

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378(b))				
Patent Number	Issue Date	Application Number	Filing Date	Docket Number (if applicable)
8089946	03-Jan-2012	12548502	27-Aug-2009	
CAUTION: Maintenance fee (and surcharge, if any) payment must correctly identify: (1) the patent number and (2) the application number of the actual U.S. application leading to issuance of that patent to ensure the fee(s) is/are associated with the correct patent. 37 CFR 1.366(c) and (d).				
Applicants claims the following fee status:				
☐ Small Entity				
☐ Micro Entity				
☒ Regular Undiscounted				
Applicants selects the following :				
☐ 3 1/2		☒ 7 1/2		☐ 11 1/2
PETITION FEE The petition fee required by 37 CFR 1.17(m) (Fee Code 1558/2558) must be paid as a condition of accepting unintentionally delayed payment of the maintenance fee.				
MAINTENANCE FEE (37 CFR 1.20(e)-(g)) The appropriate maintenance fee must be submitted with this petition.				
STATEMENT The delay in payment of the maintenance fee for this patent was unintentional. Petitioner is reminded that a delay resulting from a deliberately chosen course of action or a change in circumstance is not an unintentional delay. Petitioner is further reminded that a person seeking reinstatement of an expired patent should not make a statement that the delay in payment of the maintenance fee was unintentional unless the entire delay was unintentional, including the period from discovery that the maintenance fee was not timely paid until payment of the maintenance fee. For example, a statement that the delay in payment of the maintenance fee was unintentional would not be proper when the patentee becomes aware of an unintentional failure to timely pay the maintenance fee and then intentionally delays filing a petition for reinstatement of the patent under 37 CFR 1.378. See MPEP 2590. NOTE: Where the petition under 37 CFR 1.378 is filed more than two years after the date the patent expired for nonpayment of the maintenance fee, the United States Patent and Trademark Office requires an additional explanation of the circumstances surrounding the delay that establishes the entire delay was unintentional. This requirement is in addition to the requirement to provide a statement that the entire delay was unintentional. See <i>Clarification of the Practice for Requiring Additional Information in Petitions Filed in Patent Applications and Patents Based on Unintentional Delay</i> , 85 FR 12222 (March 2, 2020). See MPEP 711.03(c)(II)(C)-(F) for additional guidance on the information required to establish that the entire delay was unintentional.				
PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED				
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES 37 CFR 1.378(c) states: "Any petition under this section must be signed in compliance with 37 CFR 1.33(b)."				
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 has been given power of attorney in this application.
- ☒ An attorney or agent registered to practice before the Patent and Trademark Office
- ☐ A sole patentee
- ☐ A joint patentee; I certify that I am authorized to sign this submission on behalf of all the other patentees as evidenced by the power of attorney in the application
- ☐ A joint patentee; all of whom are signing this e-petition
- ☐ The assignee of record of the entire interest that qualifies as an authorized party under 37 CFR 1.33(b)

Patent Practitioner

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature

Signature	/Justin R. Nifong/		
Name	Justin R. Nifong	Registration Number	59389

Electronic Patent Application Fee Transmittal				
Application Number:		12548502		
Filing Date:		27-Aug-2009		
Title of Invention:		BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM		
First Named Inventor/Applicant Name:		Karl D. BROMMER		
Filer:		Justin Robert Nifong		
Attorney Docket Number:		C103D/US		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
MAINTENANCE FEE DUE AT 7.5 YEARS	1552	1	3760	3760
PET. DELAY PYMT MAINTAIN PATENT IN FORCE	1558	1	2100	2100
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				5860



UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
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In re Patent No. 8089946 :
Issue Date: January 3, 2012 :
Application No. 12548502 :DECISION GRANTING PETITION
Filed: August 27, 2009 :UNDER 37 CFR 1.378(b)
Attorney Docket No. C103D/US :

This is a decision on the electronic petition, filed January 14, 2021, under 37 CFR 1.378(b) to accept the unintentionally delayed payment of the 7.5 year maintenance fee for the above-identified patent.

The petition is **GRANTED**.

The maintenance fee is accepted, and the above-identified patent reinstated as of January 14, 2021. This decision also constitutes notice that the fee has been accepted. An electronic copy of the petition and this decision has been created as an entry in the Image File Wrapper. Nevertheless, petitioner should print and retain an independent copy.

Telephone inquiries related to this electronic decision should be directed to the Electronic Business Center at 1-866-217-9197.

Electronic Acknowledgement Receipt	
EFS ID:	41650299
Application Number:	12548502
Patent Number:	8089946
Confirmation Number:	7248
Petition Issued Date:	January 14,2021
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	114420
Filer:	Justin Robert Nifong
Filer Authorized By:	
Attorney Docket Number:	C103D/US
Receipt Date:	14-JAN-2021
Filing Date:	27-AUG-2009
Time Stamp:	16:40:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$5860
RAM confirmation Number	E20211DG41273122
Deposit Account	506191
Authorized User	Justin Nifong
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

37 CFR 1.16 (National application filing, search, and examination fees)
 37 CFR 1.17 (Patent application and reexamination processing fees)
 37 CFR 1.19 (Document supply fees)
 37 CFR 1.20 (Post Issuance fees)
 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition automatically granted by EFS	petition-request.pdf	38726	no	2
			bu9d14c1770431b034ccbc6d4ac03e16034d8476		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	32179	no	2
			96d83e2d3a08db541c796c2f3530b23f20ff0bc5		

Warnings:

Information:

Total Files Size (in bytes): 70905

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,502	08/27/2009	Karl D. BROMMER	C103D/US

CONFIRMATION NO. 7248

POA ACCEPTANCE LETTER

114420
Collision Communications, Inc.
5400 Trinity Road
Suite 303
Raleigh, NC 27607



Date Mailed: 06/24/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/14/2013.

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

/mbeyene/

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



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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,502	08/27/2009	Karl D. BROMMER	234/4/2 (DIV)

CONFIRMATION NO. 7248

POWER OF ATTORNEY NOTICE

79683
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511



Date Mailed: 06/24/2013

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/14/2013.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/mbeyene/

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

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

☒ Practitioners associated with the Customer Number:

114420

OR

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

Name	Registration Number	Name	Registration Number

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

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

☒ The address associated with Customer Number:

114420

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

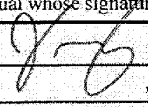
Assignee Name and Address:

Collision Communications, Inc.
20 Depot Street, Suite 2A
Peterborough, NH 03458

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

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

Signature		Date	4/10/2013
Name	Jared Fry	Telephone	(857) 222-0690
Title	Co-Chairman, Collision Communications, Inc.		

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

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

Electronic Acknowledgement Receipt	
EFS ID:	16040227
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	79683
Filer:	Theodosios Thomas/Jeanine Young
Filer Authorized By:	Theodosios Thomas
Attorney Docket Number:	234/4/2 (DIV)
Receipt Date:	14-JUN-2013
Filing Date:	27-AUG-2009
Time Stamp:	11:05:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		C103D_373_Statement.pdf	403209 17c11408cef51bb70b75f9df40fb9478022184cf	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Assignee showing of ownership per 37 CFR 3.73.	1	2
	Power of Attorney	3	3
Warnings:			
Information:			
Total Files Size (in bytes):		403209	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	Customer No.: 114420
Inventor: Karl D. Brommer	Confirmation Number: 7248
Application Number: 12/548,502	Group Art Unit: 2617
Filed: 8/27/2009	Examiner: Ariel A. Balaoing

For: Bandwidth-Efficient Wireless Network Modem

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

STATEMENT UNDER 37 CFR 3.73(b)

IN ACCORDANCE WITH 37 CFR 3.71(a), PROSECUTION OF THE PRESENT APPLICATION SHALL BE CONDUCTED BY THE ASSIGNEE, TO THE EXCLUSION OF THE INVENTOR(S).

Applicant, **Collision Communications, Inc.**, a Limited Liability Company, states that it is:

1. ☒ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title, and interest
(The extent (by percentage) of its ownership interest is _____%)

in the patent application identified above by virtue of an assignment from the inventor(s) to the current assignee as follows:

1. From: **Inventor(s)** To: **BAE Systems Information And Electronic Systems Integration Inc.**
The document was recorded in the United States Patent and Trademark Office at Reel / Frame: **030509 / 0749**, or for which a copy thereof is attached.
2. From: **BAE Systems Information And Electronic Systems Integration Inc.** To: **Collision Technology LLC**
The document was recorded in the United States Patent and Trademark Office at Reel / Frame: **026190 / 0812**, or for which a copy thereof is attached.

Additional documents in the chain of title are listed on a supplemental sheet.

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

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to the 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.

Signature: _____

Theodosios Thomas

Reg. No. 45159, Patent Counsel, Phone No. 919-233-1942 x-203

Date: 06/06/13

STATEMENT UNDER 37 CFR 3.73(c)
(Supplemental Sheet)

3. From: **Collision Technology LLC** To: **Collision Communications, Inc.**

The document was recorded in the United States Patent and Trademark Office at Reel / Frame:
028490 / 0285, or for which a copy thereof is attached.



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	01/03/2012	8089946	234/4/2 (DIV)	7248

79683 7590 12/14/2011
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511

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):

Karl D. BROMMER, Exeter, NH;



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



Bib Data Sheet

CONFIRMATION NO. 7248

SERIAL NUMBER 12/548,502	FILING OR 371(c) DATE 08/27/2009 RULE	CLASS 370	GROUP ART UNIT 2617	ATTORNEY DOCKET NO. 234/4/2 (DIV)
APPLICANTS Karl D. BROMMER, Exeter, NH; ** CONTINUING DATA ***** This application is a DIV of 10/529,019 03/24/2005 PAT 7,599,346 ** FOREIGN APPLICATIONS *****				
IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 09/09/2009				
Foreign Priority claimed ☐ yes ☒ no 35 USC 119 (a-d) conditions ☐ yes ☒ no ☐ Met after met Allowance Verified and Acknowledged Examiner's Signature _____ Initials _____		STATE OR COUNTRY NH	SHEETS DRAWING 19	TOTAL CLAIMS 8
INDEPENDENT CLAIMS 2				
ADDRESS 79683				
TITLE BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM				
FILING FEE RECEIVED 1390	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	



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NOTICE OF ALLOWANCE AND FEE(S) DUE

79683 7590 11/14/2011
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511

EXAMINER

BALAOING, ARIEL A

ART UNIT

PAPER NUMBER

2617

DATE MAILED: 11/14/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	08/27/2009	Karl D. BROMMER	234/4/2 (DIV)	7248

TITLE OF INVENTION: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	02/14/2012

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 SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

79683 7590 11/14/2011
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511

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.
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12/548,502	08/27/2009	Karl D. BROMMER	234/4/2 (DIV)	7248
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TITLE OF INVENTION: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	02/14/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
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BALAOING, ARIEL A	2617	370-346000
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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, 1 _____
(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. 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 3.111. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

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

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

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

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

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

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	08/27/2009	Karl D. BROMMER	234/4/2 (DIV)	7248

EXAMINER	
BALAOING, ARIEL A	

ART UNIT	PAPER NUMBER
2617	

79683 7590 11/14/2011
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511

DATE MAILED: 11/14/2011

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No.	Applicant(s)	
	12/548,502	BROMMER, KARL D.	
	Examiner	Art Unit	
	ARIEL BALAOING	2617	

-- 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 amendments filed 08/12/2011.

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, 9-25.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some* c) ☐ None of 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. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 (b) ☐ 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).

7. ☐ 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. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) 3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____ 4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material	5. ☐ Notice of Informal Patent Application 6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ 7. ☒ Examiner's Amendment/Comment 8. ☐ Examiner's Statement of Reasons for Allowance 9. ☐ Other _____.
--	--

/Ariel Balaoing/ Primary Examiner, Art Unit 2617	
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EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with JUSTIN NIFONG (Reg. No. 59,389) on 11/02/2011.

The application has been amended as follows:

Claim 1:

A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

a multiuser detection (MUD) module ~~adapted~~ configured to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation;

a data formatting module operatively coupled to the multiuser detection module, and ~~adapted~~ configured to produce network data packets for at least one of the K recovered signals;

a control processor operatively coupled to the formatting module, and ~~adapted~~ configured to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol

mode that exploits co-channel demodulation capabilities of the modem , wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and OAM ; and

a demultiplexer operatively coupled to the data formatting module and the control processor, and ~~adapted~~ configured to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor, wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a network data packet formatting mode in which the data formatting operates.

Claim 2:

The modem of claim 1, further comprising a front end ~~adapted~~ configured to simultaneously receive the K wirelessly transmitted signals, and to provide those signals to the MUD and a parameter estimator in a form that facilitates their subsequent processing by the multiuser detection module.

Claim 4:

The modem of claim 1, wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode ~~thereby providing backwards compatibility while continuing operation of the bandwidth efficient aggressive access protocol mode.~~

Claim 15:

A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

a multiuser detection (MUD) module receiving D inputs from D analog to digital (A/D) converters ~~adapted~~ configured to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation, simultaneously outputting K recovered signals;

a parameter estimator module receiving the D inputs from the D A/D converters;

a bank of K decoders communicating with the K MUD module outputs, the bank of K decoders producing a bn output to the MUD module from the input of K MUD module recovered signals;

a data formatting module operatively coupled to the parallel K MUD module outputs of the MUD module, and ~~adapted~~ configured to produce network data packets of the parallel K recovered signals, the parallel K recovered signal data packets communicated to a demultiplexer, wherein the data formatting module supports multiple types of network packet format modes;

the demultiplexer operatively coupled to the data formatting module, receiving the parallel K recovered signal data packets, and ~~adapted~~ configured to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user, m, associated with the modem, and to communicate m data packets of the K recovered

signal data packets to a recipient, where the selection is based on a control input from a control processor;

the control processor operatively coupled to the demultiplexer and the data formatting module, and ~~adapted~~ configured to detect with which protocol mode the at least one of the K recovered signals was transmitted, based on input from the data formatting module, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem, the control processor also configured to select a network data packet formatting mode in which the data formatting operates

a modulator operatively coupled to the control processor, the control processor enabling the transmission mode of the modulator, the transmission mode corresponding to the protocol mode in which the at least one of the K recovered signals was transmitted; and

an amplifier operatively coupled to the modulator, the amplifier in communication with at least one antenna output port.

Claim 25:

A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

a front end receiver block comprising a plurality, D, of antenna diversity ports, a plurality of D tuners, and a plurality of D analog to digital (A/D) converters;

the plurality, D, of antenna diversity ports communicating, respectively, with D antennas;

the plurality of D tuners communicating, respectively, with the D antenna diversity ports;

the plurality of D A/D converters communicating, respectively, with the D tuners, each outputting a baseband waveform, respectively corresponding to each of the D antenna diversity ports;

a multiuser detection (MUD) module receiving D inputs from the D A/D converters, wherein the MUD module is ~~adapted~~ configured to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation, simultaneously outputting K recovered signals;

a parameter estimator module receiving the D inputs from the D A/D converters, wherein the parameter estimator estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, outputting parameter estimation matrix S to the MUD module;

a bank of K decoders communicating with the K MUD module outputs, the bank of K decoders producing a bn output to the MUD module from the input of K MUD module recovered signals;

a data formatting module operatively coupled to the parallel K MUD module outputs of the MUD module, and ~~adapted~~ configured to produce network data packets

of the parallel K recovered signals, the parallel K recovered signal network data packets communicated to a demultiplexer, wherein the data formatting module supports multiple types of network data packet format modes;

the demultiplexer operatively coupled to the data formatting module, receiving the parallel K recovered signal network data packets, and ~~adapted~~ configured to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user, m, associated with the modem, and to communicate m data packets of the K recovered signal data packets to a recipient, where the selection is based on a control input from a control processor;

the control processor operatively coupled to the demultiplexer and the data formatting module, and ~~adapted~~ configured to detect with which protocol mode the at least one of the K recovered signals was transmitted, based on input from the data formatting module, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem, wherein the signals of the one of a legacy protocol mode comprise low data rate BPSK or QPSK, or BPSK and QPSK, the control processor also configured to select a network data packet formatting mode in which the data formatting operates;

a modulator operatively coupled to the control processor, the control processor providing a burst control input, enabling a transmission mode of the modulator, the transmission mode corresponding to the protocol mode in which the at least one of the

K recovered signals was transmitted, and an input of data from the user m from the demultiplexer; and

an amplifier operatively coupled to the modulator, the amplifier in communication with at least one antenna output port.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ARIEL BALAOING whose telephone number is (571)272-7317. The examiner can normally be reached on Monday-Friday from 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dwayne Bost can be reached on (571) 272-7023. 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.

Application/Control Number: 12/548,502
Art Unit: 2617

Page 9

/Ariel Balaoing/
Primary Examiner, Art Unit 2617

Search Notes 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

SEARCHED			
Class	Subclass	Date	Examiner
370	346,342,328	11/2/2011	AB
375	147,220,222	11/2/2011	AB
455	552.1,434	11/2/2011	AB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search	11/2/2011	AB
Inventor Search	5/4/2010	AB
Interference Search	11/2/2011	AB

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
370	346,342,328	11/2/2011	AB
375	147,220,222	11/2/2011	AB
455	552.1,434	11/2/2011	AB

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Issue Classification 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

ORIGINAL						INTERNATIONAL CLASSIFICATION													
CLASS		SUBCLASS				CLAIMED					NON-CLAIMED								
370		346				H	0	4	B	7 / 216 (2006.01.01)									
CROSS REFERENCE(S)						H	0	4	J	3 / 16 (2006.01.01)									
						H	0	4	W	4 / 00 (2009.01.01)									
						H	0	4	B	1 / 00 (2006.01.01)									
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					H	0	4	B	1 / 38 (2006.01.01)									
370	342	328				H	0	4	B	72 / 00 (2009.01.01)									
375	147	220	222			H	0	4	W	4 / 00 (2009.01.01)									
455	552.1	434				H	0	4	W										

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	12	17												
2	2	13	18												
-	3	14	19												
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4	9	20	25												
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6	11														
7	12														
8	13														
9	14														
10	15														
11	16														

NONE		Total Claims Allowed:	
		20	
(Assistant Examiner)	(Date)		
/ARIEL BALAOING/ Primary Examiner. Art Unit 2617		O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

<i>Index of Claims</i> 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

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

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	02/05/2010	04/09/2010	12/07/2010	04/09/2011	11/02/2011			
1	1	÷	✓	✓	✓	=			
2	2	÷	✓	✓	✓	=			
-	3	÷	✓	-	-	-			
3	4	÷	✓	✓	✓	=			
-	5	÷	N	-	-	-			
-	6	÷	N	-	-	-			
-	7	÷	N	-	-	-			
-	8	÷	N	-	-	-			
4	9					=			
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16	21					=			
17	22					=			
18	23					=			
19	24					=			
20	25					=			

EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	((multiuser "multi-user" multiple adj (user subscriber)) same (data packet) same (legacy) same (protocol format\$4) same (mode) near2 (detect\$4 select\$4 determin\$6) same (demodulat\$5 modulat\$5)).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2011/11/03 10:34

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	0	((multiuser "multi-user" multiple adj (user subscriber)) same (data packet) same (legacy) same (protocol format\$4) same (mode) near2 (detect\$4 select\$4 determin\$6) same (demodulat\$5 modulat\$5)).clm.	USPAT; UPAD	OR	OFF	2011/11/03 10:34

11/ 3/ 2011 10:35:18 AM

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)

79683 7590 11/14/2011
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511

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.
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12/548,502	08/27/2009	Karl D. BROMMER	234/4/2 (DIV)	7248
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TITLE OF INVENTION: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1740	\$300	\$0	\$2040	02/14/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
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BALAOING, ARIEL A	2617	370-346000
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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 Olive Law Group, PLLC

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

Collision Technology, LLC

(B) RESIDENCE: (CITY AND STATE OR COUNTRY)

Peterborough, NH

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

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

- ☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

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

- ☐ A check is enclosed.
☒ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-5046 (enclose an extra copy of this form).

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

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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

Authorized Signature /Bentley J. Olive/

Date November 14, 2011

Typed or printed name Bentley J. Olive

Registration No. 44,985

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

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Electronic Patent Application Fee Transmittal				
Application Number:		12548502		
Filing Date:		27-Aug-2009		
Title of Invention:		BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM		
First Named Inventor/Applicant Name:		Karl D. BROMMER		
Filer:		Bentley J. Olive		
Attorney Docket Number:		234/4/2 (DIV)		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1740	1740
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2040

Electronic Acknowledgement Receipt	
EFS ID:	11396389
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	79683
Filer:	Bentley J. Olive
Filer Authorized By:	
Attorney Docket Number:	234/4/2 (DIV)
Receipt Date:	14-NOV-2011
Filing Date:	27-AUG-2009
Time Stamp:	12:27:40
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$2040
RAM confirmation Number	17312
Deposit Account	505046
Authorized User	OLIVE,BENTLEY J
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)					
Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)					
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Notice_of_Allowance_Submittal.pdf	965824	no	1
			d3a8cb749f2e3af2ce8eaf354e44caf7e98e70b1		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32047	no	2
			5eb99fbf5937651f961b610c6b75430b27ffd6b8		
Warnings:					
Information:					
Total Files Size (in bytes):			997871		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,502	08/27/2009	Karl D. BROMMER	C003DUS

CONFIRMATION NO. 7248

POA ACCEPTANCE LETTER

79683
OLIVE LAW GROUP, PLLC
125 EDINBURGH SOUTH DRIVE, SUITE 100
CARY, NC 27511



Date Mailed: 08/19/2011

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/15/2011.

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.

/hchristian/

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



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,502	08/27/2009	Karl D. BROMMER	C003DUS

CONFIRMATION NO. 7248

POWER OF ATTORNEY NOTICE

24222

Vern Maine & Associates
547 AMHERST STREET, 3RD FLOOR
NASHUA, NH 03063-4000



Date Mailed: 08/19/2011

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/15/2011.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/hchristian/

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

POWER OF ATTORNEY FOR PATENT APPLICATIONS

Under CFR § 3.73(b), Collision Technology, LLC, a corporation, hereby certifies that it is the Assignee of the entire right, title, and interest in and to the patent applications listed below. Each of the patent applications listed below is assigned to Collision Technology, LLC. As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the Assignee was submitted for recordation pursuant to 37 CFR 3.11 as shown in the Reel/Frame numbers listed below.

Filing Date	Application Serial No.; Patent No. (if issued)	Title	Reel/Frame
10/03/2003	10/678,203; 6,831,574	MULTI-TURBO MULTI- USER DETECTOR	014073/0269 026190/0812
04/05/2004	10/818,536; 6,967,598	REDUCED COMPLEXITY MULTI-TURBO MULTI- USER DETECTOR	014525/0140 026190/0812
03/24/2005	10/529,019; 7,599,346	BANDWIDTH- EFFICIENT WIRELESS NETWORK MODEM	016520/0107 026190/0812 026193/0661
08/27/2009	12/548,502	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM	026190/0812
02/03/2004	10/486,004; 7,486,722	BANDWIDTH EFFICIENT CABLE NETWORK MODEM	013771/0874 014405/0749 026190/0812 026193/0661
02/11/2004	10/486,871; 7,245,673	WINDOWED MULTIUSER DETECTION	013816/0233 015656/0249 026190/0812 026193/0661
12/21/2004	10/497,556; 7,126,533	DIRECTION-FINDING FOR MULTIPLE COCHANNEL SOURCES	014737/0931 013824/0323 026190/0812 026193/0661
04/19/2005	10/531,772; 7,463,703	JOINT SYMBOL, AMPLITUDE, AND RATE ESTIMATOR	015999/0543 026190/0812 026193/0661
10/15/2008	12/251,571; 7,590,203	JOINT SYMBOL, AMPLITUDE, AND RATE ESTIMATOR	021690/0566 026190/0812
10/15/2008	12/251,575; 7,583,757	JOINT SYMBOL, AMPLITUDE, AND RATE ESTIMATOR	021690/0608 026190/0812
06/25/2009	12/491,332; 7,920,651	JOINT SYMBOL, AMPLITUDE, AND RATE	022879/0419 026190/0812

		ESTIMATOR	
12/23/2003	10/482,599; 7,428,261	CROSS-SYSTEM INTERFERENCE CANCELLATION FOR MULTICARRIER CDMA AND OFDM	013823/0522 014271/0189 026190/0812 026193/0661
12/01/2005	11/291,883; 7,593,473	TREE STRUCTURED MULTICARRIER MULTIPLE ACCESS SYSTEMS	016887/0516 026190/0812
12/01/2005	11/292,233; 7,817,754	M-ALGORITHM WITH PRIORITIZED USER ORDERING	017098/0162 026190/0812
04/10/2006	11/400,922; 7,783,110	SEMICOHERENT CHANNEL ESTIMATOR	017623/0177 026190/0812
08/10/2006	11/463,877; 7,613,228	M-ALGORITHM MULTIUSER DETECTOR WITH CORRELATION BASED PRUNING	018151/0479 026190/0812
09/15/2006	11/532,125; 7,593,492	COMBINATIONAL HYBRID TURBO-MUD	018272/0171 026190/0812
08/12/2009	12/539,691	METHOD FOR SIMULTANEOUS DETECTION OF A PLURALITY OF RFID TAGS USING MULTIUSER DETECTION	023099/0858 026190/0812
05/13/2010	12/742,686	MEDIA ACCESS CONTROL PROTOCOL FOR MULTIUSER DETECTION ENABLED AD-HOC WIRELESS COMMUNICATIONS	025578/0117 024673/0287 026190/0812
07/24/2003	10/626,146; 7,218,690	HYBRID TURBO-MUD FOR MULTIPLE ACCESS SYSTEMS	013859/0734 026190/0812
04/11/2002	10/120,955; 6,947,506	METHOD AND APPARATUS FOR IMPROVED TURBO MULTIUSER DETECTOR	013095/0631 026190/0812
01/23/2002	10/055,155; 6,839,390	VOTING SYSTEM FOR IMPROVING THE PERFORMANCE OF SINGLE-USER	012540/0669 024907/0140 026190/0812

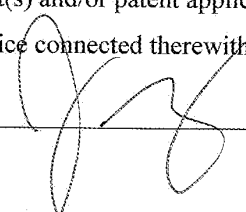
		DECODERS WITHIN AN ITERATIVE MULTI- USER DETECTION SYSTEM	
11/12/2004	10/987,140; 7,350,136	VOTING SYSTEM FOR IMPROVING THE PERFORMANCE OF SINGLE-USER DECODERS WITHIN AN ITERATIVE MULTI- USER DETECTION SYSTEM	026190/0812
07/29/2002	10/208,409; 6,704,376	POWER AND CONFIDENCE ORDERED LOW COMPLEXITY SOFT TURBOMUD WITH VOTING SYSTEM	013020/0053 026190/0812
06/08/2004	10/863,081; 7,092,464	MULTIUSER DETECTION WITH TARGETED ERROR CORRECTION CODING	014778/0014 026190/0812
03/25/2002	10/105,918; 7,110,439	SYSTEM FOR DECREASING PROCESSING TIME IN AN ITERATIVE MULTI- USER DETECTOR SYSTEM	012744/0987 026190/0812
04/25/2003	10/423,695; 7,190,747	FREQUENCY MISMATCH COMPENSATION FOR MULTIUSER DETECTION	013676/0030 026190/0812
04/25/2003	10/423,740; 7,092,452	CO-CHANNEL INTERFERENCE RECEIVER	013674/0904 026190/0812
07/29/2002	10/207,490; 7,190,743	METHOD AND APPARATUS FOR OPTIMIZING TREE PRUNING IN A MULTIUSER DETECTOR	013198/0060 026190/0812
04/16/2003	10/414,738; 7,269,223	SYSTEM AND METHOD FOR INCREASING THROUGHPUT IN A MULTIUSER DETECTION BASED MULTIPLE ACCESS	013633/0069 026190/0812

		COMMUNICATIONS SYSTEM	
02/14/2005	11/057,479; 7,724,851	RECEIVER WITH MULTIPLE COLLECTORS IN A MULTIPLE USER DETECTION SYSTEM	016000/0309 026190/0812
04/29/2002	10/134,330; 6,981,203	METHOD AND APPARATUS FOR RANDOM SHUFFLED TURBO MULTIUSER DETECTOR	012877/0237 013129/0802 026190/0812
04/25/2003	10/423,655; 7,218,665	DEFERRED DECORRELATING DECISION-FEEDBACK DETECTOR FOR SUPERSATURATED COMMUNICATIONS	013633/0393 025710/0043 026190/0812
04/24/2003	10/422,340; 6,954,482	SOFT-DECISION TRELLIS-CODED DIFFERENTIAL FREQUENCY-HOPPED SPREAD SPECTRUM (DFHSS)	013643/0771 026190/0812
04/22/2005	10/482,598; 6,999,498	MULTIUSER DETECTION AIDED MULTIPLE ACCESS DIFFERENTIAL FREQUENCY-HOPPED SPREAD SPECTRUM	013904/0597 014293/0674 026190/0812 026193/0661
04/19/2004	10/827,462; 7,376,171	MULTIUSER DETECTION AIDED MULTIPLE ACCESS DIFFERENTIAL M-ARY CODING APPLICATIONS	014602/0733 026190/0812
09/10/2003	10/659,567; 7,236,546	PIPELINED TURBO MULTIUSER DETECTION	014002/0447 026190/0812
08/07/2001	09/923,709; 7,058,422	METHOD FOR OVERUSING FREQUENCIES TO PERMIT SIMULTANEOUS TRANSMISSION OF SIGNALS FROM TWO OR MORE USERS ON THE	012100/0995 026190/0812

		SAME FREQUENCY AND TIME SLOT	
08/31/2001	09/943,770; 6,947,505	SYSTEM FOR PARAMETER ESTIMATION AND TRACKING OF INTERFERING DIGITALLY MODULATED SIGNALS	012151/0553 026190/0812
04/16/2003	10/414,784; 6,985,699	EFFICIENT AND OPTIMAL CHANNEL ENCODING AND CHANNEL DECODING IN A MULTIPLE ACCESS COMMUNICATIONS SYSTEM	013633/0018 026190/0812
04/18/2002	10/125,241; 7,233,620	BANDWIDTH-EFFICIENT WIRELESS NETWORK MODEM	012670/0320 026190/0812
06/20/2002	10/176,011; 7,200,103	REDUCED ALGORITHM RECEIVER	013191/0058 026190/0812
06/20/2002	10/175,693; 7,139,334	COOPERATIVE CODE-ENHANCED MULTI-USER COMMUNICATIONS SYSTEM	013192/0370 013194/0865 026190/0812
08/26/2002	10/228,787; 6,947,502	PARAMETER ESTIMATOR FOR A MULTIUSER DETECTION RECEIVER	013198/0089 026190/0812
09/20/2002	10/251,187; 6,826,140	MULTICHANNEL DIGITAL RECORDING SYSTEM WITH MULTI-USER DETECTION	013147/0391 026190/0812
06/30/2004	10/497,557; 7,126,890	MULTITRACK READBACK AND MULTIUSER DETECTION FOR DISK DRIVES	014764/0397 014052/0594 026190/0812 026193/0661
08/27/2010	12/869,875	QR-RLS ADAPTIVE DIGITAL FILTER WITH 18-BIT PIPELINE ARCHITECTURE	024974/0911 026190/0812 026193/0661
04/20/2011	13/090,435	DISTRIBUTED SCHEDULER DESIGN FOR MULTIUSER	026155/0754 026190/0812 026193/0661

		DETECTION ENABLED WIRELESS MOBILE AD HOC NETWORKS	
01/31/2011	13/017,819	MULTIUSER DETECTION ENABLED MEDIUM ACCESS CONTROLE IN MOBILE AD HOC NETWORKS	026126/0450 026190/0812 026193/0661
02/23/2011	12/932,318	POWER AWARE SCHEDULING AND POWER CONTROL TECHNIQUES FOR MULTIUSER DETECTION ENABLED WIRELESS AD-HOC NETWORKS	025895/0099 026190/0812 026193/0661

The undersigned, acting as the Assignee, hereby revokes all prior powers of attorney, if applicable, and appoints the practitioners associated with the customer number 79683 as my/our attorney(s) or agent(s) to prosecute the patent(s) and/or patent application(s) and transact all business in the United States Patent and Trademark Office connected therewith.

By: 
 Jared Fry
 Member, Collision Technology, LLC

Date: 8/13/2011

Electronic Acknowledgement Receipt	
EFS ID:	10732404
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	24222
Filer:	Justin Robert Nifong
Filer Authorized By:	
Attorney Docket Number:	C003DUS
Receipt Date:	15-AUG-2011
Filing Date:	27-AUG-2009
Time Stamp:	08:01:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	POA_Collision_OliveLawGroup_20110812.pdf	3476082 a15fd5bbef4103df873fa8db61954b90f35cflba	no	6

Warnings:

Information:

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: BROMMER, Karl D.

TC/AU: 2617

Serial No. 12/548,502

Examiner: BALAOING, Ariel A.

Filing or 371 (c) Date: 8/27/2009

Dkt No: C003DUS

For: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

To: Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Customer No:

24222

Commissioner:

OFFICE ACTION RESPONSE
AMENDMENT

INTRODUCTORY COMMENTS

In response to the Office's Non-Final Office Action dated 04/14/2011, the Applicant has timely enclosed herein: 20 pages Office Action Response. Applicant respectfully requests and extension of time to respond within the 1 month and submits herein the \$65.00 extension fee. Please amend the above-identified application as follows:

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

Remarks/Arguments begin on page 9 of this paper.

DEPOSIT ACCOUNT 500323 AUTHORIZATION - All necessary fees relating to the attached submittal, if any, are intended to be included. However, the Office is hereby authorized to charge any deficiency or credit any overpayment in the fees relating to the submittal to deposit account 500323, registered to Vernon C. Maine PLLC, contact telephone no. 603-886-6100.

AMENDMENTS TO THE CLAIMS

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

Claim 1. (Currently Amended) A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

a multiuser detection (MUD) module adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation;

a data formatting module operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals;

a control processor operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem, wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM; and

a demultiplexer operatively coupled to the data formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor, wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a network data packet formatting mode in which the data formatting operates, ~~and wherein the signals~~

~~of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM.~~

Claim 2. (Currently Amended) The modem of claim 1, further comprising a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals to the MUD and a parameter estimator in a form that facilitates their subsequent processing by the multiuser detection module.

Claim 3. (Canceled)

Claim 4. (Currently Amended) The modem of claim 1, wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode thereby providing backwards compatibility while continuing operation of the bandwidth efficient aggressive access protocol mode.

Claim 5-8. (Canceled)

Claim 9. (New) The modem of claim 1, further comprising a parameter estimator module receiving D diversity inputs from D analog to digital (A/D) converters, the parameter estimator module outputting an S matrix to the MUD module, wherein the S matrix comprises estimated composite signature waveforms.

Claim 10. (New) The modem of claim 1, further comprising a bank of K decoders communicating with the K MUD module outputs, the bank of K decoders producing a matrix b_n output to the MUD module from the input of K MUD module recovered signals, wherein the matrix b_n is a matrix of symbol estimates.

Claim 11. (New) The modem of claim 1, wherein the control processor is configured to detect whether wirelessly received data for each user K has been transmitted in accordance with a simultaneously transmitted single channel polling bandwidth efficient aggressive access protocol mode.

Claim 12. (New) The modem of claim 1, wherein the control processor detects which of the received data signals 1-K is the intended data signal m, based on packet header information provided by the data formatting module.

Claim 13. (New) The modem of claim 1, wherein the control processor also executes channel assignment arbitration sequences and data transmission timing sequences to operate in accordance with a beacon signal polling and scheduling bandwidth efficient aggressive access protocol mode.

Claim 14. (New) The modem of claim 1, wherein the data formatting module provides packet header information to the control processor for each of the received signals 1-K, whereby a data signal intended for a particular modem can be identified, while other received data signals can be ignored.

Claim 15. (New) A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

- a multiuser detection (MUD) module receiving D inputs from D analog to digital (A/D) converters adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation, simultaneously outputting K recovered signals;

- a parameter estimator module receiving the D inputs from the D A/D converters;

- a bank of K decoders communicating with the K MUD module outputs, the bank of K decoders producing a bn output to the MUD module from the input of K MUD module recovered signals;

- a data formatting module operatively coupled to the parallel K MUD module outputs of the MUD module, and adapted to produce network data packets of the parallel K recovered signals, the parallel K recovered signal data packets communicated to a demultiplexer, wherein the data formatting module supports multiple types of network packet format modes;

- the demultiplexer operatively coupled to the data formatting module, receiving the parallel K recovered signal data packets, and adapted to select one

of the recovered K wirelessly transmitted signals as a target signal intended for a user, m, associated with the modem, and to communicate m data packets of the K recovered signal data packets to a recipient, where the selection is based on a control input from a control processor;

the control processor operatively coupled to the demultiplexer and the data formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, based on input from the data formatting module, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem, the control processor also configured to select a network data packet formatting mode in which the data formatting operates

a modulator operatively coupled to the control processor, the control processor enabling the transmission mode of the modulator, the transmission mode corresponding to the protocol mode in which the at least one of the K recovered signals was transmitted; and

an amplifier operatively coupled to the modulator, the amplifier in communication with at least one antenna output port.

Claim 16. (New) The modem of claim 15, further comprising:

a front end receiver block comprising a plurality, D, of antenna diversity ports, a plurality of D tuners, and the plurality of D A/D converters;

the plurality, D, of antenna diversity ports communicating, respectively, with D antennas;

the plurality of D tuners communicating, respectively, with the D antenna diversity ports;

the plurality of D A/D converters communicating, respectively, with the D tuners, each outputting a baseband waveform, respectively corresponding to each of the D antenna diversity ports.

Claim 17. (New) The modem of claim 15, wherein the m data packets of the K recovered signal data packets are formatted for and provided to a network, where the selection is based on a control input from the control processor.

Claim 18. (New) The modem of claim 15, wherein the m data packets of the K recovered signal data packets are formatted for and provided to a backbone, where the selection is based on a control input from the control processor.

Claim 19. (New) The modem of claim 15, wherein the m data packets of the K recovered signal data packets are formatted for and provided to a local host, where the selection is based on a control input from the control processor.

Claim 20. (New) The modem of claim 15, wherein the data formatting module provides packet header information to the control processor for each of received signals 1-K.

Claim 21. (New) The modem of claim 20, wherein the packet header information of a data signal comprises intended destination of that data signal, whereby the data signal intended for a particular modem can be identified, while other received data signals are ignored.

Claim 22. (New) The modem of claim 15, wherein a legacy default mode is default operating mode, and an automatic switch to a non-default bandwidth efficient aggressive access protocol mode is made once all of receiving and transmitting modems communicating in an established link are identified and known to support the non-default bandwidth efficient aggressive access protocol mode.

Claim 23. (New) The modem of claim 15, wherein the modem is a polling point coordinator access point (AP) element or in a distributed coordination function (DCF) configuration, wherein the AP serves as a global timer; and the DCF provides best-effort delivery of asynchronous packet data.

Claim 24. (New) The modem of claim 15, wherein the modem supports both polling point coordinator access point (AP) and distributed coordination function (DCF) configurations, wherein the DCF employs Carrier Sense

Multiple Access with Collision Avoidance (CSMA/CA), whereby the modem transmits and receives at the same time.

Claim 25. (New) A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

- a front end receiver block comprising a plurality, D, of antenna diversity ports, a plurality of D tuners, and a plurality of D analog to digital (A/D) converters;

- the plurality, D, of antenna diversity ports communicating, respectively, with D antennas;

- the plurality of D tuners communicating, respectively, with the D antenna diversity ports;

- the plurality of D A/D converters communicating, respectively, with the D tuners, each outputting a baseband waveform, respectively corresponding to each of the D antenna diversity ports;

- a multiuser detection (MUD) module receiving D inputs from the D A/D converters, wherein the MUD module is adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation, simultaneously outputting K recovered signals;

- a parameter estimator module receiving the D inputs from the D A/D converters, wherein the parameter estimator estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal, outputting parameter estimation matrix S to the MUD module;

- a bank of K decoders communicating with the K MUD module outputs, the bank of K decoders producing a bn output to the MUD module from the input of K MUD module recovered signals;

- a data formatting module operatively coupled to the parallel K MUD module outputs of the MUD module, and adapted to produce network data packets of the parallel K recovered signals, the parallel K recovered signal

network data packets communicated to a demultiplexer, wherein the data formatting module supports multiple types of network data packet format modes;

the demultiplexer operatively coupled to the data formatting module, receiving the parallel K recovered signal network data packets, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user, m, associated with the modem, and to communicate m data packets of the K recovered signal data packets to a recipient, where the selection is based on a control input from a control processor;

the control processor operatively coupled to the demultiplexer and the data formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, based on input from the data formatting module, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem, wherein the signals of the one of a legacy protocol mode comprise low data rate BPSK or QPSK, or BPSK and QPSK, the control processor also configured to select a network data packet formatting mode in which the data formatting operates;

a modulator operatively coupled to the control processor, the control processor providing a burst control input, enabling a transmission mode of the modulator, the transmission mode corresponding to the protocol mode in which the at least one of the K recovered signals was transmitted, and an input of data from the user m from the demultiplexer; and

an amplifier operatively coupled to the modulator, the amplifier in communication with at least one antenna output port.

REMARKS

Applicant thanks the Examiner for Office Action dated April 14, 2011. Claims 1, 2, and 4 were pending in the application. Claims 1, 2, and 4 were rejected. Claims 1, 2, and 4 have been amended. New claims 9-25 are added. No new matter has been added.

Amendments to the Claims

Applicant has amended claim 1 to recite that “ the control processor is configured to select a network data packet formatting mode”.

Applicant has amended claim 2 to recite that signals are provided “ to the MUD and a parameter estimator”.

Applicant has amended claim 4 to recite “while continuing operation of the bandwidth efficient aggressive access protocol mode”.

New Claims and Support

Applicant has included new claims to further recite embodiments of Applicant’s invention. No new matter has been added, and support for amendments and new claims is summarized as follows:

Claim 1 amendment for network data packet is supported, at least, by paragraphs [0015], [0085], and [0099].

Claim 2 amendment for providing signals to the MUD and a parameter estimator is supported, at least, by Figure 1 and paragraphs [0015], [0078], [0079], [0083], and [0088].

Claim 4 amendment for continuing operation of the bandwidth efficient aggressive access protocol mode is supported, at least, by paragraphs [0014],

[0015], [0016], [0081], [0096], [0100], [0116], [0117], [0130], [0131], [0147], [0141], and [0147].

Claim 9 for parameter estimator features is supported, at least, by Figure 1 and paragraphs [0084] and [0085].

Claim 10 on operation of decoders is supported, at least, by Figure 1 and paragraph [0086].

Claim 11 on a simultaneously transmitted single channel polling bandwidth efficient aggressive access protocol mode is supported, at least, by paragraphs [0011]-[0013], [0015], [0042], [0060], [0062], [0078], [0083], [0089], [0090], [0111]-[0114], [0118], [0126], [0128], [0131], [134]-[0136], [0140], [0142], and [0146].

Claim 12 on packet header information is supported, at least, by paragraphs [0062], [0068], [0074], [0089], [0090], and [0100].

Claim 13 on a beacon signal polling and scheduling bandwidth efficient aggressive access protocol mode is supported, at least, by paragraphs [0017], [0018], [0089], [0110], [0134], [0145], and [0146].

Claim 14 where the other received data signals can be ignored is supported, at least, by paragraph [0090].

Independent claim 15 on a MUD modem device is supported, at least, by Figure 1 and paragraphs [0080], [0084], [0086], [0142], and [0143].

Claim 16 on a receiver block front end is supported, at least, by Figure 1 and paragraphs [0015], [0078], [0079], [0083], and [0088].

Claim 17 where data packets are formatted for and provided to a network is supported, at least, by Figure 1 and paragraphs [0079] and [0095].

Claim 18 where the selection is based on a control input from the control processor is supported, at least, by Figure 1 and paragraphs [0079] and [0095].

Claim 19 where data packets are formatted for and provided to a local host is supported, at least, by Figure 1 and paragraphs [0079], [0080], [0092], [0095], and [0096].

Claim 20 on packet header information is supported, at least, by paragraph [0090].

Claim 21 on intended destination is supported, at least, by paragraph [0090].

Claim 22 on legacy support is supported, at least, by paragraph [0141].

Claim 23 on AP and DCF is supported, at least, by paragraphs [0011], [0017], [0111]-[0118], [0133], [0145], and [0147].

Claim 24 on CSMA/CA is supported, at least, by paragraphs [0011], [0013], [0045], [0060], [0061], [0070], [0126], and [0147].

Independent claim 25 on a MUD modem device is supported, at least, by Figure 1 and paragraphs [0083], [0084], [0086], [0080] [0142], and [0143].

Claim Rejections – 35 USC § 103

In paragraph 2, the Office has referenced the statute from 35 USC 103 found in a prior Office Action, which is referenced herein. In paragraph 3, the Office has rejected claim 1, 2, and 4 under 35 U.S.C. 103(a) as being unpatentable over Reznik et al. (US 2002/0176392) (Reznik) in view of Urs et al. (US 6,529,488) (Urs) and further in view of Feher (US 2003/0048834) (Feher). Applicant has carefully considered the Office rejections and respectfully submits that the amended claims, as supported by the arguments herein, are distinguishable from the cited references.

As noted in the previous Response, the combination of Reznik and Urs fails to disclose or suggest parameter estimation that solves the problem of synchronizing and jointly demodulating signals at lower rates than those found in CDMA, such as those found in legacy signals, one of ordinary skill in the art could not possibly have been motivated to combine the teachings of Reznik and Urs with any reasonable expectation of success to thereby render the claimed features of independent claim 1 obvious.

According to the MPEP §2143.01, "[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found in either the references themselves or in the knowledge generally available to one of ordinary skill in the art."

A useful presentation for the proper standard for determining obviousness under 35 USC §103(a) can be illustrated as follows:

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

In an attempt to expedite prosecution, Applicant has summarized differences between the prior art and the claims at issue by claim element tables for each of the three amended claims. Related explanations follow.

Line #	CL #	CLAIM ELEMENT	1 Reznik	2. Urs	3. Feher	Notes
1	1.	A modern which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise	Abst. Fig. 7			Abst.: Reznik not a modem, only a detector producing a "total system transmission response matrix". Fig. 7 not modem but strictly a "linear multiuser detector".
2		the modem comprising: a multiuser detection module	19, 27, 31			Components not a multiuser detection module: 19 is "impulse response estimates" for subchannels [0066]; 27 is a memory where response estimate is combined with spreading codes creating 31, a total system response estimate matrix; [0068]
3		adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation	[0066], [0067] reception of input vector			Paragraphs only teach "a multiuser detector 17 ..." which performs "...various vector and matrix operations." No simultaneous demodulation.
4		a data formatting module	25, 37			25 is a "matched filter" [0067]; 37 are re-arranged matrix columns [0068] incapable of formatting data.
5		operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals;	[0067], [0068] filtering and construction of system response matrices			Paragraphs only teach a "multiuser detection module", no components are identified as coupled to it. Nor are network data packets produced.
6		a control processor	33			33 is an "arrangement processor" exclusively processing matrix columns, not a control processor. [0068], [0069], [0071].
7		operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted	[0068], [0069], [0089] computation based on different spreading factors			Paragraphs only teach user's spreading code according to Eq.3; not recited legacy and bandwidth efficient aggressive access protocol modes.
8		and a demultiplexer	23, 45			23 outputs user data "in the form of an output vector" [0066], not data packets; and 45 "re-arranges each element of the user data vector d based upon the column re-assignments" [0095], not demultiplexing data packets.
9		operatively coupled to the data formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target	[0066], [0071] output to appropriate			Paragraphs teach "various vector and matrix operations", not data packets transmitted onto a network through a demultiplexer.

		signal intended for a user associated with the modem, where the selection is based on a control input from the control processor	te user			
10		wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting module operates	[0067], [0068] multiple spreading factors			As above, paragraphs teach "various vector and matrix operations", not network data packet formatting as claimed.
11		wherein the control processor enables a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem		Col.15, Ll. 17-39 transmission and reception from a base radio including determination of legacy subscriber		Lines teach only two frequency allocations with an optional "single frequency time-slotting mode".
12		wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM.			Abst., Fig. 1a, Fig. 1b, [0008], [0106], [0110] format and code selectable processing over single or multiple inputs	Figures and paragraphs teach "pitfalls of conventional BPSK... QPSK" as used in other, 1st generation systems, not a modem that can receive these signals. No mention is made of GMSK or QAM operation.

Line #	CL #	CLAIM ELEMENT	1 Reznik	2. Urs	3. Feher	Notes
1	2.	further comprising: a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module	[0012]-[0015] receiver listens to all transmissions at once.			Paragraphs teach matched filter and RAKE receivers with subchannels based on spreading codes.
2	4.	wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode there by providing backwards compatibility		Col. 15, LI. 17-39	Abst., [0008], [0106], [0110]	Col. 15, LI. 17-39 teach two frequency allocations with an optional "single frequency time-slotting mode", not a bandwidth efficient aggressive access protocol mode alternative. Abst. and paragraphs [0008], [0106], [0110] teach "pitfalls of conventional BPSK... QPSK" as used in other systems, not a backwards compatibility mode.

Claim 1 Rejections

Regarding the rejection of the recited modem based on Reznik's abstract and Figure 7, Reznik does not teach a modem, only a multiuser detector producing a "total system transmission response matrix". More particularly, Figure 7 is not modem but strictly a "linear multiuser detector" 17.

Regarding rejection of the recited multiuser detection (MUD) module by Reznik elements 19, 27, and 31, the components are not a multiuser detection module. Element 19 represents "impulse response estimates" for subchannels (see [0066]). Element 27 is a memory where response estimate is combined with spreading codes creating. Element 31, is a total system response estimate matrix (see [0068]).

Regarding simultaneously demodulating and recovering K wirelessly transmitted signals using co-channel demodulation, Reznik paragraphs [0066] and [0067] only teach "a multiuser detector 17 ..." which performs "...various vector and matrix operations." No simultaneous demodulation producing data is disclosed.

Regarding rejection of the data formatting module by Reznik elements 25 and 37; 25 is a “matched filter” (see [0067]), and 37 represents re-arranged matrix columns (see [0068]) incapable of formatting data.

Regarding rejection of producing network data packets by Reznik paragraphs [0067] and [0068], these only teach a “multiuser detection module”, no components are identified as coupled to it. Nor are network data packets produced.

Regarding rejection of Applicant's control processor by Reznik element 33, element 33 is an “arrangement processor” exclusively processing matrix columns, not a control processor (see [0068], [0069], and [0071]).

Regarding rejection of the control processor detecting the protocol mode by Reznik paragraphs [0068], [0069], and [0089], these paragraphs only teach

user's spreading code according to Eq.3:
$$A_{i,n}^{(k)} = \sum_{j=1}^W h_j^{(k)} v_{i-j+1}^{(k,n)} ;$$

not Applicant's recited legacy and bandwidth efficient aggressive access protocol modes.

Regarding rejection of the demultiplexer by Reznik elements 23 and 45, element 23 outputs user data “in the form of an output vector” (see [0066]), not data packets; and element 45 “re-arranges each element of the user data vector d based upon the column re-assignments” (see [0095]), not demultiplexing data packets.

Regarding rejection of the demultiplexer selecting a recovered signal from control processor input by Reznik paragraphs [0066] and [0071], these paragraphs teach “various vector and matrix operations”, not data packets transmitted onto a network through a demultiplexer.

Regarding rejection of supporting and selecting formatting modes by Reznik paragraphs [0067] and [0068], these paragraphs teach, again, “various vector and matrix operations”, not network data packet formatting as claimed.

Regarding rejecting enabling one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities by Urs column 15, lines 17-39, these lines teach only two frequency allocations with an optional “single frequency time-slotting mode”, not a bandwidth efficient aggressive access protocol mode.

Lastly, regarding rejection of legacy protocol modes of low data rate BPSK, QPSK, GMSK and QAM by Feher abstract, Figures 1a, and 1b, and paragraphs [0008], [0106], and [0110], the figures and paragraphs teach “pitfalls of conventional BPSK... QPSK” as used in other, 1st generation systems, not a modem that can receive these signals. No mention is made of GMSK or QAM operation.

Claim 2 Rejection

Regarding rejection of a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module by Reznik paragraphs [0012] and [0015], these paragraphs teach matched filter and RAKE receivers with subchannels based on spreading codes, not Applicant's diversity input front end.

Claim 4 Rejection

Regarding rejection of the control processor enabling a legacy protocol mode from detecting a modem that does not support the bandwidth efficient aggressive access protocol mode by Urs column 15, lines 17-39 and Feher abstract and paragraphs [0008], [0106], and [0110]:

Urs column 15, lines 17-39 teach two frequency allocations with an optional “single frequency time--slotting mode”, not a bandwidth efficient aggressive access protocol mode alternative.

Feher abstract and paragraphs [0008], [0106], and [0110] teach “pitfalls of conventional BPSK... QPSK” as used in other systems, not a backwards compatibility mode.

Improper Combination:

Moreover, the Applicant respectfully submits that, at least, Urs is an improper combination of references, in that, when taken as a whole, there is no motivation or suggestion to combine the references to achieve the Applicant’s claimed invention. Section 2143.01 of the MPEP states: “The mere fact that references can be combined or modified is not sufficient to establish prima facie obviousness.” In addition, the “level of skill in the art cannot be relied upon to provide the suggestion to combine references.” Thus, it is inappropriate to use the Applicant’s claims as a road map in selecting a combination of references to form a 103 rejection. Rather, there must be some objective reason to combine the teachings of the references to make the claimed invention. Applicant cannot find such an objective reason.

Urs teaches "a method of ... identifying (801) a first frequency allocation and a second frequency allocation and programming a radio frequency device (401, 701, 901) to at least one of: a) simultaneously receive a first signal within

the first frequency allocation and a second signal within the second frequency allocation; and b) simultaneously transmit a first signal within the first frequency allocation and a second signal within the second frequency allocation." (abstract) Urs has no suggestion of or capability to distinguish a bandwidth efficient aggressive access protocol mode. Nor do Reznik, Urs, or Feher contain a suggestion to combine these references.

Prior Art Not Enabling

The Applicant submits that the limited description for low data rate protocol modes in Feher is lacking in specificity and detail such that one skilled in the art would not readily comprehend any form of legacy protocol modes as a fallback to bandwidth efficient aggressive access protocol modes without undue experimentation and therefore is inoperable as a prior reference for the features relied upon by the Office. There are no figures and no details in Feher as to how one would build such modem with a fallback legacy mode structure.

"In determining that quantum of prior art disclosure which is necessary to declare an applicant's invention 'not novel' or 'anticipated' within section 102, **the stated test is whether a reference contains an 'enabling disclosure'...**" *In re Hoeksema*, 399 F.2d 269, 158 USPQ 596 (CCPA 1968). A reference contains an "enabling disclosure" if the public was in possession of the claimed invention before the date of invention. "Such possession is effected if one of ordinary skill in the art could have combined the publication's description of the invention with his [or her] own knowledge to make the claimed invention." *In re Donohue*, 766 F.2d 531, 226 USPQ 619 (Fed. Cir. 1985).

Therefore, if the Office asserts Feher, the Office must show that Feher, considering Reznik and Urs, has an enabling disclosure of the desired subject matter - mere naming or description of the subject matter is insufficient, if it

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Amdt. Dated August 12, 2011
Reply to Office Action of 4/14/2011

cannot be produced without undue experimentation. *Elan Pharm., Inc. v. Mayo Found. For Med. Educ. & Research*, 346 F.3d 1051, 1054, 68 USPQ2d 1373, 1376 (Fed. Cir. 2003). The Applicant does not believe that Feher's disclosure satisfies the criteria of an enabling disclosure.

Applicant believes the above amendments and remarks to be fully responsive to the Office Action, thereby placing this application in condition for allowance. No new matter is added. Applicant requests speedy reconsideration, and further requests that Examiner contact its attorney by telephone, facsimile, or email for quickest resolution, if there are any remaining issues.

Respectfully submitted,

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Electronic Patent Application Fee Transmittal				
Application Number:		12548502		
Filing Date:		27-Aug-2009		
Title of Invention:		BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM		
First Named Inventor/Applicant Name:		Karl D. BROMMER		
Filer:		David A. Rardin/Jacqueline Judkins		
Attorney Docket Number:		C003DUS		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with \$0 paid	2251	1	65	65

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				65

Electronic Acknowledgement Receipt	
EFS ID:	10722827
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	24222
Filer:	David A. Rardin
Filer Authorized By:	
Attorney Docket Number:	C003DUS
Receipt Date:	12-AUG-2011
Filing Date:	27-AUG-2009
Time Stamp:	12:49:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$65
RAM confirmation Number	9140
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1		C003DUS_OAR_Final.pdf	173951 84540d249086ea088c441c5bb6961b8b36475d4a	yes	20
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	8	
	Applicant Arguments/Remarks Made in an Amendment		9	20	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30762 b814815a604c909b66eaeace708153319b1263512	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			204713		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/548,502		Filing Date 08/27/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =			X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	08/12/2011	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X \$ =		OR	X \$2=	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X \$ =		OR	X \$220=	0
	☐ Application Size Fee (37 CFR 1.16(s))							OR		
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0
AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		OR	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))							OR		
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.										
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".										
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/NICOLE LOVE-HENSLEY/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,502	08/27/2009	Karl D. BROMMER	C003DUS

CONFIRMATION NO. 7248

POA ACCEPTANCE LETTER

24222

Vern Maine & Associates
547 AMHERST STREET, 3RD FLOOR
NASHUA, NH 03063-4000



OC000000048839028

Date Mailed: 07/21/2011

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/14/2011.

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.

/hchristian/

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,502	08/27/2009	Karl D. BROMMER	C003DUS

CONFIRMATION NO. 7248

POWER OF ATTORNEY NOTICE

22500
BAE SYSTEMS
PO BOX 868
NHQ1-719
NASHUA, NH 03061-0868



Date Mailed: 07/21/2011

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/14/2011.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/hchristian/

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

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 OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS	Application Number	12/548502
	Filing Date	08/27/2009
	First Named Inventor	BROMMER, Karl D.
	Title	Bandwidth Efficient Wireless Network Modem
	Art Unit	2617
	Examiner Name	BALAOING, Ariel A.
	Attorney Docket Number	C003DUS

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

24222

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name			
Address			
City	State	Zip	
Country			
Telephone	Email		

I am the:

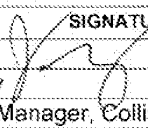
☐ Applicant/inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.

Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature		Date	7/14/2011
Name	Jared Fry	Telephone	857-222-0690
Title and Company	General Manager, Collision Technology LLC		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ *Total of _____ forms are submitted.

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

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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.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Collision Technology LLC

Application No./Patent No.: 12/548502

Filed/Issue Date: 08/27/2009

Titled: **BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM**

Collision Technology LLC, a Limited Liability Company

(Name of Assignee)

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

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or
3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

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

OR

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

1. From: BAE Systems Information and Electronic Syste To: Collision Technology LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 026190, Frame 0812, or for which a copy thereof is attached.

2. From: _____ To: _____

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

3. From: _____ To: _____

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

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

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

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

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

/David A. Rardin, Reg. No. 52,153/

Signature

July 14, 2011

Date

David A. Rardin

Attorney

Printed or Typed Name

Title

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

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Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether 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).
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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)).
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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 Acknowledgement Receipt	
EFS ID:	10518423
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	22500
Filer:	David A. Rardin/Jacqueline Judkins
Filer Authorized By:	David A. Rardin
Attorney Docket Number:	C003DUS
Receipt Date:	14-JUL-2011
Filing Date:	27-AUG-2009
Time Stamp:	13:03:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	C003DUS_TransmittalLtr.pdf	75378 cf5aad9325d4114e6c2b29fe04e1fe2a1d6a1cf4	no	1

Warnings:

Information:

2	Power of Attorney	C003DUS_PowerOfAttorney_Executed.pdf	582233 583449027e2b2c92ba3bc6a81cc9d3844bc894d7	no	2
Warnings:					
Information:					
3	Assignee showing of ownership per 37 CFR 3.73(b).	C003DUS_Statement_Under_37_CFR_3-73_b.pdf	424430 27ba23b0243719d8d465dabf7c25cc9afa9e825	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			1082041		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: BROMMER, Karl D. GAU: 2617
Serial No. 12/548502 Examiner: BALAOING, Ariel A.
Filing or 371 (c) Date: 08/27/2009 Atty Dkt. No. C003DUS
For: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

To: Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Fr:

24222

Commissioner:

TRANSMITTAL LETTER

Attached is a 1 page "POWER OF ATTORNEY" and "CHANGE OF CORRESPONDENCE ADDRESS" form PTO/SB/81. Applicant respectfully requests that the Patent Office expedite processing of this change of correspondence address under the provisions of 37 CFR 1.33.

☒ All necessary fees relating to the attached submittal, if any, are intended to be included. However, the Office is hereby authorized to charge any deficiency or credit any overpayment in the fees relating to the attached submittal to the below listed deposit account, registered to Vernon C. Maine P.L.L.C., contact telephone no. 603-886-6100. Deposit Account No. **500323**

Respectfully submitted,

/David A. Rardin, Reg. No. 52,153/

Cus. No. 24222
Vern Maine & Associates
547 Amherst St., 3rd Floor
Nashua, NH 03063-4000
Tel. No. (603) 886-6100, Fax. No. (603) 886-4796
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Vernon C. Maine, Reg. No. 37,389
Andrew P. Cernota, Reg. No. 52,711
David A. Rardin, Reg. No. 52,153
Douglas P. Burum, Reg. No. 65,019
Attorneys/Agents for Applicant



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	08/27/2009	Karl D. BROMMER	20020029DIV	7248
22500	7590	04/14/2011		
BAE SYSTEMS PO BOX 868 NASHUA, NH 03061-0868			EXAMINER BALAOING, ARIEL A	
			ART UNIT 2617	PAPER NUMBER
			MAIL DATE 04/14/2011	DELIVERY MODE PAPER

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

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

Office Action Summary	Application No. 12/548,502	Applicant(s) BROMMER, KARL D.	
	Examiner ARIEL BALAOING	Art Unit 2617	
	-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --		

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

1) ☒ Responsive to communication(s) filed on 10 February 2011.

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

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

Disposition of Claims

4) ☒ Claim(s) 1,2 and 4 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☐ Claim(s) 1,2 and 4 is/are rejected.

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

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

Application Papers

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

10) ☒ The drawing(s) filed on 27 August 2009 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

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

Attachment(s)

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

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

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

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

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
3. Claims 1,2, and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over REZNIK et al (US 2002/0176392) in view of URS et al (US 6,529,488) and further in view of FEHER (US 2003/0048834).

Regarding claim 1, REZNIK discloses a modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise (abstract; Figure 7), the modem comprising: a multiuser detection module **19, 27, 31** adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation (paragraph 66, 67; reception of input vector); a data formatting module **25, 37** operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals (paragraph 67, 68; filtering and construction of system response matrices); a control processor **33** operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted (paragraph 68, 69, 89; computation based on different spreading factors); and a demultiplexer **23, 45** operatively coupled to the data

formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor (paragraph 66, 71; output to appropriate user); wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting module operates (paragraph 67, 68; multiple spreading factors). However, REZNIK does not expressly disclose wherein the control processor enables a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem. In a similar field of endeavor, URS discloses the control processor that enables a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem (col. 15, line 17-39; transmission and reception from a base radio including determination of legacy subscriber). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify REZNIK to include the teachings of URS since URS teaches that such a modification would allow a system to transmit and receive radio communication using various frequencies and protocols based on a subscriber unit capability. However, the combination of REZNIK and URS does not expressly disclose wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM. In a similar field of endeavor, FEHER discloses

wherein a data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting operates, and wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM (abstract; Figure 1a, 1b; paragraph 8, 106, 110; format and code selectable processing over single of single or multiple inputs). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the combination of REZNIK and URS to include the teachings of FEHER, since FEHER states that such a modification would allow processing of signals based on a system selectable technology (paragraph 9).

Regarding claim 2, see the rejections of the parent claim concerning the subject matter this claim is dependent upon. REZNIK further discloses further comprising: a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module (paragraph 12-15; receiver listens to all transmissions at once).

Regarding claim 4, see the rejections of the parent claim concerning the subject matter this claim is dependent upon. The combination of REZNIK, URS, and FEHER further discloses wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy

protocol mode there by providing backwards compatibility (URS - col. 15, line 17-39;
FEHER – abstract, paragraph 8, 106, 110).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ARIEL BALAOING whose telephone number is (571)272-7317. The examiner can normally be reached on Monday-Friday from 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dwayne Bost can be reached on (571) 272-7023. 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.

/Ariel Balaoing/
Examiner, Art Unit 2617

/A. B./
Examiner, Art Unit 2617

Application/Control Number: 12/548,502
Art Unit: 2617

Page 6

Notice of References Cited	Application/Control No. 12/548,502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.	
	Examiner ARIEL BALAOING	Art Unit 2617	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2003/0048834	03-2003	Feher, Kamilo	375/219
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

<i>Index of Claims</i> 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

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

☐ Claims renumbered in the same order as presented by applicant						☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE									
Final	Original	02/05/2010	04/09/2010	12/07/2010	04/09/2011						
	1	÷	✓	✓	✓						
	2	÷	✓	✓	✓						
	3	÷	✓	-	-						
	4	÷	✓	✓	✓						
	5	÷	N	-	-						
	6	÷	N	-	-						
	7	÷	N	-	-						
	8	÷	N	-	-						

<i>Search Notes</i> 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

SEARCHED			
Class	Subclass	Date	Examiner
370	346,342,328	4/9/2010	AB
375	147,220,222	4/9/2010	AB
455	552.1,434	4/9/2010	AB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search	4/9/2011	AB
Inventor Search	5/4/2010	AB

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

--	--

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

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

Application Number	12548502	Filing Date	2009-08-27	Docket Number (if applicable)	20020029DIV	Art Unit	2617
First Named Inventor	Karl D. BROMMER			Examiner Name	Ariel A. Balaoing		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

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

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

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

☐ Other _____

☐ Enclosed

☐ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

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

☐ Other _____

FEES

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

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No. 190130

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

Signature of Registered U.S. Patent Practitioner			
Signature	/Daniel J. Long/	Date (YYYY-MM-DD)	2011-02-21
Name	Daniel J. Long	Registration Number	29404

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

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

Privacy Act Statement

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

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

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

Electronic Patent Application Fee Transmittal				
Application Number:		12548502		
Filing Date:		27-Aug-2009		
Title of Invention:		BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM		
First Named Inventor/Applicant Name:		Karl D. BROMMER		
Filer:		Daniel J. Long/Nancy Young		
Attorney Docket Number:		20020029DIV		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Request for continued examination	1801	1	810	810
Total in USD (\$)				810

Electronic Acknowledgement Receipt	
EFS ID:	9485457
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	22500
Filer:	Daniel J. Long/Nancy Young
Filer Authorized By:	Daniel J. Long
Attorney Docket Number:	20020029DIV
Receipt Date:	21-FEB-2011
Filing Date:	27-AUG-2009
Time Stamp:	14:58:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$810
RAM confirmation Number	9181
Deposit Account	190130
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Request for Continued Examination (RCE)	20020029DIV-efilingrdoc.pdf	797435 7861eafa59a7f3f49f719cafb4493375691ba d9c	no	3
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	30281 7d2ef7579546afc59e6de66481658b54199 d3506	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			827716		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/548,502		Filing Date 08/27/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =		OR	X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	02/21/2011	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 3	Minus	** 20	= 0	X \$ =		OR	X \$2=	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X \$ =		OR	X \$220=	0
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0	
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		OR	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.										
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".										
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/DEBRA a. SAVOY/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	08/27/2009	Karl D. BROMMER	20020029DIV	7248
22500	7590	02/15/2011		
BAE SYSTEMS PO BOX 868 NASHUA, NH 03061-0868			EXAMINER BALAOING, ARIEL A	
			ART UNIT 2617	PAPER NUMBER
			MAIL DATE 02/15/2011	DELIVERY MODE PAPER

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

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

Advisory Action Before the Filing of an Appeal Brief	Application No. 12/548,502	Applicant(s) BROMMER, KARL D.	
	Examiner ARIEL BALAOING	Art Unit 2617	

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

THE REPLY FILED 10 February 2011 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:

a) ☐ The period for reply expires _____ months from the mailing date of the final rejection.

b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because

(a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);

(b) ☐ They raise the issue of new matter (see NOTE below);

(c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

(d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: See Continuation Sheet. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☐ Applicant's reply has overcome the following rejection(s): _____.

6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☒ For purposes of appeal, the proposed amendment(s): a) ☒ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.

The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: _____.

Claim(s) objected to: _____.

Claim(s) rejected: 1, 2 and 4.

Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.

12. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____

13. ☐ Other: _____.

/Ariel Balaoing/
 Examiner, Art Unit 2617

Continuation of 3. NOTE: Amendments to the claim alter the scope of the previously examined claims and would require further search and consideration.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Karl BROMMER Application No.: 12/548,502
Filed: 08/27/2009 Atty. Dkt. No: 20020029 DIV
For: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

AMENDMENT AFTER FINAL REJECTION UNDER 37 C.F.R. §1.116

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

Dear Sir,

In reply to the December 27, 2010 Office Action, please consider the following:

Amendments to the Claims, as reflected in the listing of claims; and
Remarks.

PAYMENT: All necessary fees relating to the attached submittal, if any, are intended to be included. However, the Office is hereby authorized to charge any deficiency or credit any overpayment in the fees to deposit account 190130.

Respectfully submitted,

/Daniel J. Long/

Daniel J. Long, Reg. No. 29,404

Customer Number 22500
Correspondence Address:
Patent Dept. BAE SYSTEMS
PO Box 868, NHQ1-719
Nashua, NH 03061-0868

Tel. No. (603) 885-2643
Fax. No. (603) 885-2167

DO NOT ENTER

/AB/

02-13-2011

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Karl BROMMER Application No.: 12/548,502
Filed: 08/27/2009 Atty. Dkt. No: 20020029 DIV
For: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

AMENDMENT AFTER FINAL REJECTION UNDER 37 C.F.R. §1.116

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

Dear Sir,

In reply to the December 27, 2010 Office Action, please consider the following:

Amendments to the Claims, as reflected in the listing of claims; and
Remarks.

PAYMENT: All necessary fees relating to the attached submittal, if any, are intended to be included. However, the Office is hereby authorized to charge any deficiency or credit any overpayment in the fees to deposit account 190130.

Respectfully submitted,

/Daniel J. Long/

Daniel J. Long, Reg. No. 29,404

Customer Number 22500
Correspondence Address:
Patent Dept. BAE SYSTEMS
PO Box 868, NHQ1-719
Nashua, NH 03061-0868

Tel. No. (603) 885-2643
Fax. No. (603) 885-2167

REMARKS

Claims 1, 2 and 4 are pending in this application. By this Amendment, claim 1 is amended to further differentiate the feature of that claim. Support for the amendment to claim 1 can be found, for example, at least in paragraph [0053] of the Specification. Claim 4 is amended to correct minor informalities. Support for the amendment to claim 4 can be found, for example, in the original claims. Accordingly, no new matter was added. Reconsideration of the application in view of the foregoing amendments and following remarks is respectfully requested.

Entry of the amendments is proper under 37 C.F.R. §1.116 because the amendments: (a) do not raise any new issue requiring further search and/or consideration, and (b) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Accordingly, entry of the amendments is respectfully requested.

The Office Action rejects claims 1, 2 and 4 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2002/0176392 A1 to Reznik et al. (Reznik) in view of U.S. Patent No. 6,529,488 to Urs et al. (Urs). The rejection is respectfully traversed for at least the following.

The combination of Reznik and Urs would not have rendered obvious a modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising a control processor operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding

transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem, wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM, as recited in independent claim 1.

Reznik discloses a multiuser detector (MUD) that detects and decodes synchronous or asynchronous CDMA sub channels having different spreading factors with reduced computational complexity (see paragraph [0052]). That is, Reznik discloses a MUD that works on CDMA modulations. The Office action acknowledges that Reznik fails to disclose the above mentioned features of independent claim 1, but cites Urs as allegedly overcoming these deficiencies. However, Urs fails to overcome the deficiencies of Reznik with regard to the above-mentioned features of independent claim 1.

Urs discloses a method and apparatus for a single radio frequency device to simultaneously transmit and/or receive multiple different communication resources, sourced or received by different devices (see col. 2, lines 56-61). That is, Urs, like Reznik, discloses a MUD that works on CDMA modulations. The Office Action asserts that Urs' statement that, "... users might have legacy subscriber equipment that is not capable in operating in anything but the conventional single frequency time-slotting mode ..." corresponds to the claimed control processor operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem, of independent claim 1. However, the Office Action's analysis fails for at least the following.

The Office Action fails to point out where each of the positively recited features of independent claim 1 are disclosed or suggested in Urs. It is an established tenet of claim construction that “[a]ll words in a claim must be considered in judging the patentability of that claim against the [applied references].” *In re Wilson*, 424 F.2d 1382, 1385 (CCPA 1970). The mere fact that Urs discloses that Urs’ invention provides instantaneous use of two or more adjacent frequency allocations and mentions legacy subscriber equipment as an illustrative example of its operative principle, cannot reasonably be interpreted to correspond to the positively recited, above-mentioned features of independent claim 1.

Additionally, Applicant respectfully submits that one of ordinary skill in the art would not have been motivated to combine the teaching of Reznik with those of Urs with any reasonable expectation of success, to thereby render the above-mentioned features of independent claim 1 obvious.

This is because as previously noted, both Reznik and Urs disclose applying a MUD system to CDMA modulations. CDMA is modulated through chipping to attain a high bandwidth thereby simplifying digital synchronization and separation of signals. The features of independent claim 1 are directed to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem. As such, legacy signals are modulated at lower rates than those of CDMA. Because, the combination of Reznik and Urs fails to disclose or suggest parameter estimation that solves the problem of synchronizing and jointly demodulating signals at lower rates than those found in CDMA, such as those found in legacy signals, one of ordinary skill in the art could possibly have been motivated to combine the

teachings of Reznik and Urs with any reasonable expectation of success to thereby render the claimed features of independent claim 1 obvious.

Further, in an effort to expedite prosecution of this application toward allowance, Applicant has amended the language of independent claim 1 to recite “wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM,” additional features which Applicant respectfully submits are also neither disclosed or suggested, and would not have been rendered obvious by the applied references.

Accordingly, independent claim 1 is patentable over the applied references.

Claims 2 and 4 depend from independent claim 1. Accordingly, dependent claims 2 and 4 are also patentable over the applied references based at least on their dependencies, as well as for the additional features these claims recite. Accordingly, withdrawal of the rejection is respectfully requested.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Prompt reconsideration and allowance of claims 1, 2 and 4 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place the application in even better condition for allowance; the Examiner is cordially invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

/Daniel J. Long/

Customer Number 22500
Correspondence Address:
Patent Dept. BAE SYSTEMS
PO Box 868, NHQ1-719
Nashua, NH 03061-0868

Daniel J. Long, Reg. No. 29,404

Tel. No. (603) 885-2643
Fax. No. (603) 885-2167

Electronic Acknowledgement Receipt	
EFS ID:	9414138
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	22500
Filer:	Daniel J. Long/Nancy Young
Filer Authorized By:	Daniel J. Long
Attorney Docket Number:	20020029DIV
Receipt Date:	10-FEB-2011
Filing Date:	27-AUG-2009
Time Stamp:	09:03:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		20020029DIV-OAR-2-11.pdf	1380960 171fe86f8f72334e858284099302bf2ce624f4ad	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Applicant Arguments/Remarks Made in an Amendment	1	1
	Claims	2	3
	Applicant Arguments/Remarks Made in an Amendment	4	8
Warnings:			
Information:			
Total Files Size (in bytes):		1380960	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/548,502		Filing Date 08/27/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =			X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =			X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										TOTAL
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	02/10/2011	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 3	Minus	** 20	= 0	X \$ =		OR	X \$2=	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X \$ =		OR	X \$220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0	
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =		OR	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =		OR	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/MARQUITA D. JONES/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Amendments to the Claims

1. (Currently Amended) A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

a multiuser detection module adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation;

a data formatting module operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals;

a control processor operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem; and

a demultiplexer operatively coupled to the data formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor,

wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting ~~operates~~ operates, and wherein the signals of the one of a legacy protocol mode can be selected from the group consisting of low data rate BPSK, QPSK, GMSK and QAM.

2. (Original) The modem of claim 1, further comprising a front end adapted to

simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module.

3. (Canceled)

4. (Currently Amended) The modem of claim *1, wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode ~~there by~~ thereby providing backwards compatibility.

5-8. (Canceled)



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	08/27/2009	Karl D. BROMMER	20020029DIV	7248
22500	7590	12/27/2010		
BAE SYSTEMS PO BOX 868 NASHUA, NH 03061-0868			EXAMINER BALAOING, ARIEL A	
			ART UNIT 2617	PAPER NUMBER
			MAIL DATE 12/27/2010	DELIVERY MODE PAPER

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

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

Office Action Summary	Application No.		Applicant(s)	
	12/548,502		BROMMER, KARL D.	
	Examiner		Art Unit	
	ARIEL BALAOING		2617	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 13 October 2010.

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

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

Disposition of Claims

4) ☒ Claim(s) 1,2 and 4 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1,2 and 4 is/are rejected.

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

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

Application Papers

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

10) ☒ The drawing(s) filed on 27 August 2009 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

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

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

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a) ☐ All b) ☐ Some * c) ☐ None of:

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

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

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

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

Attachment(s)

1) ☐ Notice of References Cited (PTO-892) 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____. 5) ☐ Notice of Informal Patent Application 6) ☐ Other: _____.
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DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 10/13/2010 have been fully considered but they are not persuasive.
2. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., wherein the multiuser detection system applies to many different legacy signals including low data rate BPSK, QPSK, GMSK, and QAM and wherein the system address non-CDMA signals (see remarks)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
4. Claims 1,2, and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over REZNIK et al (US 2002/0176392) in view of URS et al (US 6,529,488).

Regarding claim 1, REZNIK discloses a modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise (abstract; Figure 7), the modem comprising: a multiuser detection module **19, 27, 31** adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation (paragraph 66,

67; reception of input vector); a data formatting module **25, 37** operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals (paragraph 67, 68; filtering and construction of system response matrices); a control processor **33** operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted (paragraph 68, 69, 89; computation based on different spreading factors); and a demultiplexer **23, 45** operatively coupled to the data formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor (paragraph 66, 71; output to appropriate user); wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting module operates (paragraph 67, 68; multiple spreading factors). However, REZNIK does not expressly disclose wherein the control processor enables a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem. In a similar field of endeavor, HALL discloses the control processor that enables a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem (col. 15, line 17-39; transmission and reception from a base radio including determination of legacy subscriber). Therefore it would

have been obvious to a person of ordinary skill in the art at the time the invention was made to modify REZNIK to include the teachings of URS since URS teaches that such a modification would allow a system to transmit and receive radio communication using various frequencies and protocols based on a subscriber unit capability.

Regarding claim 2, see the rejections of the parent claim concerning the subject matter this claim is dependent upon. REZNIK further discloses further comprising: a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module (paragraph 12-15; receiver listens to all transmissions at once).

Regarding claim 4, see the rejections of the parent claim concerning the subject matter this claim is dependent upon. The combination of REZNIK and URS further discloses wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode there by providing backwards compatibility (URS - col. 15, line 17-39).

Conclusion

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

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

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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ARIEL BALAOING whose telephone number is (571)272-7317. The examiner can normally be reached on Monday-Friday from 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dwayne Bost can be reached on (571) 272-7023. 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.

/Ariel Balaoing/

Application/Control Number: 12/548,502
Art Unit: 2617

Page 6

Examiner, Art Unit 2617

/A. B./
Examiner, Art Unit 2617

<i>Index of Claims</i> *1254850 2*	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

✓	Rejected
=	Allowed

-	Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

☐ Claims renumbered in the same order as presented by applicant					☐ CPA					☐ T.D.					☐ R.1.47				
CLAIM		DATE																	
Final	Original	02/05/2010	04/09/2010	12/07/2010															
	1	÷	✓	✓															
	2	÷	✓	✓															
	3	÷	✓	-															
	4	÷	✓	✓															
	5	÷	N	-															
	6	÷	N	-															
	7	÷	N	-															
	8	÷	N	-															

<i>Search Notes</i> *1254850 2*	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

SEARCHED			
Class	Subclass	Date	Examiner
370	346,342,328	4/9/2010	AB
375	147,220,222	4/9/2010	AB
455	552.1,434	4/9/2010	AB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search	12/7/2010	AB
Inventor Search	5/4/2010	AB

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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P.1/3
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OCT 13 2010

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

BROMMER

Serial No: 12/548,502

Filed: 08/27/2009

For: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

Examiner: Ariel A. Balaoing

Art Unit: 2617

Docket No. 20020029DIV

October 13, 2010

To: Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the office action of April 13, 2010, please amend the above captioned application as follows.

In the claims

Please amend the claims as is shown on the attached sheets.

OCT 13 2010

Remarks

The application has been amended to more clearly define the present invention.

Reconsideration is respectfully requested.

Claims 1-4 stand rejected as being unpatentable over REZNIK et al . (US Patent Publication No. 2002/0176392) in view of URS et al (US Patent No. 6,529,488).

REZNICK et al. and URS et al. apply to CDMA modulations. It is not obvious that a multiuser detection (MUD) system that works on CDMA waveforms will work on legacy modulations. CDMA is modulated through chipping to attain a high bandwidth thereby simplifying digital synchronization and separation of signals. The apparatus of the present invention applies MUD to many different legacy signals including low data rate BPSK, QPSK, GMSK and QAM. REZNICK et al presents a very specific embodiment for CDMA that is unlikely to work for low-bandwidth signals. The claimed apparatus of the present invention, as now amended, allows for parameter estimation that solves the problem of synchronizing and jointly demodulating signals at lower rates than those found in CDMA. In summary, Reznick et al and URS et al do not address non-CDMA signals.

It is believed that the application is now in condition for allowance. If the examiner believes that any matters are still at issue, he is requested to contact applicant's undersigned attorney.

Respectfully submitted,

/Daniel J. Long/

Daniel J. Long
Attorney for Applicant
Registration No. 29,404

BAE SYSTEMS Information and Electronic Systems Integration Inc.
P.O. Box 868
Nashua, NH 03061-0868
Tel: 603- 885-2643

I hereby certify that this correspondence is being transmitted by facsimile (571) 273-8300
to Commissioner of Patents, Box 1450, Alexandria, VA 22313-1450 on October 13, 2010.

/Daniel J. Long/
Daniel J. Long

October 13, 2010
Date of Signature
Daniel J. Long

Document code: WFEE

United States Patent and Trademark Office
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In re application of:

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Serial No: 12/548,502

Filed: 08/27/2009

For: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

Examiner: Ariel A. Balaoing

Art Unit: 2617

Docket No. 20020029DIV

October 13, 2010

To: Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450



AMENDMENT

In response to the office action of April 13, 2010, please amend the above captioned application as follows.

In the claims

Please amend the claims as is shown on the attached sheets.

Remarks

The application has been amended to more clearly define the present invention.
Reconsideration is respectfully requested.

Claims 1-4 stand rejected as being unpatentable over REZNIK et al . (US Patent Publication No. 2002/0176392) in view of URS et al (US Patent No. 6,529,488).

REZNICK et al. and URS et al. apply to CDMA modulations. It is not obvious that a multiuser detection (MUD) system that works on CDMA waveforms will work on legacy modulations. CDMA is modulated through chipping to attain a high bandwidth thereby simplifying digital synchronization and separation of signals. The apparatus of the present invention applies MUD to many different legacy signals including low data rate BPSK, QPSK, GMSK and QAM. REZNICK et al presents a very specific embodiment for CDMA that is unlikely to work for low-bandwidth signals. The claimed apparatus of the present invention, as now amended, allows for parameter estimation that solves the problem of synchronizing and jointly demodulating signals at lower rates than those found in CDMA. In summary, Reznick et al and URS et al do not address non-CDMA signals.

It is believed that the application is now in condition for allowance. If the examiner believes that any matters are still at issue, he is requested to contact applicant's undersigned attorney.

Respectfully submitted,

/Daniel J. Long/

Daniel J. Long
Attorney for Applicant
Registration No. 29,404

BAE SYSTEMS Information and Electronic Systems Integration Inc.
P.O. Box 868
Nashua, NH 03061-0868
Tel: 603- 885-2643

I hereby certify that this correspondence is being transmitted by facsimile (571) 273-8300
to Commissioner of Patents, Box 1450, Alexandria, VA 22313-1450 on October 13, 2010.

/Daniel J. Long/

Daniel J. Long

October 13, 2010

Date of Signature

Daniel J. Long

What is claimed is:

1. (currently amended) A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:

a multiuser detection module adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation;

a data formatting module operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals;

a control processor operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem; and

a demultiplexer operatively coupled to the data formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor;

wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting operates.

2.(original) The modem of claim 1 further comprising:

a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module.

3. (cancelled)

4. (original) The modem of claim 1 wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode there by providing backwards compatibility.

5. - 8. (cancelled)

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OCT 13 2010

PTO/SB/22 (07-08)

Approved for use through 07/31/2012 OMB 0861-0031
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.138(a) FY 2009 <i>(Fees pursuant to the Consolidated Appropriations Act, 2008 (H.R. 4310).)</i>		Docket Number (Optional) 20020029DIV	
Application Number 12/548502		Filed 8/27/2009	
For BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM			
Art Unit 2617		Examiner Ariel A. Balasing	
This is a request under the provisions of 37 CFR 1.138(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	
☐ One month (37 CFR 1.17(a)(1))	\$130	\$65	\$ _____
☐ Two months (37 CFR 1.17(a)(2))	\$490	\$245	\$ _____
☒ Three months (37 CFR 1.17(a)(3))	\$1110	\$555	\$ <u>1110</u>
☐ Four months (37 CFR 1.17(a)(4))	\$1730	\$865	\$ _____
☐ Five months (37 CFR 1.17(a)(5))	\$2350	\$1175	\$ _____
☐ Applicant claims small entity status. See 37 CFR 1.27.			
☐ 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 <u>190130</u>			
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/inventor.			
☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/98).			
☒ attorney or agent of record. Registration Number <u>29,404</u>			
☐ attorney or agent under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____			
<u>/Daniel J. Long/</u>		<u>October 13, 2010</u>	
Signature		Date	
<u>Daniel J. Long</u>		<u>603-885-2843</u>	
Typed or printed name		Telephone Number	
NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.			
☐ Total of _____ forms are submitted.			

This collection of information is required by 37 CFR 1.138(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 36 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 5 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 1480, Alexandria, VA 22313-1480. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1480, Alexandria, VA 22313-1480.

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

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/548,502		Filing Date 08/27/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☐ OR		OTHER THAN SMALL ENTITY		
FOR		NUMBER FILED	NUMBER EXTRA		RATE (\$)	FEE (\$)		RATE (\$)	FEE (\$)	
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A		N/A			N/A		
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A	N/A		N/A			N/A		
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A		N/A			N/A		
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =	*		X \$ =		OR	X \$ =		
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*		X \$ =			X \$ =		
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL		TOTAL		
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			(Column 3)			SMALL ENTITY OR OTHER THAN SMALL ENTITY	
AMENDMENT	10/13/2010	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)		RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(o))	* 4	Minus	** 20	= 0	X \$ =		OR	X \$52=	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X \$ =		OR	X \$220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
	TOTAL ADD'L FEE						OR		TOTAL ADD'L FEE	
AMENDMENT	10/13/2010	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)		RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(o))	* 3	Minus	** 20	= 0	X \$ =		OR	X \$52 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0	X \$ =		OR	X \$220 =	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
	TOTAL ADD'L FEE						OR		TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/LINDA W. BADIE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	08/27/2009	Karl D. BROMMER	20020029DIV	7248
22500	7590	04/13/2010		
BAE SYSTEMS PO BOX 868 NASHUA, NH 03061-0868			EXAMINER BALAOING, ARIEL A	
			ART UNIT 2617	PAPER NUMBER
			MAIL DATE 04/13/2010	DELIVERY MODE PAPER

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

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

Office Action Summary	Application No. 12/548,502		Applicant(s) BROMMER, KARL D.	
	Examiner ARIEL BALAOING		Art Unit 2617	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

1) ☒ Responsive to communication(s) filed on 01 March 2010.

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

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

Disposition of Claims

4) ☒ Claim(s) 1-8 is/are pending in the application.

4a) Of the above claim(s) 5-8 is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1-4 is/are rejected.

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

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

Application Papers

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

10) ☒ The drawing(s) filed on 27 August 2009 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a) ☐ All b) ☐ Some * c) ☐ None of:

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

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

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

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

Attachment(s)

1) ☒ Notice of References Cited (PTO-892) 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>10/20/2009 08/27/2009</u>	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ 5) ☐ Notice of Informal Patent Application 6) ☐ Other: _____
---	--

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Species 1 (claims 1-4) in the reply filed on 03/01/2010 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Rejections - 35 USC § 103

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

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

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

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

4. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over REZNIK et al (US 2002/0176392) in view of URS et al (US 6,529,488).

Regarding claim 1, REZNIK discloses a modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise (abstract; Figure 7), the modem

Art Unit: 2617

comprising: a multiuser detection module **19, 27, 31** adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation (paragraph 66, 67; reception of input vector); a data formatting module **25, 37** operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals (paragraph 67, 68; filtering and construction of system response matrices); a control processor **33** operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted (paragraph 68, 69, 89; computation based on different spreading factors); and a demultiplexer **23, 45** operatively coupled to the data formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor (paragraph 66, 71; output to appropriate user).

However, REZNIK does not expressly disclose wherein the control processor enables a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem. In a similar field of endeavor, HALL discloses the control processor that enables a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem (col. 15, line 17-39; transmission and reception from a base radio including determination of legacy subscriber). Therefore it would

have been obvious to a person of ordinary skill in the art at the time the invention was made to modify REZNIK to include the teachings of URS since URS teaches that such a modification would allow a system to transmit and receive radio communication using various frequencies and protocols based on a subscriber unit capability.

Regarding claim 2, see the rejections of the parent claim concerning the subject matter this claim is dependent upon. REZNIK further discloses further comprising: a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module (paragraph 12-15; receiver listens to all transmissions at once).

Regarding claim 3, see the rejections of the parent claim concerning the subject matter this claim is dependent upon. REZNIK further discloses wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting module operates (paragraph 67, 68; multiple spreading factors).

Regarding claim 4, see the rejections of the parent claim concerning the subject matter this claim is dependent upon. The combination of REZNIK and URS further discloses wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode there by providing backwards compatibility (URS - col. 15, line 17-39).

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

HALL et al (US 2002/0126650) – Adaptive, multi-rate waveform

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ARIEL BALAOING whose telephone number is (571)272-7317. The examiner can normally be reached on Monday-Friday from 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, V. Paul Harper can be reached on (571) 272-7605. 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.

Application/Control Number: 12/548,502
Art Unit: 2617

Page 6

/Ariel Balaoing/
Examiner, Art Unit 2617

/A. B./
Examiner, Art Unit 2617

Notice of References Cited	Application/Control No. 12/548,502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.	
	Examiner ARIEL BALAOING	Art Unit 2617	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,529,488	03-2003	Urs et al.	370/330
*	B	US-2002/0176392	11-2002	Reznik et al.	370/342
*	C	US-2002/0126650	09-2002	Hall et al.	370/349
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

<i>Index of Claims</i> 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

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

☐ Claims renumbered in the same order as presented by applicant				☐ CPA				☐ T.D.				☐ R.1.47			
CLAIM		DATE													
Final	Original	02/05/2010	04/09/2010												
	1	÷	✓												
	2	÷	✓												
	3	÷	✓												
	4	÷	✓												
	5	÷	N												
	6	÷	N												
	7	÷	N												
	8	÷	N												

Receipt date: 08/27/2009

12548502 GAU 2617

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2009. CMB 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		
	Filing Date		
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	Ariel A. Balaoing	
	Attorney Docket Number	20020029DIV	

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	4580276		1986-04-01	ANDRUZZI, JR. ET AL.	
	2	4750171		1988-06-07	KEDAR ET AL.	
	3	5546379		1996-08-13	THAWEETHAI ET AL.	
	4	5596439		1997-01-21	DANKBERG ET AL.	
	5	5752164		1998-05-12	JONES	
	6	5894500		1999-04-13	BRUCKERT ET AL.	
	7	6185197		2001-02-06	CHEUNG YEUNG ET AL.	
	8	6226277		2001-05-01	CHUAH	

EFS Web 2.1.5

/Ariel Balaoing/

04/09/2010

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.B./

Receipt date: 08/27/2009

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

Application Number		12548502 - GAU: 2617
Filing Date		
First Named Inventor	Karl D. BROMMER	
Art Unit	2617	
Examiner Name	Ariel A. Balaoing	
Attorney Docket Number	20020029DIV	

9	6240099		2001-05-29	LIM ET AL.	
10	6408019		2002-06-18	PICKERING ET AL.	
11	6417672		2002-07-09	CHONG	
12	6535554		2003-03-18	WEBSTER ET AL.	
13	6567416		2003-05-20	CHUAH	
14	4794635		1988-12-27	HESS	
15	6061406		2000-05-09	CARSON ET AL.	
16	6052364		2000-04-18	CHALMERS ET AL.	
17	6535716		2003-03-18	REICHMAN ET AL.	
18	6870808		2005-03-22	LIU ET AL.	
19	6782277		2004-08-24	CHEN ET AL.	

EFS Web 2.1.15

/Ariel Balaoing/

04/09/2010

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.B./

Receipt date: 08/27/2009

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

Application Number		12548502 - GAU: 2617
Filing Date		
First Named Inventor	Karl D. BROMMER	
Art Unit	2617	
Examiner Name	Ariel A. Balaoing	
Attorney Docket Number	20020029DIV	

20	5365516	1994-11-01	JANDRELL	
21	5530437	1996-06-01	GOLDBERG	
22	5659787	1997-08-01	SCHIELTZ	
23	6097707	2000-08-01	HODZIC ET AL.	
24	6414964	2002-07-01	HOLMQUIST ET AL.	

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

U.S.PATENT APPLICATION PUBLICATIONS

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	20010053132		2001-12-20	ATTIMONT ET AL.	
	2	20020073432		2002-06-13	KOLZE	
	3	20020061031		2002-05-01	SUGAR ET AL.	
	4	20020163933		2002-11-01	BENVENISTE	

EFS Web 2.1.15

/Ariel Balaoing/

04/09/2010

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.B./

Receipt date: 08/27/2009

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

Application Number		12548502 - GAU: 2617	
Filing Date			
First Named Inventor	Karl D. BROMMER		
Art Unit	2617		
Examiner Name	Ariel A. Balaoing		
Attorney Docket Number	20020029DIV		

5	20030179742	2003-09-01	OGIER ET AL.
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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	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	9507578	WO		1995-03-16	GARDNER ET AL.		☐
	2	11340952	JP		1999-12-10	DE GAUDENZI ET AL.		☐
	3	2000115028	JP		2000-04-21	HUANG ET AL.		☐
	4	0072455	WO		2000-11-30	DOETSCH ET AL.		☐
	5	9428642	WO		1994-12-08	THIELECKE		☐
	6	00/71843	WO		2000-11-30	SIEMENS AKTIENGESELLSCHAFT		☐
	7	2000-252918	JP		2000-09-14	OKI ELECTRIC IND CO LTD.		☐
	8	63-051742	JP		1988-03-04	FUJITSU LTD.		☐

Receipt date: 08/27/2009

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

Application Number		12548502 - GAU: 2617
Filing Date		
First Named Inventor	Karl D. BROMMER	
Art Unit	2617	
Examiner Name	Ariel A. Balaoing	
Attorney Docket Number	20020029DIV	

9	03-044234	JP		1991-02-26	FUKUDA DENSHI CO LTD.	☐
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NON-PATENT LITERATURE DOCUMENTS

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	OSTERGAARD, ROLF V., "Cable-Modems.Org: The Cable Modem Reference Guide", May 2003, pp. 1-2, Rolf V. Ostergaard.	☐
	2	PCT International Search Report dated August 2, 2002 of International Application No. PCT/US02/12401 filed April 18, 2002.	☐
	3	PCT International Search Report dated October 6, 2003 of International Application No. PCT/US03/17377 filed June 2, 2003.	☐
	4	PCT International Search Report dated January 9, 2004 of International Application No. PCT/US03/17449 filed June 2, 2003.	☐
	5	Translation of Japanese Office Action; May 23, 2006, pp. 1-4, Mail No. 200047.	☐
	6	BENDER, P. ET AL.; "CDM/HDR: A Bandwidth Efficient High Speed Wireless Data Service for Nomadic Users", Communications Magazine, IEEE, July 2000, pp. 70-77, Volume 38, Issue 7	☐
	7	"Newton (Newton's Telecom Dictionary), 1998, pp. 230.	☐
	8	"Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications", IEEE, 1997, 2 pages.	☐

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

Receipt date: 08/27/2009 INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12548502 - GAU: 2617
	Filing Date		
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	Ariel A. Balaoing	
	Attorney Docket Number	20020029DIV	

EXAMINER SIGNATURE			
Examiner Signature	/Ariel Balaoing/	Date Considered	04/09/2010
*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.			



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BIB DATA SHEET

CONFIRMATION NO. 7248

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
12/548,502	08/27/2009 RULE	370	2617	20020029DIV		
APPLICANTS Karl D. BROMMER, Exeter, NH; ** CONTINUING DATA ***** This application is a DIV of 10/529,019 03/24/2005 PAT 7,599,346 which is a 371 of PCT/US03/17377 06/02/2003 which claims benefit of 60/427,495 11/19/2002 OK /AB/ 04/09/2010 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 09/09/2009						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged /ARIEL A BALAOING/ Examiner's Signature		☐ Met after Allowance /AB/ Initials	STATE OR COUNTRY NH	SHEETS DRAWINGS 19	TOTAL CLAIMS 8	INDEPENDENT CLAIMS 2
ADDRESS BAE SYSTEMS PO BOX 868 NASHUA, NH 03061-0868 UNITED STATES						
TITLE BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM						
FILING FEE RECEIVED 1090	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		

Receipt date: 10/20/2009

12548502 - GAU: 2617

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

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		12548502
	Filing Date		2009-08-27
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	unknown	
	Attorney Docket Number	20020029DIV	

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	5987061		1999-11-16	CHEN	
	2	5652866		1997-07-29	ALDRED ET AL.	
	3	6636603		2003-10-21	MILBRANDT	
	4	7050419		2006-05-23	AZENKOT ET AL.	
	5	7023868		2006-04-04	RABENKO ET AL.	
	6	7120123		2006-10-10	QUIGLEY ET AL.	
	7	6665308		2003-12-16	RAKIB ET AL.	
	8					
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Receipt date: 10/20/2009 INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12548502	12548502 - GAU: 2617
	Filing Date		2009-08-27	
	First Named Inventor	Karl D. BROMMER		
	Art Unit	2617		
	Examiner Name	unknown		
	Attorney Docket Number	20020029DIV		

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	20020154620		2002-10-24	AZENKOT ET AL.		

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	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	JP2003500974	JP		2003-01-07		abstract not available	☐
	2	JP2000505629	JP		2000-05-09		abstract not available	☐
	3	JP2002505042	JP		2002-02-12		abstract not available	☐
	4	JP2002359583	JP		2002-12-13		abstract	☐
	5	08-065269	JP		1996-03-08		abstract	☐

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/Ariel Balaoing/

04/09/2010

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12548502	12548502 - GAU: 2617
	Filing Date		2009-08-27	
	First Named Inventor	Karl D. BROMMER		
	Art Unit	2617		
	Examiner Name	unknown		
	Attorney Docket Number	20020029DIV		

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EXAMINER SIGNATURE

Examiner Signature	/Ariel Balaoing/	Date Considered	04/09/2010
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Search Notes 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

SEARCHED			
Class	Subclass	Date	Examiner
370	346,342,328	4/9/2010	AB
375	147,220,222	4/9/2010	AB
455	552.1,434	4/9/2010	AB

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search	4/9/2010	AB
Inventor Search	5/4/2010	AB

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	"20020176392".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:11
L4	2148	(multiuser "multi-user" multiple adj user) adj detect\$3	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:13
L5	49	4 and transmission adj mode	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:15
L6	266	4 and (smart adj antenna antenna adj diversity)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:20
L7	14	4 and data near2 format\$4 and control adj processor	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:33
L8	802	(multiuser "multi- user") adj detector	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:50
L9	5	8 and legacy near3 protocol	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:50
L10	47	8 and legacy	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:51
L11	444	joint adj detector	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:53
L12	6	11 and legacy	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:53
L13	15	8 and control adj processor	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 13:54
L14	0	bandwidth adj efficient near3 aggressive	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:00
L15	6	legacy near2 protocol same control adj processor	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:00
L16	2	legacy near2 protocol same mud	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:00

L17	3	formatting adj mode same (legacy backwards adj compatibl\$4)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:03
L18	183	legacy near2 modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:08
L19	300195	legacy near2 modesame modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:08
L20	37	legacy near2 mode same modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:08
L21	65	legacy near2 mode and "455".clas.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:09
L22	51	21 and (bandwidth data adj rate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:09
L23	204	legacy near2 mode and (bandwidth data adj rate) and modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 14:12
L24	15	legacy near2 mode and (bandwidth data adj rate) and antenna adj array	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:00
L25	594	legacy near2 transmission	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:01
L26	63	25 and "455".clas.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:02
L27	92	25 and cdma	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:02
L28	136	legacy near2 (transmission mode) and cdma	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:02
L29	2	"20020126650".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:09
L30	1	29 and (process\$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:09
L31	33	legacy near2 (transmission mode) same process\$4 and cdma	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:12

L32	423	legacy near2 (transmission mode) and modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:12
L33	157	legacy near2 (transmission mode) same (select\$4 process \$4) and modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:13
L34	15	legacy near2 (transmission) same modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:15
L35	26	detect\$4 near3 protocol same transmission near2 mode	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:17
L36	75	detect\$4 near3 protocol and transmission near2 mode and legacy	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:18
L37	15	legacy adj2 (protocol mode) same transmission same processor	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:20
L38	49	legacy adj2 (protocol mode) same transmission near3 (operation mode)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:21
L39	7	legacy adj2 (mode) same transmission same modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:22
L40	286	cdma and legacy with transmission	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:26
L41	245	40 and (bandwidth data adj rate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:28
L42	2	"6529488".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:35
L43	1	42 and legacy	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/04/09 15:35
S1	2	"20090310619".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 13:39
S2	42	(multiuser "multi- user") adj detection adj (unit module)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:10

S3	5	S2 and legacy	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:11
S4	1785	antenna adj array and \$3multiplexer	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:14
S5	0	S4 and aggressive adj access	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:14
S6	3	S2 and aggressive adj access	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:15
S7	4	modem and aggressive adj access	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:15
S8	3089	modem and bandwidth near3 efficient	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:17
S9	517	modem same bandwidth near3 efficient	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:18
S10	5	mud and data adj formatting and processor and demultiplexer	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:18
S11	80	mud with modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:19
S12	48	multiple adj user adj detection and modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:20
S13	73	("20010053132" "20020061031" "20020073432" "20020154620" "20020163933" "20030179742" "4580276" "4750171" "4794635" "5365516" "5530437" "5546379" "5596439" "5652866" "5659787" "5752164" "5894500" "5987061" "6052364" "6061406" "6097707" "6185197" "6226277" "6240099" "6408019" "6414964" "6417672"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:21

		"6535554" "6535716" "6567416" "6636603" "6665308" "6782277" "6870808" "7023868" "7050419" "7120123").PN.				
S14	37	("20010053132" "20020061031" "20020073432" "20020154620" "20020163933" "20030179742" "4580276" "4750171" "4794635" "5365516" "5530437" "5546379" "5596439" "5652866" "5659787" "5752164" "5894500" "5987061" "6052364" "6061406" "6097707" "6185197" "6226277" "6240099" "6408019" "6414964" "6417672" "6535554" "6535716" "6567416" "6636603" "6665308" "6782277" "6870808" "7023868" "7050419" "7120123").PN.	US-PGPUB; USPAT	OR	ON	2010/03/10 14:21
S15	1767	(multiple adj user multiuser "multi-user") adj detection	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:29
S16	278426	"455".clas. "370".clas. "375".clas	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:29
S17	374907	"455".clas. "370".clas. "375".clas.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:29
S18	1415	S15 and S17	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:30
S19	42	S15 and legacy	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 14:30

S20	15	("20010053132" "4580276" "4750171" "4794635" "5546379" "5596439" "5752164" "5894500" "6052364" "6061406" "6151335" "6185197" "6535716" "6782277" "6870808").PN.	US-PGPUB; USPAT	OR	ON	2010/03/10 15:04
S21	17	S15 and frontend	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:07
S22	0	S1 and frontend	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:08
S23	270	S15 and front adj end	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:08
S24	2086	(multiple adj user multiuser "multi-user") adj (detection detector)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:18
S25	177	S23 and front adj end and (\$2multiplex\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:18
S26	3488	(multiple adj user multiuser "multi-user" joint) adj (detection detector)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:20
S27	265	S26 and front adj end and (\$2multiplex\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:20
S28	27	S27 and legacy	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:20
S29	10	S27 and data adj formatting	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:21
S30	343	((multiple adj user multiuser "multi-user") adj (detection detector)).ti.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:22
S31	200	S30 and S17	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:22
S32	45	S30 and modem	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:26

S33	93	S30 and (frontend front adj end array receiver) same (processor controller)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 15:28
S34	2	"20080293451".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 16:25
S35	14	("20040190480" "4211894" "5714957" "6198435" "6611511").PN.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2010/03/10 16:37

EAST Search History (Interference)

< This search history is empty >

4/ 9/ 2010 4:16:23 PM**C:\ Documents and Settings\ abalaoing\ My Documents\ EAST\ Workspaces\ 12548502.wsp**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

BROMMER

Serial No: 12/548,502

Filed: 08/27/2009

For: BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

Examiner: Ariel A. Balaoing

Art Unit: 2617

Docket No. 20020029DIV

March 1, 2010

To: Commissioner for Patents
Box 1450
Alexandria, VA 22313-1450

Dear Sir:

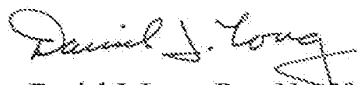
RESPONSE TO RESTRICTION REQUIREMENT AND PRELIMINARY
AMENDMENT

In response to the Restriction Requirement dated February 16, 2010, Applicant elects to prosecute the claim directed to Species I (claims 1-4).

Please also amend the above captioned application before examination in the way shown on the attached sheets.

PAYMENT: No fee or extension of time is believed to be necessary. However, in the event that any fee or extension of time is required for the prosecution of this application, please charge it against deposit account 190130.

Respectfully submitted,



Daniel J. Long, Reg. No. 29,404

BAE SYSTEMS
PO Box 868, NHQ1-719
Nashua, NH 03061-0868
Tel. No. (603) 885-2643
Fax No. (603) 885-2167

Electronic Acknowledgement Receipt	
EFS ID:	7108700
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	22500
Filer:	Daniel J. Long/Nancy Young
Filer Authorized By:	Daniel J. Long
Attorney Docket Number:	20020029DIV
Receipt Date:	01-MAR-2010
Filing Date:	27-AUG-2009
Time Stamp:	13:51:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		20020029DIV- RestrictionResponse.pdf	446861 053f198d6f24d4ea4e82e47f764bade47c004235	yes	3

Multipart Description/PDF files in .zip description			
Document Description		Start	End
Response to Election / Restriction Filed		1	1
Claims		2	3
Warnings:			
Information:			
Total Files Size (in bytes):		446861	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/548,502		Filing Date 08/27/2009		☐ To be Mailed	
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APPLICATION AS FILED – PART I					OTHER THAN SMALL ENTITY				
(Column 1)		(Column 2)		SMALL ENTITY ☐		OR		SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)			RATE (\$)	FEE (\$)	
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A				N/A		
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A				N/A		
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A				N/A		
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X \$ =		OR		X \$ =		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =				X \$ =		
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))			If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL			

APPLICATION AS AMENDED – PART II					OTHER THAN SMALL ENTITY						
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR		SMALL ENTITY	
AMENDMENT	03/01/2010	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)			RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 4	Minus	** 20	= 0	X \$ =		OR		X \$2=	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X \$ =		OR		X \$220=	0
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR			
					TOTAL ADD'L FEE		OR		TOTAL ADD'L FEE		0

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
 ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
 *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
 The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/LASHAWN MARKS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Claims

1. (Original) A modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems in the presence of interference and noise, the modem comprising:
 - a multiuser detection module adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation;
 - a data formatting module operatively coupled to the multiuser detection module, and adapted to produce network data packets for at least one of the K recovered signals;
 - a control processor operatively coupled to the formatting module, and adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem; and
 - a demultiplexer operatively coupled to the data formatting module and the control processor, and adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem, where the selection is based on a control input from the control processor.
2. (Original) The modem of claim 1 further comprising:
 - a front end adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module.
3. (Original) The modem of claim 1 wherein the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting module operates.

4. (Original) The modem of claim 1 wherein in response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor is further adapted to enable a legacy protocol mode there by providing backwards compatibility.

5.- 8. (Canceled)



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,502	08/27/2009	Karl D. BROMMER	20020029DIV	7248
22500	7590	02/16/2010		
BAE SYSTEMS PO BOX 868 NASHUA, NH 03061-0868			EXAMINER BALAOING, ARIEL A	
			ART UNIT 2617	PAPER NUMBER
			MAIL DATE 02/16/2010	DELIVERY MODE PAPER

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

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

Office Action Summary	Application No.	Applicant(s)	
	12/548,502	BROMMER, KARL D.	
	Examiner	Art Unit	
	ARIEL BALAOING	2617	

-- 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 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

1) ☒ Responsive to communication(s) filed on 27 August 2009.

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

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

Disposition of Claims

4) ☒ Claim(s) 1-8 is/are pending in the application.

 4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☐ Claim(s) _____ is/are rejected.

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

8) ☒ Claim(s) 1-8 are subject to restriction and/or election requirement.

Application Papers

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

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

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

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

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a) ☐ All b) ☐ Some * c) ☐ None of:

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

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

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

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

Attachment(s)

1) ☐ Notice of References Cited (PTO-892) 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____. 5) ☐ Notice of Informal Patent Application 6) ☐ Other: _____.
---	--

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claim 1-4, drawn to a modem which enables efficient use of bandwidth in a multi-user wireless network including a plurality of modems in the presence of interference and noise, classified in class 370, subclass 449.
 - II. Claims 5-8, drawn to a method for polling and scheduling a multi-user network that includes bandwidth efficient modems, with at least one modem designated as a polling point coordinator, classified in class 370, subclass 346.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case invention I discloses an apparatus (i.e. modem) including various modules used for determining interference and noise which differs from the method of Invention II which discloses the use of an apparatus including receiving a beacon signal and monitoring current broadcasting activity of other modems included in the network to identify an open slot available for data transmission in a channel. Both

sets of claims include limitations and processes that are exclusive to each set of claims and are not obvious variations.

3. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and examination burden if restriction were not required because one or more of the following reasons apply:

- (a) the inventions have acquired a separate status in the art in view of their different classification;
- (b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;
- (c) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);
- (d) the prior art applicable to one invention would not likely be applicable to another invention;
- (e) the inventions are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention.**

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected invention.

If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ARIEL BALAOING whose telephone number is (571)272-7317. The examiner can normally be reached on Monday-Friday from 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, V. Paul Harper can be reached on (571) 272-7605. 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.

/Ariel Balaoing/
Examiner, Art Unit 2617

/A. B./
Examiner, Art Unit 2617

<i>Index of Claims</i> 	Application/Control No. 12548502	Applicant(s)/Patent Under Reexamination BROMMER, KARL D.
	Examiner ARIEL BALAOING	Art Unit 2617

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	02/05/2010								
	1	÷								
	2	÷								
	3	÷								
	4	÷								
	5	÷								
	6	÷								
	7	÷								
	8	÷								



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,502	08/27/2009	Karl D. BROMMER	20020029DIV

CONFIRMATION NO. 7248

22500
BAE SYSTEMS
PO BOX 868
NASHUA, NH 03061-0868

PUBLICATION NOTICE



Title:BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

Publication No.US-2009-0310619-A1

Publication Date:12/17/2009

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 Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12548502
	Filing Date		2009-08-27
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	unknown	
	Attorney Docket Number	20020029DIV	

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	5987061		1999-11-16	CHEN		
	2	5652866		1997-07-29	ALDRED ET AL.		
	3	6636603		2003-10-21	MILBRANDT		
	4	7050419		2006-05-23	AZENKOT ET AL.		
	5	7023868		2006-04-04	RABENKO ET AL.		
	6	7120123		2006-10-10	QUIGLEY ET AL.		
	7	6665308		2003-12-16	RAKIB ET AL.		
	8						
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12548502	
	Filing Date		2009-08-27	
	First Named Inventor	Karl D. BROMMER		
	Art Unit	2617		
	Examiner Name	unknown		
	Attorney Docket Number	20020029DIV		

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	1	20020154620		2002-10-24	AZENKOT ET AL.		

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	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	JP2003500974	JP		2003-01-07		abstract not available	☐
	2	JP2000505629	JP		2000-05-09		abstract not available	☐
	3	JP2002505042	JP		2002-02-12		abstract not available	☐
	4	JP2002359583	JP		2002-12-13		abstract	☐
	5	08-065269	JP		1996-03-08		abstract	☐

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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.		T5

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12548502
	Filing Date		2009-08-27
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	unknown	
	Attorney Docket Number	20020029DIV	

	1		☐
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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	12548502
	Filing Date	2009-08-27
	First Named Inventor	Karl D. BROMMER
	Art Unit	2617
	Examiner Name	unknown
	Attorney Docket Number	20020029DIV

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.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

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	/Daniel J. Long/	Date (YYYY-MM-DD)	2009-10-20
Name/Print	Daniel J. Long	Registration Number	29,404

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Electronic Acknowledgement Receipt	
EFS ID:	6293309
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	22500
Filer:	Daniel J. Long
Filer Authorized By:	
Attorney Docket Number:	20020029DIV
Receipt Date:	20-OCT-2009
Filing Date:	27-AUG-2009
Time Stamp:	14:08:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed (SB/08)	20020029DIVIDS2.pdf	1177749 6b18042dba48dfe8e50c77b98d5ffe7548077698	no	5

Warnings:

Information:

A U.S. Patent Number Citation is required in the Information Disclosure Statement (IDS) form. You may remove the form to add the required data in order to correct the Informational Message or if you chose not to, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

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

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

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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
12/548,502	08/27/2009	2611	1090	20020029DIV	8	2

CONFIRMATION NO. 7248

22500
BAE SYSTEMS
PO BOX 868
NASHUA, NH 03061-0868

FILING RECEIPT



OC000000037718735

Date Mailed: 09/10/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Karl D. BROMMER, Exeter, NH;

Assignment For Published Patent Application

BAE Systems Information and Electronic Systems Integration Inc., Nashua, NH

Power of Attorney: The patent practitioners associated with Customer Number 42716

Domestic Priority data as claimed by applicant

This application is a DIV of 10/529,019 03/24/2005
which is a 371 of PCT/US03/17377 06/02/2003
which claims benefit of 60/427,495 11/19/2002

Foreign Applications

If Required, Foreign Filing License Granted: 09/09/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/548,502**

Projected Publication Date: 12/17/2009

Non-Publication Request: No

Early Publication Request: No

Title

BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

Preliminary Class

375

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page 2 of 3

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Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (06-09)

Approved for use through 07/31/2009. 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		
	Filing Date		
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	Ariel A. Balaoing	
	Attorney Docket Number	20020029DIV	

U.S. PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	4580276		1986-04-01	ANDRUZZI, JR. ET AL.	
	2	4750171		1988-06-07	KEDAR ET AL.	
	3	5546379		1996-08-13	THAWEETHAI ET AL.	
	4	5596439		1997-01-21	DANKBERG ET AL.	
	5	5752164		1998-05-12	JONES	
	6	5894500		1999-04-13	BRUCKERT ET AL.	
	7	6185197		2001-02-06	CHEUNG YEUNG ET AL.	
	8	6226277		2001-05-01	CHUAH	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	Ariel A. Balaoing	
	Attorney Docket Number	20020029DIV	

	9	6240099		2001-05-29	LIM ET AL.	
	10	6408019		2002-06-18	PICKERING ET AL.	
	11	6417672		2002-07-09	CHONG	
	12	6535554		2003-03-18	WEBSTER ET AL.	
	13	6567416		2003-05-20	CHUAH	
	14	4794635		1988-12-27	HESS	
	15	6061406		2000-05-09	CARSON ET AL.	
	16	6052364		2000-04-18	CHALMERS ET AL.	
	17	6535716		2003-03-18	REICHMAN ET AL.	
	18	6870808		2005-03-22	LIU ET AL.	
	19	6782277		2004-08-24	CHEN ET AL.	

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	Examiner Name	Ariel A. Balaoing	
	Attorney Docket Number	20020029DIV	

	20	5365516		1994-11-01	JANDRELL	
	21	5530437		1996-06-01	GOLDBERG	
	22	5659787		1997-08-01	SCHIELTZ	
	23	6097707		2000-08-01	HODZIC ET AL.	
	24	6414964		2002-07-01	HOLMQUIST ET AL.	

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U.S.PATENT APPLICATION PUBLICATIONS						
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	20010053132		2001-12-20	ATTIMONT ET AL.	
	2	20020073432		2002-06-13	KOLZE	
	3	20020061031		2002-05-01	SUGAR ET AL.	
	4	20020163933		2002-11-01	BENVENISTE	

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	Filing Date			
	First Named Inventor	Karl D. BROMMER		
	Art Unit	2617		
	Examiner Name	Ariel A. Balaoing		
	Attorney Docket Number	20020029DIV		

5	20030179742	2003-09-01	OGIER ET AL.
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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	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	9507578	WO		1995-03-16	GARDNER ET AL.		☐
	2	11340952	JP		1999-12-10	DE GAUDENZI ET AL.		☐
	3	2000115028	JP		2000-04-21	HUANG ET AL.		☐
	4	0072455	WO		2000-11-30	DOETSCH ET AL.		☐
	5	9428642	WO		1994-12-08	THIELECKE		☐
	6	00/71843	WO		2000-11-30	SIEMENS AKTIENGESELLSCHAFT		☐
	7	2000-252918	JP		2000-09-14	OKI ELECTRIC IND CO LTD.		☐
	8	63-051742	JP		1988-03-04	FUJITSU LTD.		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	Ariel A. Balaoing	
	Attorney Docket Number	20020029DIV	

	9	03-044234	JP		1991-02-26	FUKUDA DENSHI CO LTD.	☐
If you wish to add additional Foreign Patent Document citation information please click the Add button							
NON-PATENT LITERATURE DOCUMENTS							
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	OSTERGAARD, ROLF V., "Cable-Modems.Org: The Cable Modem Reference Guide", May 2003, pp. 1-2, Rolf V. Ostergaard.					☐
	2	PCT International Search Report dated August 2, 2002 of International Application No. PCT/US02/12401 filed April 18, 2002.					☐
	3	PCT International Search Report dated October 6, 2003 of International Application No. PCT/US03/17377 filed June 2, 2003.					☐
	4	PCT International Search Report dated January 9, 2004 of International Application No. PCT/US03/17449 filed June 2, 2003.					☐
	5	Translation of Japanese Office Action; May 23, 2006, pp. 1-4, Mail No. 200047.					☐
	6	BENDER, P. ET AL.; "CDM/HDR: A Bandwidth Efficient High Speed Wireless Data Service for Nomadic Users", Communications Magazine, IEEE, July 2000, pp. 70-77, Volume 38, Issue 7					☐
	7	"Newton (Newton's Telecom Dictionary), 1998, pp. 230.					☐
	8	"Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications", IEEE, 1997, 2 pages.					☐
If you wish to add additional non-patent literature document citation information please click the Add button							

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor	Karl D. BROMMER	
	Art Unit	2617	
	Examiner Name	Ariel A. Balaoing	
Attorney Docket Number		20020029DIV	

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	
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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	
Filing Date	
First Named Inventor	Karl D. BROMMER
Art Unit	2617
Examiner Name	Ariel A. Balaoing
Attorney Docket Number	20020029DIV

CERTIFICATION STATEMENT

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

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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.
- ☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- ☒ None

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	/Daniel J. Long/	Date (YYYY-MM-DD)	2009-08-25
Name/Print	Daniel J. Long	Registration Number	29,404

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Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM		
First Named Inventor/Applicant Name:		Karl D. BROMMER		
Filer:		Daniel J. Long/Nancy Young		
Attorney Docket Number:		20020029DIV		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1090

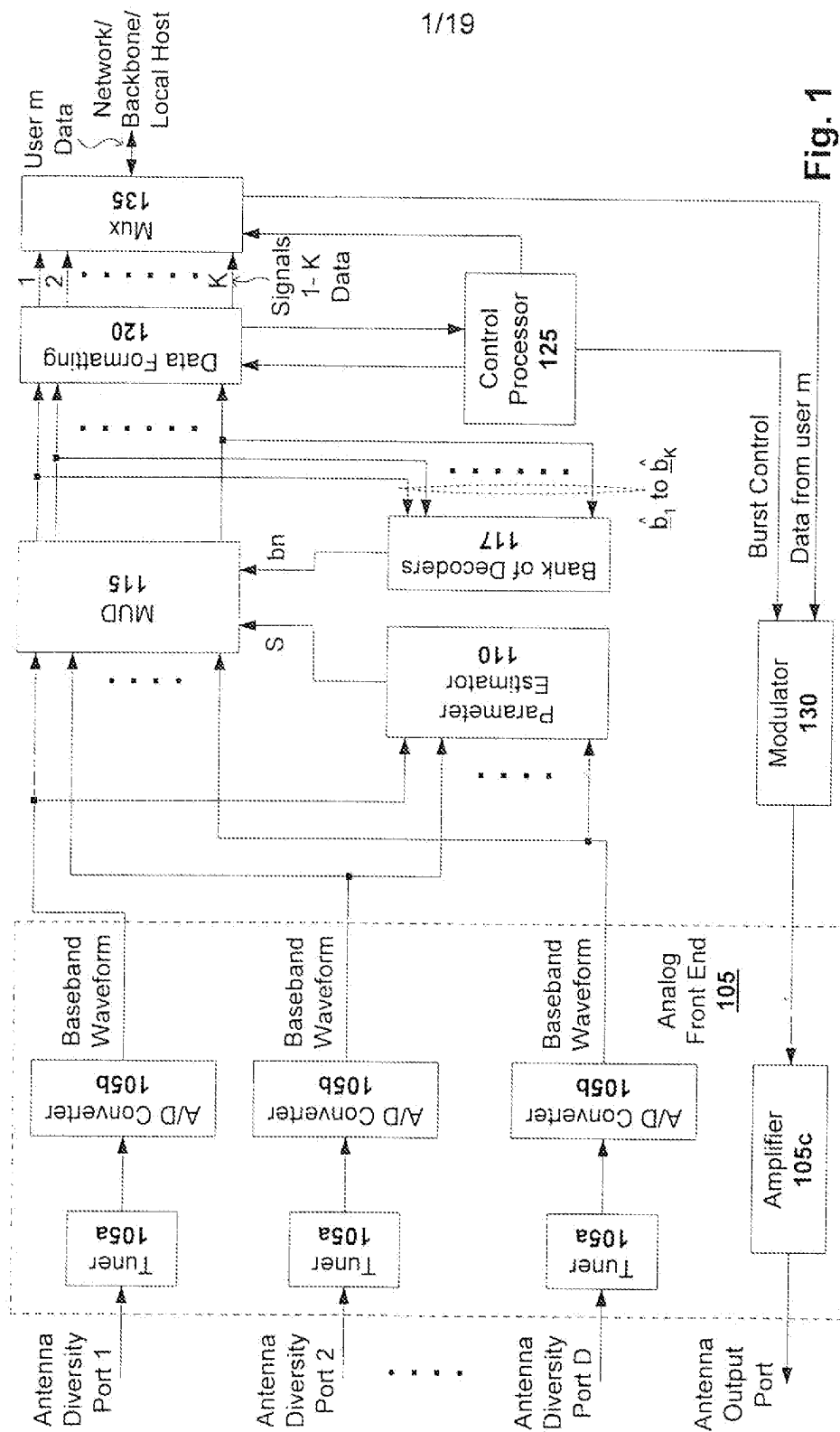
Electronic Acknowledgement Receipt	
EFS ID:	5962444
Application Number:	12548502
International Application Number:	
Confirmation Number:	7248
Title of Invention:	BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM
First Named Inventor/Applicant Name:	Karl D. BROMMER
Customer Number:	22500
Filer:	Daniel J. Long/Nancy Young
Filer Authorized By:	Daniel J. Long
Attorney Docket Number:	20020029DIV
Receipt Date:	27-AUG-2009
Filing Date:	
Time Stamp:	10:31:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$1090
RAM confirmation Number	9191
Deposit Account	190130
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Specification	20020029DIV-spec.pdf	15314930	no	35
			7e91216f711c81d6a9ea193e32ee7d0ba9cb059b		
Warnings:					
Information:					
2	Claims	20020029DIV-Claims.pdf	624030	no	2
			16a2da3555f9fa66e46318598fa88a34fcf86e2		
Warnings:					
Information:					
3	Abstract	20020029DIV-Abstract.pdf	129014	no	1
			b3c7daf3e5290e8912bb89ba46e8764e997853f6		
Warnings:					
Information:					
4	Drawings-only black and white line drawings	20020029DIV-Drawings.pdf	2873498	no	19
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Warnings:					
Information:					
5	Oath or Declaration filed	20020029DIV-POA.pdf	507088	no	1
			fd9cfe4acd8be3c850a6b712c32c5d9b78f0bce		
Warnings:					
Information:					
6	Application Data Sheet	20020029DIV-ADS.pdf	1446331	no	3
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Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
7	Information Disclosure Statement (IDS) Filed (SB/08)	20020029DIV-IDS.pdf	2131834	no	7
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Information:					
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8	Fee Worksheet (PTO-875)	fee-info.pdf	32985	no	2
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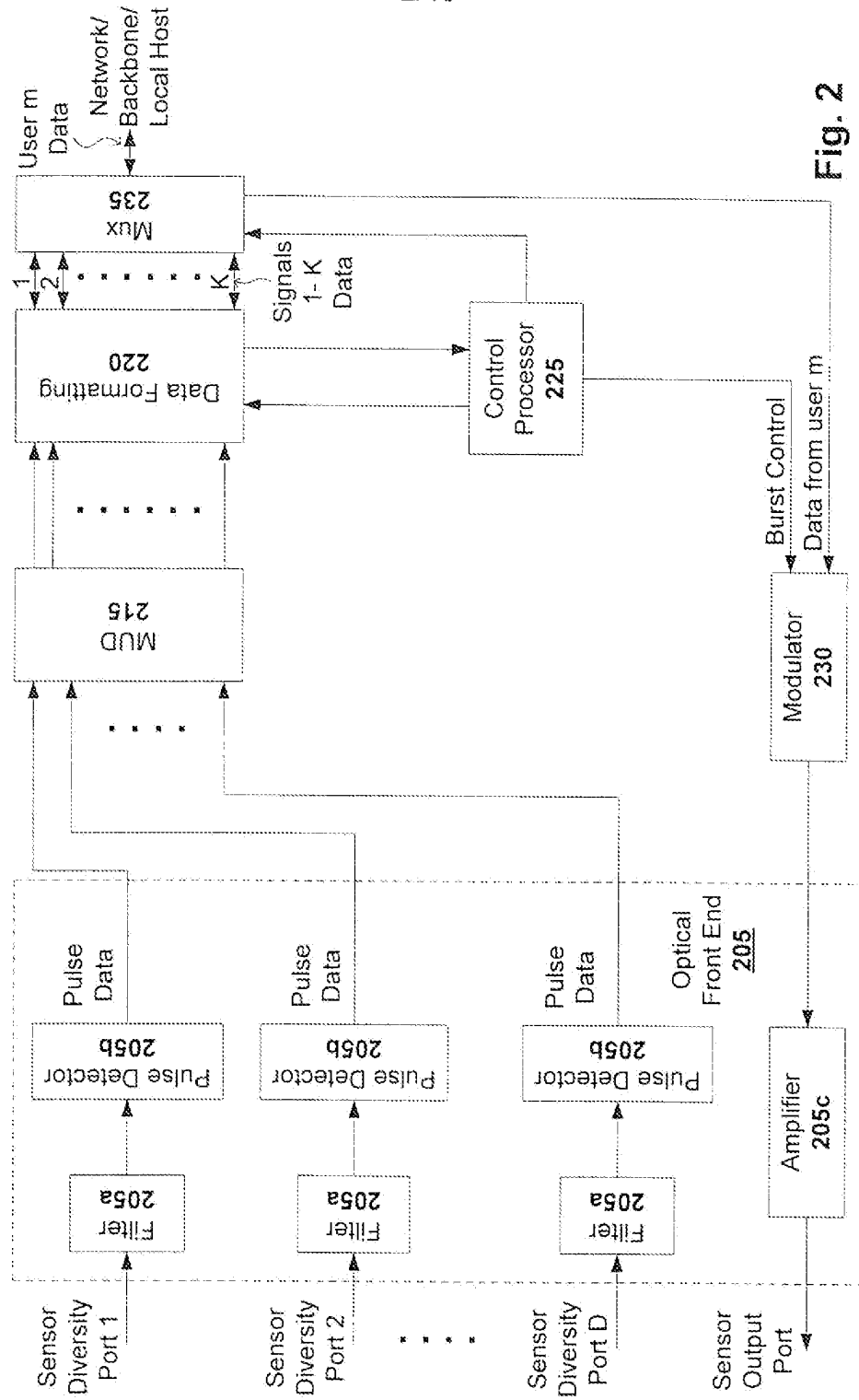


Fig. 2

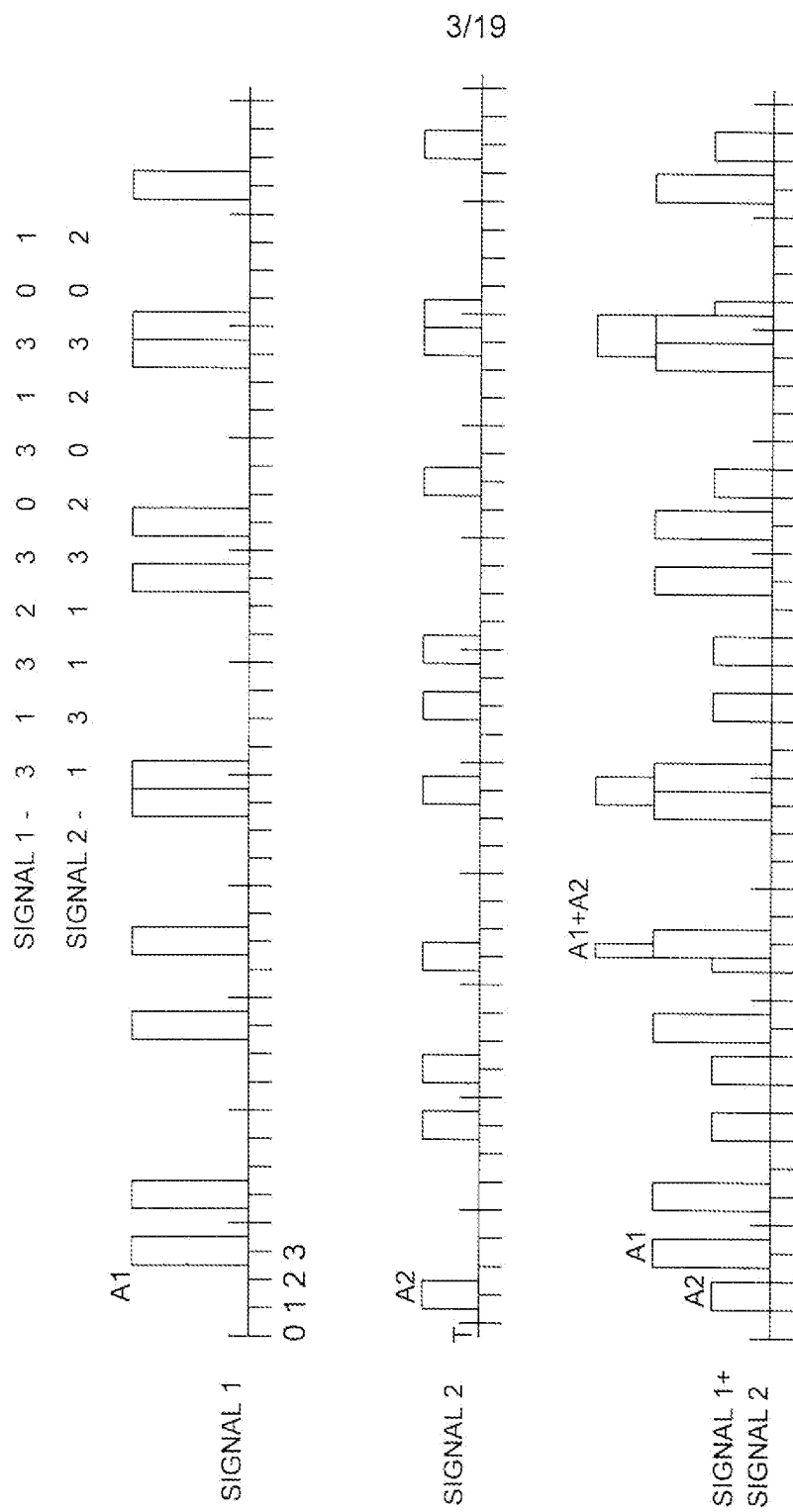


Fig. 3

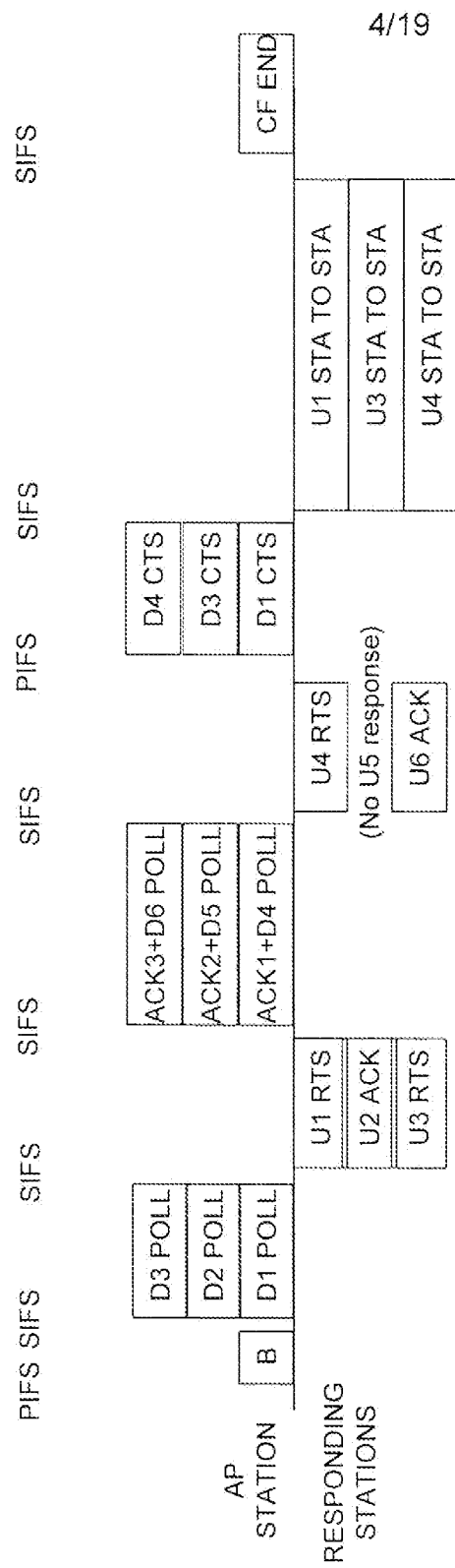
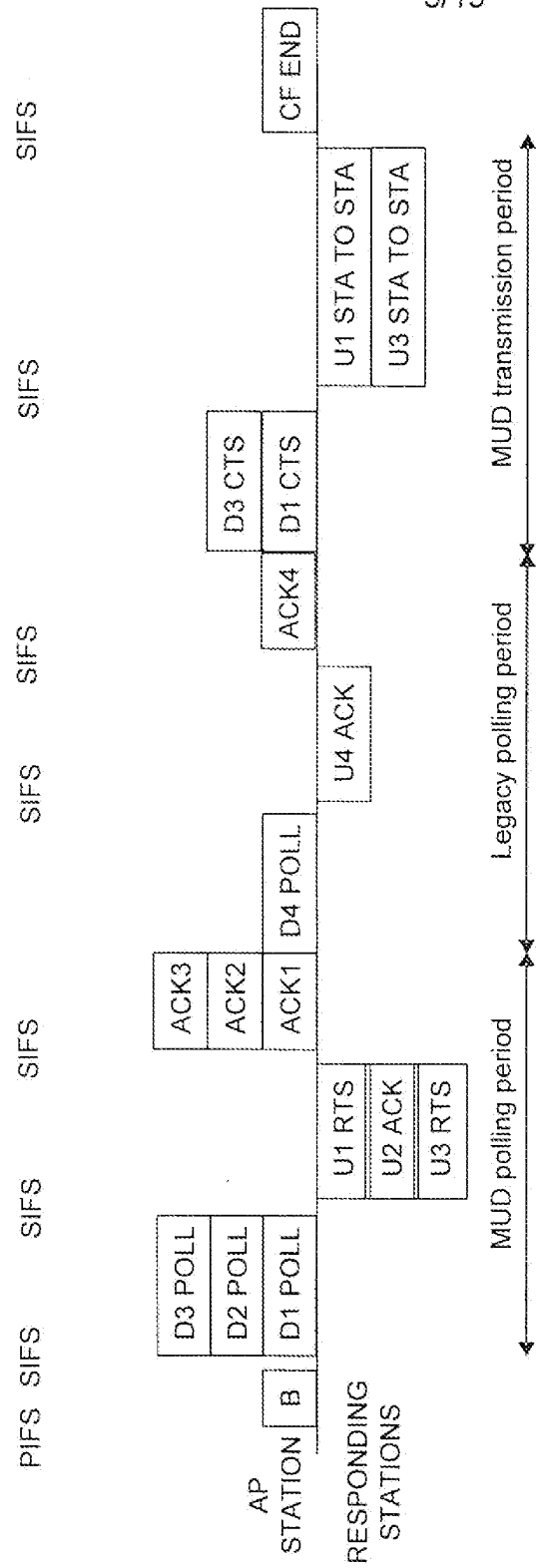


Fig. 4a



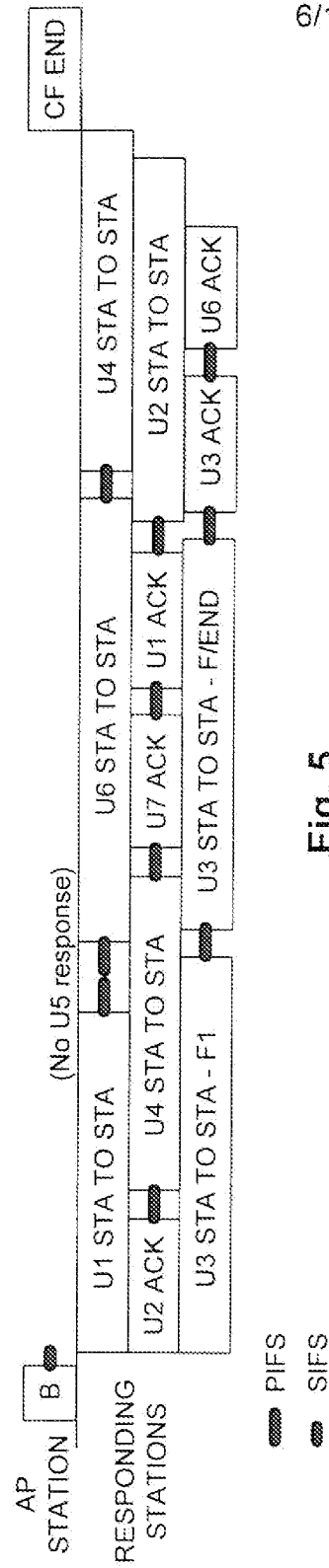


Fig. 5

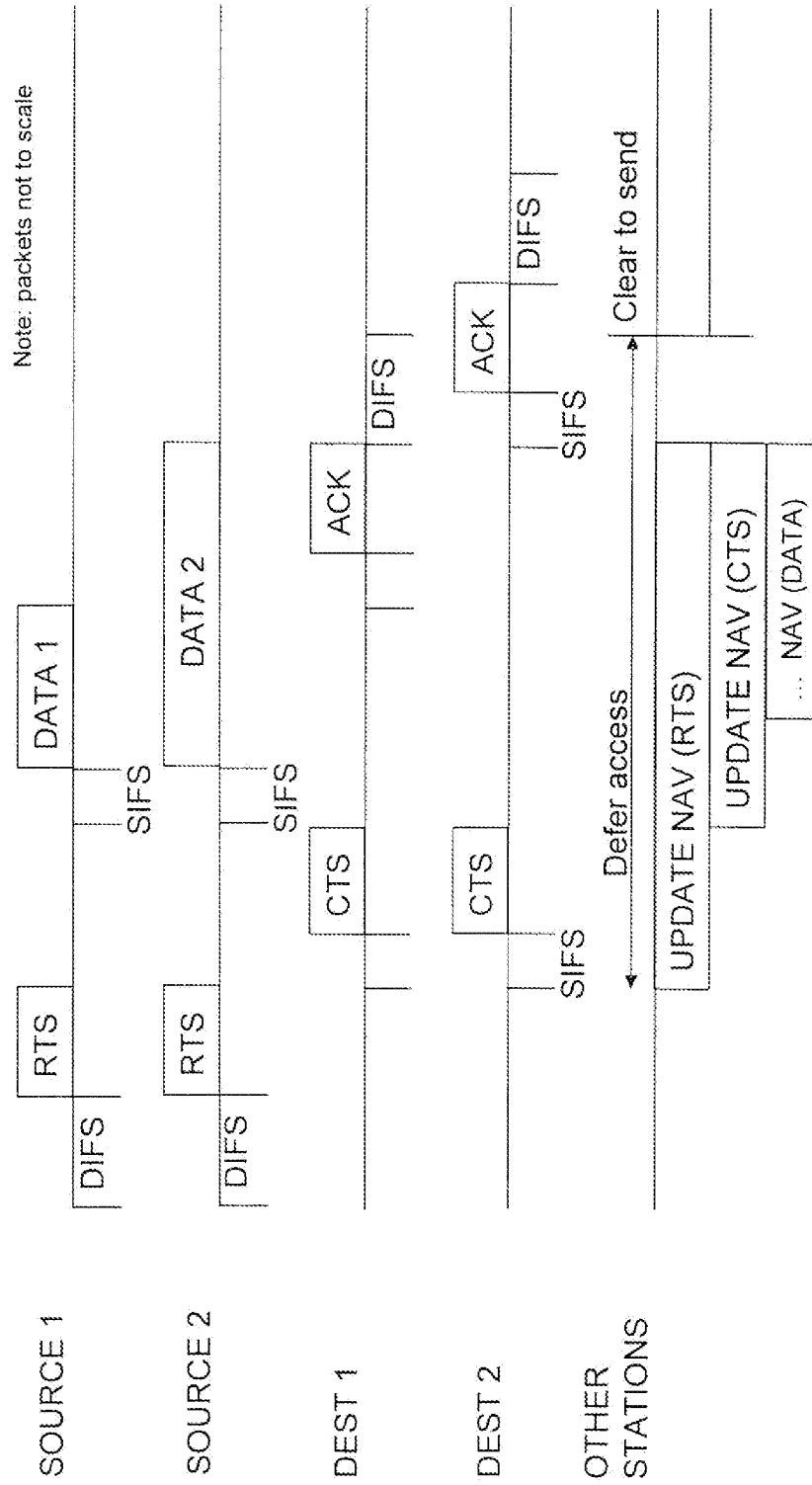


Fig. 6

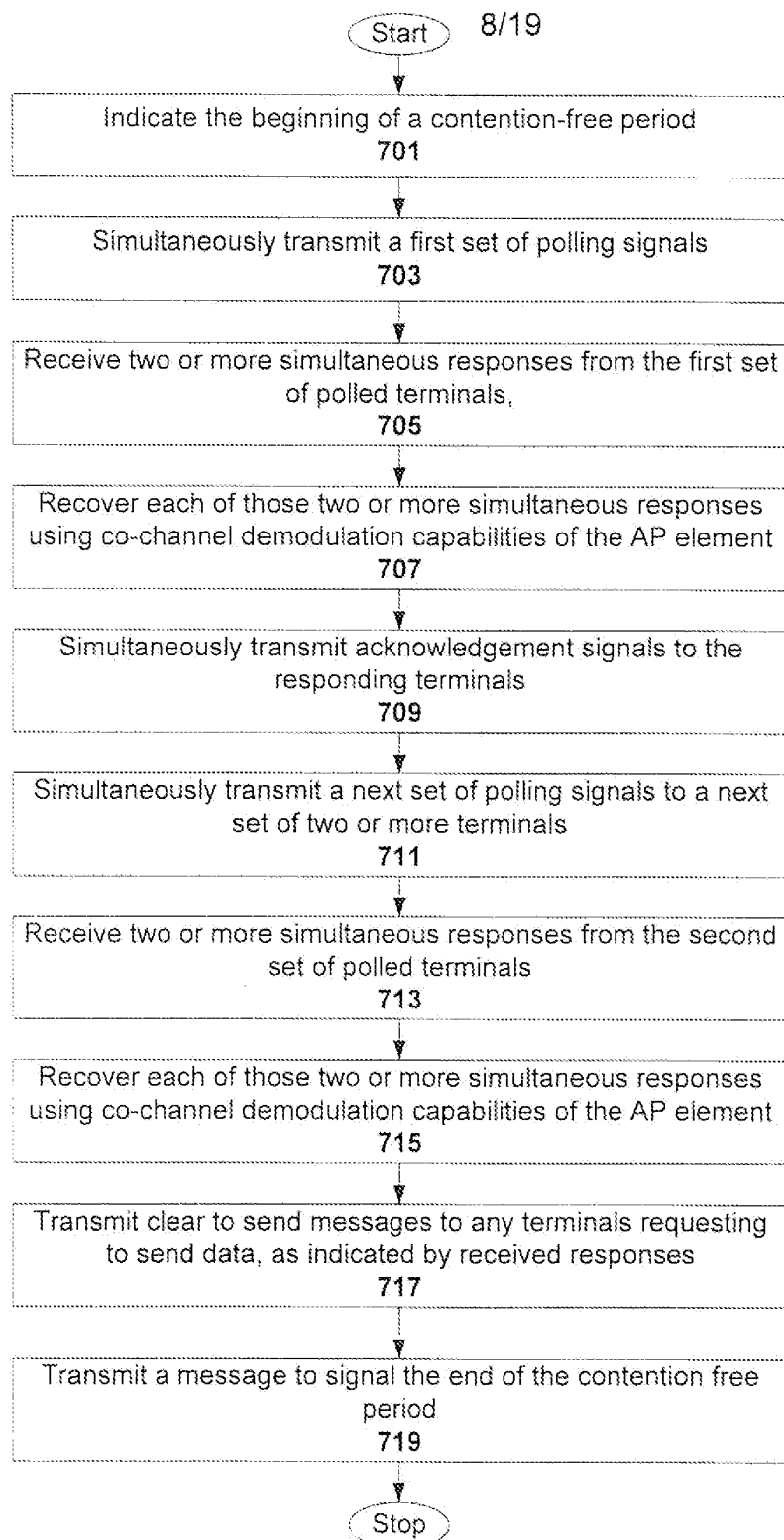


Fig. 7a

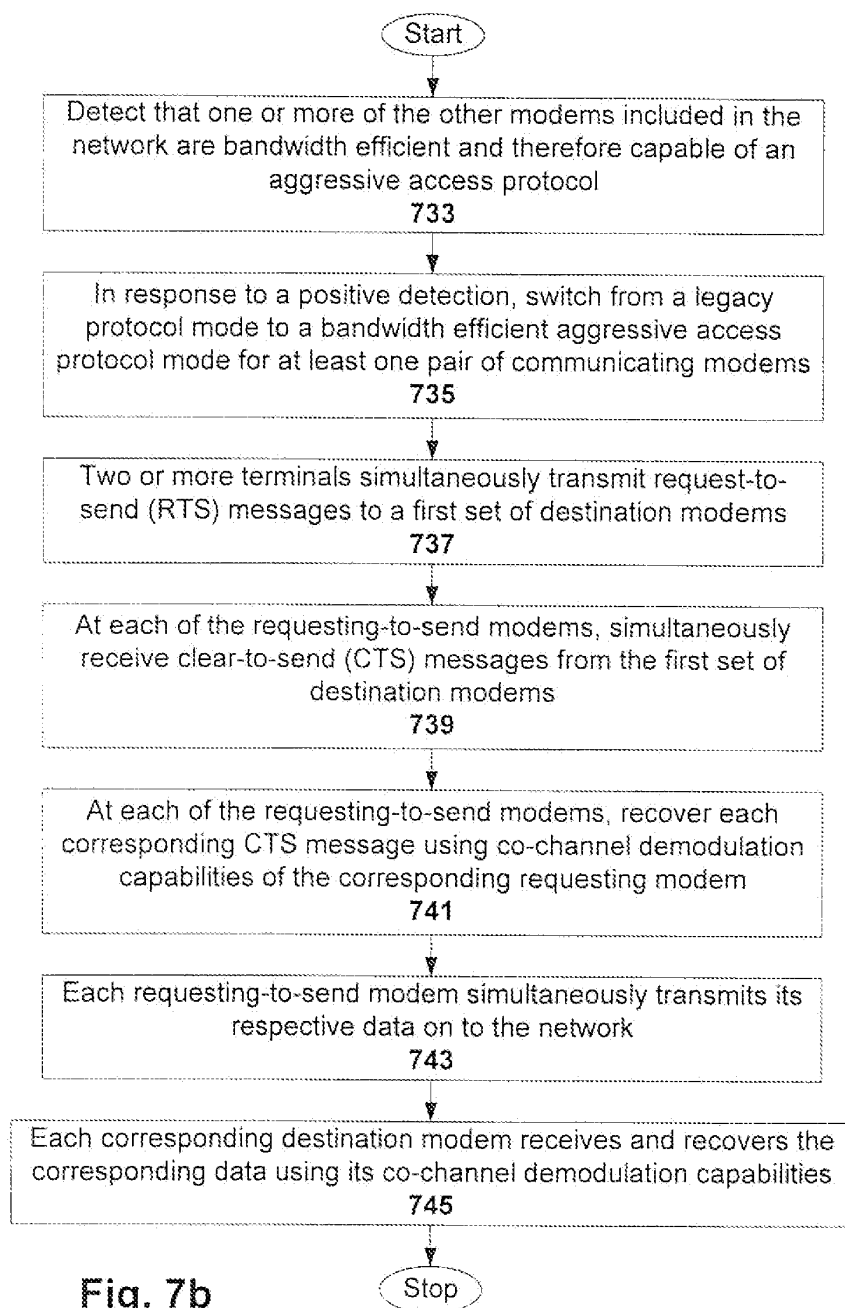
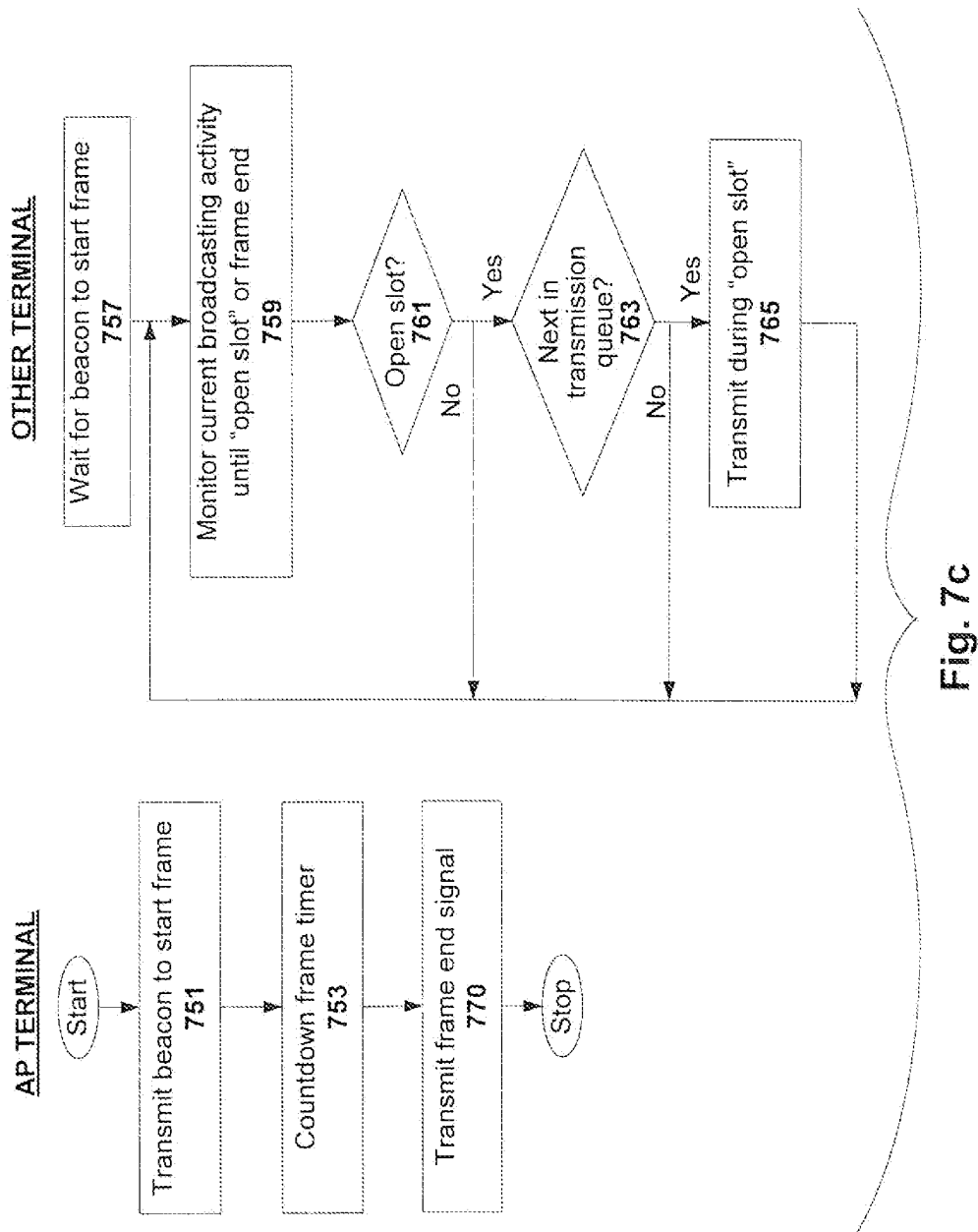


Fig. 7b



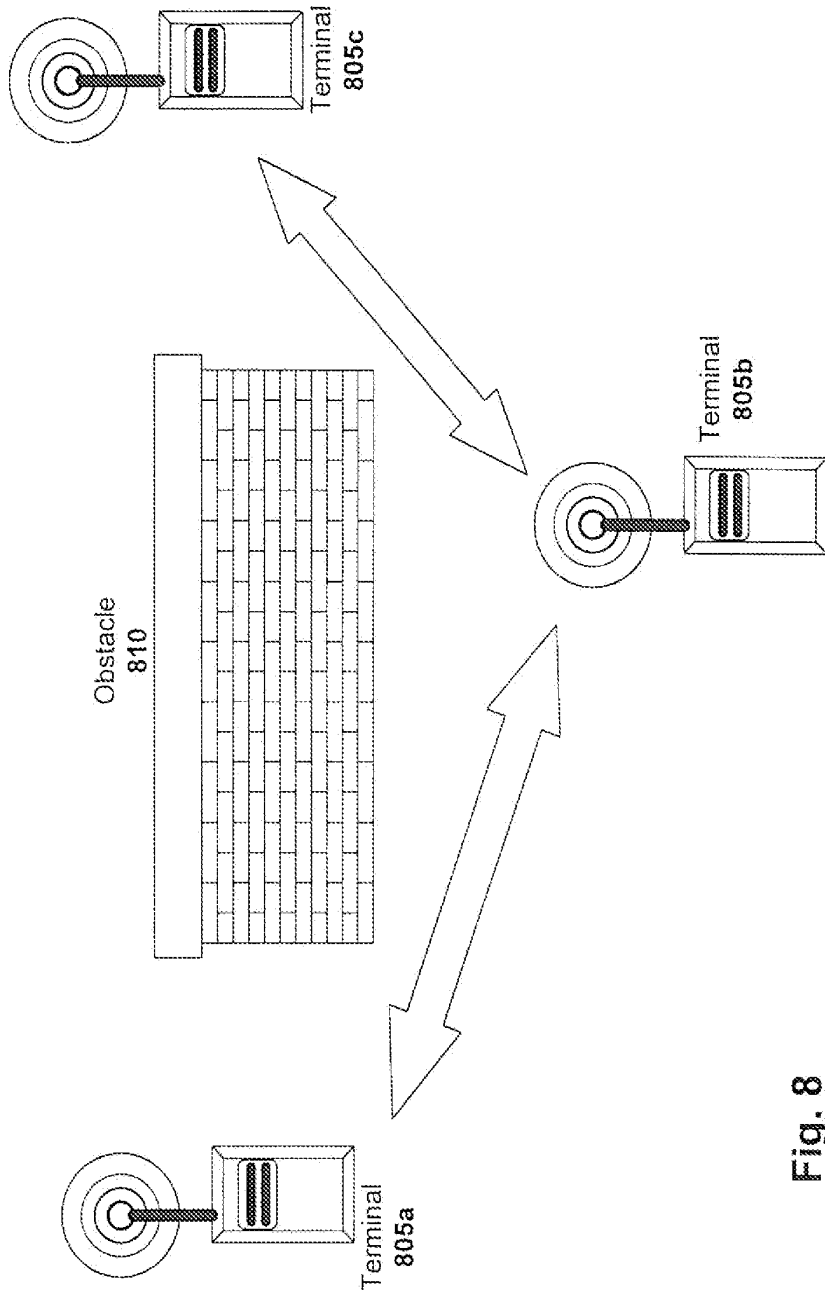


Fig. 8

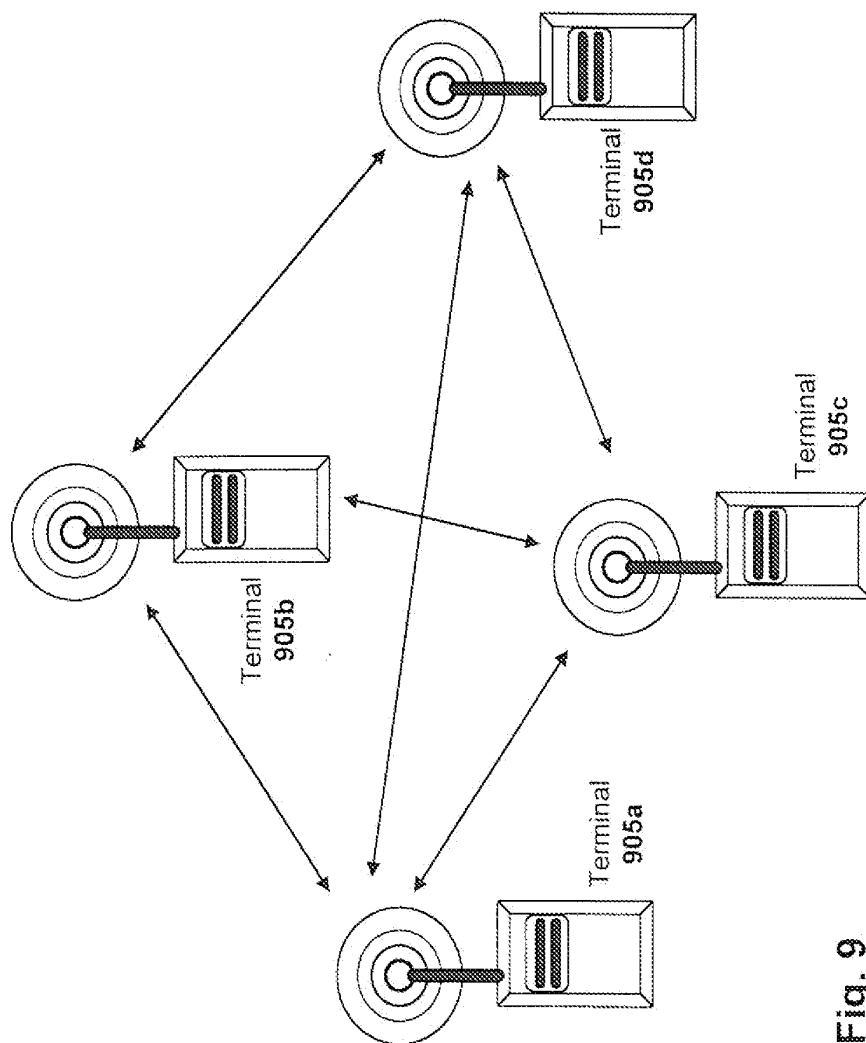


Fig. 9

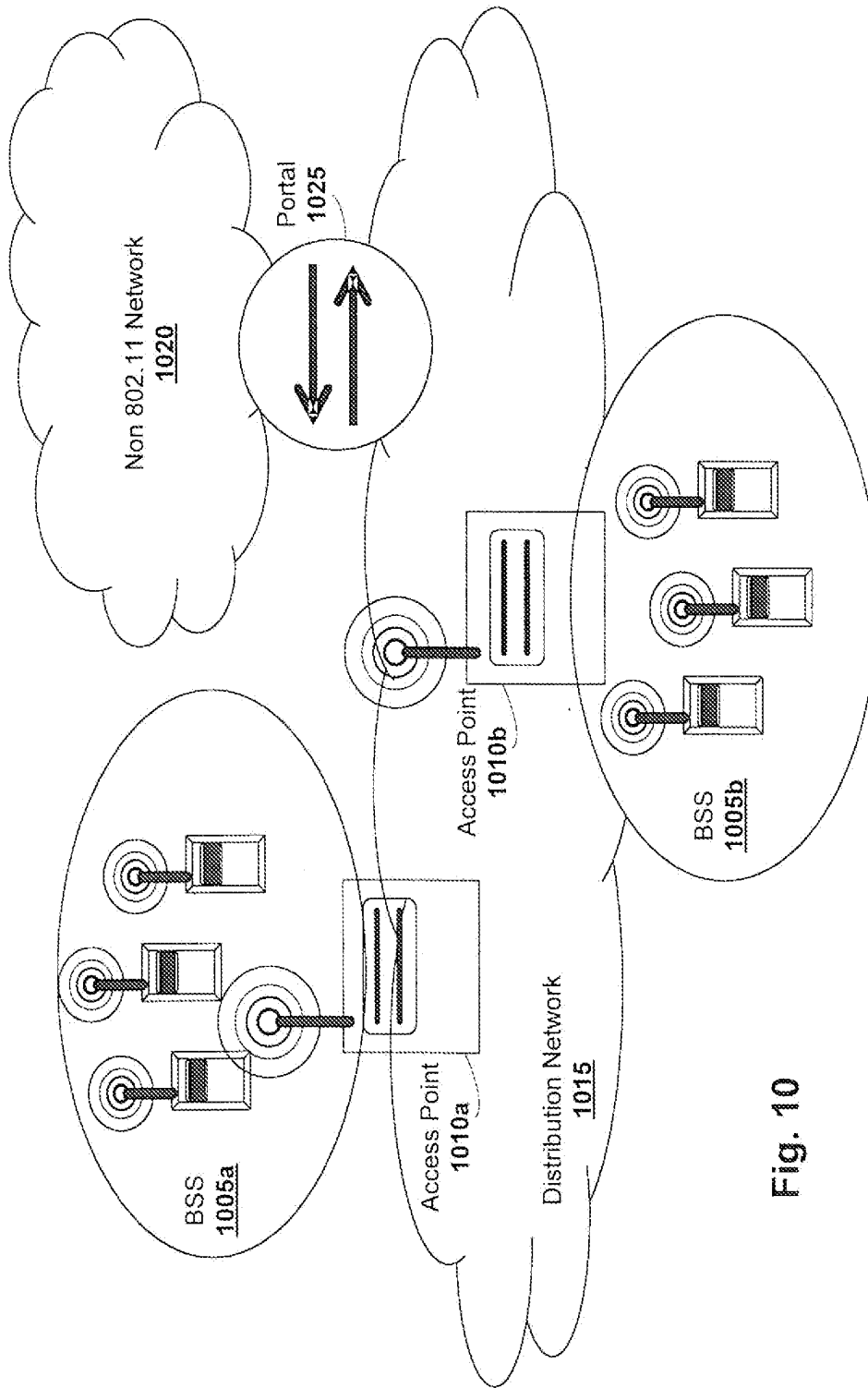


Fig. 10

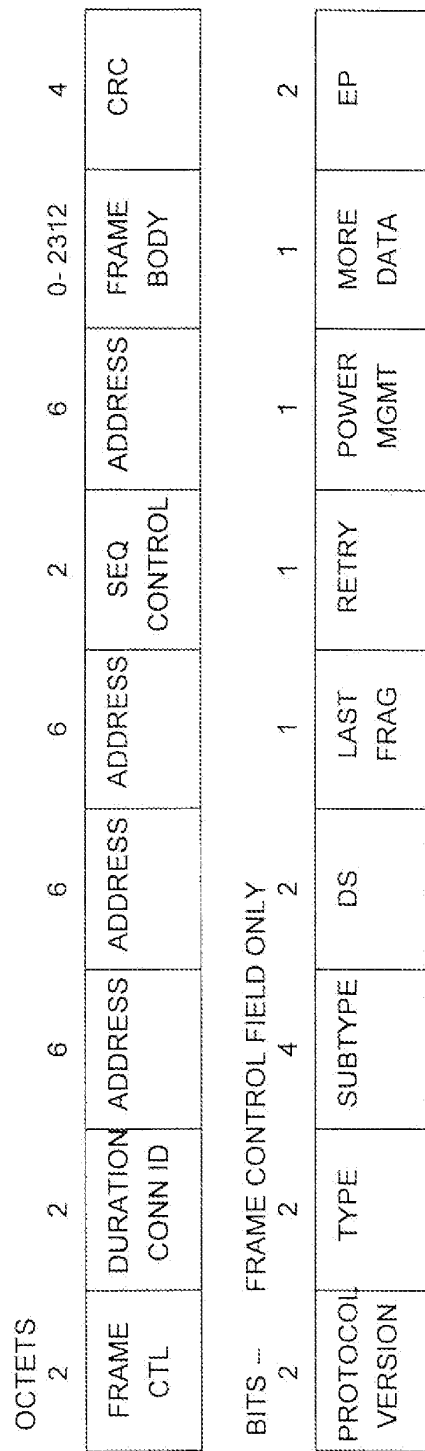


Fig. 11

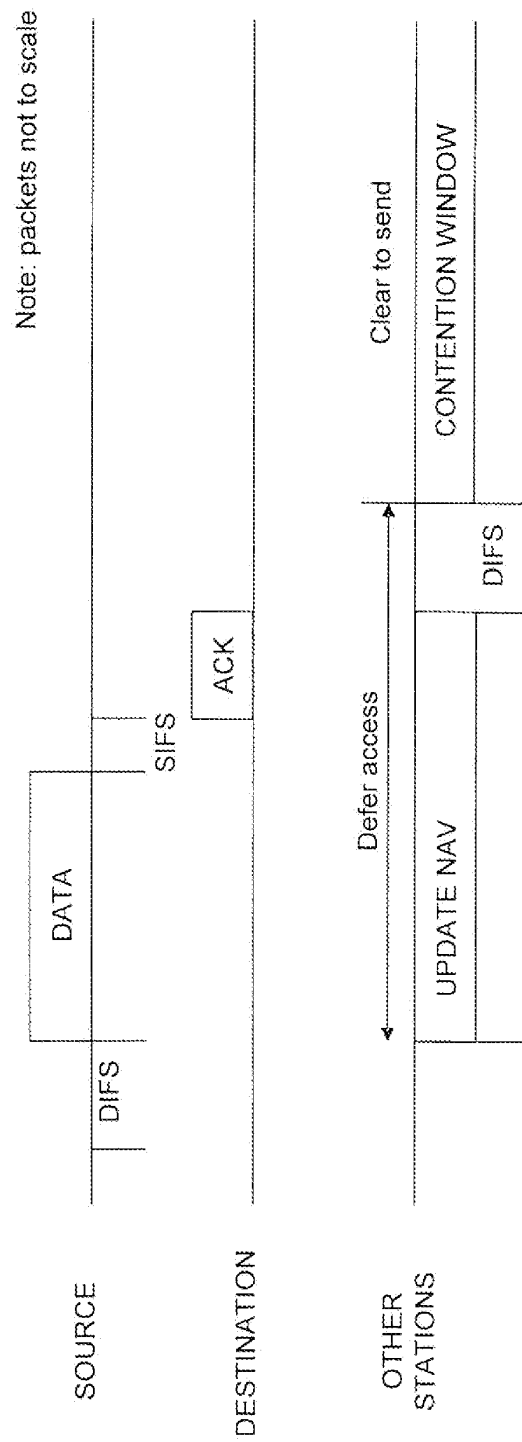


Fig. 12

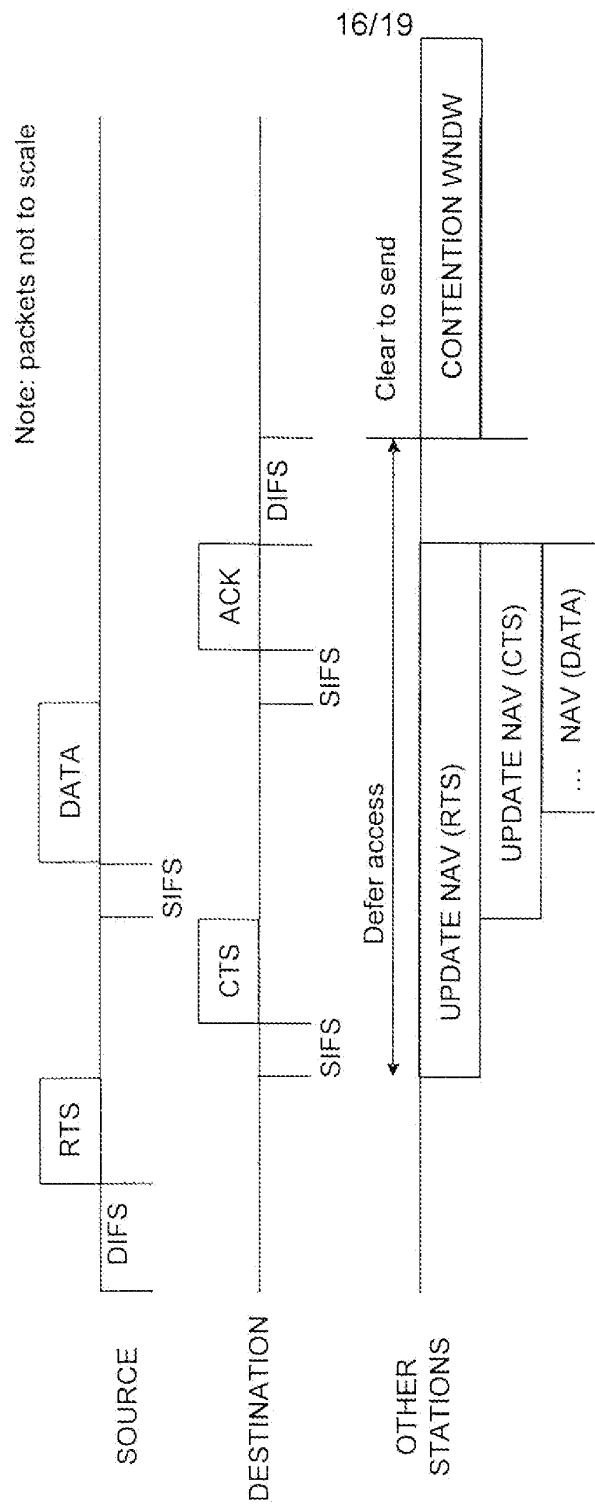


Fig. 13

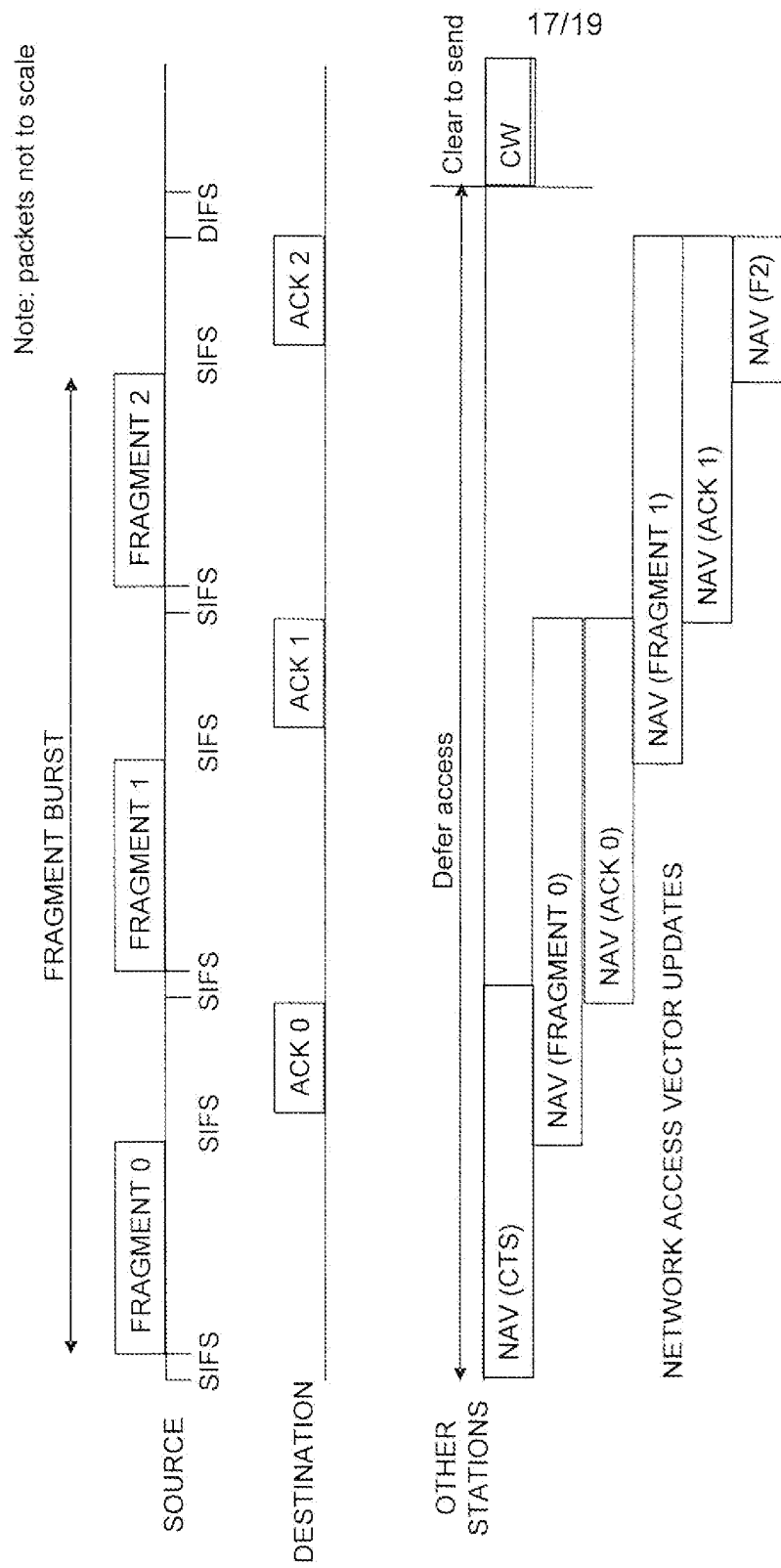


Fig. 14

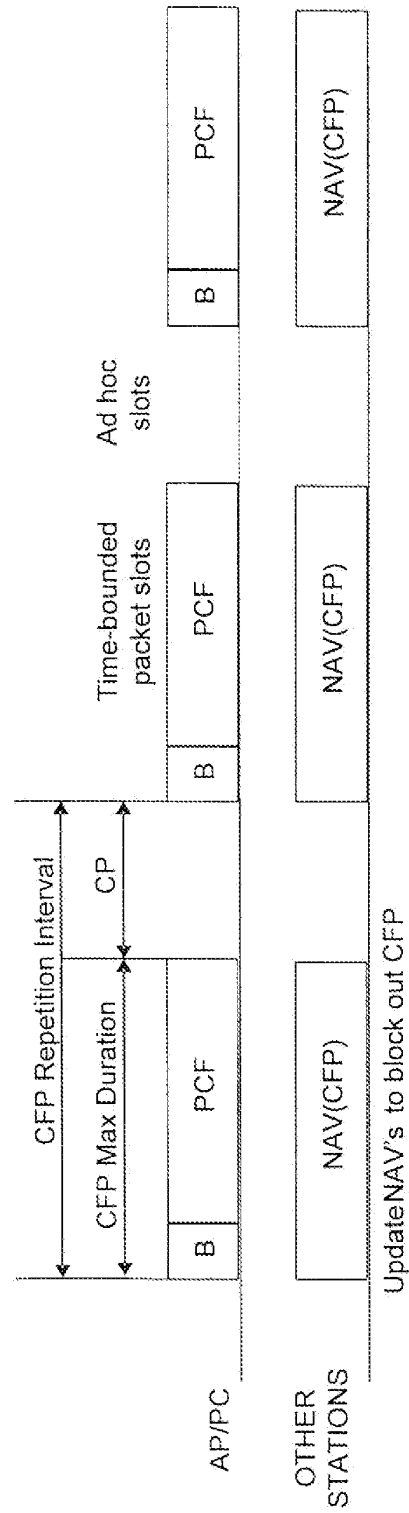


Fig. 15

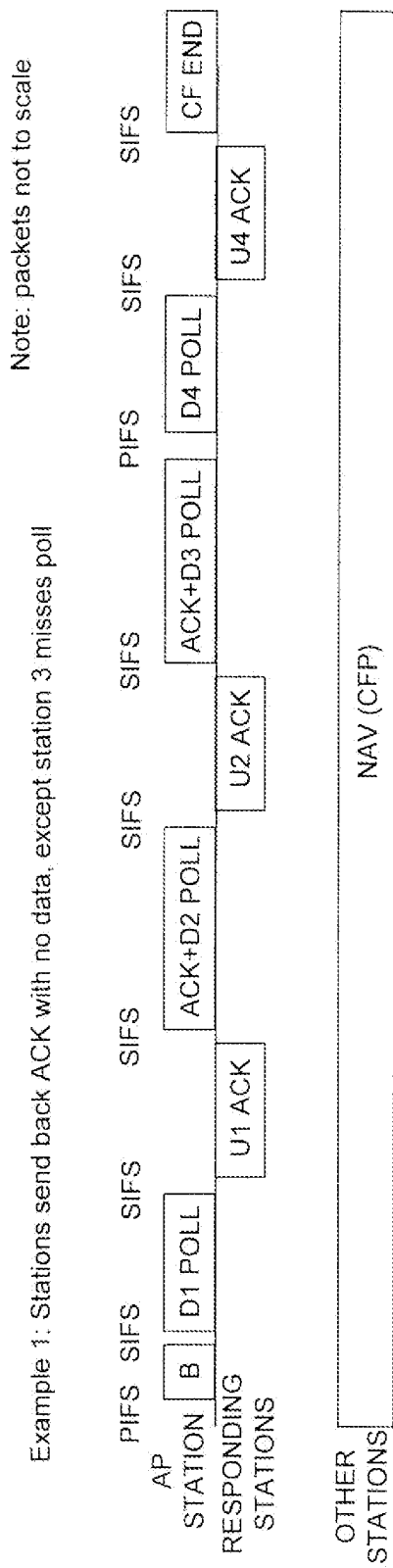
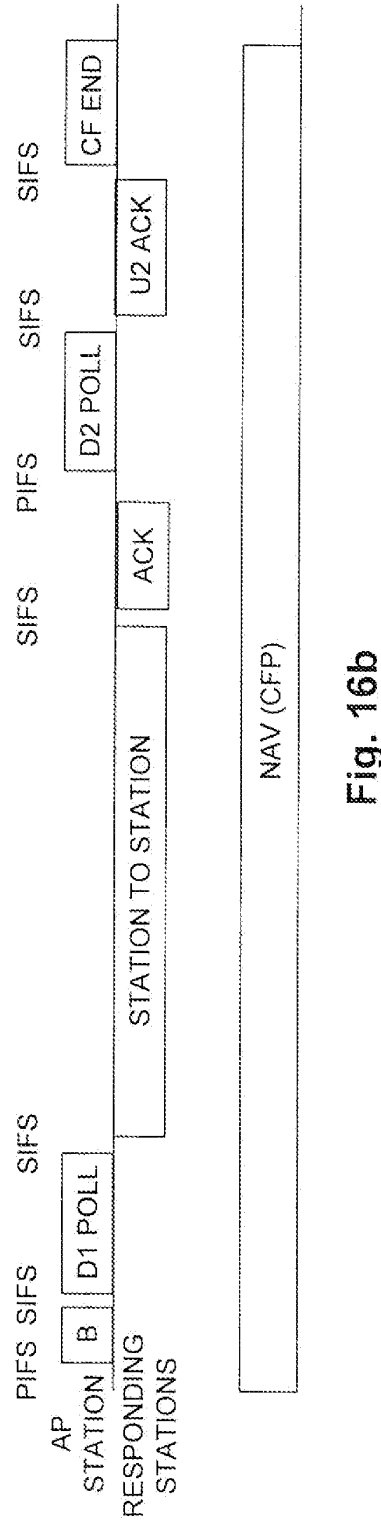


Fig. 16a

19/19

Example 2: Station 1 transmits data



Atty. Docket: 200020029

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below-named inventor, I hereby declare that:

- My residence, post-office addresses and citizenship are as stated below next to my name.
- I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought by the application for U.S. Letters Patent entitled: **BANDWIDTH-EFFICIENT WIRELESS NETWORK MODEM**, the specification of which is attached hereto and identified by Docket No. 20020029 of BAE SYSTEMS Information and Electronic Systems Integration Inc.
- I hereby state that I have reviewed and understand the contents of the above-identified application specification, including the claims.
- I acknowledge the duty to disclose information that is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, paragraph 1.56(a).
- I hereby claim foreign priority benefits under Title 35, United States Code 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:
- I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below: 60/427,495 filed 11/19/2002 and 60/284,629 filed 04/18/2001
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- I hereby declare that all statements made herein of my 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.
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- Please direct all telephone calls to Scott J. Asmus or Andrew P. Cernota at (603) 886-6100.
- Please address all correspondence to Maine and Asmus, PO Box 3445, Nashua, NH 03061-3445.

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P. O. Address:	Same as Residence

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	20020029DIV
		Application Number	
Title of Invention	BANDWIDTH-EFFICIENT WIRELESS NETWORK MODEM		
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.			

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☐ 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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Prefix	Given Name	Middle Name	Family Name	Suffix
	Karl	D.	BROMMER	
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service				
City	Exeter	State/Province	NH	Country of Residence US
Citizenship under 37 CFR 1.41(b)		US		
Mailing Address of Applicant:				
Address 1		165 High Street		
Address 2				
City	Exeter	State/Province	NH	
Postal Code	03833	Country	US	
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.				
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Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).	
☐ An Address is being provided for the correspondence information of this application.	
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Email Address	nancy.young@baesystems.com
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Application Information:

Title of the Invention	BANDWIDTH-EFFICIENT WIRELESS NETWORK MODEM		
Attorney Docket Number	20020029DIV	Small Entity Status Claimed ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	19	Suggested Figure for Publication (if any)	1

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	20020029DIV
		Application Number	
Title of Invention	BANDWIDTH-EFFICIENT WIRELESS NETWORK MODEM		

Publication Information:

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☐ 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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Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Division of	10/529019	2003-06-02
Prior Application Status	Abandoned	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	non provisional of	60/427495	2002-11-19
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	20020029DIV
		Application Number	
Title of Invention	BANDWIDTH-EFFICIENT WIRELESS NETWORK MODEM		

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Assignee 1

If the Assignee is an Organization check here. ☒

Organization Name BAE Systems Information and Electronic Systems Integration Inc.

Mailing Address Information:

Address 1	65 Spit Brook Road, NHQ1-719		
Address 2			
City	Nashua	State/Province	NH
Country	US	Postal Code	03060
Phone Number		Fax Number	
Email Address			
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Signature	/Daniel J. Long/		Date (YYYY-MM-DD)	2009-08-24
First Name	Daniel	Last Name	Long	Registration Number 29404

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BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

Inventor:
Karl D. Brommer

RELATED APPLICATIONS

[0001] This application is a divisional of U.S. National Phase of PCT Application No. PCT/US03/17377 filed June 2, 2003 and claims the benefit of U.S. Provisional Application No. 60/427,495, filed 11/19/02. In addition, PCT Application No. PCT/US03/17377 is related to PCT Application No. PCT/US03/17449, filed 6/2/03. Each of these applications is herein incorporated in its entirety by reference.

FIELD OF THE INVENTION

[0002] The invention relates to wireless networks, and more particularly, to a wireless digital signal demodulator and modulator for wireless networks where efficient use of allocated frequency bandwidth is desirable.

BACKGROUND OF THE INVENTION

[0003] Wireless networks are employed to facilitate the communication between computers and other electronic devices. Digitally modulated signals like binary phase shift keying (BPSK) or quadrature phase shift keying (QPSK) signals are transmitted between the various network nodes. Examples include satellite communications networks where terminals transmit through satellite transponders, terrestrial elements where terminals transmit through repeating towers and indoor local area networks where terminals transmit through central repeating elements or hubs. In each instance digital data is exchanged through wireless transmission with some control over the communications. The computer elements connected to these networks provide a variety of user services. Examples include telephone traffic with digital voice encoding, video conferencing, wide area computer network connectivity, and Internet service.

[0004] A variety of schemes exist for efficiently partitioning the network elements into communication channels. Frequency domain multiple access (FDMA) schemes assign each terminal to a separate, non-overlapping frequency band. Time domain multiple

access (TDMA) schemes assign each terminal to a separate non-overlapping time slot. Code division multiple access (CDMA) schemes assign each terminal to a separate modulating waveform so that the cross correlation between each terminal is negligible. Each of these schemes is inefficient in the sense that, given sufficient signal to noise strength or coding redundancy, more communicators could use the allocated bandwidth if a means for detecting the excess signal margin and means for demodulating signals in the presence of interference was provided.

[0005] For instance, FDMA refers to a communication channel wherein a signal's transmission power is concentrated into a single radio frequency band. Interference from adjacent channels is limited by the use of band pass filters. However, for each channel being assigned a different frequency, system capacity is limited by the available frequencies and by limitations imposed by channel reuse. In TDMA systems, a channel consists of a time slot or frame in a periodic train of time intervals over the same frequency, with a given signal's energy confined to one of these time slots. Adjacent channel interference is limited by the use of a time gate or other synchronization element that only passes signal energy received at the proper time. However, the system capacity is limited by the available time slots as well as by limitations imposed by channel reuse, as each channel is assigned a different time slot.

[0006] One of the goals of FDMA and TDMA systems is to try and prevent two potentially interfering signals from occupying the same frequency at the same time. In contrast, CDMA techniques allow signals to overlap in both time and frequency. CDMA signals share the same frequency spectrum and in the frequency or time domain, the CDMA signals appear to overlap one another. The use of CDMA greatly increases the capacity compared to non-overlapped TDMA/FDMA systems and permits superior voice transmissions with a high bit rate decoder. CDMA also provides for variable data rates allowing many different grades of voice quality to be offered. Finally, the scrambled signal format of CDMA eliminates cross talk and makes it more difficult to eavesdrop or monitor calls therefore providing greater security.

[0007] In a CDMA system, each signal is transmitted using spread spectrum techniques. The transmitted informational data stream is impressed upon a much higher rate data stream termed a signature sequence. The bit stream of the signature sequence data is

typically binary, and can be generated using a pseudo-noise process that appears random, but can be replicated by an authorized receiver. The informational data stream and the high bit rate signature sequence stream are combined by multiplying the two bit streams together, assuming the binary values of the two bit streams are represented by +1 or -1. This combination of the higher bit rate signature signal with the lower bit rate data stream is called spreading the informational data stream signal. Each informational data stream or channel is allocated a unique signature sequence.

[0008] In operation, a plurality of spread information signals, such as BPSK or QPSK signals, modulate a radio frequency (RF) carrier and are jointly received as a composite signal at the receiver. Each of the spread signals overlaps all of the other spread signals, as well as noise-related signals, in both frequency and time. The receiver correlates the composite signal with one of the unique signature sequences, and the corresponding information signal is isolated and despread.

[0009] A multiuser receiver would further improve signal density by permitting multiple communicators to share the same FDMA, TDMA, CDMA or other channel in cases where benign propagation conditions provide sufficient signal-to-noise margin. When margin exists, a functional multiuser receiver will successfully demodulate the desired transmitter in the presence of interfering transmitters sharing the same channel. There have been attempts at multiuser receivers, however these also have general deficiencies. One multiuser approach demodulates all user signals in an initial stage and forms an interference replica for each user. In subsequent processing all interference replicas except for the desired signal are subtracted from an input signal received to remove the interference. In the following stage, demodulation is made again about the desired signal by using a signal obtained by the initial stage. As a result, the user signal quality is improved as compared with the initial stage, and it is readily apparent that interference cancellation characteristic is gradually improved by repeating this process several times with a multistage structure. Another receiver employs a serial structure for canceling interference. When performing interference cancellation at each stage, the interference replica is transferred between stages and the interference replica is stored in memory. The deficiency here is that signals must have substantially different amplitudes for successive cancellation to be feasible. Since interfering amplitudes are arbitrary, this circumstance

rarely occurs. Moreover, successive interference cancellation tends to distort the residual signal, and at some point, the cancellation process renders the signal of interest unrecoverable.

[0010] What is needed, therefore, is a bandwidth efficient wireless network modem capable of exploiting the channel densities possible with multiuser receivers. In a more general sense, there is a need for a wireless digital signal demodulator/modulator for wireless networks where efficient use of allocated frequency bandwidth is desirable.

BRIEF SUMMARY OF THE INVENTION

[0011] One embodiment of the present invention provides a method for polling and scheduling in a multiuser network that includes a plurality of bandwidth efficient modems configured in accordance with the principles of the present invention, with at least one modem designated as a polling point coordinator access point (AP) element. The method includes indicating the beginning of a contention-free period, and simultaneously transmitting on a single channel a first set of polling signals. Each polling signal corresponds to a particular terminal included in a first set of terminals included in the network. The method proceeds with receiving two or more simultaneous responses from the first set of polled terminals, and recovering each of those two or more simultaneous responses using co-channel demodulation capabilities of the AP element. The method may further include transmitting clear-to-send messages to any terminals requesting to send data, as indicated by received responses. Note that when the receiving modems contain multiuser receivers (MUD enabled), the AP element schedules multiple interfering data transmissions in the same channel, exploiting the ability of the multiuser receivers to demodulate signals in the presence of interference from other transmitters sharing the channel.

[0012] In one such embodiment, the recovering is followed by simultaneously transmitting acknowledgement signals to the responding terminals. The recovering may also be followed by simultaneously transmitting a next set of polling signals to a next set of two or more terminals, and receiving two or more simultaneous responses from the next set of polled terminals. When requested, data transmission channels are scheduled in accordance with the ability of modems to demodulate transmissions in the presence of

interfering transmitters. Here, the method continues with recovering each of those two or more simultaneous responses using the co-channel demodulation capabilities of the AP element. These steps may be repeated, for example, until the end of the contention free period.

[0013] Another embodiment of the present invention provides a method for polling and scheduling in a multiuser network that includes a plurality of bandwidth efficient modems configured to carry out a distributed coordination function (DCF) for providing best-effort delivery of asynchronous packet data. The method includes two or more terminals simultaneously transmitting requests-to-send (RTS) messages on a single channel to a first set of destination modems, and simultaneously receiving clear-to-send (CTS) messages from the first set of destination modems at each of the requesting-to-send modems. Note that the destination terminals successfully demodulate the RTS messages by using multiuser receivers to remove the interfering signals in the channel. These destination terminals then simultaneously transmit clear to send (CTS) messages. The method proceeds with recovering each corresponding CTS message using co-channel demodulation capabilities of the corresponding requesting modem. The method continues with each requesting modem simultaneously transmitting its respective data on to the network, and each corresponding destination modem recovering the corresponding data using its co-channel demodulation capabilities. These steps may be repeated for one or more next sets of destination modems.

[0014] In one such embodiment, the method includes the preliminary steps of each modem detecting that one or more of the other modems included in the network are bandwidth efficient and therefore capable of an aggressive access protocol (which exploits co-channel demodulation capabilities), and switching from a legacy protocol mode to the bandwidth efficient aggressive access protocol mode for at least one pair of communicating modems included in the network. In another such embodiment, the method includes each modem adaptively learning modes of operation (e.g., legacy protocol mode and the bandwidth efficient aggressive access protocol mode) which each particular modem in the network is capable, and storing the learned modes operation.

[0015] Another embodiment of the present invention provides a modem which enables efficient use of bandwidth in a multiuser wireless network including a plurality of modems

in the presence of interference and noise. The modem includes a multiuser detection module that is adapted to simultaneously demodulate and recover K wirelessly transmitted signals using co-channel demodulation. A data formatting module is operatively coupled to the multiuser detection module, and is adapted to produce network data packets for at least one of the K recovered signals. A control processor is operatively coupled to the formatting module, and is adapted to detect with which protocol mode the at least one of the K recovered signals was transmitted, and to enable a corresponding transmission mode including one of a legacy protocol mode and a bandwidth efficient aggressive access protocol mode that exploits co-channel demodulation capabilities of the modem. A demultiplexer is operatively coupled to the data formatting module and the control processor, and is adapted to select one of the recovered K wirelessly transmitted signals as a target signal intended for a user associated with the modem. The selection is based on a control input from the control processor. The modem may further include a front end that is adapted to simultaneously receive the K wirelessly transmitted signals, and to provide those signals in a form that facilitates their subsequent processing by the multiuser detection module.

[0016] In one such embodiment, the data formatting module supports multiple types of format modes, and the control processor is configured to select a formatting mode in which the data formatting module operates. In response to the control processor knowing that a modem with which it is communicating does not support the bandwidth efficient aggressive access protocol mode, the control processor may further be adapted to enable a legacy protocol mode there by providing backwards compatibility.

[0017] Another embodiment of the present invention provides a method for polling and scheduling in a multiuser network that includes a plurality of bandwidth efficient modems, with at least one modem designated as a polling point coordinator access point (AP) element that operates as a global timer. The method includes receiving a beacon signal from the AP element that indicates frame start, the frame having an interval. The method further includes monitoring current broadcasting activity of other modems included in the network so as to identify an open slot available for data transmission in a channel, where two or more modems can transmit in the channel at the same time. In response to

identifying an open slot and being next in a transmission queue, the method proceeds with transmitting data in the open slot.

[0018] In one such embodiment, the transmission queue is based on a round robin scheme, where each modem included in the network is assigned a transmission priority. Alternatively, the transmission queue is based on priority information included in the beacon signal. The monitoring and transmission steps can be repeated until a global signal to end the frame is received from the AP element.

[0019] The features and advantages described herein are not all-inclusive and, in particular, many additional features and advantages will be apparent to one of ordinary skill in the art in view of the drawings, specification, and claims. Moreover, it should be noted that the language used in the specification has been principally selected for readability and instructional purposes, and not to limit the scope of the inventive subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Figure 1 illustrates a block diagram of a modem configured for demodulating/modulating co-channel signals in the radiofrequency band in accordance with one embodiment of the present invention.

[0021] Figure 2 illustrates a block diagram of a modem configured for demodulating/modulating co-channel signals in the optical/IR band in accordance with another embodiment of the present invention.

[0022] Figure 3 illustrates how an optical MUD device resolves interfering optical waveforms in the radiofrequency band in accordance with one embodiment of the present invention.

[0023] Figure 4a illustrates a timing diagram for polling and scheduling by a centralized network element employing co-channel demodulation using a bandwidth efficient network modem to increase network capacity and reliability in accordance with one embodiment of the present invention.

[0024] Figure 4b illustrates a timing diagram for polling and scheduling by a centralized network element employing co-channel demodulation to increase network capacity and

reliability while accommodating legacy network terminals unable to employ co-channel demodulation in accordance with one embodiment of the present invention.

[0025] Figure 5 illustrates a timing diagram for polling and scheduling by a centralized network element employing co-channel demodulation to increase network capacity and reliability thereby eliminating RTS/CTS scheduling overhead in accordance with one embodiment of the present invention.

[0026] Figure 6 illustrates a timing diagram for network communication using an asynchronous distributed coordination function when some network elements employ co-channel demodulation in accordance with one embodiment of the present invention.

[0027] Figure 7a illustrates a method for polling and scheduling in a communication network that includes multiple users and a plurality of bandwidth efficient modems in accordance with one embodiment of the present invention.

[0028] Figure 7b illustrates a method for polling and scheduling in a communication network that includes multiple users and a plurality of bandwidth efficient modems in accordance with another embodiment of the present invention.

[0029] Figure 7c illustrates a method for polling and scheduling in a communication network that includes multiple users and a plurality of bandwidth efficient modems in accordance with another embodiment of the present invention.

[0030] Figure 8 illustrates an example of a hidden terminal configuration.

[0031] Figure 9 illustrates a network having an 'ad hoc' organization with no central controlling element.

[0032] Figure 10 illustrates a network having centralized access point organization.

[0033] Figure 11 illustrates a frame format in accordance with the IEEE 802.11 protocol.

[0034] Figure 12 illustrates a basic channel access method, where access to the medium is controlled using interframe space intervals between the transmission of frames.

[0035] Figure 13 is a timing diagram that illustrates the RTS/CTS protocol.

[0036] Figure 14 is a timing diagram that illustrates fragment transmission for the transmission of large data blocks extending over multiple frame packets.

[0037] Figure 15 is a timing diagram that illustrates a point coordination function, where contention-free frame transfer is provided by a polling point coordinator access point element.

[0038] Figure 16 is a timing diagram that illustrates PCF polling, where a central access point can poll a network during a contention free period.

DETAILED DESCRIPTION OF THE INVENTION

[0039] Embodiments of the present invention provide a wireless digital signal demodulator/modulator for wireless networks where efficient use of allocated frequency bandwidth is desirable. In one particular embodiment, a bandwidth efficient wireless network modem is provided. The network may be, for example, a local area network (LAN), a wide area network (WAN), or any network enabling wireless modems to communicate with one another. The modem includes functions necessary to maintain interoperability with existing network devices. Before describing embodiments of the present invention, some background information on general wireless networks and configurations is provided in reference to Figures 8-16b.

General Wireless Network Requirements and Configurations

[0040] Requirements generally imposed on wireless networks include the allocation of a common frequency band for communication by the network elements. Current popular frequencies range from 900 MHz to 30 or more GHz. Means are generally provided to make the network resistant to interference from other radiofrequency sources intentionally or unintentionally transmitting at the same frequency. In some cases, the interference is due to other networks operating identical equipment on the same frequency. Spread spectrum techniques such as direct sequence modulation or frequency hopping may be employed to mitigate interference.

[0041] Another general requirement is that the network must provide means to handle situations where two network elements inadvertently transmit at the same time because they are unable to sense activity from every element in the network. This condition is referred to as the hidden terminal problem. An example of a hidden terminal configuration is shown in Figure 8. Here, three terminals are communicating as parts of a distributed wireless network. Due to the presence of an obstacle 810, terminals 805a and 805c cannot

communicate directly. Therefore if both terminals 805a and 805c attempt to transmit data to terminal 805b, they will be unable to detect the presence of each other's packets, leading to uncontrolled interference at terminal 805b. Such interference can be successfully handled by the present invention, a bandwidth efficient modem capable of simultaneously demodulating the two interfering signals.

[0042] Another general requirement is that network receivers must be able to operate in the presence of degrading propagation including multipath fading, atmospheric attenuation and dispersion. In some networks these conditions are intensified by transmission from moving vehicles. Common bit error requirements are 10^{-2} for voice packets, and 10^{-5} for data packets. Automatic repeat request (ARQ) protocols and error correction codes are often used to increase reliability. Current network throughput rates are in the 1 to 20 million bits per second range for total capacity in an indoor wireless LAN. Rates of outdoor point-to-point networks and projected satellite networks will be significantly higher. Optical networks may transmit billions of bits per second. As technology improves, higher network throughputs are anticipated.

[0043] Each of these requirements is often imposed in a system with power constraints on small network elements. Therefore, efficient implementation is often also imposed.

[0044] Some contemporary networks employ multiple protocols to ensure compatibility among diverse network elements while providing means for efficient communication. For example, the IEEE 802.11 network protocol specifies a Distributed Coordination Function (DCF) providing best-effort delivery of asynchronous packet data. This protocol ensures that any network device is able to communicate with any other network device through an asynchronous data transfer mode. In addition, it is recognized that more efficient data transmission may be desired by all or some network elements. To provide this function, this particular network protocol also specifies a Point Coordination Function (PCF). This protocol is based on polling controlled by a network access point. It is designed for transmitting delay-sensitive data. The IEEE 802.11 specification for network-compatible receivers leaves the PCF optional. Details of the polling implementation are also left to the manufacturer.

[0045] Many contemporary networks provide for 'ad hoc' organization with no central controlling element. An 'ad hoc' network is shown in Figure 9. Here, a set of terminals

905a-d (sometimes referred to as a basic service set or BSS) is shown with wireless communication links connecting each terminal to the other terminals in the network. Examples of network terminals include personal computers, personal digital assistants, printers, cellular telephones, server computers, and multifunction devices. Examples of network services include electronic mail services, other message services, music services, data file services, and voice services.

[0046] In principle, all terminals in a wireless 'ad hoc' network are able to communicate with all other terminals. This means that each terminal should be in the field of regard of all other terminals in the network. It also means that the network protocol must include means for terminals to asynchronously page and respond to all other terminals in the network. For example in the IEEE 802.11 networks, the Distribution Coordination Function provides for self-assembly and inter-element communication without polling by a central network element. While the details of this scheme show efficiency disadvantages when compared to centralized networks, the benefit is that any set of devices compliant with the protocol may be configured into a network with successful data transfer.

[0047] Another aspect of contemporary networks is the need for centralized access points. While many networks allow peer-to-peer communication, others require communication through a centralized access point. An example is shown in Figure 10. Here, a first set of terminals 1005a with wireless communication links is shown connecting each terminal to a first centralized access point 1010a. Likewise, a second set of terminals 1005b with wireless communication links is shown connecting each terminal to a second centralized access point 1010b. In addition, many terminals are able to communicate directly but it is not entirely necessary.

[0048] Each central access point 1010 polls each of its corresponding network elements 1005 to schedule communication slots for direct communication between any two network elements. Also, the central access points 1010 communicate with each other to forward data traffic from one BSS 1005 to another via the distribution network 1015. Such a configuration is sometimes referred to as an extended service set (ESS). In this example, network 1015 is further adapted with connectivity to wired or wireless elements outside the network 1015. This function is known as serving as a network portal. In this example, portal 1025 couples the network 1015 to a non 802.11 network 1020.

[0049] In terms of network topology, peer-to-peer connectivity is commonly referred to as a mesh architecture, while networks where elements communicate through centralized access points are often referred to as hub-and-spoke or star architectures. Wireless networks may be hub-and-spoke in the sense that central access points may perform network channel allocation. Even when centralized access points assign channels, communication is generally direct between network elements once channels have been assigned. However, indirect communication through the access point may also be provided by some protocols. Cellular telephone networks are based on star architectures with base terminals serving as central access points. In all networks, access to communications is an issue. In the case of mesh networks, propagation and interference may limit the ability to communicate outside the network. Equipment incompatibilities may also intentionally or unintentionally limit communication range.

[0050] In these cases, centralized access points provide means to communicate outside the network. These points extend network range by connecting to other networks otherwise inaccessible. In this sense they function as network bridges known as portals (e.g., portal 1025 of Figure 10) in some applications. They also provide specific services that may not be otherwise available to the network elements. Finally centralized access points provide means for implementing point coordination functions and other specialized protocols within a basic peer-to-peer network.

[0051] A variety of physical layer waveforms may be used to transmit the packets. In addition to modulations previously discussed, spread spectrum techniques may be used, including frequency hopping, direct sequence modulation or other techniques like orthogonal frequency domain multiplexing. Infrared or optical carriers may be used in addition to radiofrequency carriers. In each case, it is the objective to transmit packets of data by wireless communication.

[0052] In one contemporary wireless LAN, the direct sequence spread spectrum communication technique employed is to apply 11 chips per symbols to either 1 Mbps differential binary shift key (DBPSK) or 2 Mbps enhanced quadrature phase shift key QPSK. In both cases, 11 chips/symbol spreading provides an 11 MHz channel bandwidth. In addition, 11 subchannels are defined through 11 different spreading sequences. Also,

overlapping adjacent channels are separated by 30 MHz. Another variant of this LAN standard uses Orthogonal Frequency Division Multiplexing.

[0053] In the same LAN standard, the frequency hopping communication technique employed is a 79 channel hop set with 1 MHz spacing and 1 Mbps instantaneous bandwidth. The system uses 78 different hop sets, with a minimum hop rate of 2.5 hops/s. Two modulations are used for the individual hopped packets. Basic 1 Mbps is two-level Gaussian Frequency Shift Keyed (GFSK): with 1= f_c+f , 0= f_c-f . In words, a 'one' is denoted by transmission at frequency f_c+f and a 'zero' is denoted by transmission at frequency f_c-f , where f_c represents the carrier frequency and f is the FSK offset frequency. An enhanced 2 Mbps rate is provided through four-level GFSK.

[0054] In the same LAN standard, the infrared communication technique achieves a 1 Mbps data rate through quaternary pulse position modulation (PPM), where two data bits are sent as four coded bits on transmission. There is also a 2 Mbps enhanced rate achieved through 16-ary PPM, where four data bits are sent as sixteen coded bits on transmission. In this system, the carrier is on the 850-950 nm wavelength. The system is designed for indoor use with non-directed transmissions using line-of-sight or reflections.

[0055] The part of the wireless LAN protocol concerned with efficient channel scheduling is known as the Medium Access Control function. This function performs channel allocation procedures, protocol data unit (PDU) addressing, frame formatting, error checking and packet fragmenting and reassembly. To maintain universal network access while also providing for high throughput access, two distinct functions are implemented.

[0056] The primary access function is through a so-called "contention mode" where all terminals contend for access to the channel for each packet transmitted. During contention service, each terminal with a packet queued for transmission must contend for access to the channel and release the channel as soon as the packet is sent. In addition, a system may alternate between contention mode during contention period (CP) and a contention-free period (CFP). During the CFP, a central access point controls medium access, eliminating contention. However, not all network devices are capable of operating during the CFP, so a CP interval is also provided.

[0057] To provide for network control and data transfer, Medium Access Control (MAC) functions are supplied through three different types of packets, or frames. Management frames provide terminal association and dissociation with the central access point, timing and synchronization, and authentication and de-authentication. Control frames provide handshaking during the CP, positive acknowledgement during the CP, and indication of the end of the CFP. Finally, data frames provide data transmission during CP and CFP. An example packet format is shown in Figure 11.

[0058] This packet is taken from the IEEE 802.11 protocol, but it shows essential functions common to all network protocols. The packet begins with synchronization bits necessary for network receiver elements to acquire the asynchronously transmitted packet. These synch bits are not shown in the figure, but precede the packet shown. Next follows a control signaling sequence necessary for correct packet interpretation. Its fields include protocol type, power control, packet type, fragmentation information, and similar network housekeeping functions. Next are bits indicating the duration of the packet. Next are address fields for identifying the intended recipient. Next comes the actual data embedded in the packet. Last comes the error correction bits.

[0059] During contention service, means must be provided to resolve conflicts between terminals simultaneously contending for access. One scheme is to allow terminals to transmit while requiring them to detect collisions with other terminals. However, in many if not most systems, collision detection is not used because terminals usually cannot receive while they transmit. In this case, terminals must sense activity before beginning to transmit so as to lower the probability of collisions.

[0060] This method is known as Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). It forms the basis of the distributed coordination function (DCF). Carrier sensing is performed both at the physical and MAC layers. A channel is marked busy if either the physical or virtual carrier sensing mechanisms detect activity. However, this method cannot eliminate collisions due to the previously mentioned hidden terminal problem: it is impossible for all terminals to hear traffic from all other terminals, due to obstacles, propagation effects and siting errors.

[0061] To minimize contention, networks employing CSMA/CA use both physical and virtual carrier sensing. Physical carrier sensing is performed through detection of the

presence of other 802.11 wireless LAN users through packet analysis and through detection of received signal strength indications of other sources in the channel. Virtual carrier sensing is done through the MAC layer through several aspects of the protocol. One way is by using request-to-send (RTS) and clear-to-send (CTS) frames to verify channel access grants. Lack of CTS acknowledgement implies that another user is transmitting on the channel. Through propagation obstacles or through simultaneous transmission, physical detection of this carrier may not be possible. Another way is by including in the packet header a duration field telling other terminals in the network how to adjust their network timing data registers to indicate the time allocated for the current packet until the channel may again be sampled for idle status. This information is transmitted in the header of request-to-send (RTS) packets, clear-to-send (CTS) packets, and data packets.

[0062] The large size of data packets means that collisions waste much bandwidth. In addition to physical and virtual carrier detection, one additional means of reducing collision probability is to control access to the medium using interframe space intervals between the transmission of frames. The scheme is shown in Figure 12. Three distinct network elements are shown: the transmitting terminal or source, the receiving terminal or destination, and the other terminals or stations in the network. When a terminal senses an idle channel, it waits for a specified period DIFS (distributed inter-frame spacing) and samples again. If still idle, it transmits a packet.

[0063] The receiving terminal calculates a checksum. If the packet was received correctly, this receiving terminal waits another specified period SIFS (short inter-frame spacing) and transmits a positive acknowledgement frame (ACK). In the absence of obstructions, interference and other system propagation limitations, all other network terminals are intended to detect the transmitted data packet, demodulate it and use the duration field to adjust their network timing registers (NAV), including the ACK interval. Each terminal must wait for a space interval DIFS after sensing a quiet network in order to minimize collision probabilities.

[0064] In addition to guard intervals, a request-to-send/clear-to-send protocol is used to reduce collisions. For example, the source sends a 20-byte RTS packet and the destination responds with a 14-byte CTS packet. Other terminals update their network timing registers

based on this information. This scheme is shown in Figure 13. In comparison to Figure 12, this time the source or transmitting terminal sends the RTS packet after waiting appropriate intervals. The destination or receiving terminal answers with a CTS packet also after waiting appropriate intervals.

[0065] While this exchange consumes about 282 ms in a basic rate IEEE 802.11 protocol, it substantially reduces collision probability because the network timing data is encoded in both the RTS and CTS packets which are sent at different times by different devices. Therefore if one node is hidden from others in the network, at least there is a second node that may not be hidden. Collisions are more expensive during relatively long data packets compared to short RTS or CTS packets. After the RTS/CTS exchange, the transmitting terminal sends the data packet, followed by an ACK response from the receiving terminal if the transmission was successful.

[0066] The third line in the figure shows times during the exchange when other terminals in the network are able to update their network timing registers. As shown in figure 13, the RTS packet, the CTS packet, the data packet, and the ACK packet each present an independent opportunity for each element to obtain a timing update, thereby improving the reliability of the system.

[0067] This method is modified for the transmission of large data blocks extending over multiple frame packets. This scheme is shown in Figure 14. Terminals transmitting large data blocks must fragment the block into multiple packets, sending them consecutively with positive acknowledgement. If ACK is not received, the source releases the channel and recontends for access, beginning with the unacknowledged packet. The RTS/CTS protocol is only used for the first packet, as duration information is contained in each packet header. The third line in Figure 14 shows times during the exchange when other terminals in the network are able to update their network timing registers. The RTS packet, the CTS packet, each data packet (e.g., fragment 0, 1, 2), and each ACK packet each present an independent opportunity for each element to obtain a timing update, thereby improving the reliability of the system.

[0068] If packets still collide (despite the precautions previously discussed), terminals use a random back-off procedure where a small random amount is added to the usual guard wait time. If the channel is clear after this interval, access is re-attempted. If collision still

occurs, a new random back-off time is generated, then access is re-attempted yet again. A weakness of this method is the lack of a mechanism to guarantee minimum delay for time-bounded services.

[0069] One method of providing such a mechanism is through the optional contention-free frame transfer provided by a polling point coordinator access point (AP/PC) element, as shown in Figure 15. Terminals capable of being polled and operating in the contention-free period (CFP) are CF-aware terminals. The polling method is left to the implementer. This Point Coordination Function (PCF) must coexist with the distributed coordination function (DCF). An adjustable parameter known as the CFP repetition interval determines the PCF frequency. An adjustable parameter known as the CFP max duration determines length of the PCF. A Beacon frame signal B initiates the CFP. The frame allocations are shown in Figure 15. The network alternates between CFP and CP times. During CFP times, network elements block out their transmissions unless they are scheduled to transmit by the polling element. This is shown schematically on the "other stations" line of Figure 15.

[0070] Figure 16 shows two polling timing diagrams (16a and 16b), and is one example of how a central access point might poll a network during the contention free period. Figure 16a shows the polling sequences for the case where no terminals responding to the polling (stations 1, 2 and 4) transmit data and one terminal (station 3) is not responding to the poll. Figure 16a shows three time lines, one for the access point polling of the terminals, one for the terminals responding to polls, and one for all other terminals in the network.

[0071] The contention free period begins with a standard waiting guard time followed by transmission of the beacon packet (B) by the central access point terminal. All terminals receive this beacon and block out the contention free time in their network timing registers where asynchronous distributed coordination functions are not to be transmitted. After waiting the standard guard time SIFS to ensure no contention occurs, the access point broadcasts a polling packet (D1 POLL) to terminal 1. Terminal 1 receives and decodes this packet, waits the standard guard time SIFS, then broadcasts back an ACK packet (U1 ACK) indicating that it has no data to send.

[0072] The access point now broadcasts an ACK followed by a polling packet to terminal 2 (ACK + D2 POLL). The extra ACK packet is to increase the probability that other terminals in the network hear the transaction with terminal 1, due to the hidden terminal problem. Similar to terminal 1, terminal 2 has no data to send so it waits the guard time, then broadcasts an ACK packet (U2 ACK). The access point proceeds to transmit an ACK followed by a polling packet to terminal 3 (ACK + D3 POLL). Terminal 3 does not respond as it is powered down, cannot hear the broadcast, or has some other problem. In such a case, the access point waits a longer standard guard time PIFS (point inter-frame spacing), then proceeds to poll terminal 4 by transmitting a polling packet (D4 POLL). Terminal 4 responds with an ACK packet (U4 ACK). At this point the contention free period has nearly elapsed, so the access point broadcasts the CF END packet, indicating the end of the contention-free period.

[0073] Figure 16b shows a variation where terminal 1 transmits data in response to the poll. In this instance, the contention free period begins as in Figure 16a, with the central access point broadcasting the beacon packet (B) followed by the polling packet (D1 POLL) to terminal 1. This time, terminal one responds with a terminal-to-terminal data packet (STATION TO STATION). Other terminals will receive this broadcast from terminal 1. The intended recipient will decode its destination address in the packet header and then recover the data.

[0074] Terminal 1 then sends an ACK packet (ACK) indicating that it has completed transmission. The intended recipient must wait until it is polled at some later time before it can acknowledge receipt of data from terminal 1. The central access point then polls terminal 2 in the manner used for terminal 1 and all other terminals (D2 POLL). Terminal 2 responds with an ACK packet (U2 ACK) indicating that it has no data to transmit. At this point the contention free period has nearly elapsed, so the access point broadcasts the CF END packet, indicating the end of the contention-free period.

[0075] With this background information on wireless networks and configurations in mind, embodiments of the present invention will now be described in reference to Figures 1-7.

Bandwidth Efficient RF Modem

[0076] Figure 1 illustrates a block diagram of an RF modem configured for transmitting as well as simultaneously demodulating interfering digital signals on the same channel in the RF band in accordance with one embodiment of the present invention. The modem includes an analog front end 105, a parameter estimator module 110, a multiuser detection (MUD) module 115, a bank of decoders 117, a data formatting module 120, a control processor 125, a modulator 130, and a demultiplexer 135. The analog front end includes a number of antenna inputs, with each input associated with a tuner 105a and an analog-to-digital (A/D) converter 105b, and an amplifier 105c.

[0077] On the receiver side, wirelessly transmitted signals are received at the antenna diversity ports, processed through the analog front end 105, demodulated/recovered by modules 110, 115, and 117, and formatted by data formatting module 120. The resulting data signals 1-K are then provided to demultiplexer 135, which is adapted to select data signal m, the signal of interest (one of the data signals 1-K). This selected signal m is then provided to user m, for example, via a network or direct connections. The data formatting module 120 and the demultiplexer 135 operate pursuant to control input from the control processor 125.

[0078] On the transmitter side, the demultiplexer 135 receives transmission data m from the network/backbone or local host using a bidirectional line from user m. The data is modulated by module 130 in accordance with burst control provided by the control processor 125, amplified by amplifier 105c, and provided to the antenna output port for wireless transmission. In general, the control processor 125 controls the flow of data out of the modulator 130, thereby controlling when the modem transmits, and when the modem does not transmit for user m.

[0079] Note that each user 1-K has their own modem. Signals 1-K are received by one modem due to overpacking of the channel to exploit the bandwidth-efficient ability of the modem to receive and demodulate multiple interfering digital signals. The local control processor 125 deliberately causes interfering waveforms to be transmitted only when assigned to do so by a central access point, or only in cases where it has sensed the presence of exclusively bandwidth efficient modems transmitting and receiving at the same

time. Otherwise, a legacy transmission mode is supported also, thereby providing backwards compatibility if the intended receiving modem is not configured to operate in accordance with the principles of the present invention.

RF Receiver - MUD Enabled

[0080] The antenna inputs may be from multiple polarizations or multiple locations or both in order to enhance the ability of the co-channel receiver to demodulate many interfering signals simultaneously. Note that D is the number of diversity ports, while K is the number of estimated co-channel interfering signals. The antenna inputs feed corresponding front end tuners 105a, each of which downconverts higher frequency signals into baseband signals or other relatively lower frequency signals prior to processing. At baseband, A/D converters 105b digitize each received signal into sampled data streams. Filtering, amplification, and other conventional processing, may also be implemented in the analog front end 105.

[0081] The sampled data streams are provided as inputs to the parameter estimation module 110, which is a synchronization device for interfering digital signals. The parameter estimation module 110 estimates the relative received timing offsets, phases, received amplitudes, and multipath structure for each of the interfering signals present in the received signal. The result of such parameter estimation is a matrix (S) of estimated composite signature waveforms for each of the K users, which is used by the MUD module 115 to help separate the channel signals.

[0082] The MUD module 115 uses the S matrix of estimated composite signature waveforms in addition to inputs from all A/D converters 105b to recover the data bits from the interfering signals as is conventionally done. The MUD module 115 supplies the recovered data bits as inputs to the formatting module 120, which operates as a buffering device and produces network data packets for each of the K interfering transmissions. The packet format depends on factors such as the given application and protocols being used by the communicating modems.

[0083] Note that the MUD module 115 is operatively coupled to a bank of decoders (1- K) 117, with each decoder communicatively coupled to a corresponding output of the

MUD module 115. The bank of decoders receives a recovered symbol stream ($\hat{b}_1$ to $\hat{b}_K$) for each of the K users output by the MUD module 115, and provides error correction for each user by converting symbols to bits, comparing present bits to prior bits and/or subsequent bits, and then converting the bits back to symbols. Any number of various decoding algorithms can be employed here, such as Soft Viterbi or BCJR decoding. The result of such conventional error correction is a matrix ($b(n)$) of symbol estimates which are used by the MUD module 115 in the iterative process to provide better estimates of the particular symbols.

[0084] The iterative demodulation process carried out by modules 110, 115, and 117 for each user can be continued, for example, until a specified number of iterations is reached or until the difference between the compensated symbol estimates for the current and previous iterations are below a predefined threshold.

[0085] Each of the analog front end 105, parameter estimation module 110, MUD module 115, and bank of decoders 117 can be implemented in conventional technology. However, variations are also possible. For example, the parameter estimator 117 can be configured as described in U.S. Patent Application No. 10/228,787, titled, "Parameter Estimator for a Multiuser Detection Receiver." The MUD module 115 can be configured to operate as an MMSE MUD with prior information about the symbols as described in U.S. Application No. 10/105,918, titled "System for Decreasing Processing Time in an Iterative Multi-User Detector System." Each of these applications is herein incorporated by reference in its entirety.

[0086] The data formatting module 120 is implemented in conventional technology, but is further adapted to operate in conjunction with the control processor 125. In particular, control processor 125 may be configured to select the formatting mode in which the data formatting module 120 operates. The formatting mode will depend on the network or backbone (e.g., ATM, PSTN, ISDN, personal computer) to which the modem is feeding the received data streams. The data formatter module 120 can be configured to support multiple types of format modes. The control processor 125 is configured to detect whether the wirelessly received data for each user k has been transmitted in accordance with the principles of the present invention, and also to detect which of the received data signals 1-

K is the intended data signal m, based on packet header information provided by the data formatting module 120. The control processor 125 enables the corresponding transmission mode (e.g., legacy mode or bandwidth efficient mode in accordance with the present invention). The control processor 125 also executes the channel assignment arbitration sequences and data transmission timing sequences necessary to operate in accordance with the present invention.

[0087] The recovered data signals 1-K are output by the data formatting module 120, and provided to the demultiplexer 135, which selects the intended signal m based on input provided by the control processor 125. In one example embodiment, the control processor 125 receives packet header information for each of the received signals 1-K from the data formatting module 120. The packet header information of a data signal includes, among other information, the intended destination of that data signal. As such, the data signal intended for a particular modem can be identified, while the other received data signals can be ignored. Thus, the control processor 125 interrogates header information, and provides a control signal to the demultiplexer 135 that allows only the intended data signal m to be passed. In addition, the control processor 125 uses the packet headers of the interfering modems to determine which modems are sharing the channel. The source and destination addresses of the packet headers allow the control processor 125 to maintain logs of which modems are able to successfully transmit and receive data simultaneously. These logs facilitate adaptive scheduling techniques.

RF Transmitter

[0088] Data m is provided from the network/backbone or local host for user m to the demultiplexer 135, which buffers the outgoing data in preparation for providing it to the modulator 130, which operates under the control of the control processor 125. A number of access schemes (e.g., FDMA, TDMA, CDMA) and modulations (e.g., binary phase shift key, quadrature phase shift key, direct sequence spread spectrum, quadrature amplitude modulation, orthogonal frequency division multiplexing and pulse position modulation), can be implemented by the modulator 130. Transmission time is triggered by the burst control of control processor 125. The functionality of the control processor 125 will be discussed in reference to Figures 4-7. This control processor 125 can be implemented, for example, with a set of software instructions executing on a microprocessor, a digital signal

processor, or other suitable processing environment. Alternatively, the control processor 125 can be implemented in special purpose built silicon (e.g., ASIC or FPGA).

Bandwidth Efficient Optical Modem

[0089] Figure 2 illustrates a block diagram of an optical modem configured for transmitting as well as simultaneously demodulating interfering digital signals on the same channel in accordance with another embodiment of the present invention. The receiver includes an optical front end 205, an MUD module 215, a data formatting module 220, a control processor 225, a modulator 230, and a demultiplexer 235. The optical front end 205 includes a number of sensor inputs, with each input associated with a bandpass filter 205a and a pulse detector 205b.

[0090] On the receiver side, optically transmitted signals are received at the sensor diversity ports, processed through the optical front end 205, demodulated/recovered by module 215, and formatted by data formatting module 220. The resulting data signals 1-K are then provided to the demultiplexer 235, which is adapted to select data signal m, the signal of interest as previously explained. The other signals are discarded as unwanted interference except where signaling information is used to operate the network protocol as described above. For example, the duration field is used to know when a given interfering signal will end its transmission. The selected signal m is then provided to user m, for example, via a network or direct connections. The data formatting module 220 and the demultiplexer 235 operate pursuant to the control processor 125.

[0091] On the transmitter side, the demultiplexer 235 receives transmission data m from the network/backbone or local host using a bidirectional line from user m, modulated by module 230 in accordance with burst control provided by the control processor 225, amplified by amplifier 205c, and provided to the sensor output port for optical transmission. As with the embodiment of Figure 1, the control processor 225 controls the flow of data out of the modulator 230, thereby controlling when the modem transmits, and when the modem does not transmit for user m. A legacy transmission mode is supported also, thereby providing backwards compatibility if any of the remote modems with which this modem is communicating or sharing the time slot is not configured to operate in accordance with the principles of the present invention.

Optical Receiver - MUD Enabled

[0092] Sensor inputs may be from multiple polarizations or multiple locations or both in order to enhance the ability of the co-channel receiver to demodulate many interfering signals simultaneously. These sensor inputs feed front-end band-pass filters 205a that feed the filtered signals to corresponding pulse detectors 205b. These detectors 205b detect each received pulse, estimating its time of arrival and amplitude. Lasing, filtering, amplification, and other conventional optical processing, may also be implemented in the optical front end 205.

[0093] The pulse detection data streams are provided as inputs to the optical MUD module 215. The MUD module 215 uses pulse time of arrival and amplitude to resolve the interfering signals, and its principle of operation is further discussed in reference to Figure 3. The MUD module 215 supplies the recovered data bits as inputs to a formatting module 220, which operates as a buffering device and produces network data packets for each of the K interfering transmissions. The packet format depends on factors such as the given application and protocols being used by the communicating modems. Note that, due to the nature of optical transmission, no parameter estimation or decoder modules are required here.

[0094] The optical front end 205 and MUD module 215 can be implemented in conventional technology. The data formatting module 220 can also be implemented in conventional technology, but is further adapted to operate in conjunction with the control processor 225 as previously discussed in reference to Figure 1. Recall the data formatter module 220 can be configured to support multiple types of format modes. The control processor 225 is configured to detect whether the optically received data for each user k has been transmitted in accordance with the principles of the present invention, and also to detect which of the received data signals 1-K is the intended data signal m, based on packet header information provided by the data formatting module 220. The control processor 225 enables the corresponding transmission mode (e.g., legacy mode or bandwidth efficient mode in accordance with the present invention).

[0095] The recovered data signals 1-K are output by the data formatting module 220, and provided to the demultiplexer 235, which selects the intended signal m based on input provided by the control processor 225 as previously explained.

Optical Transmitter

[0096] Data m is provided from the network/backbone or local host for user m to the demultiplexer 235, which buffers the outgoing data in preparation for providing it to the modulator 230, which operates under the control of the control processor 225. A number of access schemes (e.g., FDMA, TDMA, CDMA) and modulations (e.g., pulse position modulation, on-off keyed, quadrature amplitude modulation) can be implemented by the modulator 230. Transmission time is triggered by the burst control of control processor 225. The functionality of the control processor 225 will be discussed in reference to Figures 4-7. As previously discussed, the control processor can be implemented in software, hardware, firmware, and any combination thereof. For example, control processor 225 can be implemented with a set of software instructions executing on a microprocessor, a digital signal processor, or other suitable processing environment. Alternatively, the control processor 225 can be implemented in special purpose built silicon (e.g., ASIC or FPGA).

Optical Mud Module

[0097] Figure 3 shows the principle of operation underlying an optical MUD module 210 of Figure 2 with an example of two interfering optical signals. The first line shows amplitude as a function of time for the first of two interfering radiated signals (signal 1). It can be seen that idealized square pulses are radiated at constant amplitude A_1 . In pulse position modulation (PPM), the position of each pulse determines the data transmitted. By measuring the time of arrival relative to the last pulse, it is possible to assign one or more bits to the symbol depending on the timing resolution of the corresponding pulse detector 205b.

[0098] For simplicity, the example shows a 4-state pulse detector 205b, where pulses can arrive at four different values relative to one another, corresponding to two bits per symbol. The horizontal axis is marked with symbol frame intervals (long lines) and sampling times (short lines). All time indices begin with zero. For example, the first pulse of signal 1 arrives during sampling time three in the frame, corresponding to a 'three' or a '11' in a simple symbol encoding. The next pulse arrives during sampling time one of the next frame, corresponding to a 'one' or a '01' in a simple symbol encoding. Note that while the data is encoded in the time of arrival, each pulse arrives with the same amplitude A_1 .

[00999] The second line shows amplitude as a function of time for the second of two interfering radiated signals (signal 2). Again, there are idealized square pulses radiated at some different constant amplitude A_2 . The pulses also arrive at a different symbol phase relative to the first set of pulses as indicated by the 'T'. The third line shows the situation when both signal 1 and signal 2 radiate a sensor port at the same time. Now four possible amplitudes are received: A_1 , A_2 , A_1+A_2 and 0.

[00100] Using an intensity level detector to implement each of the pulse detectors 205b, it is possible to generate not only the pulse time of arrival, but also its amplitude. By sorting through this data, the interfering pulse streams may be separated out. Using the differing symbol phases of signal 1 and signal 2 will further improve the demodulator's ability to separate the interfering signals. Polarization data could also be used. These pulse deinterleaving techniques are well-known in the art. In addition, diversity reception may be employed by having multiple input sensors to the MUD module 215 as shown in Figure 2. Note that perfectly square pulses are illustrated in Figure 3, and are an idealization for illustration purposes. The actual pulse shape will approximate the ideal sufficiently well for required performance, assuming sufficiently high SNR.

Bandwidth Efficient Protocol - AP Configuration

[00101] Figure 4a shows the timing diagram for polling and scheduling by a centralized network element configured for a network employing bandwidth efficient modems configured in accordance with an embodiment of the present invention. This functionality can be carried out, for example, by the control processor of a modem configured as shown in Figures 1 and 2 (modules 125 or 225), where that particular modem is designated as a polling point coordinator access point (AP/PC) element. Comparison can be made to Figures 16a-b, which show the timing diagram for polling and scheduling by a centralized network element using conventional modems.

[00102] In this particular example, terminals 1, 3, and 4 request-to-send and later transmit data, terminals 2 and 6 send back ACK with no data, and terminal 5 misses poll. In Figure 4a, it is assumed for simplicity that all modems have the ability to recover data signals in the presence of two interfering signals. In this case, the contention-free period begins as in Figure 16 with the beacon signal (B). This signal is immediately followed by transmission of simultaneous polling signals (D1 POLL, D2 POLL, D3 POLL) to three terminals. Since

the central network element (AP STATION) transmits the three signals simultaneously, the three signals are generated from a single functional element using an optimal phase relationship for signal recovery.

[00103] At the end of the guard interval, all three terminals (stations 1, 2, and 3) transmit back simultaneously (U1 RTS, U2 ACK, U3 RTS). Using the co-channel demodulation capabilities of the bandwidth efficient modem, the central network element (AP STATION) recovers all three interfering signals. In the example of Figure 4a, two of the three polled terminals have requested network access (stations 1 and 3, by virtue of their RTS responses).

[00104] At the end of the guard interval, the central element (AP STATION) transmits simultaneously ACK signals to the first three terminals, followed immediately by polling signals to the next set of three terminals (ACK1 + D4 POLL, ACK2 + D5 POLL, ACK3 + D6 POLL). At the end of the guard interval, two terminals (stations 4 and 6) transmit back simultaneously (U4 RTS, U6 ACK) while one terminal (station 5) fails to respond. One of the terminals requests network access (station 4, by virtue of its RTS response), making a total of three out of the first six terminals polled.

[00105] The central network element (AP STATION) then sends back clear-to-send messages (D1 CTS, D3 CTS, D4 CTS) to the three requesting terminals. At the end of the guard interval, all three terminals (stations 1, 3, and 4) simultaneously transmit messages to other terminals in the network. Polling and transmission continues in this manner until the end of the contention free period frame. At this point, the central network element (AP STATION) transmits a message (CF END) to signal the end of the period. It can be seen from the diagram, that network throughput has been tripled by the three-fold parallelism in comparison to the ordinary modem case of Figure 16.

Backwards Compatibility for Legacy Terminals

[00106] Figure 4b demonstrates how polling and scheduling by a centralized network element (AP STATION) are modified for the case where a network employs legacy terminals not having bandwidth efficient modems in accordance with the principles of the present invention. In this case, the contention-free period (CFP) is subdivided into bandwidth efficient MUD polling periods and legacy polling periods. In this particular

example, legacy terminal U4 uses a dedicated legacy polling slot, while other terminals (U1, U2, and U3) have bandwidth efficient modems that use the bandwidth efficient MUD polling periods.

[00107] During the bandwidth efficient periods, communication is as described in reference to Figure 4a, exploiting the parallelism possible with co-channel demodulation (MUD). During the legacy period, communication is as described in reference to Figures 16a-b – one terminal per channel at any given time. It will be apparent to one of ordinary skill in the art to generalize Figures 4a and 4b to cases where N terminals are able to communicate in parallel.

[00108] It is possible in some networks that different combinations of terminals are able to communicate successfully at the same time. Through long-term network operation, the central network element (AP STATION) can collect statistics on successful simultaneous packet transmissions. These statistics, which can be stored in a memory accessible by the control processor, can be used to optimally schedule combinations of two, three, or more terminals as propagation and SNR allow. In this respect, the network throughput increases over time through adaptive scheduling by the central network element (AP STATION). Numerous schemes which leverage historical data for learning and optimization purposes will be apparent in light of this disclosure

Reduced Overhead

[00109] Figure 5 shows a further refinement of the protocol demonstrated in Figure 4a when RTS/CTS overhead is eliminated. Recall that RTS/CTS signaling is used to increase robustness of networks associated with hidden terminals and other interference problems. In cases where bandwidth efficient modems successfully tolerate network interference, the RTS/CTS signaling overhead is an unnecessary cost.

[00110] Here, terminals (RESPONDING STATIONS) know their priority in the queue and broadcast in the next available time slot. In this particular example, three terminals can transmit in the channel at the same time. Each available terminal broadcasts its data in the channel pursuant to an assigned terminal priority. The terminal priority may be, for example, assigned based on a random number generation, or on a first come, first served or round robin scheme.

[00111] After the beacon frame (B), terminal 1 (U1) immediately begins broadcasting (U1 STA TO STA) in the channel. In addition, terminal 2 (U2) broadcasts an ACK (U2 ACK) to release the channel to the next priority terminal. Terminal 3 (U3) is the third terminal broadcasting in the channel. Note that terminal 3 sends a two-fragment message (U3 STA TO STA - F1 followed by U3 STA TO STA - F/END) since its data is too long for a single frame.

[00112] Terminal 4 begins broadcasting (U4 STA TO STA) in the channel as soon as terminal 2 releases the channel, as indicated by a guard interval (e.g., quiet period). After terminal 1 releases the channel, terminal 5 (U5) does not respond, thereby forfeiting use of the channel to terminal 6 (U6), which broadcasts its data (U6 STA TO STA) in the channel after waiting for a specified guard interval. After terminal 4 releases the channel, terminal 7 (U7) indicates that it does not need the channel (U7 ACK) and releases the channel. Terminal 1 then indicates that it does not need the channel (U1 ACK) and releases it as well. Terminal 2 is then allowed to broadcast its data (U2 STA TO STA) in the channel. Thus, at any given time, up to three terminals can be broadcasting in the channel at the same time. As one terminal releases the channel, the next priority terminal can access the channel or simply forfeit its turn to the next priority terminal.

[00113] Use of channel continues based on terminal priorities until the end of the frame. A further refinement would be, for example, eliminating the ACK requirement before channel release. It can be seen by comparison with Figure 4a that this method further increases throughput in two ways. First, the time needed for polls and acknowledgements is removed. In addition, the send time needed for RTS and CTS signals is removed. The improvement may be calculated in terms of the percentage of terminals polled and responding that no request was needed, and in terms of the ratio of time spent on RTS/CTS relative to the time spent actually transmitting data packets.

Bandwidth Efficient Protocol - Distributed Coordination Function Configuration

[00114] Figure 6 shows how bandwidth efficient terminals configured in accordance with the principles of the present invention also improve network access in cases where no centralized network element is employed – the distributed coordination function (DCF) case. In the example shown in Figure 6, two terminals (SOURCE 1 and SOURCE 2) simultaneously transmit requests to send (RTS) packets. This can happen inadvertently,

for example, due to the hidden terminal problem. Alternatively, it can happen deliberately because both terminals have detected that most terminals in the network are bandwidth efficient and are executing the protocol with more aggressive access than possible with non-bandwidth efficient modems, by exploiting the capability to recover data transmissions in the presence of interfering signals.

[00115] In either case, a conventional pair of terminals would be unable to recover the data, would detect the collision and be forced to resend after at least the length of time necessary for a random back-off protocol. It may also be necessary to wait the length of time required to wait for an ACK from the receiving terminals. When no such ACK is received, the terminals would know that the collision occurred and initiate the random back-off protocol. In either case, much time is lost due to the collision.

[00116] In contrast, with bandwidth efficient modems configured as described herein, both terminals are able to recover data simultaneously. No collision and no delays occur. Instead, both receiving terminals (DEST 1 and DEST 2) send back clear-to-send (CTS) packets. Upon receipt of these packets, both transmitting terminals transmit their packets (DATA 1 and DATA 2) simultaneously. The packets may be different lengths as shown in the example.

[00117] At the end of the transmission, the network is available for use by any terminals, exactly as is the case in Figure 12. For the simultaneous transmissions to successfully transpire according to the timing shown in Figure 6, both transmitting terminals and both receiving terminals must contain bandwidth efficient modems configured as described herein. However, it is not necessary for other terminals in the network to be bandwidth efficient.

[00118] Mechanisms exist within legacy terminals for detecting activity at given times on the network through means such as received signal strength indication. Thus, bandwidth efficient modems configured in accordance with embodiments of the present invention can be added to networks with legacy terminals without disrupting operation. Over time, bandwidth efficient modems operating in a network will learn which terminals are able to receive data in the presence of interfering packets. This learning can be accomplished by, for example, maintaining statistics on success rates on attempted co-channel transmissions. After an adaptive learning period, bandwidth efficient terminals will only transmit in co-

channel mode to other terminals that are known to be configured as efficient bandwidth modems and therefore able to recover the co-channel data.

[00119] One method for implementing this learning period would be to program bandwidth efficient modems in accordance with the principles of the present invention to refrain from simultaneous broadcasting during certain time sub-intervals to ensure that legacy terminals can transmit during some time slots. Over time, the bandwidth-efficient modems can use co-channel reception statistics to determine which other modems can receive interference. This information is computed by demodulating packet addresses and maintaining counts of the percentage of successful transmissions to that recipient in the presence of interference.

Methodology

[00120] Figure 7a illustrates a method for polling and scheduling in a communication network that includes multiple users and three or more bandwidth efficient modems in accordance with one embodiment of the present invention. This method can be carried out, for example, by a modem configured as discussed in reference to Figures 1 and 2, where that particular modem is designated as a polling point coordinator access point (AP) element.

[00121] The method begins with indicating 701 the beginning of a contention-free period. In one embodiment, this indication is provided by transmitting a beacon signal (B). The method proceeds with simultaneously transmitting 703 a first set (two or more) of polling signals, where each polling signal corresponds to a particular terminal included in a first set of terminals included in the network. In one embodiment, the polling signals are generated by the AP element using an optimal phase relationship to facilitate signal recovery.

[00122] After transmission of the polling signals is completed (e.g., as detected by the end of a guard interval), the method proceeds with receiving 705 two or more simultaneous responses from the first set of polled terminals, and recovering 707 each of those two or more simultaneous responses using co-channel demodulation capabilities of the AP element. The responses may include, for example, ACK and/or RTS as previously explained. At the end of a guard interval indicating the receipt of the two or more

simultaneous responses, the method may further proceed with simultaneously transmitting 709 acknowledgement signals to the responding terminals, followed by simultaneously transmitting 711 a next set of polling signals to a next set of two or more terminals. Note that transmitting steps 709 and 711 can be effectively combined into a single step (e.g., ACK 1 + D4 POLL).

[00123] The method proceeds (e.g., at the end of a guard interval) with receiving 713 two or more simultaneous responses from the next set of polled terminals, and recovering 715 each of those two or more simultaneous responses using co-channel demodulation capabilities of the AP element. The method proceeds with transmitting 717 clear-to-send messages to any terminals requesting to send data, as indicated by received responses. Those terminals may then (e.g., at the end of a guard interval) simultaneously transmit messages to other terminals in the network.

[00124] Polling and transmission may continue in this manner until the end of the contention free period frame. In one such embodiment, the method further includes monitoring (with the AP element) the channel, and transmitting CTS messages to queued terminals when currently transmitting terminals complete data transmission. In response to no terminals being queued, the method goes back to step 703, where the AP element polls more elements in the network. Note that the same channel may be used, or a different channel. Further note that the transmitting 717 of the CTS messages may occur directly after the receiving 705 and recovering 707 steps, thereby eliminating steps 709 to 715 (i.e., only one set of polling signals is transmitted, and one set of corresponding responses is received). Alternatively, there may be any number of subsequent 709-715 steps prior to step 717. After the terminal transmission period (e.g., as indicated by a guard interval), the method may further include transmitting 719 a message to signal the end of the contention free period.

[00125] The indicating and transmitting steps (701, 703, 709, 711, 717, and 719) can be carried out, for example, by the control processor (125 and 225), while the receiving and recovering steps (705, 707, 713, and 715) can be carried out by the MUD module (115 and 215). Variations on this example embodiment, as well as the supporting roles of the front end (105 and 205), modulator (130 and 230), and other componentry (e.g., 110, 117) will be apparent in light of this disclosure.

[00126] Figure 7b illustrates a method for polling and scheduling in a communication network that includes multiple users and a plurality of bandwidth efficient modems in accordance with another embodiment of the present invention. This method can be carried out, for example, in a network having four or more modems each configured with a control processor as discussed in reference to Figures 1 and 2 (modules 125 or 225), where there is no centralized network element, referred to herein as the distributed coordination function (DCF) case.

[00127] The method begins with two or more terminals simultaneously transmitting 737 requests-to-send (RTS) messages to a first set of destination modems. This can happen inadvertently due to propagation and collisions or intentionally as previously explained. In either case, the method may further include preliminary steps, with each modem detecting 733 that one or more of the other modems included in the network are bandwidth efficient and therefore capable of an aggressive access protocol, and switching 735 from a legacy protocol mode to a bandwidth efficient aggressive access protocol mode for at least one pair of communicating modems included in the network.

[00128] These preliminary steps may be eliminated, for example, as part of an adaptive scheme where modems of the network learn the modes of operation (e.g., legacy and bandwidth efficient aggressive access protocol in accordance with the present invention) which each particular modem in the network is capable. Thus, while a legacy mode could be the default mode, an automatic switch to a bandwidth efficient aggressive access protocol mode could be made once all of receiving and transmitting modems communicating in an established link are identified and known to support that mode.

[00129] The method proceeds with simultaneously receiving 739 clear-to-send (CTS) messages from the first set of destination modems at each of the requesting-to-send modems of step 737, and recovering 741 each corresponding CTS message using co-channel demodulation capabilities of the corresponding requesting modem. The method then proceeds with each requesting modem simultaneously transmitting 743 its respective data on to the network, and each corresponding destination modem receiving and recovering 745 the corresponding data using its co-channel demodulation capabilities (e.g., an optical or linear MMSE MUD algorithm). The method of Figure 7b may be repeated as necessary when data becomes available for transmission.

[00130] The detecting, switching, and transmitting steps (733, 735, 737, and 743) can be carried out, for example, by the control processor (125 and 225), while the receiving and recovering steps (739, 741, and 745) can be carried out by the MUD module (115 and 215). Variations on this example embodiment, as well as the supporting roles of the front end (105 and 205), modulator (130 and 230), and other componentry (e.g., 110, 117) will be apparent in light of this disclosure.

[00131] Figure 7c illustrates a method for polling and scheduling in a communication network that includes multiple users and three or more bandwidth efficient modems in accordance with another embodiment of the present invention. This method on the left side of the figure can be carried out, for example, by a modem configured as discussed in reference to Figures 1 and 2, where that particular modem is designated as a polling point coordinator access point (AP) element. The method on the right side of the figure can also be carried out by the other terminals in the network, which can also be configured as discussed in reference to Figures 1 and 2. This particular embodiment eliminates the need for RTS/CTS signaling overhead.

[00132] The ability to handle co-channel interference without losing long time intervals due to collision resets allows for much simpler and more efficient communication schemes (as discussed in reference to Figure 5). In this example, the AP terminal acts like a global timer. It broadcasts 751 a beacon signal to indicate frame start. Then it counts 753 the frame interval before sending 770 a global signal to end the frame. Frames are desirable here, as they provide a means to maintain global network timing, and further provide for reset from race conditions.

[00133] In this example, each terminal communicatively coupled with the AP terminal accesses time slots in round robin fashion. Terminals maintain records of their place in the queue based on the round robin scheme. Alternatively, access priority information could be broadcast by the AP terminal as part of the beacon packet. Each terminal waits 757 for the beacon signal to indicate frame start. Since each terminal is able to recover data from all other terminals broadcasting simultaneously, each terminal monitors 759 which terminals are currently broadcasting. When a slot opens up 761, each terminal knows whether or not it is first in the queue 763 (e.g., based on the round robin scheme, where each modem included in the network is assigned a transmission priority). The terminal

that is first in the queue broadcasts 765 in the empty slot. Round robin access continues until the end of the frame.

[00134] Thus, both AP and DCF configurations can employ the principles of the present invention. In either case, the method may further include supporting legacy modem communication when a bandwidth efficient aggressive access protocol mode in accordance with the present invention is not enabled for one or both of a pair of communicating modems. In addition, the method may further include adaptively learning which modems included in the network support the bandwidth efficient aggressive access protocol mode, and storing the learned information for access by modems of the network. The storage (e.g., RAM or flash memory) may be local to each modem, or a central storage located on the network.

[00135] The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of this disclosure. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.

CLAIMS

What is claimed is:

- 1 1. A modem which enables efficient use of bandwidth in a multiuser
2 wireless network including a plurality of modems in the presence of
3 interference and noise, the modem comprising:
4 a multiuser detection module adapted to simultaneously demodulate and recover K
5 wirelessly transmitted signals using co-channel demodulation;
6 a data formatting module operatively coupled to the multiuser detection module,
7 and adapted to produce network data packets for at least one of the K
8 recovered signals;
9 a control processor operatively coupled to the formatting module, and adapted to
10 detect with which protocol mode the at least one of the K recovered signals
11 was transmitted, and to enable a corresponding transmission mode
12 including one of a legacy protocol mode and a bandwidth efficient
13 aggressive access protocol mode that exploits co-channel demodulation
14 capabilities of the modem; and
15 a demultiplexer operatively coupled to the data formatting module and the control
16 processor, and adapted to select one of the recovered K wirelessly
17 transmitted signals as a target signal intended for a user associated with the
18 modem, where the selection is based on a control input from the control
19 processor.

1 2. The modem of claim 1 further comprising:
2 a front end adapted to simultaneously receive the K wirelessly transmitted signals,
3 and to provide those signals in a form that facilitates their subsequent
4 processing by the multiuser detection module.

1 3. The modem of claim 1 wherein the data formatting module supports
2 multiple types of format modes, and the control processor is configured to select a
3 formatting mode in which the data formatting module operates.

1 4. The modem of claim 1 wherein in response to the control processor
2 knowing that a modem with which it is communicating does not support the bandwidth
3 efficient aggressive access protocol mode, the control processor is further adapted to
4 enable a legacy protocol mode there by providing backwards compatibility.

1 5. A method for polling and scheduling in a multiuser network that includes
2 three or more bandwidth efficient modems, with at least one modem designated as a
3 polling point coordinator access point (AP) element that operates as a global timer, the
4 method comprising:

5 receiving a beacon signal from the AP element that indicates frame start, the frame
6 having an interval;

7 monitoring current broadcasting activity of other modems included in the network
8 so as to identify an open slot available for data transmission in a channel,
9 where two or more modems can transmit in the channel at the same time;
10 and

11 in response to identifying an open slot and being next in a transmission queue,
12 transmitting data in the open slot.

1 6. The modem of claim 5 wherein the transmission queue is based on a round
2 robin scheme, where each modem included in the network is assigned a transmission
3 priority.

1 7. The modem of claim 5 wherein the transmission queue is based on priority
2 information included in the beacon signal.

1 8. The modem of claim 5 wherein the monitoring and transmission steps are
2 repeated until a global signal to end the frame is received from the AP element.

BANDWIDTH EFFICIENT WIRELESS NETWORK MODEM

ABSTRACT OF THE DISCLOSURE

A modem that provides efficient use of wireless network bandwidth in the presence of multiuser interference and noise is disclosed. The modem design provides for compatibility with existing network hardware and protocols so that new efficient modems may be added to the network without removing installed hardware and software.

