

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
filed in the U.S. District Court Northern District of Texas on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 3:16-cv-00477-B	DATE FILED 2/19/2016	U.S. DISTRICT COURT Northern District of Texas
PLAINTIFF CommScope Technologies LLC		DEFENDANT Dali Wireless Inc
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,326,218	12/4/2012	CommScope Technologies LLC
2 7,639,982	12/29/2009	CommScope Technologies LLC
3 8,577,286	11/5/2013	CommScope Technologies LLC
4 7,848,747	12/7/2010	CommScope Technologies LLC
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input checked="" type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,332,402	5/3/2016	CommScope Technologies LLC,
2 9,031,521	5/12/2015	Dali
3 9,531,473	12/27/2016	Dali
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK Karen Mitchell	(BY) DEPUTY CLERK s/Yolanda Pace	DATE 9/13/2017
-------------------------	-------------------------------------	-------------------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

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PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK Karen Mitchell	(BY) DEPUTY CLERK S/Thomas Drew	DATE 2/19/2016
-------------------------	------------------------------------	-------------------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/662,948	11/05/2013	8577286	100.019US04	9673

34206 7590 10/16/2013
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

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):

Philip M. Wala, Savage, MN;
ADC TELECOMMUNICATIONS, INC., Shakopee, MN

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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.

34206 7590 07/03/2013
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/662,948	10/29/2012	Philip M. Wala	100.019US04	9673

TITLE OF INVENTION: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1780	\$300	\$0	\$2080	10/03/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, DUC M	2648	455-517000

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 Fogg & Powers LLC

2 _____

3 _____

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

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

(A) NAME OF ASSIGNEE

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

ADC Telecommunications, Inc.

Shakopee, MN

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-2008 is attached.~~
- ☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 502432 (enclose an extra copy of this form).

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

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

☐ Applicant asserting small entity status. See 37 CFR 1.27

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

☐ Applicant changing to regular undiscounted fee status.

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

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

Authorized Signature /Wade A. Whisenant/

Date October 2, 2013

Typed or printed name Wade A. Whisenant

Registration No. 59,593

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

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

Electronic Patent Application Fee Transmittal

Application Number:	13662948			
Filing Date:	29-Oct-2012			
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT			
First Named Inventor/Applicant Name:	Philip M. Wala			
Filer:	Wade A. Whisenant/Emily Reller			
Attorney Docket Number:	100.019US04			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	1780	1780
Publ. Fee- Early, Voluntary, or Normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2080

Electronic Acknowledgement Receipt

EFS ID:	17025311
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Wade A. Whisenant/Emily Reller
Filer Authorized By:	Wade A. Whisenant
Attorney Docket Number:	100.019US04
Receipt Date:	03-OCT-2013
Filing Date:	29-OCT-2012
Time Stamp:	13:28:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$2080
RAM confirmation Number	12743
Deposit Account	502432
Authorized User	WHISENANT, WADE A.

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (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)	00376735.PDF	115260	no	2
			2ca72159e00537c64b4b4a0fa028fa801ce76e13		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	32138	no	2
			29b43309db2be18c58525b5ae63851a959557038		

Warnings:

Information:

Total Files Size (in bytes):			147398
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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.

Applicant(s)	Wala	RESPONSE TO NOTICE REQUIRING INVENTOR'S OATH OR DECLARATION
Serial No.	13/662,948	
Filing Date	10/29/2012	
Group Art Unit	Unknown	
Examiner Name	Unknown	
Confirmation No.	9673	
Attorney Docket No.	100.019US04	
Title: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		

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

Applicant has reviewed the Informational Notice to Applicant mailed on February 4, 2013 and the Notice Requiring Inventor's Oath or Declaration mailed on August 8, 2013. Filed herewith is the executed declaration for the inventor Philip M. Wala.

Applicant believes that no fees are due with this submission. If necessary, please charge any additional fees or credit any overpayments to Deposit Account No. 502432.

If the Examiner has any questions or concerns regarding this application, please contact the undersigned at 952-465-0770.

Respectfully submitted,

Date: August 9, 2013

/Wade A. Whisenant/
Wade Whisenant
Reg. No. 59593

Attorneys for Applicant
Fogg & Powers LLC
5810 W. 78th St. Ste 100
Minneapolis, MN 55439
T – (952) 465-0770
F – (952) 465-0771

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.

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**Title of
Invention

POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

As the below named inventor, I hereby declare that:

This declaration
is directed to:☐
☒

The attached application, or

United States application or PCT International application number 13/662,948filed on 10/29/2012.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTORInventor: Philip M. WalaDate: 7/3/2013Signature: 

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

Electronic Acknowledgement Receipt

EFS ID:	16547021
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Wade A. Whisenant/Emily Reller
Filer Authorized By:	Wade A. Whisenant
Attorney Docket Number:	100.019US04
Receipt Date:	09-AUG-2013
Filing Date:	29-OCT-2012
Time Stamp:	12:47:52
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	00382620.PDF	66376 74ef09f144f902c17d9b8a4674ac04c67dfb1c2	no	1

Warnings:

Information:

SOLiD Ex. 1017

Page 12

2	Oath or Declaration filed	00376738.PDF	53194 f3c884195d5b238f7a33c97486e72b0168fa5b9c	no	1
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
Total Files Size (in bytes):				119570	
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>					



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.
13/662,948	10/29/2012	Philip M. Wala	100.019US04	9673
7590 FOGG & POWERS LLC 5810 W 78TH STREET SUITE 100 MINNEAPOLIS, MN 55439			EXAMINER NGUYEN, DUC M	
			ART UNIT	PAPER NUMBER
			2648	
			NOTIFICATION DATE	DELIVERY MODE
			08/08/2013	ELECTRONIC

NOTICE REQUIRING INVENTOR'S OATH OR DECLARATION

An inventor's oath or declaration in compliance with 37 CFR 1.63 or 1.64 executed by or with respect to each inventor has not yet been submitted.

An oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each inventor **MUST** be filed **no later than the date on which the issue fee is paid**. See 35 U.S.C. 115(f). Failure to timely comply will result in ABANDONMENT of this application. This period for reply is not extendable under 37 CFR 1.136(a).

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

(571)-272-4200 or 1(888)-786-0101

Patent Publication Branch

Office of Data Management



UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

34206 7590 07/03/2013
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

EXAMINER

NGUYEN, DUC M

ART UNIT

PAPER NUMBER

2648

DATE MAILED: 07/03/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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13/662,948

10/29/2012

Philip M. Wala

100.019US04

9673

TITLE OF INVENTION: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1780	\$300	\$0	\$2080	10/03/2013

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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.

34206 7590 07/03/2013
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/662,948	10/29/2012	Philip M. Wala	100.019US04	9673

TITLE OF INVENTION: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1780	\$300	\$0	\$2080	10/03/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, DUC M	2648	455-517000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). <input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. <input type="checkbox"/> "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. <div> 1 _____ 2 _____ 3 _____ </div>
---	---

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

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

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

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

4a. The following fee(s) are submitted: <input type="checkbox"/> Issue Fee <input type="checkbox"/> Publication Fee (No small entity discount permitted) <input type="checkbox"/> Advance Order - # of Copies _____	4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above) <input type="checkbox"/> A check is enclosed. <input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached. <input type="checkbox"/> The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).
---	--

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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

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

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

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

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

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



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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.
13/662,948	10/29/2012	Philip M. Wala	100.019US04	9673

34206 7590 07/03/2013
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

EXAMINER

NGUYEN, DUC M

ART UNIT PAPER NUMBER

2648

DATE MAILED: 07/03/2013

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 13/662,948	Applicant(s) WALA ET AL.	
	Examiner DUC M. NGUYEN	Art Unit 2648	AIA (First Inventor to File) Status No

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

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

1. ☒ This communication is responsive to 6/20/13.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-40. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
* Certified copies not received: _____.


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

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. <input type="checkbox"/> Notice of References Cited (PTO-892) 2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>6/20/13</u> 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material 4. <input type="checkbox"/> Interview Summary (PTO-413), Paper No./Mail Date _____.	5. <input type="checkbox"/> Examiner's Amendment/Comment 6. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance 7. <input type="checkbox"/> Other _____.
---	---

/DUC M NGUYEN/ Primary Examiner, Art Unit 2648	6/27/13
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Search Notes 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.
	Examiner DUC M NGUYEN	Art Unit 2648

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	7,14, 16, 20 , 22, 560, 561	4/4/13	DN
370	906, 907, 501, 535-537	4/4/13	DN
Updated	same as aboves	6/27/13	DN

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search history	4/4/13	DN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
455	14, 16, 20, 561	6/27/13	DN
370	907	6/27/13	DN

	/DUC M NGUYEN/ Primary Examiner.Art Unit 2648
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EAST Search History


EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	25	09/619431	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/06/27 15:20
L2	9966	455/14 455/16 455/20 455/561 370/907	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/06/27 15:48

EAST Search History (Interference)


Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	9968	455/14 455/16 455/20 455/561 370/907	US-PGPUB; USPAT; UPAD	OR	ON	2013/06/27 15:48
L4	36	3 and (digital\$3 near2 (summer adder sum\$4 add\$4)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/06/27 15:49

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<i>Index of Claims</i> 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.
	Examiner DUC M NGUYEN	Art Unit 2648


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

<input checked="" type="checkbox"/> Claims renumbered in the same order as presented by applicant				<input type="checkbox"/> CPA				<input checked="" type="checkbox"/> T.D.				<input type="checkbox"/> R.1.47			
CLAIM		DATE													
Final	Original	04/19/2013	06/27/2013												
	1	✓	=												
	2	✓	=												
	3	✓	=												
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	35	✓	=												
	36	✓	=												



<p align="center"><i>Index of Claims</i></p> 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.
	Examiner DUC M NGUYEN	Art Unit 2648

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


<input checked="" type="checkbox"/> Claims renumbered in the same order as presented by applicant				<input type="checkbox"/> CPA				<input checked="" type="checkbox"/> T.D.				<input type="checkbox"/> R.1.47			
CLAIM		DATE													
Final	Original	04/19/2013	06/27/2013												
	37	✓	=												
	38	✓	=												
	39	✓	=												
	40	✓	=												

Issue Classification 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.	
	Examiner DUC M NGUYEN	Art Unit 2648	

CPC						
Symbol					Type	Version
H04B		7	/	2606	F	20130101
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CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
				
				

NONE		Total Claims Allowed:	
		40	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/DUC M NGUYEN/ Primary Examiner.Art Unit 2648	6/27/13	1	4
(Primary Examiner)	(Date)		

Issue Classification 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.
	Examiner DUC M NGUYEN	Art Unit 2648

<input checked="" type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input checked="" type="checkbox"/> T.D. <input type="checkbox"/> R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17		33										
	2		18		34										
	3		19		35										
	4		20		36										
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	12		28												
	13		29												
	14		30												
	15		31												
	16		32												

NONE		Total Claims Allowed: 40	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/DUC M NGUYEN/ Primary Examiner.Art Unit 2648	6/27/13	1	4
(Primary Examiner)	(Date)		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13662948
	Filing Date		2012-10-29
	First Named Inventor	Wala	
	Art Unit	2648	
	Examiner Name	Duc M. Nguyen	
	Attorney Docket Number	100.019US04	

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					

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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	0209319	WO		2002-01-31	Wala		<input type="checkbox"/>

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

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

T⁵

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

Application Number	13662948
Filing Date	2012-10-29
First Named Inventor	Wala
Art Unit	2648
Examiner Name	Duc M. Nguyen
Attorney Docket Number	100.019US04

1	CHINESE PATENT OFFICE, "Notification to Grant Patent Right for Invention", "from Foreign Counterpart of U.S. Application No. 09/619,431", 5/28/2013, Page(s) 1-3, Published in: CN	<input type="checkbox"/>
2	INTERNATIONAL SEARCHING AUTHORITY, "International Search Report", "from Foreign Counterpart of U.S. Application No. 09/619,431", 11/15/2001, Page(s) 1-7, Published in: WO	<input type="checkbox"/>
3	EUROPEAN PATENT OFFICE, "Extended European Search Report", "from Foreign Counterpart of U.S. Application No. 09/619,431", 1/14/2011, Page(s) 1-9, Published in: EP	<input type="checkbox"/>

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

EXAMINER SIGNATURE

Examiner Signature	/Duc Nguyen/	Date Considered	06/27/2013
--------------------	--------------	-----------------	------------

*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	13662948
Filing Date	2012-10-29
First Named Inventor	Wala
Art Unit	2648
Examiner Name	Duc M. Nguyen
Attorney Docket Number	100.019US04

CERTIFICATION STATEMENT

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

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

OR

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

- ☐ See attached certification statement.
- ☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- ☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Wade A. Whisenant/	Date (YYYY-MM-DD)	2013-06-20
Name/Print	Wade A. Whisenant	Registration Number	59593

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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Applicant(s)	Wala	<u>AMENDMENT AND RESPONSE UNDER 37 C.F.R. § 1.111</u>
Serial No.	13/662,948	
Filing Date	10/29/2012	
Confirmation No.	9673	
Examiner Name	NGUYEN, DUC M	
Group Art Unit	2648	
Attorney Docket No.	100.019US04	
Title: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		

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

The Office Action mailed on April 24, 2013 has been reviewed. Please amend the above-identified application as follows.

Remarks begin on page 2 of this paper.

Serial No.: 13/662,948

Filing Date: 10/29/2012

Attorney Docket No. 100.019US04

Title: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

REMARKS

The Office Action mailed on April 24, 2013 has been reviewed. Claims 1-40 are pending in this application.

Double Patenting Rejection

Claims 1-40 were rejected under a nonstatutory obviousness-type double patenting rejection over claims 1-79 of U.S. Patent No. 6,704,545. Claims 1-40 were rejected under a nonstatutory obviousness-type double patenting rejection over claims 1-81 of U.S. Patent No. 7,639,982. Claims 1-40 were rejected under a nonstatutory obviousness-type double patenting rejection over Claims 1-28 of U.S. Patent No. 8,326,218. A Terminal Disclaimer in compliance with 37 CFR 1.321(b)(iv) has been submitted via e-Terminal Disclaimer on EFS Web to overcome these rejections.

CONCLUSION

Applicant respectfully submits that claims **1-40** are in condition for allowance and notification to that effect is earnestly requested. If necessary, please charge any additional fees or credit overpayments to Deposit Account No. 502432.

If the Examiner has any questions or concerns regarding this application, please contact the undersigned at the telephone number listed below.

Respectfully submitted,

Date: June 19, 2013

/Wade A. Whisenant/

Wade A. Whisenant

Reg. No. 59593

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13662948	
	Filing Date		2012-10-29	
	First Named Inventor	Wala		
	Art Unit	2648		
	Examiner Name	Duc M. Nguyen		
	Attorney Docket Number	100.019US04		

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

Application Number	13662948
Filing Date	2012-10-29
First Named Inventor	Wala
Art Unit	2648
Examiner Name	Duc M. Nguyen
Attorney Docket Number	100.019US04

1	CHINESE PATENT OFFICE, "Notification to Grant Patent Right for Invention", "from Foreign Counterpart of U.S. Application No. 09/619,431", 5/28/2013, Page(s) 1-3, Published in: CN	<input type="checkbox"/>
2	INTERNATIONAL SEARCHING AUTHORITY, "International Search Report", "from Foreign Counterpart of U.S. Application No. 09/619,431", 11/15/2001, Page(s) 1-7, Published in: WO	<input type="checkbox"/>
3	EUROPEAN PATENT OFFICE, "Extended European Search Report", "from Foreign Counterpart of U.S. Application No. 09/619,431", 1/14/2011, Page(s) 1-9, Published in: EP	<input type="checkbox"/>

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

Application Number	13662948
Filing Date	2012-10-29
First Named Inventor	Wala
Art Unit	2648
Examiner Name	Duc M. Nguyen
Attorney Docket Number	100.019US04

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- ☐ See attached certification statement.
- ☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- ☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Wade A. Whisenant/	Date (YYYY-MM-DD)	2013-06-20
Name/Print	Wade A. Whisenant	Registration Number	59593

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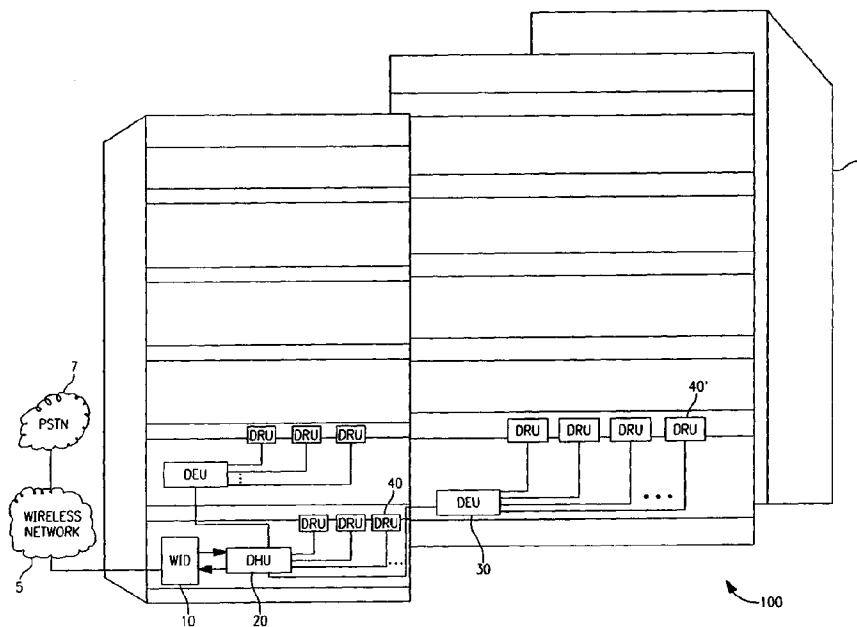
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(54) Title: A METHOD FOR POINT-TO-MULTIPOINT COMMUNICATION USING DIGITAL RADIO FREQUENCY TRANSPORT



(57) Abstract: A digital radio frequency transport system that performs bi-directional simultaneous digital radio frequency distribution is provided. The transport system includes a digital host unit and at least two digital remote units coupled to the digital host unit. The bi-directional simultaneous digital radio frequency distribution is performed between the digital host unit and the at least two digital remote units.

WO 02/09319 A1

A METHOD FOR POINT-TO-MULTIPOINT COMMUNICATION USING DIGITAL RADIO FREQUENCY
TRANSPORT**Technical Field**

The present invention is related to high capacity mobile communications systems, and more particularly to a point-to-multipoint digital micro-cellular communication system.

Background Information

With the widespread use of wireless technologies additional signal coverage is needed in urban as well as suburban areas. One obstacle to providing full coverage in these areas is steel frame buildings. Inside these tall shiny buildings (TSBs), signals transmitted from wireless base stations attenuate dramatically and thus significantly impact the ability to communicate with wireless telephones located in the buildings. In some buildings, very low power ceiling mounted transmitters are mounted in hallways and conference rooms within the building to distribute signals throughout the building. Signals are typically fed from a single point and then split in order to feed the signals to different points in the building.

In order to provide coverage a single radio frequency (RF) source needs to simultaneously feeds multiple antenna units, each providing coverage to a different part of a building for example. Simultaneous bi-directional RF distribution often involves splitting signals in the forward path (toward the antennas) and combining signals in the reverse path (from the antennas). Currently this can be performed directly at RF frequencies using passive splitters and combiners to feed a coaxial cable distribution network. In passive RF distribution systems, signal splitting in the forward path is significantly limited due to inherent insertion loss associated with the passive devices. Each split reduces the level of the signal distributed in the building thereby making reception, e.g. by cell phones, more difficult. In addition, the high insertion loss of coaxial cable at RF frequencies severely limits the maximum distance over which RF signals can be distributed. Further, the system lacks any means to compensate for variations of insertion loss in each path.

Another solution to distributing RF signals in TSBs is taking the RF signal from a booster or base station, down converting it to a lower frequency, and distributing it via Cat 5 (LAN) or coaxial cable wiring to remote antenna units. At the remote antenna units, the signal is up converted and transmitted. While down-conversion reduces insertion loss, the signals are still susceptible to noise and limited dynamic range. Also, each path in the distribution network requires individual gain adjustment to compensate for the insertion loss in that path.

In another approach, fiber optic cables are used to distribute signals to antennas inside of a building. In this approach, RF signals are received from a bi-directional amplifier or base station. The RF signals directly modulate an optical signal, which is transported throughout the building as analog modulated light signals over fiber optic cable. Unfortunately, conventional systems using analog optical modulation transmission over optical fibers require highly sophisticated linear lasers to achieve adequate performance. Also, analog optical systems are limited in the distance signals can be transmitted in the building. Typically, this limitation is made worse due to the use of multimode fiber that is conventionally available in buildings. Multimode fiber is wider than single mode fiber and supports a number of different reflection modes so that signals tend to exhibit dispersion at the terminating end of the fiber. In addition, analog installation typically includes significant balancing when setting up the system. Further, RF levels in the system need to be balanced with the optical levels. If there is optical attenuation, the RF levels need to be readjusted. In addition, if the connectors are not well cleaned or properly secured, the RF levels can change.

Digitization of the RF spectrum prior to transport solves many of these problems. The level and dynamic range of digitally transported RF remains unaffected over a wide range of path loss. This allows for much greater distances to be covered, and eliminates the path loss compensation problem. However, this has been strictly a point-to-point architecture. One drawback with digitally transported RF in a point-to-point architecture is the equipment and cost requirement. A host RF to digital interface device is needed for each remote antenna unit. In particular,

for use within a building or building complex the number of RF to digital interface devices and the fiber to connect these devices is burdensome. For example, in a building having 20 floors, the requirement may include 20 host RF to digital interface devices for 20 remote antenna units, 1 per floor. In some applications more than one remote antenna unit per floor may be required. As a result, there is a need in the art for improved techniques for distributing RF signals in TSBs, which would incorporate the benefits of digital RF transport into a point-to-multipoint architecture.

Summary of the Invention

The above-mentioned problems with distributing RF signals within a building and other problems are addressed by the present invention and will be understood by reading and studying the following specification.

In one embodiment, a digital radio frequency transport system is provided. The transport system includes a digital host unit and at least two digital remote units coupled to the digital host unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

In another embodiment, a digital radio frequency transport system is provided. The transport system includes a digital host unit and at least one digital expansion unit coupled to the digital host unit. The transport system further includes at least two digital remote units, each coupled to one of the digital host unit and the digital expansion unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

In an alternate embodiment, a method of performing point-to-multipoint radio frequency transport is provided. The method includes receiving radio frequency signals at a digital host unit and converting the radio frequency signals to a digitized radio frequency spectrum. The method also includes optically transmitting the digitized radio frequency spectrum to a plurality of digital remote units. The method further includes receiving the digitized radio frequency spectrum at the plurality of digital remote units, converting the digitized radio frequency spectrum to analog radio frequency signals and transmitting the analog radio frequency signals via a main radio frequency antenna at each of the plurality of digital remote units.

Brief Description of the Drawings

Figure 1 is an illustration of one embodiment of a point-to-multipoint communication system according to the teachings of the present invention.

Figure 2 is a block diagram of one embodiment of a communication system according to the teachings of the present invention.

Figure 3 is a block diagram of another embodiment of a communication system according to the teachings of the present invention.

Figure 4 is a block diagram of one embodiment of a digital host unit according to the teachings of the present invention.

Figure 5 is a block diagram of one embodiment of a digital remote unit according to the teachings of the present invention.

Figure 6 is a block diagram of one embodiment of a digital expansion unit according to the teachings of the present invention.

Figure 7 is a block diagram of one embodiment of a microcell base station according to the teachings of the present invention.

Figure 8 is an illustration of one embodiment of an overflow algorithm for a channel summer according to the teachings of the present invention.

Detailed Description

In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

Figure 1 is an illustration of one exemplary embodiment of a point-to-multipoint digital transport system shown generally at 100 and constructed according to the teachings of the present invention. The point-to-multipoint digital transport system 100 is shown distributed within a complex of tall shiny buildings (TSBs) 2. Although system 100 is shown in a complex of TSBs 2, it is understood that system 100 is not limited to this embodiment. Rather, system 100 in other embodiments is used to distribute signals in a single building, or other appropriate structure or indoor or outdoor location that exhibits high attenuation to RF signals. Advantageously, system 100 uses digital summing of digitized RF signals from multiple antennas to improve signal coverage in structures, such as TSBs.

Point-to-multipoint digital transport of RF signals is accomplished through a network of remote antenna units or digital remote units 40 and 40' and a digital host unit 20, which interfaces with a wireless network 5 which is coupled to the public switched telephone network (PSTN), or a mobile telecommunications switching office (MTSO) or other switching office/network. System 100 operates by transporting RF signals digitally over fiber optic cables. Signals received at DHU 20 are distributed to multiple DRUs 40 and 40' to provide coverage throughout a building complex. In addition, signals received at each of the DRUs 40 and 40' are summed together at the DHU 20 for interface to a wireless network.

In one embodiment, digital expansion unit DEU 30 is situated between the DHU 20 and one or more DRUs. In the forward path, DEU 30 expands the coverage area by splitting signals received from DHU 20 to a plurality of DRUs 40'. In the reverse path, DEU 30 receives signals from a plurality of DRUs 40', digitally sums

the signals together and transports them to a DHU 20 or another DEU such as 30. This system allows for successive branching of signals using DEUs 30 and expanded coverage to multiple DRUs 40 and 40'. This system provides an efficient way of providing signal coverage for wireless communication without added attenuation loss and distance constraint found with analog systems. By using DEUs 30, antennas can be placed further from DHU 20 without adversely affecting signal strength since shorter fiber optic cables can be used.

Digital transport system 100 includes a wireless interface device (WID) 10 that provides an interface to a wireless network. In one embodiment, the WID 10 includes either conventional transmitters and receivers or all digital transmitter and receiver equipment, and interface circuitry to a mobile telecommunications switching office (MTSO). In one embodiment, the wireless interface device 10 is coupled to an MTSO via a T1 line and receives and transmits signals between the MTSO and the DHU 20. In another embodiment, the wireless interface device 10 is coupled to the public switched telephone network (PSTN). In one embodiment, WID 10 comprises a base station and connects directly to DHU 20 via coaxial cables. In another embodiment, WID 10 comprises a base station and wirelessly connects to DHU 20 via a bi-directional amplifier that is connected to an antenna. In one embodiment, the antenna is an outdoor antenna.

WID 10 communicates signals between wireless units and the wireless network via digital remote units DRUs 40 and 40'. WID 10 is coupled to DHU 20. The DHU 20 is coupled to at least one digital expansion unit DEU 30 and a plurality of DRUs 40. In addition, DEU 30 is coupled to a plurality of DRUs 40'. The DHU 20 receives RF signals from WID 10 and converts the RF signals to digital RF signals. DHU 20 further optically transmits the digital RF signals to multiple DRUs 40 either directly or via one or more DEUs 30.

Each DRU 40 and 40' is connected through a fiber optic cable (or optionally another high bandwidth carrier) to transport digital RF signals to one of DHU 20 or DEU 30. In one embodiment, the fiber optic cable comprises multimode fiber pairs coupled between the DRUs 40 and the DHU 20, between the DRUs 40 and 40' and

the DEUs 30 and between the DEUs 30 and the DHU 20. In one embodiment, the DEU 30 is coupled to the DHU 20 via single mode fiber and the DEU 30 is coupled to the DRUs 40' via multimode fiber pairs. Although, transport system 100 has been described with fiber optic cable other carriers may be used, e.g., coaxial cable.

In another embodiment, the DHU 20 is coupled to the DRUs 40 by a direct current power cable in order to provide power to each DRU 40. In one embodiment, the direct current power cable delivers 48 VDC to each DRU 40 connected to the DHU 20. In another embodiment, the DEU 30 is coupled to DRUs 40' by a direct current power cable to provide power to each DRU 40'. In one embodiment, the direct current power cable delivers 48 VDC to each DRU 40' connected to the DEU 30. In an alternate embodiment, DRUs 40 and 40' are connected directly to a power supply. In one embodiment, the power supply provides DC power to the DRUs 40 and 40'. In an alternate embodiment, the power supply provides AC power to the DRUs 40 and 40'. In one embodiment, DRUs 40 and 40' each include an AC/DC power converter.

Both DHU 20 and DEU 30 split signals in the forward path and sum signals in the reverse path. In order to accurately sum the digital signals together at DHU 20 or DEU 30 the data needs to come in to the DHU 20 or DEU 30 at exactly the same rate. As a result all of the DRUs 40 and 40' need to be synchronized so that their digital sample rates are all locked together. Synchronizing the signals in time is accomplished by locking everything to the bit rate over the fiber. In one embodiment, the DHU 20 sends out a digital bit stream and the optical receiver at the DEU 30 or DHU 40 detects that bit stream and locks its clock to that bit stream. In one embodiment, this is being accomplished with a multiplexer chip set and local oscillators, as will be described below. Splitting and combining the signals in a digital state avoids the combining and splitting losses experienced with an analog system. In addition, transporting the digital signals over multimode fiber results in a low cost transport system that is not subject to much degradation.

The down-conversion and up-conversion of RF signals are implemented by mixing the signal with a local oscillator (LO) at both the DRUs and the DHU. In

order for the original frequency of the RF signal to be restored, the signal must be up-converted with an LO that has exactly the same frequency as the LO that was used for down conversion. Any difference in LO frequencies will translate to an equivalent end-to-end frequency offset. In the embodiments described, the down conversion and up conversion LOs are at locations remote from one another. Therefore, in one preferred embodiment, frequency coherence between the local and remote LO's is established as follows: at the DHU end, there is a 142 MHz reference oscillator which establishes the bit rate of 1.42 GHz over the fiber. This reference oscillator also generates a 17.75 MHz reference clock which serves as a reference to which LO's at the DHU are locked.

At each of the DRUs, there is another 17.75 MHz clock, which is recovered from the optical bit stream with the help of the clock and bit recovery circuits. Because this clock is recovered from the bit stream generated at the host, it is frequency coherent with the reference oscillator at the host. A reference 17.75 MHz clock is then generated to serve as a reference for the remote local oscillators. Because the remote recovered bit clock is frequency coherent with the host master clock, the host and remote reference clocks, and any LO's locked to them, are also frequency coherent, thus ensuring that DHU and DRU LO's are locked in frequency. It is understood that in other embodiments the bit rate over the fiber may vary and the frequency of the clocks will also vary.

Figure 2 is a block diagram of one embodiment of a communication system, shown generally at 200 and constructed according to the teachings of the present invention. In this embodiment, a digital host unit (DHU) 220 is coupled to a bi-directional amplifier (BDA) 211. The BDA 211 receives communication signals from a wireless interface device (WID) and transports the communication signals as RF signals to the DHU 220 and receives RF signals from DHU 220 and transmits the RF signals to the WID. The DHU 220 receives RF signals from the BDA 211 and digitizes the RF signals and optically transmits the digital RF signals to multiple DRUs via transmission lines 214-1 to 214-N. DHU 220 also receives digitized RF signals over transmission lines 216-1 to 216-N from a plurality of DRUs either

directly or indirectly via DEUs, reconstructs the corresponding analog RF signals, and applies them to BDA 211. In one embodiment, DHU 220 receives signals directly from a plurality N of DRUs. The signals are digitally summed and then converted to analog signals and transmitted to BDA 211. In another embodiment, DHU 220 receives signals from one or more DEUs and one or more DRUs directly. Again, the signals are all digitally summed and then converted to analog signals and transmitted to BDA 211. The signals received via transmission lines 216-1 to 216-N may be received directly from a DRU or signals that are received by a DEU and summed together and then transported via 216-1 to 216-N to DHU 220 for additional summing and conversion for transport to BDA 211. DEUs provide a way to expand the coverage area and digitally sum signals received from DRUs or other DEUs for transmission in the reverse path to other DEUs or DHU 220. In one embodiment, transmission lines 214-1 to 214-N and 216-1 to 216-N comprise multimode fiber pairs. In an alternate embodiment, each fiber pair is replaced by a single fiber, carrying bi-directional optical signals through the use of wavelength division multiplexing (WDM). In an alternate embodiment, transmission lines 214-1 to 214-N and 216-1 to 216-N comprise single mode fibers. In one embodiment, N is equal to six. In an alternate embodiment, the number of transmission lines in the forward path direction 214-1 to 214-N is not equal to the number of transmission lines in the reverse path direction 216-1 to 216-N.

Figure 3 is a block diagram of an alternate embodiment of a communication system shown generally at 300 and constructed according to the teachings of the present invention. Communication system 300 includes a base station 310 coupled to a DHU 320. Base station 310 includes conventional transmitters and receivers 323 and 328, respectively, and conventional radio controller or interface circuitry 322 to an MTSO or telephone switched network. DHU 320 is coupled to base station 310. DHU 320 is also coupled to transmission lines 314-1 to 314-M, which transmit in the forward path direction and transmission lines 316-1 to 316-M, which transmit in the reverse path direction.

DHU 320 essentially converts the RF spectrum to digital in the forward path and from digital to analog in the reverse path. In the forward path, DHU 320 receives the combined RF signal from transmitters 323, digitizes the combined signal and transmits it in digital format over fibers 314-1 to 314-M, which are connected directly to a plurality of DRUs or indirectly to one or more DRUs via one or more DEUs.

In one embodiment, DHU 320 receives signals directly from a plurality M of DRUs. The signals are digitally summed and then converted to analog signals and transmitted to base station 310. In another embodiment, DHU 320 receives signals from one or more DEUs and one or more DRUs directly. Again, the signals are all digitally summed and then converted to analog signals and transmitted to base station 310. The signals received via transmission lines 316-1 to 316-M may be received directly from a DRU or signals that are received by a DEU and summed together and then transported via 316-1 to 316-M to DHU 320 for additional summing and conversion for transport to base station 210. DEUs provide a way to expand the coverage area by splitting signals in the forward path and digitally summing signals received from DRUs or other DEUs in the reverse path for transmission upstream to other DEUs or a DHU. In the reverse path, DHU 320 also receives digitized RF signals over fibers 316-1 to 316-M from a plurality of DRUs, either directly or indirectly via DEUs, reconstructs the corresponding analog RF signal, and applies it to receivers 328.

In one embodiment, transmission lines 314-1 to 314-M and 316-1 to 316-M comprise multimode fiber pairs. In an alternate embodiment, each fiber pair is replaced by a single fiber, carrying bi-directional optical signals through the use of wavelength division multiplexing (WDM). In an alternate embodiment, transmission lines 314-1 to 314-M and 316-1 to 316-M comprise single mode fibers. In one embodiment, M is equal to six. In an alternate embodiment, the number of transmission lines in the forward path direction 314-1 to 314-M is not equal to the number of transmission lines in the reverse path direction 316-1 to 316-M.

Referring now to FIG. 4, there is shown one embodiment of a DHU 420 constructed according to the teachings of the present invention. DHU 420 includes an RF to digital converter 491 receiving the combined RF signals from a wireless interface device such as a base station, BDA or the like. RF to digital converter 491 provides a digitized traffic stream that is transmitted to multiplexer 466. Multiplexer 466 converts the parallel output of the A/D converter into a framed serial bit stream. At the output of the multiplexer is a 1 to P fan out buffer 407, which splits the digital signal P ways. There are P optical transmitters 431-1 to 431-P one feeding each of the P optical transmission lines 414-1 to 414-P. The digitized signals are applied to fibers 414-1 to 414-P for transmission to corresponding DRUs either directly or via DEUs. In one embodiment, P is equal to 6.

In one embodiment, DHU 420 includes an amplifier 450 that receives the combined RF signal from a wireless interface device such as a base station or BDA. The combined RF signal is amplified and then mixed by mixer 452 with a signal received from local oscillator 468. Local oscillator 468 is coupled to reference oscillator 415. In one embodiment the local oscillator is coupled to a frequency divider circuit 470, which is in turn coupled to reference oscillator 415. The local oscillator is locked to the reference oscillator 415 as a master clock so that the down conversion of the RF signals is the same as the up conversion. The result is end to end, from DHU to DRU, or DHU to one or more DEUs to DRU, no frequency shift in the signals received and transmitted. The local oscillator 463 is also coupled to a synthesizer circuit 476.

The output signal of mixer 452 is provided to amplifier 454 amplified and then filtered via intermediate frequency (IF) filter 456. The resultant signal is the combined RF signal converted down to an IF signal. The IF signal is mixed with another signal originating from the reference oscillator 415 via mixer 460. The output of mixer 460 is summed together at 462 with a signal produced by field programmable gate array (FPGA) 467. The output is then converted from an analog signal to a digital signal via analog/digital (A/D) converter 464 once converted the digital RF signal is applied to multiplexer 466. In one embodiment, the A/D

converter 464 is a 14-bit converter handling a 14-bit signal. In other embodiments, the A/D converter 464 may be of any size to accommodate an appropriate signal. In one embodiment, the input signal from FPGA 467 is a dither signal from dither circuit 462 that adds limited out of band noise to improve the dynamic range of the RF signal.

In one embodiment, DHU 420 includes an alternating current to digital current power distribution circuit 6 that provides direct current power to each of the DRUs coupled to DHU 420.

DHU 420 further includes a plurality of digital optical receivers 418-1 to 418-P in the reverse path. Receivers 418-1 to 418-P each output an electronic digital signal, which is applied to clock and bit recovery circuits 445-1 to 445-P, respectively, for clock and bit recovery of the electronic signals. The signals are then applied to demultiplexers 441-1 to 441-P, respectively, which extract the digitized signals generated at the DRUs, as will be explained in detail below. Demultiplexers 441-1 to 441-P further extract alarm (monitoring) and voice information framed with the digitized signals. The digitized signals output at each demultiplexer 441-1 to 441-P are then applied to FPGA 467 where the signals are summed together and then applied to digital to RF converter 495. Converter 495 operates on the sum of the digitized signals extracted by demultiplexers 441-1 to 441-P, reconstructing baseband replicas of the RF signals received at all the digital remote units. The baseband replicas are then up-converted to their original radio frequency by mixing with a local oscillator 482 and filtering to remove image frequencies. Local oscillator 482 is coupled to synthesizer 476 and reference oscillator as discussed with respect to local oscillator 468 above.

In one embodiment, digital to RF converter 495 includes digital to analog (D/A) converter 484 coupled to an output of FPGA 467 the digitized RF signals are converted to analog RF signals and then mixed with a signal from reference oscillator 415 by mixer 492. The signal is then filtered by IF filter 490 and amplified by amplifier 488. The resultant signal is then mixed with a signal from

local oscillator 482 and then applied to RF filter 484, amplifier 480 and RF filter 478 for transmission by a wireless interface device such as a BDA or base station.

In one embodiment, FPGA 467 includes an alarm/control circuit 474, which extracts overhead bits from DRUs to monitor error and alarm information. In one embodiment, the FPGA 467 includes a summer 498, which mathematically sums together the digital RF signals received from fibers 416-1 to 416-P. In another embodiment FPGA includes an overflow algorithm circuit 486 coupled to the output of summer 486. The algorithm circuit 496 allows the summed digital RF signals to saturate and keep the summed signal within a defined number of bits. In one embodiment, the algorithm circuit includes a limiter. In one embodiment, the RF signals are 14-bit signals and when summed and limited by summer 498 and overflow algorithm 496 result in a 14-bit output signal.

For example, in one embodiment each of the digital RF signals received from fibers 416-1 to 416-P, where P is equal to 6, comprise 14 bit inputs. All of those 6 different 14 bit inputs then go into summer 498. In order to allow for overflow, at least 17 bits of resolution is needed in the summer 498 to handle a worst-case scenario when all 6 of the 14 bit inputs are at full scale at the same time. In this embodiment, a 17-bit wide summer 498 is employed to handle that dynamic range. Coming out of summer 498 is needed a 14-bit signal going in the reverse path. In one embodiment, an algorithm circuit 496 for managing the overflow is implemented. In one embodiment, the summer and 498 and overflow algorithm 496 are included in FPGA 467. In one embodiment, overflow algorithm 496 acts like a limiter and allows the sum to saturate and keeps the summed signal within 14 bits. In an alternate embodiment, overflow algorithm circuit 496 controls the gain and scales the signal dynamically to handle overflow conditions.

Figure 8 illustrates one embodiment of an algorithm 863 for a channel summer 865 in order to limit the sum of input signals 0 to 5 to 14 bits. In this embodiment, input signals 0 to 5 comprise 6 signals that are summed together by summer 865. The sum of input signals 0 to 5 is reduced to a signal having 14 bits or less by the algorithm 863. It is understood that the algorithm 863 is by example and

is not meant to restrict the type of algorithm used to limit the sum of signals 0 to 5 to 14 bits or less.

For example, when the sum of the 6 input signals 0 to 5 is greater than or equal to 13FFBh then the sum is divided by 6 for a signal that is 14 bits or less. When the sum of the 6 input signals 0 to 5 is greater than 13FFBh but less than or equal to FFFCh then the sum is divided by 5 for a signal that is 14 bits or less. When the sum of the 6 input signals 0 to 5 is greater than FFFCh but less than BFFDh then the sum is divided by 4 for a signal that is 14 bits or less. When the sum of the 6 input signals 0 to 5 is greater BFFDh but less than 7FFEh then the sum is divided by 3 for a signal that is 14 bits or less. Finally, when the sum of the 6 input signals 0 to 5 is greater than 7FFEh but less than or equal to 3FFFh then the sum is divided by 2 for a signal that is 14 bits or less.

Figure 5 is a block diagram of one embodiment of a digital remote unit (DRU) 540 constructed according to the teachings of the present invention. A digital optical receiver 501 receives the optical digital data stream transmitted from a DHU directly or via a DEU. Receiver 501 converts the optical data stream to a corresponding series of electrical pulses. The electrical pulses are applied to clock and bit recovery circuit 503. The series of electrical pulses are then applied to demultiplexer 505. Demultiplexer 505 extracts the digitized traffic signals and converts the signals from serial to parallel. The output parallel signal is then applied to digital to RF converter 595 for conversion to RF and transmission to duplexer 547. RF converter 595 is connected to the main antenna 599 through a duplexer 547. Accordingly, radio frequency signals originating from a wireless interface device are transmitted from main antenna 547.

In one embodiment, digital to RF converter 595 includes a digital-to-analog (D/A) converter 509, which reconstructs the analog RF signal and applies it to IF 504 and amplifier 506. The analog signal is mixed with an output signal of reference oscillator 515 by mixer 502. The output of amplifier 506 is mixed with a signal from local oscillator 519 that locks the RF signal with the return digital signal via reference oscillator 515 that is coupled to local oscillator 519. In one

embodiment, the reference oscillator is coupled to frequency divider 517 that in turn is coupled to local oscillators 519 and 529. The local oscillators 519 and 529 are also coupled to synthesizer 521 that is coupled to programmable logic device 525.

RF signals received at main antenna 599 are passed through duplexer 547 to RF to digital converter 593. The RF signals are converted to digital signals and then applied to multiplexer 536 converted from parallel-to-serial and optically transmitted via optical transmitter 532 to a DEU or DHU.

In one embodiment, RF to digital converter 593 includes a first amplifier 543 that receives RF signals from duplexer 547, amplifies the signals and transmits them to digital attenuator 539. In one embodiment, amplifier 543 is a low noise amplifier. Digital attenuator 539 receives the amplified signals and digitally attenuates the signal to control the levels in case of an overload situation. RF to digital converter 593 further includes a second amplifier 537, which receives the attenuated signals, amplifies the signals and applies the amplified signals to mixer 535. Mixer 535 mixes the amplified signals with a signal received from local oscillator 529. The resultant signals are applied to a third amplifier 533 an IF filter 548 and a fourth amplifier 546 in series to down convert to an IF signal. The IF signal is then mixed with a signal from reference oscillator 515 and the mixed signal is summed with a signal from dither circuit 527. The resultant signal is applied to analog-to-digital converter 538 and converted to a digital signal. The output digital signal is then applied to a multiplexer 536. In one embodiment, the multiplexer 536 multiplexes the signal together with a couple of extra bits to do framing and control information. In one embodiment, multiplexer 536, clock and bit recovery circuit and demultiplexer 505 comprise a multiplexer chip set.

Programmable logic circuit 525 programs synthesizer 521 for the reference oscillator and for the up and down conversion of local oscillators 519 and 529. The programmable logic circuit 525 looks for error conditions, for out of lock conditions on the oscillators and reports error modes and looks for overflow condition in the A/D converter 538. If an overflow condition occurs the programmable logic circuit 525 indicates that you are saturating and adds some extra attenuation at digital

attenuator 539 in order to reduce the RF signal levels coming in from RF antenna 599 and protect the system from overload.

In one embodiment, DRU 540 includes an internal direct current power distribution system 5. In one embodiment, the distribution system receives 48 VDC and internally distributes 3 outputs of +3.8V, +5.5V and +8V.

Figure 6 is a block diagram of one embodiment of a digital expansion unit (DEU) 630 constructed according to the teachings of the present invention. DEU 630 is designed to receive optical signals and transmit optical signals. An optical receiver 651 receives digitized RF signals and transmits them to clock and bit recovery circuit 653 that performs clock and bit recovery to lock the local clock and clean up the signal. The signals are then split into X RF digital signals by 1 to X fan out buffer 607. The signals are then transmitted via optical transmitters 655-1 to 655-X to X receiving units such as DEUs or DRUs. The X receiving units may be any combination of DEUs or DRUs. In one embodiment, X is equal to six.

DEU 630 also includes optical receivers 669-1 to 669-X, which receive digitized RF signals directly from DRUs or indirectly via DEUs. In operation the signals are received, applied to clock and bit recovery circuits 673-1 to 673-X respectively to lock the local clock and clean up the signals and then applied to demultiplexers 671-1 to 671-X. Demultiplexers 671-1 to 671-X each extract the digitized traffic and apply the samples to field programmable gate array 661. The signals are summed together digitally and transmitted to multiplexer 657, which multiplexes the signal together with a couple of extra bits to do framing and control information. In addition, the multiplexer 657 converts the signals parallel to serial. The signals are then applied to optical transmitter 659 for further transmission. In one embodiment, the signals are directly transmitted to a DHU or indirectly via one or more additional DEUs.

In one embodiment, the FPGA 661 includes summer 665, which mathematically sums together the digital RF signals received from demultiplexers 671-1 to 671-X. In another embodiment, FPGA 661 includes an overflow algorithm circuit 663 coupled to the output of summer 665. The algorithm circuit 663 allows

the summed digital RF signals to saturate and keep the summed signal within a defined number of bits. In one embodiment, the algorithm circuit includes a limiter. In one embodiment, the RF signals are 14-bit signals and when summed and limited by summer 665 and overflow algorithm 663 result in a 14-bit output signal.

In one embodiment, DEU 630 includes an alternating current to digital current power distribution circuit 7 that provides direct current power to each of the DRUs coupled to DEU 630.

In an alternate embodiment, the digital host unit (DHU) and wireless interface device (WID) are located some distance from the building being served. The DHU in the building is replaced by a DEU, and the link between that DEU and the remotely located DHU is via single mode fiber. Figure 7 is a block diagram of this embodiment. A microcell base station shown generally at 700 includes conventional transmitters and receivers 723 and 728, respectively, and conventional radio controller or interface circuitry 722. In the forward path, a DHU 767 receives the combined RF signal from transmitters 723, digitizes the combined signal and transmits it in digital format over single mode fiber to a DEU. In the reverse path, DHU 767 receives digitized RF signal from a DEU, reconstructs the corresponding analog RF signal, and applies it to receivers 728.

In another alternate embodiment, the wireless interface device (WID) is a software defined base station, and the interface between the DHU and WID takes place digitally, eliminating the need for the RF to digital conversion circuitry in the DHU.

Conclusion

A digital radio frequency transport system has been described. The transport system includes a digital host unit and at least two digital remote units coupled to the digital host unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

In addition, a digital radio frequency transport system has been described. The transport system includes a digital host unit and at least one digital expansion unit coupled to the digital host unit. The transport system further includes at least two digital remote units, each coupled to one of the digital host unit and the digital expansion unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and that at least two digital remote units.

Further, a method of performing point-to-multipoint radio frequency transport has been described. The method includes receiving analog radio frequency signals at a digital host unit and converting the analog radio frequency signals to digitized radio frequency signals. The method also includes splitting the digitized radio frequency signals into a plurality of a digital radio frequency signals and optically transmitting the digital radio frequency signals to a plurality of digital remote units. The method further includes receiving the digital radio frequency signals at a plurality of digital remote units, converting the digital radio frequency signals to analog radio frequency signals and transmitting the signals via a main radio frequency antenna at each of the plurality of digital remote units.

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiments shown. For example, a digital remote unit is not limited to the receipt and summing and splitting and transmitting of digitized radio frequency signals. In other embodiments, the digital host unit is capable of receiving and summing analog radio frequency signals in addition to or instead of digitized radio frequency signals. As well, the digital host unit is capable of splitting and transmitting analog radio frequency signals in addition to or instead of digitized radio frequency signals. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is intended that this invention be limited only by the claims and the equivalents thereof.

What is claimed is:

1. A digital radio frequency transport system, comprising:
a digital host unit; and
at least two digital remote units coupled to the digital host unit, wherein the digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.
2. The system of claim 1, further comprising a wireless interface device coupled to the digital host unit.
3. The system of claim 2, wherein the wireless interface device comprises a base station that couples directly to the digital host unit via coaxial cables.
4. The system of claim 2, wherein the wireless interface device comprises a base station that wirelessly connects to the digital host unit via bi-directional amplifier that is coupled to an antenna.
5. The system of claim 1, wherein the at least two digital remote units each include a main radio frequency antenna which transmits and receives radio frequency signals.
6. The system of claim 1, wherein the digital host unit includes a radio frequency to digital converter that converts a main radio frequency signal to a digitized radio frequency signal.

7. The system of claim 6, wherein the digital host unit further includes a multiplexer which splits the digitized radio frequency signal into at least two digital signals for optical transmission to the at least two digital remote units.
8. The system of claim 1, wherein the digital host unit includes local oscillators coupled to a reference oscillator for synchronization of the radio frequency signal in the forward direction and in the reverse direction.
9. The system of claim 1, wherein the digital host unit is coupled to each of the at least two digital remote units by a multimode fiber pair.
10. The system of claim 1, wherein the digital host unit includes:
 - at least two optical receivers each coupled to one of the at least two digital remote units;
 - at least two clock and bit recover circuits each coupled to an output of one of the at least two optical receivers; and
 - at least two demultiplexers each coupled to an output of one of the at least two clock and bit recovery circuits.
11. The system of claim 10, wherein the digital host unit further includes a field programmable gate array coupled to an output of each of the at least two demultiplexers, wherein the field programmable gate array receives a digital radio frequency signal from each of the at least two demultiplexers.
12. The system of claim 11, wherein the field programmable gate array includes a summer that sums together the digital radio frequency signals from each of the at least two demultiplexers.
13. The system of claim 12, wherein the field programmable gate array further includes an overflow algorithm circuit, which allows the summed digital radio

frequency signals to saturate and keeps the summed signal within a defined number of bits.

14. The system of claim 13, wherein the overflow algorithm circuit comprises a limiter.

15. The system of claim 12, wherein the digital host unit further includes a digital to radio frequency converter coupled to an output of the field programmable gate array, wherein the radio frequency converter receives the summed digital radio frequency signal and converts it to an analog radio frequency signal.

16. The system of claim 15, wherein the digital to radio frequency converter comprises a digital to analog converter.

17. The system of claim 7, wherein the digital host unit further comprises an alarm/control interface circuit coupled to the multiplexer.

18. The system of claim 1, wherein the at least two digital remote units each comprise:

- an optical receiver;

- a clock and bit recovery circuit coupled to an output of the optical receiver;

- a demultiplexer coupled to an output of the clock and bit recovery circuit;

- a digital to radio frequency converter coupled to the output of the demultiplexer;

- a duplexer coupled to an output of the digital to radio frequency converter;

and

- a main radio frequency antenna coupled to an output of the duplexer.

19. The system of claim 1, wherein the at least two digital remote units each comprise:

- a main radio frequency antenna;
- a duplexer coupled to the main radio frequency antenna;
- a radio frequency to digital converter coupled to an output of the duplexer;
- a multiplexer coupled to an output of the radio frequency to digital converter;
- and
- an optical transmitter coupled to an output of the multiplexer.

20. The system of claim 18, wherein the at least two digital remote units each further comprise:

- a duplexer coupled to the main radio frequency antenna;
- a radio frequency to digital converter coupled to an output of the duplexer;
- a multiplexer coupled to an output of the radio frequency to digital converter;
- and

an optical transmitter coupled to an output of the multiplexer.

21. The system of claim 20, wherein the digital to radio frequency converter includes a digital to analog converter.

22. The system of claim 20, wherein the radio frequency converter includes an analog to digital converter.

23. The system of claim 20, wherein the at least two digital remote units each further comprise a programmable logic circuit coupled to an output of the radio frequency to digital converter and a reference oscillator coupled between the programmable logic circuit and the clock and bit recovery circuit, wherein the programmable logic circuit monitors the system for error conditions and reports error modes.

24. The system of claim 23, wherein the at least two digital remote units each further comprise a synthesizer circuit coupled to an output of the programmable logic device and a first and a second local oscillator coupled to a first and a second output, respectively, of the synthesizer.

25. The system of claim 1, further comprising a digital expansion unit coupled to the digital host unit, wherein the digital expansion unit contains circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the digital remote unit.

26. The system of claim 25, wherein the digital expansion unit comprises:
an optical receiver;
a clock and bit recovery circuit coupled to an output of the optical receiver;
and
a plurality of optical transmitters coupled to an output of the clock and bit recovery circuit, wherein the optical transmitters are each coupleable to a digital remote unit or a digital expansion unit.

27. The system of claim 25, wherein the digital expansion unit comprises:
a plurality of optical receivers;
a plurality of clock and bit recovery circuits each coupled to an output of one of the plurality of optical receivers;
a plurality of demultiplexers each coupled to an output of one of the clock and bit recovery circuits;
a summer coupled to an output of each of the plurality of demultiplexers;
a multiplexer coupled to an output of the field programmable gate array; and
an optical transmitter coupled to an output of the multiplexer.

28. The system of claim 27, wherein the summer comprises a field programmable gate array that sums together digital radio frequency signals from the plurality of demultiplexers.

29. The system of claim 28, wherein the field programmable gate array includes an overflow algorithm circuit, which allows the summed digital radio frequency signals to saturate and keeps the summed signal within a defined number of bits.

30. The system of claim 29, wherein the overflow algorithm circuit comprises a limiter.

31. The system of claim 25, wherein the digital expansion unit is coupled to the digital host unit by a multimode fiber pair.

32. The system of claim 25, wherein the digital expansion unit is coupled to the digital host unit by single mode fiber.

33. A digital radio frequency transport system, comprising:
a digital host unit;
at least one digital expansion unit coupled to the digital host unit; and
at least two digital remote units, each coupled to one of the digital host unit and the digital expansion unit, wherein the digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

34. The system of claim 33, further comprising a wireless interface device coupled to the digital host unit.

35. The system of claim 34, wherein the wireless interface device comprises a base station that couples directly to the digital host unit via coaxial cables.

36. The system of claim 34, wherein the wireless interface device comprises a base station that wirelessly connects to the digital host unit via a bi-directional amplifier that is coupled to an antenna.

37. The system of claim 33, wherein at least one digital remote unit is coupled to the digital host unit.

38. The system of claim 33, wherein at least one digital remote unit is coupled to one of the at least two digital expansion units.

39. The system of claim 33, wherein the at least one digital expansion units are each coupled to the digital host unit via a multimode fiber pair.

40. The system of claim 33, wherein the at least one digital expansion unit is coupled to the digital host unit via a single mode fiber.

41. The system of claim 33, wherein the at least one digital expansion unit comprises:

an optical receiver;

a clock and bit recovery circuit coupled to an output of the optical receiver;

and

a plurality of optical transmitters coupled to an output of the clock and bit recovery circuit, wherein the optical transmitters are each coupleable to a digital remote unit or a digital expansion unit.

42. The system of claim 33, wherein the at least one digital expansion unit comprises:

a plurality of optical receivers;

a plurality of clock and bit recovery circuits each coupled to an output of one of the plurality of optical receivers;

a plurality of demultiplexers each coupled to an output of one of the clock and bit recovery circuits;

a summer coupled to an output of each of the plurality of demultiplexers;

a multiplexer coupled to an output of the field programmable gate array; and

an optical transmitter coupled to an output of the multiplexer.

43. The system of claim 42, wherein the summer includes a field programmable gate array that sums together digital radio frequency signals from the plurality of demultiplexers.

44. The system of claim 42, wherein the field programmable gate array includes an overflow algorithm circuit, which allows the summed digital radio frequency signals to saturate and keeps the summed signal within a defined number of bits.

45. The system of claim 44, wherein the overflow algorithm circuit comprises a limiter.

46. The system of claim 33, wherein the digital host unit includes a radio frequency to digital converter that converts a main radio frequency signal to a digitized radio frequency signal.

47. The system of claim 46, wherein the digital host unit further includes a multiplexer which splits the digitized radio frequency signal into at least two digital signals for optical transmission to the at least two digital remote units.

48. The system of claim 33, wherein the digital host unit includes local oscillators coupled to a reference oscillator for synchronization of the radio frequency signal in the forward direction and in the reverse direction.

49. The system of claim 33, wherein the digital host unit includes:
at least two optical receivers each coupled to one of the at least two digital expansion units;
at least two clock and bit recover circuits each coupled to an output of one of the at least two optical receivers; and
at least two demultiplexers each coupled to an output of one of the at least two clock and bit recovery circuits.
50. The system of claim 49, wherein the digital host unit further includes a summer coupled to an output of each of the at least two demultiplexers, wherein the summer receives a digital radio frequency signal from each of the at least two demultiplexers.
51. The system of claim 50, wherein the summer includes a field programmable gate array that sums together the digital radio frequency signals from each of the at least two demultiplexers.
52. The system of claim 51, wherein the field programmable gate array includes an overflow algorithm circuit, which allows the summed digital radio frequency signals to saturate and keeps the summed signal within a defined number of bits.
53. The system of claim 52, wherein the overflow algorithm circuit comprises a limiter.
54. The system of claim 52, wherein the digital host unit further includes a digital to radio frequency converter coupled to an output of the field programmable gate array, wherein the radio frequency converter receives the summed digital radio frequency signal and converts it to an analog radio frequency signal.

55. The system of claim 54, wherein the digital to radio frequency converter comprises a digital to analog converter.

56. The system of claim 51, wherein the field programmable gate array includes an alarm/control interface circuit.

57. A method of performing multipoint-to-point digital radio frequency transport, the method comprising:
receiving analog radio frequency signals at multiple digital remote units;
converting the analog radio frequency signals to digital radio frequency signals at each of the digital remote units;
optically transmitting the digital radio frequency signals from each of the digital remote units to a digital host unit;
receiving the multiple digital radio frequency signals at the digital host unit;
summing the multiple digital radio frequency signals together; and
converting the digital radio frequency signals back to analog radio frequency signals and transmitting the signals to a wireless interface device for further transmission to a switched telephone network.

58. The method of claim 57, wherein converting the analog radio frequency signals to digital radio frequency signals comprises amplifying the analog radio frequency signals.

59. The method of claim 57, wherein converting the analog radio frequency signals to digital radio frequency signals comprises synchronizing a reverse path local oscillator to a master clock so as to reduce end-to-end frequency translation.

60. A method of performing point-to-multipoint digital radio frequency transport, the method comprising:
receiving radio frequency signals at a digital host unit;

converting the radio frequency signals to a digitized radio frequency spectrum;
optically transmitting the digitized radio frequency spectrum to a plurality of digital remote units;
receiving the digitized radio frequency spectrum at the plurality of digital remote units;
converting the digitized radio frequency spectrum to analog radio frequency signals; and
transmitting the analog radio frequency signals via a main radio frequency antenna at each of the plurality of digital remote units.

61. The method of claim 60, wherein converting the radio frequency signals to a digitized radio frequency spectrum comprises amplifying the radio frequency signals.

62. The method of claim 60, wherein converting the radio frequency signals to a digitized radio frequency spectrum digital radio frequency signals comprises synchronizing a forward path local oscillator to a reference oscillator so as to reduce end-to-end frequency translation.

63. The method of claim 60, wherein converting the digitized radio frequency spectrum to analog radio frequency signals comprises amplifying the analog radio frequency signals.

64. The method of claim 60, wherein converting the digitized radio frequency spectrum to analog radio frequency signals comprises synchronizing a forward path local oscillator to a reference oscillator so as to reduce end-to-end frequency translation.

- 65 . A method of performing point-to-multipoint digital radio frequency transport, the method comprising:
- receiving radio frequency signals at a digital host unit;
 - converting the radio frequency signals to a digitized radio frequency spectrum;
 - optically transmitting a first digitized radio frequency spectrum to a first plurality of digital remote units and at least one digital expansion unit;
 - receiving the digitized radio frequency spectrum at the first plurality of digital remote units;
 - converting the digitized radio frequency spectrum to analog radio frequency signals at each of the first plurality of digital remote units;
 - receiving the digital radio frequency signals at the at least one digital expansion unit;
 - optically transmitting a second digitized radio frequency spectrum to a second plurality of digital remote units;
 - receiving the second digitized radio frequency spectrum at the second plurality of digital remote units;
 - converting the second digitized radio frequency spectrum to analog radio frequency signals at each of the second plurality of digital remote units; and
 - transmitting the analog radio frequency signals via a main radio frequency antenna at each of the first and second plurality of digital remote units.
66. A digital radio frequency transport system, comprising:
- a digital host unit; and
 - at least two digital remote units coupled to the digital host unit, wherein the at least two digital remote units each include:
 - a main radio frequency antenna;
 - a duplexer coupled to the main radio frequency antenna which receives

radio frequency signals in the reverse path and transmits radio frequency signals in the forward path;
a radio frequency to digital converter coupled to the duplexer in the reverse path;
a digital to radio frequency converter coupled to the duplexer in the forward path;
a multiplexer chip set coupled to the radio frequency to digital converter in the reverse path and the digital to radio frequency converter in the forward path;
an optical transmitter coupled to an output of the multiplexer chip set;
and
an optical receiver coupled to an input of the multiplexer chip set;
wherein the digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

67. The system of claim 66, wherein the digital host unit includes an alarm/control interface circuit.

68. The system of claim 66, wherein the digital host unit includes:
at least two optical receivers each coupled to one of the at least two digital remote units;
at least two clock and bit recover circuits each coupled to an output of one of the at least two optical receivers; and
at least two demultiplexers each coupled to an output of one of the at least two clock and bit recovery circuits.

69. The system of claim 66, wherein the digital host unit further includes a field programmable gate array coupled to an output of each of the at least two

demultiplexers, wherein the field programmable gate array receives a digital radio frequency signal from each of the at least two demultiplexers.

70. The system of claim 69, wherein the field programmable gate array includes a summer that sums together the digital radio frequency signals from each of the at least two demultiplexers.

71. The system of claim 70, wherein the field programmable gate array further includes an overflow algorithm circuit, which allows the summed digital radio frequency signals to saturate and keeps the summed signal within a defined number of bits.

72. The system of claim 71, wherein the overflow algorithm circuit comprises a limiter.

73. The system of claim 70, wherein the digital host unit further includes a digital to radio frequency converter coupled to an output of the field programmable gate array, wherein the radio frequency converter receives the summed digital radio frequency signal and converts it to an analog radio frequency signal.

74. The system of claim 73, wherein the digital to radio frequency converter comprises a digital to analog converter.

75. A digital radio frequency transport system, comprising:
a digital host unit, wherein the digital host unit includes:
a radio frequency to digital converter;
a multiplexer coupled to an output of the radio frequency to digital converter;
a plurality of optical transmitters coupled to an output of the multiplexer

a first local oscillator coupled to an input of the radio frequency to digital converter;

a reference oscillator coupled to an input of the first local oscillator;

a second local oscillator coupled to an output of the reference oscillator;

a digital to radio frequency converter coupled to an output of the second local oscillator;

a channel summer coupled to an input of the digital to radio frequency converter;

a plurality of demultiplexers coupled to the channel summer;

a plurality of clock and bit recovery circuits, wherein each of the plurality of clock and bit recovery circuits are coupled to one of each of the plurality of demultiplexers; and

a plurality of optical receivers, wherein each of the plurality of optical receivers are coupled to one of each of the plurality of optical receivers;

at least two digital remote units each coupled to one of the plurality of optical receivers, wherein the digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

76. The system of claim 75, wherein the at least two digital remote units each comprise:

an optical receiver;

a clock and bit recovery circuit coupled to an output of the optical receiver;

a demultiplexer coupled to an output of the clock and bit recovery circuit;

a digital to radio frequency converter coupled to an output of the demultiplexer;

a duplexer coupled to an output of the digital to radio frequency converter;

and

a main radio frequency antenna coupled to an output of the duplexer.

77. The system of claim 75, wherein the at least two digital remote units each comprise:

- a main radio frequency antenna;
- a duplexer coupled to the main radio frequency antenna;
- a radio frequency to digital converter coupled to an output of the duplexer;
- a multiplexer coupled to an output of the radio frequency to digital converter;
- and
- an optical transmitter coupled to an output of the multiplexer.

78. The system of claim 76, wherein the at least two digital remote units each further comprise:

- a duplexer coupled to the main radio frequency antenna;
- a radio frequency to digital converter coupled to an output of the duplexer;
- a multiplexer coupled to an output of the radio frequency to digital converter;
- and
- an optical transmitter coupled to an output of the multiplexer.

79. The system of claim 78, wherein the digital to radio frequency converter includes a digital to analog converter.

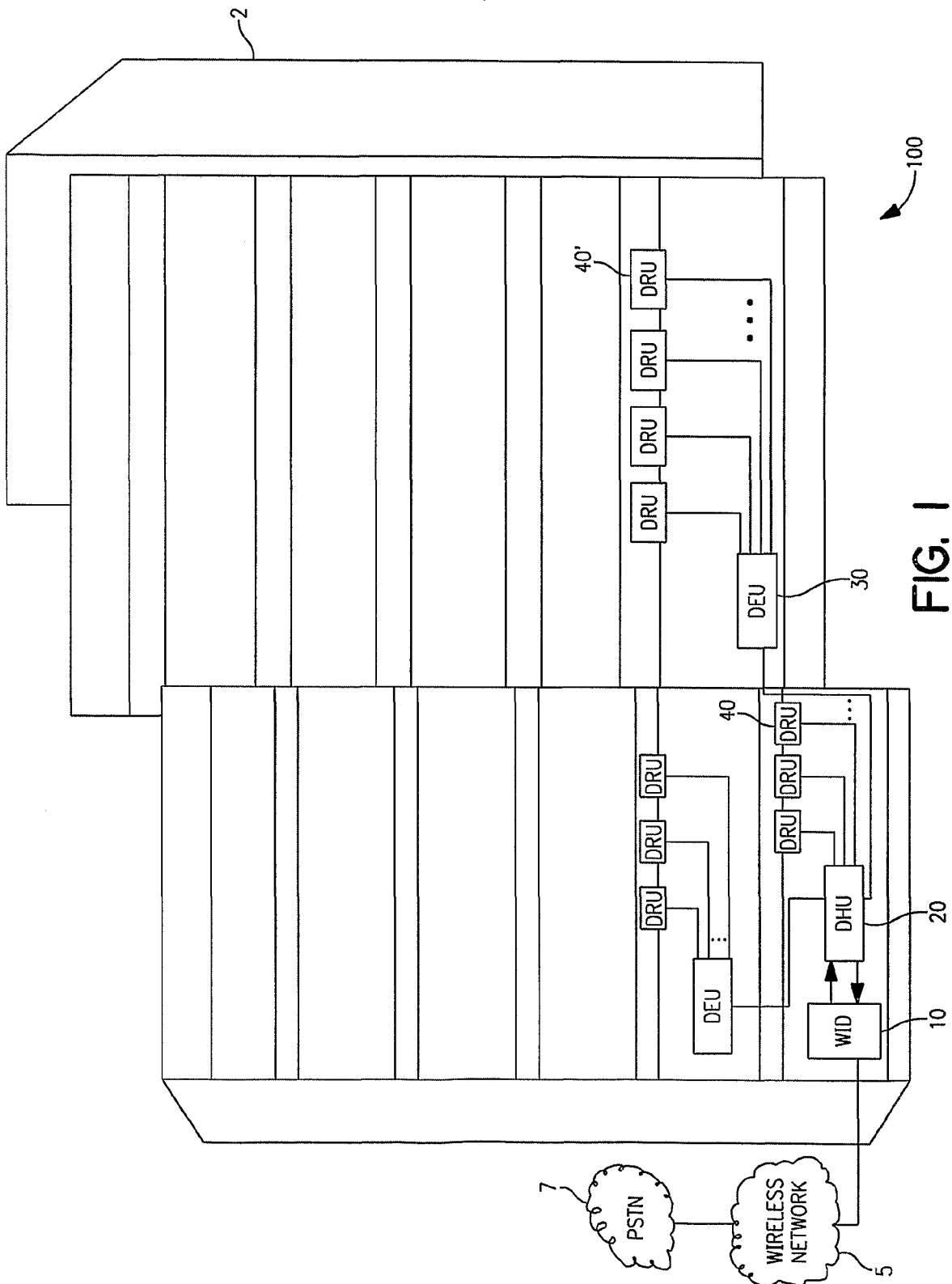
80. The system of claim 78, wherein the radio frequency converter includes an analog to digital converter.

81. The system of claim 78, wherein the at least two digital remote units each further comprise a programmable logic circuit coupled to an output of the radio frequency to digital converter and a reference oscillator coupled between the programmable logic circuit and the clock and bit recovery circuit, wherein the

programmable logic circuit monitors the system for error conditions and reports error modes.

82. The system of claim 81, wherein the at least two digital remote units each further comprise a synthesizer circuit coupled to an output of the programmable logic device and a first and a second local oscillator coupled to a first and a second output, respectively, of the synthesizer.

83. A digital radio frequency transport system, comprising:
a digital host unit, wherein the digital host unit includes a channel summer;
at least one digital expansion unit coupled to the digital host unit; and
at least two digital remote units coupled to the digital host unit, wherein the digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.



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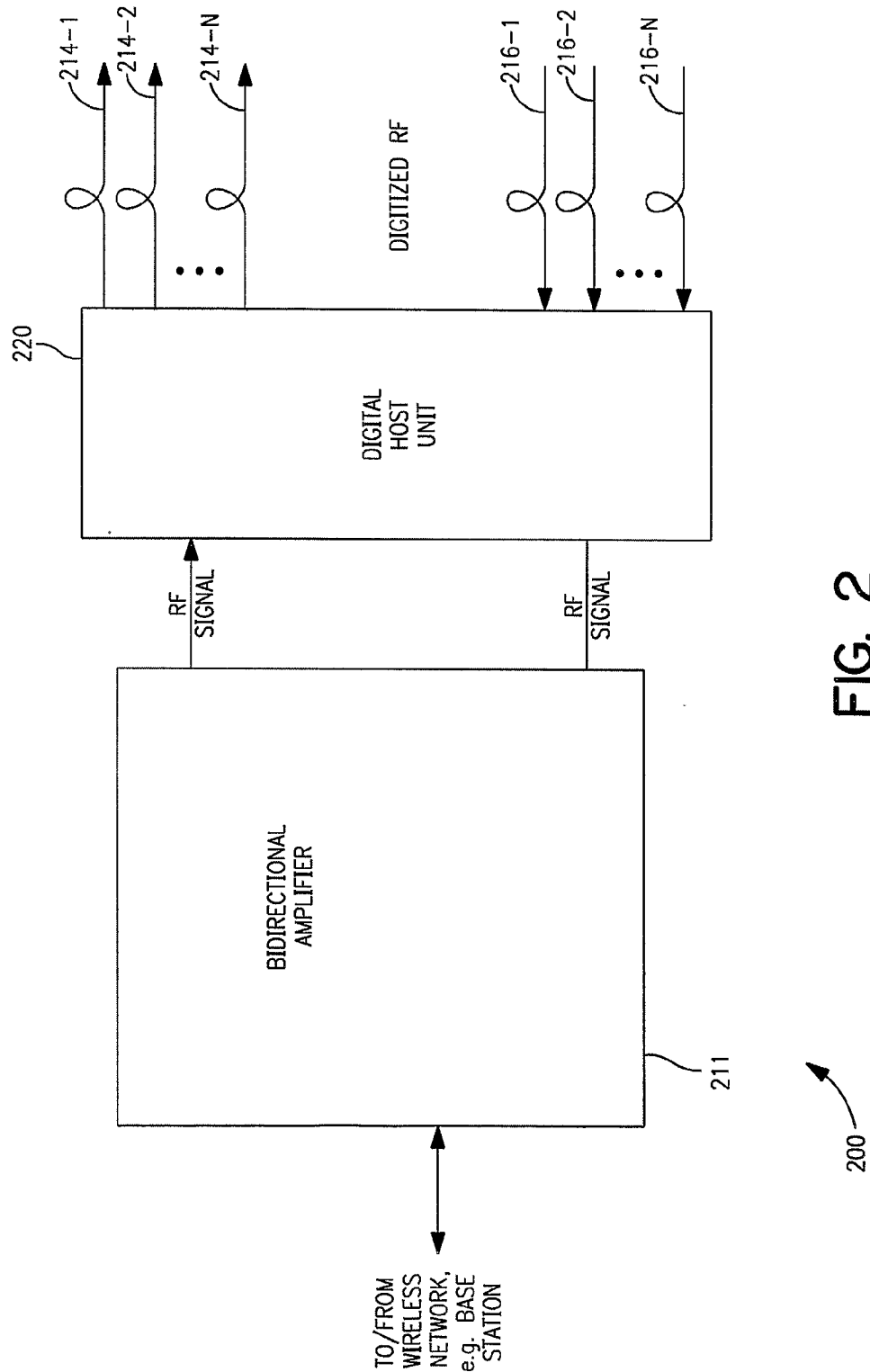


FIG. 2

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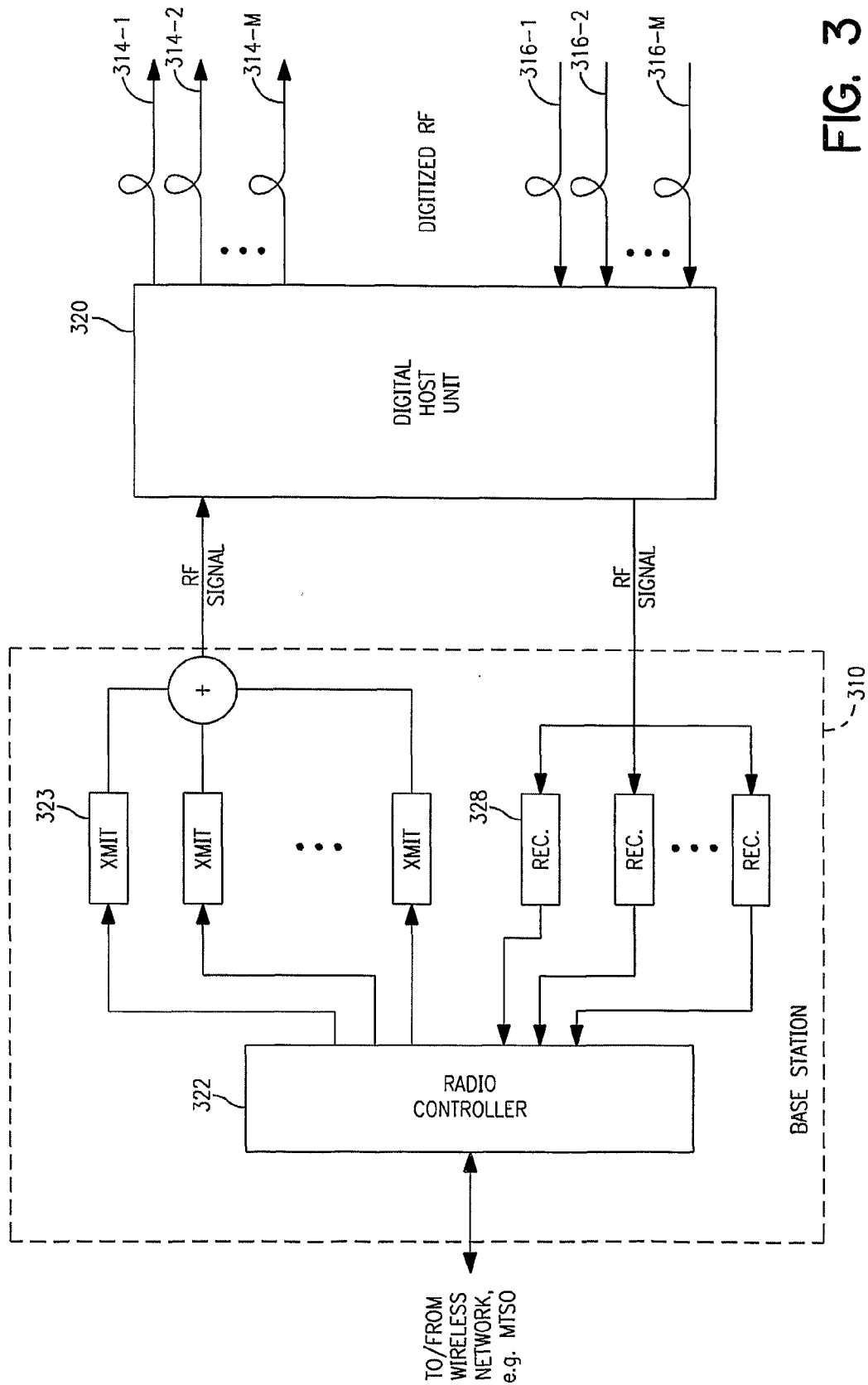
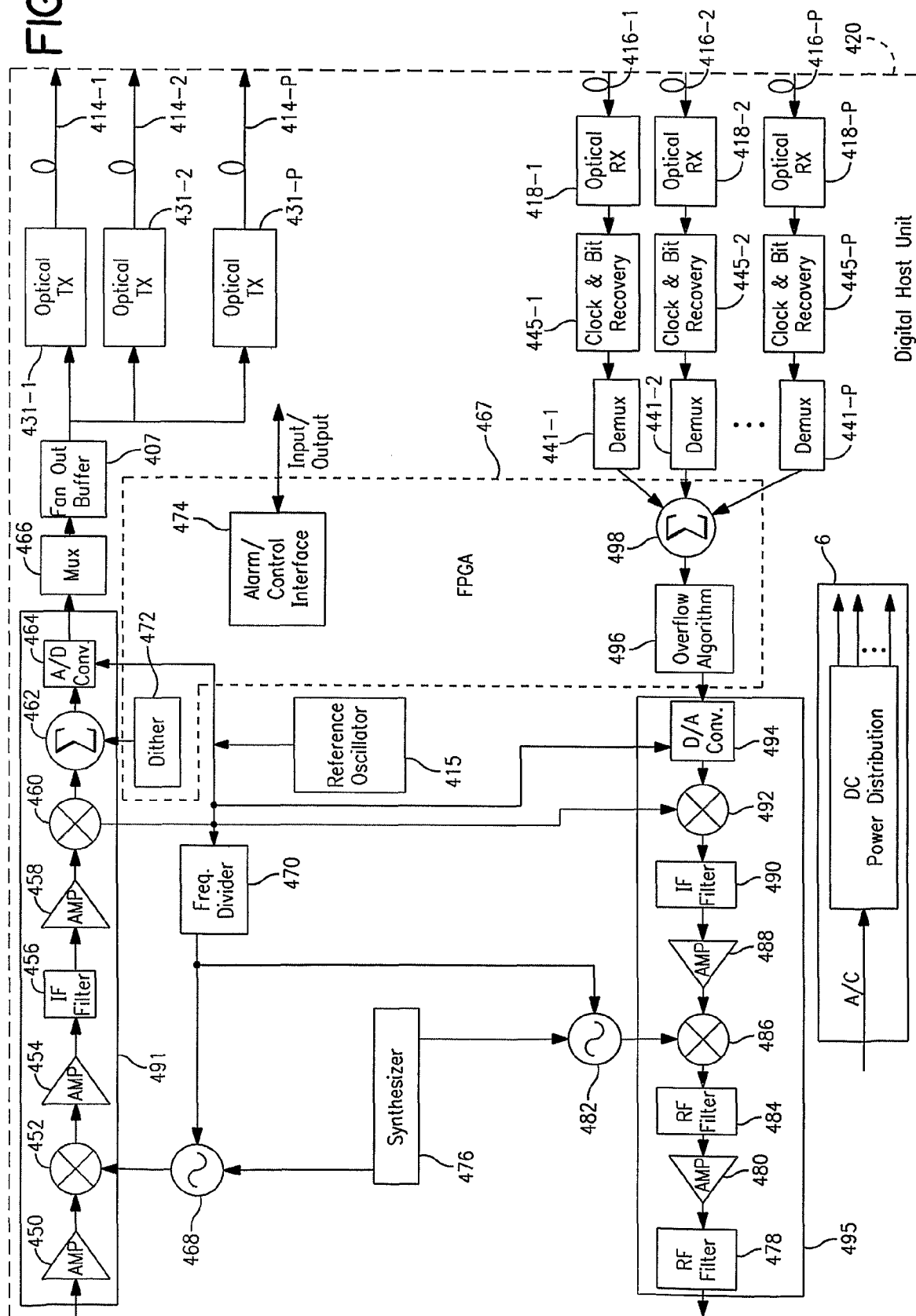


FIG. 3

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FIG. 4



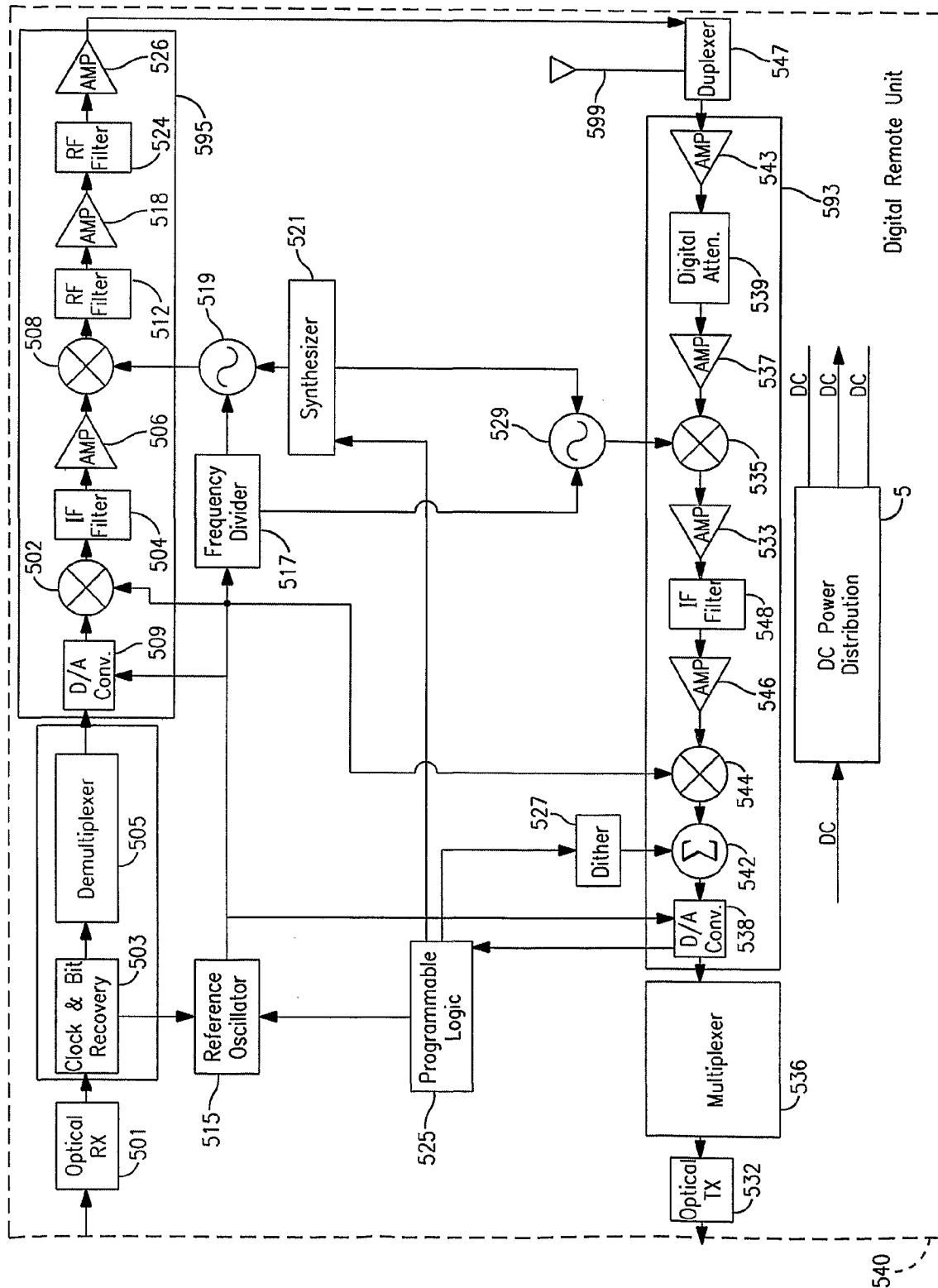
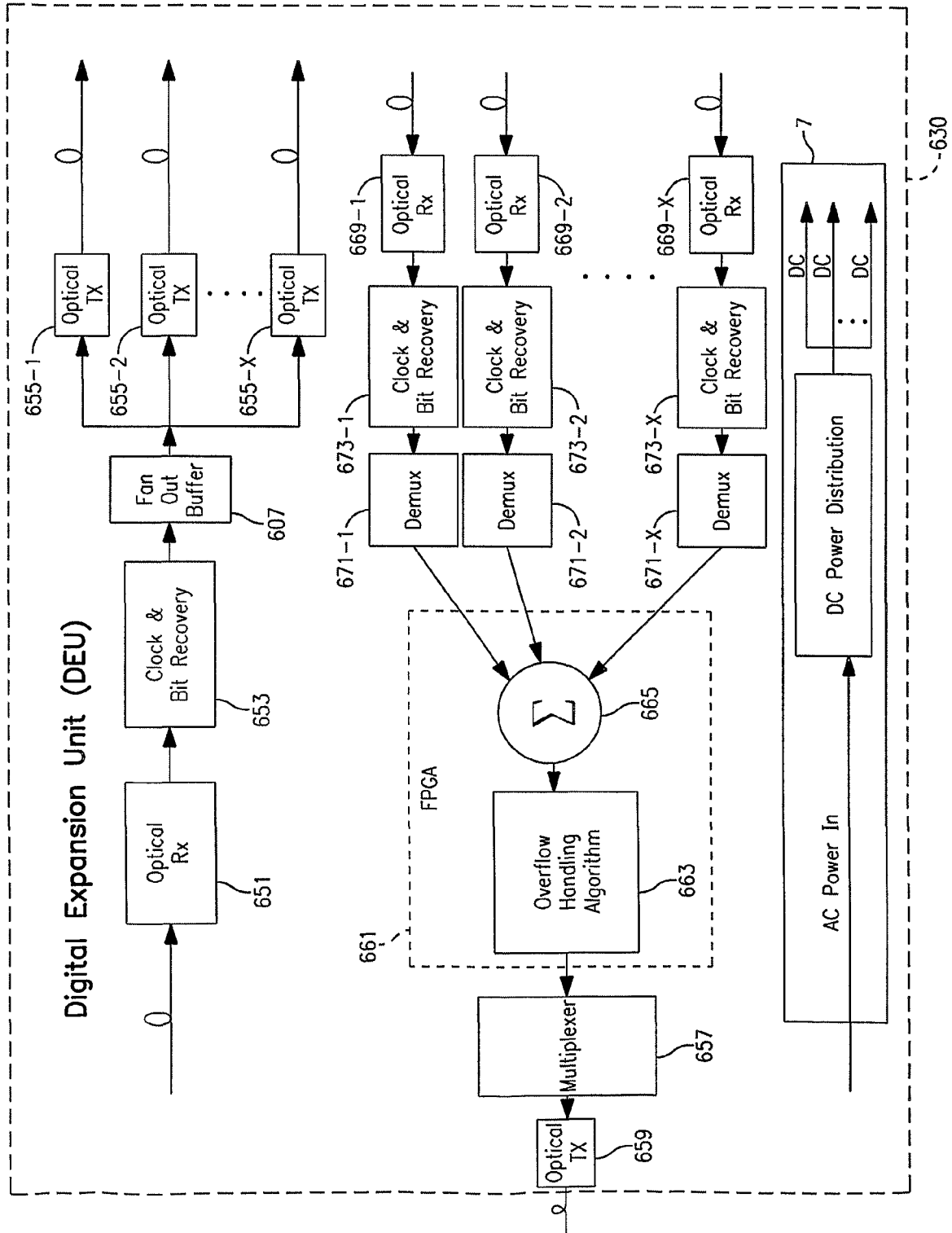
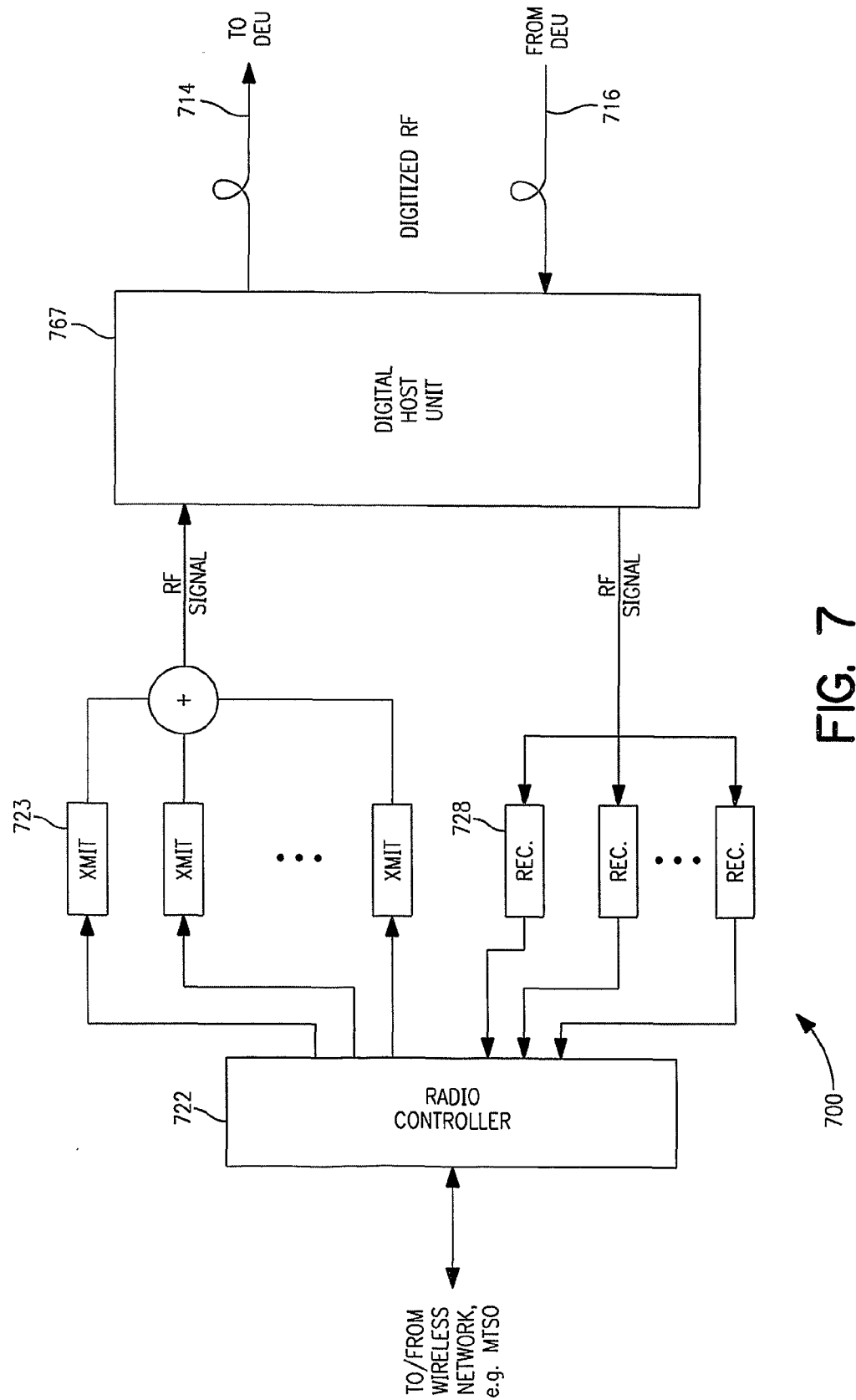


FIG. 6



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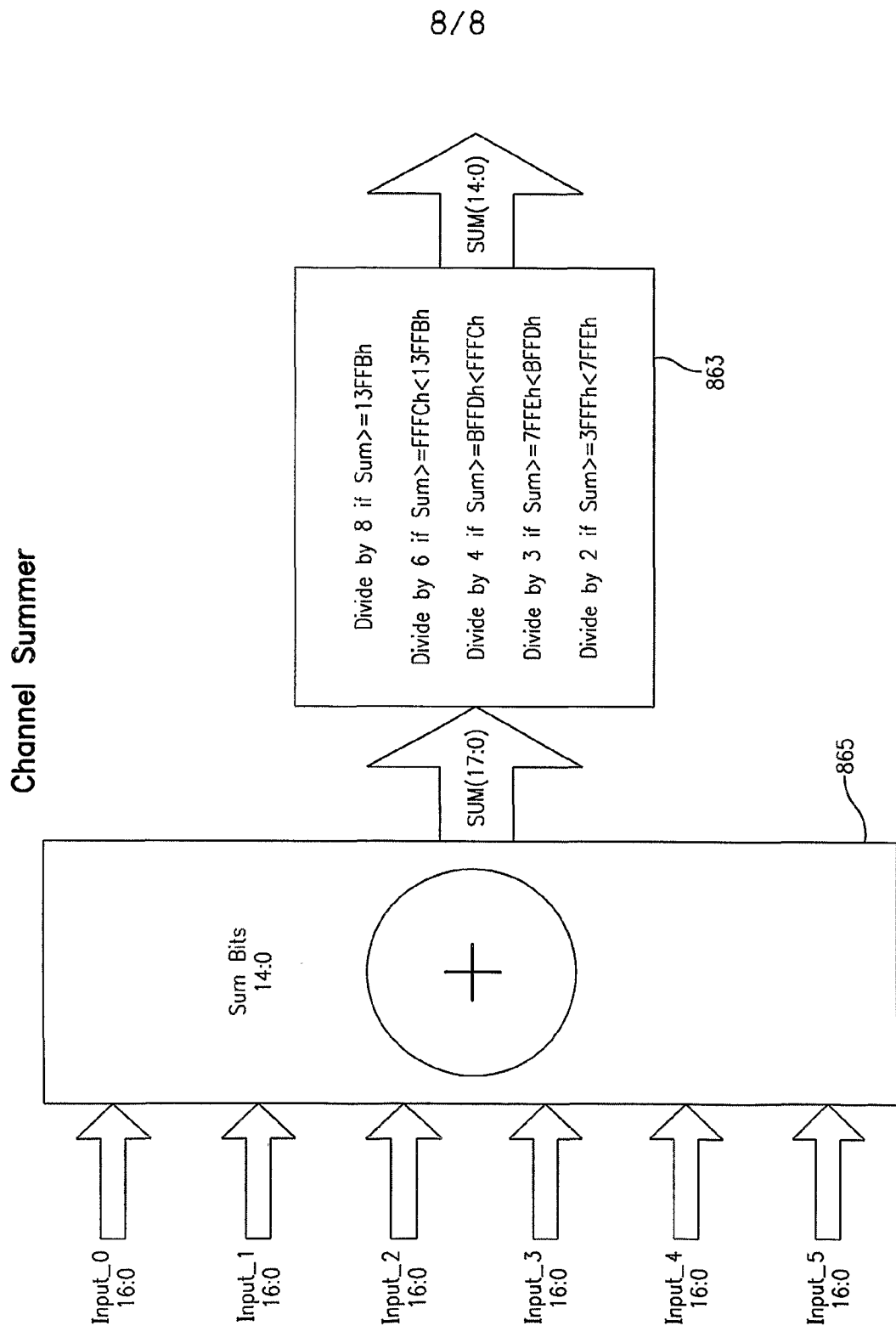


FIG. 8

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 01/21021

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B7/26

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B H04Q

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

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

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 774 789 A (DUBOVSKY GEORGE S ET AL) 30 June 1998 (1998-06-30) column 1, line 51 - line 61 column 6, line 6 -column 7, line 32; figures 1,2	1-32
Y	US 5 765 099 A (LAU KAM Y ET AL) 9 June 1998 (1998-06-09) column 1, line 19 - line 23 column 11, line 66 -column 12, line 7; claims 1-8; figure 11 --- -/--	33-83

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *Z* document member of the same patent family

Date of the actual completion of the international search

5 November 2001

Date of mailing of the international search report

15/11/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Sorrentino, A

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/21021

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>NAKATSUGAWA M ET AL: "SOFTWARE RADIO BASE AND PERSONAL STATIONS FOR CELLULAR/PCS SYSTEMS"</p> <p>VTC 2000-SPRING. 2000 IEEE 51ST. VEHICULAR TECHNOLOGY CONFERENCE PROCEEDINGS. TOKYO, JAPAN, MAY 15-18, 2000, IEEE VEHICULAR TECHNOLOGY CONFERENCE, NEW YORK, NY: IEEE, US,</p> <p>vol. 1 OF 3. CONF. 51,</p> <p>15 May 2000 (2000-05-15), pages 617-621, XP000970694</p> <p>ISBN: 0-7803-5719-1</p> <p>the whole document</p> <p>---</p>	1-83
A	<p>US 5 946 622 A (BOJERYD NILS JOHAN)</p> <p>31 August 1999 (1999-08-31)</p> <p>column 1, line 53 - line 61</p> <p>column 2, line 29 -column 3, line 14;</p> <p>figures 1-5</p> <p>---</p>	1,33,57, 60,65, 66,75,83
A	<p>AKOS D M ET AL: "DIRECT BANDPASS SAMPLING OF MULTIPLE DISTINCT RF SIGNALS"</p> <p>IEEE TRANSACTIONS ON COMMUNICATIONS, IEEE INC. NEW YORK, US,</p> <p>vol. 47, no. 7, July 1999 (1999-07), pages 983-988, XP000849074</p> <p>ISSN: 0090-6778</p> <p>abstract</p> <p>paragraphs '0002!, '0003!</p> <p>---</p>	1,33,57, 60,65, 66,75,83
A	<p>EP 0 664 621 A (ORTEL CORP)</p> <p>26 July 1995 (1995-07-26)</p> <p>column 1, line 51 -column 2, line 52</p> <p>-----</p>	1,33,57, 60,65, 66,75,83

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/21021

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5774789	A	30-06-1998	EP 0954910 A1 JP 11510355 T WO 9722186 A1	10-11-1999 07-09-1999 19-06-1997
US 5765099	A	09-06-1998	AU 715343 B2 AU 2811297 A CA 2251959 A1 EP 0894369 A1 JP 2000509224 T US 6157810 A WO 9740590 A1 US 6014546 A US 5983070 A US 5930682 A	20-01-2000 12-11-1997 30-10-1997 03-02-1999 18-07-2000 05-12-2000 30-10-1997 11-01-2000 09-11-1999 27-07-1999
US 5946622	A	31-08-1999	AU 733200 B2 AU 5508298 A BR 9713086 A CN 1276135 A DE 19782122 T0 FI 991131 A GB 2334857 A , B JP 2001503951 T WO 9823116 A2	10-05-2001 10-06-1998 28-03-2000 06-12-2000 28-10-1999 19-07-1999 01-09-1999 21-03-2001 28-05-1998
EP 0664621	A	26-07-1995	US 5457557 A AU 695818 B2 AU 1134795 A CA 2140699 A1 CN 1121281 A EP 0664621 A1 JP 7261061 A US 5515469 A	10-10-1995 20-08-1998 03-08-1995 22-07-1995 24-04-1996 26-07-1995 13-10-1995 07-05-1996

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

To:

FOGG, SLIFER & POLGLAZE, P.A.
Attn. Fogg, David N.
P.O. Box 581009
Minneapolis, MN 55458-1009
UNITED STATES OF AMERICA

Date of mailing
(day/month/year)

15/11/2001

Applicant's or agent's file reference

100.019W001

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/US 01/21021

International filing date
(day/month/year)

03/07/2001

Applicant

ADC TELECOMMUNICATIONS, INC.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46).

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Lisa O'Sullivan

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 100.019W001	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/US 01/21021	International filing date (day/month/year) 03/07/2001	(Earliest) Priority Date (day/month/year) 19/07/2000
Applicant ADC TELECOMMUNICATIONS, INC.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

A METHOD FOR POINT-TO-MULTIPOINT COMMUNICATION USING DIGITAL RADIO FREQUENCY TRANSPORT

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B7/26

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B H04Q

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

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

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 774 789 A (DUBOVSKY GEORGE S ET AL) 30 June 1998 (1998-06-30) column 1, line 51 - line 61 column 6, line 6 -column 7, line 32; figures 1,2	1-32
Y	US 5 765 099 A (LAU KAM Y ET AL) 9 June 1998 (1998-06-09) column 1, line 19 - line 23 column 11, line 66 -column 12, line 7; claims 1-8; figure 11 -/-	33-83

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

5 November 2001

Date of mailing of the international search report

15/11/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Sorrentino, A

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>NAKATSUGAWA M ET AL: "SOFTWARE RADIO BASE AND PERSONAL STATIONS FOR CELLULAR/PCS SYSTEMS"</p> <p>VTC 2000-SPRING. 2000 IEEE 51ST. VEHICULAR TECHNOLOGY CONFERENCE PROCEEDINGS. TOKYO, JAPAN, MAY 15-18, 2000, IEEE VEHICULAR TECHNOLOGY CONFERENCE, NEW YORK, NY: IEEE, US,</p> <p>vol. 1 OF 3. CONF. 51,</p> <p>15 May 2000 (2000-05-15), pages 617-621, XP000970694</p> <p>ISBN: 0-7803-5719-1</p> <p>the whole document</p>	1-83
A	<p>US 5 946 622 A (BOJERYD NILS JOHAN)</p> <p>31 August 1999 (1999-08-31)</p> <p>column 1, line 53 - line 61</p> <p>column 2, line 29 -column 3, line 14;</p> <p>figures 1-5</p>	1,33,57, 60,65, 66,75,83
A	<p>AKOS D M ET AL: "DIRECT BANDPASS SAMPLING OF MULTIPLE DISTINCT RF SIGNALS"</p> <p>IEEE TRANSACTIONS ON COMMUNICATIONS, IEEE INC. NEW YORK, US,</p> <p>vol. 47, no. 7, July 1999 (1999-07), pages 983-988, XP000849074</p> <p>ISSN: 0090-6778</p> <p>abstract</p> <p>paragraphs '0002!, '0003!</p>	1,33,57, 60,65, 66,75,83
A	<p>EP 0 664 621 A (ORTEL CORP)</p> <p>26 July 1995 (1995-07-26)</p> <p>column 1, line 51 -column 2, line 52</p>	1,33,57, 60,65, 66,75,83

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5774789	A	30-06-1998	EP 0954910 A1	10-11-1999
			JP 11510355 T	07-09-1999
			WO 9722186 A1	19-06-1997
US 5765099	A	09-06-1998	AU 715343 B2	20-01-2000
			AU 2811297 A	12-11-1997
			CA 2251959 A1	30-10-1997
			EP 0894369 A1	03-02-1999
			JP 2000509224 T	18-07-2000
			US 6157810 A	05-12-2000
			WO 9740590 A1	30-10-1997
			US 6014546 A	11-01-2000
			US 5983070 A	09-11-1999
			US 5930682 A	27-07-1999
US 5946622	A	31-08-1999	AU 733200 B2	10-05-2001
			AU 5508298 A	10-06-1998
			BR 9713086 A	28-03-2000
			CN 1276135 A	06-12-2000
			DE 19782122 T0	28-10-1999
			FI 991131 A	19-07-1999
			GB 2334857 A , B	01-09-1999
			JP 2001503951 T	21-03-2001
			WO 9823116 A2	28-05-1998
EP 0664621	A	26-07-1995	US 5457557 A	10-10-1995
			AU 695818 B2	20-08-1998
			AU 1134795 A	03-08-1995
			CA 2140699 A1	22-07-1995
			CN 1121281 A	24-04-1996
			EP 0664621 A1	26-07-1995
			JP 7261061 A	13-10-1995
			US 5515469 A	07-05-1996

Electronic Patent Application Fee Transmittal

Application Number:	13662948			
Filing Date:	29-Oct-2012			
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT			
First Named Inventor/Applicant Name:	Philip M. Wala			
Filer:	Wade A. Whisenant/Lisa Gentry			
Attorney Docket Number:	100.019US04			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
Total in USD (\$)				180

Electronic Acknowledgement Receipt

EFS ID:	16084728
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Wade A. Whisenant/Lisa Gentry
Filer Authorized By:	Wade A. Whisenant
Attorney Docket Number:	100.019US04
Receipt Date:	20-JUN-2013
Filing Date:	29-OCT-2012
Time Stamp:	13:03:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 180
RAM confirmation Number	11708
Deposit Account	502432
Authorized User	FOGG, DAVID N.

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		00374433.PDF	94265	yes	2
			2450f2424519c236fde5a6fc0b262f50c69c943		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Applicant Arguments/Remarks Made in an Amendment		2	2	
Warnings:					
Information:					
2	Non Patent Literature	00374410.PDF	224424	no	3
			35e3d4e5d3802ff3824009473e26919a56e456ad		
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	00374622.PDF	773511	no	4
			f14106044d0e84ceec748f658973e8c93817641c		
Warnings:					
Information:					
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4	Foreign Reference	00203219.PDF	1974224	no	47
			b403050dc742e24b00d23fb7f5da3417a033bfe6		
Warnings:					
Information:					
5	Non Patent Literature	00170752.PDF	462917	no	7
			0bc86107e9d2038690708de6d63458452248bf97		
Warnings:					
Information:					
6	Non Patent Literature	00262239.PDF	387190	no	9
			9c5bbde289e01823604786eab9a749babfa909c8		
Warnings:					
Information:					

7	Fee Worksheet (SB06)	fee-info.pdf	30481 36f44b669a7e7f10b14e6fbaee48c1949b8379ea	no	2
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Information:					
Total Files Size (in bytes):				3947012	
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Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce
Electronic Petition Request	TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	
Application Number	13662948	
Filing Date	29-Oct-2012	
First Named Inventor	Philip Wala	
Attorney Docket Number	100.019US04	
Title of Invention	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT	
<input checked="" type="checkbox"/> Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action <input checked="" type="checkbox"/> This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.		
Owner	Percent Interest	
ADC Telecommunications, Inc.	100%	
<p>The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)</p> <p>6704545 7639982 8326218</p> <p>as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.</p> <p>In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:</p> <ul style="list-style-type: none"> - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. 		

☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

☐ Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

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

☐ Applicant(s) status remains as SMALL ENTITY.

☒ Applicant(s) status remains as other than SMALL ENTITY.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 59593

☐ A sole inventor

☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors

☐ A joint inventor; all of whom are signing this request

☐ The assignee of record of the entire interest that has properly made itself of record pursuant to 37 CFR 3.71

Signature	/Wade A. Whisenant/
Name	Wade A. Whisenant

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	13662948			
Filing Date:	29-Oct-2012			
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT			
First Named Inventor/Applicant Name:	Philip M. Wala			
Filer:	Wade A. Whisenant/Lisa Gentry			
Attorney Docket Number:	100.019US04			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Statutory or Terminal Disclaimer	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				160

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 13662948

Filing Date: 29-Oct-2012

Applicant/Patent under Reexamination: Wala et al.

Electronic Terminal Disclaimer filed on June 19, 2013

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	16083067
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Wade A. Whisenant/Lisa Gentry
Filer Authorized By:	Wade A. Whisenant
Attorney Docket Number:	100.019US04
Receipt Date:	19-JUN-2013
Filing Date:	29-OCT-2012
Time Stamp:	14:16:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 160
RAM confirmation Number	540
Deposit Account	502432
Authorized User	FOGG, DAVID N.

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

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	34216 e34cbff1d0600356abb7dca44c545a4e1b80602f	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30288 35c28f963b40d088e2415e9af84c6ff3407a377b	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			64504		
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>					



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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
13/662,948	10/29/2012	Philip M. Wala	100.019US04

CONFIRMATION NO. 9673

PUBLICATION NOTICE



OC000000061275641

34206
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

Title:POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

Publication No.US-2013-0122952-A1

Publication Date:05/16/2013

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.

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UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/662,948	10/29/2012	Philip M. Wala	100.019US04

34206
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

CONFIRMATION NO. 9673
POA ACCEPTANCE LETTER



Date Mailed: 05/15/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/03/2013.

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.

/nhassani/

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(c).

I hereby appoint:

☒ Practitioners associated with the Customer Number: 34206

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 and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

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

☒ The address associated with Customer Number: 34206

OR

<input type="checkbox"/> Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

ADC Telecommunications, Inc.
1187 Park Place
Shakopee, MN 55379

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

<p>SIGNATURE OF Assignee of Record</p> <p>The individual whose signature and title is supplied below is authorized to act on the behalf of the assignee</p>		
Signature		Date: 23 MAY 2010
Name	Driscoll A. Nina	Telephone: 41 7144 70980
Title	Vice President of Intellectual Property	

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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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: ADC Telecommunications, Inc.

Application No./Patent No.: 13/662,948 Filed/Issue Date: 10/29/2012

Titled: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

ADC Telecommunications, Inc., a Corporation _____,
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

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

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is _____ %. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

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

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

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

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

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

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

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

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

[Page 1 of 2]

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STATEMENT UNDER 37 CFR 3.73(c)

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Reel _____, Frame _____, or for which a copy thereof is attached.

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

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The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.☐ Additional documents in the chain of title are listed on a supplemental sheet(s).☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

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

/Wade A. Whisenant/
Signature_____
May 6, 2013
Date_____
Wade A. Whisenant (Attorney)
Printed or Typed Name_____
59,593
Title or Registration Number

ASSIGNMENT

WHEREAS, I, Philip M. Wala, residing at 504 14th Avenue NW, Waseca, MN 56093, made certain new and useful inventions and improvements for which I executed an application for Letters Patent of the United States on Even Date Herewith, which is entitled POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT (the "Application").

AND WHEREAS, ADC Telecommunications, Inc., a corporation organized and existing under and by virtue of the laws of the State of Minnesota, and having an office and place of business at 12501 Whitewater Drive, Minnetonka, MN 55343, (hereinafter "Assignee") is desirous of acquiring the entire right, title and interest in and to the inventions, improvements and the Application and in and to the Letters Patent to be obtained therefor;

NOW, THEREFORE, to all whom it may concern, be it known that for good and valuable consideration, the receipt and sufficiency whereof is hereby acknowledged, I have sold, assigned, and transferred, and by these presents do sell, assign and transfer unto the Assignee, its successors or assigns, the entire right, title and interest for all countries in and to all inventions and improvements disclosed in the Application, and in and to the Application, all divisions, continuations, or renewals thereof, all Letters Patent which may be granted therefrom, and all reissues or extensions of such patents, and in and to any and all applications which have been or shall be filed in any foreign countries for Letters Patent on the inventions and improvements, including an assignment of all rights under the provisions of the International Convention, and all Letters Patent of foreign countries which may be granted therefrom; and I do hereby authorize and request the Commissioner of Patents and Trademarks to issue any and all United States Letters Patent for the inventions and improvements to the Assignee as the assignee of the entire right, title and interest in and to the same, for the use of the Assignee, its successors and assigns.

AND, for the consideration identified above, I do agree that I and my executors and legal representatives will make, execute and deliver any and all other instruments in writing including any and all further application papers, affidavits, assignments and other documents, and will communicate to the Assignee, its successors and representatives all facts known to me relating to the improvements and the history thereof and will testify in all legal proceedings and generally do all things which may be necessary or desirable more effectually to secure to and vest in the Assignee, its successors or assigns the entire right, title and interest in and to the improvements, inventions, applications, Letters Patent, rights, titles, benefits, privileges and advantages hereby sold, assigned and conveyed, or intended so to be.

Assignment

Page 2 of 2

Title: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

Attorney Docket: 100.019US01

AND, furthermore I covenant and agree with the Assignee, its successors and assigns, that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been made to others by me and that full right to convey the same as herein expressed is possessed by me.

IN TESTIMONY WHEREOF, I have hereunto set my hand this 19th day of JULY, 2000.



Philip M. Wala

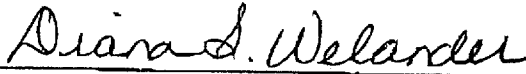
STATE of Minnesota

)ss.

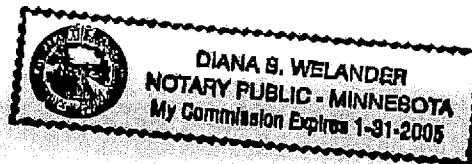
COUNTY of Wasega

On this 19th day of July, 2000, before me personally appeared Philip M. Wala to me known and known to me to be the person described in and who executed the foregoing instrument, and he duly acknowledged to me that he executed the same for the uses and purposes therein set forth.

[SEAL]



Notary Public



Electronic Acknowledgement Receipt

EFS ID:	15700736
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Wade A. Whisenant/Emily Reller
Filer Authorized By:	Wade A. Whisenant
Attorney Docket Number:	100.019US04
Receipt Date:	06-MAY-2013
Filing Date:	29-OCT-2012
Time Stamp:	16:01:25
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	00366160.PDF	295429 cc695013a0b4d758d37f9727dc4c900026368d6b	no	1

Warnings:

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing

Information:

2	Assignee showing of ownership per 37 CFR 3.73.	00366471.PDF	409417	no	4
			0102dc274dc1b7b50a5d6aa266fe6488a6218773		

Warnings:

Information:

Total Files Size (in bytes):			704846
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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.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

☒ Practitioners associated with the Customer Number:

34206

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 and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

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

☒ The address associated with Customer Number:

34206

OR

<input type="checkbox"/> Firm or Individual Name			
Address			
City	State	Zip	
Country			
Telephone	Email		

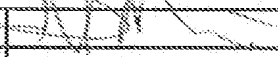
Assignee Name and Address:

ADC Telecommunications, Inc.
1187 Park Place
Shakopee, MN 55379

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

SIGNATURE of Assignee of Record

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

Signature		Date	23 MAY 2010
Name	Driscoll A. Nina	Telephone	41 7144 70980
Title	Vice President of Intellectual Property		

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.

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.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	13/662,948
Filing Date	10/29/2012
First Named Inventor	Wala
Title	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
Art Unit	2648
Examiner Name	Duc M. Nguyen
Attorney Docket Number	100.019US04

SIGNATURE of Applicant or Patent Practitioner

Signature	/Wade A. Whisenant/	Date	May 3, 2013
Name	Wade Whisenant	Telephone	952-465-0770
Registration Number	59593		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.



*Total of _____ forms are submitted.

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:	15683556
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Wade A. Whisenant/Emily Reller
Filer Authorized By:	Wade A. Whisenant
Attorney Docket Number:	100.019US04
Receipt Date:	03-MAY-2013
Filing Date:	29-OCT-2012
Time Stamp:	14:42:15
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	00366160.PDF	295429 cc695013a0b4d758d37f9727dc4c900026368d6b	no	1

Warnings:

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing

Information:

2	List-up to 10 attys appointed in a POA	00366163.PDF	86849	no	1
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Warnings:

Information:

Total Files Size (in bytes):			382278
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/662,948	10/29/2012	Philip M. Wala	100.019US04	9673
34206	7590	04/24/2013	EXAMINER	
FOGG & POWERS LLC 5810 W 78TH STREET SUITE 100 MINNEAPOLIS, MN 55439			NGUYEN, DUC M	
			ART UNIT	PAPER NUMBER
			2648	
			NOTIFICATION DATE	DELIVERY MODE
			04/24/2013	ELECTRONIC

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

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

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

DAVID@FOGGLAW.COM
docketing@fogglaw.com

Office Action Summary	Application No. 13/662,948	Applicant(s) WALA ET AL.	
	Examiner DUC M. NGUYEN	Art Unit 2648	AIA (First Inventor to File) Status No

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

Period for Reply

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

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

Status

- 1) ☒ Responsive to communication(s) filed on 29 October 2012.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 5) ☒ Claim(s) 1-40 is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) _____ is/are allowed.
- 7) ☒ Claim(s) 1-40 is/are rejected.
- 8) ☐ Claim(s) _____ is/are objected to.
- 9) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

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

Application Papers

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

Priority under 35 U.S.C. § 119

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

Certified copies:

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

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

Interim copies:

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

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 3) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>10/29/12, 3/22/13</u> | 4) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The references listed in the information disclosure statements submitted on 10/29/12 and 3/22/13 have been considered by the examiner (see attached PTO-1449).

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to

be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims **1-40** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-79 of U.S. Patent No. **6,704,545**.

Although the conflicting claims are not identical, they are not patentably distinct from each other because they both claim a host unit with an interface that digitally sums corresponding upstream digital RF samples received from a plurality of remote units to produce summed upstream digital RF samples and then converting the summed upstream digital RF samples to a replicated upstream analog wireless RF signal.

4. Claims **1-40** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-81 of U.S. Patent No. **7,639,982**.

Although the conflicting claims are not identical, they are not patentably distinct from each other because they both claim a host unit with an interface that digitally sums corresponding upstream digital RF samples received from a plurality of remote units to produce summed upstream digital RF samples and then converting the summed upstream digital RF samples to a replicated upstream analog wireless RF signal.

5. Claims **1-40** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-28 of U.S. Patent No. **8,326,218**.

Although the conflicting claims are not identical, they are not patentably distinct from

Art Unit: 2648

each other because they both claim a host unit with an interface that digitally sums corresponding upstream digital RF samples received from a plurality of remote units to produce summed upstream digital RF samples and then converting the summed upstream digital RF samples to a replicated upstream analog wireless RF signal.

Conclusion

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

See the attached PTO-892.

7. **Any response to this action should be mailed to:**

Commissioner of Patents

P.O. Box 1450

Alexandria, VA 22313-1450

or faxed to:

(571) 273-8300 (for **formal** communications intended for entry)

(571)-273-7893 (for informal or **draft** communications).

Hand-delivered responses should be brought to Customer Service Window,
Randolph Building, 401 Dulany Street, Alexandria, VA 22314.

Any inquiry concerning this communication or communications from the examiner should be directed to Duc M. Nguyen whose telephone number is (571) 272-7893,

Art Unit: 2648

Monday-Thursday (9:00 AM - 5:00 PM), or faxed to (571)-273-7893 (for informal or **draft** communications).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay Maung can be reached on 571-272-7882. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

/Duc M. Nguyen/

Primary Examiner, Art Unit 2648

Apr 19, 2013

Notice of References Cited	Application/Control No. 13/662,948	Applicant(s)/Patent Under Reexamination WALA ET AL.	
	Examiner DUC M. NGUYEN	Art Unit 2648	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,812,605	09-1998	Smith et al.	375/308
*	B	US-5,715,235	02-1998	Sawahashi et al.	370/206
*	C	US-8,326,218	12-2012	Wala, Philip M.	455/16
	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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13662948	
	Filing Date		2012-10-29	
	First Named Inventor	Wala		
	Art Unit	2648		
	Examiner Name	Duc Nguyen		
	Attorney Docket Number	100.019US04		

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					

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

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

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

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FOREIGN PATENT DOCUMENTS							Remove	
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							<input type="checkbox"/>

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

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

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

Application Number	13662948
Filing Date	2012-10-29
First Named Inventor	Wala
Art Unit	2648
Examiner Name	Duc Nguyen
Attorney Docket Number	100.019US04

1	CHINESE PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 2/4/2013, Page(s) 1-7, Published in: CN	<input type="checkbox"/>
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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	13662948
Filing Date	2012-10-29
First Named Inventor	Wala
Art Unit	
Examiner Name	
Attorney Docket Number	100.019US04

CERTIFICATION STATEMENT

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

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

OR

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

☐ See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Jon M. Powers/	Date (YYYY-MM-DD)	2013-03-22
Name/Print	Powers, Jon M.	Registration Number	43868

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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	Filing Date		2012-10-29
	First Named Inventor	Wala wala	
	Art Unit	2648	
	Examiner Name	Duc Nguyen	
	Attorney Docket Number	100.019US04	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4183054		1980-01-08	Patisaul et al.	
	2	4611323		1986-09-09	Hessenmuller	
	3	4628501		1986-12-09	Loscoe	
	4	4654843		1987-03-31	Roza et al.	
	5	4667319		1987-05-19	CHUM	
	6	4691292		1987-09-01	Rothweiler	
	7	4760573		1988-07-26	Calvignac et al.	
	8	4999831		1991-03-12	Grace	

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9	5193109		1993-03-09	Chien-Yeh Lee	
10	5243598		1993-09-07	Lee	
11	5321736		1994-06-14	Beasley	
12	5321849		1994-06-14	Lemson	
13	5339184		1994-08-16	Tang	
14	5499047		1996-03-12	Terry et al.	
15	5603080		1997-02-11	Kallander et al.	
16	5621786		1997-04-15	Fischer et al.	
17	5627879		1997-05-06	Russell et al.	
18	5642405		1997-06-24	Fischer et al.	
19	5644622		1997-07-01	Russell et al.	

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20	5657374		1997-08-12	Russell et al.	
21	5708961		1998-01-13	Hylton et al.	
22	5724385		1998-03-03	Levin et al.	
23	5765097		1998-06-09	Dail	
24	5765099		1998-06-09	Georges et al.	
25	5774789		1998-06-30	Van der Kaay et al.	
26	5802173		1998-09-01	Hamilton-Piercy et al.	
27	5809431		1998-09-15	Bustamante et al.	
28	5852651		1998-12-22	Fischer et al.	
29	5878325		1999-03-02	Dail	
30	5946622		1999-08-31	Bojeryd	

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31	5969837		1999-10-19	Farber et al.	
32	5978650		1999-11-02	Fischer et al.	
33	6005884		1999-12-21	Cook et al.	
34	6112086		2000-08-29	Wala	
35	6147786		2000-11-14	Pan	
36	6181687		2001-01-30	Bisdikian	
37	6192216		2001-02-20	Sabat, Jr. et al.	
38	6198558		2001-03-06	Graves et al.	
39	6262981		2001-07-17	Schmutz	
40	6275990		2001-08-14	Dapper et al.	
41	6317884		2001-11-13	Eames et al.	

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42	6337754		2002-01-08	Imajo	
43	6356374		2002-03-12	Farhan	
44	6362908		2002-03-26	Kimbrough et al.	
45	6373611		2002-04-16	Farhan et al.	
46	6374124		2002-04-16	Slabinski	
47	6449071		2002-09-10	Farhan et al.	
48	6466572		2002-10-15	Ethridge et al.	
49	6480551		2002-11-12	Ohishi et al.	
50	6486907		2002-11-26	Farber et al.	
51	6697603		2004-02-24	Lovinggood et al.	
52	6771933		2004-08-03	Eng et al.	

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53	6785558		2004-08-31	Stratford et al.	
54	6801767		2004-10-05	Schwartz et al.	
55	7035671		2006-04-25	Solum	

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	3	0391597	EP		1990-10-10	Chu		<input type="checkbox"/>

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4	0664621	EP		1995-07-26	Zarem et al.		<input type="checkbox"/>
5	9115927	WO		1991-10-17	Cook et al.		<input type="checkbox"/>

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17	U.S. PATENT AND TRADEMARK OFFICE, "Final Office Action", "Application Serial No. 10/740,944", 7/18/2007, Page(s) 1-21	<input type="checkbox"/>
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19	U.S. PATENT AND TRADEMARK OFFICE, "Final Office Action", "Application Serial No. 10/740,944", 10/14/2008, Page(s) 1-25	<input type="checkbox"/>
20	U.S. PATENT AND TRADEMARK OFFICE, "Notice of Allowance", "Application Serial No. 10/740,944", 8/13/2009, Page(s) 1-12	<input type="checkbox"/>
21	U.S. PATENT AND TRADEMARK OFFICE, "Office Action", "Application Serial No. 10/740,944", 8/24/2006, Page(s) 1-19	<input type="checkbox"/>
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23	U.S. PATENT AND TRADEMARK OFFICE, "Office Action", "Application Serial No. 10/740,944", 4/3/2008	<input type="checkbox"/>
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26	U.S. PATENT AND TRADEMARK OFFICE, "Office Action", "Application Serial No. 12/617,215", 4/11/2012, Page(s) 1-12	<input type="checkbox"/>
27	AKOS ET AL., "DIRECT BANDPASS SAMPLING OF MULTIPLE DISTINCT RF SIGNALS", 7/1/1999, Page(s) 983-988, Volume 47, Publisher: IEEE Transactions on Communications	<input type="checkbox"/>
28	FOXCOW WIRELESS PROPRIETARY INFORMATION, "LITENNA IN-BUILDING RF DISTRIBUTION SYSTEM", 1998, Page(s) 1-8	<input type="checkbox"/>
29	FOXCOW WIRELESS PROPRIETARY INFORMATION, "APPLICATION NOTE RFIBER-RF FIBEROPTIC LINKS FOR WIRELESS APPLICATIONS", 1998, Page(s) 3-11	<input type="checkbox"/>

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30	GRACE, MARTIN K., "Synchronous Quantized Subcarrier Multiplexing for Transport of Video, Voice and Data", "IEEE Journal on Selected Areas in Communications", Sept. 1990, Page(s) 1351-1358, Volume 8, Number 7, Publisher: IEEE	<input type="checkbox"/>
31	HARVEY ET AL., "Cordless Communications Utilising Radio Over Fibre Techniques for the Local Loop", "IEEE International Conference on Communications", June 1991, Page(s) 1171-1175, Publisher: IEEE	<input type="checkbox"/>
32	NAKATSUGAWA ET AL., "SOFTWARE RADIO BASE AND PERSONAL STATIONS FOR CELLULAR/PCS SYSTEMS", 2000, Page(s) 617-621, Publisher: IEEE	<input type="checkbox"/>
33	WALA, "A New Microcell Architecture Using Digital Optical Transport ", "Freedom Through Wireless Technology", 5/18/93, Page(s) 585-588, Publisher: Proceedings of the Vehicular Technology Conference, New York, IEEE, Published in: US	<input type="checkbox"/>

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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.



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BIB DATA SHEET

CONFIRMATION NO. 9673

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
13/662,948	10/29/2012	455	2648	100.019US04		
RULE						
APPLICANTS Philip M. Wala, Savage, MN; ADC Telecommunications, Inc., Shakopee, MN ** CONTINUING DATA ***** This application is a CON of 12/617,215 11/12/2009 PAT 8326218 * which is a CON of 10/740,944 12/19/2003 PAT 7639982 which is a CON of 09/619,431 07/19/2000 PAT 6704545 (*)Data provided by applicant is not consistent with PTO records. Yes DN No DN ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 11/19/2012						
Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Verified and /DUC M NGUYEN/ Acknowledged Examiner's Signature		<input type="checkbox"/> Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
			MN	8	40	5
ADDRESS FOGG & POWERS LLC 5810 W 78TH STREET SUITE 100 MINNEAPOLIS, MN 55439 UNITED STATES						
TITLE POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT						
FILING FEE RECEIVED 3130	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees			
			<input type="checkbox"/> 1.16 Fees (Filing)			
			<input type="checkbox"/> 1.17 Fees (Processing Ext. of time)			
			<input type="checkbox"/> 1.18 Fees (Issue)			
			<input type="checkbox"/> Other _____			
			<input type="checkbox"/> Credit			

EAST Search History


EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	6760	(digital\$3 near (summed added))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:48
L2	558	1 and "455"/\$7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:48
L3	633	1 and "370"/\$7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:48
L4	862	1 and "375"/\$7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:48
L5	313	1 and "455"/\$7.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:49
L6	380	1 and "370"/\$7.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:49
L7	692	1 and "375"/\$7.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:49
L8	1149	5 6 7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 09:49
L9	392	8 and wireless	US-PGPUB;	OR	ON	2013/04/04 09:49

			USPAT; USOCR; EPO; JPO; DERWENT			
L10	7	("5715235").URPN.	USPAT	OR	ON	2013/04/04 10:26
L11	4	("4578815" "5117502" "5193223" "5245340").PN.	US- PGPUB; USPAT; USOCR	OR	ON	2013/04/04 10:26
L12	0	10 and (digital\$3 near (summed added))	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 10:28
L13	0	11 and (digital\$3 near (summed added))	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 10:28
L14	66	("3783385" "3783413" "3991277" "4101738" "4112374" "4206320" "4230956" "4237551" "4301533" "4355405" "4492962" "4514760" "4517586" "4616364" "4621337" "4652858" "4803727" "4806881" "4825448" "4881222" "4884265" "4890283" "4893316" "4962510" "5010585" "5101501" "5103459" "5109390" "5124672" "5136612" "5159608" "5170413" "5175878" "5179360" "5187809" "5210775" "5220557" "5220583" "5224119" "5224122" "5274836" "5278837" "5287543" "5293329" "5295153" "5299192" "5309479" "5313279" "5323157" "5347284" "5373532" "5396489" "5406629" "5412352").PN. OR ("5812605").URPN.	US- PGPUB; USPAT; USOCR	OR	ON	2013/04/04 10:59
L15	3	14 and (digital\$3 near (summed added))	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 11:01
L16	173	("5535240" "6118810" "6167099" "6253060" "6370185" "6389078").PN. OR ("6697603").URPN.	US- PGPUB; USPAT; USOCR	OR	ON	2013/04/04 11:32
L17	2	16 and (digital\$3 near (summed added))	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 11:32
L18	426	(digital near repeater).ti,ab,clm.	US- PGPUB; USPAT; USOCR;	OR	ON	2013/04/04 11:40

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L19	7	18 and (digital\$3 near (summed added))	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 11:41
L20	255	(digital near repeater).bsum.	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2013/04/04 11:42
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4/ 4/ 2013 11:44:57 AM
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Search Notes 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.
	Examiner DUC M NGUYEN	Art Unit 2648

CPC- SEARCHED		
Symbol	Date	Examiner


CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	7,14, 16, 20 , 22, 560, 561	4/4/13	DN
370	906, 907, 501, 535-537	4/4/13	DN

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search history	4/4/13	DN


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

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<i>Index of Claims</i> 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.
	Examiner DUC M NGUYEN	Art Unit 2648

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

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant		<input type="checkbox"/> CPA		<input type="checkbox"/> T.D.		<input type="checkbox"/> R.1.47			
CLAIM		DATE							
Final	Original	04/19/2013							
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	2	✓							
	3	✓							
	4	✓							
	5	✓							
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	36	✓							

<p align="center"><i>Index of Claims</i></p> 	Application/Control No. 13662948	Applicant(s)/Patent Under Reexamination WALA ET AL.
	Examiner DUC M NGUYEN	Art Unit 2648

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

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47										
CLAIM		DATE								
Final	Original	04/19/2013								
	37	✓								
	38	✓								
	39	✓								
	40	✓								

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13662948	
	Filing Date		2012-10-29	
	First Named Inventor	Wala		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	100.019US04		

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

Application Number		13662948
Filing Date		2012-10-29
First Named Inventor	Wala	
Art Unit		
Examiner Name		
Attorney Docket Number	100.019US04	

1	CHINESE PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 2/4/2013, Page(s) 1-7, Published in: CN	<input type="checkbox"/>
2	CHINESE PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 1/23/2013, Page(s) 1-11, Published in: CN	<input type="checkbox"/>

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Examiner Signature		Date Considered	
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*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	13662948
Filing Date	2012-10-29
First Named Inventor	Wala
Art Unit	
Examiner Name	
Attorney Docket Number	100.019US04

CERTIFICATION STATEMENT

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

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

OR

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

☐ See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Jon M. Powers/	Date (YYYY-MM-DD)	2013-03-22
Name/Print	Powers, Jon M.	Registration Number	43868

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

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

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	15329230
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Jon M. Powers/Robert Thrumston
Filer Authorized By:	Jon M. Powers
Attorney Docket Number:	100.019US04
Receipt Date:	22-MAR-2013
Filing Date:	29-OCT-2012
Time Stamp:	11:51:32
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) Form (SB08)	00357909.PDF	759599 4a1dee4281ee0a904da2424b36eddb258a02be99	no	4

Warnings:

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Page 151

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2	Non Patent Literature	00357891.PDF	337663 ede6f5fe4b6429f28bbe88e31504d29e725b52a	no	7
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Warnings:

Information:

3	Non Patent Literature	00357897.PDF	514530 7593e56e123d9a6b3ab8e315dca74b695ebdbc3	no	11
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Total Files Size (in bytes):			1611792		
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New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 13/662,948				
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	390			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	620			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250			
TOTAL CLAIMS (37 CFR 1.16(j))	40 minus 20 =	* 20			OR	x 62 =	1240			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	5 minus 3 =	* 2				x 250 =	500			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	3000			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		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))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT B		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))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
<div style="font-size: x-small;"> * If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. </div>										



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
13/662,948	10/29/2012	2631	3130	100.019US04	40	5

CONFIRMATION NO. 9673

UPDATED FILING RECEIPT



34206
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

Date Mailed: 02/04/2013

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Inventor(s)

Philip M. Wala, Savage, MN;

Applicant(s)

ADC Telecommunications, Inc., Shakopee, MN

Assignment For Published Patent Application

ADC TELECOMMUNICATIONS, INC., Shakopee, MN

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/617,215 11/12/2009 PAT 8326218 *
which is a CON of 10/740,944 12/19/2003 PAT 7639982
which is a CON of 09/619,431 07/19/2000 PAT 6704545

(*)Data provided by applicant is not consistent with PTO records.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/662,948**

Projected Publication Date: 05/16/2013

Non-Publication Request: No

Early Publication Request: No

Title

POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

Preliminary Class

375

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/662,948	10/29/2012	Philip M. Wala	100.019US04

CONFIRMATION NO. 9673

34206
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

NOTICE



Date Mailed: 02/04/2013

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
All

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Electronic Acknowledgement Receipt

EFS ID:	14790955
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Jon M. Powers/Lisa Gentry
Filer Authorized By:	Jon M. Powers
Attorney Docket Number:	100.019US04
Receipt Date:	25-JAN-2013
Filing Date:	29-OCT-2012
Time Stamp:	14:12:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes	01/30/2013 MTEKLEMI 00000060 13662948
Payment Type	Credit Card	01 FC:1051 130.00 OP
Payment was successfully received in RAM	\$130	
RAM confirmation Number	561	Adjustment date: 01/30/2013 MTEKLEMI 01/28/2013 INTEFSW 00000561 13662948 01 FC:1000 -130.00 OP
Deposit Account	502432	
Authorized User	FOGG, DAVID N.	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:		
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)		

Applicant(s)	Wala	COMMUNICATION RE: NOTICE TO FILE CORRECTED APPLICATION PAPERS UNDER 37 C.F.R. §1.84
Serial No.	13/662,948	
Filing Date	10/29/2012	
Confirmation No.	9673	
Examiner Name	Unknown	
Group Art Unit	Unknown	
Attorney Docket No.	100.019US04	
Title: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		

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

In response to the Notice to File Corrected Application Papers mailed November 26, 2012, attached are 8 sheets of corrected drawings for the above-identified patent application.

The attached sheets of drawings include changes to all the Figures included with in the original filing –Figs. 1-8. These sheets, which include Figs. 1-8, replace the original sheets including Figs. 1-8. These replacements sheets present the drawings in proper “formal” form, without any copy marks. No substantive changes were made to the drawings.

Based on the above, it is respectfully submitted that Applicants have complied with the 37 C.F.R. §1.84 as set forth on the Notice to File Corrected Application Papers.

If the Examiner has any questions or concerns regarding this application, please contact the undersigned at 952-465-0770.

Respectfully submitted,

Date: 2013-01-25

/Jon M. Powers/
Jon M. Powers
Reg. No. 43868

Attorneys for Applicant
Fogg & Powers LLC
5810 W. 78th Street, Ste. 100
Minneapolis, MN 55439
T – (952) 465-0770
F – (952) 465-0771

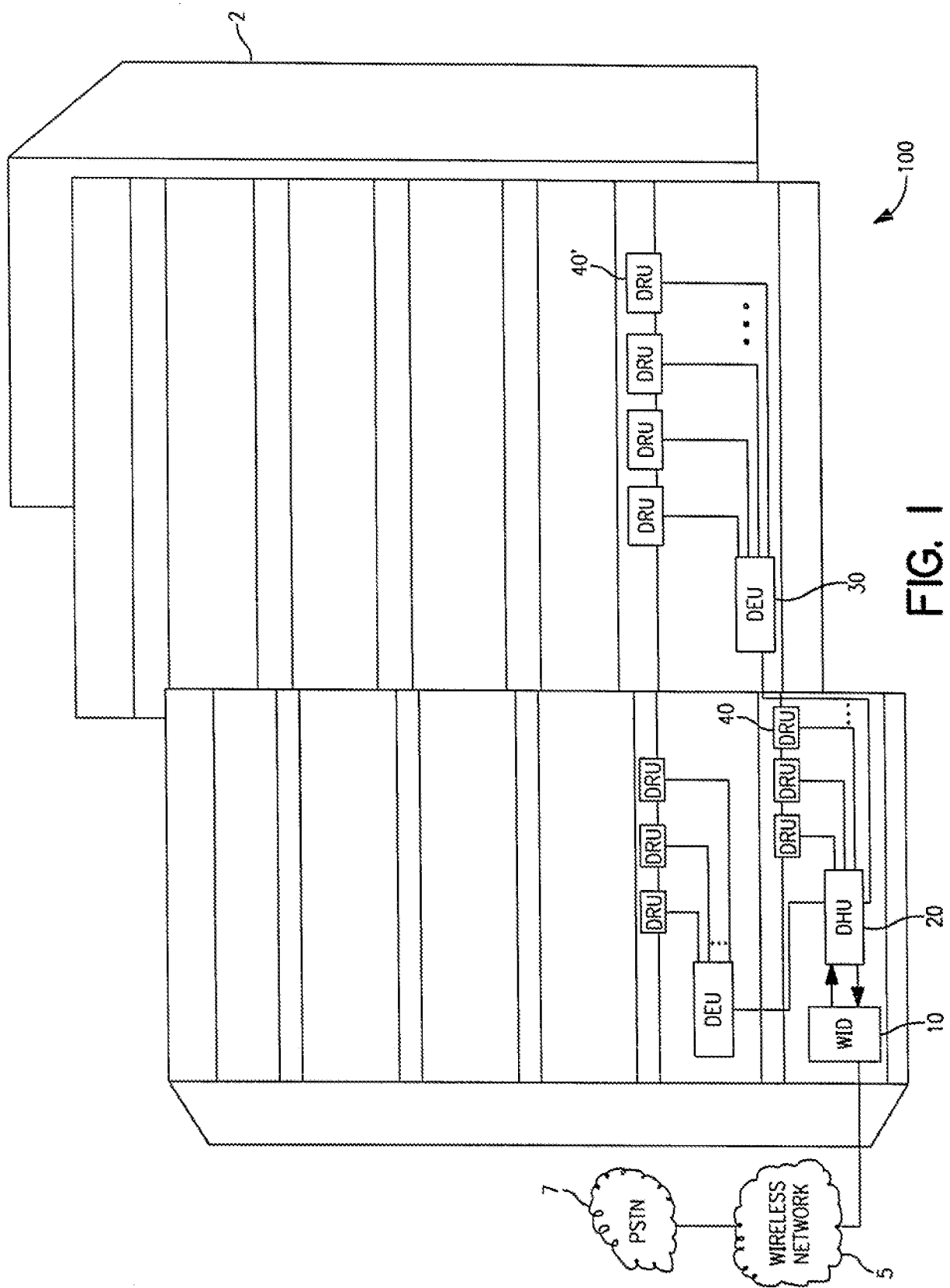


FIG. 1

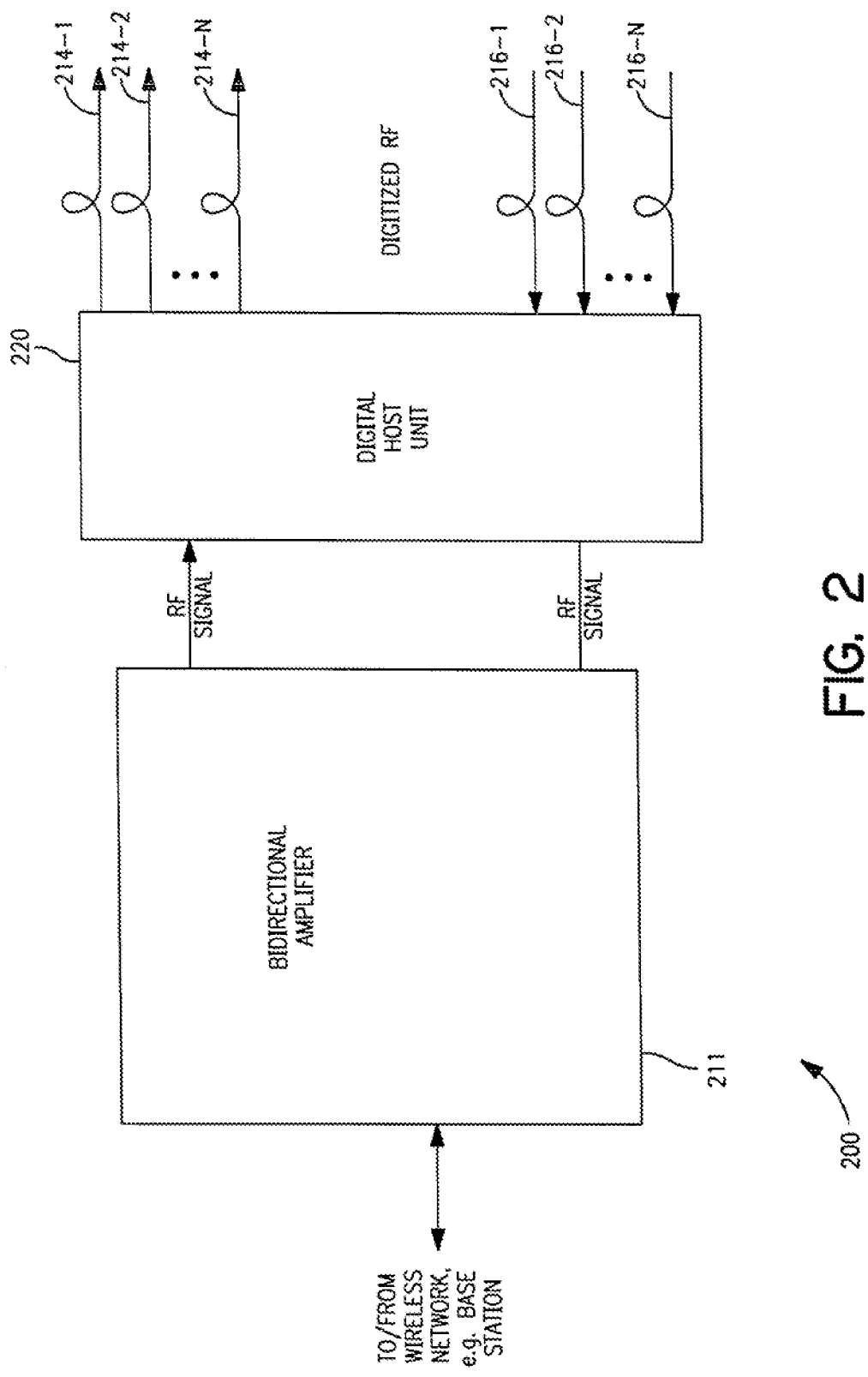


FIG. 2

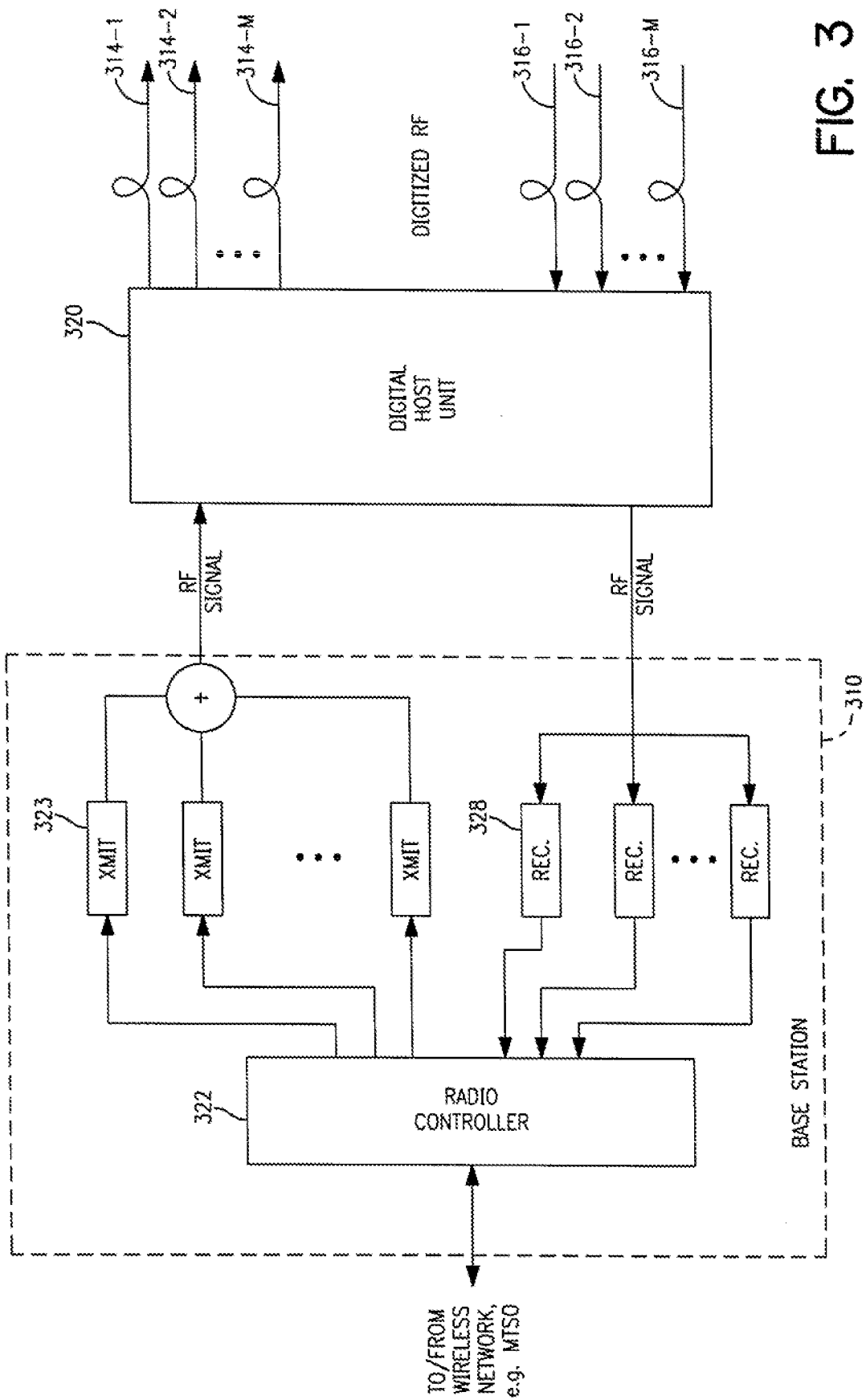


FIG. 3

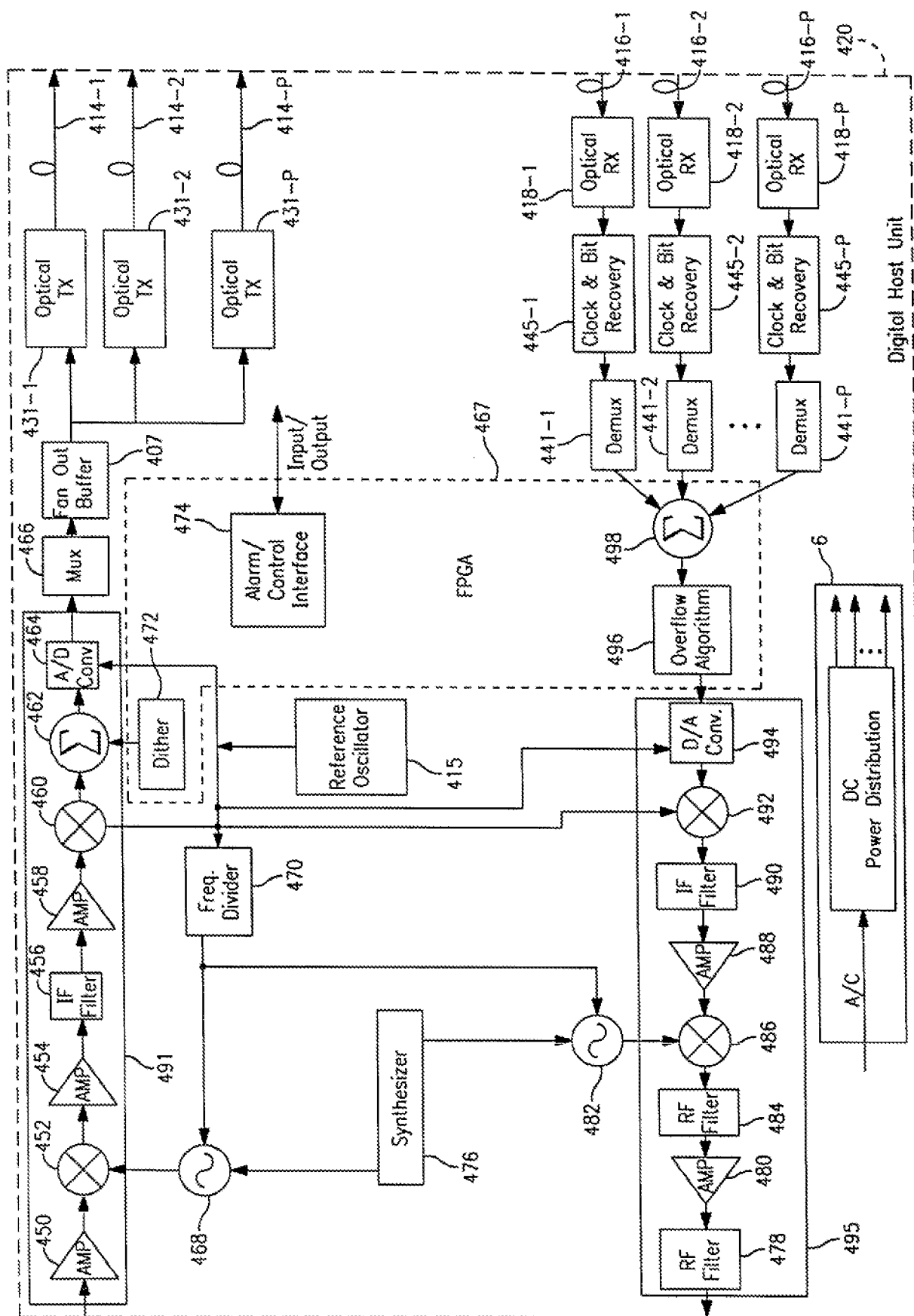


FIG. 4

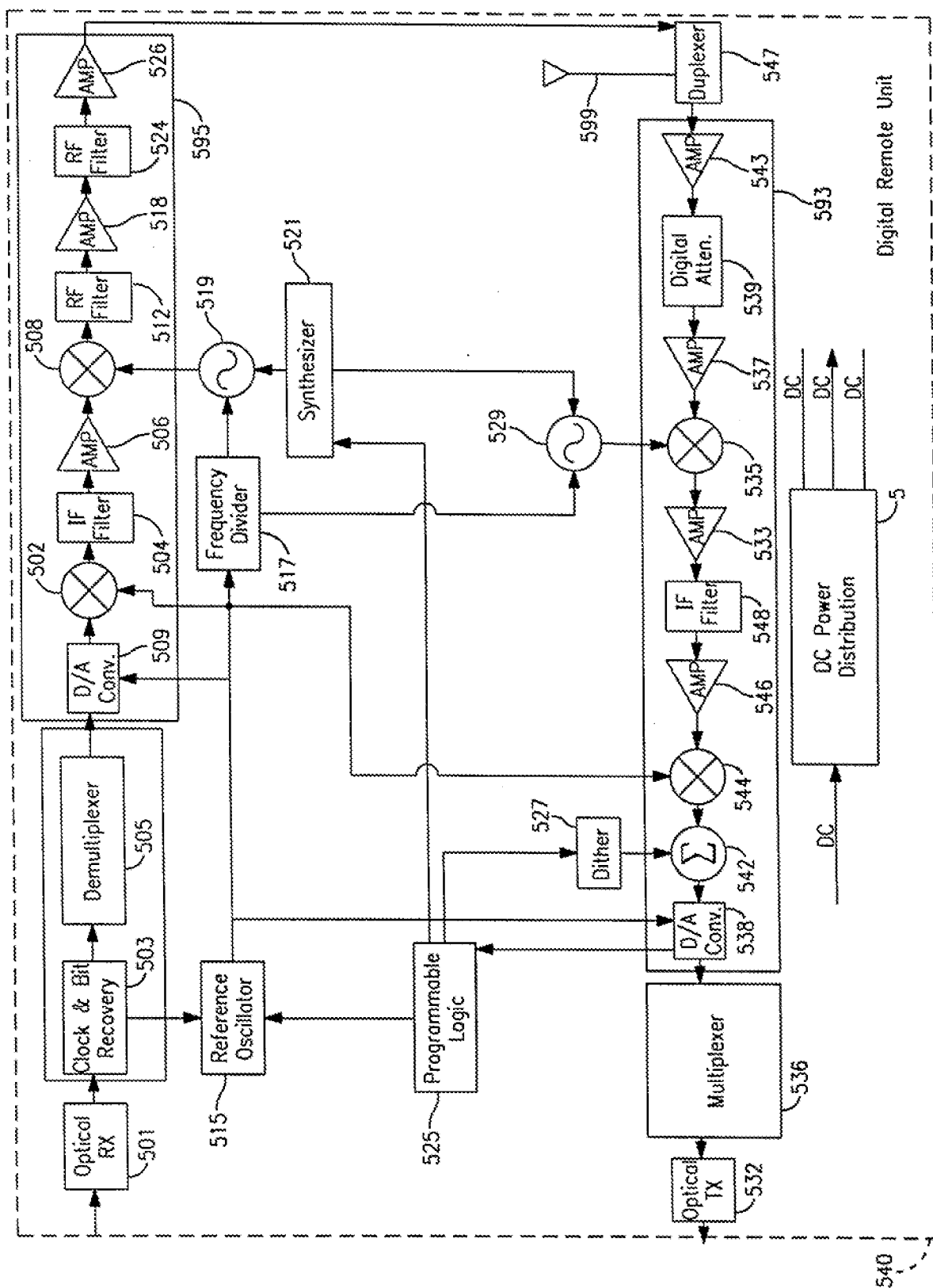


FIG. 5

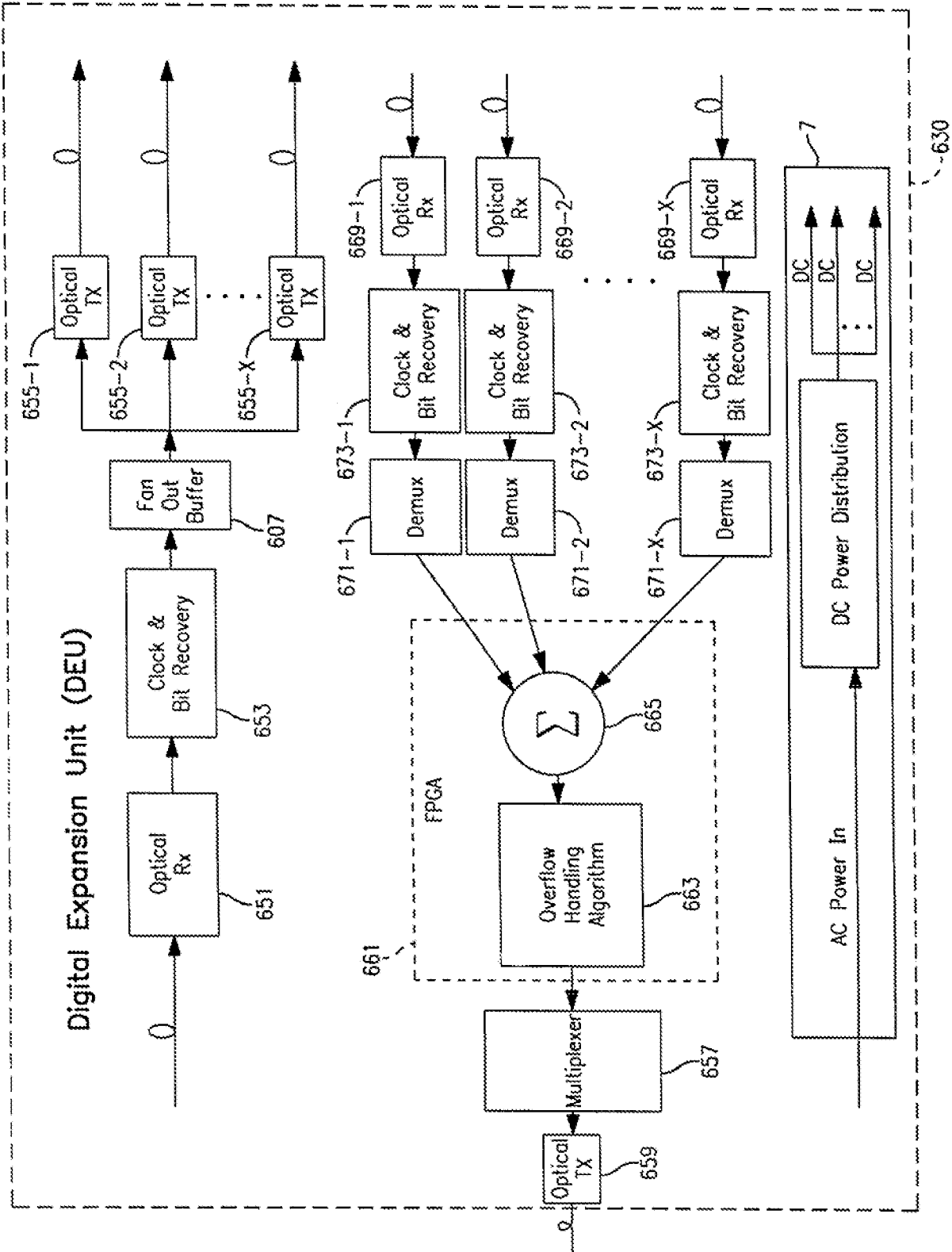


FIG. 6

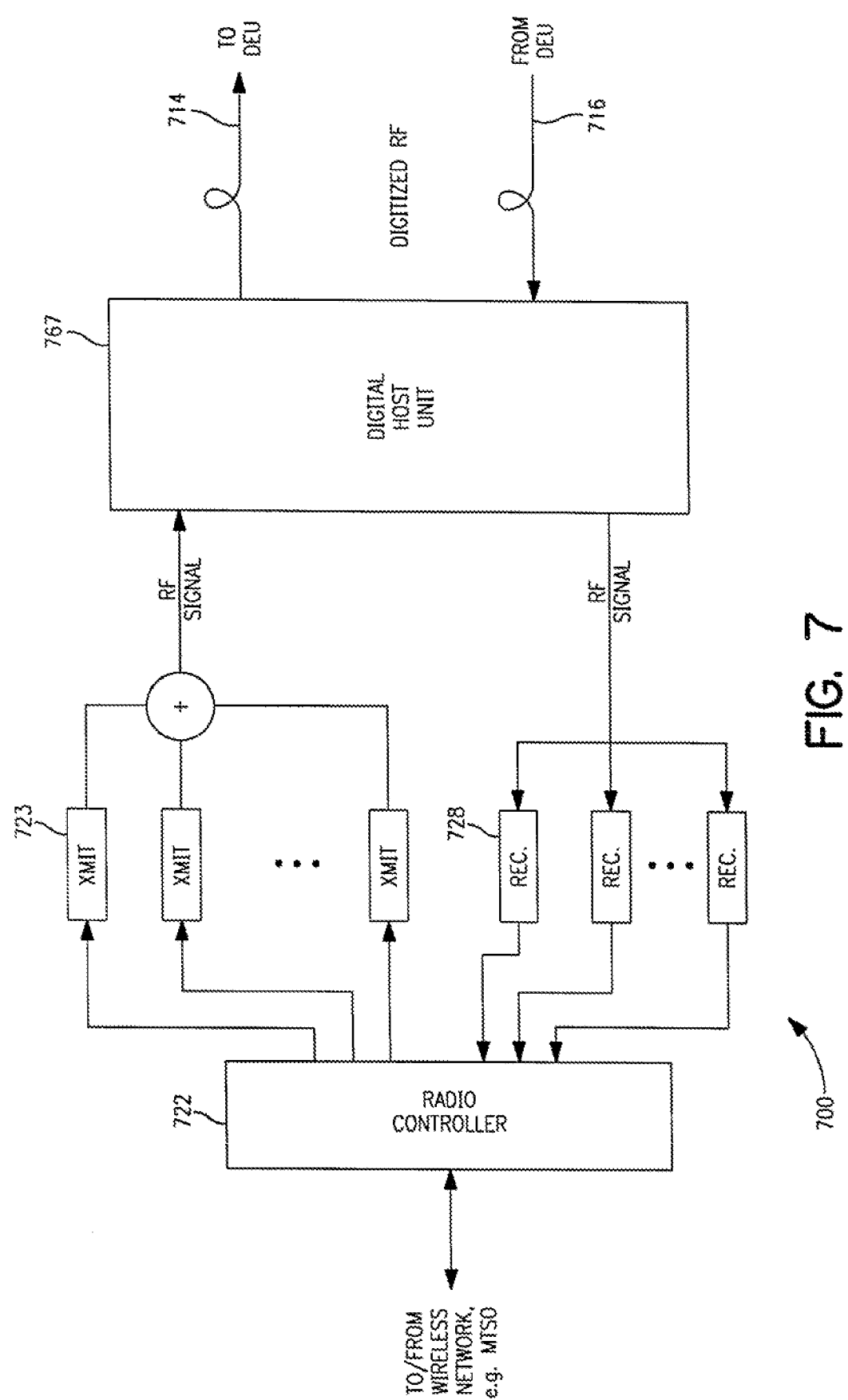


FIG. 7

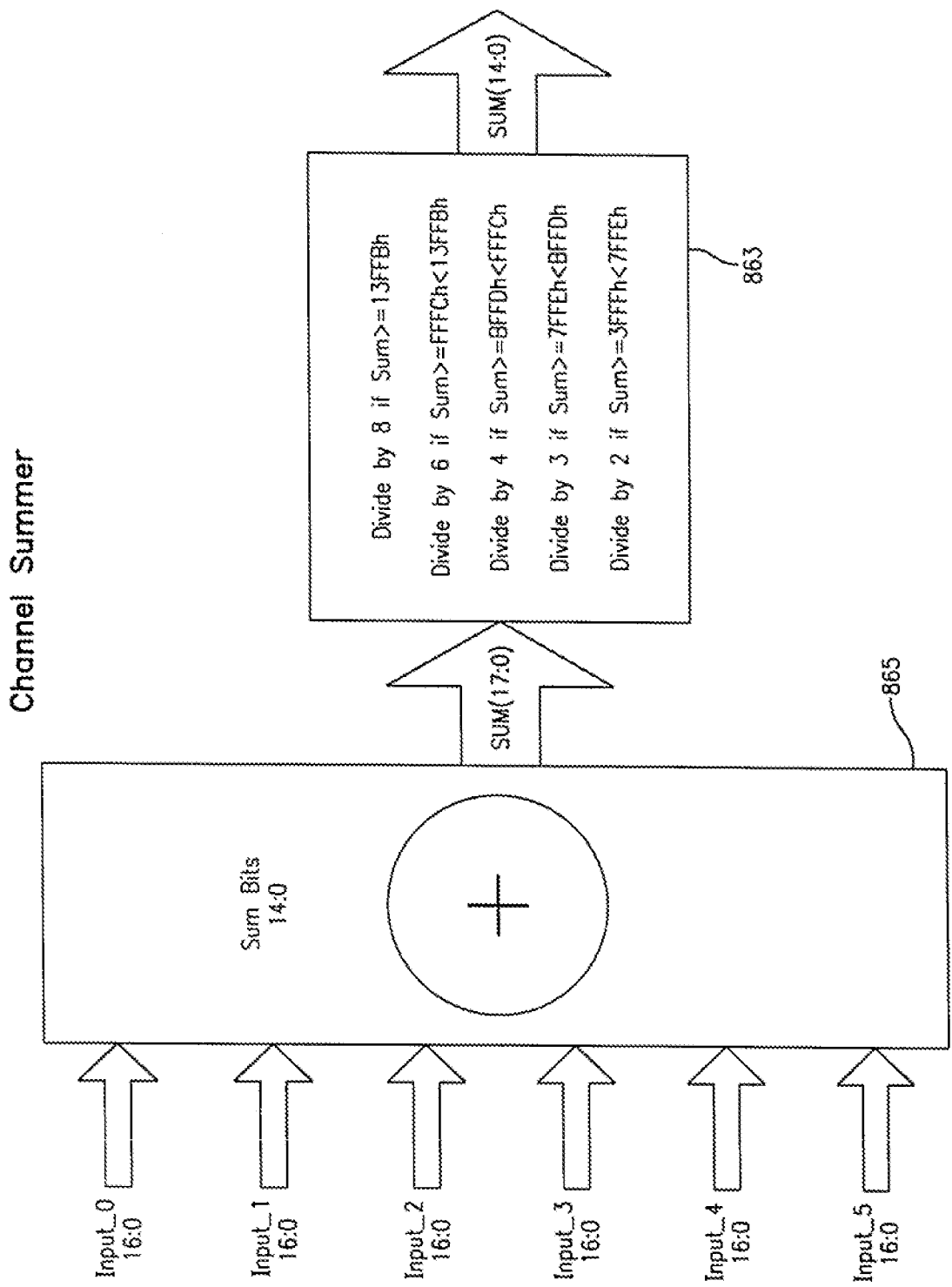


FIG. 8

Electronic Patent Application Fee Transmittal

Application Number:	13662948			
Filing Date:	29-Oct-2012			
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT			
First Named Inventor/Applicant Name:	Philip M. Wala			
Filer:	Jon M. Powers/Lisa Gentry			
Attorney Docket Number:	100.019US04			
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:				
Processing Fee, except for Provis. apps	1808	1	130	130
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				130

Electronic Acknowledgement Receipt

EFS ID:	14790955
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Jon M. Powers/Lisa Gentry
Filer Authorized By:	Jon M. Powers
Attorney Docket Number:	100.019US04
Receipt Date:	25-JAN-2013
Filing Date:	29-OCT-2012
Time Stamp:	14:12:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 130
RAM confirmation Number	561
Deposit Account	502432
Authorized User	FOGG, DAVID N.

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	00342744.PDF	117598 7f6b82374b6cb439105f3d14102e4bab432274ea	no	1
Warnings:					
Information:					
2	Drawings-only black and white line drawings	00341899.PDF	3857199 4038ac6a3b7bc0e83cee77fb406396482d7e0767	no	8
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30378 b2e07057780ca5352ea7aa09a50a7d7c585a4a53	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			4005175		
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
13/662,948

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	390
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A				N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A				N/A	250
TOTAL CLAIMS (37 CFR 1.16(j))	40	minus 20 = *	20			OR	x 62 =	1240
INDEPENDENT CLAIMS (37 CFR 1.16(h))	5	minus 3 = *	2				x 250 =	500
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))								0.00
				TOTAL			TOTAL	3000

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT A		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))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT B		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))							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.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
13/662,948	10/29/2012	2631	3000	100.019US04	40	5

CONFIRMATION NO. 9673

34206
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

FILING RECEIPT



OC000000057712445

Date Mailed: 11/26/2012

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Applicant(s)

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Assignment For Published Patent Application

ADC TELECOMMUNICATIONS, INC., Shakopee, MN

Power of Attorney: None

Domestic Priority data as claimed by applicant

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/662,948**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

Title

POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

Preliminary Class

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/662,948	10/29/2012	Philip M. Wala	100.019US04

CONFIRMATION NO. 9673

FORMALITIES LETTER



34206
FOGG & POWERS LLC
5810 W 78TH STREET
SUITE 100
MINNEAPOLIS, MN 55439

Date Mailed: 11/26/2012

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given **TWO MONTHS** from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - The drawings must be reasonably free from erasures and must be free from alterations, overwriting, interlineations, folds, and copy marks. See Figure(s) 1-8.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of \$ **130** for a non-small entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is \$ **130** for a non-small entity

- \$ **130** Surcharge.

Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
All

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

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

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
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For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/sgorems/

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

Electronic Acknowledgement Receipt

Adjustment date: 11/20/2012 CCETIN
 11/19/2012 CCETIN 00000036 502432 13662948
 01 FC:1051 130.00 CR

EFS ID:	14096624
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Jon M. Powers
Filer Authorized By:	
Attorney Docket Number:	100.019US04
Receipt Date:	29-OCT-2012
Filing Date:	
Time Stamp:	15:38:42
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 3000
RAM confirmation Number	1499
Deposit Account	502432
Authorized User	FOGG, DAVID N.

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 1.21 (Miscellaneous fees and charges)

Electronic Acknowledgement Receipt

EFS ID:

14096624

Application Number:

13662948

International Application Number:**Confirmation Number:**

9673

11/19/2012 CCETIN 00000036 502432 13662948
01 FC:1051 130.00 DA

Title of Invention:

POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

First Named Inventor/Applicant Name:

Philip M. Wala

Customer Number:

34206

Filer:

Jon M. Powers

Filer Authorized By:**Attorney Docket Number:**

100.019US04

Receipt Date:

29-OCT-2012

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Authorized User

FOGG, DAVID N.

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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 1.21 (Miscellaneous fees and charges)

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	Filing Date		
	First Named Inventor	Wala	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	100.019US04	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4183054		1980-01-08	Patisaul et al.	
	2	4611323		1986-09-09	Hessenmuller	
	3	4628501		1986-12-09	Loscoe	
	4	4654843		1987-03-31	Roza et al.	
	5	4667319		1987-05-19	CHUM	
	6	4691292		1987-09-01	Rothweiler	
	7	4760573		1988-07-26	Calvignac et al.	
	8	4999831		1991-03-12	Grace	

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Application Number		
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Art Unit		
Examiner Name		
Attorney Docket Number	100.019US04	

9	5193109		1993-03-09	Chien-Yeh Lee	
10	5243598		1993-09-07	Lee	
11	5321736		1994-06-14	Beasley	
12	5321849		1994-06-14	Lemson	
13	5339184		1994-08-16	Tang	
14	5499047		1996-03-12	Terry et al.	
15	5603080		1997-02-11	Kallander et al.	
16	5621786		1997-04-15	Fischer et al.	
17	5627879		1997-05-06	Russell et al.	
18	5642405		1997-06-24	Fischer et al.	
19	5644622		1997-07-01	Russell et al.	

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	20	5657374		1997-08-12	Russell et al.	
	21	5708961		1998-01-13	Hylton et al.	
	22	5724385		1998-03-03	Levin et al.	
	23	5765097		1998-06-09	Dail	
	24	5765099		1998-06-09	Georges et al.	
	25	5774789		1998-06-30	Van der Kaay et al.	
	26	5802173		1998-09-01	Hamilton-Piercy et al.	
	27	5809431		1998-09-15	Bustamante et al.	
	28	5852651		1998-12-22	Fischer et al.	
	29	5878325		1999-03-02	Dail	
	30	5946622		1999-08-31	Bojeryd	

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	31	5969837		1999-10-19	Farber et al.	
	32	5978650		1999-11-02	Fischer et al.	
	33	6005884		1999-12-21	Cook et al.	
	34	6112086		2000-08-29	Wala	
	35	6147786		2000-11-14	Pan	
	36	6181687		2001-01-30	Bisdikian	
	37	6192216		2001-02-20	Sabat, Jr. et al.	
	38	6198558		2001-03-06	Graves et al.	
	39	6262981		2001-07-17	Schmutz	
	40	6275990		2001-08-14	Dapper et al.	
	41	6317884		2001-11-13	Eames et al.	

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Art Unit		
Examiner Name		
Attorney Docket Number	100.019US04	

	42	6337754		2002-01-08	Imajo	
	43	6356374		2002-03-12	Farhan	
	44	6362908		2002-03-26	Kimbrough et al.	
	45	6373611		2002-04-16	Farhan et al.	
	46	6374124		2002-04-16	Slabinski	
	47	6449071		2002-09-10	Farhan et al.	
	48	6466572		2002-10-15	Ethridge et al.	
	49	6480551		2002-11-12	Ohishi et al.	
	50	6486907		2002-11-26	Farber et al.	
	51	6697603		2004-02-24	Lovinggood et al.	
	52	6771933		2004-08-03	Eng et al.	

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	53	6785558		2004-08-31	Stratford et al.	
	54	6801767		2004-10-05	Schwartz et al.	
	55	7035671		2006-04-25	Solum	

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	1	1127056	CN		1996-07-17	Russell et al.		<input type="checkbox"/>
	2	3707244	DE		1988-09-15	Schalamon		<input type="checkbox"/>
	3	0391597	EP		1990-10-10	Chu		<input type="checkbox"/>

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First Named Inventor	Wala	
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Attorney Docket Number	100.019US04	

4	0664621	EP		1995-07-26	Zarem et al.		<input type="checkbox"/>
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	7	CHINESE PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 6/21/2012, Page(s) 1-18, Published in: CN	<input type="checkbox"/>

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Examiner Name		
Attorney Docket Number	100.019US04	

8	CHINESE PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 4/6/2012, Page(s) 1-12, Published in: CN	<input type="checkbox"/>
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10	EUROPEAN PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 2/24/2006, Page(s) 1-5, Published in: EP	<input type="checkbox"/>
11	EUROPEAN PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 3/6/2007, Page(s) 1-4, Published in: EP	<input type="checkbox"/>
12	EUROPEAN PATENT OFFICE, "Office Action", "from Foreign Counterpart of U.S. Application No. 09/619,431", 11/16/2010, Page(s) 1-4, Published in: EP	<input type="checkbox"/>
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STATEMENT BY APPLICANT**
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Application Number		
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First Named Inventor	Wala	
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Examiner Name		
Attorney Docket Number	100.019US04	

19	U.S. PATENT AND TRADEMARK OFFICE, "Final Office Action", "Application Serial No. 10/740,944", 10/14/2008, Page(s) 1-25	<input type="checkbox"/>
20	U.S. PATENT AND TRADEMARK OFFICE, "Notice of Allowance", "Application Serial No. 10/740,944", 8/13/2009, Page(s) 1-12	<input type="checkbox"/>
21	U.S. PATENT AND TRADEMARK OFFICE, "Office Action", "Application Serial No. 10/740,944", 8/24/2006, Page(s) 1-19	<input type="checkbox"/>
22	U.S. PATENT AND TRADEMARK OFFICE, "Final Office Action", "Application Serial No. 10/740,944", 2/5/2007, Page(s) 1-16	<input type="checkbox"/>
23	U.S. PATENT AND TRADEMARK OFFICE, "Office Action", "Application Serial No. 10/740,944", 4/3/2008	<input type="checkbox"/>
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25	U.S. PATENT AND TRADEMARK OFFICE, "Notice of Allowance", "Application Serial No. 12/617,215", 8/2/2012, Page(s) 1-11	<input type="checkbox"/>
26	U.S. PATENT AND TRADEMARK OFFICE, "Office Action", "Application Serial No. 12/617,215", 4/11/2012, Page(s) 1-12	<input type="checkbox"/>
27	AKOS ET AL., "DIRECT BANDPASS SAMPLING OF MULTIPLE DISTINCT RF SIGNALS", 7/1/1999, Page(s) 983-988, Volume 47, Publisher: IEEE Transactions on Communications	<input type="checkbox"/>
28	FOXCOW WIRELESS PROPRIETARY INFORMATION, "LITENNA IN-BUILDING RF DISTRIBUTION SYSTEM", 1998, Page(s) 1-8	<input type="checkbox"/>
29	FOXCOW WIRELESS PROPRIETARY INFORMATION, "APPLICATION NOTE RFIBER-RF FIBEROPTIC LINKS FOR WIRELESS APPLICATIONS", 1998, Page(s) 3-11	<input type="checkbox"/>

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor	Wala	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	100.019US04	

30	GRACE, MARTIN K., "Synchronous Quantized Subcarrier Multiplexing for Transport of Video, Voice and Data", "IEEE Journal on Selected Areas in Communications", Sept. 1990, Page(s) 1351-1358, Volume 8, Number 7, Publisher: IEEE	<input type="checkbox"/>
31	HARVEY ET AL., "Cordless Communications Utilising Radio Over Fibre Techniques for the Local Loop", "IEEE International Conference on Communications", June 1991, Page(s) 1171-1175, Publisher: IEEE	<input type="checkbox"/>
32	NAKATSUGAWA ET AL., "SOFTWARE RADIO BASE AND PERSONAL STATIONS FOR CELLULAR/PCS SYSTEMS", 2000, Page(s) 617-621, Publisher: IEEE	<input type="checkbox"/>
33	WALA, "A New Microcell Architecture Using Digital Optical Transport ", "Freedom Through Wireless Technology", 5/18/93, Page(s) 585-588, Publisher: Proceedings of the Vehicular Technology Conference, New York, IEEE, Published in: US	<input type="checkbox"/>

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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.

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Application Number	
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Art Unit	
Examiner Name	
Attorney Docket Number	100.019US04

CERTIFICATION STATEMENT

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

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

OR

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

☐ See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Jon M. Powers/	Date (YYYY-MM-DD)	2012-10-29
Name/Print	Powers, Jon M.	Registration Number	43868

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

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

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

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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.

!Applicant	Wala	IDS COMMUNICATION
Serial No.	Not Assigned	
Filing Date	Herewith	
Group Art Unit	Not Assigned	
Examiner Name	Unknown	
Confirmation No.	Not Assigned	
Attorney Docket No.	100.019US04	
Title: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		

In compliance with 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. § 1.97, *et seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. All of the references listed were previously disclosed by the Applicant or cited by the Examiner in the parent applications 09/619,431 filed on 7/19/2000, 10/740,944 filed on 12/19/2003 and 12/617,215 filed on 11/12/2009; copies are therefore not enclosed.

The below listed documents have not been made of record in the parent application and therefore are being included herewith:

- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 7/8/2005
- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 5/11/2007
- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 10/26/2007
- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 3/7/2007
- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 3/19/2010
- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 11/2/2010

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ATTORNEY DOCKET NO. 100.019US04

TITLE: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 6/21/2012
- "Chinese Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 4/6/2012
- "EPO Communication under Rule 71(3) EPC" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 5/3/2011
- "EPO Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 2/24/2006
- "EPO Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 3/6/2007
- "EPO Office Action" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 11/16/2010
- "EPO Summons to Attend Oral Proceedings" from Foreign Counterpart of U.S. Application No. 09/619,431 mailed 5/21/2010
- "Notice of Allowance" of Application Serial No. 09/619,431 mailed 8/12/2003
- "Office Action" of Application Serial No. 09/619,431 mailed 3/13/2003
- "Final Office Action" of Application Serial No. 10/740,944 mailed 4/25/2007
- "Final Office Action" of Application Serial No. 10/740,944 mailed 7/18/2007
- "Final Office Action" of Application Serial No. 10/740,944 mailed 10/3/2007
- "Final Office Action" of Application Serial No. 10/740,944 mailed 10/14/2008
- "Notice of Allowance" of Application Serial No. 10/740,944 mailed 8/13/2009
- "Office Action" of Application Serial No. 10/740,944 mailed 8/24/2006
- "Final Office Action" of Application Serial No. 10/740,944 mailed 2/5/2007
- "Office Action" of Application Serial No. 10/740,944 mailed 4/3/2008
- "Office Action" of Application Serial No. 10/740,944 mailed 2/27/2009
- "Notice of Allowance" of Application Serial No. 12/617,215 mailed 8/2/2012
- "Office Action" of Application Serial No. 12/617,215 mailed 4/11/2012

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ATTORNEY DOCKET NO. 100.019US04

TITLE: POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

Applicant respectfully requests that this Information Disclosure Statement (IDS) be entered and the documents listed on the attached Form 1449 be considered by the Examiner and made of record. Pursuant to the provisions of MPEP §609, Applicant requests that a copy of the 1449 form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Respectfully submitted,

Date: October 29, 2012

/Jon M. Powers/

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Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT			
First Named Inventor/Applicant Name:	Philip M. Wala			
Filer:	Jon M. Powers/Lisa Gentry			
Attorney Docket Number:	100.019US04			
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	390	390
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Claims in excess of 20	1202	20	62	1240
Independent claims in excess of 3	1201	2	250	500
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				3000

Electronic Acknowledgement Receipt

EFS ID:	14096624
Application Number:	13662948
International Application Number:	
Confirmation Number:	9673
Title of Invention:	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT
First Named Inventor/Applicant Name:	Philip M. Wala
Customer Number:	34206
Filer:	Jon M. Powers
Filer Authorized By:	
Attorney Docket Number:	100.019US04
Receipt Date:	29-OCT-2012
Filing Date:	
Time Stamp:	15:38:42
Application Type:	Utility under 35 USC 111(a)

Payment information:

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Payment Type	Credit Card
Payment was successfully received in RAM	\$ 3000
RAM confirmation Number	1499
Deposit Account	502432
Authorized User	FOGG, DAVID N.

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 1.21 (Miscellaneous fees and charges)

SOLiD Ex. 1017

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		00327905.PDF	131707	yes	27
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	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	18	
	Claims		19	26	
	Abstract		27	27	
Warnings:					
Information:					
2	Drawings-only black and white line drawings	00327834.PDF	201396	no	8
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3	Application Data Sheet	00327837.PDF	1367071	no	5
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Information:					
4	Information Disclosure Statement (IDS) Form (SB08)	00325407.PDF	1473834	no	12
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Page 108

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Page 199

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New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT

Cross Reference to Related Applications

[0001] This application is a continuation of U.S. Application Serial No. 12/617,215, filed on November 12, 2009 entitled “POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT”, which, in turn, is a continuation of U.S. Application Serial No. 10/740,944, filed on December 19, 2003 entitled “POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT” (which issued as U.S. Patent No. 7,639,982), which, in turn, is a continuation of U.S. Application Serial No. 09/619,431, filed on July 19, 2000, entitled “POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT” (which issued as U.S. Patent No. 6,704,545). All of the preceding applications and patents are incorporated herein by reference.

Technical Field

[0002] The present invention is related to high capacity mobile communications systems, and more particularly to a point-to-multipoint digital micro-cellular communication system.

Background Information

[0003] With the widespread use of wireless technologies additional signal coverage is needed in urban as well as suburban areas. One obstacle to providing full coverage in these areas is steel frame buildings. Inside these tall shiny buildings (TSBs), signals transmitted from wireless base stations attenuate dramatically and thus significantly impact the ability to communicate with wireless telephones located in the buildings. In some buildings, very low power ceiling mounted transmitters are mounted in hallways and conference rooms within the building to distribute signals throughout the building. Signals are typically fed from a single point and then split in order to feed the signals to different points in the building.

[0004] In order to provide coverage a single radio frequency (RF) source needs to simultaneously feeds multiple antenna units, each providing coverage to a different part of a building for example. Simultaneous bi-directional RF distribution often involves splitting signals in the forward path (toward the antennas) and combining signals in the reverse path (from the antennas). Currently this can be performed directly at RF frequencies using passive splitters and combiners to feed a coaxial cable distribution network. In passive RF distribution systems, signal splitting in the forward path is significantly limited due to inherent insertion loss associated with the passive devices. Each split reduces the level of the signal distributed in the building thereby making reception, e.g. by cell phones, more difficult. In addition, the high insertion loss of coaxial cable at RF frequencies severely limits the maximum distance over which RF signals can be distributed. Further, the system lacks any means to compensate for variations of insertion loss in each path.

[0005] Another solution to distributing RF signals in TSBs is taking the RF signal from a booster or base station, down converting it to a lower frequency, and distributing it via Cat 5 (LAN) or coaxial cable wiring to remote antenna units. At the remote antenna units, the signal is up converted and transmitted. While down-conversion reduces insertion loss, the signals are still susceptible to noise and limited dynamic range. Also, each path in the distribution network requires individual gain adjustment to compensate for the insertion loss in that path.

[0006] In another approach, fiber optic cables are used to distribute signals to antennas inside of a building. In this approach, RF signals are received from a bi-directional amplifier or base station. The RF signals directly modulate an optical signal, which is transported throughout the building as analog modulated light signals over fiber optic cable. Unfortunately, conventional systems using analog optical modulation transmission over optical fibers require highly sophisticated linear lasers to achieve adequate performance. Also, analog optical systems are limited in the distance signals can be transmitted in the building. Typically, this limitation is made worse due to the use of multimode fiber that is conventionally available in buildings. Multimode fiber is wider than single mode fiber and supports a number of different reflection modes so that signals tend to exhibit dispersion at the terminating end of the fiber. In addition,

analog installation typically includes significant balancing when setting up the system. Further, RF levels in the system need to be balanced with the optical levels. If there is optical attenuation, the RF levels need to be readjusted. In addition, if the connectors are not well cleaned or properly secured, the RF levels can change.

[0007] Digitization of the RF spectrum prior to transport solves many of these problems. The level and dynamic range of digitally transported RF remains unaffected over a wide range of path loss. This allows for much greater distances to be covered, and eliminates the path loss compensation problem. However, this has been strictly a point-to-point architecture. One drawback with digitally transported RF in a point-to-point architecture is the equipment and cost requirement. A host RF to digital interface device is needed for each remote antenna unit. In particular, for use within a building or building complex the number of RF to digital interface devices and the fiber to connect these devices is burdensome. For example, in a building having 20 floors, the requirement may include 20 host RF to digital interface devices for 20 remote antenna units, 1 per floor. In some applications more than one remote antenna unit per floor may be required. As a result, there is a need in the art for improved techniques for distributing RF signals in TSBs, which would incorporate the benefits of digital RF transport into a point-to-multipoint architecture.

Summary

[0008] The above-mentioned problems with distributing RF signals within a building and other problems are addressed by the present invention and will be understood by reading and studying the following specification.

[0009] In one embodiment, a digital radio frequency transport system is provided. The transport system includes a digital host unit and at least two digital remote units coupled to the digital host unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

[0010] In another embodiment, a digital radio frequency transport system is provided. The transport system includes a digital host unit and at least one digital expansion unit coupled to the digital host unit. The transport system further includes at least two

digital remote units, each coupled to one of the digital host unit and the digital expansion unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

[0011] In an alternate embodiment, a method of performing point-to-multipoint radio frequency transport is provided. The method includes receiving radio frequency signals at a digital host unit and converting the radio frequency signals to a digitized radio frequency spectrum. The method also includes optically transmitting the digitized radio frequency spectrum to a plurality of digital remote units. The method further includes receiving the digitized radio frequency spectrum at the plurality of digital remote units, converting the digitized radio frequency spectrum to analog radio frequency signals and transmitting the analog radio frequency signals via a main radio frequency antenna at each of the plurality of digital remote units.

Brief Description of the Drawings

[0012] Figure 1 is an illustration of one embodiment of a point-to-multipoint communication system according to the teachings of the present invention.

[0013] Figure 2 is a block diagram of one embodiment of a communication system according to the teachings of the present invention.

[0014] Figure 3 is a block diagram of another embodiment of a communication system according to the teachings of the present invention.

[0015] Figure 4 is a block diagram of one embodiment of a digital host unit according to the teachings of the present invention.

[0016] Figure 5 is a block diagram of one embodiment of a digital remote unit according to the teachings of the present invention.

[0017] Figure 6 is a block diagram of one embodiment of a digital expansion unit according to the teachings of the present invention.

[0018] Figure 7 is a block diagram of one embodiment of a microcell base station according to the teachings of the present invention.

[0019] Figure 8 is an illustration of one embodiment of an overflow algorithm for a channel summer according to the teachings of the present invention.

Detailed Description

[0020] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

[0021] Figure 1 is an illustration of one exemplary embodiment of a point-to-multipoint digital transport system shown generally at 100 and constructed according to the teachings of the present invention. The point-to-multipoint digital transport system 100 is shown distributed within a complex of tall shiny buildings (TSBs) 2. Although system 100 is shown in a complex of TSBs 2, it is understood that system 100 is not limited to this embodiment. Rather, system 100 in other embodiments is used to distribute signals in a single building, or other appropriate structure or indoor or outdoor location that exhibits high attenuation to RF signals. Advantageously, system 100 uses digital summing of digitized RF signals from multiple antennas to improve signal coverage in structures, such as TSBs.

[0022] Point-to-multipoint digital transport of RF signals is accomplished through a network of remote antenna units or digital remote units 40 and 40' and a digital host unit 20, which interfaces with a wireless network 5 which is coupled to the public switched telephone network (PSTN), or a mobile telecommunications switching office (MTSO) or other switching office/network. System 100 operates by transporting RF signals digitally over fiber optic cables. Signals received at DHU 20 are distributed to multiple DRUs 40 and 40' to provide coverage throughout a building complex. In addition, signals received at each of the DRUs 40 and 40' are summed together at the DHU 20 for interface to a wireless network.

[0023] In one embodiment, digital expansion unit DEU 30 is situated between the DHU 20 and one or more DRUs. In the forward path, DEU 30 expands the coverage area by splitting signals received from DHU 20 to a plurality of DRUs 40'. In the reverse path, DEU 30 receives signals from a plurality of DRUs 40', digitally sums the signals

together and transports them to a DHU 20 or another DEU such as 30. This system allows for successive branching of signals using DEUs 30 and expanded coverage to multiple DRUs 40 and 40'. This system provides an efficient way of providing signal coverage for wireless communication without added attenuation loss and distance constraint found with analog systems. By using DEUs 30, antennas can be placed further from DHU 20 without adversely affecting signal strength since shorter fiber optic cables can be used.

[0024] Digital transport system 100 includes a wireless interface device (WID) 10 that provides an interface to a wireless network. In one embodiment, the WID 10 includes either conventional transmitters and receivers or all digital transmitter and receiver equipment, and interface circuitry to a mobile telecommunications switching office (MTSO). In one embodiment, the wireless interface device 10 is coupled to an MTSO via a T1 line and receives and transmits signals between the MTSO and the DHU 20. In another embodiment, the wireless interface device 10 is coupled to the public switched telephone network (PSTN). In one embodiment, WID 10 comprises a base station and connects directly to DHU 20 via coaxial cables. In another embodiment, WID 10 comprises a base station and wirelessly connects to DHU 20 via a bi-directional amplifier that is connected to an antenna. In one embodiment, the antenna is an outdoor antenna.

[0025] WID 10 communicates signals between wireless units and the wireless network via digital remote units DRUs 40 and 40'. WID 10 is coupled to DHU 20. The DHU 20 is coupled to at least one digital expansion unit DEU 30 and a plurality of DRUs 40. In addition, DEU 30 is coupled to a plurality of DRUs 40'. The DHU 20 receives RF signals from WID 10 and converts the RF signals to digital RF signals. DHU 20 further optically transmits the digital RF signals to multiple DRUs 40 either directly or via one or more DEUs 30.

[0026] Each DRU 40 and 40' is connected through a fiber optic cable (or optionally another high bandwidth carrier) to transport digital RF signals to one of DHU 20 or DEU 30. In one embodiment, the fiber optic cable comprises multimode fiber pairs coupled between the DRUs 40 and the DHU 20, between the DRUs 40 and 40' and the DEUs 30 and between the DEUs 30 and the DHU 20. In one embodiment, the DEU 30

is coupled to the DHU 20 via single mode fiber and the DEU 30 is coupled to the DRUs 40' via multimode fiber pairs. Although, transport system 100 has been described with fiber optic cable other carriers may be used, e.g., coaxial cable.

[0027] In another embodiment, the DHU 20 is coupled to the DRUs 40 by a direct current power cable in order to provide power to each DRU 40. In one embodiment, the direct current power cable delivers 48 VDC to each DRU 40 connected to the DHU 20. In another embodiment, the DEU 30 is coupled to DRUs 40' by a direct current power cable to provide power to each DRU 40'. In one embodiment, the direct current power cable delivers 48 VDC to each DRU 40' connected to the DEU 30. In an alternate embodiment, DRUs 40 and 40' are connected directly to a power supply. In one embodiment, the power supply provides DC power to the DRUs 40 and 40'. In an alternate embodiment, the power supply provides AC power to the DRUs 40 and 40'. In one embodiment, DRUs 40 and 40' each include an AC/DC power converter.

[0028] Both DHU 20 and DEU 30 split signals in the forward path and sum signals in the reverse path. In order to accurately sum the digital signals together at DHU 20 or DEU 30 the data needs to come in to the DHU 20 or DEU 30 at exactly the same rate. As a result all of the DRUs 40 and 40' need to be synchronized so that their digital sample rates are all locked together. Synchronizing the signals in time is accomplished by locking everything to the bit rate over the fiber. In one embodiment, the DHU 20 sends out a digital bit stream and the optical receiver at the DEU 30 or DRU 40 detects that bit stream and locks its clock to that bit stream. In one embodiment, this is being accomplished with a multiplexer chip set and local oscillators, as will be described below. Splitting and combining the signals in a digital state avoids the combining and splitting losses experienced with an analog system. In addition, transporting the digital signals over multimode fiber results in a low cost transport system that is not subject to much degradation.

[0029] The down-conversion and up-conversion of RF signals are implemented by mixing the signal with a local oscillator (LO) at both the DRUs and the DHU. In order for the original frequency of the RF signal to be restored, the signal must be up-converted with an LO that has exactly the same frequency as the LO that was used for

down conversion. Any difference in LO frequencies will translate to an equivalent end-to-end frequency offset. In the embodiments described, the down conversion and up conversion LOs are at locations remote from one another. Therefore, in one preferred embodiment, frequency coherence between the local and remote LO's is established as follows: at the DHU end, there is a 142 MHz reference oscillator which establishes the bit rate of 1.42 GHz over the fiber. This reference oscillator also generates a 17.75 MHz reference clock which serves as a reference to which LO's at the DHU are locked.

[0030] At each of the DRUs, there is another 17.75 MHz clock, which is recovered from the optical bit stream with the help of the clock and bit recovery circuits. Because this clock is recovered from the bit stream generated at the host, it is frequency coherent with the reference oscillator at the host. A reference 17.75 MHz clock is then generated to serve as a reference for the remote local oscillators. Because the remote recovered bit clock is frequency coherent with the host master clock, the host and remote reference clocks, and any LO's locked to them, are also frequency coherent, thus ensuring that DHU and DRU LO's are locked in frequency. It is understood that in other embodiments the bit rate over the fiber may vary and the frequency of the clocks will also vary.

[0031] Figure 2 is a block diagram of one embodiment of a communication system, shown generally at 200 and constructed according to the teachings of the present invention. In this embodiment, a digital host unit (DHU) 220 is coupled to a bi-directional amplifier (BDA) 211. The BDA 211 receives communication signals from a wireless interface device (WID) and transports the communication signals as RF signals to the DHU 220 and receives RF signals from DHU 220 and transmits the RF signals to the WID. The DHU 220 receives RF signals from the BDA 211 and digitizes the RF signals and optically transmits the digital RF signals to multiple DRUs via transmission lines 214-1 to 214-N. DHU 220 also receives digitized RF signals over transmission lines 216-1 to 216-N from a plurality of DRUs either directly or indirectly via DEUs, reconstructs the corresponding analog RF signals, and applies them to BDA 211. In one embodiment, DHU 220 receives signals directly from a plurality N of DRUs. The signals are digitally summed and then converted to analog signals and transmitted to BDA 211. In another embodiment, DHU 220 receives signals from one or more DEUs

and one or more DRUs directly. Again, the signals are all digitally summed and then converted to analog signals and transmitted to BDA 211. The signals received via transmission lines 216-1 to 216-N may be received directly from a DRU or signals that are received by a DEU and summed together and then transported via 216-1 to 216-N to DHU 220 for additional summing and conversion for transport to BDA 211. DEUs provide a way to expand the coverage area and digitally sum signals received from DRUs or other DEUs for transmission in the reverse path to other DEUs or DHU 220. In one embodiment, transmission lines 214-1 to 214-N and 216-1 to 216-N comprise multimode fiber pairs. In an alternate embodiment, each fiber pair is replaced by a single fiber, carrying bi-directional optical signals through the use of wavelength division multiplexing (WDM). In an alternate embodiment, transmission lines 214-1 to 214-N and 216-1 to 216-N comprise single mode fibers. In one embodiment, N is equal to six. In an alternate embodiment, the number of transmission lines in the forward path direction 214-1 to 214-N is not equal to the number of transmission lines in the reverse path direction 216-1 to 216-N.

[0032] Figure 3 is a block diagram of an alternate embodiment of a communication system shown generally at 300 and constructed according to the teachings of the present invention. Communication system 300 includes a base station 310 coupled to a DHU 320. Base station 310 includes conventional transmitters and receivers 323 and 328, respectively, and conventional radio controller or interface circuitry 322 to an MTSO or telephone switched network. DHU 320 is coupled to base station 310. DHU 320 is also coupled to transmission lines 314-1 to 314-M, which transmit in the forward path direction and transmission lines 316-1 to 316-M, which transmit in the reverse path direction.

[0033] DHU 320 essentially converts the RF spectrum to digital in the forward path and from digital to analog in the reverse path. In the forward path, DHU 320 receives the combined RF signal from transmitters 323, digitizes the combined signal and transmits it in digital format over fibers 314-1 to 314-M, which are connected directly to a plurality of DRUs or indirectly to one or more DRUs via one or more DEUs.

[0034] In one embodiment, DHU 320 receives signals directly from a plurality M of DRUs. The signals are digitally summed and then converted to analog signals and

transmitted to base station 310. In another embodiment, DHU 320 receives signals from one or more DEUs and one or more DRUs directly. Again, the signals are all digitally summed and then converted to analog signals and transmitted to base station 310. The signals received via transmission lines 316-1 to 316-M may be received directly from a DRU or signals that are received by a DEU and summed together and then transported via 316-1 to 316-M to DHU 320 for additional summing and conversion for transport to base station 210. DEUs provide a way to expand the coverage area by splitting signals in the forward path and digitally summing signals received from DRUs or other DEUs in the reverse path for transmission upstream to other DEUs or a DHU. In the reverse path, DHU 320 also receives digitized RF signals over fibers 316-1 to 316-M from a plurality of DRUs, either directly or indirectly via DEUs, reconstructs the corresponding analog RF signal, and applies it to receivers 328.

[0035] In one embodiment, transmission lines 314-1 to 314-M and 316-1 to 316-M comprise multimode fiber pairs. In an alternate embodiment, each fiber pair is replaced by a single fiber, carrying bi-directional optical signals through the use of wavelength division multiplexing (WDM). In an alternate embodiment, transmission lines 314-1 to 314-M and 316-1 to 316-M comprise single mode fibers. In one embodiment, M is equal to six. In an alternate embodiment, the number of transmission lines in the forward path direction 314-1 to 314-M is not equal to the number of transmission lines in the reverse path direction 316-1 to 316-M.

[0036] Referring now to FIG. 4, there is shown one embodiment of a DHU 420 constructed according to the teachings of the present invention. DHU 420 includes an RF to digital converter 491 receiving the combined RF signals from a wireless interface device such as a base station, BDA or the like. RF to digital converter 491 provides a digitized traffic stream that is transmitted to multiplexer 466. Multiplexer 466 converts the parallel output of the A/D converter into a framed serial bit stream. At the output of the multiplexer is a 1 to P fan out buffer 407, which splits the digital signal P ways. There are P optical transmitters 431-1 to 431-P one feeding each of the P optical transmission lines 414-1 to 414-P. The digitized signals are applied to fibers 414-1 to

414-P for transmission to corresponding DRUs either directly or via DEUs. In one embodiment, P is equal to 6.

[0037] In one embodiment, DHU 420 includes an amplifier 450 that receives the combined RF signal from a wireless interface device such as a base station or BDA. The combined RF signal is amplified and then mixed by mixer 452 with a signal received from local oscillator 468. Local oscillator 468 is coupled to reference oscillator 415. In one embodiment the local oscillator is coupled to a frequency divider circuit 470, which is in turn coupled to reference oscillator 415. The local oscillator is locked to the reference oscillator 415 as a master clock so that the down conversion of the RF signals is the same as the up conversion. The result is end to end, from DHU to DRU, or DHU to one or more DEUs to DRU, no frequency shift in the signals received and transmitted. The local oscillator 463 is also coupled to a synthesizer circuit 476.

[0038] The output signal of mixer 452 is provided to amplifier 454 amplified and then filtered via intermediate frequency (IF) filter 456. The resultant signal is the combined RF signal converted down to an IF signal. The IF signal is mixed with another signal originating from the reference oscillator 415 via mixer 460. The output of mixer 460 is summed together at 462 with a signal produced by field programmable gate array (FPGA) 467. The output is then converted from an analog signal to a digital signal via analog/digital (A/D) converter 464 once converted the digital RF signal is applied to multiplexer 466. In one embodiment, the A/D converter 464 is a 14-bit converter handling a 14-bit signal. In other embodiments, the A/D converter 464 may be of any size to accommodate an appropriate signal. In one embodiment, the input signal from FPGA 467 is a dither signal from dither circuit 462 that adds limited out of band noise to improve the dynamic range of the RF signal.

[0039] In one embodiment, DHU 420 includes an alternating current to digital current power distribution circuit 6 that provides direct current power to each of the DRUs coupled to DHU 420.

[0040] DHU 420 further includes a plurality of digital optical receivers 418-1 to 418-P in the reverse path. Receivers 418-1 to 418-P each output an electronic digital signal, which is applied to clock and bit recovery circuits 445-1 to 445-P, respectively, for clock and bit recovery of the electronic signals. The signals are then applied to

demultiplexers 441-1 to 441-P, respectively, which extract the digitized signals generated at the DRUs, as will be explained in detail below. Demultiplexers 441-1 to 441-P further extract alarm (monitoring) and voice information framed with the digitized signals. The digitized signals output at each demultiplexer 441-1 to 441-P are then applied to FPGA 467 where the signals are summed together and then applied to digital to RF converter 495. Converter 495 operates on the sum of the digitized signals extracted by demultiplexers 441-1 to 441-P, reconstructing baseband replicas of the RF signals received at all the digital remote units. The baseband replicas are then up-converted to their original radio frequency by mixing with a local oscillator 482 and filtering to remove image frequencies. Local oscillator 482 is coupled to synthesizer 476 and reference oscillator as discussed with respect to local oscillator 468 above.

[0041] In one embodiment, digital to RF converter 495 includes digital to analog (D/A) converter 484 coupled to an output of FPGA 467 the digitized RF signals are converted to analog RF signals and then mixed with a signal from reference oscillator 415 by mixer 492. The signal is then filtered by IF filter 490 and amplified by amplifier 488. The resultant signal is then mixed with a signal from local oscillator 482 and then applied to RF filter 484, amplifier 480 and RF filter 478 for transmission by a wireless interface device such as a BDA or base station.

[0042] In one embodiment, FPGA 467 includes an alarm/control circuit 474, which extracts overhead bits from DRUs to monitor error and alarm information. In one embodiment, the FPGA 467 includes a summer 498, which mathematically sums together the digital RF signals received from fibers 416-1 to 416-P. In another embodiment FPGA includes an overflow algorithm circuit 486 coupled to the output of summer 486. The algorithm circuit 496 allows the summed digital RF signals to saturate and keep the summed signal within a defined number of bits. In one embodiment, the algorithm circuit includes a limiter. In one embodiment, the RF signals are 14-bit signals and when summed and limited by summer 498 and overflow algorithm 496 result in a 14-bit output signal.

[0043] For example, in one embodiment each of the digital RF signals received from fibers 416-1 to 416-P, where P is equal to 6, comprise 14 bit inputs. All of those 6 different 14 bit inputs then go into summer 498. In order to allow for overflow, at least

17 bits of resolution is needed in the summer 498 to handle a worst-case scenario when all 6 of the 14 bit inputs are at full scale at the same time. In this embodiment, a 17-bit wide summer 498 is employed to handle that dynamic range. Coming out of summer 498 is needed a 14-bit signal going in the reverse path. In one embodiment, an algorithm circuit 496 for managing the overflow is implemented. In one embodiment, the summer and 498 and overflow algorithm 496 are included in FPGA 467. In one embodiment, overflow algorithm 496 acts like a limiter and allows the sum to saturate and keeps the summed signal within 14 bits. In an alternate embodiment, overflow algorithm circuit 496 controls the gain and scales the signal dynamically to handle overflow conditions.

[0044] Figure 8 illustrates one embodiment of an algorithm 863 for a channel summer 865 in order to limit the sum of input signals 0 to 5 to 14 bits. In this embodiment, input signals 0 to 5 comprise 6 signals that are summed together by summer 865. The sum of input signals 0 to 5 is reduced to a signal having 14 bits or less by the algorithm 863. It is understood that the algorithm 865 is by example and is not meant to restrict the type of algorithm used to limit the sum of signals 0 to 5 to 14 bits or less.

[0045] For example, when the sum of the 6 input signals 0 to 5 is greater than or equal to 13FFBh then the sum is divided by 6 for a signal that is 14 bits or less. When the sum of the 6 input signals 0 to 5 is greater than 13FFBh but less than or equal to FFFCh then the sum is divided by 5 for a signal that is 14 bits or less. When the sum of the 6 input signals 0 to 5 is greater than FFFCh but less than BFFDh then the sum is divided by 4 for a signal that is 14 bits or less. When the sum of the 6 input signals 0 to 5 is greater BFFDh but less than 7FFEh then the sum is divided by 3 for a signal that is 14 bits or less. Finally, when the sum of the 6 input signals 0 to 5 is greater than 7FFEh but less than or equal to 3FFFh then the sum is divided by 2 for a signal that is 14 bits or less.

[0046] Figure 5 is a block diagram of one embodiment of a digital remote unit (DRU) 540 constructed according to the teachings of the present invention. A digital optical receiver 501 receives the optical digital data stream transmitted from a DHU directly or via a DEU. Receiver 501 converts the optical data stream to a corresponding series of electrical pulses. The electrical pulses are applied to clock and bit recovery circuit 503.

The series of electrical pulses are then applied to demultiplexer 505. Demultiplexer 505 extracts the digitized traffic signals and converts the signals from serial to parallel.. The output parallel signal is then applied to digital to RF converter 595 for conversion to RF and transmission to duplexer 547. RF converter 595 is connected to the main antenna 599 through a duplexer 547. Accordingly, radio frequency signals originating from a wireless interface device are transmitted from main antenna 547.

[0047] In one embodiment, digital to RF converter 595 includes a digital-to-analog (D/A) converter 509, which reconstructs the analog RF signal and applies it to IF 504 and amplifier 506. The analog signal is mixed with an output signal of reference oscillator 515 by mixer 502. The output of amplifier 506 is mixed with a signal from local oscillator 519 that locks the RF signal with the return digital signal via reference oscillator 515 that is coupled to local oscillator 519. In one embodiment, the reference oscillator is coupled to frequency divider 517 that in turn is coupled to local oscillators 519 and 529. The local oscillators 519 and 529 are also coupled to synthesizer 521 that is coupled to programmable logic device 525.

[0048] RF signals received at main antenna 599 are passed through duplexer 547 to RF to digital converter 593. The RF signals are converted to digital signals and then applied to multiplexer 536 converted from parallel-to-serial and optically transmitted via optical transmitter 532 to a DEU or DHU.

[0049] In one embodiment, RF to digital converter 593 includes a first amplifier 543 that receives RF signals from duplexer 547, amplifies the signals and transmits them to digital attenuator 539. In one embodiment, amplifier 543 is a low noise amplifier. Digital attenuator 539 receives the amplified signals and digitally attenuates the signal to control the levels in case of an overload situation. RF to digital converter 593 further includes a second amplifier 537, which receives the attenuated signals, amplifies the signals and applies the amplified signals to mixer 535. Mixer 535 mixes the amplified signals with a signal received from local oscillator 529. The resultant signals are applied to a third amplifier 533 an IF filter 548 and a fourth amplifier 546 in series to down convert to an IF signal. The IF signal is then mixed with a signal from reference oscillator 515 and the mixed signal is summed with a signal from dither circuit 527. The resultant signal is applied to analog-to-digital converter 538 and converted to a

digital signal. The output digital signal is then applied to a multiplexer 536. In one embodiment, the multiplexer 536 multiplexes the signal together with a couple of extra bits to do framing and control information. In one embodiment, multiplexer 536, clock and bit recovery circuit and demultiplexer 505 comprise a multiplexer chip set.

[0050] Programmable logic circuit 525 programs synthesizer 521 for the reference oscillator and for the up and down conversion of local oscillators 519 and 529. The programmable logic circuit 525 looks for error conditions, for out of lock conditions on the oscillators and reports error modes and looks for overflow condition in the A/D converter 538. If an overflow condition occurs the programmable logic circuit 525 indicates that you are saturating and adds some extra attenuation at digital attenuator 539 in order to reduce the RF signal levels coming in from RF antenna 599 and protect the system from overload.

[0051] In one embodiment, DRU 540 includes an internal direct current power distribution system 5. In one embodiment, the distribution system receives 48 VDC and internally distributes 3 outputs of +3.8V, +5.5V and +8V.

[0052] Figure 6 is a block diagram of one embodiment of a digital expansion unit (DEU) 630 constructed according to the teachings of the present invention. DEU 630 is designed to receive optical signals and transmit optical signals. An optical receiver 651 receives digitized RF signals and transmits them to clock and bit recovery circuit 653 that performs clock and bit recovery to lock the local clock and clean up the signal. The signals are then split into X RF digital signals by 1 to X fan out buffer 607. The signals are then transmitted via optical transmitters 655-1 to 655-X to X receiving units such as DEUs or DRUs. The X receiving units may be any combination of DEUs or DRUs. In one embodiment, X is equal to six.

[0053] DEU 630 also includes optical receivers 669-1 to 669-X, which receive digitized RF signals directly from DRUs or indirectly via DEUs. In operation the signals are received, applied to clock and bit recovery circuits 673-1 to 673-X respectively to lock the local clock and clean up the signals and then applied to demultiplexers 671-1 to 671-X. Demultiplexers 671-1 to 671-X each extract the digitized traffic and apply the samples to field programmable gate array 661. The signals are summed together digitally and transmitted to multiplexer 657, which multiplexes the signal together with

a couple of extra bits to do framing and control information. In addition, the multiplexer 657 converts the signals parallel to serial. The signals are then applied to optical transmitter 659 for further transmission. In one embodiment, the signals are directly transmitted to a DHU or indirectly via one or more additional DEUs.

[0054] In one embodiment, the FPGA 661 includes summer 665, which mathematically sums together the digital RF signals received from demultiplexers 671-1 to 671-X. In another embodiment, FPGA 661 includes an overflow algorithm circuit 663 coupled to the output of summer 665. The algorithm circuit 663 allows the summed digital RF signals to saturate and keep the summed signal within a defined number of bits. In one embodiment, the algorithm circuit includes a limiter. In one embodiment, the RF signals are 14-bit signals and when summed and limited by summer 665 and overflow algorithm 663 result in a 14-bit output signal.

[0055] In one embodiment, DEU 630 includes an alternating current to digital current power distribution circuit 7 that provides direct current power to each of the DRUs coupled to DEU 630.

[0056] In an alternate embodiment, the digital host unit (DHU) and wireless interface device (WID) are located some distance from the building being served. The DHU in the building is replaced by a DEU, and the link between that DEU and the remotely located DHU is via single mode fiber. Figure 7 is a block diagram of this embodiment.

A microcell base station shown generally at 700 includes conventional transmitters and receivers 723 and 728, respectively, and conventional radio controller or interface circuitry 722. In the forward path, a DHU 767 receives the combined RF signal from transmitters 723, digitizes the combined signal and transmits it in digital format over single mode fiber to a DEU. In the reverse path, DHU 767 receives digitized RF signal from a DEU, reconstructs the corresponding analog RF signal, and applies it to receivers 728.

[0057] In another alternate embodiment, the wireless interface device (WID) is a software defined base station, and the interface between the DHU and WID takes place digitally, eliminating the need for the RF to digital conversion circuitry in the DHU.

Conclusion

[0058] A digital radio frequency transport system has been described. The transport system includes a digital host unit and at least two digital remote units coupled to the digital host unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and the at least two digital remote units.

[0059] In addition, a digital radio frequency transport system has been described. The transport system includes a digital host unit and at least one digital expansion unit coupled to the digital host unit. The transport system further includes at least two digital remote units, each coupled to one of the digital host unit and the digital expansion unit. The digital host unit includes shared circuitry that performs bi-directional simultaneous digital radio frequency distribution between the digital host unit and that at least two digital remote units.

[0060] Further, a method of performing point-to-multipoint radio frequency transport has been described. The method includes receiving analog radio frequency signals at a digital host unit and converting the analog radio frequency signals to digitized radio frequency signals. The method also includes splitting the digitized radio frequency signals into a plurality of a digital radio frequency signals and optically transmitting the digital radio frequency signals to a plurality of digital remote units. The method further includes receiving the digital radio frequency signals at a plurality of digital remote units, converting the digital radio frequency signals to analog radio frequency signals and transmitting the signals via a main radio frequency antenna at each of the plurality of digital remote units.

[0061] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiments shown. For example, a digital remote unit is not limited to the receipt and summing and splitting and transmitting of digitized radio frequency signals. In other embodiments, the digital host unit is capable of receiving and summing analog radio frequency signals in addition to or instead of digitized radio frequency signals. As well, the digital host

unit is capable of splitting and transmitting analog radio frequency signals in addition to or instead of digitized radio frequency signals. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is intended that this invention be limited only by the claims and the equivalents thereof.

What is claimed is:

1. A system for use with a coverage area in which one or more wireless units wirelessly transmit using a wireless radio frequency spectrum, the system comprising:
 - a first unit; and
 - a plurality of second units communicatively coupled to the first unit using at least one communication medium, wherein each of the plurality of second units is associated with a portion of the coverage area;
 - wherein each of the plurality of second units receives a respective analog wireless signal comprising the radio frequency spectrum and any transmissions from any of the wireless units that are within the portion of the coverage area associated with that second unit;
 - wherein each of the plurality of second units generates respective digital RF samples indicative of the respective analog wireless signal received at that second unit;
 - wherein each of the plurality of second units communicates the respective digital RF samples generated by that second unit to the first unit using the at least one communication medium;
 - wherein the first unit digitally sums corresponding digital RF samples received from the plurality of second units to produce summed digital RF samples; and
 - wherein the system is configured so that an input used for base station processing is derived from the resulting summed digital RF samples.
2. The system of claim 1, wherein the system includes base station signal processing functionality configured to perform base station processing.
3. The system of claim 2, wherein the base station processing functionality is at least one of: co-located with the first unit and remote from the first unit.

4. The system of claim 1, wherein the system comprises at least a portion of a base station for performing the base station processing.
5. The system of claim 1, wherein the system further comprises software configured to perform the base station processing using the input derived from the resulting summed digital RF samples.
6. The system of claim 5, wherein the first unit comprises the software configured to perform the base station processing using the input derived from the resulting summed digital RF samples.
7. The system of claim 1, wherein the system is configured to convert the summed digital RF samples to a replicated analog wireless radio frequency signal.
8. The system of claim 7, wherein the system comprises a digital-to-analog converter to convert the summed digital RF samples to the replicated analog wireless radio frequency signal.
9. The system of claim 1, wherein each of the plurality of second units comprises:
a respective analog-to-digital converter to digitize the respective analog wireless radio frequency signal received at that second unit in order to produce the respective digital RF samples.
10. The system of claim 1, wherein each of the plurality of second units generates the respective digital RF samples indicative of the respective analog wireless signal received at that second unit by frequency shifting the respective analog wireless radio frequency signal received at that second unit and digitizing the frequency-shifted analog wireless radio frequency signal.
11. The system of claim 1, wherein each of the plurality of second units generates the respective digital RF samples indicative of the respective analog wireless signal

received at that second unit by down converting the respective analog wireless radio frequency signal received at that second unit and digitizing the down-converted analog wireless radio frequency signal.

12. The system of claim 1, wherein the first unit digitally sums the corresponding digital RF samples received from the plurality of second units in order to produce the summed digital RF samples at a resolution greater than a resolution of the digital RF samples being summed.

13. The system of claim 1, wherein the wireless radio frequency spectrum comprises a cellular radio frequency spectrum.

14. The system of claim 1, wherein the at least one communication medium comprises at least one of: a single mode optical fiber, a multi-mode optical fiber, and a coaxial cable.

15. A first unit for use with a coverage area in which one or more wireless units transmit in a wireless radio frequency spectrum, the first unit comprising:

an interface to communicatively couple the first unit to a plurality of second units using at least one communication medium, wherein each of the plurality of second units is associated with a portion of the coverage area and each of the plurality of second units receives a respective analog wireless signal comprising the wireless radio frequency spectrum and any transmissions from any of the wireless units that are within the portion of the coverage area associated with that second unit and wherein each of the plurality of second units generates respective digital RF samples indicative of the respective analog wireless signal received at that second unit, wherein the interface is used to receive the digital RF samples from the plurality of second units;

a digital summer to digitally sum corresponding digital RF samples received from the plurality of second units to produce summed digital RF samples; and

wherein the first unit is configured so that an input used for base station processing is derived from the resulting summed digital RF samples.

16. The first unit of claim 15, wherein the base station processing is at least of: co-located with the first unit and remote from the first unit.
17. The first unit of claim 15, wherein the base station processing is performed by at least a portion of a base station.
18. The first unit of claim 15, wherein the first unit further comprises software configured to perform the base station processing using the input derived from the resulting summed digital RF samples.
19. The first unit of claim 15, wherein the first unit is configured to convert the summed digital RF samples to a replicated analog wireless radio frequency signal.
20. The first unit of claim 19, wherein the first unit comprises a digital-to-analog converter to convert the summed digital RF samples to the replicated analog wireless radio frequency signal.
21. The first unit of claim 15, wherein the first unit digitally sums the corresponding digital RF samples received from the plurality of second units in order to produce the summed digital RF samples at a resolution greater than a resolution of the digital RF samples being summed.
22. The first unit of claim 15, wherein the wireless radio frequency spectrum comprises a cellular radio frequency spectrum.
23. A method used with wireless radio frequency signals within a coverage area in which one or more wireless units transmit in a wireless radio frequency spectrum, the method using a first unit and a plurality of second units, each of the plurality of second units being associated with a portion of the coverage area, the method comprising:
at each of the plurality of second units:

receiving a respective analog wireless signal comprising the wireless radio frequency spectrum and any transmissions from any of the wireless units that are within the portion of the coverage area associated with that second unit;

generating respective digital RF samples indicative of the respective analog wireless signal received at that second unit; and

communicating the respective digital RF samples generated by that second unit to the first unit using at least one communication medium; and

at the first unit, digitally summing corresponding digital RF samples received from the plurality of second units to produce summed digital RF samples.

24. The method of claim 23, further comprising performing base station processing using an input derived from the resulting summed digital RF samples.

25. The method of claim 24, wherein the base station processing is at least one of: co-located with the first unit and remote from the first unit.

26. The method of claim 24, wherein the base station processing is performed by at least a portion of a base station.

27. The method of claim 23, further comprising converting the summed digital RF samples to a replicated analog wireless radio frequency signal.

28. The method of claim 23, wherein the corresponding digital RF samples are digitally summed at a resolution greater than a resolution of the digital RF samples being summed.

29. The method of claim 23, wherein the wireless radio frequency spectrum comprises a cellular radio frequency spectrum.

30. The method of claim 23, wherein, at each of the plurality of second units, generating the respective digital RF samples indicative of the respective analog wireless signal received at that second unit comprises:

frequency shifting the respective analog wireless radio frequency signal received at that second unit; and
digitizing the frequency-shifted analog wireless radio frequency signal.

31. The method of claim 23, wherein, at each of the plurality of second units, generating the respective digital RF samples indicative of the respective analog wireless signal received at that second unit comprises:

down converting the respective analog wireless radio frequency signal received at that second unit; and
digitizing the down-converted analog wireless radio frequency signal.

32. A system comprising:

a first unit; and

a plurality of second units communicatively coupled to the first unit using at least one communication medium, wherein each of the plurality of second units having an associated respective coverage area;

wherein each of the plurality of second units receives a respective analog wireless signal comprising a wireless radio frequency spectrum;

wherein each of the plurality of second units generates respective digital RF samples indicative of the respective analog wireless signal received at that second unit;

wherein each of the plurality of second units communicates the respective digital RF samples generated by that second unit to the first unit using the at least one communication medium;

wherein the first unit digitally sums corresponding digital RF samples received from the plurality of second units to produce summed digital RF samples; and

wherein the system is configured so that an input used for wireless protocol processing is derived from the resulting summed digital RF samples.

33. The system of claim 32, wherein the wireless protocol processing is at least one of: co-located with the first unit and remote from the first unit.

34. The system of claim 32, wherein the system comprises at least a portion of a base station for performing the wireless protocol processing.

35. The system of claim 32, wherein the system further comprises software configured to perform the wireless protocol processing using the input derived from the resulting summed digital RF samples.

36. The system of claim 35, wherein the first unit comprises the software configured to perform the wireless protocol processing using the input derived from the resulting summed digital RF samples.

37. A first unit comprising:

an interface to communicatively couple the first unit to a plurality of second units using at least one communication medium, wherein each of the plurality of second units is associated with a respective coverage area and each of the plurality of second units receives a respective analog wireless signal comprising a wireless radio frequency spectrum and wherein each of the plurality of second units generates respective digital RF samples indicative of the respective analog wireless signal received at that second unit, wherein the interface is used to receive the digital RF samples from the plurality of second units;

a digital summer to digitally sum corresponding digital RF samples received from the plurality of second units to produce summed digital RF samples; and

wherein the first unit is configured so that an input used for wireless protocol processing is derived from the resulting summed digital RF samples.

38. The first unit of claim 37, wherein the wireless protocol processing is at least of: co-located with the first unit and remote from the first unit.

39. The first unit of claim 37, wherein the wireless protocol processing is performed by at least a portion of a base station.

40. The first unit of claim 37, wherein the first unit further comprises software configured to perform the wireless protocol processing using the input derived from the resulting summed digital RF samples.

Abstract of the Disclosure

One embodiment is directed to a system for use with a coverage area in which one or more wireless units wirelessly transmit using a wireless radio frequency spectrum. The system comprises a first unit, and a plurality of second units communicatively coupled to the first unit using at least one communication medium. Each of the plurality of second units generates respective digital RF samples indicative of a respective analog wireless signal received at that second unit. Each of the plurality of second units communicates the respective digital RF samples generated by that second unit to the first unit using the at least one communication medium. The first unit digitally sums corresponding digital RF samples received from the plurality of second units to produce summed digital RF samples. The system is configured so that an input used for base station processing is derived from the resulting summed digital RF samples.

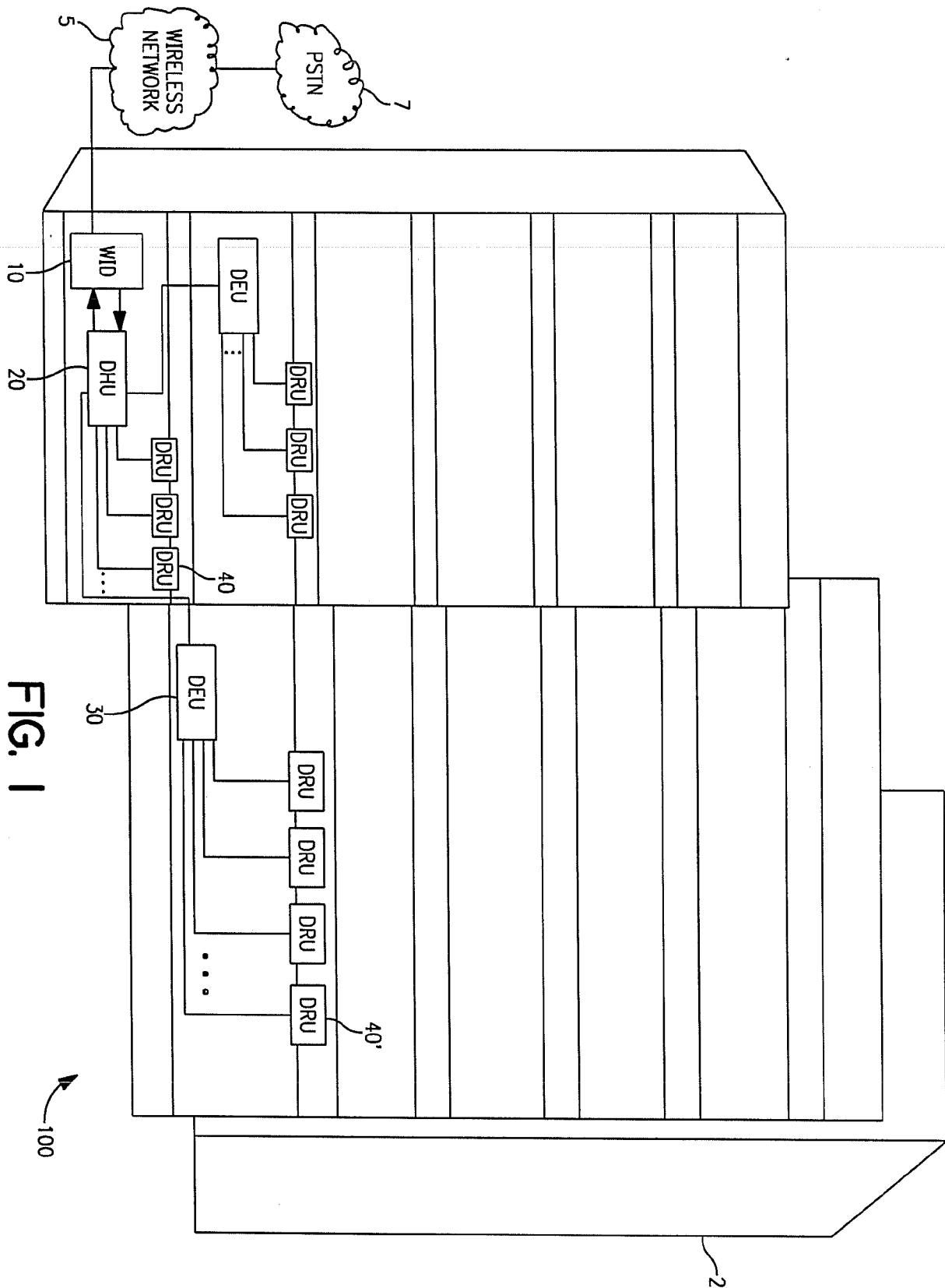


FIG. 1

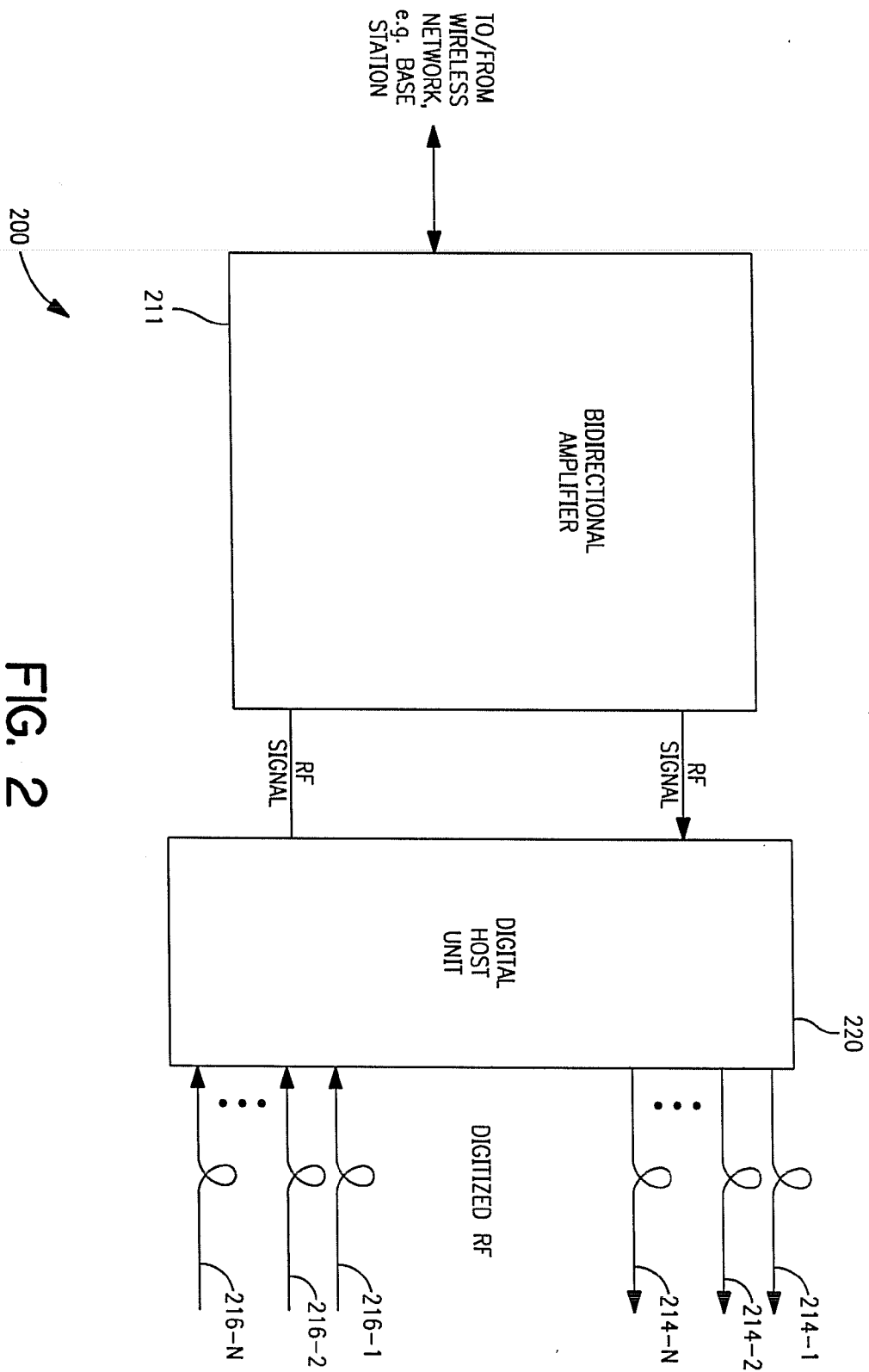


FIG. 2

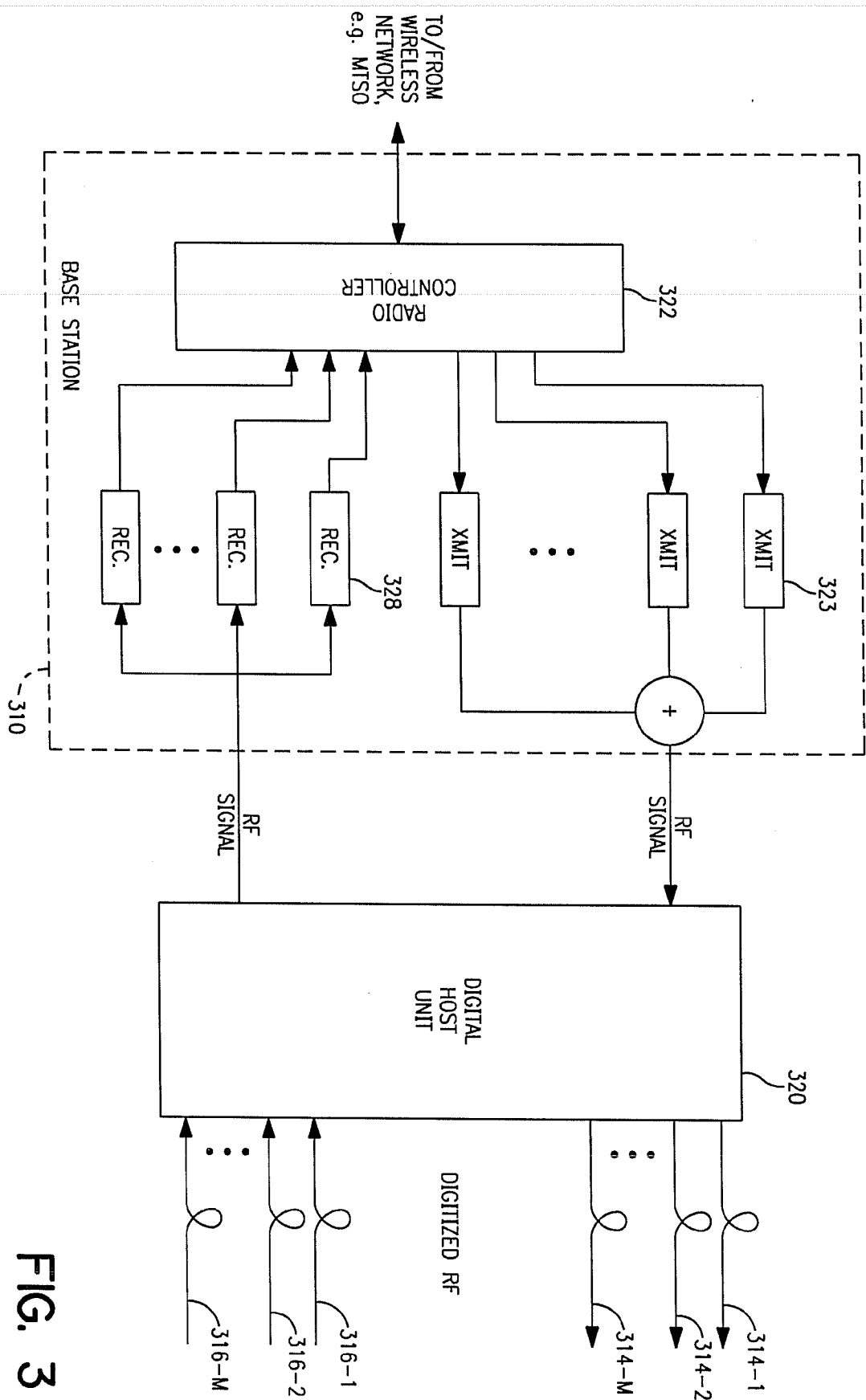


FIG. 3

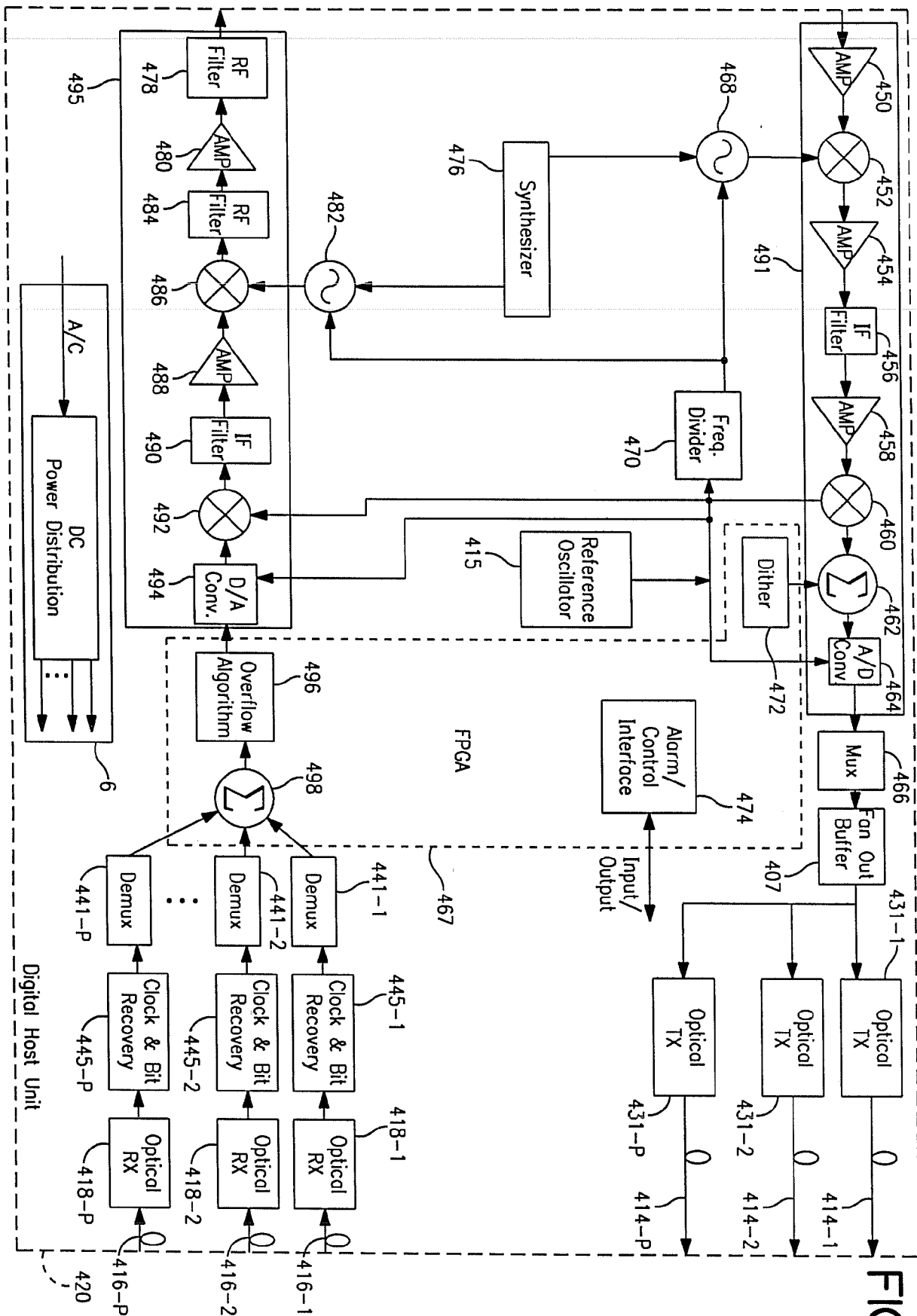


FIG. 4

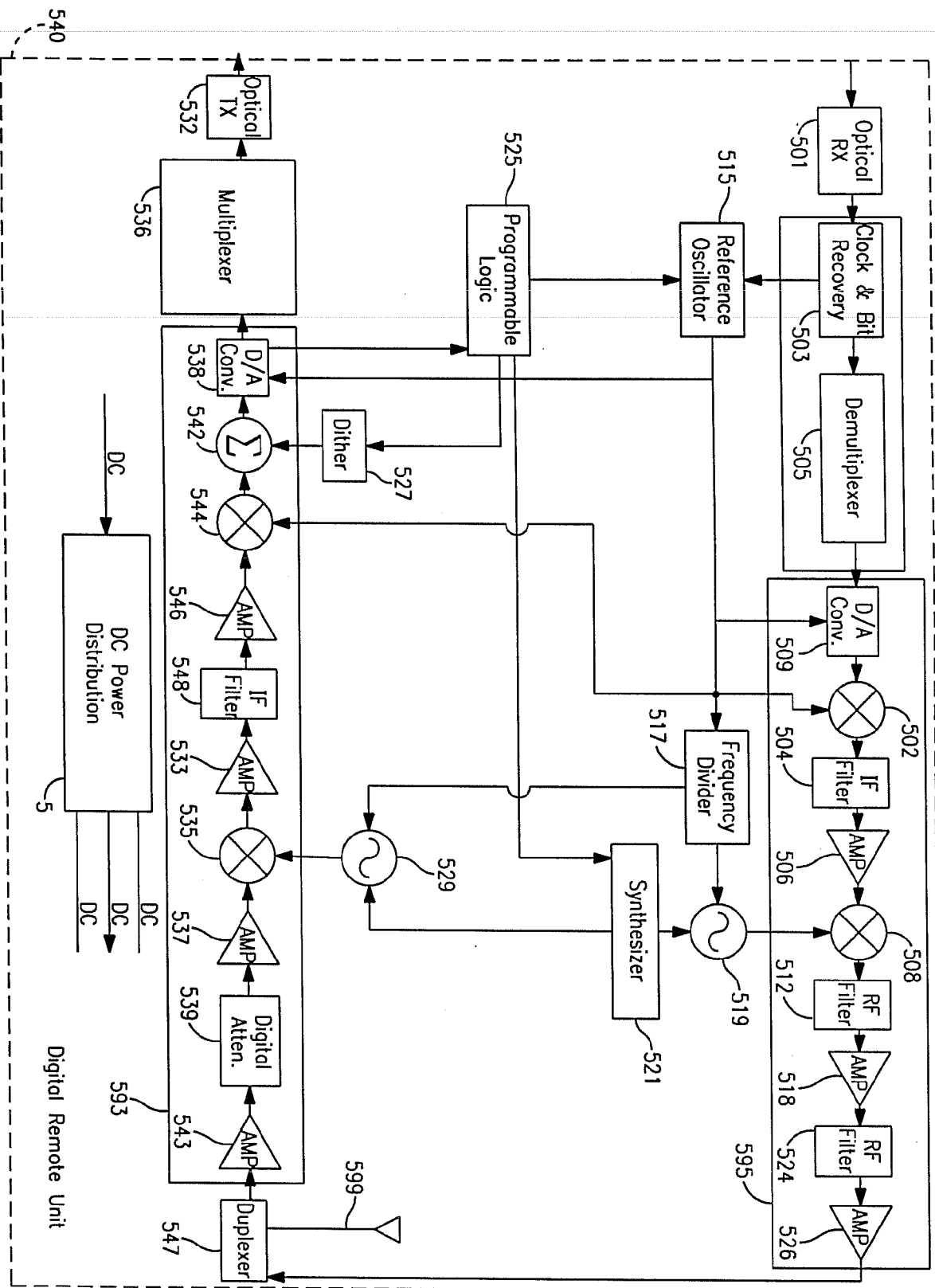


FIG. 5

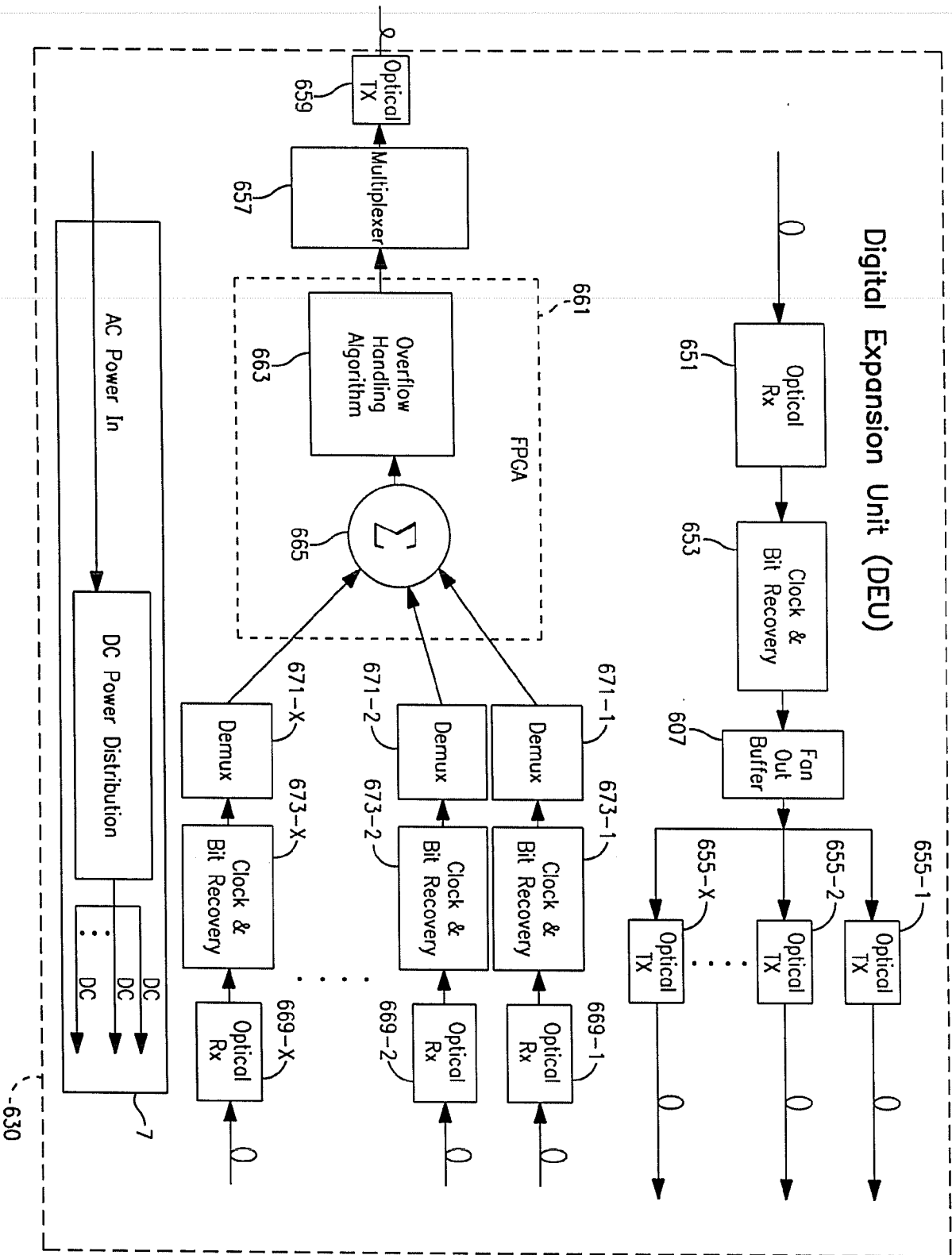


FIG. 6

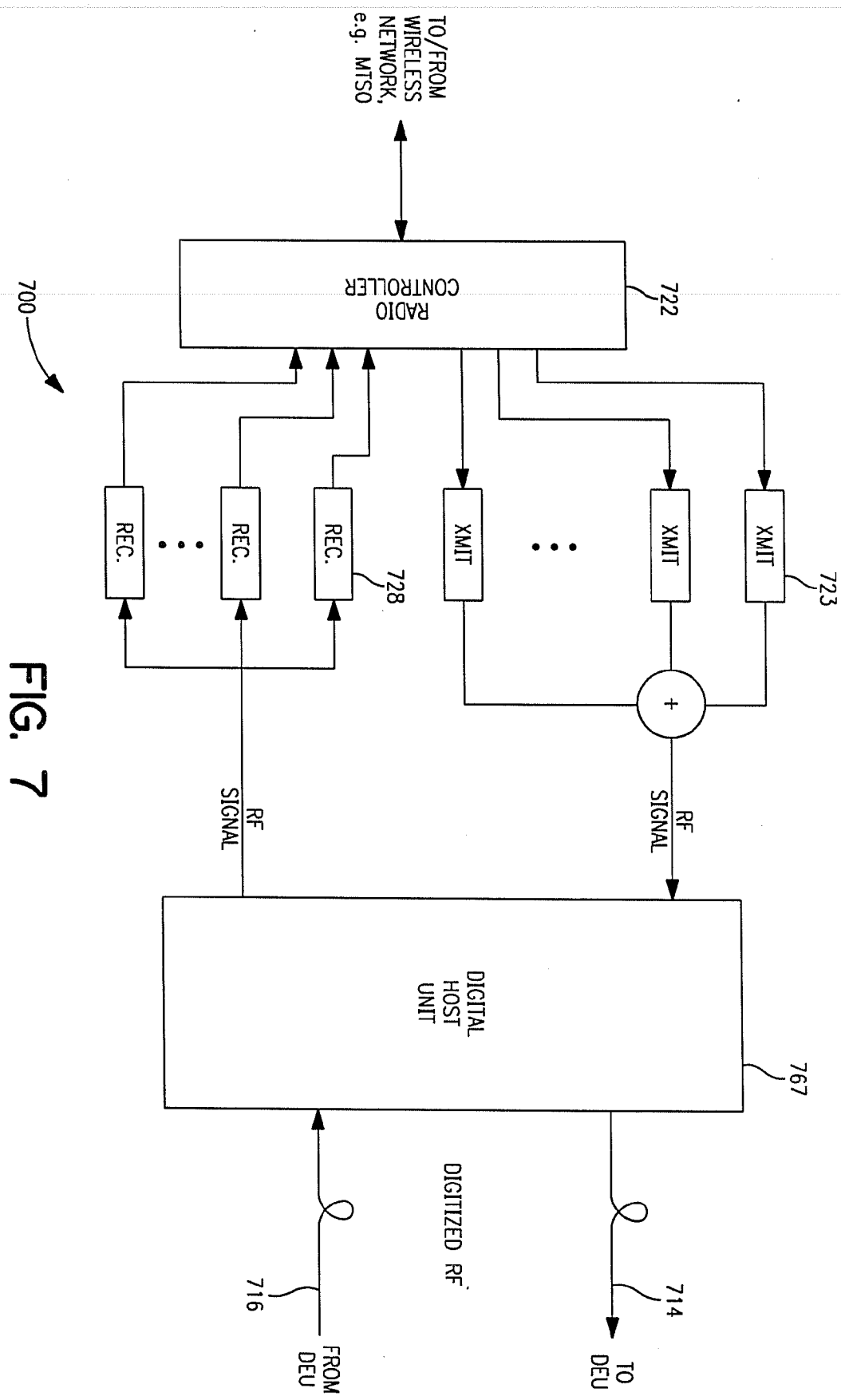


FIG. 7

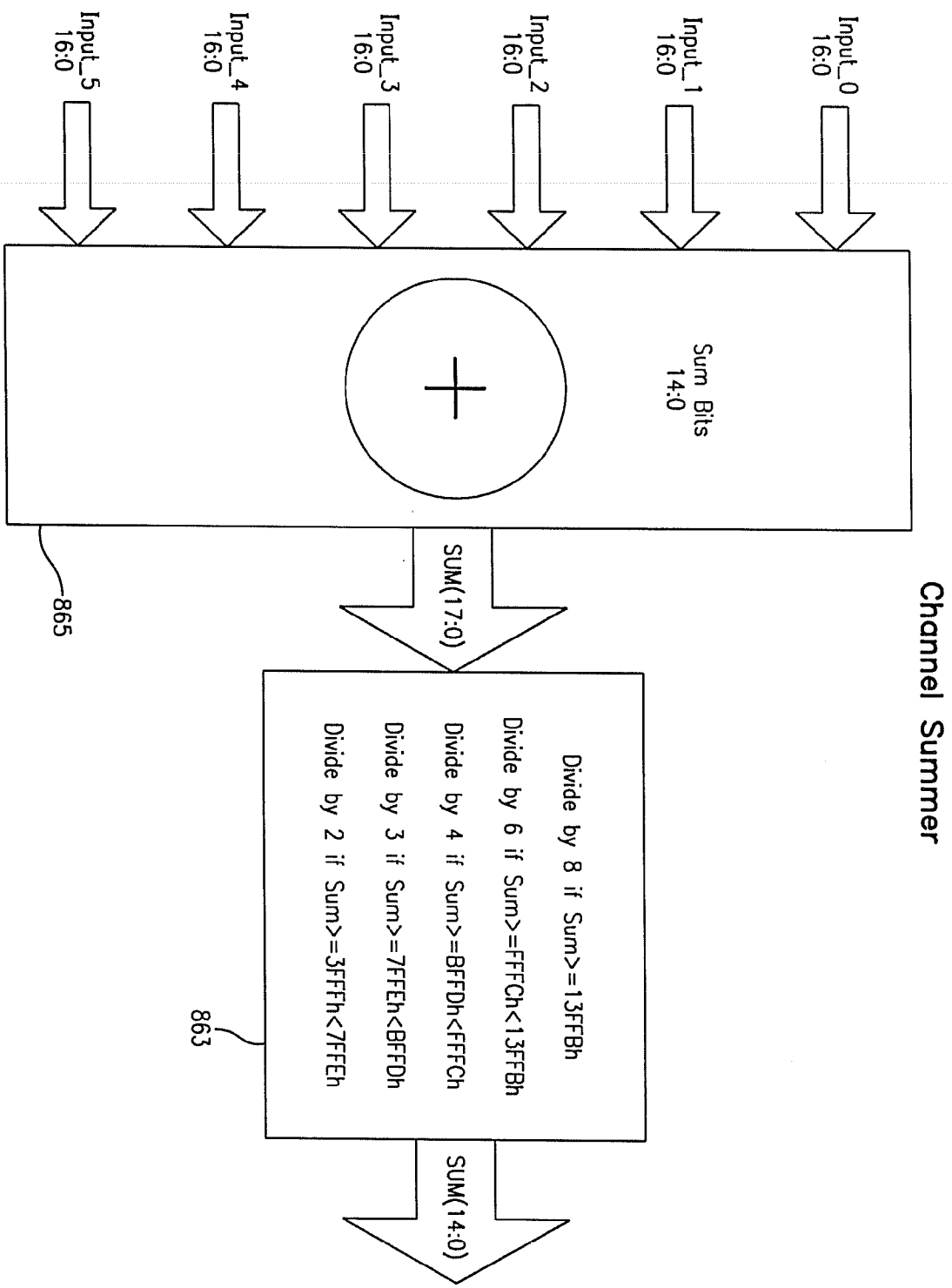


FIG. 8

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100.019US04
		Application Number	
Title of Invention	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		
<p>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.</p> <p>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.</p>			

Secrecy Order 37 CFR 5.2

<input type="checkbox"/> Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--

Inventor Information:

Inventor 1					Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name		Suffix	
Mr.	Philip	M.	Wala			
Residence Information (Select One) <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service						
City	Savage	State/Province	MN	Country of Residence ⁱ	US	
Mailing Address of Inventor:						
Address 1		14082 Toledo Court				
Address 2						
City	Savage	State/Province	MN			
Postal Code	55378	Country ⁱ	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.						Add

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<input type="checkbox"/> An Address is being provided for the correspondence Information of this application.		
Customer Number	34206	
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Application Information:

Title of the Invention	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		
Attorney Docket Number	100.019US04	Small Entity Status Claimed	<input type="checkbox"/>
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)	8	Suggested Figure for Publication (if any)	17

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100.019US04
		Application Number	
Title of Invention	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		

Publication Information:

<input type="checkbox"/>	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
<input type="checkbox"/>	Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

<p>Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.</p>											
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Please Select One:	<input checked="" type="radio"/> Customer Number	<input type="radio"/> US Patent Practitioner	<input type="radio"/> Limited Recognition (37 CFR 11.9)								
Customer Number	34206										

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.					
Prior Application Status	Pending		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)		
	Continuation of	12/617215	2009-11-12		
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12/617215	Continuation of	10/740944	2003-12-19	7639982	2009-12-29
Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
10/740944	Continuation of	09/619431	2000-07-19	6704545	2004-03-09
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.					Add

Foreign Priority Information:

<p>This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).</p>
--

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100.019US04
		Application Number	
Title of Invention	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		

			Remove
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Priority Claimed
			<input type="radio"/> Yes <input checked="" type="radio"/> No
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Authorization to Permit Access:

<input checked="" type="checkbox"/> Authorization to Permit Access to the Instant Application by the Participating Offices
<p>If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.</p> <p>In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.</p> <p>In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.</p>

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.	
Applicant 1	
<p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p>	
Remove	
<input checked="" type="radio"/> Assignee	<input type="radio"/> Legal Representative under 35 U.S.C. 117
<input type="radio"/> Person to whom the inventor is obligated to assign.	<input type="radio"/> Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100.019US04
		Application Number	
Title of Invention	POINT-TO-MULTIPOINT DIGITAL RADIO FREQUENCY TRANSPORT		

Name of the Deceased or Legally Incapacitated Inventor :			
If the Assignee is an Organization check here. <input checked="" type="checkbox"/>			
Organization Name	ADC Telecommunications, Inc.		
Mailing Address Information:			
Address 1	1187 Park Place		
Address 2			
City	Shakopee	State/Province	MN
Country i	US	Postal Code	55379
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Signature:Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications					
Signature	/Jon M. Powers/			Date (YYYY-MM-DD)	2012-10-29
First Name	Jon M.	Last Name	Powers	Registration Number	43868
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This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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.
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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.