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NOTICE OF ALLOWANCE AND FEE(S) DUE

24244 7590 09/06/2007

MICHAEL W LANDRY
5098 SEACHASE STREET
SAN DIEGO, CA 92130

EXAMINER

QURESHI, AFSAR M

ART UNIT

PAPER NUMBER

2616

DATE MAILED: 09/06/2007

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/322,834	12/18/2002	Anton Monk	9228	6744

TITLE OF INVENTION: BROADBAND NETWORK FOR COAXIAL CABLE USING MULTI-CARRIER MODULATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$700	\$0	\$0	\$700	12/06/2007

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

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

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

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

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

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

If the SMALL ENTITY is shown as NO:

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

24244 7590 09/06/2007

MICHAEL W LANDRY
5098 SEACHASE STREET
SAN DIEGO, CA 92130

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/322,834	12/18/2002	Anton Monk	9228	6744

TITLE OF INVENTION: BROADBAND NETWORK FOR COAXIAL CABLE USING MULTI-CARRIER MODULATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$700	\$0	\$0	\$700	12/06/2007

EXAMINER	ART UNIT	CLASS-SUBCLASS
QURESHI, AFSAR M	2616	370-235000

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

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

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

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

(A) NAME OF ASSIGNEE

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

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

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

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

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

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

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

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

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

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

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.



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10/322,834	12/18/2002	Anton Monk	9228	6744
24244	7590	09/06/2007		
MICHAEL W LANDRY 5098 SEACHASE STREET SAN DIEGO, CA 92130				
			EXAMINER QURESHI, AFSAR M	
			ART UNIT 2616	PAPER NUMBER
DATE MAILED: 09/06/2007				

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 1159 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 1159 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.

CA

Notice of Allowability	Application No.	Applicant(s)	
	10/322,834	MONK ET AL.	
	Examiner	Art Unit	
	Afsar M. Qureshi	2616	

-- 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 amendmen, dtd 4/03/2007 and Telephonic Interview dated 4/10/2007t.
2. ☒ The allowed claim(s) is/are 1,3,4,10 (now renumbered as 1-4).
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

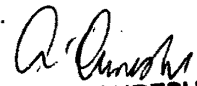
Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date 4/11/2007.

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)

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. ☐ Notice of References Cited (PTO-892) 2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ 4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material | <ol style="list-style-type: none"> 5. ☐ Notice of Informal Patent Application 6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date _____ 7. ☒ Examiner's Amendment/Comment 8. ☒ Examiner's Statement of Reasons for Allowance 9. ☐ Other _____ |
|---|--|


AFSAR QURESHI
PRIMARY EXAMINER

4/11/07

EXAMINER'S AMENDMENT ✓

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

Authorization for this examiner's amendment was given in a telephone interview with Michael W. Landry on 4/10/2007.

The application has been amended as follows:

1. IN THE CLAIMS:

Claim 1, line 8, after "signaling" added -- ; wherein network devices transmit probe messages through the cable wiring and analyze received probe message signals to determine channel characteristics and bit loading is selected based on the determined channel characteristics --

Claim 2, Cancelled.

Claim 3, line 1, deleted "claim 2" ; replaced with -- claim 1 --

Claim 4, line 1, deleted "claim 2" , replaced with -- claim 1 --

2. Applicant, in response to Election/Restriction, cancelled claims 5-9, without traverse (see Interview Summary).

Drawings

3. The following changes to the drawings have been approved by the examiner and agreed upon by applicant: Figure 1, submitted on, 3/17/2003, should be labeled as "PRIOR ART" (see drawings submitted on 12/18/2002. In order to avoid abandonment of the application, applicant must make these above agreed upon drawing changes.

REASONS FOR ALLOWANCE

4. Claims 1, 3, 4 and 10 are allowed over prior art of record.

The following is an examiner's statement of reasons for allowance:

The prior art of record, Dodds et al. (US 6,886,181) and an article "*Multicarrier Modulation for Data Transmission; An Idea Whose Time has Come*", by John A.C. Bingham, IEEE, alone or in combination, fails to disclose a network device for communicating data to other network devices by utilizing unique method step of determining channel characteristics and a bit loading profile used to transmit data by analyzing received probe message signals (claims 1 and 10).

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

Art Unit: 2616

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Afsar M. Qureshi whose telephone number is (571) 272 3178. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Field Lynn can be reached on (571) 272 2092. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


AFSAR QURESHI
PRIMARY EXAMINER
4/11/2007

Interview Summary	Application No.		Applicant(s)	
	10/322,834		MONK ET AL.	
	Examiner		Art Unit	
	Afsar M. Qureshi		2616	

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

(1) Afsar M. Qureshi. (3) _____

(2) Michael Landry. (4) _____

Date of Interview: 10 April 2007.

Type: a) ☒ Telephonic b) ☐ Video Conference
c) ☐ Personal [copy given to: 1) ☐ applicant 2) ☐ applicant's representative]

Exhibit shown or demonstration conducted: d) ☐ Yes e) ☐ No.
If Yes, brief description: _____

Claim(s) discussed: 1-4 and 10.

Identification of prior art discussed: _____

Agreement with respect to the claims f) ☒ was reached. g) ☐ was not reached. h) ☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: In order to expedite the allowance, Applicant's attorney agreed to amend claim 1 per Examiner's suggestion and cancel claim 2, also, amend claims 3 and 4 to correct the dependency.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.



Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

AFSAR QURESHI
Examiner Signature Required 4/10/07

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No: 10/322,834 Confirmation No. 6744

Attorney Docket: 9228

5 Filed: 12/18/2002

Applicant: Monk, et. al

Title: Broadband Network for Coaxial Cable Using Multi-carrier Modulation

Examiner/GAU: Afsar M Qureshi / 2616

10 Date: 4/3/2007

Amendment / Election

Mail Stop Amendment (filed online)

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

Dear Sir:

20

In response to the Office Action mailed 3/19/2007, please accept the following election and amendments:

Claims starting on page 2.

25 Remarks on page 4.

Claim amendments:

1. (Original) A data communication network comprising:

5 at least two network devices, each network device comprising a multi-carrier modulator for modulating data, an up converter for translating the modulated data to an RF carrier frequency, a down converter for translating an RF signal, and a multi-carrier demodulator for demodulating the translated RF signal to produce data; and

10 cable wiring comprising a splitter with a common port and a plurality of tap ports, and a plurality of segments of coaxial cable connecting between the splitter tap ports and the network devices;

whereby network devices communicate with each other through the cable wiring using multi-carrier signaling.

15

2. (Original) The data communication network of claim 1 wherein network devices transmit probe messages through the cable wiring and analyze received probe message signals to determine channel characteristics and bit loading is selected based on the determined channel characteristics.

20 3. (Original) The data communication network of claim 2 wherein a network device comprises a means for determining signal activity and selects a frequency band for operation that is not used by other services.

4. (Original) The data communication network of claim 2 wherein the network shares the cable wiring
25 with a cable television service and the network device up converter translates the modulated data to an RF carrier frequency above the frequency used by the cable television service.

5-9 (Canceled)

10. (Original) A network device for communicating data to other network devices over a coaxial wiring system comprising a splitter and a plurality of cable segments connected between the splitter and the network devices, the network device comprising:

a data modulator to produce a multicarrier modulated signal;

5 a demodulator for multicarrier modulated signal to produce data;

means for producing and transmitting a probe message; and

means for receiving and analyzing a probe message to determine a bit loading profile used to transmit data.

10

Remarks

Claims - Election

Claims were restricted in the office action.

5

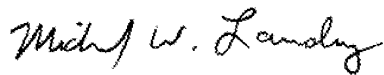
In a phone message left with the Examiner on 3/21/07, election was made to have Group I examined, claims 1-4 and 10. A phone message from the Examiner on 3/22/07 confirmed the election. The reply provides written verification of the election.

10 Claims 1-4 and 10 remain.

Claims in the non-elected Group II, claims 5-9, have been canceled.

15 If it is felt that direct communication would serve to advance prosecution of this case, the examiner is invited to call the attorney at the below listed telephone number.

Respectfully submitted,



20

Michael W. Landry
Attorney for Applicants
Reg. No. 38,216
5098 Seachase St.
San Diego CA 92130
858-229-6801
mlandry@iprsolutions.com

25

Electronic Acknowledgement Receipt

EFS ID:	1651366
Application Number:	10322834
International Application Number:	
Confirmation Number:	6744
Title of Invention:	Broadband network for coaxial cable using multi-carrier modulation
First Named Inventor/Applicant Name:	Anton Monk
Customer Number:	24244
Filer:	Michael William Landry
Filer Authorized By:	
Attorney Docket Number:	9228
Receipt Date:	03-APR-2007
Filing Date:	18-DEC-2002
Time Stamp:	20:16:23
Application Type:	Utility

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Response to Election / Restriction Filed	9228-Election-Response.pdf	79792	no	4

Warnings:

Information:	
Total Files Size (in bytes):	79792
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.	



UNITED STATES PATENT AND TRADEMARK OFFICE

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24244 7590 03/19/2007
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5098 SEACHASE STREET
SAN DIEGO, CA 92130

EXAMINER

QURESHI, AFSAR M

ART UNIT	PAPER NUMBER
----------	--------------

2616

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
31 DAYS	03/19/2007	PAPER

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

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/322,834	MONK ET AL.	
	Examiner	Art Unit	
	Afsar M. Qureshi	2616	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) ____ is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☒ Claim(s) 1-10 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

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

Attachment(s)

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

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-4, 10, drawn to network component and two way spectrum, classified in class 725, subclass 127.
- II. Claims 5--9, drawn to orthogonal functions, classified in class 370, subclass 208.

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

(i) Inventions Group I and Group II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed. The subcombination has separate utility of channel estimation, modulating using OFDM, channel estimation training sequence, QPSK encoded OFDM, bit loading etc. The examiner has required restriction between combination and subcombination inventions. Where applicant elects a subcombination, and claims thereto are subsequently found allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37 CFR 1.104. See MPEP § 821.04(a). Applicant is advised that if any claim presented in a

continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

(ii) Inventions Group I and Group II are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct if they do not overlap in scope and are not obvious variants, and if it is shown that at least one subcombination is separately usable. In the instant case, subcombination Group II has separate utility such as channel estimation, modulating using OFDM, channel estimation training sequence, QPSK encoded OFDM. See MPEP § 806.05(d).

The examiner has required restriction between subcombinations usable together. Where applicant elects a subcombination and claims thereto are subsequently found allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37 CFR 1.104. See MPEP § 821.04(a). Applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

2. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required

because the inventions have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

3. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.

4. Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48 (b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48 (b) and by a fee required under 37 CFR 1.17 (i).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Afsar M. Qureshi whose telephone number is (571) 272 3178.

Art Unit: 2616

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Field Lynn can be reached on (571) 272 2092. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


AFSAR QURESHI
PRIMARY EXAMINER

3/7/2007



UNITED STATES
PATENT AND
TRADEMARK OFFICE

Commissioner for Patents
Washington, DC 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/322,834	12/18/2002	Anton Monk	9228

24244
MICHAEL W LANDRY
5098 SEACHASE STREET
SAN DIEGO, CA 92130

CONFIRMATION NO. 6744
FORMALITIES LETTER

OC00000009437855

Date Mailed: 01/28/2003

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 are required. The drawings submitted are not acceptable because:
 - The drawing sheets do not have the appropriate margin(s) (see 37 CFR 1.84(g)). Each sheet must include a top margin of at least 2.5 cm. (1 inch), a left side margin of at least 2.5 cm. (1 inch), a right side margin of at least 1.5 cm. (5/8 inch), and a bottom margin of at least 1.0 cm. (3/8 inch). See Figures(s) 3,10.

*A copy of this notice **MUST** be returned with the reply.*

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PART 2 - COPY TO BE RETURNED WITH RESPONSE



10322834 12/18/2002

03 CO

PTO/SB/21 (01-03)

Approved for use through 04/30/2003. OMB 0651-0031

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

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

TRANSMITTAL FORM (to be used for all correspondence after initial filing)	Application Number	10/322,834	
	Filing Date	12/18/2002	
	First Named Inventor	Monk	
	Art Unit	2661	
	Examiner Name		
Total Number of Pages in This Submission	12	Attorney Docket Number	9228

ENCLOSURES (Check all that apply)		
☐ Fee Transmittal Form	☒ Drawing(s)	☐ After Allowance Communication to Group
☐ Fee Attached	☐ Licensing-related Papers	☐ Appeal Communication to Board of Appeals and Interferences
☐ Amendment/Reply	☐ Petition	☐ Appeal Communication to Group (Appeal Notice, Brief, Reply Brief)
☐ After Final	☐ Petition to Convert to a Provisional Application	☐ Proprietary Information
☐ Affidavits/declaration(s)	☐ Power of Attorney, Revocation	☐ Status Letter
☐ Extension of Time Request	☐ Change of Correspondence Address	☐ Other Enclosure(s) (please identify below):
☐ Express Abandonment Request	☐ Terminal Disclaimer	
☐ Information Disclosure Statement	☐ Request for Refund	
☐ Certified Copy of Priority Document(s)	☐ CD, Number of CD(s)	
☒ Response to Missing Parts/Incomplete Application	Remarks	
☐ Response to Missing Parts under 37 CFR 1.52 or 1.53	Replacement Drawings	
SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT		
Firm or Individual	Michael W. Landry	
Signature		
Date	3/11/2003	

CERTIFICATE OF TRANSMISSION/MAILING		
I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Washington, DC 20231 on this date: 3/11/2003		
Typed or printed	Michael W. Landry	
Signature		Date 3/11/2003

This collection of information is required by 37 CFR 1.5. 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, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, Washington, DC 20231.

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

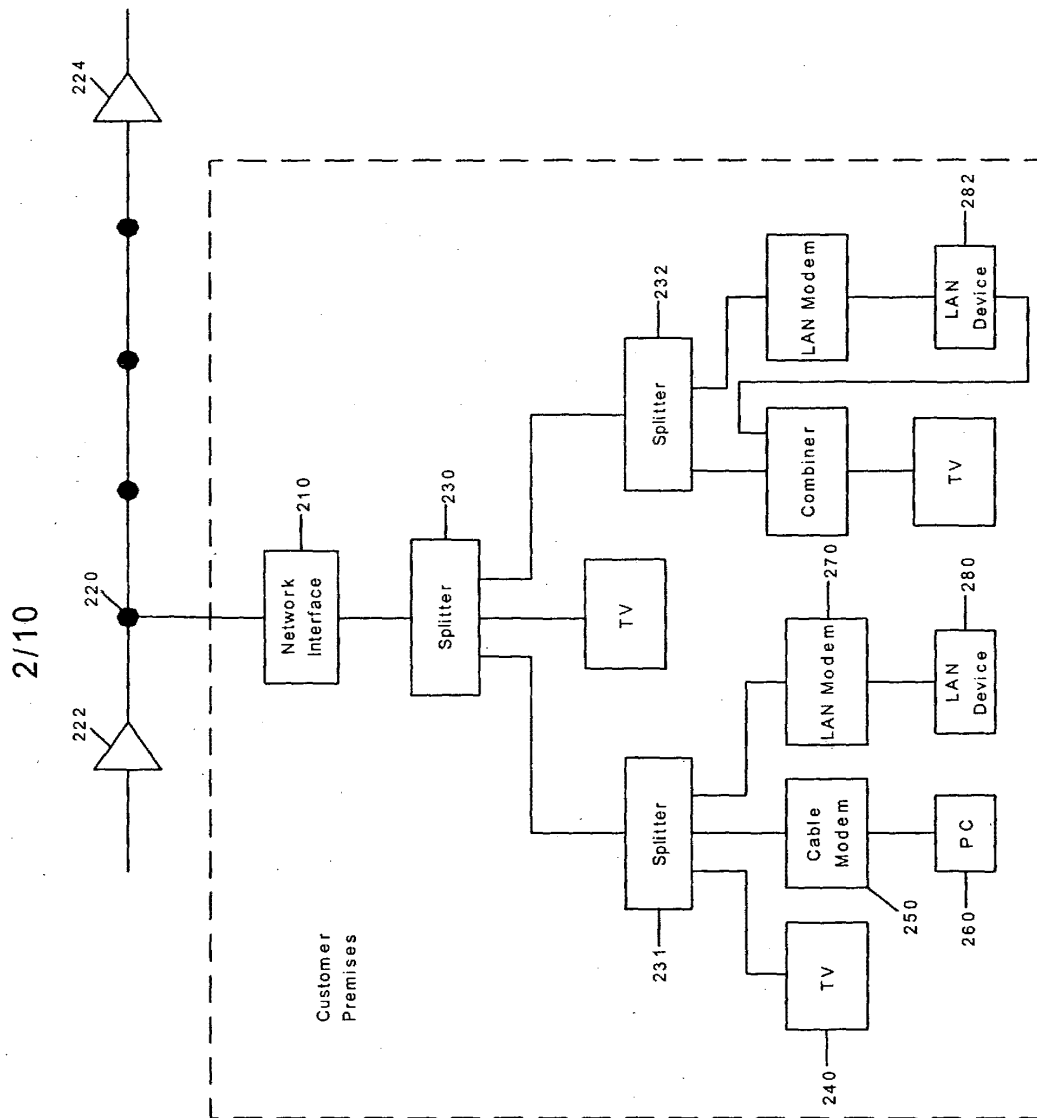


Fig. 2



3/10

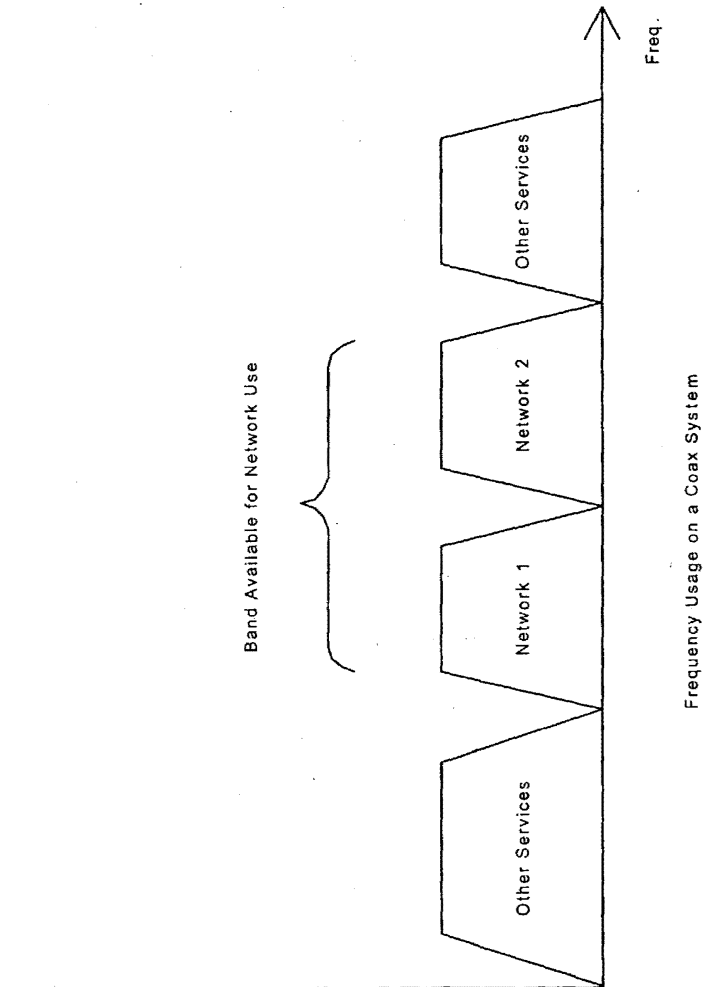


Fig. 3



105854-001703

4/10

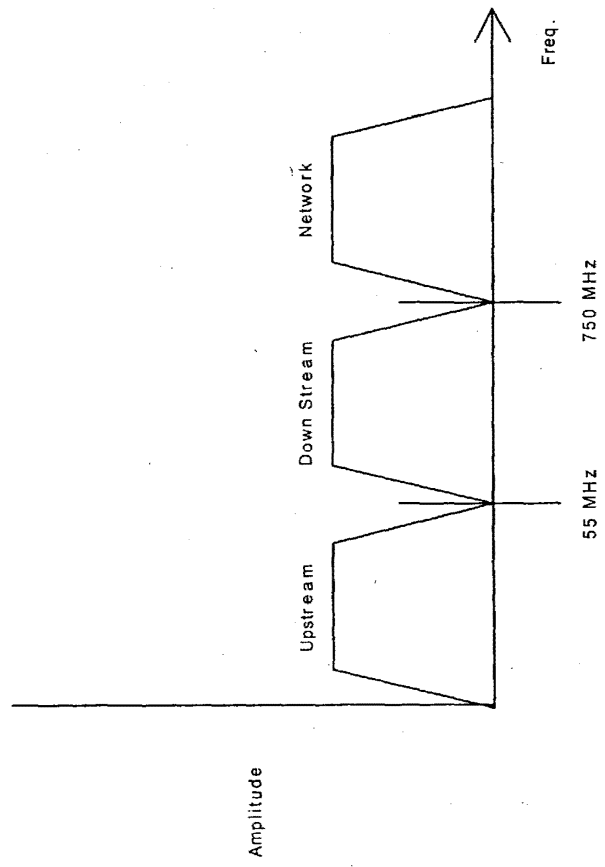


Fig. 4



5/10

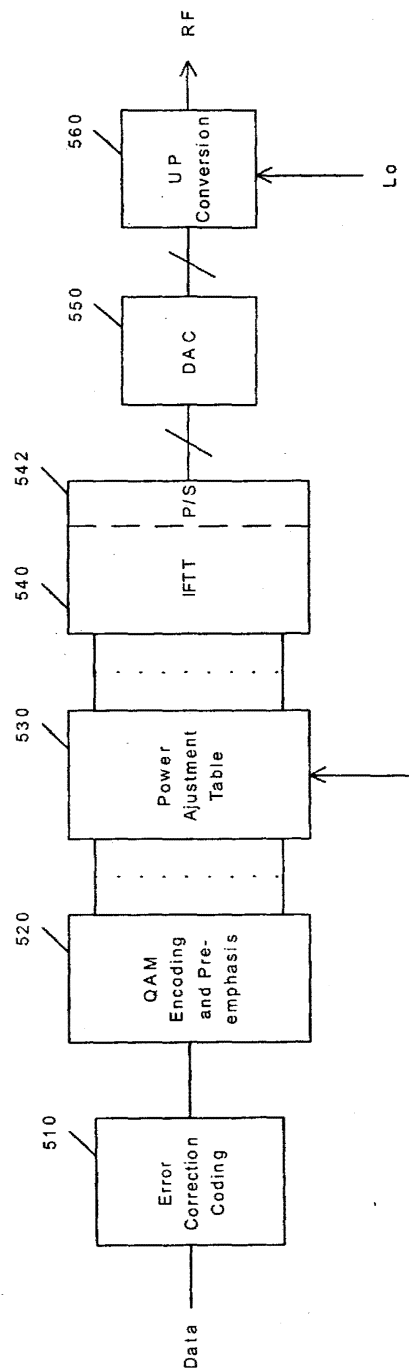
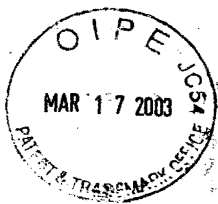


Fig. 5



00000004.000000

6/10

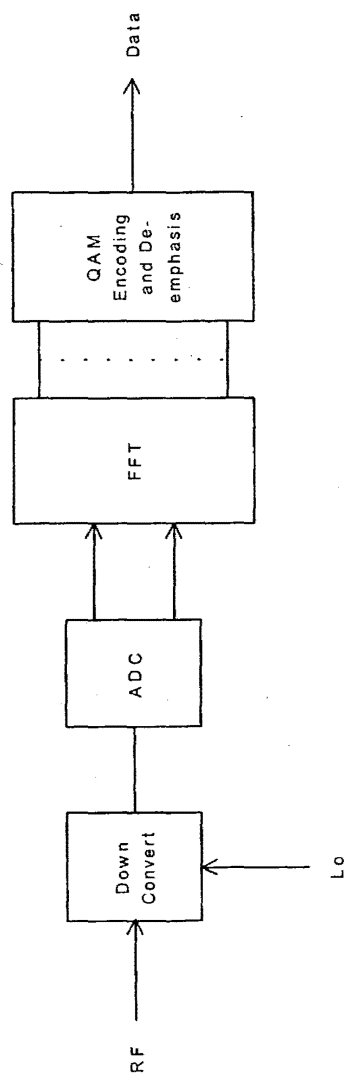


Fig. 6



7/10

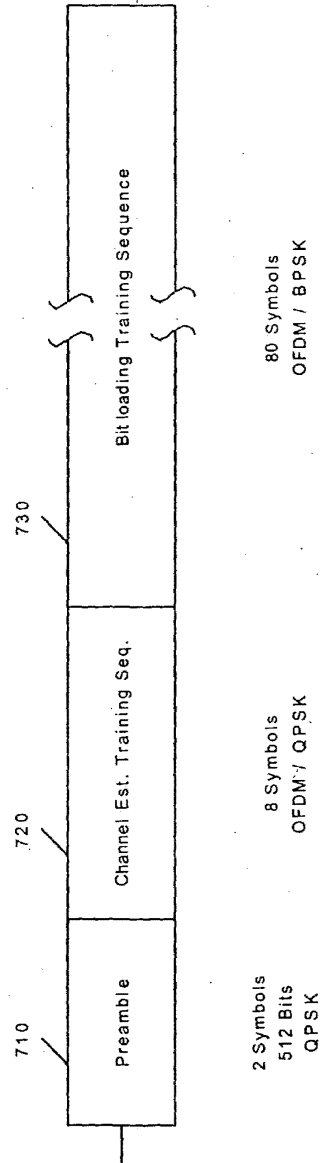


Fig. 7

8/10

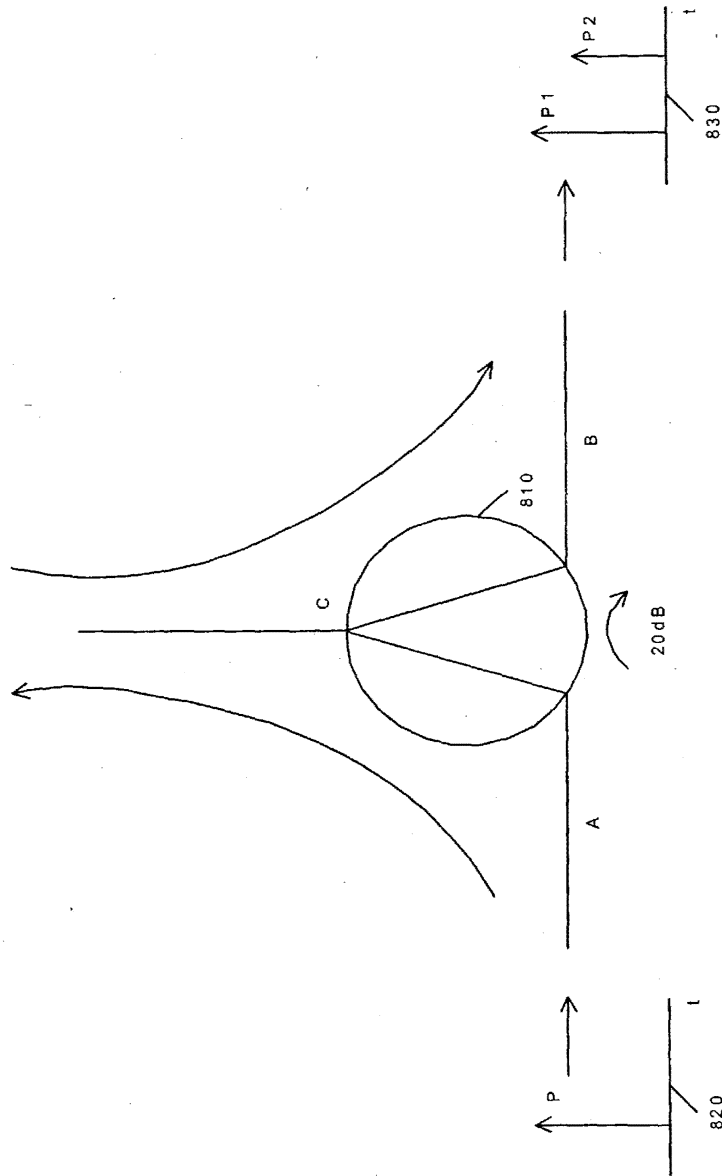


Fig. 8



9/10

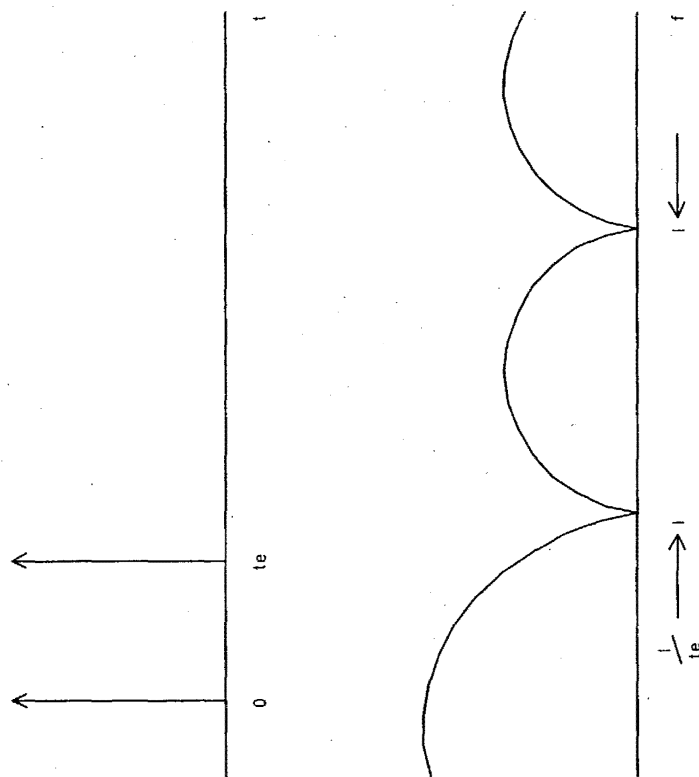


Fig. 9



3113-23334-4331703

10/10

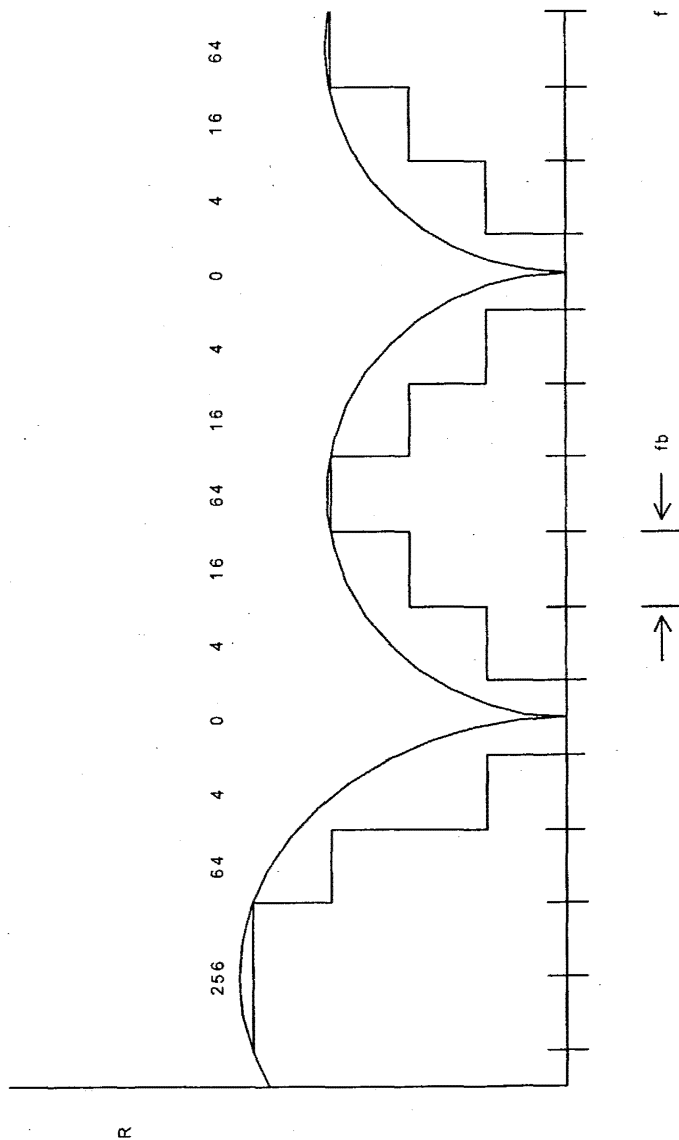


Fig. 10



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APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/322,834	12/18/2002	Anton Monk	9228

24244
MICHAEL W LANDRY
5098 SEACHASE STREET
SAN DIEGO, CA 92130

CONFIRMATION NO. 6744

FORMALITIES LETTER



OC000000009437855

Date Mailed: 01/28/2003

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 are required. The drawings submitted are not acceptable because:
 - The drawing sheets do not have the appropriate margin(s) (see 37 CFR 1.84(g)). Each sheet must include a top margin of at least 2.5 cm. (1 inch), a left side margin of at least 2.5 cm. (1 inch), a right side margin of at least 1.5 cm. (5/8 inch), and a bottom margin of at least 1.0 cm. (3/8 inch). See Figures(s) 3, 10.

*A copy of this notice **MUST** be returned with the reply.*

Customer Service Center
Initial Patent Examination Division (703) 308-1202

PART 3 - OFFICE COPY

12/18/02

13062 U.S. PTO

12-20-02 10:22:34 12/18/02

13062 U.S. PTO
107322834

12/18/02

Please type a plus sign (+) inside this box → +

Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.**UTILITY
PATENT APPLICATION
TRANSMITTAL**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	9228
First Inventor	Anton Monk
Title	Broadband Network for Coaxial Cable Using Multi-carrier Modulation
Express Mail Label No.	EU828750385US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Applicant claims small entity status.
See 37 CFR 1.27.
3. ☒ Specification [Total Pages **21**]
(preferred arrangement set forth below)
- Descriptive title of the invention
 - Cross Reference to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to sequence listing, a table, or a computer program listing appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets **10**]
5. Oath or Declaration [Total Pages **3**]
- a. ☒ Newly executed (original or copy)
- b. ☐ Copy from a prior application (37 CFR 1.63 (d))
(for continuation/divisional with Box 18 completed)
- i. ☐ **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s)
named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☐ Application Data Sheet. See 37 CFR 1.76

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
- a. ☐ Computer Readable Form (CRF)
- b. Specification Sequence Listing on:
- i. ☐ CD-ROM or CD-R (2 copies); or
- ii. ☐ paper
- c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☒ Assignment Papers (cover sheet & document(s))
10. ☒ 37 CFR 3.73(b) Statement (when there is an assignee) ☒ Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☒ Nonpublication Request under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
17. ☐ Other: _____

18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:

☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. **10/230,687**

Prior application information: Examiner _____ Group Art Unit: **2661**

For CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

19. CORRESPONDENCE ADDRESS

☒ Customer Number or Bar Code Label **24244** (Insert Customer No. or Attach Barcode Label) or ☐ Correspondence address below

Name				
Address	24244			
City	PATENT TRADEMARK OFFICE	State	Zip Code	
Country	Telephone	858-229-6801	Fax	858-509-0184

Name (Print/Type)	Michael W. Landry	Registration No. (Attorney/Agent)	38,216
Signature	<i>Michael W. Landry</i>	Date	12/18/02

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

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FEE TRANSMITTAL for FY 2002

Patent fees are subject to annual revision.

☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 452

Complete if Known

Application Number
Filing Date
First Named Inventor Anton Monk
Examiner Name
Group Art Unit
Attorney Docket No. 9228

METHOD OF PAYMENT (check all that apply)

☒ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☒ Deposit Account:

Deposit Account Number 502165
Deposit Account Name Michael W. Landry

The Commissioner is authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☒ Credit any overpayments
☒ Charge any additional fee(s) during the pendency of this application
☐ Charge fee(s) indicated below, except for the filing fee to the above identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
101 740	201 370	Utility filing fee	370
106 330	206 165	Design filing fee	
107 510	207 255	Plant filing fee	
108 740	208 370	Reissue filing fee	
114 160	214 80	Provisional filing fee	

SUBTOTAL (1) (\$) 370

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

Extra Claims Fee from below Fee Paid
Total Claims 10 -20** = 0 x =
Independent Claims 4 -3** = 1 x 42 = 42
Multiple Dependent Claims =

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description
103 18	203 9	Claims in excess of 20
102 84	202 42	Independent claims in excess of 3
104 280	204 140	Multiple dependent claim, if not paid
109 84	209 42	** Reissue independent claims over original patent
110 18	210 9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (\$) 42

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
105 130	205 65	Surcharge - late filing fee or oath	
127 50	227 25	Surcharge - late provisional filing fee or cover sheet	
139 130	139 130	Non-English specification	
147 2,520	147 2,520	For filing a request for <i>ex parte</i> reexamination	
112 920*	112 920*	Requesting publication of SIR prior to Examiner action	
113 1,840*	113 1,840*	Requesting publication of SIR after Examiner action	
115 110	215 55	Extension for reply within first month	
116 400	216 200	Extension for reply within second month	
117 920	217 460	Extension for reply within third month	
118 1,440	218 720	Extension for reply within fourth month	
128 1,960	228 980	Extension for reply within fifth month	
119 320	219 160	Notice of Appeal	
120 320	220 160	Filing a brief in support of an appeal	
121 280	221 140	Request for oral hearing	
138 1,510	138 1,510	Petition to institute a public use proceeding	
140 110	240 55	Petition to revive - unavoidable	
141 1,280	241 640	Petition to revive - unintentional	
142 1,280	242 640	Utility issue fee (or reissue)	
143 460	243 230	Design issue fee	
144 620	244 310	Plant issue fee	
122 130	122 130	Petitions to the Commissioner	
123 50	123 50	Processing fee under 37 CFR 1.17(q)	
126 180	126 180	Submission of Information Disclosure Stmt	
581 40	581 40	Recording each patent assignment per property (times number of properties)	40
146 740	246 370	Filing a submission after final rejection (37 CFR § 1.129(a))	
149 740	249 370	For each additional invention to be examined (37 CFR § 1.129(b))	
179 740	279 370	Request for Continued Examination (RCE)	
169 900	169 900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$) 40

SUBMITTED BY

Name (Print/Type) Michael W. Landry
Signature *M W Landry*

Registration No (Attorney/Agent) 38,216

Complete (if applicable)

Telephone 858-229-6801

Date 12/18/02

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Monk, et al.

Application No./Patent No.: _____ Filed/Issue Date: 12/18/2002

Entitled: Broadband Network for Coaxial Cable Using Multi-carrier Modulation

Entropic Communications, Inc. a Corporation

(Name of Assignee)

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

states that it is:

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

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

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

OR

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

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

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

- [X] Copies of assignments or other documents in the chain of title are attached.
[NOTE: A separate copy (*i.e.*, the original assignment document or a true copy of the original document) must be submitted to Assignment Division in accordance with 37 CFR Part 3, if the assignment is to be recorded 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.

12/16/02
Date

Date _____

Itzhak Gurantz

Typed or printed name

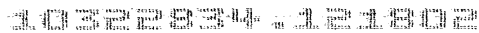


Signature _____

CEO, Entropic Communications Inc.

Title

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO:** Assistant Commissioner for Patents, Washington, DC 20231.



PTO/SB/35 (11-00)

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

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NONPUBLICATION REQUEST UNDER 35 U.S.C. 122(b)(2)(B)(i)	First Named Inventor	Monk
	Title	Broadband Network for Coaxial Cable Using Multi-carrier Modulation
	Atty Docket Number	9228

I hereby 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 agreement, that requires publication at eighteen months after filing.

I hereby request that the attached application not be published under 35 U.S.C. 122(b).

12/18/02

Date

Michael W. Landry

Signature

Michael W. Landry

Typed or printed name

This request must be signed in compliance with 37 CFR 1.33(b) and submitted with the application **upon filing**.

Applicant may rescind this nonpublication request at any time. If applicant rescinds a request that an application not be published under 35 U.S.C. 122(b), the application will be scheduled for publication at eighteen months from the earliest claimed filing date for which a benefit is claimed.

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EXPRESS ABANDONMENT UNDER 37 CFR 1.138		Docket Number (Optional) 9223
To: Assistant Commissioner for Patents Washington, DC 20231	In re Application of Monk, et al.	
	Application Number 10/230,687	Filed 8/29/2002
	For Broadband Network for Coaxial Cable Using Multi-carrier Modulation	
	Art Unit 2661	Examiner

Please **check only one** of boxes 1-3 below:
(If no box is checked, this paper will be treated as a request for express abandonment as of the filing date of this paper.)

1. ☐ **Express Abandonment**
 I request that the above-identified application be expressly abandoned as of the filing date of this paper.
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(Attorney or agent registration number)

Michael W. Landry

Signature

Michael W. Landry

Typed or printed name

12/18/02

Date

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

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Broadband Network for Coaxial Cable Using Multi-carrier Modulation

Inventors:

Anton Monk, Brett Bernath, Itzhak Gurantz, Ladd El Wardani, Ron Porat

Docket: 9223

RELATED APPLICATIONS

This application is a continuation application of U.S. patent application No. 10/230,687 filed August 29, 2002 entitled "Broadband Network for Coaxial Cable Using Multi-carrier Modulation" now abandoned, which claims priority to U.S. provisional patent application No. 60/316,820, filed August 30, 2001 entitled "Broadband Local Area Network Using Coaxial Cable"; U.S. provisional patent application No. 60/363,420 filed March 12, 2002 entitled "Method of bit and energy loading to reduce interference effects in devices sharing a communication medium"; and U.S. provisional patent application No. 60/385,361, filed June 3, 2002 entitled "Power loading to reduce interference effects in devices sharing a communication medium", each of which is incorporated herein by reference.

Related application: "Network interface and broadband local area network using coaxial cable" serial number 09/910,412 filed July 21, 2001, incorporated herein by reference.

TECHNICAL FIELD

This invention relates to broadband communication networks and specifically to communications using coaxial cable building wiring.

BACKGROUND

In a coaxial cable based local area network (LAN), communication between nodes occurs over a shared coaxial cable. When the coaxial cable used for the LAN is shared with a community aerial television or cable TV (CATV) service the signals must be separated to avoid interference. The LAN signal can use one band of frequencies and the cable TV service can use a different band. A typical cable TV

configuration for a home is shown in Fig. 1. Signal splitters are used to distribute downstream signals from the point of entry (POE) to the various terminals in the home, which can include cable converter boxes, televisions, and cable modems, generally referred to as customer premise equipment (CPE). Each terminal device may have the ability to transmit as well as receive. The upstream signals
5 transmitted by the terminal device flows through the signal splitters back to the POE and into the cable plant and are received by the head end. The signal splitters are functioning as signal combiners for upstream signals. Devices communicating with the head end generally do not communicate with each other.

10 Signal splitters are commonly used in home and other building type coaxial cable wiring. They have an input port and multiple output ports. The input port can also be considered a common port. The output ports can also be considered tap ports. Splitters are generally passive devices and can be constructed using lumped element circuits with discrete transformers, inductors, capacitors, and resistors. Splitters can also be constructed using strip line or microstrip circuits. A typical two-way splitter splits the power
15 equally between the two output ports if each port is terminated equally. Thus each output would have a power level 3 dB lower than the input. Ideally, a splitter transfers all power from the input port to the output ports. In a practical implementation there is a modest power loss in the splitter due to impedance mismatches, non-zero resistances, dissipative losses in circuit elements, and other non-ideal properties. These losses amount to approximately 0.5 dB, thus a practical two-way splitter provides -3.5dB power
20 level to each output.

Splitters are generally bi-directional; they can also function as signal combiners, which sum the power from multiple ports into a single output. The ports used as outputs in a splitter configuration become
25 inputs ports for the combining configuration. The common port becomes the output port.

A splitter may have 3 or more tap ports. There is typically an N-way splitter at the point of entry of a building that distributes the incoming CATV signal to each room of the building. The N-way splitter also combines the signals from each room, providing a return path for devices such as cable modems to
30 transmit back to the cable head-end.

Splitters can be designed with power dividing ratios that are not equal. Instead of a 3 dB loss to each port, one port can have, for example 1.15 dB loss, and the other 6 dB. This corresponds to 75%/25% coupling. This type of splitter could be used to balance signal power at all terminal devices when there are multiple levels of signal splitters. A branch that terminates directly to a terminal device would be connected to a higher loss tap port. A branch that contains additional splitters would be connected to a lower loss tap port, which provides extra power to compensate for the loss of additional splitters.

Another characteristic of interest in signal splitters is the isolation between output ports. The isolation is typically between 10 dB and 40 dB. This isolation attenuates signals communicating between tap ports. The signal splitter/combiner is therefore directional, power flows to and from the common port to the tap ports, but power is attenuated between tap ports.

In a conventional cable TV or cable modem use, this isolation is desirable because terminal devices do not communicate with each other, they only communicate through the POE with the cable head-end. In a LAN system, terminal devices must communicate directly with each other, therefore attenuation between tap ports in the signal splitters results in an undesirable signal loss. Presenting a further problem to terminal to terminal communications is the variation in attenuation in different branches of the building wiring. All terminal devices are not connected directly to the main splitter, but may be connected at a secondary splitter, for example in a room. The level of attenuation between different pairs of terminal devices needing to communicate may vary by 10 to 40 dB or more.

Several buildings may be connected to one splitter at the street. Although the isolation of this splitter is high, some coupling between taps occurs, allowing transmission from one building to another. This is a source of interference between LANs in neighboring buildings.

Another approach to overcoming the splitter inter-port isolation is to replace the main splitter at the building POE with a symmetric power splitter/combiner. In a symmetric splitter, power entering any port is divided among the other ports. A symmetric splitter/combiner is not directional. This type of splitter has 3 dB or more additional loss compared to a directional signal splitter. The additional loss is greater depending on the number of tap ports. A power amplifier may be required to boost the signal to compensate for this loss. A bi-directional device, such as a cable modem, requires a reverse path so the

amplifier needs to be bi-directional. Another disadvantage to this approach is that installation is required; each coax connected to the existing N-way directional splitter must be disconnected and moved to the new splitter. Another disadvantage of this approach is that power must be available for the amplifier, which is not generally present in the area a typical main splitter is located.

5

Imperfect terminations at connections create micro reflections within the cable wiring. The dominant main signal and reflected signal combine in the channel. A reflection anywhere in the wiring produces a multipath signal in some or all wiring branches that creates inter-symbol interference (ISI). The multipath signal has a delay and amplitude difference relative to the main signal. In the frequency domain, a reflection produces ripples in the response of the channel, creating amplitude variations across the pass band. In the time domain, ISI is seen as an impairment to the shape of the digital signal pulses. ISI will degrade the bit error rate (BER) performance of the communication channel. To overcome the effects of reflections, an adaptive equalizer is commonly used in the terminal device receiver. This creates a filter response that restores a flat frequency response impaired by the multipath signal.

15

The signals transmitted by LAN devices can create interference with televisions and set top boxes even though the LAN signals are out of band of these receivers, due to down conversion and signal mixing in the receivers.

20

Broadband networks are described in U.S. patent 5,889,765 "Bi-directional communications Network" issued to Gibbs, U.S. patents 5,940,387 and 6,005,861 "Home Multimedia Network Architecture" issued to Humpleman, U.S. patent 5,870,513 "Bi-directional Cable Network with a Mixing Tap or Suppressing Undesirable Noise in Signals From a Remote End of the Network" issued to Williams, U.S. patent 5,805,591 Subscriber Network Interface issued to Naboulsi, U.S. patent 6,008,368 "Ethernet Transport Facility Over Digital Subscriber Lines issued to Rubinstain", U.S. patent 6,137,793 "Reverse Path Multiplexer for Use in High Speed Data Transmissions" issued to Gorman, and U.S. patent 6,091,932 "Bidirectional Point to Multipoint Network Using Multicarrier Modulation" issued to Langlais, each of which is incorporated herein by reference.

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30

Gibbs discloses a broadband network overlaid with the cable service frequencies using dynamically allocated TDMA protocols. Humpleman patents disclose a home network using an active network

interface unit to couple the home network to the external network. Williams discloses a method of reducing noise accumulated in the frequency bands used by an upstream signal. Naboulsi discloses an active network interface for an asynchronous transfer mode (ATM) network. Rubinstain discloses a method of transporting Ethernet over twisted pair lines. Gorman discloses an active reverse path
 5 multiplexer for communication between the cable head-end and subscriber cable modems. Langlais discloses a two-way data transmission system for communicating between an upstream and downstream unit using OFDM.

U.S. patent 6,091,932 "Bidirectional point to multipoint network using multicarrier modulation",
 10 incorporated herein by reference, discloses various techniques for implementing OFDM communication. This reference discloses the use of OFDM for communicating between a terminal device and the cable head-end.

U.S. patent 6,292,651 "Communication system with multicarrier transport distribution network between
 15 a head end terminal and remote units" incorporated herein by reference discloses communication between a cable head end and remote units and discloses techniques using OFDM for such communication. U.S. patent 5,959,967 "Digital transmission system", incorporated herein by reference, issued to Humphrey discloses an OFDM transmission system used to communicate over a twisted pair loop. U.S. patent 5,371,548 "System for transmission of digital data using orthogonal frequency division
 20 multiplexing", incorporated herein by reference, issued to Williams discloses an OFDM system for data transmission during the vertical blanking interval of a television signal. U.S. patent 5,488,632 "Transmission and reception in a hostile interference environment", incorporated herein by reference, issued to Mason discloses additional techniques for implementing an OFDM modulator and demodulator. U.S. patent 3,488,445 "Orthogonal Frequency Multiplex Data Transmission System",
 25 incorporated herein by reference, issued to Chang and U.S. patent 3,511,936 "Multiply Orthogonal System for Transmitting Data Signals Through Frequency Overlapping Channels", incorporated herein by reference, disclose OFDM data transmission techniques.

A reflected signal and an attenuated signal passing through a splitter port creates a multipath
 30 environment. The received power level of the direct signal relative to the reflected signals can vary between equal levels to one signal being substantially greater than the other. The multipath environment

impairs the ability to achieve high data rates in a communication network. The signal reflections and tap port isolation of splitters existing in a typical cable TV wiring configuration presents a problem to shared usage of the cable for a LAN system. The prior art references address communicating between a cable head end and in-home units but do not address the impairments present in the home wiring that restricts high bandwidth communication between devices within the home.

SUMMARY OF THE INVENTION

The present invention uses a form of multi-carrier modulation, orthogonal frequency division multiplex (OFDM), to transmit digital data signals through the coaxial cable wiring installed in homes. Communication is achieved through splitters and signal impairments caused by reflections and attenuation are overcome. Bit loading, along with power loading, adaptive power control, and frequency coordination can be used individually or in combination to implement a network that overcomes the problem of multipath and high attenuation in building cable wiring that would restrict the ability of terminal devices to communicate with each other.

Channel probing messages formed using a predetermined bit sequence and length are transmitted between network devices to estimate the channel characteristics, including the multipath characteristics and a profile of the signal to noise ratio over the frequency band of interest. The probe messages are transmitted using robust modulation, for example QPSK, to insure the message can be received. The probe messages are transmitted without bit loading, that is all carriers have the same robust modulation and all carriers have the same power. The receiving device processes the probe messages as received and determines the impairment present at each carrier frequency. Based on the estimate of the channel, bit loading is applied to increase the modulation order at carriers with high signal to noise ratio and lower the modulation order at carriers with low signal to noise ratio.

Power loading of the individual carriers forming the OFDM signal allows the data network signal to minimize interference to the other services using the cable. Selective avoidance of specific carrier frequencies avoids interference from the other services to the network signal.

The data network established allows point-to-point communication between any two devices connected to the network and point-to-multipoint communication for broadcast or multicast of data messages. The data network overlays cable or satellite services and uses parts of the frequency spectrum not used by these other services.

5

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing a prior art coaxial signal distribution plan.

Fig. 2 is a diagram showing a signal distribution plan according to the present invention.

10 Fig. 3 shows a representative frequency allocation between network services and other services on a coaxial wiring system, including the use by two different networks.

Fig. 4 shows a representative frequency allocation between cable service upstream/downstream signals and an overlaid local area network.

Fig. 5. shows a block diagram of an OFDM modulator in accordance with the present invention.

15 Fig. 6. shows a block diagram of an OFDM demodulator in accordance with the present invention.

Fig. 7 shows an example of a bit loading probe message in accordance with the present invention.

Fig. 8 shows a multipath signal created by a splitter.

Fig. 9 shows a time domain and frequency domain plot of a signal experiencing multipath.

20 Fig.10 shows a bit loaded OFDM waveform in accordance with the present invention overlaid on an impaired frequency response.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 2, LAN modem 270 provides modulation and demodulation of the waveform
25 transmitted over the cable. LAN modem 270 has an interface to communicate with a LAN device 280, which is the source or destination of data transmitted over the LAN. LAN device 280 can be, for example, a personal computer (PC). LAN device 282 can be, for example, a modulator to produce a signal for driving a TV through a signal combiner. Network interface 210 is optional, it provides an additional signal coupling path between wiring branches if needed and is described more fully in co-
30 pending application 09/910412 "Network interface and broadband local area network using coaxial

cable". Additional networks can be connected to taps in the cable plant. The networks can reside in the same or different building.

LAN devices 280 and 282 can be used for digital video services or data services. LAN device 282, for example, can extract digital video data from a transport stream, such as an MPEG stream, transmitted over the network and decode the transport stream to produce an analog video signal suitable for connection to a standard TV set.

Existing devices, such as TV 240 and cable modem 250 connected to PC 260, use frequency bands distinct from the frequency band used by the LAN and therefore operate in a normal manner.

The frequencies used by the LAN can be located above the standard cable use frequencies, which extend to 550 MHz, 750 MHz, or 850 MHz. Other frequency plans can be used, for example where a block of frequencies is available in the middle of the cable band. The filter cut-off frequencies are selected according to the frequencies bands used. Satellite systems generally use frequencies above 950 MHz to communicate the received signal from the out door unit (ODU) to the integrated receiver decoder (IRD) set top box. A LAN would use frequencies below 950 MHz in this case.

Referring to Fig 3, more than one network can occupy the frequency band used for network services. The amount of spectrum used by a particular network depends on the data bandwidth needed for the service provided. Fig. 4 shows the spectrum used by cable upstream and downstream signals with a network signal using the spectrum above the cable band.

The present invention can use a time division duplex (TDD) protocol for communications. In a TDD system, receive and transmit data are communicated during different time intervals, generally using the same frequency. The advantage of using TDD is that the transceiver design is simplified. Different users share a common frequency channel through the use of time division multiple access (TDMA). In a TDMA system each user transmits during a different time interval. Users are assigned one or more slots of predetermined length in a framing structure that contains multiple slots. All users are synchronized by a beacon message broadcast on the network. The beacon message provides a common time reference to the users and can include other network management information.

Some building wiring possesses reflections due to mismatched impedances and inter-port coupling in splitters to provide sufficient signal path between terminal devices for communication. Loss from one terminal device to another is in the range of approximately 25 dB to 50 dB. In a coaxial cable environment signal-to-noise ratio (SNR) is generally high. To be useful the SNR is preferably in the range of 8 to greater than 30 dB.

Individual terminal devices will receive different power levels that vary according to the signal loss experienced between the transmitting device and the receiving device. An automatic gain control (AGC) circuit in the receiver levels the power presented to the intermediate frequency (IF) or base band processing sections. The AGC measures received power, at an RF, IF, or base band signal point and controls an amplifier to produce a constant level at the measurement point, or some other predetermined processing point.

Adaptive Power Control

The signal loss between terminal devices may be unknown and variable. In the present invention, an adaptive transmit power level is used to control the power level received by a terminal device. This function can be implemented in each terminal device or as part of the network management function provided by a central controller. An AGC circuit in the receiver can correct the residual variations in the signal power level.

An originating terminal device transmits a channel probing message to a responding terminal device for the purpose of determining received power level. The responding device measures the power and communicates a reply message containing the received power level. This message exchange can be transmitted using a robust modulation such as BPSK or QPSK, where the main messaging could be transmitted using higher order modulation, for example multilevel QAM.

Alternatively, the power measurement messaging can be transmitted using FM, which is not sensitive to power levels. Soft clipping in the RF, IF, and base band circuits may occur. This levels the signal and

produces some harmonic content that is removed by low-pass filters and allows demodulation and decoding of the message.

The originating terminal device transmits the channel probing message at a predetermined power level.

- 5 Alternatively, the message can embed a data field that indicates the transmitted power of the message. Using either source of information, the responding terminal device can adapt its transmitted power during the response to provide a desired power level at the originating device. By evaluating the received power measurement data in the response message, the originating device has a direct evaluation of the signal loss due to the channel. The power level of subsequent transmissions by the originating
- 10 device to a responding device is set according to the channel loss measurement. An acknowledgement message is sent from the originating device to the responding device to conclude the communication establishment sequence.

- In one embodiment, the power measurement can be made by observing the AGC control level, which
- 15 represents the received power level.

OFDM Waveform Modulator and Demodulator

- Multi-tone modulation uses a set of modulating carriers that are integer multiples of a common
- 20 frequency and the symbol period is the inverse of the common frequency. Multi-tone modulation is also called discrete multi-tone (DMT) and orthogonal frequency division multiplexing (OFDM). OFDM utilizes quadrature phase shift keying (QPSK) and multi-level quadrature amplitude modulation (QAM) wherein each OFDM carrier can be modulated by an amplitude/phase-varying signal. QPSK is composed a sine and a cosine wave of identical frequency with phase modulation applied to each carrier
- 25 independently. QAM is composed of sine and cosine waves with phase modulation and amplitude modulation. QPSK is an m-ary QAM signal with $m=2$. These signals can be represented using complex numbers. To modulate, data bits are encoded into a number of m-ary QAM constellations, which then modulate the respective carriers. The carriers are summed together for transmission over the channel. Each carrier is independent and can be independently decoded in the receiver. All carriers are related in
- 30 frequency, being an integer multiple of a base frequency.

discrete multi-tone communication system” discloses a technique for bit loading applied to discrete multi-tone modulation.

The frequency channels in OFDM may be called frequency bins or simply bins. The power in individual frequency bins can be adjusted to compensate for insertion loss that varies as a function of frequency. The power level in regions of the channel can be altered by scaling the complex valued vector for the bins where power adjustment is needed before applying the inverse Fourier transform. In order to avoid interference with certain bands in the RF spectrum, the power level of certain bins can be reduced to zero.

An OFDM receiver uses a discrete Fourier transform (DFT) to convert the modulated signal back into data. The OFDM receiver receives all the carriers at once and performs the transform on a block of data points.

Various types of forward error correction can be applied to transmitted data blocks, such as Reed-Solomon and convolutional coding. Interleaving can be applied to data blocks to increase the robustness of the error correction. De-interleaving and error correction coding are applied in the receiver to recover the transmitted data without errors.

An OFDM receiver may also employ time domain equalization (TEQ), frequency domain equalization (FEQ), or both. Equalizers can be adaptive and may be of the decision feedback (DFE) type or decision directed type such as least mean square (LMS) algorithm.

Fig 5 shows a block diagram of a representative OFDM modulator according to the present invention.

Data input is optionally coded with check bits by error correction coder 510 to facilitate error correction in the receiver. QAM encoder 520 divides the input data into many bit streams and applies a QAM symbol mapping to each bit stream. The bit streams correspond to the carriers. Symbol mapping maps a short sequence of bit, from 2 for QPSK to 8 for 256-QAM, into an I and Q amplitude value. The I and Q amplitude values output from QAM encoder 520 are modified by power adjustment table 530, which adjusts the amplitude levels to effect the power level of each carrier in the transmitted signal. The values in power adjustment table 530 are empirically derived or analytically derived and set to levels

that avoid interference with other devices. Inverse Fast Fourier Transform (IFFT) 540 performs a frequency domain to time domain transformation that converts the complex series of frequency amplitude values into a time sequence. The IFFT output array is converted to a serial data stream by a parallel to serial converter 542 as part of IFFT 540. The digital time sequence is converted to an analog representation by digital to analog (DAC) 550. The analog signal is translated to a suitable carrier frequency by up converter 560. The time sequence can be either real valued or complex valued samples. In the case of complex values, DAC 550 would be a dual DAC and up converter 560 would be a quadrature modulator. An amplifier provides the appropriate overall power for the signal to be inserted into the communications medium.

Power adjustment table 530 may also be used to influence the order of modulation generated by QAM encoder 520 for each of the carriers. Higher power level carriers can support higher order of modulation and lower power levels require lower order modulation. The selection of QAM modulation order is bit loading, the selection of carrier power is power loading. The power profile used to avoid interference can alter both the power in each carrier and the number of bits transmitted in each symbol of each carrier.

Fig. 6 is a block diagram of a representative demodulator for use with the present invention. The inverse of the modulator operations are performed to reproduce digital data. Not shown are operations of carrier and symbol timing recovery, which can be performed using techniques well known in the art.

Multi-carrier system architecture is covered in ADSL/VDSL Principles by DR. Dennis J. Rauchmayer, Macmillan Technical Publishing, 1999 and DSL Simulation Techniques and Standards Development for Digital Subscriber Line Systems by Dr. Walter Y. Chen, Macmillan Technology Publishing, 1998, incorporated herein by reference.

Channel Probing Message

Channel probing messages are transmitted between network devices to estimate the channel characteristics. The channel probe uses a predetermined bit sequence which is known by the receiving

selected pattern for the second half of the preamble. This pattern provides desirable auto-correlation properties.

Schmidl, et al. "Robust Frequency and Timing Synchronization for OFDM", IEEE Transactions on Communications, vol. 45, No. 12, pp. 1613-1621 (1997) and Minn, et al. "On Timing Offset Estimation for OFDM Systems", IEEE Communications Letters, Vol. 4, No. 7, pp. 242-244, incorporated herein by reference, describe techniques for forming and processing sequences to synchronize receivers to data transmissions over frequency-selective channels.

The signal processing and computations performed on signal samples needed for modulating, demodulating, channel estimation, and other operations can be performed by dedicated hardware resources or by a programmed signal processor. A typical system will utilize both hardware and software techniques to perform the needed signal processing. Signal processing circuitry can be integrated into a single system on a chip (SOC), partitioned into several chips, or programmed into a field programmable gate array (FPGA).

Fig. 8 shows a schematic representation of a splitter 810 with a signal burst 820 of power P entering splitter port A. The signal burst will couple to port B with attenuation of, for example, 20 dB producing signal P_1 . The signal burst will also couple to port C with a loss of 3.5 dB and pass up the wiring branch to a point that produces some reflection with a particular attenuation. The reflected signal will pass down the wiring branch to splitter port C and couple to port B with a power level of P_2 . The resulting signal 830 present at port B will be a signal burst of power P_1 followed by the echo of power P_2 . Depending on the level of the reflection and the isolation from port A to port B, the first signal burst arriving at port B can be higher or lower in power than the second signal burst arriving. The time displacement of the two arrivals is dependant upon the cable length of the wiring branch connected to port C.

Fig. 9 shows a time domain plot of two signal bursts, one arriving at time 0 and the other arriving at time $t_{sub.e}$. The corresponding frequency domain plot shows nulls in the spectrum with a separation of $1/t_{sub.e}$. This diagram shows the effect of two time displaced signals arriving at a single point and the effect on the frequency response of the signal.

Fig.10 shows a bit loaded OFDM waveform in accordance with the present invention overlaid on an impaired frequency response. The band used to transmit the OFDM signal is segmented into frequency bins of width $f_{sub.b}$. Each frequency bin is encoded with a QAM constellation of 4, 16, 64, or 256 points. The level of response through the channel at each frequency bin, which corresponds to the SNR, determines the order of modulation used. The higher the channel response in a particular bin, the more information is encoded by using a higher density constellation. Frequencies bins located at deep nulls may have insufficient SNR to support a useful signal and are not used. No signal is transmitted in these bins.

Frequency Coordination

When a terminal device is powered up, it scans the available frequency band to determine if there is communication activity occurring and determine the frequencies that are already in use. This activity can be originating from a network in the same building as the terminal device, another building where the signal is leaking through the tap, or from cable or satellite services sharing the cable. The scan can be done using the same receiver signal path that is used for data communication. An FFT performed on an array of data samples taken from the A/D converter provide information about signal activity in the channel. The LO can be changed to sweep the scan over wider frequency band than a single FFT. The step size can be from less than 1 MHz to 10 MHz or more, and depends on the frequency spacing established for the network.

Alternatively to the FFT approach, detection of activity can be achieved by measuring the received signal power with an envelope detector, which can be done using digital samples or an AM detector using a diode and filter circuit. Another approach to envelope detection is monitoring an automatic gain control (AGC) level that represents the received signal strength.

Another approach to activity detection is to fully demodulate the received signal and decode the data stream. Using this technique, the terminal can recognize a network or device identifier contained in the data frames to decide if the activity is from a desired network or undesired network. If a desired network is detected, the terminal will attempt to gain access. If an undesired network is detected the

frequency band used will be logged as unusable. The network or device ID can be transmitted in a base coding modulation, such as QPSK. This allows the scanning terminal to synchronize to and decode enough information to identify the activity without knowing the specific modulation used in the terminal specific and payload portions of the frame.

5

Once a clear area of the available frequency band is determined, the network controller node can begin transmitting network access information to allow other devices to gain access to the network within the home.

- 10 An alternative to frequency coordination between networks is to insert a blocking filter at the POE of the home. This prevents egress of signals from the home and ingress of signals from other homes. The filter is a low pass or band pass filter that allows CATV signals to pass unaffected and blocks the frequencies used by the network. An additional benefit is to insure privacy of the network data. The communication activity scan would then detect any cable or satellite services and use other frequency
- 15 bands for the network.

What is claimed is:

1. A data communication network comprising:

5 at least two network devices, each network device comprising a multi-carrier modulator for modulating data, an up converter for translating the modulated data to an RF carrier frequency, a down converter for translating an RF signal, and a multi-carrier demodulator for demodulating the translated RF signal to produce data; and

10 cable wiring comprising a splitter with a common port and a plurality of tap ports, and a plurality of segments of coaxial cable connecting between the splitter tap ports and the network devices;

whereby network devices communicate with each other through the cable wiring using multi-carrier signaling.

15 2. The data communication network of claim 1 wherein network devices transmit probe messages through the cable wiring and analyze received probe message signals to determine channel characteristics and bit loading is selected based on the determined channel characteristics.

20 3. The data communication network of claim 2 wherein a network device comprises a means for determining signal activity and selects a frequency band for operation that is not used by other services.

4. The data communication network of claim 2 wherein the network shares the cable wiring with a cable television service and the network device up converter translates the modulated data to an RF
25 carrier frequency above the frequency used by the cable television service.

5. A method of communicating digital data between a plurality of terminal devices connected to coaxial wiring installed in a building comprising a splitter and segments of coaxial cable, the method comprising the steps of:

30 in a first terminal device, modulating the digital data using bit loaded orthogonal frequency division multiplex (OFDM) to create a modulated signal;

up converting the modulated signal to a predetermined radio frequency to create a radio frequency signal;

transmitting the radio frequency signal over the coaxial wiring network at a predetermined power level;

5 in a second terminal device, receiving the radio frequency signal from the coaxial wiring network;

downconverting the radio frequency signal to create a base band signal; and
demodulating the base band signal to create received digital data.

10 6. The method of claim 5 wherein the predetermined radio frequency is above the frequency used by other services transmitting over the coaxial wiring.

7. The method of claim 5 comprising the further steps of:

scanning all possibly frequencies for activity; and

15 selecting a frequency for network communication where no activity is detected.

8. A method of characterizing a communication channel used for communication between devices comprising the steps of:

20 forming a probe message comprising a preamble, a channel estimation training sequence, and a bit loading training sequence;

transmitting the probe message through the communication channel;

25 receiving the probe message;

from the received probe message, analyzing the preamble to estimate carrier and timing offset, analyzing the channel estimation training sequence to produce a set of equalizer coefficients, and analyzing the bit loading training sequence to determine a bit loading profile used for transmitting data.

30

9. The method of claim 8 wherein the preamble is a predetermined sequence of QPSK encoded data bits; the channel estimation training sequence is a predetermined sequence of QPSK encoded OFDM symbols; and the bit loading training sequence is a predetermined sequence of BPSK encoded OFDM symbols.

5

10. A network device for communicating data to other network devices over a coaxial wiring system comprising a splitter and a plurality of cable segments connected between the splitter and the network devices, the network device comprising:

a data modulator to produce a multicarrier modulated signal;

10

a demodulator for multicarrier modulated signal to produce data;

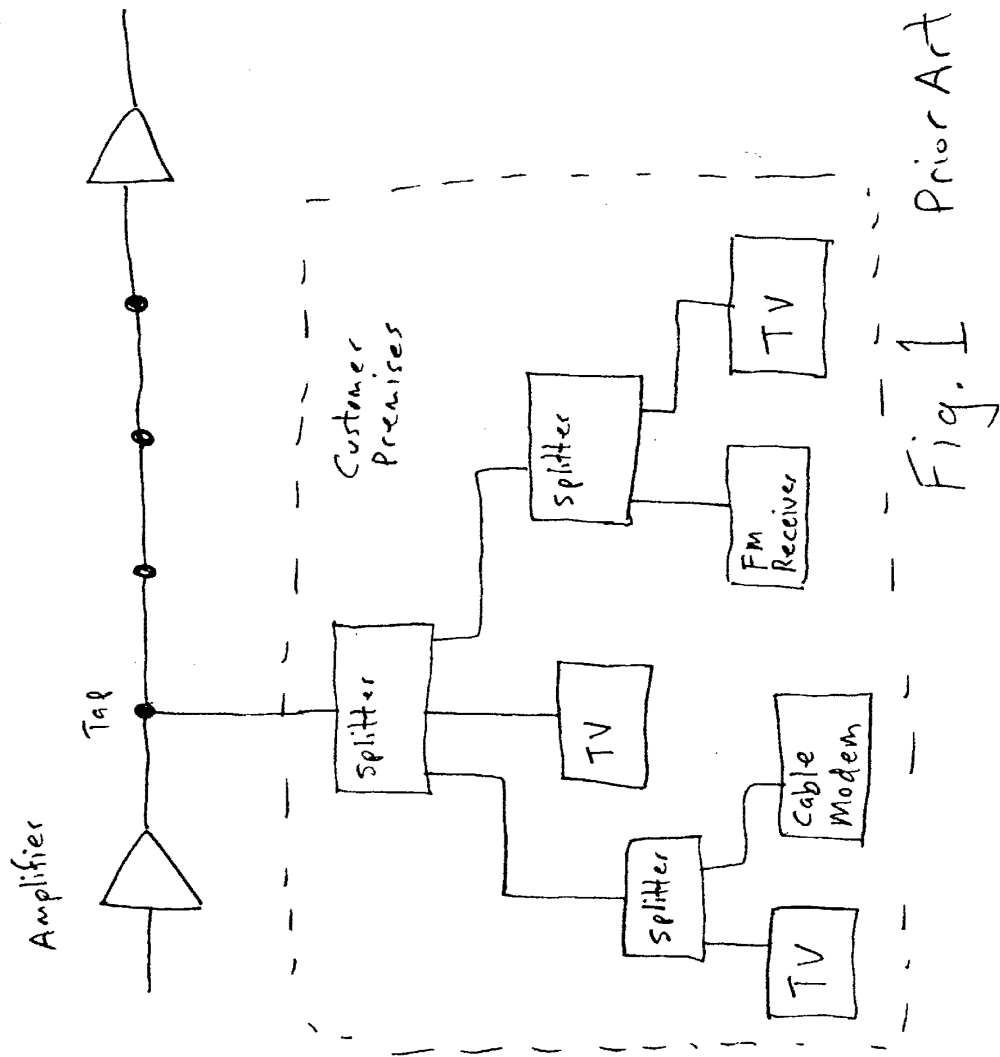
means for producing and transmitting a probe message; and

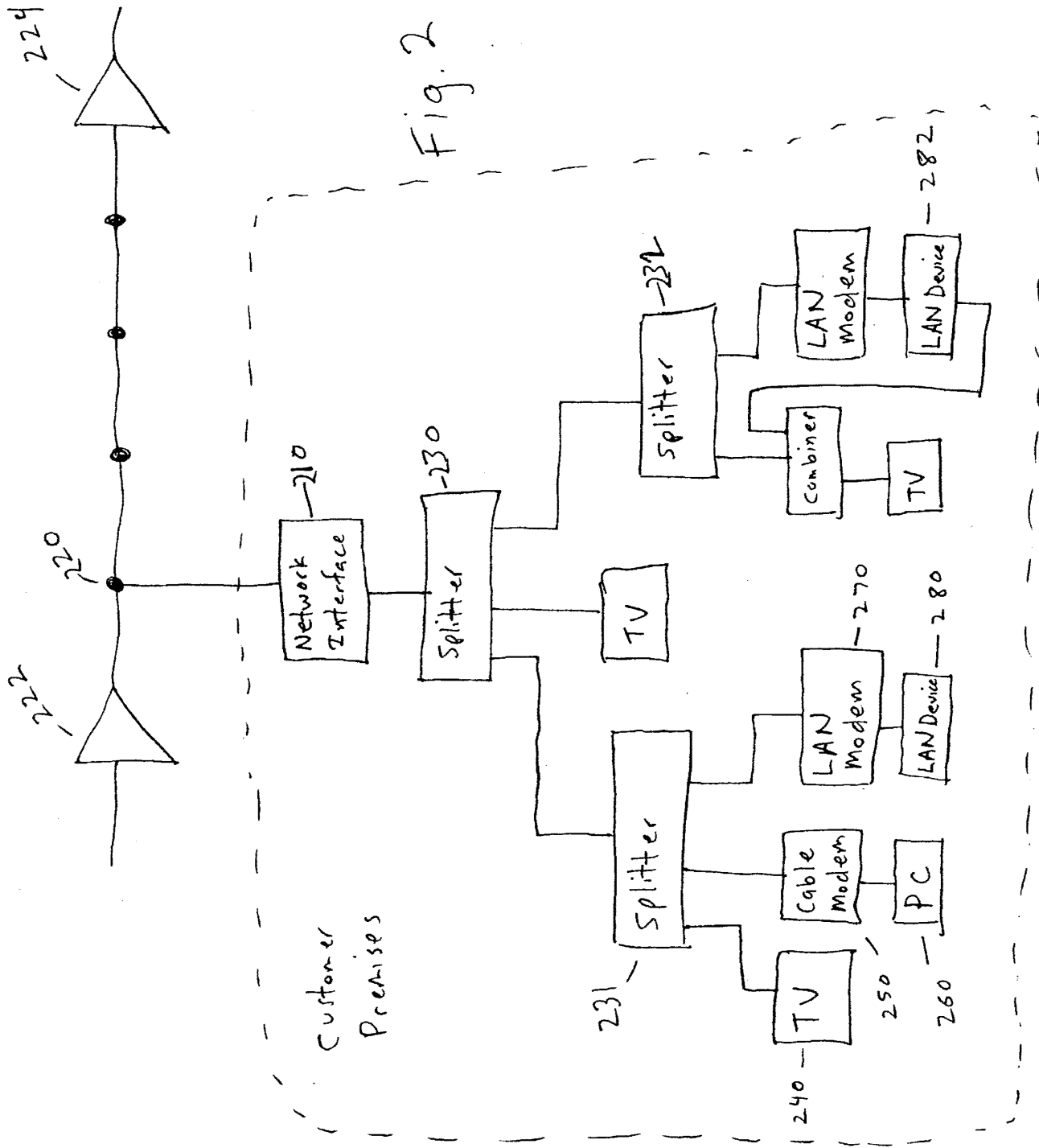
means for receiving and analyzing a probe message to determine a bit loading profile used to transmit data.

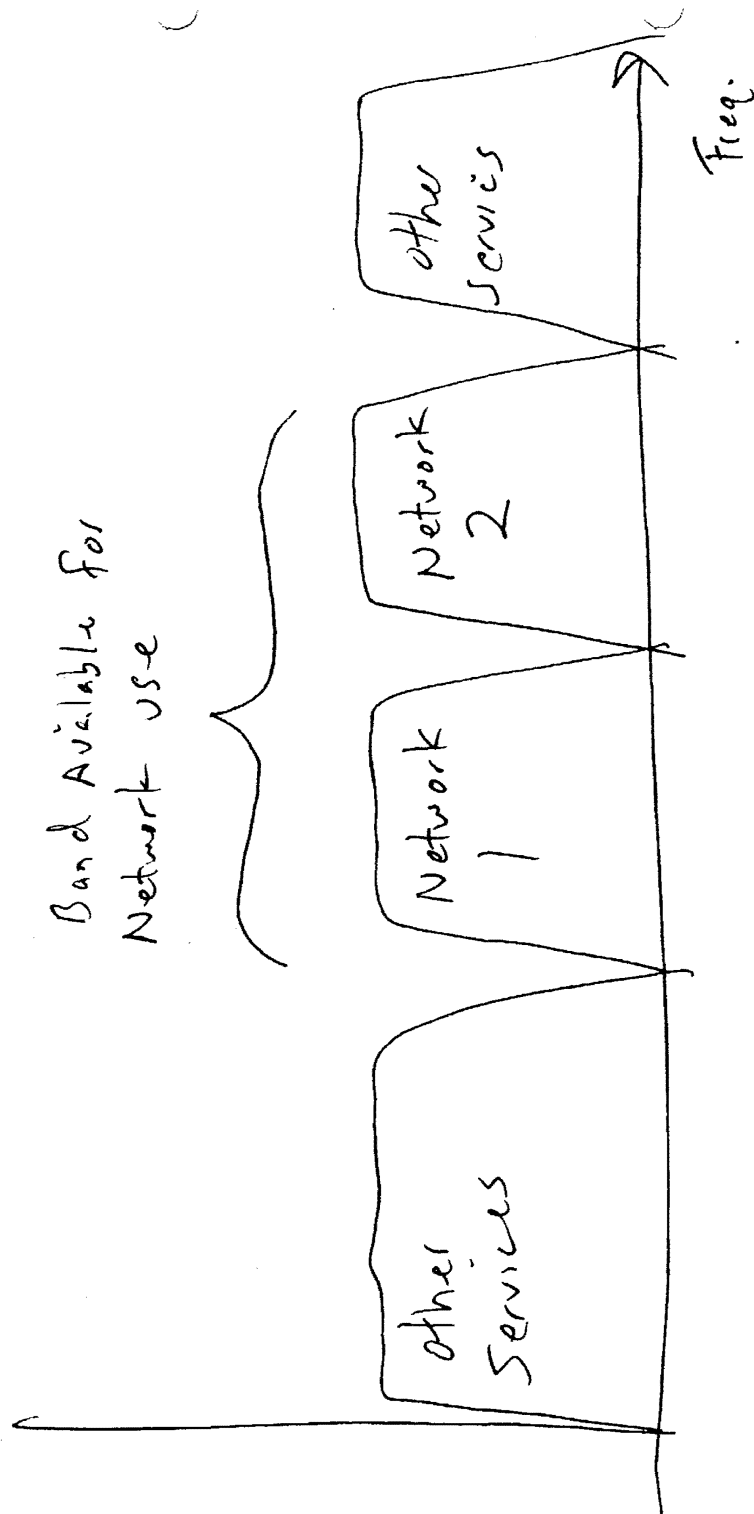
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ABSTRACT

A broadband local area data network uses coaxial cable wiring for interconnection of terminal devices. Orthogonal frequency division multiplexing (OFDM) with bit loading is used to overcome channel
5 impairments and provide a path for terminal devices to transmit to and receive from other terminal devices. Probe messages are sent between devices to characterize the communication channel and determine optimum bit loading. The data network shares the cable spectrum with other services and uses frequency bands not used by other services. Adaptive power control can be used to maintain signal
10 to noise ratio in a communication between terminal devices. Frequency coordination can be used to avoid interference between the LAN communications and other services transmitted on the cable.







Frequency Usage on a Coax System

Fig 3

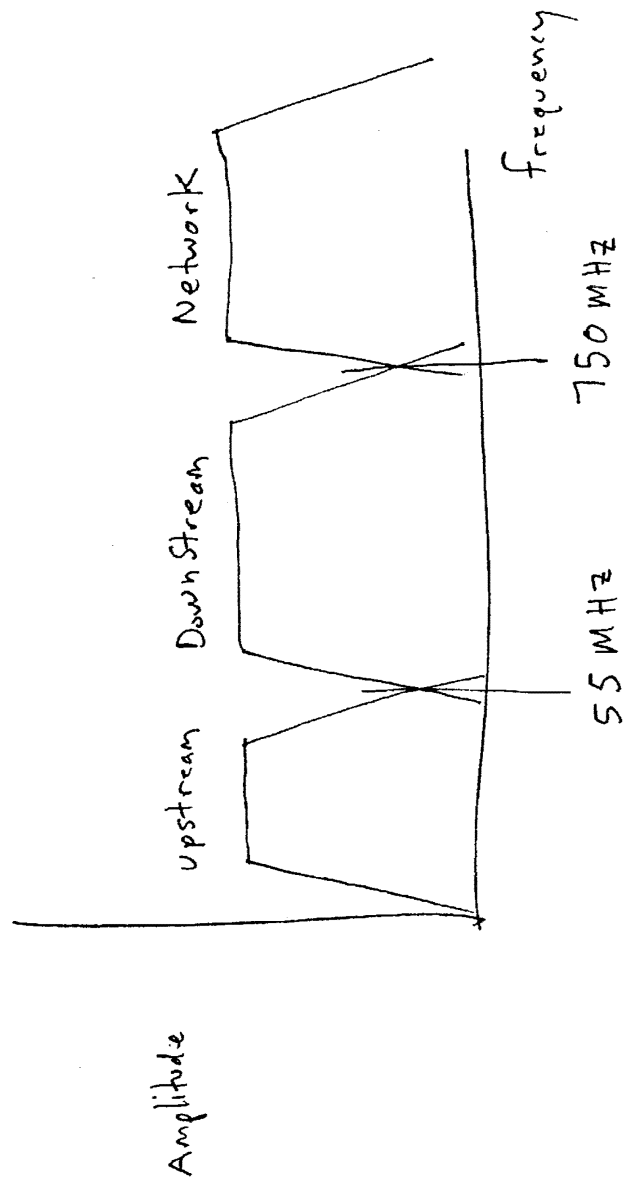


Fig 4

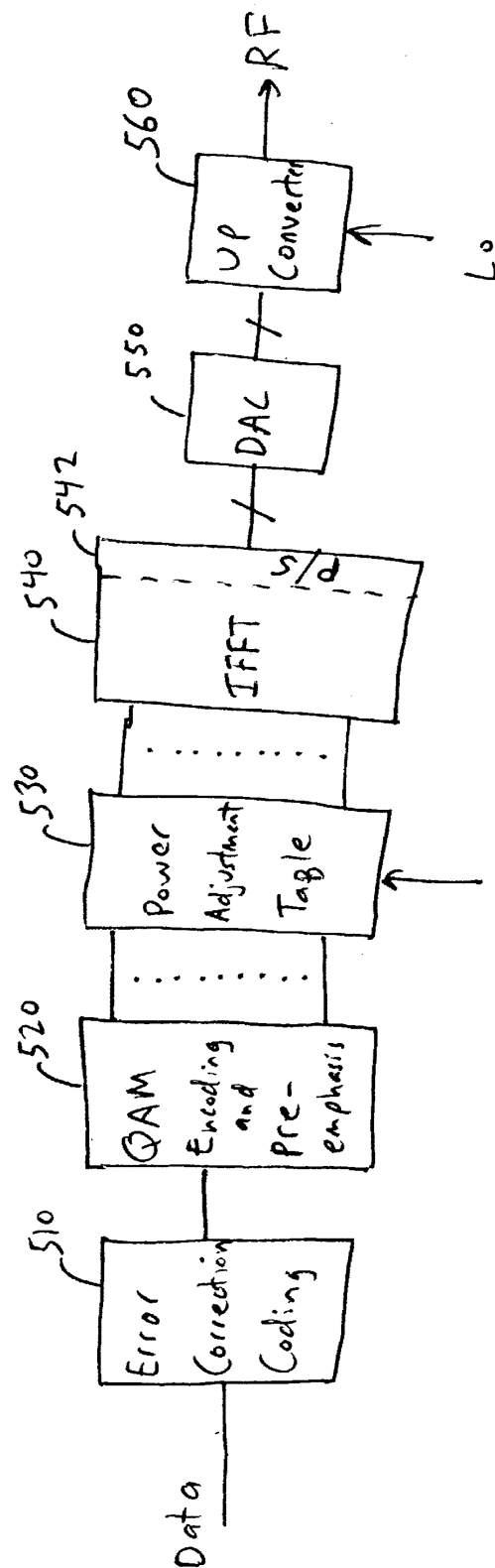


Fig 5

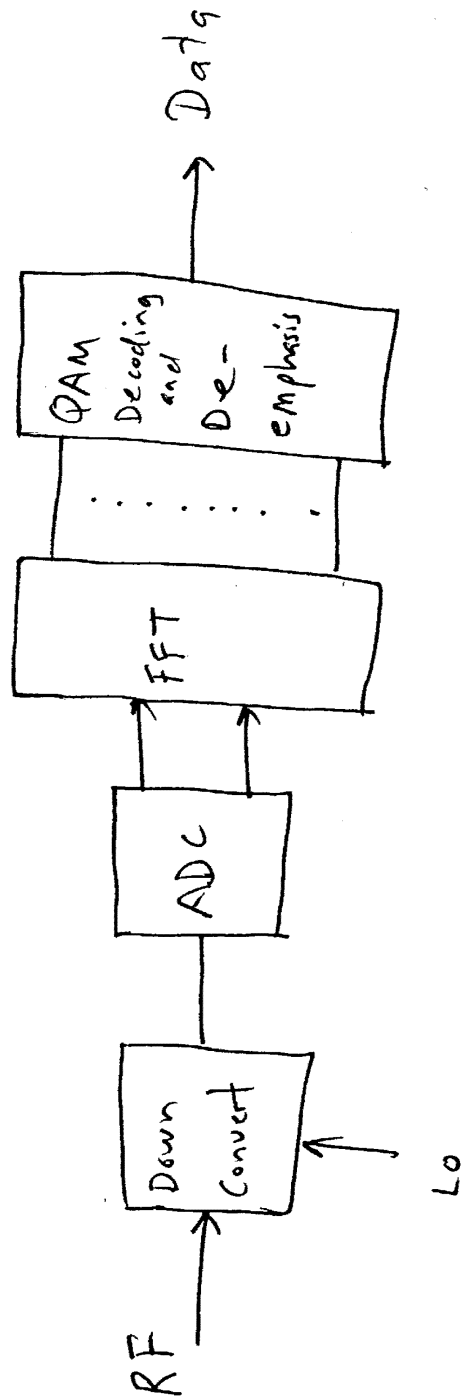
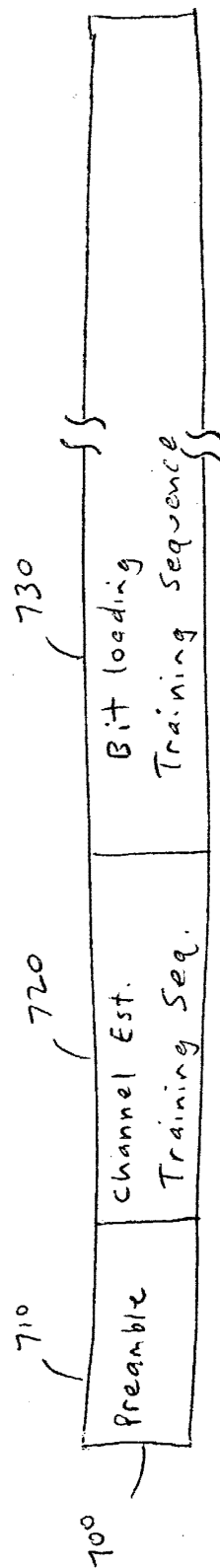


Fig 6



2 symbols	8 symbols	80 Symbols
512 Bits	OFDM/QPSK	OFDM/BPSK
QPSK		

Fig 7

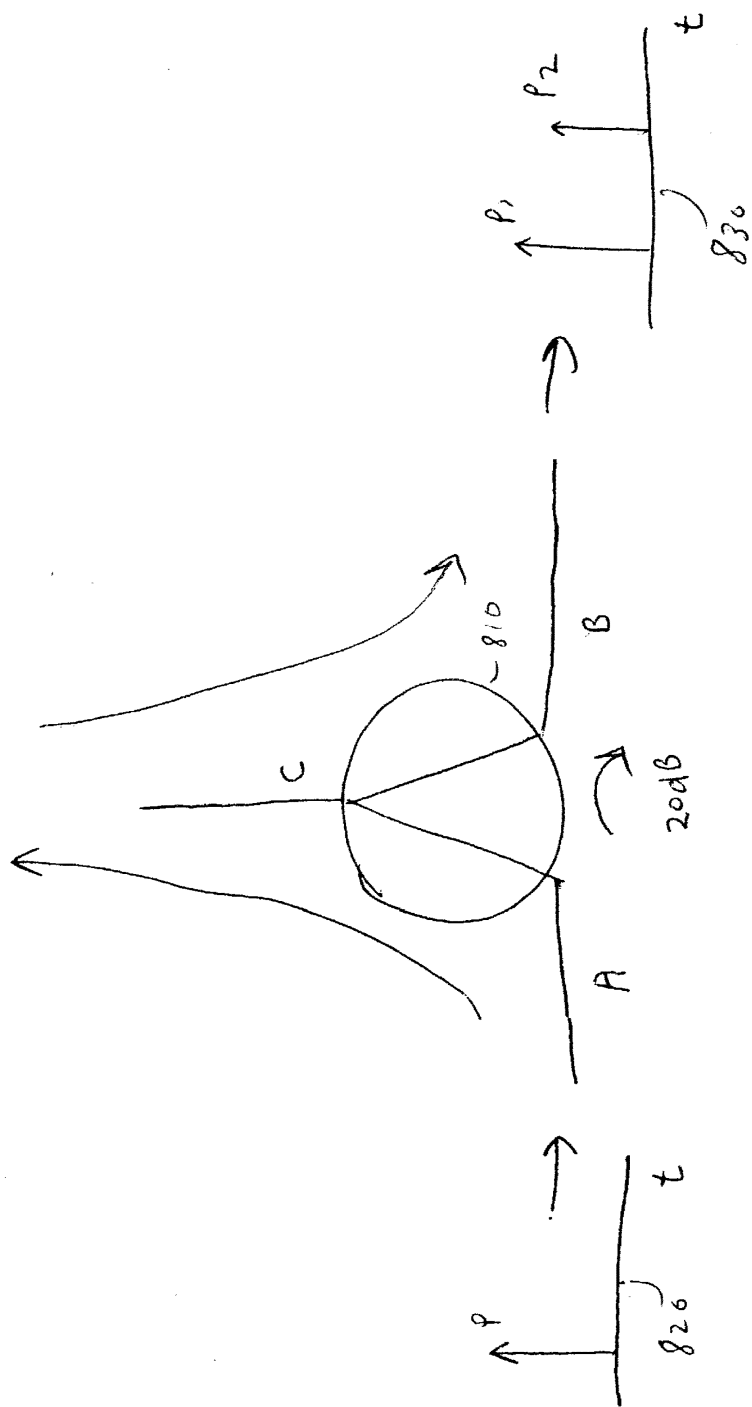


Fig 8

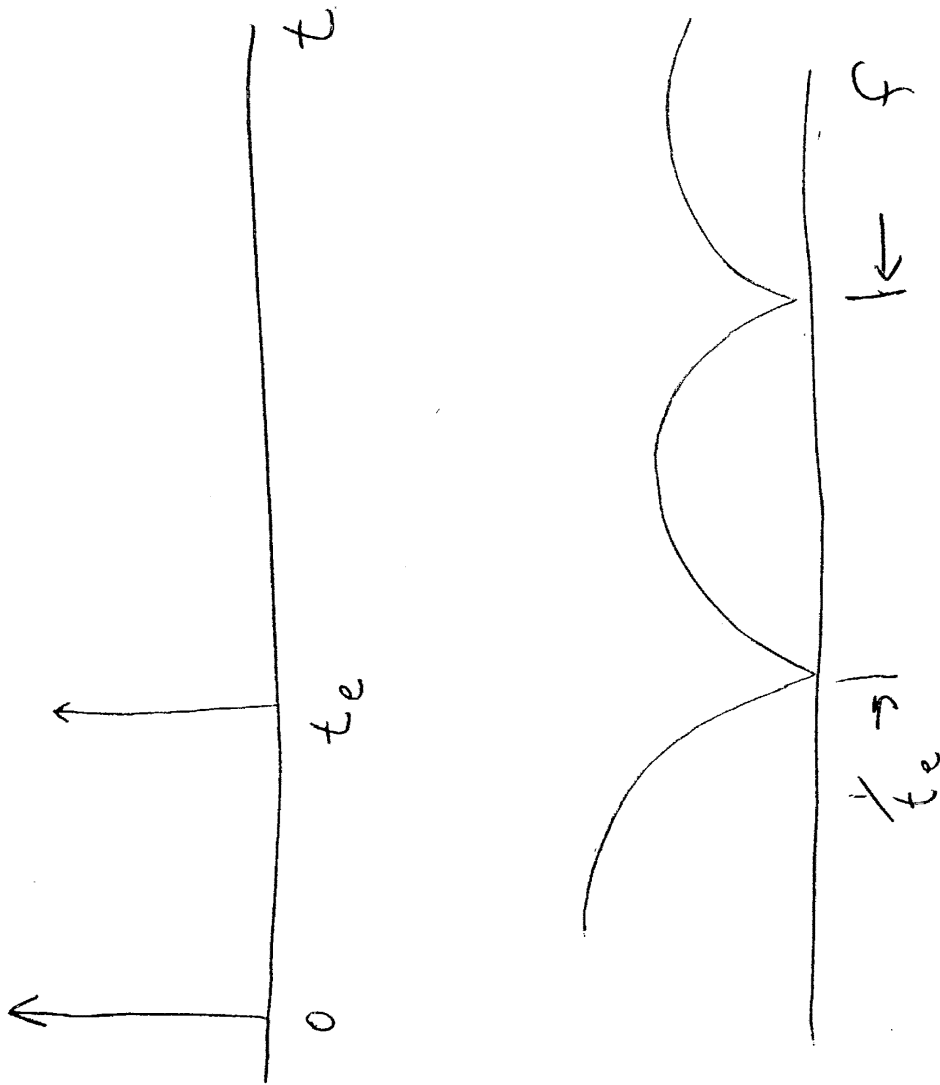


Fig 9

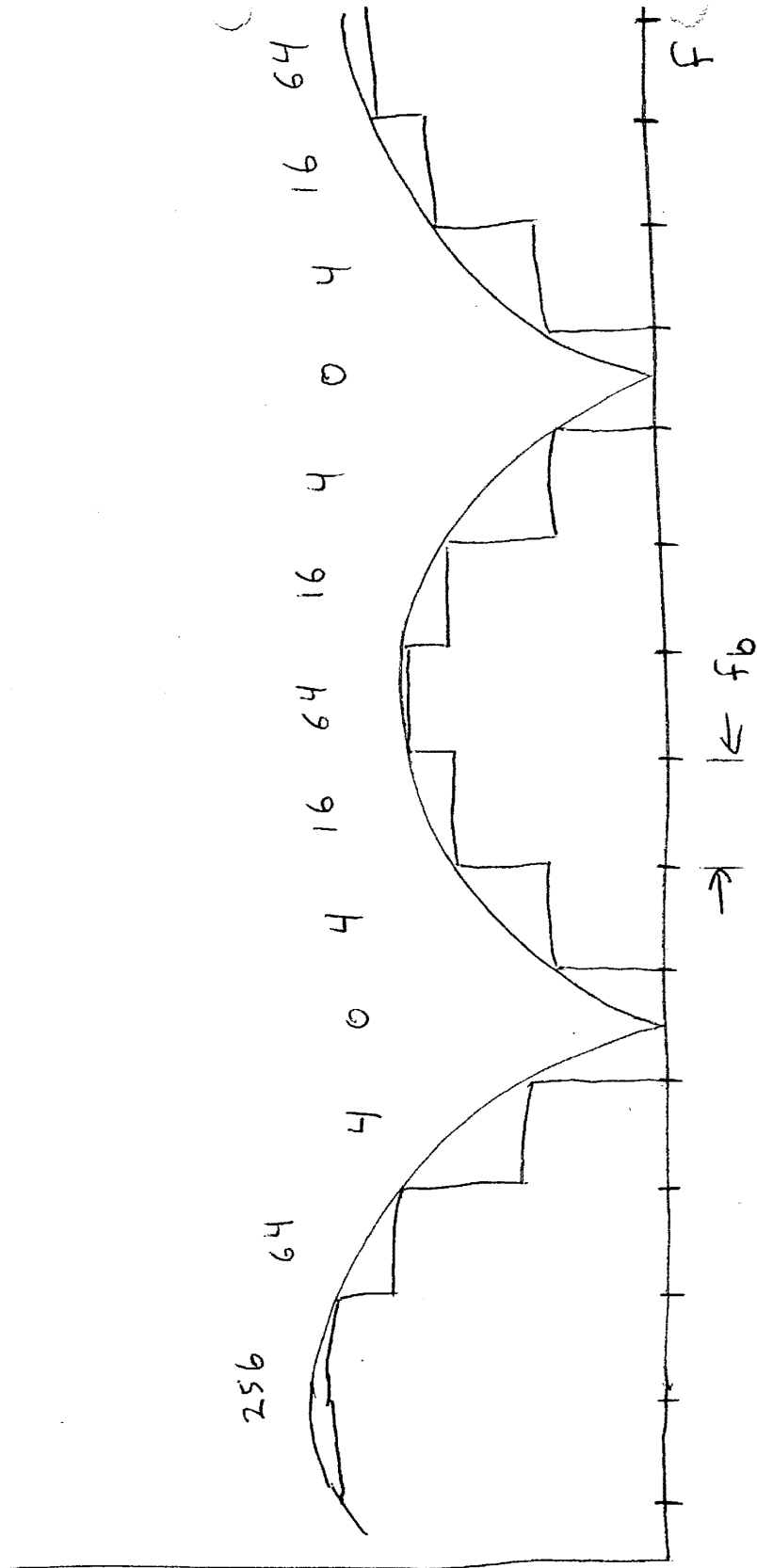


Fig 10

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Attorney Docket Number</td> <td>9228</td> </tr> <tr> <td>First Named Inventor</td> <td>Monk</td> </tr> <tr> <td colspan="2" style="text-align: center;">COMPLETE IF KNOWN</td> </tr> <tr> <td>Application Number</td> <td></td> </tr> <tr> <td>Filing Date</td> <td>12/18/02</td> </tr> <tr> <td>Art Unit</td> <td></td> </tr> <tr> <td>Examiner Name</td> <td></td> </tr> </table>	Attorney Docket Number	9228	First Named Inventor	Monk	COMPLETE IF KNOWN		Application Number		Filing Date	12/18/02	Art Unit		Examiner Name	
Attorney Docket Number	9228														
First Named Inventor	Monk														
COMPLETE IF KNOWN															
Application Number															
Filing Date	12/18/02														
Art Unit															
Examiner Name															

As the below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Broadband Network for Coaxial Cable Using Multi-carrier Modulation

(Title of the Invention)

the specification of which

☒ is attached hereto

OR

☐ was filed on (MM/DD/YYYY)

as United States Application Number or PCT International

Application Number	and was amended on (MM/DD/YYYY)	(if applicable).
--------------------	---------------------------------	------------------

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

[Page 1 of 2]

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10/31/2002 12:12:00

PTO/SB/01 (10-01)

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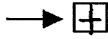
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Michael Landry Name							
5098 Seachase St. Address							
San Diego City				CA State		92130 ZIP	
USA Country		858-229-6801 Telephone				858-509-0184 Fax	
I hereby declare that all statements made herein of my own knowledge are true and that all statements 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 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.							
NAME OF SOLE OR FIRST INVENTOR :				☐ A petition has been filed for this unsigned inventor			
Given Name Anton (first and middle [if any])				Family Name Monk or Surname			
Inventor's Signature <i>A. Monk</i>						Date 12/16/02	
San Diego Residence: City		CA State		USA Country		USA Citizenship	
10618 Ambergldes Ln Mailing Address							
San Diego City		CA State		92130 ZIP		USA Country	
NAME OF SECOND INVENTOR:				☐ A petition has been filed for this unsigned inventor			
Given Name Brett (first and middle [if any])				Family Name Bernath or Surname			
Inventor's Signature <i>KE BE</i>						Date 12/16/02	
San Diego Residence: City		CA State		USA Country		USA Citizenship	
4167 Calle Mar De Ballenas Mailing Address							
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☒ Additional inventors are being named on the 1 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.							

[Page 2 of 2]



PTO/SB/02A (10-00)

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DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet Page <u>1</u> of <u>1</u>
--------------------	---

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name: Itzhak		Family Name or Surname: Gurantz	
Inventor's Signature:		Date: 12/16/02	
San Diego Residence: City	CA State	USA Country	USA Citizenship
5584 Shannon Ridge Lane Mailing Address			
Mailing Address			
City: San Diego	CA State	92130 ZIP	USA Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name: Ladd		Family Name or Surname: El Wardani	
Inventor's Signature:		Date: 12/16/02	
La Jolla Residence: City	CA State	USA Country	USA Citizenship
6416 La Jolla Scenic Dr. South Mailing Address			
Mailing Address			
City: La Jolla	CA State	92037 ZIP	USA Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name: Ron		Family Name or Surname: Porat	
Inventor's Signature:		Date: 12/16/02	
La Jolla Residence: City	CA State	USA Country	Israel Citizenship
8695 Via Mallorca #24 Mailing Address			
Mailing Address			
City: La Jolla	CA State	92037 ZIP	USA Country

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Application Number	
Filing Date	12/18/02
First Named Inventor	Monk
Title	Broadband Network for Coaxial ...
Group Art Unit	
Examiner Name	
Attorney Docket Number	9228

I hereby appoint:

☒ Practitioners at Customer Number

24244

OR

☐ Practitioner(s) named below:

Name	Registration Number
Michael W. Landry	38,216



as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

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24244

OR



☐ Firm or
Individual Name

Michael W. Landry

Address

5098 Seachase St.

Address

City

San Diego

State

CA

Zip

92130

Country

Telephone

858-229-6801

Fax

858-509-0184

I am the:

☐ Applicant/Inventor.

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

Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

SIGNATURE of Applicant or Assignee of Record

Name

Itzhak Gurantz, CEO Entropic Communications Inc.

Signature

Date

12/16/02

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

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FEE RECORD SHEET

12/23/2002 HBELETE1 00000036 10322834

01 FC:2001	370.00 OP
02 FC:2201	42.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2001 — 481-697/59173

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 2001

Application or Docket Number

9228

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	10	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	10 minus 20= *	
INDEPENDENT CLAIMS	4 minus 3= *	1
MULTIPLE DEPENDENT CLAIM PRESENT ☐		

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

CLAIMS AS AMENDED - PART II

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total	*	Minus	**
Independent	*	Minus	***
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐			

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total	*	Minus	**
Independent	*	Minus	***
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐			

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT C	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
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Independent	*	Minus	***
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RATE	FEE
BASIC FEE	370.00
X\$ 9=	
X42=	42.5
+140=	
TOTAL	412.5

RATE	FEE
BASIC FEE	740.00
X\$18=	
X84=	
+280=	
TOTAL	

SMALL ENTITY

OR

OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE
X\$ 9=	
X42=	
+140=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X84=	
+280=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$ 9=	
X42=	
+140=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X84=	
+280=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$ 9=	
X42=	
+140=	
TOTAL ADDIT. FEE	

RATE	ADDITIONAL FEE
X\$18=	
X84=	
+280=	
TOTAL ADDIT. FEE	

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET (FOR USE WITH FORM PTO-875)							SERIAL NO.	FILING DATE					
							APPLICANT(S)						
CLAIMS													
	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT			•		•		•	
	IND.	DEP.	IND.	DEP.	IND.	DEP.		IND.	DEP.	IND.	DEP.	IND.	DEP.
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TOTAL DEP.	6						TOTAL DEP.						
TOTAL CLAIMS	10						TOTAL CLAIMS						

PTO-1360 (3-78)

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