustment process is performed for each UE in a cell. The constant value, however, may be non-uniform among the UEs depending upon the configuration of the system.

[0044] In a closed loop TPC scheme, the inner loop SNIR is maintained via a closed loop method using binary feedback. The feedback indicates either power up or power down. Every time a TPC command is received an integrator in the UE is used within the inner loop to update the UE transmit power by a step amount +/-Δ dB. The TPC commands themselves are derived by the network and are signalled to the UE via a downlink channel. When calculating the proper TPC command to send, the network measures the received SNIR and compares this measured value to an SNIR Target value. If the SNIR is too low, an up command is sent. If the SNIR is too high, a down command is sent. The target SNIR value is updated by the outer loop based upon the observed error performance of the link. In this way, both the inner and outer feedback

loops are closed by the TPC signalling.

[0045] FIGURE 3 illustrates a wireless communication system using a closed loop scheme. The closed loop scheme includes an outer loop in which a UE transmits 300 user data over the radio link in an uplink signal 302 that contain the user data 304. The network determines 306 an error metric of the received uplink signal. Using the error metric, the network computes and updates 308 an SNIR Target value.

[0046] The closed loop scheme also includes an inner loop in which the network measures 310 the received SNIR of the uplink signal 302. The network compares 312 the measured SNIR with the SNIR Target determined in the outer loop. The inner loop generates and transmits 314 a TPC command based on the comparison 312. A downlink signal 316 carries the TPC command 318 over the radio link. The UE accumulates 320 the TPC commands and uses the accumulated TPC commands to set 322 a transmit power for future uplink transmissions 300.

[0047] A mobile radio system employing either an open loop scheme or a closed loop scheme has its advantages and disadvantages.

[0048] The open loop scheme advantageously adapts quickly to path loss changes. If the path loss is observed to have worsened, for example by 15 dB in one 10 ms interval, the transmit power may be adjusted accordingly. A further advantage is that the open loop may continue to be partially updated in the absence of user-specific feedback signalling. For example, when a UE does not receive updated SNIR Target values, the outer loop pauses but changes in the path loss may continue to be tracked.

[0049] Disadvantageously, the timeslot interference level update rate in an open loop system is relatively slow. Therefore, a system using an open loop scheme is slower to adapt to interference changes than a system using the closed loop scheme. A further disadvantage of the open loop scheme is that interference is considered to be the same for all UEs in a particular uplink timeslot. That is, each UE assigned to a timeslot uses the same interference measurement signalled by the

base station on the BCH. A commonly used interference measurement table makes assumptions about the statistical nature of the interference and does not consider the individual cross-correlation properties of the uplink channelization codes. It is thus left to the outer loop to compensate for these effects, but unfortunately on a slow basis.

[0050] Conversely, the closed loop only scheme is less able to adapt to fast path loss changes because the closed loop can only move by a step Δ dB during each update. Thus, if the path loss has changed between updates by 15 dB and the step Δ dB value is only 1 dB, the closed loop is not able to adjust quickly since it can move only by 1 dB during each cycle. Therefore, for the same update rate (e.g., once per 10 ms), a closed loop TPC scheme is less able to track the fast fading observed in common mobile radio channels. Furthermore, the closed loop may not be updated during a pause in transmission of the TPC commands.

[0051] Advantageously, the closed loop is relatively quick to respond to uplink interference changes since both path loss and interference are accommodated by the same loop. The closed loop scheme using TPC commands has a further advantage in that it allows for per-user interference adaptation, in contrast to the open loop scheme, which broadcasts an average interference table for each timeslot.

[0052] In accordance with the present invention, aspects of both an open loop scheme and a closed loop scheme are strategically combined to form a power control method. Some embodiments of the present invention advantageously combine elements of both open loop and closed loop schemes to control power levels, thereby avoiding one or more of the disadvantages associated with either of the separately used schemes.

[0053] In accordance with some embodiments of the present invention, a UE incorporates the TPC structure of a closed loop scheme and the path loss estimation structure of an open loop scheme. Some embodiments of the present invention allow for both relatively quick adaptation to fast fading and also allow for per-user

interference adaptation, and retain the ability to partially update the power control loop even in the temporary absence of TPC commands.

[0054] Some embodiments of the present invention require modifications to one or more elements of a standard mobile radio system. For example, some embodiments require changes to just a UE, while other embodiments require modifications to just the network. Embodiments that modify a UE but not the network allow the UE of the present invention to operate with legacy base stations. Similarly, embodiments that modify the network but not the UE allow the network of the present invention to operate with legacy UEs. Still other embodiments of the present invention require modification to both the network and the UE. Embodiments modifying standard network elements may include changes to just a base station but not a radio network

controller (RNC). Other embodiments modify both a base station and an RNC.

[0055] Some embodiments of the present invention, incorporate a loop having three components: an open loop component located in the UE, an SNIR comparison loop located in the network, and an SNIR update component also located in the network.

[0056] First, an open loop component may be located in the UE and driven by measured beacon received power levels and path loss calculations. This loop tries to adapt to all instantaneous path loss changes on a per-beacon transmission basis. The partial power calculated by this loop is a function of the beacon signal transmission power (P_{Tx}) and the beacon received signal code power (RSCP) and is denoted $P_{open}(k)$, where k represents the current frame number. P_{Tx} is known to the UE and derived from the base station signalled power level (428, FIGURE 4) and the measured power level for frame k, ($RSCP(k)$), may be determined by the UE receiver (432, FIGURE 4). $P_{open}(k)$ may also be a function of a constant value (C) to ensure that the transmission arrives at an appropriate power level.

$$P_{open}(k) = P_{Tx} - RSCP(k) + C$$

[0057] Second, an SNIR comparison loop is located in the network, such as in the Node-B. The SNIR comparison loop is driven by received SNIR metrics. A received SNIR is compared to a SNIR Target value, which is set by an outer loop. A comparison result leads to the signalling of a TPC command that is signalled to the UE to change its transmit power. Binary signalling may be used, such that the TPC command indicates a change in transmission power by a fixed amount either up or down. Alternately, a multi-level TPC command may be used.

[0058] Third, an outer loop is located in the network, such as in the Node-B or RNC. The outer loop is driven by the data error statistics observed on the uplink transmissions. The outer loop is responsible for setting an SNIR Target level for the SNIR comparison loop.

[0059] An optional auxiliary process in the UE adjusts the transmit power based upon: (a) y_{SF}, the spreading factor (SF) of the physical channel; and (b) β_{TFC}, the selected transport format (TFC).

[0060] Thus, for the current frame k, the UE may calculate the transmit power $P_{Tx}(k)$ as shown below where K is the initial frame number determined when the power control process begins; $TPCi$ is -1 for a down TPC command, $+1$ for an up TPC command and 0 if no TPC command is received; and $step$ is the magnitude of the amount added to an accumulator upon receipt of each TPC command. The transmit power $P_{Tx}(k)$ may be updated for every frame period. Alternatively, the transmit power $P_{Tx}(k)$ may be updated each time a new TPC command is received. Alternatively, the transmit power $P_{Tx}(k)$ may be updated only when either a TPC command or a new power level is received from the network.

$$P_{Tx}(k) = P_{open(k)} + step \cdot \sum_{i=k-K}^{k} TPC_i + y_{SF} + \beta_{TFC}$$

[0061] An embodiment of a power control scheme, in accordance with the present invention, is shown diagrammatically in FIGURE 4. The y_{SF} and β_{TFC} adjustment factors are not shown for diagrammatical clarity.

[0062] FIGURE 4 illustrates a wireless communication system using elements of both open loop and closed loop schemes, in accordance with the present invention. A UE transmits 400 user data at a determined transmit power level. An uplink signal 402, which includes the user data 404, propagates through the radio link. The network receives an attenuated version of the transmitted signal.

[0063] The network determines 406 an error metric of the uplink signal 402. Optionally, the network measures an uplink interference level and may update 422 an interference measurement table. Data measured or computed from uplink measurements may be entered into the interference measurement table. The interference measurement table may include average measured interference levels for each uplink timeslot. Within the network the error metric may be used to update 408 an SNIR Target value.

[0064] The network also transmits 424 a beacon signal. The downlink signal 426, which includes an indication of the beacon transmit power level 428, propagates over the radio link. Optionally, the network may broadcast the interference measurements 430. The UE saves 432 the signalled power level, measures the received power level and, if available, saves 434 the interference measurements for later processing.

[0065] As in a closed loop scheme, a UE transmits 400 user data over the radio link in an uplink signal 402 that contain the user data 404. The network determines 406 an error metric of the received uplink signal. Using the error metric, the network computes and updates 408 an SNIR Target value.

[0066] The network also measures 410 the received SNIR of the uplink signal 402. The network compares 412 the measured SNIR with the determined SNIR Target. The network generates and transmits 414 a TPC command based on the comparison 412. A downlink signal 416 carries the TPC command 418 over the radio link. The UE accumulates 420 the TPC commands and uses the accumulated TPC commands in part to set 436 the transmit power level for future uplink transmissions 400.

[0067] As in an open loop scheme, with the measured power level and the signalled beacon power level, the UE may determine a path loss $P_{open}(k)$. The UE may use the saved received interference measurements $I(k)$ to adjust the transmission power following a pause in transmission or following a pause in receipt of TPC commands. The UE may use the accumulated TPC commands $\sum_{i=k-K}^{k} TPC_i$ the computed path loss $P_{open}(k)$, adjustment factors y_{SF} & β_{TFC} and optionally, adjustments based upon $I(k)$ to set 436 a transmit power level. This transmit power level $P_{Tx}(k)$ may be used to set the uplink power level of transmitted 400 user data on the uplink 402.

[0068] The downlink signal 426, which contains the power level 428 and may contain the interference measurements 430, is broadcast in a cell. Previous UEs using a closed loop scheme do not use measurements of the downlink received power while monitoring the power level signalling in a beacon broadcast to set the uplink transmission power. Similarly, previous UEs using a closed loop scheme do not compute or do not use computations of the downlink path loss while processing TPC commands. A previous UE simply follows the TPC commands as it is instructed to set its transmit power level. If a network instructs a known UE to increase its transmit power by one step amount, the previous UE shall increase its power level by one step amount.

[0069] In accordance to the present invention, a UE may receive a TPC command instructing it to change its transmit power by one step level in a particular direction, but the UE may actually change its transmit power level by a different amount or in fact an amount in the opposite direction. The UE uses the TPC only as a factor in determining whether to increase transmit power level, decrease transmit power level or leave the transmit power level unchanged.

[0070] For example, assume a UE just transmitted a burst to a Node-B at 20 dBm over a radio link with a path loss of 110 dB. The received power at the Node-B receiver would be -90 dBm, which is the difference between 20 dBm and a loss of

110 dB. Next, assume the Node-B wants to receive an uplink signal from the UE at -89 dBm. The Node-B would signal and the UE would receive a TPC command instructing the UE to increase the uplink transmit power level by 1 dB. Also assume that the path loss improves from the previous frame to this frame by +10 dB (e.g., from 110 dB to 100 dB).

[0071] A previous UE would transmit the next burst at +21 dBm, which is the sum of the previous level (+20 dBm) and the step increase (1 dB). The transmitted +21 dBm signal would probably reach the Node-B at -79 dBm, a signal level that is +10 dB too great because the channel improvement was not taken into account.

[0072] In accordance with the present invention, a UE would account for the new path loss. The previous transmit power level of +20 dBm would be decreased by +10 dB to account for the improved channel path loss of +10 dB. The resulting transmit power level would then be +10 dBm. The UE also accounts for the TPC command by adjusting the transmit power level by the desired step of +l dB, resulting in a new transmit power level of +11 dBm, which both accounts for the improved channel (+10 dB) and accommodates the Node-B's desire to have a received signal with a step increase (+1 dB). The +11 dBm would reach the Node-B at the desired level of -89 dBm if the channel pathloss estimate was accurate. As shown in this example, the transmit power level dropped 9 dB (from +20 dBm to +11 dBm) even though the Node-B TPC command instructed an increase of 1 dB.

[0073] Therefore, even though a UE receives a network TPC command instructing it to step up or down its uplink transmit power by 1 dB, the UE may actually change the transmit power level by a different amount. In fact, the UE transmit power level may change in a direction opposite of the TPC command as exemplified above.

[0074] During a period of inactivity on the uplink 402, TPC commands 418 may not have been received by the UE. The UE transmit power level for a subsequent initial transmission 400 may be determined using current updates of the open loop component. That is, the initial transmit power level may be

determined based on the beacon power level 428, the measured 432 received power level, and optionally the interference measurements 430. The open loop component does not require feedback, thus may continue to be updated every beacon transmission even during the uplink transmission pause.

[0075] The history stored in the TPC accumulator may be stale. In some circumstances the history may be considered useful and is not reset. Alternatively, the accumulated TPC history could be used to set the uplink transmit power level but with some excess power margin added to ensure a clean start to the loop. Alternatively, the UE may decide to discard the accumulated TPC history and to reset it to a default or initial value. The default or initial value may optionally be based upon a received interference measurement table 430.

[0076] The ability of the open loop component to compensate for fast fading is a function of the channel speed and the delay between the beacon timeslot and the uplink timeslots. Open loop control is often effective at pedestrian speeds as well as at higher speeds if the uplink slots are placed close in time to the beacon. At high mobile speeds, it is likely that power control performance will be improved if beacon RSCP filtering is enabled at the UE. The UE is responsible for detecting whether or not filtering should be applied to the open loop component. Automatic detection of the channel speed may be performed by the UE in order to control the enabling of RSCP filtering. In some embodiments of the present invention, a UE disables a combined open loop/closed loop scheme operating in accordance with the present invention when a UE passes a threshold value indicative of mobile speed.

[0077] Simulations have been performed to illustrate the performance advantages of some embodiments of the present invention. The radio channel simulated here represents an ITU indoor to outdoor and pedestrian model B channel as described in ITU-R M.1225 Guidelines for Evaluation of Radio Transmission Technologies for IMT-2000. The outer loop SNIR target was based upon a 1% error rate. A residual SNIR error term observed at the base station was monitored.

[0078] FIGURES 5A, 5B and 5C each illustrate a simulated probability density function of the received SNIR in the network. In each of the simulations, approximately 10,000 received SNIR values are sampled. Simulation results for each scenario are grouped and collected into bins. The vertical axis shows a number of occurrences for a particular range (bin) of received SNIR values. A sampled received SNIR value that fall within a range defined by a bin is counted as an occurrence for that bin.

[0079] FIGURE 5A shows simulation results for a system using only an open loop scheme. In this plot, the bin width is approximately 0.42 dB. The simulation results show a system good at tracking fast fading in the channel, but not as able to track the interference variations included in the simulation. These values are only updated at the UE via signalling every 160 ms. As such, the error term shows considerable variance at the receiver.

[0080] FIGURE 5B shows simulation results for a system using only a closed loop scheme. In this plot, the bin width is approximately 0.48 dB. The simulation results show a system better able to track the interference changes, but not as able to track the path loss due to being limited in response to the TPC command +/- 1 dB step size.

[0081] FIGURE 5C shows simulation results for a system combining aspects of both open and closed loop schemes (as shown in FIGURE 4). In this plot, the bin width is approximately 0.24 dB. The simulation results show a system able to respond to both path loss and interference changes. Additionally, the residual SNIR error term shows less variance. The plot shows that the variance of this distribution is considerably reduced for the combined power control scheme.

[0082] For the above simulations (using the same fading and interference profiles for each loop method), the following mean transmit powers were obtained:

Power Control Method	**Mean Transmit Power for 1% BLER**

Open Loop: (FIGURE 2)	5.76 dB
Closed Loop: (FIGURE 3)	5.48 dB
Combined Loops: (FIGURE 4)	3.59 dB

Table 1 – Performance of Power Control Schemes

[0083] For the simulated channel and interference scenario, the combined scheme is able to maintain a 1% block error rate (BLER) using 2.17 dB less power than the open loop scheme and 1.89 dB less power than the closed loop scheme. In a real system, this power saving may equate to greater cell coverage, higher uplink capacity and throughput, and increased battery life. The magnitude of the gains may change with different channel speeds, types and interference profiles but the performance of the combined should be better than both the open loop and closed loop schemes when used individually.

[0084] In terms of signalling overhead, the combined scheme helps to avoid a need to signal SNIR Target and interference levels on downlink channels, and has a similar signalling efficiency as the closed loop scheme. In some embodiments, the signalling efficiency is 1 bit per update.

[0085] In a system using the combined power control scheme, a new physical channel on the downlink may be used to carry fast allocation and scheduling information to a user, thereby informing the UE of the uplink resources that it may use. This new physical channel could also be used as the feedback channel for the combined power control scheme. For example, an allocation/scheduling channel could carry TPC commands. Alternatively, the combined scheme may be applied to existing channel types (dedicated or shared uplink physical channels) for UTRA TDD as well as to other TDD systems.

[0086] Some embodiments of the present invention control uplink power levels and may be incorporated into a UE with supporting features incorporated into a base station. For example, a Node-B or RNC may be implemented with a new parameter, either included in a signalling command or a broadcast message, where the new parameter instructs a UE to enable or disable the setting of uplink

transmit power level based on both the path loss estimation and the TPC commands. A parameter may indicate whether a UE is to use open loop power control, closed loop power control or a combined scheme.

[0087] Some embodiments of the present invention operate with a downlink signal including both a TPC command and an indication of the downlink transmit power level. In these embodiments, the downlink signal provides both downlinks 416 and 430 (FIGURE 4) in one signal. A UE may receive one physical channel that it decodes for TPC commands, decodes for downlink power level indications, and measures for received power levels. In these embodiments, the UE measures a power level of a received signal, receives a TPC command, and calculates a transmit power level based on the power level of the received signal and the TPC command.

[0088] While the invention has been described in terms of particular embodiments and illustrative figures, those of ordinary skill in the art will recognize that the invention is not limited to the embodiments or figures described. For example, the combined uplink power control scheme described above may be implemented a mirror image for controlling downlink power. In this case, functions performed by the UE for a combined uplink scheme may be performed by the network. Similarly, functions performed by the network for the combined uplink scheme may be performed by the UE.

[0089] The figures provided are merely representational and may not be drawn to scale. Certain proportions thereof may be exaggerated, while others may be minimized. The figures are intended to illustrate various implementations of the invention that can be understood and appropriately carried out by those of ordinary skill in the art.

[0090] Therefore, it should be understood that the invention can be practiced with modification and alteration within the spirit and scope of the appended claims. The description is not intended to be exhaustive or to limit the invention to the precise form disclosed. It should be understood that the invention can be practiced

with modification and alteration and that the invention be limited only by the claims and the equivalents thereof.

* * *

CLAIMS

What is claimed is:

1. A method comprising:

transmitting, by a first network device, a first indication of a transmission power level of the first network device so that a user equipment (UE) can determine a pathloss;

transmitting, by the first network device to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled;

transmitting, by the first network device on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel;

receiving, by the first network device from the UE on the shared uplink channel, an uplink signal; and

receiving, by a second network device from the first network device, data of the uplink signal.

2. The method of claim 1, further comprising:

accumulating, by the UE, TPC commands if the second indication indicates accumulation is enabled or does not accumulate TPC commands if the second indication indicates accumulation is not enabled.

3. The method of claim 1, wherein the TPC command is a multi-level TPC command.

4. The method of claim 1, further comprising:

setting, by the UE, uplink transmission power level of the uplink signal based on the TPC command, a determined pathloss, and a format of the uplink signal.

5. A wireless system comprising:

a first network device configured to transmit a first indication of a transmission power level of the first network device so that a user equipment (UE) can determine a pathloss;

the first network device is further configured to transmit, to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled;

the first network device is further configured to transmit, on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel;

the first network device is further configured to receive, from the UE on the shared uplink channel, an uplink signal; and

a second network device is configured to receive, from the first network device, data of the uplink signal.

6. The wireless system of claim 5 further comprising:

the UE configured to accumulate TPC commands if the second indication indicates accumulation is enabled or does not accumulate TPC commands if the second indication indicates accumulation is not enabled.

7. The wireless system of claim 5, wherein the TPC command is a multi-level TPC command.

8. The wireless system of claim 5, further comprising:

the UE is configured to set uplink transmission power level of the uplink signal based on the TPC command, a determined pathloss, and a format of the uplink signal.

9. A network device comprising:

circuitry configured to transmit a first indication of a transmission power

level of the network device so that a user equipment (UE) can determine a pathloss;

the circuitry is further configured to transmit, to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled;

the circuitry is further configured to transmit, on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel; and

the circuitry is further configured to receive, from the UE on the shared uplink channel, an uplink signal.

10. The network device of claim 9 further comprising:

the circuitry is further configured to transmit, to a second network device, data of the uplink signal.

11. The network device of claim 9, wherein the TPC command is a multi-level TPC command.

12. A method performed by a network device, the method comprising:

transmitting, by the network device, a first indication of a transmission power level of the network device so that a user equipment (UE) can determine a pathloss;

transmitting, by the network device to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled;

transmitting, on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel; and

receiving, from the UE on the shared uplink channel, an uplink signal.

13. The method of claim 12 further comprising:

transmitting, to a second network device, data of the uplink signal.

14. The method of claim 12, wherein the TPC command is a multi-level TPC command.

ABSTRACT

A first network device may transmit a first indication of a transmission power level of the first network device so that a user equipment (UE) can determine a pathloss. The first network device may also transmit, to the UE, a second indication of whether accumulation of transmit power control (TPC) commands is enabled. The first network device may also transmit, on a single channel to the UE, a TPC command and scheduling information related to a shared uplink channel.

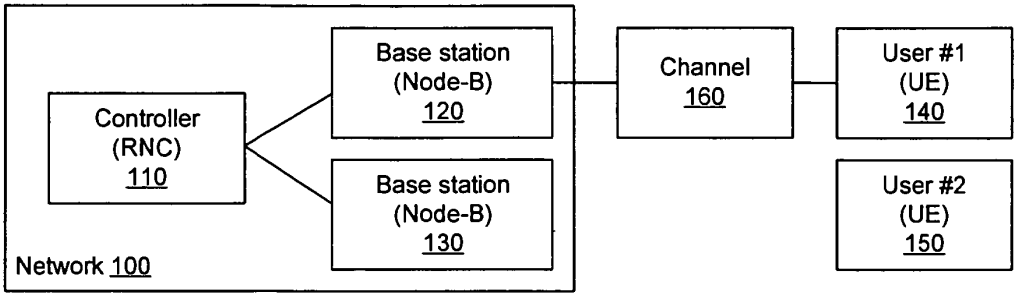


FIGURE 1

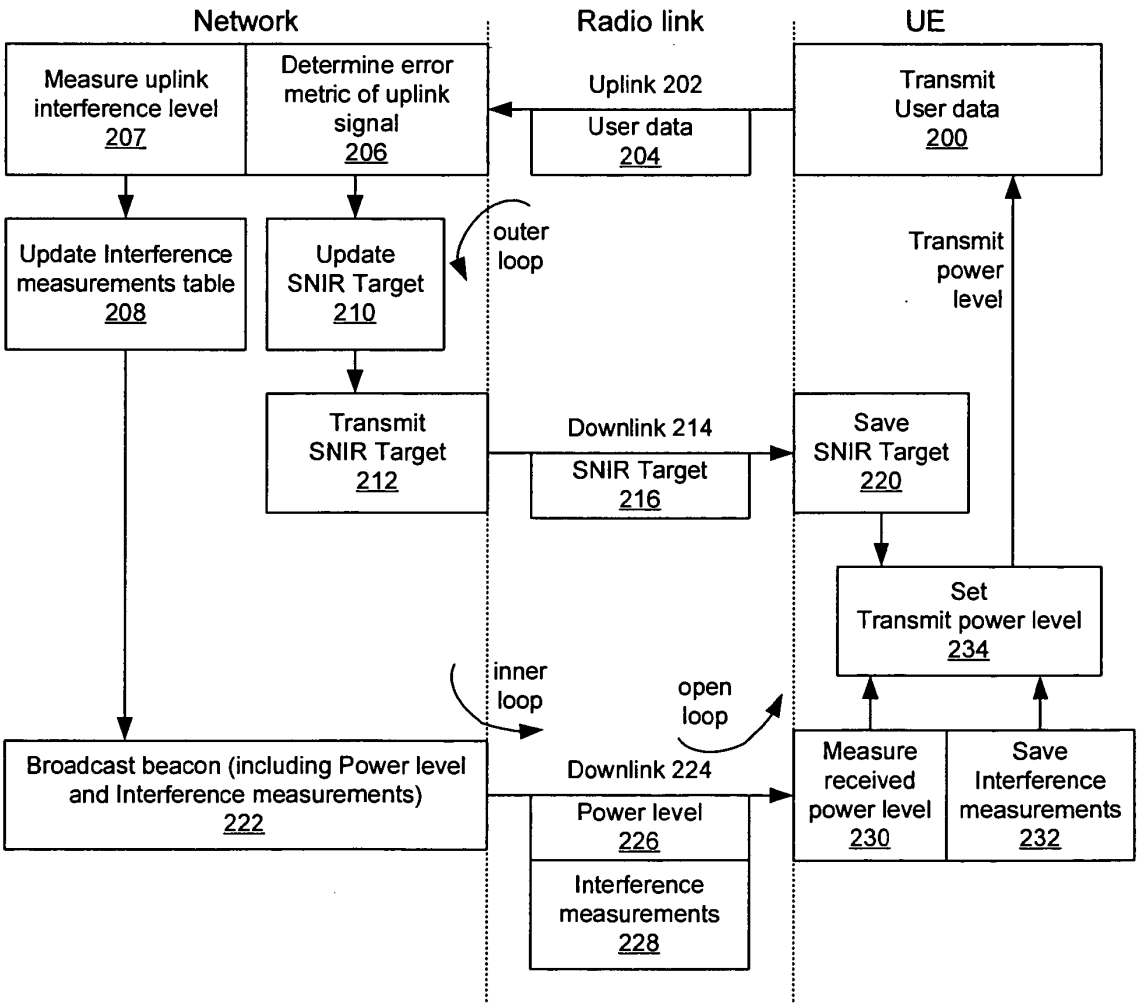


FIGURE 2

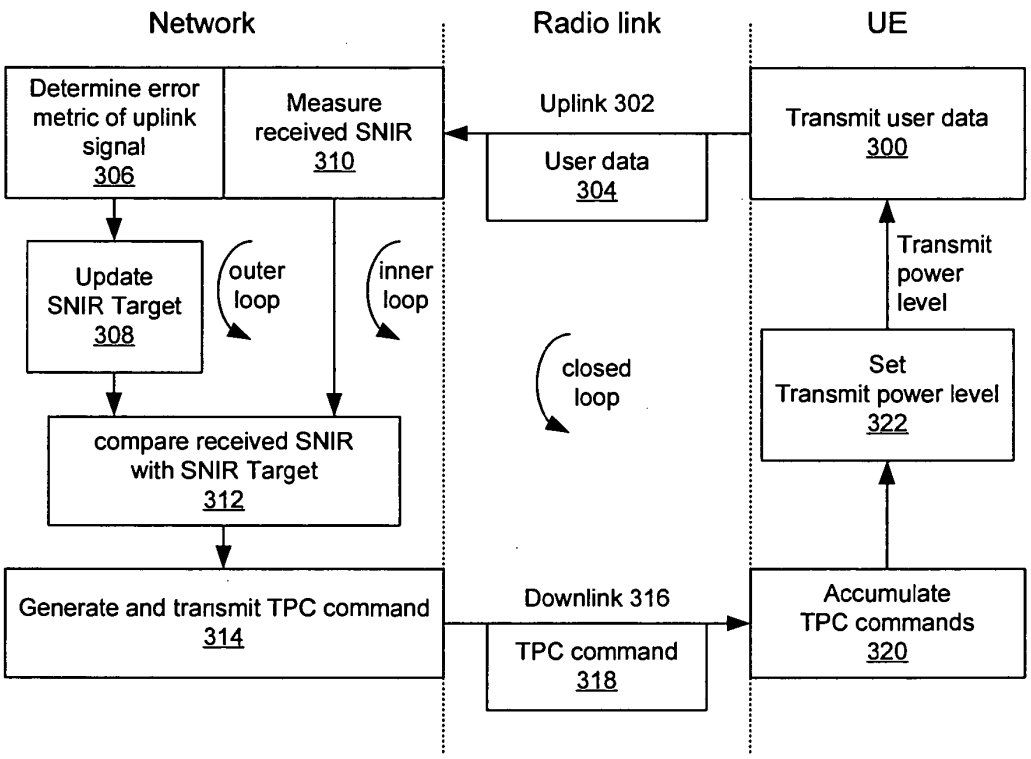

Network
Radio link
UE
Determine error metric of uplink signal 306
Measure received SNIR 310
Uplink 302
User data 304
Transmit user data 300
Update SNIR Target 308
outer loop
inner loop
Transmit power level
closed loop
Set Transmit power level 322
compare received SNIR with SNIR Target 312
Generate and transmit TPC command 314
Downlink 316
TPC command 318
Accumulate TPC commands 320

FIGURE 3

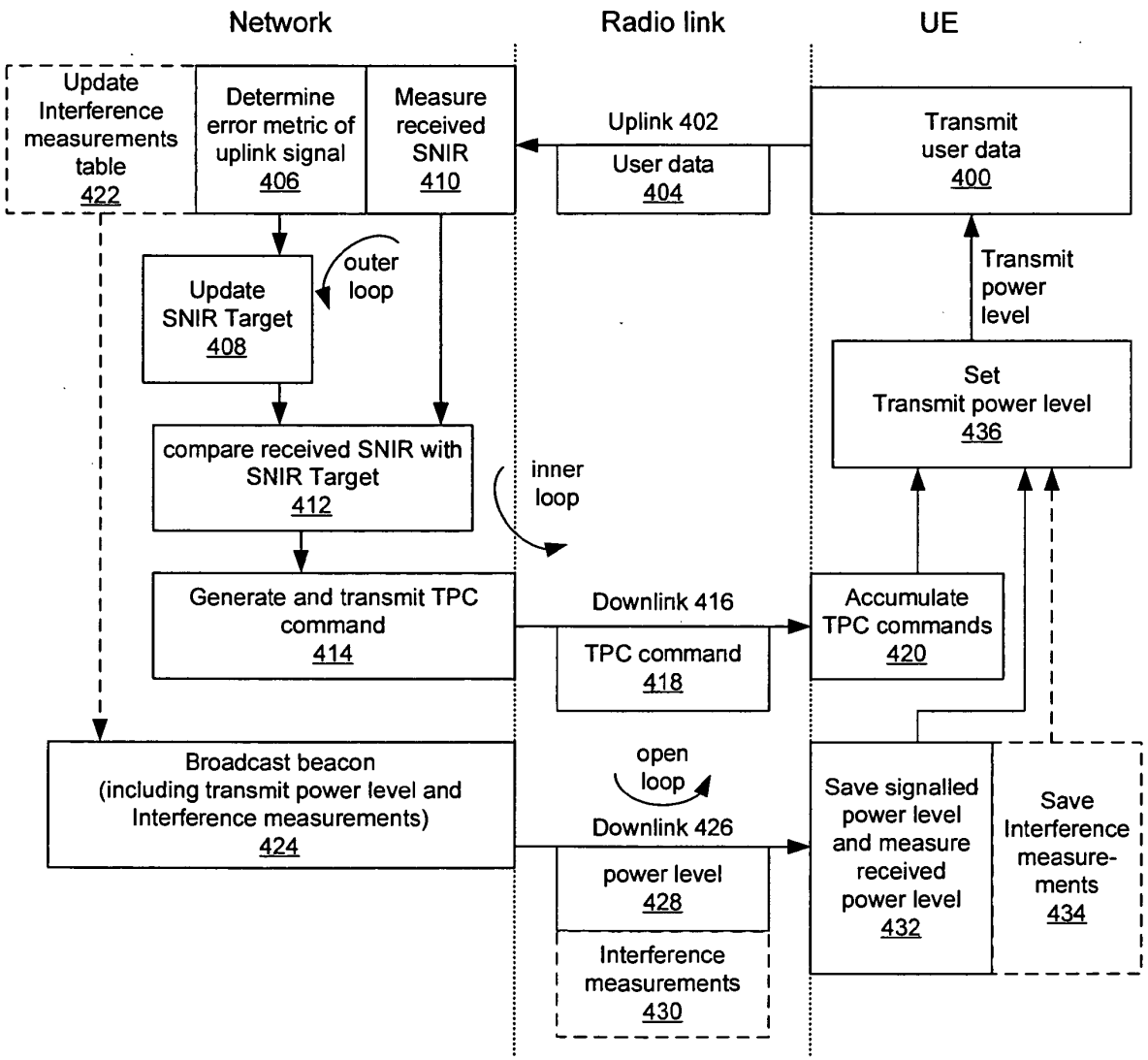

Network
Radio link
UE
Update Interference measurements table 422
Determine error metric of uplink signal 406
Measure received SNIR 410
Uplink 402
User data 404
Transmit user data 400
Update SNIR Target 408
outer loop
Transmit power level
Set Transmit power level 436
compare received SNIR with SNIR Target 412
inner loop
Generate and transmit TPC command 414
Downlink 416
TPC command 418
Accumulate TPC commands 420
Broadcast beacon (including transmit power level and Interference measurements) 424
open loop
Downlink 426
power level 428
Interference measurements 430
Save signalled power level and measure received power level 432
Save Interference measure-ments 434

FIGURE 4

FIGURE 5A

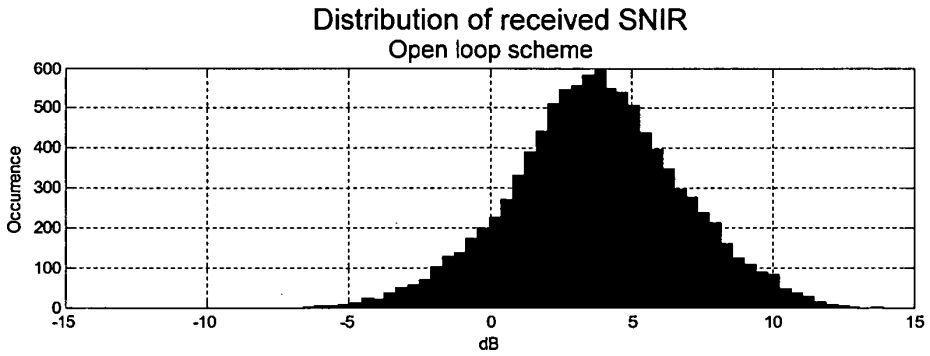


FIGURE 5B

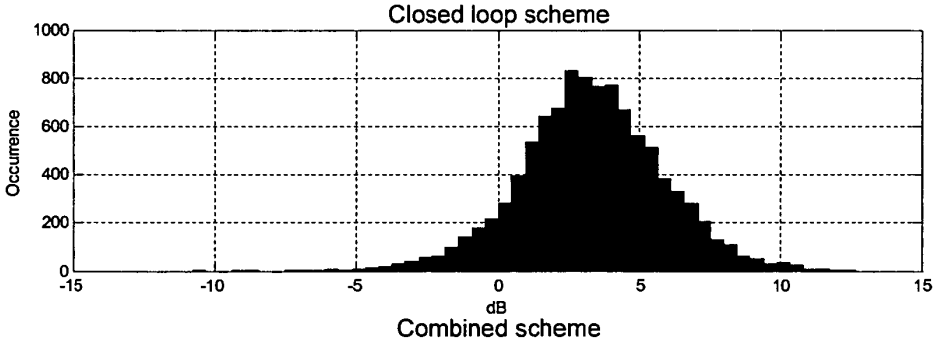
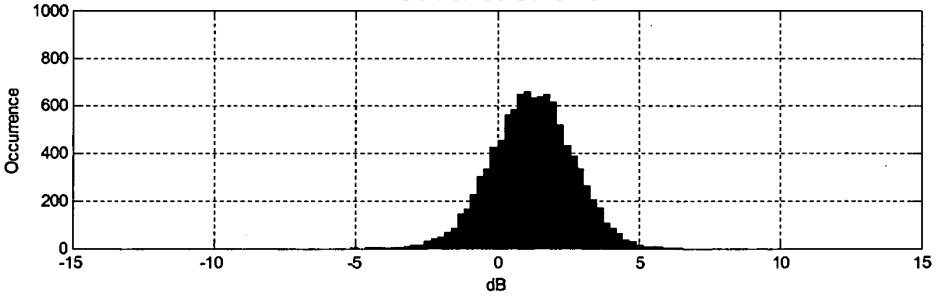


FIGURE 5C



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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN207446
	Application Number	
Title of Invention	POWER CONTROL 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.)

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Title of the Invention	POWER CONTROL IN A WIRELESS NETWORK		
Attorney Docket Number	IPW2-USCN207446	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	4	**Suggested Figure for Publication (if any)**	3

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN207446
	Application Number	
Title of Invention	POWER CONTROL IN A WIRELESS NETWORK	

Filing By Reference :

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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

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☐ 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.

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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, or 365(c) or indicate National Stage entry from a PCT application. Providing this 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 blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	13727153	2012-12-26
Prior Application Status	Patented		Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13727153	Continuation of	10917968	2004-08-12	8897828	2014-11-25

PTO/AIA/14 (12-13)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN207446
	Application Number	
Title of Invention	POWER CONTROL IN A WIRELESS NETWORK	

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

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(d). 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(h)(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. Add

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.

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN207446
	Application Number	
Title of Invention	POWER CONTROL IN A WIRELESS NETWORK	

If 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 World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date o f filing this Authorization.

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 Remove

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 Holding 81 LLC		
Mailing Address Information For Applicant:			
Address 1	7251 W. Lake Mead Blvd.		
Address 2	Suite 300		
City	Las Vegas	**State/Province**	NV
Country [i]	US	Postal Code	89128
Phone Number		Fax Number	

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN207446
	Application Number	
Title of Invention	POWER CONTROL IN A WIRELESS NETWORK	

Email Address	

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

Assignee Information including Non-Applicant Assignee Information:

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

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.

Remove

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

Organization Name	Intellectual Ventures Holding 81 LLC

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	7251 W. Lake Mead Blvd.		
Address 2	Suite 300		
City	Las Vegas	**State/Province**	NV
Country i	US	Postal Code	89128
Phone Number		Fax Number	
Email Address			

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

Signature:

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Signature	/Harry Vartanian/			Date (YYYY-MM-DD)	2015-05-15
First Name	Harry	Last Name	Vartanian	Registration Number	56787

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IPW2-USCN207446
	Application Number	
Title of Invention	POWER CONTROL IN A WIRELESS NETWORK	

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 C o o p eration Treaty.

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

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

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

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

PTO/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	POWER CONTROL 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 13/727,153 filed on December 26, 2012.

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: Nicholas W. ANDERSON Date (Optional): 19th March 2013

Signature: /nwa/

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.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Filer:	Harry Vartanian/Elizabeth McGinty
Attorney Docket Number:	IPW2-USCN207446

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	420	420
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**2020**

Electronic Acknowledgement Receipt	
EFS ID:	22361946
Application Number:	14713719
International Application Number:	
Confirmation Number:	3361
Title of Invention:	POWER CONTROL IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Nicholas W. Anderson
Customer Number:	3624
Filer:	Harry Vartanian/Elizabeth McGinty
Filer Authorized By:	Harry Vartanian
Attorney Docket Number:	IPW2-USCN207446
Receipt Date:	15-MAY-2015
Filing Date:	
Time Stamp:	16:31:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$2020
RAM confirmation Number	3276
Deposit Account	220493
Authorized User	VARTANIAN, HARRY
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IPW2-USCN207446-Application-20150515.PDF	161526 14d50635e122eaa17f720f388abfd32f2ff4fd94	yes	28
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Specification		1	23	
	Claims		24	27	
	Abstract		28	28	
Warnings:					
Information:					
2	Drawings-only black and white line drawings	IPW2-USCN207446-Drawings-20150515.PDF	76657 a2249054461699e4b97ae2f3b0b5410df161cd99	no	4
Warnings:					
Information:					
3	Application Data Sheet	IPW2-USCN207446-ADS-20150515.PDF	1894980 56a02d42db44689c46b15519d41b41216b90907a	no	7
Warnings:					
Information:					
4	Oath or Declaration filed	IPW2-USCN207446-ParentSignedDeclaration-Anderson-20150515.PDF	1541934 e61c60b7d4d484e83029c93c81bc07a228a7b79b	no	1
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	36767 bf2ee0a3a3d6d366b25a6dd56ce916a05a83a787	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	3711864		

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

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

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