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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 10/131,864         | 04/25/2002            | William J. Crilly JR. | 1640-003.101           |

**CONFIRMATION NO. 8941**

**POA ACCEPTANCE LETTER**

22145  
KLEIN, O'NEILL & SINGH, LLP  
16755 VON KARMAN AVENUE  
SUITE 275  
IRVINE, CA 92606



Date Mailed: 03/14/2018

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 03/12/2018.

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

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/deelliott/



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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 10/131,864         | 04/25/2002            | William J. Crilly JR. | 43273-502001US         |

**CONFIRMATION NO. 8941**

**POWER OF ATTORNEY NOTICE**

64046  
Mintz Levin/San Diego Office  
One Financial Center  
Boston, MA 02111



OC000000098036690

Date Mailed: 03/14/2018

**NOTICE REGARDING CHANGE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 03/12/2018.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71.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

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/deelliott/

## POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

| Application Number | Filing Date |
|--------------------|-------------|
|                    |             |

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

- ☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:
- OR
- ☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

- ☒ The address associated with the above-mentioned Customer Number
- OR
- ☐ The address associated with Customer Number:
- OR

|                         |  |       |  |     |
|-------------------------|--|-------|--|-----|
| Firm or Individual Name |  |       |  |     |
| Address                 |  |       |  |     |
| City                    |  | State |  | Zip |
| Country                 |  |       |  |     |
| Telephone               |  | Email |  |     |

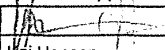
I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

**XR Communications, LLC d/b/a Vivato Technologies**

- ☐ Inventor or Joint Inventor (title not required below)
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

### SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

|           |                                                                                     |                 |           |
|-----------|-------------------------------------------------------------------------------------|-----------------|-----------|
| Signature |  | Date (Optional) | 1/10/2018 |
| Name      | Kai Hansen                                                                          |                 |           |
| Title     | Managing Member                                                                     |                 |           |

**NOTE:** Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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| Electronic Acknowledgement Receipt   |                                                 |
|--------------------------------------|-------------------------------------------------|
| EFS ID:                              | 32029304                                        |
| Application Number:                  | 10131864                                        |
| International Application Number:    |                                                 |
| Confirmation Number:                 | 8941                                            |
| Title of Invention:                  | MULTIPATH COMMUNICATION METHODS AND APPARATUSES |
| First Named Inventor/Applicant Name: | William J. Crilly                               |
| Customer Number:                     | 64046                                           |
| Filer:                               | Glen L. Nuttall/Mariel Boyan                    |
| Filer Authorized By:                 | Glen L. Nuttall                                 |
| Attorney Docket Number:              | 43273-502001US                                  |
| Receipt Date:                        | 12-MAR-2018                                     |
| Filing Date:                         | 25-APR-2002                                     |
| Time Stamp:                          | 18:32:39                                        |
| Application Type:                    | Utility under 35 USC 111(a)                     |

### Payment information:

| Submitted with Payment |                      | no                                       |                                              |                  |                  |
|------------------------|----------------------|------------------------------------------|----------------------------------------------|------------------|------------------|
| <b>File Listing:</b>   |                      |                                          |                                              |                  |                  |
| Document Number        | Document Description | File Name                                | File Size(Bytes)/<br>Message Digest          | Multi Part /.zip | Pages (if appl.) |
| 1                      |                      | 1640-003-101--<br>POAAsFiled03122018.pdf | 203110                                       | yes              | 2                |
|                        |                      |                                          | b7415bb567fcbfcd4b5e0e589f9c94570a3a<br>9923 |                  |                  |

| Multipart Description/PDF files in .zip description |  |       |     |
|-----------------------------------------------------|--|-------|-----|
| Document Description                                |  | Start | End |
| Transmittal Letter                                  |  | 1     | 1   |
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**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

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

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

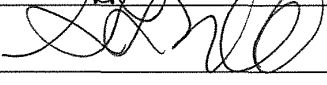
**New International Application Filed with the USPTO as a Receiving Office**  
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International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

## TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

|                        |                                                 |
|------------------------|-------------------------------------------------|
| Application Number     | 10/131,864                                      |
| Filing Date            | April 25, 2002                                  |
| First Named Inventor   | William J. Crilly                               |
| Title                  | MULTIPATH COMMUNICATION METHODS AND APPARATUSES |
| Art Unit               | 2611                                            |
| Examiner Name          | CORRIELUS, JEAN B                               |
| Attorney Docket Number | 1640-003.101                                    |

### SIGNATURE of Applicant or Patent Practitioner

|                                                    |                                                                                     |                     |                |
|----------------------------------------------------|-------------------------------------------------------------------------------------|---------------------|----------------|
| Signature                                          |  | Date (Optional)     | March 12, 2018 |
| Name                                               | Glen L. Nuttall                                                                     | Registration Number | 46,188         |
| Title (if Applicant is a juristic entity)          |                                                                                     |                     |                |
| Applicant Name (if Applicant is a juristic entity) |                                                                                     |                     |                |

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ \*Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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| 10/131,864         | 04/25/2002            | William J. Crilly JR. | 43273-502001US         |

**CONFIRMATION NO. 8941**

**POA ACCEPTANCE LETTER**

64046  
MINTZ, LEVIN, COHN, FERRIS, GLOVSKY AND POPEO, P.C  
ONE FINANCIAL CENTER  
BOSTON, MA 02111



OC000000052226076

Date Mailed: 01/30/2012

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 01/19/2012.

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

/sleutchit/

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



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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 10/131,864         | 04/25/2002            | William J. Crilly JR. | 1959-4                 |

**CONFIRMATION NO. 8941**

**POWER OF ATTORNEY NOTICE**

81178

Daniel P. Burke, Esq.

Daniel P. Burke & Associates, PLLC

240 Townsend Square

Oyster Bay, NY 11771



OC000000052226033

Date Mailed: 01/30/2012

**NOTICE REGARDING CHANGE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 01/19/2012.

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

/sleutchit/

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

| PATENT – POWER OF ATTORNEY<br>OR<br>REVOCATION OF POWER OF ATTORNEY<br>WITH A NEW POWER OF ATTORNEY<br>AND<br>CHANGE OF CORRESPONDENCE ADDRESS |  | Patent Number        | 7,177,369                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------|-------------------------------------------------|
|                                                                                                                                                |  | Issue Date           | February 13, 2007                               |
|                                                                                                                                                |  | First Named Inventor | William J. Crilly, Jr.                          |
|                                                                                                                                                |  | Title                | Multipath Communication Methods and Apparatuses |
|                                                                                                                                                |  | Attorney Docket No.  | 43273-502001US                                  |

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

☐ A Power of Attorney is submitted herewith.  
OR  
☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 64046

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

| Practitioner(s) Name | Registration Number | Practitioner(s) Name | Registration Number |
|----------------------|---------------------|----------------------|---------------------|
|                      |                     |                      |                     |

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

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

OR

☐ Firm or Individual Name

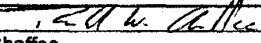
Address

|         |           |       |
|---------|-----------|-------|
| City    | State     | Zip   |
| Country | Telephone | Email |

I am the:

☐ Inventor, having ownership of the patent.  
OR  
☒ Patent owner.  
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on \_\_\_\_\_

**SIGNATURE of Inventor or Patent Owner**

|                   |                                                                                     |           |         |
|-------------------|-------------------------------------------------------------------------------------|-----------|---------|
| Signature         |  | Date      | 1/14/12 |
| Name              | Ron Chaffee                                                                         | Telephone |         |
| Title and Company | CEO, XR Communications, LLC D/B/A Vivato, Inc.                                      |           |         |

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

☐ \*Total of 1 forms are submitted.

**STATEMENT UNDER 37 CFR 3.73(b)**

Applicant/Patent Owner: William J. Crilly, Jr.

Application No./Patent No.: 7,177,369 Filed/Issue Date: February 13, 2007

Titled: MULTIPATH COMMUNICATION METHODS AND APPARATUSES

XR Communications, LLC D/B/A Vivato, Inc., a Limited Liability Company  
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in  
(The extent (by percentage) of its ownership interest is \_\_\_\_\_ %); or
3. ☐ an assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made) the patent application/patent identified above by virtue of either:
  - A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy 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 follows:

1. From: William J. Crilly To: Mabuhay Networks, Inc.  
The document was recorded in the United States Patent and Trademark Office at  
Reel 012849, Frame 0727, or for which a copy thereof is attached.
2. From: Mabuhay Networks, Inc. To: Vivato, Inc.  
The document was recorded in the United States Patent and Trademark Office at  
Reel 013937, Frame 0808, or for which a copy thereof is attached.
3. From: Vivato, Inc. To: Wayout Wireless, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel 018313, Frame 0608, or for which a copy thereof is attached.

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

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

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

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

Ron Chaffee  
Signature

1/16/12  
Date

Ron Chaffee  
Printed or Typed Name

CEO  
Title

**STATEMENT UNDER 37 CFR 3.73(b) - Supplemental Sheet**

Continuation of chain of title from the inventor(s) to the current assignee.

4. From: Wayout Wireless, LLC To: Vivato Networks, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel 019704 , Frame 0789 , or for which a copy thereof is attached.
5. From: Vivato Networks, LLC To: Vivato Networks Holdings, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel 020196 , Frame 0093 , or for which a copy thereof is attached.
6. From: Vivato Networks Holdings, LLC To: Aequitas Equipment Finance, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel 022783 , Frame 0433 , or for which a copy thereof is attached.
7. From: Aequitas Equipment Finance, LLC To: XR Communications LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel 023691 , Frame 0645 , or for which a copy thereof is attached.
8. From: \_\_\_\_\_ To: \_\_\_\_\_  
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9. From: \_\_\_\_\_ To: \_\_\_\_\_  
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10. From: \_\_\_\_\_ To: \_\_\_\_\_  
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13. From: \_\_\_\_\_ To: \_\_\_\_\_  
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14. From: \_\_\_\_\_ To: \_\_\_\_\_  
The document was recorded in the United States Patent and Trademark Office at  
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| Electronic Acknowledgement Receipt   |                                                 |
|--------------------------------------|-------------------------------------------------|
| EFS ID:                              | 11874257                                        |
| Application Number:                  | 10131864                                        |
| International Application Number:    |                                                 |
| Confirmation Number:                 | 8941                                            |
| Title of Invention:                  | MULTIPATH COMMUNICATION METHODS AND APPARATUSES |
| First Named Inventor/Applicant Name: | William J. Crilly                               |
| Customer Number:                     | 81178                                           |
| Filer:                               | Carl A. Kukkonen/Teri Barnett                   |
| Filer Authorized By:                 | Carl A. Kukkonen                                |
| Attorney Docket Number:              | 1959-4                                          |
| Receipt Date:                        | 19-JAN-2012                                     |
| Filing Date:                         | 25-APR-2002                                     |
| Time Stamp:                          | 14:54:37                                        |
| Application Type:                    | Utility under 35 USC 111(a)                     |

### Payment information:

| Submitted with Payment |                      | no                     |                                              |                  |                  |
|------------------------|----------------------|------------------------|----------------------------------------------|------------------|------------------|
| <b>File Listing:</b>   |                      |                        |                                              |                  |                  |
| Document Number        | Document Description | File Name              | File Size(Bytes)/<br>Message Digest          | Multi Part /.zip | Pages (if appl.) |
| 1                      | Power of Attorney    | 43273_502001US_Rev.pdf | 370413                                       | no               | 3                |
|                        |                      |                        | 87fb7eae1be1100c148a9d2865f2324cfddb<br>eca1 |                  |                  |
| <b>Warnings:</b>       |                      |                        |                                              |                  |                  |
| <b>Information:</b>    |                      |                        |                                              |                  |                  |

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

**New Applications Under 35 U.S.C. 111**

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

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

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

**New International Application Filed with the USPTO as a Receiving Office**

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| 10/131,864         | 04/25/2002            | William J. Crilly JR. | 1959-4                 |

81178  
Daniel P. Burke, Esq.  
Daniel P. Burke & Associates, PLLC  
240 Townsend Square  
Oyster Bay, NY 11771

**CONFIRMATION NO. 8941**  
**POA ACCEPTANCE LETTER**



Date Mailed: 07/20/2010

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/qtran/

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 10/131,864         | 04/25/2002            | William J. Crilly JR. | MN1-001US              |

**CONFIRMATION NO. 8941**

**POWER OF ATTORNEY NOTICE**

Christopher R. Ambrose  
Ambrose Law Group LLC, Bend Offices  
Ste 201  
805 SW Industrial Way  
Bend, OR 97702



OC000000042641193\*

Date Mailed: 07/20/2010

**NOTICE REGARDING CHANGE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 07/06/2010.

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

/qtran/

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



10/13/2004

TFW

PTO/SB/96 (07-09)

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

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

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**STATEMENT UNDER 37 CFR 3.73(b)**

Applicant/Inventor/Owner: William J. Crilly, Jr.

Application No./Patent No.: 7,177,369

Filed/Issue Date: 2/13/2007

Titled:

**MULTIPATH COMMUNICATION METHODS AND APPARATUSES**

XR Communications LLC

, a Limited Liability Company

(Name of Assignee)

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

states that it is:

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

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

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

OR

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

1. From: Crilly, William J., Jr. To: Mabuhay Networks, Inc.

The document was recorded in the United States Patent and Trademark Office at  
Reel 012849, Frame 0727, or for which a copy thereof is attached.

2. From: Mabuhay Networks, Inc. To: Vivato, Inc.

The document was recorded in the United States Patent and Trademark Office at  
Reel 013937, Frame 0808, or for which a copy thereof is attached.

3. From: Vivato, Inc. To: Wayout Wireless, LLC

The document was recorded in the United States Patent and Trademark Office at  
Reel 018313, Frame 0608, or for which a copy thereof is attached.

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

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

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

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

Daniel P. Burke  
Signature

6/29/10  
Date

Daniel P. Burke

Attorney of Record

Printed or Typed Name

Title

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

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



**Supplemental Sheet for Statement Under 37 CFR 3.73(b) for Patent No. 7,177,369**

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

4. From: Wayout Wireless, LLC To: Vivato Networks, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel: 019704, Frame: 0789, or for which a copy thereof is attached.
5. From: Vivato Networks, LLC now known as Vivato Networks, Inc.  
To: Vivato Networks Holdings, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel: 020196, Frame: 0093, or for which a copy thereof is attached.
6. From: Vivato Networks Holdings, Inc., Formerly Vivato Networks Holdings, LLC  
To: Aequitas Equipment Finance, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel: 022783, Frame: 0433, or for which a copy thereof is attached.
7. From: Aequitas Equipment Finance, LLC To: XR Communications, LLC  
The document was recorded in the United States Patent and Trademark Office at  
Reel: 023691, Frame: 0645, or for which a copy thereof is attached.



PTO/SB/81A (12-08)  
Approved for use through 11/30/2011. OMB 0851-0035  
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|                                                                                                                                                            |                        |                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------------|
| <b>PATENT - POWER OF ATTORNEY<br/>OR<br/>REVOCATION OF POWER OF ATTORNEY<br/>WITH A NEW POWER OF ATTORNEY<br/>AND<br/>CHANGE OF CORRESPONDENCE ADDRESS</b> | Patent Number          | 7,177,369                          |
|                                                                                                                                                            | Issue Date             | 2/13/2007                          |
|                                                                                                                                                            | First Named Inventor   | William J. Crilly, Jr.             |
|                                                                                                                                                            | Title                  | Multiple Beam Antenna Base Station |
|                                                                                                                                                            | Attorney Docket Number | 1959-4                             |

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

☐ A Power of Attorney is submitted herewith.

OR

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

OR

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

| Practitioner(s) Name | Registration Number |
|----------------------|---------------------|
| Daniel P. Burke      | 30,735              |
|                      |                     |
|                      |                     |
|                      |                     |

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

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

OR

☒ The address associated with Customer Number:

81178

OR

|                                                             |                                                           |       |                    |           |
|-------------------------------------------------------------|-----------------------------------------------------------|-------|--------------------|-----------|
| <input checked="" type="checkbox"/> Firm or Individual Name | Daniel P. Burke                                           |       |                    |           |
| Address                                                     | Daniel P. Burke & Associates, PLLC<br>240 Townsend Square |       |                    |           |
| City                                                        | Oyster Bay                                                | State | New York           | Zip 11771 |
| Country                                                     | US                                                        |       |                    |           |
| Telephone                                                   | 516-802-0560                                              | Email | dburke@dpburke.com |           |

I am the:

☐ Inventor, having ownership of the patent.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(b) (Form PTO/SB/86) submitted herewith or filed on \_\_\_\_\_

**SIGNATURE of Inventor or Patent Owner**

|                   |                                  |           |              |
|-------------------|----------------------------------|-----------|--------------|
| Signature         |                                  | Date      | 9/13/2010    |
| Name              | ADRIAN ZAZUL                     | Telephone | 212 400 7950 |
| Title and Company | President, XR Communications LLC |           |              |

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

☐ \*Total of \_\_\_\_\_ forms are submitted.

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

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

DOCKET: 1959-4

PATENT OWNER : **END Communications LLC**  
PATENT NO. : **7,177,369**  
ISSUED : **February 13, 2007**  
FOR : **Multipath Communication Methods and Apparatuses**



Certificate of Mailing

I hereby certify that the following correspondence:

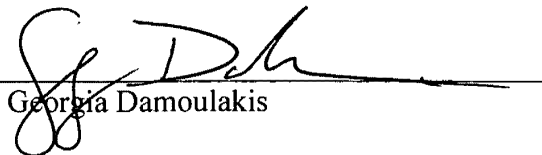
- Executed Power of Attorney (PTO/SB/81A) (1 page)
- Statement Under 37 CFR 3.73(b) (PTO/SB/96) and supplemental sheet with additional documents in chain of title (2 page)
- Certificate of Mailing (1 page)
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on July 1, 2010.

Signature \_\_\_\_\_

  
Georgia Damoulakis



IFW

PTO/SB/123 (01-06)  
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Address to:  
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Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

|                        |                        |
|------------------------|------------------------|
| Patent Number          | 7,177,369              |
| Issue Date             | February 13, 2007      |
| Application Number     | 10/131,864             |
| Filing Date            | April 25, 2002         |
| First Named Inventor   | William J. Crilly, Jr. |
| Attorney Docket Number | 760.0030001            |

Please change the Correspondence Address for the above-identified patent to:

☐ The address associated with Customer Number:

OR

☒ **Firm or  
Individual Name** Christopher R. Ambrose

Ambrose Law Group LLC, Bend Office  
805 SW Industrial Way, Ste 201

**Address**

**City** Bend **State** OR **ZIP** 97702

**Country** U.S.A.

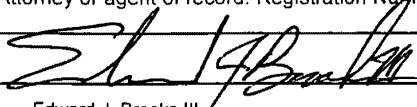
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This form will not affect any "fee address" provided for the above-identified patent. To change a "fee address" use the "Fee Address Indication Form" (PTO/SB/47).

I am the:

- ☐ Patentee.
- ☐ 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).
- ☒ Attorney or agent of record. Registration Number 40,925

**Signature** 

**Typed or  
Printed Name** Edward J. Brooks III

**Date** May 1, 2008 **Telephone** (612) 236-0120

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

☒ \*Total of 1 forms are submitted.

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

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant: William J. Crilly, Jr.  
Serial No.: 10/131,864  
Filed: April 25, 2002

Confirmation No. 8941  
Examiner: Jean B. Corrielus  
Art Unit: 2611  
Docket: 760.0030001

Title: IMPROVED MULTIPATH COMMUNICATION METHODS AND APPARATUSES

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☒ Form PTO/SB/123 Change of Correspondence Address-Patent (1 pg.)

**\*PLEASE ASSOCIATE THIS APPLICATION WITH CUSTOMER NUMBER 38356\***

**CERTIFICATE UNDER 37 C.F.R. §1.8:** The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: **MS POST ISSUE** Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on this 1<sup>st</sup> day of May, 2008.

Aaron Morris  
Name  
[Signature]  
Signature

Respectfully Submitted,  
William J. Crilly, Jr.

By: Brooks, Cameron & Huebsch, PLLC  
1221 Nicollet Avenue, Suite 500  
Minneapolis, MN 55403

[Signature]  
Atty: Edward J. Brooks III (Jay)  
Reg. No.: 40,925

5/1/2008  
Date:



## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
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[www.uspto.gov](http://www.uspto.gov)

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 10/131,864      | 02/13/2007 | 7177369    | MN1-001US           | 8941             |

38356 7590 01/24/2007  
BROOKS & CAMERON, PLLC  
1221 NICOLLET MALL #500  
MINNEAPOLIS, MN 55403

### ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 810 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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

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

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

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

William J. Crilly JR., Liberty Lake, WA;

## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail

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**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 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)

38356 7590 10/02/2006

**BROOKS & CAMERON, PLLC**  
**1221 NICOLLET MALL #500**  
**MINNEAPOLIS, MN 55403**

12/28/2006 SDENB082 00000032 10131864

01 FC:2501

02 FC:1504

700.00 DP  
300.00 DP

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.

|                            |                    |
|----------------------------|--------------------|
| <u>Alison L. Subendran</u> | (Depositor's name) |
| <u>[Signature]</u>         | (Signature)        |
| <u>12/21/06</u>            | (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
|-----------------|-------------|----------------------|---------------------|------------------|

10/131,864

04/25/2002

William J. Crilly JR.

MN1-001US

8941

TITLE OF INVENTION: MULTIPATH COMMUNICATION METHODS AND APPARATUSES

| APPLN. TYPE    | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|--------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | YES          | \$700         | \$300               | \$0                  | \$1000           | 01/02/2007 |

| EXAMINER          | ART UNIT | CLASS-SUBCLASS |
|-------------------|----------|----------------|
| CORRIELUS, JEAN B | 2611     | 375-296000     |

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 Brooks & Cameron, PLLC
- 2 1221 Nicollet Ave, Ste 500
- 3 Minneapolis, MN 55403

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)

Vivato, Inc.Portland, ORPlease 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

[Signature]

Date

12/21/2006

Typed or printed name

Edward J. Brooks III

Registration No.

40,925

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

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant: William J. Crilly, Jr.  
Serial No.: 10/131,864  
Filed: April 25, 2002

Confirmation No. 8941  
Examiner: Jean B. Corrielus  
Art Unit: 2611  
Docket: 760.0030001

Title: IMPROVED MULTIPATH COMMUNICATION METHODS AND APPARATUSES

**MS ISSUE FEE**

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

We are transmitting herewith the following attached items and information (as indicated with an "X"):

- ☒ Return postcard (1).
- ☒ Check in the amount of \$1,000.00 to cover the Small Entity Issue Fee Payment and the Publication Fee Payment.
- ☒ Issue Fee Transmittal Form PTOL-85 (1 pg.).

**\*PLEASE ASSOCIATE THIS APPLICATION WITH CUSTOMER NUMBER 38356\***

**CERTIFICATE UNDER 37 C.F.R. §1.8:** The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: **MS ISSUE FEE** Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on this 21<sup>st</sup> day of December, 2006.

Alison L. Subendera  
Name

AK  
Signature

Respectfully Submitted,  
William J. Crilly, Jr.

By: BROOKS & CAMERON, PLLC  
1221 Nicollet Avenue, Suite 500  
Minneapolis, MN 55403

Edward J. Brooks III

Atty: Edward J. Brooks III  
Reg. No.: 40,925

12/21/2006  
Date:



# UNITED STATES PATENT AND TRADEMARK OFFICE

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

| APPLICATION NO.                                                            | FILING DATE | FIRST NAMED INVENTOR  | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|----------------------------------------------------------------------------|-------------|-----------------------|---------------------|------------------|
| 10/131,864                                                                 | 04/25/2002  | William J. Crilly JR. | MN1-001US           | 8941             |
| 38356                                                                      | 7590        | 11/15/2006            | EXAMINER            |                  |
| BROOKS & CAMERON, PLLC<br>1221 NICOLLET MALL #500<br>MINNEAPOLIS, MN 55403 |             |                       | CORRIELUS, JEAN B   |                  |
|                                                                            |             |                       | ART UNIT            | PAPER NUMBER     |
|                                                                            |             |                       | 2611                |                  |

DATE MAILED: 11/15/2006

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

**Supplemental  
Notice of Allowability**

**Application No.**

10/131,864

**Applicant(s)**

CRILLY, WILLIAM J.

**Examiner**

Jean B. Corielus

**Art Unit**

2611

**-- 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 the phone interview on 11/8/06.
2. ☒ The allowed claim(s) is/are 1-41, 43, 45-80, 82 and 84-95, renumbered as 1-91, respectively.
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 \_\_\_\_\_.

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

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413),  
Paper No./Mail Date \_\_\_\_\_
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_

  
Jean B. Corielus  
Primary Examiner  
Art Unit: 2611

11-13-06

**EXAMINER'S AMENDMENT**

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

Authorization for this examiner's amendment was given in a telephone interview with Edward J Brooks on 11/8/06.

The application has been amended as follows:

**IN THE CLAIMS:**

Claim 52, "44" has been changed to --43--.

Claim 53, "44" has been changed to --43--.

Claim 55, "44" has been changed to --43--.

Claim 57, "44" has been changed to --43--.

Claim 58, "44" has been changed to --43--.

Claim 59, "44" has been changed to --43--.

Claim 66, "44" has been changed to --43--.

Claim 67, "44" has been changed to --43--.

Claim 68, "44" has been changed to --43--.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jean B. Corrielus whose telephone number is 571-272-3020.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. 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.

  
Jean B Corrielus  
Primary Examiner  
Art Unit 2611

11-13-06





# UNITED STATES PATENT AND TRADEMARK OFFICE

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P.O. Box 1450  
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## NOTICE OF ALLOWANCE AND FEE(S) DUE

38356 7590 10/02/2006  
BROOKS & CAMERON, PLLC  
1221 NICOLLET MALL #500  
MINNEAPOLIS, MN 55403

|                   |              |
|-------------------|--------------|
| EXAMINER          |              |
| CORRIELUS, JEAN B |              |
| ART UNIT          | PAPER NUMBER |

2611  
DATE MAILED: 10/02/2006

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
|-----------------|-------------|----------------------|---------------------|------------------|

10/131,864 04/25/2002 William J. Crilly JR. MN1-001US 8941

TITLE OF INVENTION: MULTIPATH COMMUNICATION METHODS AND APPARATUSES

| APPLN. TYPE    | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|--------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | YES          | \$700         | \$300               | \$0                  | \$1000           | 01/02/2007 |

**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)

38356 7590 10/02/2006

BROOKS & CAMERON, PLLC  
1221 NICOLLET MALL #500  
MINNEAPOLIS, MN 55403

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. |
|-----------------|-------------|-----------------------|---------------------|------------------|
| 10/131,864      | 04/25/2002  | William J. Crilly JR. | MN1-001US           | 8941             |

TITLE OF INVENTION: MULTIPATH COMMUNICATION METHODS AND APPARATUSES

| APPLN. TYPE    | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|--------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | YES          | \$700         | \$300               | \$0                  | \$1000           | 01/02/2007 |

| EXAMINER          | ART UNIT | CLASS-SUBCLASS |
|-------------------|----------|----------------|
| CORRIELUS, JEAN B | 2611     | 375-296000     |

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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www.uspto.gov

|                                                                            |             |                       |                     |                  |
|----------------------------------------------------------------------------|-------------|-----------------------|---------------------|------------------|
| APPLICATION NO.                                                            | FILING DATE | FIRST NAMED INVENTOR  | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 10/131,864                                                                 | 04/25/2002  | William J. Crilly JR. | MN1-001US           | 8941             |
| 38356                                                                      | 7590        | 10/02/2006            | EXAMINER            |                  |
| BROOKS & CAMERON, PLLC<br>1221 NICOLLET MALL #500<br>MINNEAPOLIS, MN 55403 |             |                       | CORRIELUS, JEAN B   |                  |
|                                                                            |             |                       | ART UNIT            | PAPER NUMBER     |
|                                                                            |             |                       | 2611                |                  |
| DATE MAILED: 10/02/2006                                                    |             |                       |                     |                  |

**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 810 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 810 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.

57

| Notice of Allowability | Application No.  | Applicant(s)       |  |
|------------------------|------------------|--------------------|--|
|                        | 10/131,864       | CRILLY, WILLIAM J. |  |
|                        | Examiner         | Art Unit           |  |
|                        | Jean B. Corielus | 2611               |  |

-- 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 9/21/06.

2. ☒ The allowed claim(s) is/are 1-41,43,45-80,82 and 84-95, renumbered as 1-91, respectively.

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 \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)

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

3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date \_\_\_\_\_

4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

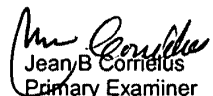
5. ☐ Notice of Informal Patent Application (PTO-152)

6. ☐ Interview Summary (PTO-413), Paper No./Mail Date \_\_\_\_\_

7. ☒ Examiner's Amendment/Comment

8. ☐ Examiner's Statement of Reasons for Allowance

9. ☐ Other \_\_\_\_\_

  
Jean B. Corielus  
Primary Examiner  
Art Unit: 2611  
9-28-06

**EXAMINER'S AMENDMENT**

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

The application has been amended as follows:

**IN THE CLAIMS:**

Claim 85, "83" has been changed to --82--.

Claim 86, "83" has been changed to --82--.

Claim 88, "83" has been changed to --82--.

Claim 89, "83" has been changed to --82--.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jean B. Corrielus whose telephone number is 571-272-3020. The examiner can normally be reached on Maxi-Flex.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Application/Control Number: 10/131,864  
Art Unit: 2611

Page 3

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Jean B Corrielus  
Primary Examiner  
Art Unit 2611

9-28-06



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8ib Data Sheet

CONFIRMATION NO. 8941

|                             |                                                |              |                        |                                     |
|-----------------------------|------------------------------------------------|--------------|------------------------|-------------------------------------|
| SERIAL NUMBER<br>10/131,864 | FILING OR 371(c)<br>DATE<br>04/25/2002<br>RULE | CLASS<br>375 | GROUP ART UNIT<br>2611 | ATTORNEY DOCKET<br>NO.<br>MN1-001US |
|-----------------------------|------------------------------------------------|--------------|------------------------|-------------------------------------|

## APPLICANTS

William J. Crilly JR., Liberty Lake, WA;

\* CONTINUING DATA ..... *YES* .....

This appln claims benefit of 60/287,163 04/27/2001

\* FOREIGN APPLICATIONS ..... *NONE* .....F REQUIRED, FOREIGN FILING LICENSE GRANTED \*\* \*\* SMALL ENTITY \*\*  
10/12/2002

|                                                                                                                                                    |                           |                        |                         |                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------|-------------------------|----------------------------|
| Foreign Priority claimed<br><input type="checkbox"/> yes <input checked="" type="checkbox"/> no                                                    | STATE OR<br>COUNTRY<br>WA | SHEETS<br>DRAWING<br>5 | TOTAL<br>CLAIMS<br>8591 | INDEPENDENT<br>CLAIMS<br>3 |
| 5 USC 119 (a-d) conditions met<br><input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> Not after Allowance |                           |                        |                         |                            |
| Certified and<br>acknowledged<br>Examiner's Signature <i>[Signature]</i> Initials                                                                  |                           |                        |                         |                            |

ADDRESS #38356  
9150

## TITLE

Multipath communication methods and apparatuses

|                                |                                                                                                                   |                                                                                                                                                                                                                                                                                 |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FILING FEE<br>RECEIVED<br>1045 | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees ( Filing )<br><input type="checkbox"/> 1.17 Fees ( Processing Ext. of time )<br><input type="checkbox"/> 1.18 Fees ( Issue )<br><input type="checkbox"/> Other _____<br><input type="checkbox"/> Credit |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                  |                                |  |                                                |  |
|------------------------------------------------------------------------------------------------------------------|--------------------------------|--|------------------------------------------------|--|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b> |  | <b>Applicant(s)/Patent under Reexamination</b> |  |
|                                                                                                                  | 10/131,864                     |  | CRILLY, WILLIAM J.                             |  |
|                                                                                                                  | <b>Examiner</b>                |  | <b>Art Unit</b>                                |  |
|                                                                                                                  | Jean B. Corrielus              |  | 2611                                           |  |

| ISSUE CLASSIFICATION                                                                                                             |   |          |   |       |                                                                                                                              |                                   |  |  |  |                                 |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------|---|----------|---|-------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--|--|--|---------------------------------|--|--|--|--|
| ORIGINAL                                                                                                                         |   |          |   |       | CROSS REFERENCE(S)                                                                                                           |                                   |  |  |  |                                 |  |  |  |  |
| CLASS                                                                                                                            |   | SUBCLASS |   |       | CLASS                                                                                                                        | SUBCLASS (ONE SUBCLASS PER BLOCK) |  |  |  |                                 |  |  |  |  |
| 375                                                                                                                              |   | 296      |   |       | 375                                                                                                                          | 285                               |  |  |  |                                 |  |  |  |  |
| INTERNATIONAL CLASSIFICATION                                                                                                     |   |          |   |       |                                                                                                                              |                                   |  |  |  |                                 |  |  |  |  |
| H                                                                                                                                | 0 | 4        | K | 1/02  |                                                                                                                              |                                   |  |  |  |                                 |  |  |  |  |
| H                                                                                                                                | 0 | 4        | L | 25/03 |                                                                                                                              |                                   |  |  |  |                                 |  |  |  |  |
|                                                                                                                                  |   |          |   | 25/49 |                                                                                                                              |                                   |  |  |  |                                 |  |  |  |  |
|                                                                                                                                  |   |          |   | /     |                                                                                                                              |                                   |  |  |  |                                 |  |  |  |  |
|                                                                                                                                  |   |          |   | /     |                                                                                                                              |                                   |  |  |  |                                 |  |  |  |  |
| _____<br>(Assistant Examiner) (Date)                                                                                             |   |          |   |       | <br>Jean B. Corrielus<br>(Primary Examiner) |                                   |  |  |  | <b>Total Claims Allowed: 91</b> |  |  |  |  |
|  9/29/06<br>(Legal Instruments Examiner) (Date) |   |          |   |       |                                                                                                                              |                                   |  |  |  | O.G. Print Claim(s)<br>42       |  |  |  |  |

| <input type="checkbox"/> Claims renumbered in the same order as presented by applicant |          |  |       |          |  |       |          |  |       | <input type="checkbox"/> CPA |  | <input type="checkbox"/> T.D. |          | <input type="checkbox"/> R.1.47 |       |          |
|----------------------------------------------------------------------------------------|----------|--|-------|----------|--|-------|----------|--|-------|------------------------------|--|-------------------------------|----------|---------------------------------|-------|----------|
| Final                                                                                  | Original |  | Final | Original |  | Final | Original |  | Final | Original                     |  | Final                         | Original |                                 | Final | Original |
| 1                                                                                      | 1        |  | 31    | 31       |  | 59    | 61       |  |       | 121                          |  |                               | 151      |                                 |       | 181      |
| 2                                                                                      | 2        |  | 32    | 32       |  | 60    | 62       |  |       | 122                          |  |                               | 152      |                                 |       | 182      |
| 3                                                                                      | 3        |  | 33    | 33       |  | 61    | 63       |  |       | 123                          |  |                               | 153      |                                 |       | 183      |
| 4                                                                                      | 4        |  | 34    | 34       |  | 62    | 64       |  |       | 124                          |  |                               | 154      |                                 |       | 184      |
| 5                                                                                      | 5        |  | 35    | 35       |  | 63    | 65       |  |       | 125                          |  |                               | 155      |                                 |       | 185      |
| 6                                                                                      | 6        |  | 36    | 36       |  | 64    | 66       |  |       | 126                          |  |                               | 156      |                                 |       | 186      |
| 7                                                                                      | 7        |  | 37    | 37       |  | 65    | 67       |  |       | 127                          |  |                               | 157      |                                 |       | 187      |
| 8                                                                                      | 8        |  | 38    | 38       |  | 66    | 68       |  |       | 128                          |  |                               | 158      |                                 |       | 188      |
| 9                                                                                      | 9        |  | 39    | 39       |  | 67    | 69       |  |       | 129                          |  |                               | 159      |                                 |       | 189      |
| 10                                                                                     | 10       |  | 40    | 40       |  | 68    | 70       |  |       | 130                          |  |                               | 160      |                                 |       | 190      |
| 11                                                                                     | 11       |  | 41    | 41       |  | 69    | 71       |  |       | 131                          |  |                               | 161      |                                 |       | 191      |
| 12                                                                                     | 12       |  |       | 42       |  | 70    | 72       |  |       | 132                          |  |                               | 162      |                                 |       | 192      |
| 13                                                                                     | 13       |  | 42    | 43       |  | 71    | 73       |  |       | 133                          |  |                               | 163      |                                 |       | 193      |
| 14                                                                                     | 14       |  |       | 44       |  | 72    | 74       |  |       | 134                          |  |                               | 164      |                                 |       | 194      |
| 15                                                                                     | 15       |  | 43    | 45       |  | 73    | 75       |  |       | 135                          |  |                               | 165      |                                 |       | 195      |
| 16                                                                                     | 16       |  | 44    | 46       |  | 74    | 76       |  |       | 136                          |  |                               | 166      |                                 |       | 196      |
| 17                                                                                     | 17       |  | 45    | 47       |  | 75    | 77       |  |       | 137                          |  |                               | 167      |                                 |       | 197      |
| 18                                                                                     | 18       |  | 46    | 48       |  | 76    | 78       |  |       | 138                          |  |                               | 168      |                                 |       | 198      |
| 19                                                                                     | 19       |  | 47    | 49       |  | 77    | 79       |  |       | 139                          |  |                               | 169      |                                 |       | 199      |
| 20                                                                                     | 20       |  | 48    | 50       |  | 78    | 80       |  |       | 140                          |  |                               | 170      |                                 |       | 200      |
| 21                                                                                     | 21       |  | 49    | 51       |  |       | 81       |  |       | 141                          |  |                               | 171      |                                 |       | 201      |
| 22                                                                                     | 22       |  | 50    | 52       |  | 79    | 82       |  |       | 142                          |  |                               | 172      |                                 |       | 202      |
| 23                                                                                     | 23       |  | 51    | 53       |  |       | 83       |  |       | 143                          |  |                               | 173      |                                 |       | 203      |
| 24                                                                                     | 24       |  | 52    | 54       |  | 80    | 84       |  |       | 144                          |  |                               | 174      |                                 |       | 204      |
| 25                                                                                     | 25       |  | 53    | 55       |  | 81    | 85       |  |       | 145                          |  |                               | 175      |                                 |       | 205      |
| 26                                                                                     | 26       |  | 54    | 56       |  | 82    | 86       |  |       | 146                          |  |                               | 176      |                                 |       | 206      |
| 27                                                                                     | 27       |  | 55    | 57       |  | 83    | 87       |  |       | 147                          |  |                               | 177      |                                 |       | 207      |
| 28                                                                                     | 28       |  | 56    | 58       |  | 84    | 88       |  |       | 148                          |  |                               | 178      |                                 |       | 208      |
| 29                                                                                     | 29       |  | 57    | 59       |  | 85    | 89       |  |       | 149                          |  |                               | 179      |                                 |       | 209      |
| 30                                                                                     | 30       |  | 58    | 60       |  | 86    | 90       |  |       | 150                          |  |                               | 180      |                                 |       | 210      |

|                                                                                                          |  |                                              |  |                                                                      |  |
|----------------------------------------------------------------------------------------------------------|--|----------------------------------------------|--|----------------------------------------------------------------------|--|
| <b>Search Notes</b><br> |  | <b>Application/Control No.</b><br>10/131,864 |  | <b>Applicant(s)/Patent under Reexamination</b><br>CRILLY, WILLIAM J. |  |
|                                                                                                          |  | <b>Examiner</b><br>Jean B. Corrielus         |  | <b>Art Unit</b><br>2611                                              |  |

| SEARCHED |          |           |          |
|----------|----------|-----------|----------|
| Class    | Subclass | Date      | Examiner |
| 375      | 296;285  | 6/28/2006 | JBC      |
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| INTERFERENCE SEARCHED |          |           |          |
|-----------------------|----------|-----------|----------|
| Class                 | Subclass | Date      | Examiner |
| 375                   | 296;285  | 9/27/2006 | JBC      |
|                       |          |           |          |
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| SEARCH NOTES<br>(INCLUDING SEARCH STRATEGY) |           |      |
|---------------------------------------------|-----------|------|
|                                             | DATE      | EXMR |
| EAST                                        | 6/28/2006 | JBC  |
| East                                        | 8/22/2006 | JBC  |
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| APPLICATION NUMBER | FILING OR 371 (c) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|------------------------|-----------------------|------------------------|
| 10/131,864         | 04/25/2002             | William J. Crilly JR. | MN1-001US              |

38356  
BROOKS & CAMERON, PLLC  
1221 NICOLLET MALL #500  
MINNEAPOLIS, MN 55403

CONFIRMATION NO. 8941



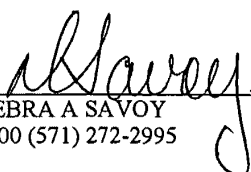
\*OC000000020588987\*

Date Mailed: 09/26/2006

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/21/2006.

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

  
DEBRA A SAVOY  
2600 (571) 272-2995

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| 10/131,864         | 04/25/2002             | William J. Crilly JR. | MN1-001US              |

29150  
 LEE & HAYES, PLLC  
 421 W. RIVERSIDE AVE, STE 500  
 SPOKANE, WA 99201

CONFIRMATION NO. 8941



\*OC000000020588919\*

Date Mailed: 09/26/2006

## NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/21/2006.

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

  
 DEBRA A SAVOY  
 2600 (571) 272-2995

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Bib Data Sheet

CONFIRMATION NO. 8941

|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   |                               |                                                                                                                                                                                                                                                                                 |                                         |                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------------|
| <b>SERIAL NUMBER</b><br>10/131,864                                                                                                                                                                                                                                                                                                                                                                 | <b>FILING OR 371(c) DATE</b><br>04/25/2002<br><b>RULE</b>                                                         | <b>CLASS</b><br>375           | <b>GROUP ART UNIT</b><br>2611                                                                                                                                                                                                                                                   | <b>ATTORNEY DOCKET NO.</b><br>MN1-001US |                                |
| <b>APPLICANTS</b><br>William J. Crilly JR., Liberty Lake, WA;<br><b>** CONTINUING DATA *****</b><br>This appln claims benefit of 60/287,163 04/27/2001<br><b>** FOREIGN APPLICATIONS *****</b><br><b>IF REQUIRED, FOREIGN FILING LICENSE GRANTED.** SMALL ENTITY **</b><br>** 06/12/2002                                                                                                           |                                                                                                                   |                               |                                                                                                                                                                                                                                                                                 |                                         |                                |
| Foreign Priority claimed <input type="checkbox"/> yes <input checked="" type="checkbox"/> no<br>35 USC 119 (a-d) conditions <input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> Met after<br>met Allowance<br>Verified and Acknowledged <u>                    </u> Examiner's Signature <u>                    </u> Initials <u>                    </u> |                                                                                                                   | <b>STATE OR COUNTRY</b><br>WA | <b>SHEETS DRAWING</b><br>5                                                                                                                                                                                                                                                      | <b>TOTAL CLAIMS</b><br>95               | <b>INDEPENDENT CLAIMS</b><br>3 |
| <b>ADDRESS</b><br>38356                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                   |                               |                                                                                                                                                                                                                                                                                 |                                         |                                |
| <b>TITLE</b><br>Multipath communication methods and apparatuses                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   |                               |                                                                                                                                                                                                                                                                                 |                                         |                                |
| <b>FILING FEE RECEIVED</b><br>1045                                                                                                                                                                                                                                                                                                                                                                 | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: |                               | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees ( Filing )<br><input type="checkbox"/> 1.17 Fees ( Processing Ext. of time )<br><input type="checkbox"/> 1.18 Fees ( Issue )<br><input type="checkbox"/> Other _____<br><input type="checkbox"/> Credit |                                         |                                |

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| PATENT APPLICATION FEE DETERMINATION RECORD                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |                 |              |                     | Application or Docket Number<br><b>10/13/06</b> |                     |                               |                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------|--------------|---------------------|-------------------------------------------------|---------------------|-------------------------------|---------------------|
| Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                         |                 | SMALL ENTITY |                     | OR<br>OTHER THAN SMALL ENTITY                   |                     |                               |                     |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                                                  | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE (\$)       | FEE (\$)     | RATE (\$)           | FEE (\$)                                        | FEE (\$)            |                               |                     |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| SEARCH FEE<br>(37 CFR 1.16(a), (f), or (m))                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| EXAMINATION FEE<br>(37 CFR 1.16(a), (p), or (q))                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| TOTAL CLAIMS<br>(37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                               | minus 20 = *                       | X               | =            | X                   | =                                               |                     |                               |                     |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                               | minus 3 = *                        | X               | =            | X                   | =                                               |                     |                               |                     |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                                             | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |                 |              |                     |                                                 |                     |                               |                     |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL           |              | TOTAL               |                                                 |                     |                               |                     |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                         |                 | (Column 3)   |                     | SMALL ENTITY                                    |                     | OR<br>OTHER THAN SMALL ENTITY |                     |
| AMENDMENT #                                                                                                                                                                                                                                                                                                                                                                                                                          | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA   | RATE (\$)    | ADDITIONAL FEE (\$) | RATE (\$)                                       | ADDITIONAL FEE (\$) | RATE (\$)                     | ADDITIONAL FEE (\$) |
| 9/26/06                                                                                                                                                                                                                                                                                                                                                                                                                              | 91                                                                                                                                                                                                                            | Minus ** 95                        | =               | X            | =                   | X                                               | =                   | X                             | =                   |
| Independent (37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                                                         | 3                                                                                                                                                                                                                             | Minus *** 3                        | =               | X            | =                   | X                                               | =                   | X                             | =                   |
| Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                    | TOTAL ADD'L FEE |              | TOTAL ADD'L FEE     |                                                 | TOTAL ADD'L FEE     |                               |                     |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                         |                 | (Column 3)   |                     | SMALL ENTITY                                    |                     | OR<br>OTHER THAN SMALL ENTITY |                     |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                                          | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA   | RATE (\$)    | ADDITIONAL FEE (\$) | RATE (\$)                                       | ADDITIONAL FEE (\$) | RATE (\$)                     | ADDITIONAL FEE (\$) |
| Total (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                                                               | *                                                                                                                                                                                                                             | Minus **                           | =               | X            | =                   | X                                               | =                   | X                             | =                   |
| Independent (37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                                                         | *                                                                                                                                                                                                                             | Minus ***                          | =               | X            | =                   | X                                               | =                   | X                             | =                   |
| Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                    | TOTAL ADD'L FEE |              | TOTAL ADD'L FEE     |                                                 | TOTAL ADD'L FEE     |                               |                     |
| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p> |                                                                                                                                                                                                                               |                                    |                 |              |                     |                                                 |                     |                               |                     |

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

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Application No. : 10/131,864 Confirmation No.: 8941  
Applicant: : William J. Crilly, Jr.  
Filed: : April 25, 2002  
TC/A.U. : 2611  
Examiner: : Jean B. Corrielus  
  
Docket: : 760.0030001  
Customer No.: : 38356

**MS AMENDMENT**  
Commissioner for Patents  
P.O. BOX 1450  
Alexandria, VA 22313-1450

**RESPONSE TO EXAMINER TELECONFERENCE**  
**OF AUGUST 28, 2006**

Dear Examiner Corrielus:

In response to the Teleconference of August 28, 2006, please amend the above-identified application as follows:

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

**Remarks/Arguments** begin on page 20 of this paper.

**Amendments to the Claims:**

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

**Listing of Claims:**

1. (Currently Amended) A method comprising:  
identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device;  
determining at least one forward path pre-equalization parameter based on said at least one transmission delay; and  
modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal.
2. (Original) The method as recited in Claim 1, further comprising:  
receiving said reverse path data signal over at least one reverse transmission path.
3. (Original) The method as recited in Claim 2, further comprising:  
transmitting said modified forward path data signal over at least one forward transmission path.

4. (Original) The method as recited in Claim 1, wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.
5. (Original) The method as recited in Claim 1, wherein said modified forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.
6. (Original) The method as recited in Claim 5, wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data.
7. (Original) The method as recited in Claim 6, further comprising:  
generating corresponding Quadrature Phase Shift Keying (QPSK)  
modulation values based on said sub-carrier pre-equalized OFDM data.
8. (Original) The method as recited in Claim 4, wherein identifying said at least one multipath transmission delay includes:  
identifying at least one multipath transmission delay spread that is greater than a guard interval.
9. (Original) The method as recited in Claim 1, wherein said reverse path data signal includes identifiable training data.
10. (Currently Amended) The method as recited in Claim 9, further comprising:  
comparing said received identifiable training data to a local version  
of said training data to identify said at least one multipath transmission delay within said reverse path data signal.

11. (Original) The method as recited in Claim 3, wherein modifying said forward path data signal based on at least one forward path pre-equalization parameter further includes:

selectively inverting and applying a measured channel response to said forward path data signal to significantly reduce subsequent induced deleterious channel response changes to said modified forward path data signal during transmission over said at least one forward transmission path.

12. (Original) The method as recited in Claim 3, wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path.

13. (Previously Presented) The method as recited in Claim 1, wherein identifying said at least one multipath transmission delay, determining said at least one forward path pre-equalization parameter, and modifying said forward path data signal are performed by a transmitting device.

14. (Previously Presented) The method as recited in Claim 13, wherein said transmitting device includes a base station device that is operatively configured for use in a wireless communication system.

15. (Previously Presented) The method as recited in Claim 13, further comprising:

using at least one transmitting device receive antenna operatively coupled to said transmitting device to receive said reverse path data signal over at least one reverse transmission path from the receiving device.

16. (Previously Presented) The method as recited in Claim 15, wherein said receiving device includes a customer premise equipment (CPE) device that is operatively configured for use in a wireless communication system.

17. (Original) The method as recited in Claim 16, wherein said CPE device includes at least one device selected from a group of devices comprising a computer, a portable computer, a personal digital assistant (PDA), and a mobile communication device.

18. (Previously Presented) The method as recited in Claim 15, wherein said at least one transmitting device receive antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

19. (Previously Presented) The method as recited in Claim 15, wherein said transmitting device is operatively coupled to a plurality of first device receive antennas.

20. (Previously Presented) The method as recited in Claim 13, further comprising;

receiving said reverse path data signal over at least one reverse transmission path; and

causing said transmitting device to post equalize at least a portion of said received reverse path signal.

21. (Previously Presented) The method as recited in Claim 15, wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes:

determining at least one angle of arrival of said reverse path data signal with respect to said at least one transmitting device receive antenna.

22. (Previously Presented) The method as recited in Claim 15, further comprising:

using at least one receiving device transmit antenna operatively coupled to said receiving device and configured to transmit said reverse path data signal over said at least one reverse transmission path to said transmitting device.

23. (Previously Presented) The method as recited in Claim 22, wherein a plurality of receiving device transmit antennas are operatively coupled to said receiving device and configured to transmit said reverse path data signal over said at least one reverse transmission path to said transmitting device.

24. (Previously Presented) The method as recited in Claim 22, further comprising:

causing said receiving device to transmit at least two reverse path data signals over said at least one reverse transmission path to said transmitting device.

25. (Original) The method as recited in Claim 24, wherein said at least two reverse path data signals include Orthogonal Frequency-Division Multiple Access (OFDMA) data.

26. (Previously Presented) The method as recited in Claim 22, further comprising:

causing said receiving device to transmit said reverse path data signal over said at least one reverse transmission path to said transmitting device at a bit rate less than about 6 Mbps.

27. (Previously Presented) The method as recited in Claim 22, further comprising:

causing said receiving device to transmit corresponding receiving device transmission power level information to said transmitting device; and

causing said transmitting device to adjust at least one transmission power level associated with said forward path data signal based on said receiving device transmission power level information.

28. (Currently Amended) The method as recited in Claim 13, further comprising:

using at least one transmitting device transmit antenna operatively coupled to said transmitting device to transmit said modified forward path data signal over at least one forward transmission path to ~~[[a]]~~ the receiving device.

29. (Previously Presented) The method as recited in Claim 28, wherein said at least one transmitting device transmit antenna is operatively configured to provide transmission diversity when transmitting said modified forward path data signal.

30. (Previously Presented) The method as recited in Claim 28, wherein said at least one transmitting device transmit antenna is operatively configured to provide spatial division transmission utilizing a spatial division technique when transmitting said modified forward path data signal as a narrow signal to reduce multipath propagation.

31. (Previously Presented) The method as recited in Claim 28, wherein said at least one transmitting device transmit antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

32. (Previously presented) The method as recited in Claim 28, further comprising:

setting at least one antenna pointing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter.

33. (Previously Presented) The method as recited in Claim 28, further comprising:

setting at least one phased array antenna transmission directing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter.

34. (Previously Presented) The method as recited in Claim 28, further comprising:

selectively transmitting said modified forward path data signal at one angle with respect to said transmitting device transmit antenna.

35. (Previously Presented) The method as recited in Claim 28, further comprising:

selecting said at least one transmitting device transmit antenna from a plurality of transmitting device transmit antennas that are each operatively coupled to said transmitting device.

36. (Previously presented) The method as recited in Claim 35, further comprising:

selectively transmitting a plurality of beams using two or more transmitting device transmit antennas.

37. (Previously Presented) The method as recited in Claim 36, wherein each of said transmitted plurality of beams is selectively adjusted in phase and amplitude to reduce multipath affects when received by said receiving device.

38. (Previously Presented) The method as recited in Claim 28, further comprising:

using at least one receiving device receive antenna operatively coupled to said receiving device and configured to receive said modified forward path data signal over said at least one forward transmission path from said transmitting device.

39. (Previously Presented) The method as recited in Claim 38, wherein a plurality of receiving device receive antennas are operatively coupled to said receiving device and configured to receive said modified forward path data signal over said at least one forward transmission path from said transmitting device.

40. (Original) The method as recited in Claim 1, wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes:  
iteratively selectively identifying different forward path pre-equalization parameters over time to operatively identify and subsequently ignore aliased multipath delays within said reverse path data signal.

41. (Original) The method as recited in Claim 1, wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes:

sub-band equalizing said forward path data signal using corresponding frequency domain reverse path data.

42. (Canceled)

43. (Currently Amended) A system comprising:

a first device operatively configured to connect to at least a second device over a wireless communication path, said first device having logic that is configured to detect a multipath transmission delay in at least one reverse path data signal transmitted by said second device, determine at least one forward path pre-equalization parameter based on said detected multipath transmission delay, and pre-equalize a forward path data signal that is to be transmitted to said second device based on said at least one forward path pre-equalization parameter; said first device further comprising:

at least one first device antenna; and

at least one transceiver operatively coupled to said at least one first device antenna and said logic, said at least one transceiver being configured to receive said reverse path data signal over at least one reverse transmission path using said at least one first device antenna and provide said reverse path data signal to said logic, and transmit said forward path data signal from said logic over at least one forward transmission path;

wherein said logic is further configured to cause said transceiver to selectively establish different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal based on said at least one forward path pre-equalization parameter.

44. (Canceled)

45. (Original) The system as recited in Claim 43, wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.

46. (Previously Presented) The system as recited in Claim 43, wherein said forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.

47. (Previously Presented) The system as recited in Claim 46, wherein said forward path data signal includes sub-carrier pre-equalized OFDM data.

48. (Original) The system as recited in Claim 47, wherein said logic is further configured to produce corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data.

49. (Original) The system as recited in Claim 45, wherein said logic detects said multipath transmission delay by identifying at least one multipath transmission delay spread that is greater than a guard interval.

50. (Original) The system as recited in Claim 43, wherein said reverse path data signal includes identifiable training data.

51. (Previously Presented) The system as recited in Claim 50, wherein said logic is further configured to compare said identifiable training data to a non-multipath delayed version of said training data to detect said multipath transmission delay.

52. (Previously Presented) The system as recited in Claim 44, wherein said logic is configured to selectively invert and apply a measured channel response to said forward path data signal to significantly reduce subsequent induced deleterious channel response changes to said forward path data signal during transmission over said at least one forward transmission path.

53. (Original) The system as recited in Claim 44, wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path.

54. (Previously Presented) The system as recited in Claim 43, wherein said first device includes a base station device that is operatively configured for use in a wireless communication system.

55. (Previously Presented) The system as recited in Claim 44, wherein said second device is a customer premise equipment (CPE) device that is operatively configured for use in a wireless communication system.

56. (Original) The system as recited in Claim 55, wherein said CPE device includes at least one device selected from a group of devices comprising a computer, a portable computer, a personal digital assistant (PDA), and a mobile communication device.

57. (Original) The system as recited in Claim 44, wherein said first device is operatively coupled to a plurality of first device receive antennas.

58. (Original) The system as recited in Claim 44, wherein said logic is configured to post-equalize at least a portion of said received reverse path signal.

59. (Original) The system as recited in Claim 44, wherein said logic is further configured to determine at least one angle of arrival of said reverse path data signal with respect to said at least one first device antenna.

60. (Previously Presented) The system as recited in Claim 55, wherein said second device includes at least one second device antenna that is operatively configured to transmit said reverse path data signal over said at least one reverse transmission path to said first device and receive said transmitted forward path data signal from said first device over said at least one forward transmission path.

61. (Previously Presented) The system as recited in Claim 60, wherein said second device includes a plurality of second device antennas that are operatively configured to transmit said reverse path data signal over said at least one reverse transmission path to said first device.

62. (Previously Presented) The system as recited in Claim 60, wherein said second device is configured to transmit at least two reverse path data signals over said at least one reverse transmission path to said first device.

63. (Original) The system as recited in Claim 62, wherein said at least two reverse path data signals include Orthogonal Frequency-Division Multiple Access (OFDMA) data.

64. (Previously Presented) The system as recited in Claim 60, wherein said second device is configured to transmit said reverse path data signal over said at least one reverse transmission path to said first device at a bit rate less than about 6 Mbps.

65. (Previously Presented) The system as recited in Claim 60, wherein said second device is configured to transmit corresponding second device transmission power level information to said first device, and said first device is further configured to adjust at least one transmission power level associated with said forward path data signal based on said second device transmission power level information.

66. (Previously Presented) The system as recited in Claim 44, wherein said at least one first device antenna is operatively configured to provide transmission diversity when transmitting said forward path data signal.

67. (Previously Presented) The system as recited in Claim 44, wherein said at least one first device antenna is operatively configured to provide spatial division transmission utilizing a spatial division technique when transmitting said forward path data signal as a narrow signal to reduce multipath propagation.

68. (Original) The system as recited in Claim 44, wherein said at least one first device antenna includes at least one first device transmit antenna and at least one first device receive antenna.

69. (Original) The system as recited in Claim 68, wherein said at least one first device transmit antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

70. (Original) The system as recited in Claim 68, wherein said at least one first device receive antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

71. (Original) The system as recited in Claim 68, wherein said logic is further configured to establish at least one antenna pointing parameter associated with said at least one first device transmit antenna based on said at least one forward path pre-equalization parameter.

72. (Original) The system as recited in Claim 68, wherein said logic is further configured to establish at least one phased array antenna transmission directing parameter associated with said at least one first device transmit antenna based on said at least one forward path pre-equalization parameter.

73. (Previously Presented) The system as recited in Claim 68, wherein said logic is further configured to cause said at least one transceiver to selectively transmit said forward path data signal at one angle with respect to said at least one first device transmit antenna.

74. (Previously Presented) The system as recited in Claim 68, wherein said logic is further configured to cause said at least one transceiver to select said at least one first device transmit antenna from a plurality of first device transmit antennas that are each operatively coupled to said first device.

75. (Previously Presented) The system as recited in Claim 74, wherein said logic is further configured to cause said at least one transceiver to selectively transmit a plurality of beams using two or more first device transmit antennas.

76. (Original) The system as recited in Claim 75, wherein each of said transmitted plurality of beams is selectively adjusted in phase and amplitude to reduce multipath affects when received by said second device.

77. (Original) The system as recited in Claim 60, wherein said at least one second device antenna includes at least one second device transmit antenna and at least one second device receive antenna.

78. (Previously Presented) The system as recited in Claim 77, wherein said second device includes a plurality of second device receive antennas that are configured to receive said transmitted forward path data signal over said at least one forward transmission path from said first device.

79. (Previously Presented) The system as recited in Claim 43, wherein said logic is further configured to iteratively selectively test different forward path pre-equalization parameters over time such that aliased multipath delays within said reverse path data signal are identifiable.

80. (Original) The system as recited in Claim 43, wherein said logic is configured to provide sub-band equalizing of said forward path data signal using corresponding frequency domain reverse path data.

81. (Canceled)

82. (Currently Amended) An apparatus comprising:  
an Orthogonal Frequency Division Multiplexing (OFDM) processor  
configured to receive coded data and output corresponding OFDM data;  
a pre-equalizer operatively coupled to said OFDM processor and configured  
to receive said OFDM data and output pre-equalized OFDM data based on gathered  
reverse link data;  
at least one antenna; and  
an antenna signal processing component operatively coupled to said  
pre-equalizer and said at least one antenna, said antenna signal processing  
component being configured to receive said pre-equalized OFDM data from said  
pre-equalizer and apply a corresponding transmittable forward link data signal to  
said at least one antenna, the antenna signal processing component being further  
configured to receive a transmitted reverse link data signal using said at least one  
antenna and output corresponding reverse link data; and  
reverse link logic operatively coupled to said at least one antenna, said  
reverse link logic being configured to detect at least one multipath induced delay in  
said reverse link data and provide said gathered reverse link data to said pre-  
equalizer based on said multipath induced delay, wherein said reverse link logic is  
further configured to cause selectively establishing different transmission power  
levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones  
in said transmittable forward link data signal.

83. (Canceled)

84. (Original) The apparatus as recited in Claim 82, wherein said pre-equalized  
OFDM data includes sub-carrier pre-equalized OFDM data.

85. (Previously Presented) The apparatus as recited in Claim 83, wherein said  
reverse link logic detects said at least one multipath induced delay by identifying at  
least one transmission delay spread that is greater than a guard interval.

86. (Original) The apparatus as recited in Claim 83, wherein said reverse link data signal includes identifiable training data.

87. (Previously Presented) The apparatus as recited in Claim 86, wherein said reverse link logic is further configured to compare said identifiable training data to a non-delayed version of said training data to detect said at least one transmission delay.

88. (Original) The apparatus as recited in Claim 83, wherein said pre-equalizer is configured to selectively invert and apply a measured channel response to said OFDM data.

89. (Original) The apparatus as recited in Claim 83, wherein a reverse transmission path carrying said transmitted reverse link data signal towards said antenna is at least substantially reciprocal to a forward transmission path carrying said transmittable forward link data signal away from said at least one antenna.

90. (Original) The apparatus as recited in Claim 82, wherein said apparatus includes a base station device suitable for use in a wireless communication system.

91. (Previously Presented) The apparatus as recited in Claim 82, wherein said at least one antenna is operatively configured to provide transmission diversity.

92. (Previously Presented) The apparatus as recited in Claim 82, wherein said at least one antenna is operatively configured to provide a spatial division technique to transmit the data signal as a narrow signal to reduce multipath propagation.

93. (Original) The apparatus as recited in Claim 82, wherein said at least one antenna includes at least one transmit antenna and at least one receive antenna.

94. (Original) The apparatus as recited in Claim 93, wherein said at least one transmit antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

95. (Original) The apparatus as recited in Claim 93, wherein said at least one receive antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

### **REMARKS/ARGUMENTS**

Applicant kindly requests allowance of the subject application.

Claims 1, 10, 28, 43, and 82 are amended, claims 42, 44, 81, and 83 are canceled, and no new claims have been added; as a result, claims 1-41, 43, 45-80, 82, and 84-95 are now pending in this application.

#### **Teleconference August 28, 2006 with Examiner**

Applicant appreciates the Examiner calling in an effort to advance prosecution to place the application in condition for allowance. As discussed on August 28, 2006, independent claims 1, 43, and 82 are amended herein to place the application in condition for allowance. Specifically:

Claim 1 is amended to include the allowable feature(s) of claim 42 (now canceled). Claim 43 is amended to include the allowable feature(s) of claims 44 and 81 (both now canceled). Claim 82 is amended to include the allowable feature(s) of claims 81 and 83 (both now canceled).

#### **Claim Objections**

In the previous Office Action dated July 11, 2006, claims 14, 16, 29-30, 43-44, 54-55, 60-62, 64-67, 73-75, 78-79, 81, 83, 87, 89, and 91-92 were objected to for various informalities (*Office Action* p.2). Appropriate corrections were provided in the Response from the Applicant, and Applicant requested that the claim objections be withdrawn.

#### **Drawing Objections**

In the previous Office Action dated July 11, 2006, the Drawings were objected to because, for example, claim 82 recited a pre-equalizer operatively coupled to a transceiver which is not shown in an embodiment in the drawings (*Office Action* p.3). Appropriate correction was provided and Applicant requested that the drawing objections be withdrawn.

35 U.S.C. §112 Claim Rejections

In the previous Office Action dated July 11, 2006, claims 44, 46-48, 52-53, 55-78, 81, 83, and 85 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite (*Office Action* pp. 2-3). Appropriate corrections were provided in the Response from the Applicant, and Applicant requested that the §112 claim rejections be withdrawn.

Allowable Subject Matter

Applicant notes with appreciation the allowance of claims 1-43, 45, 49-51, 54, 79-80, 82, 84, and 86-95.

Claims 44, 46-48, 52-53, 55-78, 81, 83, and 85 were indicated as being allowable if rewritten to overcome the 35 U.S.C. §112 rejection (*Office Action* p.4). Appropriate amendments were provided in a Response from the Applicant such that the allowed claims would overcome the claim objections described below. Appropriate amendments were also provided for the allowable claims to overcome the 35 U.S.C. §112 rejection. Accordingly, claims 1-41, 43, 45-80, 82, and 84-95 are in condition for allowance.

**CONCLUSION**

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 236-0120 to facilitate prosecution of this matter.

**CERTIFICATE UNDER 37 CFR §1.8:** The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: **MS AMENDMENT** Commissioner of Patents, P.O. BOX 1450, Alexandria, VA 22313-1450 on this 18<sup>th</sup> day of September, 2006.

Alison L. Sibenla  
Name

AL  
Signature

Respectfully Submitted,  
William J. Crilly, Jr.

By his Representatives,  
BROOKS & CAMERON, PLLC  
1221 Nicollet Avenue, Suite 500  
Minneapolis, MN 55403

By: Edward J. Brooks III  
Edward J. Brooks III  
Reg. No. 40,925

Date: 9/18/2006



PTO/SB/02 (01-06)  
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**REVOCATION OF POWER OF  
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AND  
CHANGE OF CORRESPONDENCE ADDRESS**

|                        |                   |
|------------------------|-------------------|
| Application Number     | 10/131,864        |
| Filing Date            | April 25, 2002    |
| First Named Inventor   | William J. Crilly |
| Art Unit               | 2811              |
| Examiner Name          | JEAN B CORRIELUS  |
| Attorney Docket Number | MN1-0001US        |

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

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint the practitioners associated with the Customer Number:

38356

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

☒ The address associated with  
Customer Number:

38356

OR

☐ Firm or  
Individual Name

Address

City

State

Zip

Country

Telephone

Email

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**

Signature

Name

Gary Haycox

Date

9/15/06

Telephone

503-703-3435

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

☐ Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 1.36. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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**STATEMENT UNDER 37 CFR 3.73(b)**

Applicant/Patent Owner: Vivato, Inc.

Application No./Patent No./Control No.: 10/131,864 Filed/Issue Date: April 25, 2002

Entitled: IMPROVED MULTIPATH COMMUNICATION METHODS AND APPARATUSES

Vivato, Inc., a Corporation

(Name of Assignee)

(Type of Assignee: 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 a true copy of the original assignment is attached.

OR

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

1. From: William J. Crilly Jr. To: Mabuhay Networks, Inc.  
The document was recorded in the United States Patent and Trademark Office at  
Reel 012849, Frame 0727, or for which a copy thereof is attached.

2. From: Mabuhay Networks, Inc. To: Vivato, Inc.  
The document was recorded in the United States Patent and Trademark Office at  
Reel 013937, Frame 0808, 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.

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

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

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

Gary Haycox  
Signature

Gary Haycox

Printed or Typed Name

Chief Executive Officer  
Title

9/15/06  
Date

503-703-3435

Telephone Number

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

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IFM 2611

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant: William J. Crilly, Jr.  
Serial No.: 10/131,864  
Filed: April 25, 2002

Confirmation No. 8941  
Examiner: Jean B. Corrielus  
Art Unit: 2611  
Docket: 760.0030001

Title: IMPROVED MULTIPATH COMMUNICATION METHODS AND APPARATUSES

**MS AMENDMENT**

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

We are transmitting herewith the following attached items and information (as indicated with an "X"):

- ☒ Return postcard (1).
- ☒ Response to Examiner Teleconference of August 28, 2006 (22 pgs.).
- ☒ Revocation and Power of Attorney with New Power of Attorney and Change of Correspondence Address (1 pg.).
- ☒ Statement Under 37 CFR 3.73(b) (1 pg.).

**\*PLEASE ASSOCIATE THIS APPLICATION WITH CUSTOMER NUMBER 38356\***

**CERTIFICATE UNDER 37 C.F.R. §1.8:** The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: MS AMENDMENT Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on this 18<sup>th</sup> day of September, 2006.

Alison L. Suber  
Name  
ASL  
Signature

Respectfully Submitted,  
William J. Crilly, Jr.

By: BROOKS & CAMERON, PLLC  
1221 Nicollet Avenue, Suite 500  
Minneapolis, MN 55403

Edward J. Brooks III  
Atty: Edward J. Brooks III  
Reg. No.: 40,925  
9/18/2006  
Date:



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| APPLICATION NO.                                                         | FILING DATE | FIRST NAMED INVENTOR  | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-------------------------------------------------------------------------|-------------|-----------------------|---------------------|------------------|
| 10/131,864                                                              | 04/25/2002  | William J. Crilly JR. | MN1-001US           | 8941             |
| 29150                                                                   | 7590        | 09/20/2006            | EXAMINER            |                  |
| LEE & HAYES, PLLC<br>421 W. RIVERSIDE AVE, STE 500<br>SPOKANE, WA 99201 |             |                       | CORRIELUS, JEAN B   |                  |
|                                                                         |             |                       | ART UNIT            | PAPER NUMBER     |
|                                                                         |             |                       | 2611                |                  |

DATE MAILED: 09/20/2006

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

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/131,864             | CRILLY, WILLIAM J.  |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Jean B. Corrielus      | 2611                |  |

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

**Period for Reply**

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

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

**Status**

1) ☒ Responsive to communication(s) filed on 31 July 2006.

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) 1-95 is/are pending in the application.

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

5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

6) ☒ Claim(s) 1-41, 43-80 and 82-95 is/are rejected.

7) ☒ Claim(s) 42 and 81 is/are objected to.

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

**Application Papers**

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

10) ☐ The drawing(s) filed on \_\_\_\_\_ 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)**

|                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                      |
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| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)<br>2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)<br>3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____. | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____.<br>5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)<br>6) <input type="checkbox"/> Other: _____. |
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**DETAILED ACTION**

***Allowable Subject Matter***

1. The indicated allowability of claims 1-41, 43-80 and 82-95 is withdrawn in view of the newly discovered reference(s) to Yamamoto and Bao et al. Rejections based on the newly cited reference(s) follow.

***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-5, 9, 11-17, 20, 22, 28, 29, 38, 40, 43-46, 50, 52-56, 58, 60, 66, 68, 77, and 79 are rejected under 35 U.S.C. 102(e) as being anticipated by Yamamoto US patent No. 6,252,914.

As per claim 1, Yamamoto discloses a method and apparatus fig. 1 and 2 comprising estimating propagation path characteristics using circuit 32 (note that by estimating the propagation path characteristics, multipath transmission delay is inherently identified or recognized because the multipath is one of the component that affect characteristics of the communication path) within a reverse path data signal

received from a receiving device 2 ; determining at least one forward path pre-equalization parameter (i. e coefficients see section 51) based on said propagation path characteristics (multipath transmission delay) and filtering (modifying) using section 52 a forward path data signal that is to be transmitted to the receiving device 2 based on said coefficients (forward path pre-equalization) supplied by circuit 51.

As per claim 2, the reverse path data signal is received over at least one reverse path 3 see fig. 1.

As per claim 3, the modified forward data signal (i.e. output of circuit 50) is transmitted over at least one forward transmission path 3 see fig. 1.

As per claim 4, Yamamoto teaches a QPSK modulation scheme is used at the forward path, the reverse path has to use the same type of modulation as well. see col. 4, lines 57-64.

As per claim 5, the forward path includes at least one type of data selected from QPSK see col. 4, lines 57-64.

As per claim 9, said reverse path data signal includes reference signal (identifiable training data) see col. 2, line8-10.

As per claim 11, Yamamoto teaches that a measured of channel response is inverted and applied to said forward path to reduce subsequent channel response changes to said modified forward path data signal during transmission see col. 2, lines 35-42.

As per claim 12, the reverse path is the reciprocal of the forward path see col. 2, lines 35-49.

As per claim 13, the steps recited in claim 1 are performed at the transmitting device 1.

As per claim 14, the transmitting device includes a base station for use inherently in wireless transmission see fig. 1.

As per claim 15, the transmitting device 1 inherently includes an antenna coupled thereto to receive data signal from the receiving device 2.

As per claim 16, the receiving device 2 inherently includes a customer premise equipment configured for use in a wireless system.

As per claim 17, the CPE is a mobile communication device see fig. 1.

As per claim 20, the data is received over a reverse path and the transmitting device 50 post equalizes a portion of said received signal using equalizer 30.

As per claim 22, the transmitting device inherently includes an antenna coupled thereto to transmit data signal to said transmitting device 1.

As per claim 28, see claim 15.

As per claim 29, said transmit antenna inherently provides transmission diversity because of the multipath signal generated.

As per claim 38, see claim 22.

As per claim 40, the pre-equalization parameters generated by Yamamoto have to be different from each other because of the dynamic nature of the transmission path.

As per claim 43, see claim 1.

As per claim 44, the reference further teaches that multipath compensation is provided see col. 3, lines 5-8 therefore the system is a wireless system and inherently includes a first device antenna coupled to the transceiver of fig.1 or 2 and the logic.

as per claim 45 see claim 4.

as per claim 46 see claim 5.

As per claim 50 see claim 9.

As per claim 52 see claim 11.

As per claim 53 see claim 12.

As per claim 54 see claim 14.

As per claim 55, see claim 16.

As per claim 56, see claim 17.

as per claim 58, see claim 20.

As per claim 60, see claim 22.

as per claim 66, see claim 28.

As per claim 68, the antenna inherently includes a transmit and receive antenna.

As per claim 77 see claim 38.

As per claim 79, see claim 40.

***Claim Rejections - 35 USC § 103***

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

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

5. Claims 6-8, 10, 18-19, 21, 23-27, 30-37, 39, 41, 47-49, 51, 57, 59, 61-65, 67, 69-76, 78 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto.

As per claim 6, as applied to claim 1 above, Yamamoto discloses every feature of the claimed invention but does not explicitly teach that the signal includes subcarrier pre-equalized OFDM data. However, modifying the signal to include subcarrier pre-equalized OFDM data would have been obvious to one of ordinary skill in the art and the motivation to do so would have been to provide compatibility with systems that uses OFDM modulation scheme.

As per claim 7, it would have been obvious to use OFDM data to generate QPSK modulation values so as to provide compatibility with systems that uses QPSK modulation scheme.

As per claim 8, it would have obvious to one skill in the art to identify transmission delay that is greater than a guard interval for enhanced detection.

As per claim 10, it is known in the art to compare a received training sequence with a local training sequence so as to provide proper indication of transmission medium.

As per claim 18, it would have been obvious that the type of antenna would have been adaptive type so as to take advantage of its enhanced technological feature.

As per claim 19, it would have been obvious to couple the device with a plurality of antenna to enhance signal detection.

As per claim 21, it would have been obvious to one skill in the art to determine at least one angle of arrival of said reverse path with respect to said receive antenna so as to so as to detect delays associated with the received signal.

As per claim 23, it would have been obvious to one skill in the art to include a plurality of transmit antenna in the receiving device to enhance signal detection.

As per claim 24, it would have been obvious to one skill in the art to cause said receiving device to transmit at least two reverse path signals over said at least one reverse transmission path so as to satisfy system requirements.

As per claim 25, see claim 6.

As per claim 26, it would have been obvious to one skill in the art to cause said receiving device to transmit said reverse path signal at a bit rate less than 6 Mbps for better performance.

As per claim 27, it would have been obvious to one skill in the art to cause the receiving device to transmit power level information to the transmit device to adjust its power level so as to reduce signal interference.

as per claim 30, it would have been obvious to one skill in the art to provide spatial division transmission so as to improve signal detection.

As per claim 31, see claim 18.

As per claims 32 and 33, it would have been obvious to one skill in the art to set at least one antenna pointing parameter or phase array associated with said transmit antenna based on the pre-equalization parameter so as to improve signal detection.

As per claim 34, it would have been obvious to one skill in the art to selectively transmit said modify forward path at one angle with respect to said transmit antenna for better performance.

As per claim 35, it would have been obvious to one skill in the art to select one antenna from a plurality of antenna to improve system flexibility.

As per claim 36, it would have been obvious to one skill in the art to selectively transmit a plurality of beam using at least two transmit antenna in order to improve signal detection.

As per claim 37 it would have been obvious to one skill in the art to adjust the plurality of beams in amplitude and in phase so as to improve signal detection.

As per claim 39, it would have been obvious to one skill in the art to include a plurality of receive antennas to receive said modified data signal for better performance.

As per claim 41, it would have been obvious to one skill in the art to subband equalize said forward path using corresponding reverse path data so as to remove interference.

As per claim 47 see claim 6.

As per claim 48 see claim 7.

As per claim 49 see claim 8.

As per claim 51 see claim 10.

As per claim 57 see claim 19.

As per claim 59 see claim 21.

As per claim 61 see claim 23.

As per claim 62 see claim 24.  
As per claim 63, see claim 25.  
As per claim 64 see claim 26.  
As per claim 65 see claim 27 .  
As per claim 67 see claim 30.  
As per claims 69 and 70, see claim 31.  
As per claim 71 see claim 32.  
As per claim 72 see claim 33.  
As per claim 73 see claim 34.  
As per claim 74 see claim 35.  
As per claim 75 see claim 36.  
As per claim 76 see claim 37.  
As per claim 78 see claim 39.  
As per claim 80 see claim 41.

6. Claims 82-95 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao et al US patent No. 6,792,049.

As per claim 82, Bao et al teaches an apparatus (figs. 2 and 3) comprising: a processor (110-140) configured to receive coded data 101 and output corresponding data; a pre-equalizer 312 operatively coupled to said processor(110-140) and configured to receive said data and output pre-equalized data based on gathered reverse link data; at least one antenna see col. 6, line 28 ; an antenna signal

processing component 314 operatively coupled to said pre-equalizer 314 and said at least one antenna, said antenna signal processing component 314 being configured to receive said pre-equalized data from said pre-equalizer 312 and apply a corresponding transmittable forward link data signal to said at least one antenna. However, Bao does not explicitly teach an OFDM processor is coupled to the pre-equalizer. However, as noted in the background of the invention col. 1 lines 41-43 it is well known in the art to use an OFDM processor to generate OFDM data. Given that fact, it would have been obvious to one skill in the art to incorporate an OFDM processor in Bao et al so as to provide compatibility with system that uses OFDM modulation scheme.

As per claim 83, the apparatus of Bao further comprising a reverse link logic 316 inherently coupled to the antenna and configured to detect channel characteristics (multipath induced delay) and provide said gathered reverse link data to said pre-equalizer see fig. 3 and col. 4, lines 17-33.

As per claim 84, Bao discloses every feature of the claimed invention but does not explicitly teach that the signal includes subcarrier pre-equalized OFDM data. However, modifying the signal to include subcarrier pre-equalized OFDM data would have been obvious to one of ordinary skill in the art and the motivation to do so would have been to provide compatibility with systems that uses OFDM modulation scheme.

As per claim 85, it would have obvious to one skill in the art to identify transmission delay that is greater than a guard interval for enhanced detection.

As per claim 86 said reverse link includes training data see col. 5, lines 55-60.

As per claim 87, the received training sequence and a delay version of the training sequence are compared see col. 5, lines 55-60.

As per claim 88, it would have been obvious to one skill in the art to invert and apply a measured channel response to said OFDM data so as to undo the effect of the transmission medium.

As per claim 89, the reverse path is inherently reciprocal to the forward path.

As per claim 90, the system include a base station use for wireless transmission see col. 3, lines 11, col. 6, lines 37-38.

As per claim 91, the antenna is configured to provide diversity see col. 6, line 29.

As per claim 92 Bao uses spatial diversity see col. 6, line 37.

As per claim 93, the apparatus includes at least one transmit antenna and at least one receive antenna see col. 6, lines 28-29.

As per claims 94 and 95, it would have been obvious that the type of antenna would have been adaptive type so as to take advantage of its enhanced technological feature.

### ***Claim Objections***

7. Claims 10, 28, 83 and 85-89 are objected to because of the following informalities:

Claim 10, line 2, "received" should be deleted, so as to be consistent with antecedent in claim 9.

Claim 28, line 5, "a" should be replaced by --the-- so as to be make use of antecedent in claim 1.

Claim 83, last line, after "pre-equalizer", based on said multipath induced delay" should be inserted. Note that any claim whose base claim s objected is likewise objected. Appropriate correction is required.

***Allowable Subject Matter***

8. Claims 42 and 81 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jean B. Corrielus whose telephone number is 571-272-3020. The examiner can normally be reached on Maxi-Flex.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. 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.

  
Jean/B Corrielus  
Primary Examiner  
Art Unit 2611  
9-18-06

|                                   |                                       |                                                                  |             |
|-----------------------------------|---------------------------------------|------------------------------------------------------------------|-------------|
| <b>Notice of References Cited</b> | Application/Control No.<br>10/131,864 | Applicant(s)/Patent Under<br>Reexamination<br>CRILLY, WILLIAM J. |             |
|                                   | Examiner<br>Jean B. Corrielus         | Art Unit<br>2611                                                 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Name                  | Classification |
|---|---|--------------------------------------------------|-----------------|-----------------------|----------------|
| * | A | US-6,792,049 B1                                  | 09-2004         | Bao et al.            | 375/285        |
| * | B | US-6,252,914 B1                                  | 06-2001         | Yamamoto, Takeshi     | 375/296        |
| * | C | US-6,324,220 B1                                  | 11-2001         | Sellars, Malcolm Paul | 375/296        |
| * | D | US-5,881,108 A                                   | 03-1999         | Herzberg et al.       | 375/296        |
| * | E | US-6,445,750                                     | 09-2002         | Chen et al.           | 375/300        |
| * | F | US-6,314,135 B1                                  | 11-2001         | Schneider et al.      | 375/232        |
| * | G | US-5,881,363 A                                   | 03-1999         | Ghosh et al.          | 725/125        |
|   | H | US-                                              |                 |                       |                |
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**FOREIGN PATENT DOCUMENTS**

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**NON-PATENT DOCUMENTS**

| * |   | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|-------------------------------------------------------------------------------------------|
|   | U |                                                                                           |
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\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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| <b>Search Notes</b><br> |  | <b>Application/Control No.</b><br>10/131,864 | <b>Applicant(s)/Patent under Reexamination</b><br>CRILLY, WILLIAM J. |  |
|                                                                                                          |  | <b>Examiner</b><br>Jean B. Corrielus         | <b>Art Unit</b><br>2611                                              |  |

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| Class    | Subclass | Date      | Examiner |
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| EAST                                        | 6/28/2006 | JBC  |
| East                                        | 8/22/2006 | JBC  |
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# Index of Claims



Application/Control No.

10/131,864

Examiner

Jean B. Corrielus

Applicant(s)/Patent under Reexamination

CRILLY, WILLIAM J.

Art Unit

2611

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|       | 129      |      |  |  |  |
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|       | 149      |      |  |  |  |
|       | 150      |      |  |  |  |

US-PAT-NO: 7054375  
DOCUMENT- US 7054375 B2  
IDENTIFIER:  
TITLE: Method and apparatus for error reduction in an  
orthogonal modulation system

---

**Abstract Text - ABTX (1):**

A method and apparatus reduces error in a communication system that includes multiple orthogonal subcarriers by suppressing a subcarrier in a transmitting communication device and by equalizing a received signal in a receiving communication device. Subcarrier suppression is based on a determination of a signal quality metric with respect to each subcarrier or is based on a determination of excessive signal power overdriving an amplifier of the receiving communication device. Equalization of the received signal is based on an equalization function that reduces a multipath delay introduced to the transmitted signal when the multipath delay exceeds a tolerable multipath delay.

**Brief Summary Text - BSTX (4):**

The limited availability of bandwidth is a critical constraint on the capacity of wireless communication systems. To enhance capacity, orthogonal modulation schemes, such as Orthogonal Frequency Division Multiplexing (OFDM), have been developed for the modulation of information onto a carrier and subsequent transmission of the modulated signal.

## EAST Search History

| Ref # | Hits   | Search Query                                     | DBs                                         | Default Operator | Plurals | Time Stamp       |
|-------|--------|--------------------------------------------------|---------------------------------------------|------------------|---------|------------------|
| L1    | 3      | "6757335".pn. "6560292".pn.                      | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 19:18 |
| L2    | 1699   | 375/316.ccls.                                    | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 19:18 |
| L3    | 250982 | (multiplex\$\$ combin\$4 assemb\$4)<br>same rate | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 19:19 |
| L4    | 292    | 2 and 3                                          | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:41 |
| L5    | 949    | 375/296.ccls.                                    | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:42 |
| L6    | 4470   | equali\$5 near4 feedback                         | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:42 |
| L7    | 44     | 5 and 6                                          | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:45 |
| L8    | 9      | ofdm and 7                                       | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:50 |
| L9    | 3562   | reverse adj channel                              | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:51 |
| L10   | 44     | 9 same equali\$7                                 | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:51 |
| L11   | 1      | 5 and 10                                         | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/08/22 20:53 |

## EAST Search History

|     |       |                                                                                                                                                  |                                             |    |    |                  |
|-----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----|----|------------------|
| L12 | 0     | ofdm and 11                                                                                                                                      | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR | ON | 2006/08/22 20:54 |
| L13 | 0     | orthogonal and 11                                                                                                                                | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR | ON | 2006/08/22 20:54 |
| L14 | 8     | ("4577329"   "4866736"   "5008903"  <br>"5251328"   "5263051"   "5291520"  <br>"5513216"   "5646957").PN.                                        | US-PGPUB;<br>USPAT;<br>USOCR                | OR | ON | 2006/08/22 20:54 |
| L15 | 10    | ("5646957").URPN.                                                                                                                                | USPAT                                       | OR | ON | 2006/08/22 20:58 |
| L16 | 2353  | (orthogonal adj frequency) ofdm                                                                                                                  | USPAT                                       | OR | ON | 2006/08/22 20:59 |
| L17 | 29    | 9 same equali\$7                                                                                                                                 | USPAT                                       | OR | ON | 2006/08/22 20:59 |
| L18 | 0     | 16 and 17                                                                                                                                        | USPAT                                       | OR | ON | 2006/08/22 20:59 |
| L19 | 52    | 16 and 5                                                                                                                                         | USPAT                                       | OR | ON | 2006/08/22 21:11 |
| L20 | 358   | pre-equali\$5 (pre adj equaliz\$4)                                                                                                               | USPAT                                       | OR | ON | 2006/08/22 21:12 |
| L21 | 483   | pre-equali\$7 (pre adj equaliz\$7)                                                                                                               | USPAT                                       | OR | ON | 2006/08/22 21:12 |
| L22 | 21    | 16 and 21                                                                                                                                        | USPAT                                       | OR | ON | 2006/08/22 21:17 |
| L23 | 57465 | (feedback reverse) same (filter\$5<br>equali\$6)                                                                                                 | USPAT                                       | OR | ON | 2006/08/22 21:19 |
| L24 | 391   | 23 and 16                                                                                                                                        | USPAT                                       | OR | ON | 2006/08/22 21:19 |
| L25 | 14    | 5 and 24                                                                                                                                         | USPAT                                       | OR | ON | 2006/08/22 21:20 |
| L26 | 11    | ("4860317"   "5809033"   "5881363"  <br>"5999542"   "6243425"   "6314135"  <br>"6324220"   "6327302"   "6640248"  <br>"6678320"   "6693958").PN. | US-PGPUB;<br>USPAT;<br>USOCR                | OR | ON | 2006/08/22 21:22 |

1       **IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

2       Application Serial No. ....10/131,864  
3       Filing Date .....04/25/2002  
4       Inventorship .....Crilly  
5       Applicant ..... Vivato, Inc.  
6       Group Art Unit .....2611  
7       Examiner ..... Jean B. Corrielus  
8       Attorney's Docket No. ....MN1-0001US  
9       Title: Improved Multipath Communication Methods and Apparatuses

10       **RESPONSE TO OFFICE ACTION DATED JULY 11, 2006**

11       To:       Commissioner for Patents  
12               P.O. Box 1450  
13               Alexandria, VA 22313-1450

14       From:    David A. Morasch       Tel. 509-324-9256 ext. 210  
15               Customer # 22801       Fax 509-323-8979

16                       **INDEX**

17                       List of Claims / Amendments:    Page 2

18                       Remarks Section:               Page 25

**LIST OF CLAIMS / AMENDMENTS**

Claims 1-43, 45, 49-51, 54, 79-80, 82, 84, and 86-95 are allowed.

Please amend claims 14, 16, 29-30, 43-44, 46-47, 51-52, 54-55, 60-62, 64-67, 73-75, 78-79, 81-83, 85, 87, and 91-92 as shown herein.

Claims 1-95 are pending and are listed following:

1. **(previously presented)** A method comprising:  
identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device;  
determining at least one forward path pre-equalization parameter based on said at least one transmission delay; and  
modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter.

2. **(original)** The method as recited in Claim 1, further comprising:  
receiving said reverse path data signal over at least one reverse transmission path.

3. **(original)** The method as recited in Claim 2, further comprising:  
transmitting said modified forward path data signal over at least one forward transmission path.

1           **4. (original)**   The method as recited in Claim 1, wherein said reverse  
2 path data signal includes at least one type of data selected from a group of  
3 different types of data comprising Orthogonal Frequency Division Multiplexing  
4 (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.

5  
6           **5. (original)**   The method as recited in Claim 1, wherein said  
7 modified forward path data signal includes at least one type of data selected from a  
8 group of different types of data comprising Orthogonal Frequency Division  
9 Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.

10  
11           **6. (original)**   The method as recited in Claim 5, wherein said  
12 modified forward path data signal includes sub-carrier pre-equalized OFDM data.

13  
14           **7. (original)**   The method as recited in Claim 6, further comprising:  
15 generating corresponding Quadrature Phase Shift Keying (QPSK)  
16 modulation values based on said sub-carrier pre-equalized OFDM data.

17  
18           **8. (original)**   The method as recited in Claim 4, wherein identifying  
19 said at least one multipath transmission delay includes:

20           identifying at least one multipath transmission delay spread that is greater  
21 than a guard interval.

22  
23           **9. (original)**   The method as recited in Claim 1, wherein said reverse  
24 path data signal includes identifiable training data.  
25

1  
2       **10. (original)**   The method as recited in Claim 9, further comprising:  
3       comparing said received identifiable training data to a local version of said  
4       training data to identify said at least one multipath transmission delay within said  
5       reverse path data signal.

6  
7       **11. (original)**   The method as recited in Claim 3, wherein modifying  
8       said forward path data signal based on at least one forward path pre-equalization  
9       parameter further includes:

10       selectively inverting and applying a measured channel response to said  
11       forward path data signal to significantly reduce subsequent induced deleterious  
12       channel response changes to said modified forward path data signal during  
13       transmission over said at least one forward transmission path.

14  
15       **12. (original)**   The method as recited in Claim 3, wherein said at least  
16       one reverse transmission path is substantially reciprocal to said at least one  
17       forward transmission path.

18  
19       **13. (previously presented)**   The method as recited in Claim 1,  
20       wherein identifying said at least one multipath transmission delay, determining  
21       said at least one forward path pre-equalization parameter, and modifying said  
22       forward path data signal are performed by a transmitting device.

1           **14. (currently amended)**   The method as recited in Claim 13,  
2 wherein said transmitting device includes a base station device that is operatively  
3 ~~configurable~~ configured for use in a wireless communication system.

4  
5           **15. (previously presented)**   The method as recited in Claim 13,  
6 further comprising:

7           using at least one transmitting device receive antenna operatively coupled  
8 to said transmitting device to receive said reverse path data signal over at least one  
9 reverse transmission path from the receiving device.

10  
11           **16. (currently amended)**   The method as recited in Claim 15,  
12 wherein said receiving device includes a customer premise equipment (CPE)  
13 device that is operatively ~~configurable~~ configured for use in a wireless  
14 communication system.

15  
16           **17. (original)**   The method as recited in Claim 16, wherein said CPE  
17 device includes at least one device selected from a group of devices comprising a  
18 computer, a portable computer, a personal digital assistant (PDA), and a mobile  
19 communication device.  
20  
21  
22  
23  
24  
25

1           **18. (previously presented)** The method as recited in Claim 15,  
2 wherein said at least one transmitting device receive antenna includes at least one  
3 type of antenna selected from a group of suitable types of antennas comprising at  
4 least one omnidirectional type of antenna, at least one beam type of antenna, at  
5 least one phased array type of antenna, and at least one adaptive antenna.

6  
7           **19. (previously presented)** The method as recited in Claim 15,  
8 wherein said transmitting device is operatively coupled to a plurality of first  
9 device receive antennas.

10  
11           **20. (previously presented)** The method as recited in Claim 13,  
12 further comprising;

13           receiving said reverse path data signal over at least one reverse transmission  
14 path; and

15           causing said transmitting device to post equalize at least a portion of said  
16 received reverse path signal.

17  
18           **21. (previously presented)** The method as recited in Claim 15,  
19 wherein determining said at least one forward path pre-equalization parameter  
20 based on said at least one transmission delay further includes:

21           determining at least one angle of arrival of said reverse path data signal  
22 with respect to said at least one transmitting device receive antenna.  
23  
24  
25

1           **22. (previously presented)** The method as recited in Claim 15,  
2 further comprising:

3           using at least one receiving device transmit antenna operatively coupled to  
4 said receiving device and configured to transmit said reverse path data signal over  
5 said at least one reverse transmission path to said transmitting device.

6  
7           **23. (previously presented)** The method as recited in Claim 22,  
8 wherein a plurality of receiving device transmit antennas are operatively coupled  
9 to said receiving device and configured to transmit said reverse path data signal  
10 over said at least one reverse transmission path to said transmitting device.

11  
12           **24. (previously presented)** The method as recited in Claim 22,  
13 further comprising:

14           causing said receiving device to transmit at least two reverse path data  
15 signals over said at least one reverse transmission path to said transmitting device.

16  
17           **25. (original)** The method as recited in Claim 24, wherein said at  
18 least two reverse path data signals include Orthogonal Frequency-Division  
19 Multiple Access (OFDMA) data.

1           **26. (previously presented)** The method as recited in Claim 22,  
2 further comprising:

3           causing said receiving device to transmit said reverse path data signal over  
4 said at least one reverse transmission path to said transmitting device at a bit rate  
5 less than about 6 Mbps.

6  
7           **27. (previously presented)** The method as recited in Claim 22,  
8 further comprising:

9           causing said receiving device to transmit corresponding receiving device  
10 transmission power level information to said transmitting device; and

11           causing said transmitting device to adjust at least one transmission power  
12 level associated with said forward path data signal based on said receiving device  
13 transmission power level information.

14  
15           **28. (previously presented)** The method as recited in Claim 13,  
16 further comprising:

17           using at least one transmitting device transmit antenna operatively coupled  
18 to said transmitting device to transmit said modified forward path data signal over  
19 at least one forward transmission path to a receiving device.

20  
21           **29. (currently amended)** The method as recited in Claim 28,  
22 wherein said at least one transmitting device transmit antenna is operatively  
23 configurable configured to provide transmission diversity when transmitting said  
24 modified forward path data signal.  
25

1  
2       **30. (currently amended)**     The method as recited in Claim 28,  
3 wherein said at least one transmitting device transmit antenna is operatively  
4 ~~configurable~~ configured to provide spatial division transmission utilizing a spatial  
5 division technique when transmitting said modified forward path data signal as a  
6 narrow signal to reduce multipath propagation.

7  
8       **31. (previously presented)**   The method as recited in Claim 28,  
9 wherein said at least one transmitting device transmit antenna includes at least one  
10 type of antenna selected from a group of suitable types of antennas comprising at  
11 least one omnidirectional type of antenna, at least one beam type of antenna, at  
12 least one phased array type of antenna, and at least one adaptive antenna.

13  
14       **32. (previously presented)**   The method as recited in Claim 28,  
15 further comprising:

16       setting at least one antenna pointing parameter associated with said at least  
17 one transmitting device transmit antenna based on said at least one forward path  
18 pre-equalization parameter.

19  
20       **33. (previously presented)**   The method as recited in Claim 28,  
21 further comprising:

22       setting at least one phased array antenna transmission directing parameter  
23 associated with said at least one transmitting device transmit antenna based on said  
24 at least one forward path pre-equalization parameter.  
25

1  
2       **34. (previously presented)** The method as recited in Claim 28,  
3 further comprising;  
4       selectively transmitting said modified forward path data signal at one angle  
5 with respect to said transmitting device transmit antenna.

6  
7       **35. (previously presented)** The method as recited in Claim 28,  
8 further comprising:  
9       selecting said at least one transmitting device transmit antenna from a  
10 plurality of transmitting device transmit antennas that are each operatively coupled  
11 to said transmitting device.

12  
13       **36. (previously presented)** The method as recited in Claim 35,  
14 further comprising:  
15       selectively transmitting a plurality of beams using two or more transmitting  
16 device transmit antennas.

17  
18       **37. (previously presented)** The method as recited in Claim 36,  
19 wherein each of said transmitted plurality of beams is selectively adjusted in phase  
20 and amplitude to reduce multipath affects when received by said receiving device.  
21  
22  
23  
24  
25

1       **38. (previously presented)** The method as recited in Claim 28,  
2 further comprising:

3           using at least one receiving device receive antenna operatively coupled to  
4 said receiving device and configured to receive said modified forward path data  
5 signal over said at least one forward transmission path from said transmitting  
6 device.

7  
8       **39. (previously presented)** The method as recited in Claim 38,  
9 wherein a plurality of receiving device receive antennas are operatively coupled to  
10 said receiving device and configured to receive said modified forward path data  
11 signal over said at least one forward transmission path from said transmitting  
12 device.

13  
14       **40. (original)** The method as recited in Claim 1, wherein determining  
15 said at least one forward path pre-equalization parameter based on said at least one  
16 transmission delay further includes:

17           iteratively selectively identifying different forward path pre-equalization  
18 parameters over time to operatively identify and subsequently ignore aliased  
19 multipath delays within said reverse path data signal.  
20  
21  
22  
23  
24  
25

1           **41. (original)**   The method as recited in Claim 1, wherein determining  
2 said at least one forward path pre-equalization parameter based on said at least one  
3 transmission delay further includes:

4           sub-band equalizing said forward path data signal using corresponding  
5 frequency domain reverse path data.

6  
7           **42. (original)**   The method as recited in Claim 1, wherein modifying  
8 said forward path data signal based on said at least one forward path pre-  
9 equalization parameter further includes:

10           selectively setting different transmission power levels for at least two  
11 Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path  
12 data signal based on said at least one forward path pre-equalization parameter.

13  
14           **43. (currently amended)**   A system comprising:  
15           a first device operatively ~~configurable~~ configured to connect to at least a  
16 second device over a wireless communication path, said first device having logic  
17 that is configured to detect a multipath transmission delay in at least one reverse  
18 path data signal transmitted by said second device, determine at least one forward  
19 path pre-equalization parameter based on said detected multipath transmission  
20 delay, and pre-equalize a forward path data signal that is to be transmitted to said  
21 second device based on said at least one forward path pre-equalization parameter.  
22  
23  
24  
25

1           **44. (currently amended)**     The system as recited in Claim 43,  
2 wherein said first device further comprising:

3                 at least one first device antenna; and

4                 at least one transceiver operatively coupled to said at least one first device  
5 antenna and said logic, said at least one transceiver being ~~configurable~~ configured  
6 to receive said reverse path data signal over at least one reverse transmission path  
7 using said at least one first device antenna and provide said reverse path data  
8 signal to said logic, and transmit said ~~modified~~ forward path data signal from said  
9 logic over at least one forward transmission path.

10  
11           **45. (original)**     The system as recited in Claim 43, wherein said  
12 reverse path data signal includes at least one type of data selected from a group of  
13 different types of data comprising Orthogonal Frequency Division Multiplexing  
14 (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.

15  
16           **46. (currently amended)**     The system as recited in Claim 43,  
17 wherein said ~~modified~~ forward path data signal includes at least one type of data  
18 selected from a group of different types of data comprising Orthogonal Frequency  
19 Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK)  
20 data.

21  
22           **47. (currently amended)**     The system as recited in Claim 46,  
23 wherein said ~~modified~~ forward path data signal includes sub-carrier pre-equalized  
24 OFDM data.  
25

1  
2       **48. (original)**   The system as recited in Claim 47, wherein said logic  
3 is further configured to produce corresponding Quadrature Phase Shift Keying  
4 (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data.

5  
6       **49. (original)**   The system as recited in Claim 45, wherein said logic  
7 detects said multipath transmission delay by identifying at least one multipath  
8 transmission delay spread that is greater than a guard interval.

9  
10       **50. (original)**   The system as recited in Claim 43, wherein said  
11 reverse path data signal includes identifiable training data.

12  
13       **51. (currently amended)**   The system as recited in Claim 50,  
14 wherein said logic is further configured to compare said received identifiable  
15 training data to a non-multipath delayed version of said training data to detect said  
16 multipath transmission delay.

17  
18       **52. (currently amended)**   The system as recited in Claim 44,  
19 wherein said logic is configured to selectively invert and apply a measured  
20 channel response to said forward path data signal to significantly reduce  
21 subsequent induced deleterious channel response changes to said modified  
22 forward path data signal during transmission over said at least one forward  
23 transmission path.  
24  
25

1           **53. (original)**   The system as recited in Claim 44, wherein said at  
2 least one reverse transmission path is substantially reciprocal to said at least one  
3 forward transmission path.

4  
5           **54. (currently amended)**   The system as recited in Claim 43,  
6 wherein said first device includes a base station device that is operatively  
7 ~~configurable~~ configured for use in a wireless communication system.

8  
9           **55. (currently amended)**   The system as recited in Claim 44,  
10 ~~further comprising: wherein~~ said second device, ~~in the form of~~ is a customer  
11 premise equipment (CPE) device that is operatively ~~configurable~~ configured for  
12 use in a wireless communication system.

13  
14           **56. (original)**   The system as recited in Claim 55, wherein said CPE  
15 device includes at least one device selected from a group of devices comprising a  
16 computer, a portable computer, a personal digital assistant (PDA), and a mobile  
17 communication device.

18  
19           **57. (original)**   The system as recited in Claim 44, wherein said first  
20 device is operatively coupled to a plurality of first device receive antennas.

21  
22           **58. (original)**   The system as recited in Claim 44, wherein said logic  
23 is configured to post-equalize at least a portion of said received reverse path  
24 signal.  
25

1  
2       **59. (original)**   The system as recited in Claim 44, wherein said logic  
3 is further configured to determine at least one angle of arrival of said reverse path  
4 data signal with respect to said at least one first device antenna.

5  
6       **60. (currently amended)**   The system as recited in Claim 55,  
7 wherein said second device includes at least one second device antenna that is  
8 operatively ~~configurable~~ configured to transmit said reverse path data signal over  
9 said at least one reverse transmission path to said first device and receive said  
10 transmitted ~~modified~~ forward path data signal from said first device over said at  
11 least one forward transmission path.

12  
13       **61. (currently amended)**   The system as recited in Claim 60,  
14 wherein said second device includes a plurality of second device antennas that are  
15 operatively ~~configurable~~ configured to transmit said reverse path data signal over  
16 said at least one reverse transmission path to said first device.

17  
18       **62. (currently amended)**   The system as recited in Claim 60,  
19 wherein said second device is ~~configurable~~ configured to transmit at least two  
20 reverse path data signals over said at least one reverse transmission path to said  
21 first device.

1       **63. (original)**   The system as recited in Claim 62, wherein said at  
2   least two reverse path data signals include Orthogonal Frequency-Division  
3   Multiple Access (OFDMA) data.

4  
5       **64. (currently amended)**   The system as recited in Claim 60,  
6   wherein said second device is ~~configurable~~ configured to transmit said reverse  
7   path data signal over said at least one reverse transmission path to said first device  
8   at a bit rate less than about 6 Mbps.

9  
10       **65. (currently amended)**   The system as recited in Claim 60,  
11   wherein said second device is ~~configurable~~ configured to transmit corresponding  
12   second device transmission power level information to said first device, and said  
13   first device is further ~~configurable~~ configured to adjust at least one transmission  
14   power level associated with said forward path data signal based on said second  
15   device transmission power level information.

16  
17       **66. (currently amended)**   The system as recited in Claim 44,  
18   wherein said at least one first device antenna is operatively ~~configurable~~  
19   configured to provide transmission diversity when transmitting said ~~modified~~  
20   forward path data signal.

1           **67. (currently amended)**   The system as recited in Claim 44,  
2 wherein said at least one first device antenna is operatively ~~configurable~~  
3 configured to provide spatial division transmission utilizing a spatial division  
4 technique when transmitting said ~~modified~~ forward path data signal as a narrow  
5 signal to reduce multipath propagation.

6  
7           **68. (original)**   The system as recited in Claim 44, wherein said at  
8 least one first device antenna includes at least one first device transmit antenna  
9 and at least one first device receive antenna.

10  
11           **69. (original)**   The system as recited in Claim 68, wherein said at  
12 least one first device transmit antenna includes at least one type of antenna  
13 selected from a group of suitable types of antennas comprising at least one  
14 omnidirectional type of antenna, at least one beam type of antenna, at least one  
15 phased array type of antenna, and at least one adaptive antenna.

16  
17           **70. (original)**   The system as recited in Claim 68, wherein said at  
18 least one first device receive antenna includes at least one type of antenna selected  
19 from a group of suitable types of antennas comprising at least one omnidirectional  
20 type of antenna, at least one beam type of antenna, at least one phased array type  
21 of antenna, and at least one adaptive antenna.  
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1           **71. (original)**   The system as recited in Claim 68, wherein said logic  
2 is further configured to establish at least one antenna pointing parameter  
3 associated with said at least one first device transmit antenna based on said at least  
4 one forward path pre-equalization parameter.

5  
6           **72. (original)**   The system as recited in Claim 68, wherein said logic  
7 is further configured to establish at least one phased array antenna transmission  
8 directing parameter associated with said at least one first device transmit antenna  
9 based on said at least one forward path pre-equalization parameter.

10  
11           **73. (currently amended)**   The system as recited in Claim 68,  
12 wherein said logic is further ~~configurable~~ configured to cause said at least one  
13 transceiver to selectively transmit said ~~modified~~ forward path data signal at one  
14 angle with respect to said at least one first device transmit antenna.

15  
16           **74. (currently amended)**   The system as recited in Claim 68,  
17 wherein said logic is further ~~configurable~~ configured to cause said at least one  
18 transceiver to select said at least one first device transmit antenna from a plurality  
19 of first device transmit antennas that are each operatively coupled to said first  
20 device.  
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1       **75. (currently amended)**     The system as recited in Claim 74,  
2 wherein said logic is further ~~configurable~~ configured to cause said at least one  
3 transceiver to selectively transmit a plurality of beams using two or more first  
4 device transmit antennas.

5  
6       **76. (original)**     The system as recited in Claim 75, wherein each of  
7 said transmitted plurality of beams is selectively adjusted in phase and amplitude  
8 to reduce multipath affects when received by said second device.

9  
10       **77. (original)**     The system as recited in Claim 60, wherein said at  
11 least one second device antenna includes at least one second device transmit  
12 antenna and at least one second device receive antenna.

13  
14       **78. (currently amended)**     The system as recited in Claim 77,  
15 wherein said second device includes a plurality of second device receive antennas  
16 that are ~~configurable~~ configured to receive said transmitted ~~modified~~ forward path  
17 data signal over said at least one forward transmission path from said first device.

18  
19       **79. (currently amended)**     The system as recited in Claim 43,  
20 wherein said logic is further ~~configurable~~ configured to iteratively selectively test  
21 different forward path pre-equalization parameters over time such that aliased  
22 multipath delays within said reverse path data signal are identifiable.

1           **80. (original)**   The system as recited in Claim 43, wherein said logic  
2 is configured to provide sub-band equalizing of said forward path data signal using  
3 corresponding frequency domain reverse path data.

4  
5           **81. (currently amended)**   The system as recited in Claim 43 ~~44~~,  
6 wherein said logic is further ~~configurable~~ configured to cause said transceiver to  
7 selectively establish different transmission power levels for at least two  
8 Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path  
9 data signal based on said at least one forward path pre-equalization parameter.

10  
11           **82. (currently amended)**   An apparatus comprising:  
12       an Orthogonal Frequency Division Multiplexing (OFDM) processor  
13 configured to receive coded data and output corresponding OFDM data;  
14       a pre-equalizer operatively coupled to said OFDM processor and  
15 configured to receive said OFDM data and output pre-equalized OFDM data based  
16 on gathered reverse link data;  
17       at least one antenna; and  
18       ~~a transceiver~~ an antenna signal processing component operatively coupled  
19 to said pre-equalizer and said at least one antenna, said ~~transceiver~~ antenna signal  
20 processing component being configured to receive said pre-equalized OFDM data  
21 from said pre-equalizer and apply a corresponding transmittable forward link data  
22 signal to said at least one antenna.

1  
2       **83. (currently amended)**     The apparatus as recited in Claim 82,  
3 wherein said ~~transceiver~~ antenna signal processing component is ~~configurable~~  
4 configured to receive a transmitted reverse link data signal using said at least one  
5 antenna and output corresponding reverse link data, and further comprising:

6       reverse link logic operatively coupled to said at least one antenna ~~and said~~  
7 ~~operatively coupled to said at least one first device antenna~~, said reverse link logic  
8 being configured to detect at least one multipath induced delay in said reverse link  
9 data and provide associated said gathered reverse link data to said pre-equalizer.

10  
11       **84. (original)**     The apparatus as recited in Claim 82, wherein said  
12 pre-equalized OFDM data includes sub-carrier pre-equalized OFDM data.

13  
14       **85. (currently amended)**     The apparatus as recited in Claim 82 ~~83~~,  
15 wherein said reverse link logic detects said at least one multipath induced delay by  
16 identifying at least one transmission delay spread that is greater than a guard  
17 interval.

18  
19       **86. (original)**     The apparatus as recited in Claim 83, wherein said  
20 reverse link data signal includes identifiable training data.  
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1       **87. (currently amended)**     The apparatus as recited in Claim 86,  
2 wherein said reverse link logic is further configured to compare said received  
3 identifiable training data to a non-delayed version of said training data to detect  
4 said at least one transmission delay.

5  
6       **88. (original)**     The apparatus as recited in Claim 83, wherein said  
7 pre-equalizer is configured to selectively invert and apply a measured channel  
8 response to said OFDM data.

9  
10       **89. (original)**     The apparatus as recited in Claim 83, wherein a  
11 reverse transmission path carrying said transmitted reverse link data signal  
12 towards said antenna is at least substantially reciprocal to a forward transmission  
13 path carrying said transmittable forward link data signal away from said at least  
14 one antenna.

15  
16       **90. (original)**     The apparatus as recited in Claim 82, wherein said  
17 apparatus includes a base station device suitable for use in a wireless  
18 communication system.

19  
20       **91. (currently amended)**     The apparatus as recited in Claim 82,  
21 wherein said at least one antenna is operatively ~~configurable~~ configured to provide  
22 transmission diversity.  
23  
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1           **92. (currently amended)**   The apparatus as recited in Claim 82,  
2 wherein said at least one antenna is operatively ~~configurable~~ configured to provide  
3 a spatial division technique to transmit the data signal as a narrow signal to reduce  
4 multipath propagation.

5  
6           **93. (original)**   The apparatus as recited in Claim 82, wherein said at  
7 least one antenna includes at least one transmit antenna and at least one receive  
8 antenna.

9  
10          **94. (original)**   The apparatus as recited in Claim 93, wherein said at  
11 least one transmit antenna includes at least one type of antenna selected from a  
12 group of suitable types of antennas comprising at least one omnidirectional type of  
13 antenna, at least one beam type of antenna, at least one phased array type of  
14 antenna, and at least one adaptive antenna.

15  
16          **95. (original)**   The apparatus as recited in Claim 93, wherein said at  
17 least one receive antenna includes at least one type of antenna selected from a  
18 group of suitable types of antennas comprising at least one omnidirectional type of  
19 antenna, at least one beam type of antenna, at least one phased array type of  
20 antenna, and at least one adaptive antenna.

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**REMARKS**

Applicant respectfully requests reconsideration and allowance of the subject application. Claims 1-95 are pending, of which claims 14, 16, 29-30, 43-44, 46-47, 51-52, 54-55, 60-62, 64-67, 73-75, 78-79, 81-83, 85, 87, and 91-92 have been amended to place the application in condition for allowance.

**Allowable Subject Matter**

Claims 1-43, 45, 49-51, 54, 79-80, 82, 84, and 86-95 have been allowed, and claims 44, 46-48, 52-53, 55-78, 81, 83, and 85 are indicated as being allowable if rewritten to overcome the 35 U.S.C. §112 rejection (*Office Action* p.4). Applicant appreciates the indications of allowability.

Appropriate amendments have been provided for allowed claims to overcome the claim objections as described below. Appropriate amendments have also been provided for the allowable claims to overcome the 35 U.S.C. §112 rejection. Accordingly, all pending claims 1-95 are in condition for allowance.

**Claim Objections**

Claims 14, 16, 29-30, 43-44, 54-55, 60-62, 64-67, 73-75, 78-79, 81, 83, 87, 89, and 91-92 are objected to for various informalities (*Office Action* p.2). Appropriate corrections have been provided and Applicant respectfully requests that the claim objections be withdrawn. Specifically:

Claims 14, 16, 29-30, 43-44, 54-55, 60-62, 64-67, 73-75, 78-79, 81, 83, and 91-92 are amended to replace “configurable” with “configured”;

1 Claims 30, 67, and 92 are amended to clarify “spatial division”. Support for  
2 the claim amendments can be found in the specification at least at page 8,  
3 lines 15-22;

4 Claims 51 and 87 are amended to delete “received”;

5 Claim 55 is amended to replace “further comprising” with “wherein”;

6 Claim 83 is amended to delete “associated”;

7 Claim 85 is amended to be dependent upon claim 83; and

8 Claim 89 is dependent upon claim 83 which is dependent upon claim 82.  
9 Claim 89 recites “said transmittable forward link data signal” which is introduced in  
10 claim 82. As such, claim 89 has not been amended to delete “transmittable” as the  
11 Office suggests.

### 12 **Drawing Objections**

13 The Drawings are objected to because, for example, claim 82 recites a  
14 pre-equalizer operatively coupled to a transceiver which is not shown in an  
15 embodiment in the drawings (*Office Action* p.3). Appropriate correction has been  
16 provided and Applicant respectfully requests that the drawing objections be  
17 withdrawn.  
18

19 Specifically, claim 82 is amended to recite “an antenna signal processing  
20 component operatively coupled to said pre-equalizer and said at least one  
21 antenna”, as shown in Fig. 3. Support for the amendment can be found in the  
22 specification at least at p.19 lines 6-19. Accordingly, corrected drawing sheets are  
23 not required.  
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1 **IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

2 Serial No. ....10/131,864  
3 Filing Date .....4/25/2002  
4 Confirmation No.....8941  
5 Inventorship ..... William J. Crilly, Jr.  
6 Applicant ..... Mabuhay Networks  
Group Art Unit .....2611  
7 Examiner .....JEAN B. CORRIELUS  
Attorney's Docket No. ....MN1-0001US  
8 Title: Improved Multipath Communication Methods And Apparatuses

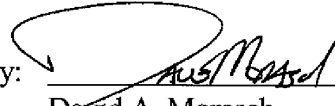
9 To: Commissioner for Patents  
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10 From: David A. Morasch (Tel. 509-324-9256; Fax 509-323-8979)  
11 Customer Number: 29150  
12 Lee & Hayes, PLLC  
13 421 W. Riverside Avenue, Suite 500  
Spokane, WA 99201

14 Fees will be paid by credit card through the EFS Web; however the  
15 Commissioner is hereby authorized to charge any deficiency of fees and credit any  
16 overpayments to Deposit Account Number 12-0769.

17  
18 Respectfully Submitted,

19  
20 Dated: July 31, 2006

21 By: 

22 David A. Morasch  
Reg. No. 42905  
23 (509) 324-9256  
24  
25

## Electronic Acknowledgement Receipt

|                                          |                                                 |
|------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                           | 1134897                                         |
| <b>Application Number:</b>               | 10131864                                        |
| <b>Confirmation Number:</b>              | 8941                                            |
| <b>Title of Invention:</b>               | Multipath communication methods and apparatuses |
| <b>First Named Inventor:</b>             | William J. Crilly                               |
| <b>Customer Number:</b>                  | 29150                                           |
| <b>Filer:</b>                            | Daniel Leo Hayes/Rebekah Glass                  |
| <b>Filer Authorized By:</b>              | Daniel Leo Hayes                                |
| <b>Attorney Docket Number:</b>           | MN1-001US                                       |
| <b>Receipt Date:</b>                     | 31-JUL-2006                                     |
| <b>Filing Date:</b>                      | 25-APR-2002                                     |
| <b>Time Stamp:</b>                       | 19:12:52                                        |
| <b>Application Type:</b>                 | Utility                                         |
| <b>International Application Number:</b> |                                                 |

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### File Listing:

| Document Number | Document Description | File Name  | File Size(Bytes) | Multi Part | Pages |
|-----------------|----------------------|------------|------------------|------------|-------|
| 1               |                      | AC5099.pdf | 741949           | yes        | 28    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Multipart Description                            |        |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------|-----|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Doc Desc                                         | Start  | End |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Amendment - After Non-Final Rejection            | 1      | 1   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Claims                                           | 2      | 24  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Applicant Arguments/Remarks Made in an Amendment | 25     | 27  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Miscellaneous Incoming Letter                    | 28     | 28  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                  |        |     |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                  |        |     |
| Total Files Size (in bytes):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  | 741949 |     |
| <p><b>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.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> |                                                  |        |     |

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| PATENT APPLICATION FEE DETERMINATION RECORD                               |                                                                                                                                                                                                                               |                                    |               |                 | Application or Docket Number<br><b>10/131864</b> |                 |                     |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------|-----------------|--------------------------------------------------|-----------------|---------------------|
| Substitute for Form PTO-875                                               |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
| APPLICATION AS FILED - PART I                                             |                                                                                                                                                                                                                               |                                    |               |                 | SMALL ENTITY OR OTHER THAN SMALL ENTITY          |                 |                     |
| (Column 1)                                                                |                                                                                                                                                                                                                               | (Column 2)                         |               |                 |                                                  |                 |                     |
| FOR                                                                       | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE (\$)     | FEE (\$)        | RATE (\$)                                        | FEE (\$)        |                     |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
| SEARCH FEE<br>(37 CFR 1.16(d), (e), or (f))                               |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
| EXAMINATION FEE<br>(37 CFR 1.16(g), (h), or (i))                          |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
| TOTAL CLAIMS<br>(37 CFR 1.16(j))                                          | minus 20 =                                                                                                                                                                                                                    | *                                  | X             | =               | X                                                | =               |                     |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(k))                                    | minus 3 =                                                                                                                                                                                                                     | *                                  | X             | =               | X                                                | =               |                     |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(l))                                  | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(m). |                                    |               |                 |                                                  |                 |                     |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(n))                         |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
| * If the difference in column 1 is less than zero, enter "0" in column 2. |                                                                                                                                                                                                                               |                                    | TOTAL         |                 | TOTAL                                            |                 |                     |
| APPLICATION AS AMENDED - PART II                                          |                                                                                                                                                                                                                               |                                    |               |                 | SMALL ENTITY OR OTHER THAN SMALL ENTITY          |                 |                     |
| (Column 1)                                                                |                                                                                                                                                                                                                               | (Column 2)                         | (Column 3)    |                 |                                                  |                 |                     |
| AMENDMENT A                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$)       | ADDITIONAL FEE (\$)                              | RATE (\$)       | ADDITIONAL FEE (\$) |
| Total<br>(37 CFR 1.16(o))                                                 | 95                                                                                                                                                                                                                            | 95                                 | 0             | X 25 =          | <del>X</del>                                     | X               | =                   |
| Independent<br>(37 CFR 1.16(p))                                           | 3                                                                                                                                                                                                                             | 3                                  | 0             | X 100 =         |                                                  | X               | =                   |
| Application Size Fee (37 CFR 1.16(s))                                     |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(q))           |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
|                                                                           |                                                                                                                                                                                                                               |                                    |               | TOTAL ADD'L FEE |                                                  | TOTAL ADD'L FEE |                     |
| AMENDMENT B                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$)       | ADDITIONAL FEE (\$)                              | RATE (\$)       | ADDITIONAL FEE (\$) |
| Total<br>(37 CFR 1.16(o))                                                 | 95                                                                                                                                                                                                                            | 95                                 | 1             | X               | =                                                | X               | =                   |
| Independent<br>(37 CFR 1.16(p))                                           | 3                                                                                                                                                                                                                             | 3                                  | 1             | X               | =                                                | X               | =                   |
| Application Size Fee (37 CFR 1.16(s))                                     |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(q))           |                                                                                                                                                                                                                               |                                    |               |                 |                                                  |                 |                     |
|                                                                           |                                                                                                                                                                                                                               |                                    |               | TOTAL ADD'L FEE |                                                  | TOTAL ADD'L FEE |                     |

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.  
\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".  
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| APPLICATION NO.                                                         | FILING DATE | FIRST NAMED INVENTOR  | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-------------------------------------------------------------------------|-------------|-----------------------|---------------------|------------------|
| 10/131,864                                                              | 04/25/2002  | William J. Crilly JR. | MN1-001US           | 8941             |
| 29150                                                                   | 7590        | 07/11/2006            | EXAMINER            |                  |
| LEE & HAYES, PLLC<br>421 W. RIVERSIDE AVE, STE 500<br>SPOKANE, WA 99201 |             |                       | CORRIELUS, JEAN B   |                  |
|                                                                         |             |                       | ART UNIT            | PAPER NUMBER     |
|                                                                         |             |                       | 2611                |                  |
| DATE MAILED: 07/11/2006                                                 |             |                       |                     |                  |

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

|                              |                                      |  |                                           |  |
|------------------------------|--------------------------------------|--|-------------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/131,864 |  | <b>Applicant(s)</b><br>CRILLY, WILLIAM J. |  |
|                              | <b>Examiner</b><br>Jean B. Corrielus |  | <b>Art Unit</b><br>2611                   |  |
|                              |                                      |  |                                           |  |

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

**Period for Reply**

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

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

**Status**

1) ☒ Responsive to communication(s) filed on 13 June 2006.

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) 1-95 is/are pending in the application.

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

5) ☒ Claim(s) 1-43, 45, 49-51, 54, 79, 80, 82, 84 and 86-95 is/are allowed.

6) ☒ Claim(s) 44, 46-48, 52, 53, 55-78, 81, 83 and 85 is/are rejected.

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

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

**Application Papers**

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

10) ☐ The drawing(s) filed on \_\_\_\_\_ 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) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)<br>2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)<br>3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____. | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____.<br>5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)<br>6) <input type="checkbox"/> Other: _____. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**DETAILED ACTION**

***Claim Objections***

1. Claims 14, 16, 29, 30, 43, 44, 54, 55, 60, 61, 62, 64, 65, 66, 67, 73, 74, 75, 78, 79, 81, 83, 87, 89, 91 and 92 are objected to because of the following informalities:  
claim 14, line 3, "configurable" should be replaced by "configured" the same comment applies equally to claims 16, 29, 30, 43, 44, 54, 55, 60, 61, 62, 64, 65, 66, 67, 73, 74, 75, 78, 79, 81, 83, 91, 92 and to any other claims reciting similar limitation.  
Claim 30, line 3, what does it mean by "spatial division"? The same comment applies to claim 67, and 92.  
Claim 55, "further comprising" should be replaced by "wherein".  
Claim 83, line 9, "associated" should be deleted.  
The dependency of claim 85 should be changed to "83" so as to provided antecedent basis for the recitation "said reverse ling logic" and "said at least one multipath".  
Claim 87, line 2, "received" should be deleted. The same comment applied to claim 51, line 2.  
Claim 89, line 4, "transmittable" should deleted. Note that any claim whose base claim is objected is likewise objected.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 44, 46-48, 52, 53, 55-78, 81, 83 and 85 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 44, line before last, "said modified forward path" lacks of proper antecedent basis.

Claim 46, lines 1-2, "said modified forward path" lacks of proper antecedent basis.

Claim 81 the limitation "said transceiver" lacks of proper antecedent basis.

Claim 83 the limitation "reverse link logic operatively coupled to said at least one antenna and said operatively coupled to said at least one first device antenna" is unclear. In addition, the limitation "said operatively coupled" and "said at least one first device antenna" lack of proper antecedent basis.

Note that any claim whose base claim is objected is likewise objected.

### ***Drawings***

4. The drawings are objected to because the claims for instance claim 82 recites "a pre-equalizer" operatively coupled to a "transceiver". However it is noted that the drawing fig. 3 shows the functional block diagram of a "transceiver" as included function blocks 302 304 306 and 308. There is no embodiment of the drawing showing "a pre-equalizer" coupled to a "transceiver". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as

"amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

5. Applicant's arguments, see comment pages 36 and 39, filed 6/13/06, with respect to rejection of claims 1, 43 and 82 have been fully considered and are persuasive. The rejection of claims 1-95 has been withdrawn.

***Allowable Subject Matter***

6. Claims 1-43, 45, 49-51, 54, 79-80, 82, 84, 86-95 allowed. However, the claims must be amended if necessary to overcome any objection set forth above.

7. Claims 44, 46-48, 52, 53, 55-78, 81, 83 and 85 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

Application/Control Number: 10/131,864  
Art Unit: 2611

Page 5

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jean B. Corielus whose telephone number is 571-272-3020. The examiner can normally be reached on Maxi-Flex.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. 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.

  
Jean B. Corielus  
Primary Examiner  
Art Unit 2611

7-7-06

|                                   |                                       |                                                                  |             |
|-----------------------------------|---------------------------------------|------------------------------------------------------------------|-------------|
| <b>Notice of References Cited</b> | Application/Control No.<br>10/131,864 | Applicant(s)/Patent Under<br>Reexamination<br>CRILLY, WILLIAM J. |             |
|                                   | Examiner<br>Jean B. Corrielus         | Art Unit<br>2611                                                 | Page 1 of 1 |

U.S. PATENT DOCUMENTS

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Name         | Classification |
|---|---|--------------------------------------------------|-----------------|--------------|----------------|
| * | A | US-6,674,808 B1                                  | 01-2004         | Griph et al. | 375/285        |
|   | B | US-                                              |                 |              |                |
|   | C | US-                                              |                 |              |                |
|   | D | US-                                              |                 |              |                |
|   | E | US-                                              |                 |              |                |
|   | F | US-                                              |                 |              |                |
|   | G | US-                                              |                 |              |                |
|   | H | US-                                              |                 |              |                |
|   | I | US-                                              |                 |              |                |
|   | J | US-                                              |                 |              |                |
|   | K | US-                                              |                 |              |                |
|   | L | US-                                              |                 |              |                |
|   | M | US-                                              |                 |              |                |

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

# Index of Claims



Application/Control No.

10/131,864

Examiner

Jean B. Corielus

Applicant(s)/Patent under  
Reexamination

CRILLY, WILLIAM J.

Art Unit

2611

|   |          |
|---|----------|
| √ | Rejected |
| = | Allowed  |

|   |                                |
|---|--------------------------------|
| - | (Through numeral)<br>Cancelled |
| + | Restricted                     |

|   |              |
|---|--------------|
| N | Non-Elected  |
| I | Interference |

|   |          |
|---|----------|
| A | Appeal   |
| O | Objected |

| Claim |          | Date    |  | Claim |          | Date    |  | Claim |          | Date    |  |
|-------|----------|---------|--|-------|----------|---------|--|-------|----------|---------|--|
| Final | Original | 6/28/06 |  | Final | Original | 6/28/06 |  | Final | Original | 6/28/06 |  |
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|       | 2        | =       |  |       | 52       | √       |  |       | 102      |         |  |
|       | 3        | =       |  |       | 53       | √       |  |       | 103      |         |  |
|       | 4        | =       |  |       | 54       | =       |  |       | 104      |         |  |
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|       | 12       | =       |  |       | 62       | √       |  |       | 112      |         |  |
|       | 13       | =       |  |       | 63       | √       |  |       | 113      |         |  |
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|       | 47       | √       |  |       | 97       |         |  |       | 147      |         |  |
|       | 48       | √       |  |       | 98       |         |  |       | 148      |         |  |
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|       | 50       | =       |  |       | 100      |         |  |       | 150      |         |  |

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| <b>Search Notes</b><br> | <b>Application/Control No.</b> | <b>Applicant(s)/Patent under Reexamination</b> |  |
|                                                                                                          | 10/131,864                     | CRILLY, WILLIAM J.                             |  |
|                                                                                                          | <b>Examiner</b>                | <b>Art Unit</b>                                |  |
|                                                                                                          | Jean B. Corrielus              | 2611                                           |  |

| SEARCHED |          |           |          |
|----------|----------|-----------|----------|
| Class    | Subclass | Date      | Examiner |
| 375      | 296;285  | 6/28/2006 | JBC      |
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| Class                 | Subclass | Date | Examiner |
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| SEARCH NOTES<br>(INCLUDING SEARCH STRATEGY) |           |      |
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|                                             | DATE      | EXMR |
| EAST                                        | 6/28/2006 | JBC  |
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Bib Data Sheet

CONFIRMATION NO. 8941

| SERIAL NUMBER                                                                                                                                                                                                                                                                                                                     | FILING OR 371(c)<br>DATE                                                                                          | CLASS                     | GROUP ART UNIT                                                                                                                                                                                                                                                                  | ATTORNEY DOCKET<br>NO. |                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------------|
| 10/131,864                                                                                                                                                                                                                                                                                                                        | 04/25/2002<br>RULE                                                                                                | 375                       | 2611                                                                                                                                                                                                                                                                            | MN1-001US              |                            |
| <b>APPLICANTS</b><br>William J. Crilly JR., Liberty Lake, WA;<br><b>** CONTINUING DATA *****</b> <i>YES/11</i><br>This appln claims benefit of 60/287,163 04/27/2001<br><b>** FOREIGN APPLICATIONS *****</b> <i>NONE/11</i><br><b>IF REQUIRED, FOREIGN FILING LICENSE GRANTED **</b> 06/12/2002 <b>** SMALL ENTITY **</b>         |                                                                                                                   |                           |                                                                                                                                                                                                                                                                                 |                        |                            |
| Foreign Priority claimed <input type="checkbox"/> yes <input checked="" type="checkbox"/> no<br>35 USC 119 (a-d) conditions met <input type="checkbox"/> yes <input checked="" type="checkbox"/> no <input type="checkbox"/> Met after Allowance<br>Verified and Acknowledged<br>Examiner's Signature <i>[Signature]</i> Initials |                                                                                                                   | STATE OR<br>COUNTRY<br>WA | SHEETS<br>DRAWING<br>5                                                                                                                                                                                                                                                          | TOTAL<br>CLAIMS<br>95  | INDEPENDENT<br>CLAIMS<br>3 |
| <b>ADDRESS</b><br>29150                                                                                                                                                                                                                                                                                                           |                                                                                                                   |                           |                                                                                                                                                                                                                                                                                 |                        |                            |
| <b>TITLE</b><br>Multipath communication methods and apparatuses                                                                                                                                                                                                                                                                   |                                                                                                                   |                           |                                                                                                                                                                                                                                                                                 |                        |                            |
| <b>FILING FEE<br/>RECEIVED</b><br>1045                                                                                                                                                                                                                                                                                            | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: |                           | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees ( Filing )<br><input type="checkbox"/> 1.17 Fees ( Processing Ext. of time )<br><input type="checkbox"/> 1.18 Fees ( Issue )<br><input type="checkbox"/> Other _____<br><input type="checkbox"/> Credit |                        |                            |

## EAST Search History

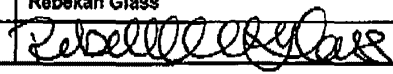
| Ref # | Hits    | Search Query                                         | DBs                                         | Default Operator | Plurals | Time Stamp       |
|-------|---------|------------------------------------------------------|---------------------------------------------|------------------|---------|------------------|
| L1    | 5352    | (equali\$4) near5 (reverse (feed adj back) feedback) | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/06/28 18:11 |
| L2    | 3392814 | transmi\$5                                           | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/06/28 18:12 |
| L3    | 1684    | 1 same 2                                             | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/06/28 18:12 |
| L4    | 144     | ofdm and 3                                           | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/06/28 18:13 |
| L5    | 1011    | pre-equali\$6                                        | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/06/28 18:13 |
| L6    | 12      | 4 and 5                                              | US-PGPUB;<br>USPAT;<br>EPO; JPO;<br>DERWENT | OR               | ON      | 2006/06/28 18:13 |
| L7    | 5       | ("2002/0159537").URPN.                               | USPAT                                       | OR               | ON      | 2006/06/28 18:33 |
| L8    | 700     | 375/296.ccls.                                        | USPAT                                       | OR               | ON      | 2006/06/28 18:34 |
| L9    | 44      | ofdm and 8                                           | USPAT                                       | OR               | ON      | 2006/06/28 18:34 |
| L10   | 41      | 9 not 4                                              | USPAT                                       | OR               | ON      | 2006/06/28 18:34 |

PTO/SB/21 (08-03)

Approved for use through 07/31/2006. 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                                                                                                                                                                                                                                                                                              |                                                                                     | Application Number                                                                         |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------|
| (to be used for all correspondence after initial filing)                                                                                                                                                                                                                                                      |                                                                                     | 10/131,864                                                                                 |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | Filing Date                                                                                |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | 4/25/2002                                                                                  |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | First Named Inventor                                                                       |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | William J. Crilly, Jr.                                                                     |      |
| Group Art Unit                                                                                                                                                                                                                                                                                                |                                                                                     | 2634                                                                                       |      |
| Examiner Name                                                                                                                                                                                                                                                                                                 |                                                                                     | STEPHEN CHIN                                                                               |      |
| Attorney Docket Number                                                                                                                                                                                                                                                                                        |                                                                                     | MN1-001US                                                                                  |      |
| Total Number of Pages in This Submission                                                                                                                                                                                                                                                                      |                                                                                     | 42                                                                                         |      |
| ENCLOSURES (check all that apply)                                                                                                                                                                                                                                                                             |                                                                                     |                                                                                            |      |
| <input checked="" type="checkbox"/> Fee Transmittal Form                                                                                                                                                                                                                                                      |                                                                                     | <input type="checkbox"/> Drawing(s)                                                        |      |
| <input type="checkbox"/> Fee Attached                                                                                                                                                                                                                                                                         |                                                                                     | <input type="checkbox"/> Licensing-related Papers                                          |      |
| <input checked="" type="checkbox"/> Amendment / Reply                                                                                                                                                                                                                                                         |                                                                                     | <input type="checkbox"/> Petition                                                          |      |
| <input type="checkbox"/> After Final                                                                                                                                                                                                                                                                          |                                                                                     | <input type="checkbox"/> Petition to Convert to a Provisional Application                  |      |
| <input type="checkbox"/> Affidavits/declaration(s)                                                                                                                                                                                                                                                            |                                                                                     | <input type="checkbox"/> Power of Attorney, Revocation                                     |      |
| <input type="checkbox"/> Extension of Time Request                                                                                                                                                                                                                                                            |                                                                                     | <input type="checkbox"/> Change of Correspondence Address                                  |      |
| <input type="checkbox"/> Express Abandonment Request                                                                                                                                                                                                                                                          |                                                                                     | <input type="checkbox"/> Terminal Disclaimer                                               |      |
| <input type="checkbox"/> Information Disclosure Statement                                                                                                                                                                                                                                                     |                                                                                     | <input type="checkbox"/> Request for Refund                                                |      |
| <input type="checkbox"/> Certified Copy of Priority Documents                                                                                                                                                                                                                                                 |                                                                                     | <input type="checkbox"/> CD, Number of CD(s)                                               |      |
| <input type="checkbox"/> Response to Missing Parts/Incomplete Application                                                                                                                                                                                                                                     |                                                                                     | <input type="checkbox"/> After Allowance Communication to Group                            |      |
| <input type="checkbox"/> Response to Missing Parts under 37 CFR 1.52 or 1.53                                                                                                                                                                                                                                  |                                                                                     | <input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences        |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | <input type="checkbox"/> Appeal Communication to Group (Appeal Notice, Brief, Reply Brief) |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | <input type="checkbox"/> Proprietary Information                                           |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | <input type="checkbox"/> Status Letter                                                     |      |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | <input type="checkbox"/> Other Enclosure(s) (please identify below):                       |      |
| Remarks                                                                                                                                                                                                                                                                                                       |                                                                                     |                                                                                            |      |
| SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT                                                                                                                                                                                                                                                                    |                                                                                     |                                                                                            |      |
| Firm or Individual Name                                                                                                                                                                                                                                                                                       | David A. Morasch/Reg. No. 42905                                                     |                                                                                            |      |
| Signature                                                                                                                                                                                                                                                                                                     |  |                                                                                            |      |
| Date                                                                                                                                                                                                                                                                                                          | June 13, 2006                                                                       |                                                                                            |      |
| 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, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below. |                                                                                     |                                                                                            |      |
| Typed or printed name                                                                                                                                                                                                                                                                                         | Rebekah Glass                                                                       |                                                                                            |      |
| Signature                                                                                                                                                                                                                                                                                                     |  |                                                                                            | Date |
|                                                                                                                                                                                                                                                                                                               |                                                                                     | 6/13/06                                                                                    |      |

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PTO/SB/17 (12-04)

Approved for use through 07/31/2006. OMB 0651-0032

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Effective on 12/09/2004.  
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).**FEE TRANSMITTAL**  
**For FY 2005**☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$ ) 0.00

**Complete If Known**

|                      |                        |
|----------------------|------------------------|
| Application Number   | 10/131,864             |
| Filing Date          | 4/25/2002              |
| First Named Inventor | William J. Crilly, Jr. |
| Examiner Name        | STEPHEN CHIN           |
| Art Unit             | 2634                   |
| Attorney Docket No.  | MN1 -001US             |

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JUN 13 2006**METHOD OF PAYMENT (check all that apply)**☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): \_\_\_\_\_☒ Deposit Account Deposit Account Number: 12-0769 Deposit Account Name: Lee & Hayes, PLLC

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below☐ Charge fee(s) indicated below, except for the filing fee☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17☒ Credit any overpayments

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**FEE CALCULATION****1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

| Application Type | FILING FEES |                       | SEARCH FEES |                       | EXAMINATION FEES |                       | Fees Paid (\$) |
|------------------|-------------|-----------------------|-------------|-----------------------|------------------|-----------------------|----------------|
|                  | Fee (\$)    | Small Entity Fee (\$) | Fee (\$)    | Small Entity Fee (\$) | Fee (\$)         | Small Entity Fee (\$) |                |
| Utility          | 300         | 150                   | 500         | 250                   | 200              | 100                   |                |
| Design           | 200         | 100                   | 100         | 50                    | 130              | 65                    |                |
| Plant            | 200         | 100                   | 300         | 150                   | 160              | 80                    |                |
| Reissue          | 300         | 150                   | 500         | 250                   | 600              | 300                   |                |
| Provisional      | 200         | 100                   | 0           | 0                     | 0                | 0                     |                |

**2. EXCESS CLAIM FEES**

| Fee Description                                                                                         | Fee (\$) | Small Entity Fee (\$) |
|---------------------------------------------------------------------------------------------------------|----------|-----------------------|
| Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent            | 50       | 25                    |
| Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent | 200      | 100                   |
| Multiple dependent claims                                                                               | 360      | 180                   |

|                                                                       |                     |                 |                      |                                  |                 |                      |
|-----------------------------------------------------------------------|---------------------|-----------------|----------------------|----------------------------------|-----------------|----------------------|
| <b>Total Claims</b>                                                   | <b>Extra Claims</b> | <b>Fee (\$)</b> | <b>Fee Paid (\$)</b> | <b>Multiple Dependent Claims</b> | <b>Fee (\$)</b> | <b>Fee Paid (\$)</b> |
| - 20 or HP =                                                          | x                   | 50              | =                    |                                  |                 |                      |
| HP = highest number of total claims paid for, if greater than 20      |                     |                 |                      |                                  |                 |                      |
| <b>Indep. Claims</b>                                                  | <b>Extra Claims</b> | <b>Fee (\$)</b> | <b>Fee Paid (\$)</b> |                                  |                 |                      |
| - 3 or HP =                                                           | x                   | 200             | =                    |                                  |                 |                      |
| HP = highest number of independent claims paid for, if greater than 3 |                     |                 |                      |                                  |                 |                      |

**3. APPLICATION SIZE FEE**

If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

|                     |                     |                                                         |                 |                      |
|---------------------|---------------------|---------------------------------------------------------|-----------------|----------------------|
| <b>Total Sheets</b> | <b>Extra Sheets</b> | <b>Number of each additional 50 or fraction thereof</b> | <b>Fee (\$)</b> | <b>Fee Paid (\$)</b> |
| - 100 =             | / 50 =              | (round up to a whole number) x                          |                 |                      |

**4. OTHER FEE(S)**

Non-English Specification, \$130 fee (no small entity discount)

Other: \_\_\_\_\_

**SUBMITTED BY**

Signature

Registration No.  
(Attorney/Agent)

42905

Telephone (509) 324-9256

Name (Print/Type)

David A. Morasch

Date

Jun 13, 2006

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application Serial No. ....10/131,864  
Filing Date .....04/25/2002  
Inventorship.....Crilly  
Applicant ..... Vivato, Inc.  
Group Art Unit .....2637  
Examiner .....Angelo, C.J.  
Attorney's Docket No. ....MN1-0001US  
Title: Improved Multipath Communication Methods and Apparatuses

**RESPONSE TO OFFICE ACTION DATED DECEMBER 13, 2006**

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

From: David A. Morasch Tel. 509-324-9256 ext. 210  
Fax 509-323-8979  
Customer # 22801

**INDEX**

Specification Amendments: Page 2  
List of Claims / Amendments: Page 4  
Remarks Section: Page 29

lee@haves

1

MN1-0001US.M01

PAGE 3/42 \* RCVD AT 6/13/2006 6:42:10 PM [Eastern Daylight Time] \* SVR:USPTO-EFXXRF-2/15 \* DNIS:2738300 \* CSID:15093238979 \* DURATION (mm:ss):10-30

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**SPECIFICATION AMENDMENTS**

Please amend the specification as follows:

Substitute the paragraph starting at page 15, line 20, with the following:

Reference is now made to Fig. 1, which is a block diagram depicting an exemplary communication system 100 operating in a multipath environment. Here, a base station device 102 is configured to exchange data with at least one customer premise equipment (CPE) device 104 through an antenna 108 and over a wireless communication link. Base station device 102 is further operatively configured to send and receive data via one or more networks 106. In this manner, data can be received through network 106 by base station 102, and then forwarded over a wireless communication link to CPE device 104 using antenna 108. Likewise, in reverse order, CPE device 104 can transmit data over a wireless communication link to base station device 102 through antenna 108, and base station 102 may then forward the received data to other device device(s) via network 106.

Substitute the paragraph starting at page 17, line 24, with the following:

Transceiver 208 is configured to receive data from and provide data to CPE mechanism(s) 210. CPE mechanism(s) 210 is representative of one or more mechanisms associated with the functionality of CPE device 104. Thus, for example, in certain implementations CPE device 104 includes a computer or like computing device. As such, CPE mechanism(s) 210 may take the form of a

1 processor that is coupled to memory and operatively configured to perform  
2 functions in accord with one or more computer instructional programs, e.g.,  
3 application programs. In still other implementations, CPE device [[1-4]] 104 may  
4 include a mobile telephone, in which case, CPE mechanism(s) 210 may include a  
5 signal processor and other circuitry for converting digital audio data into an  
6 applicable analog audio signal and converting an analog audio signal into  
7 corresponding digital data.

8  
9 Substitute the paragraph starting at page 18, line 11, with the following:

10 Logic 212 is provided in this example to represent any applicable additional  
11 logic/circuitry that may be used to implement the all or part of the methods and  
12 apparatuses of the present invention. In certain implementations, logic 212 may  
13 be incorporated in transceiver 208. For this reason, logic 212 is depicted within a  
14 dashed line box.

15  
16 Substitute the paragraph starting at page 24, line 20, with the following:

17 ~~As an~~ An example of known headers that may be used to support training  
18 sequences, sequences can be found in the IEEE 802.11a standard. IEEE 802.11a  
19 provides short and long sequences totaling a duration of about 8  $\mu$ s. The 8  $\mu$ s may  
20 be used to ascertain delay spread to approximately 8  $\mu$ s delay. The known  
21 sequences have sufficient low frequency energy per burst (here, low being  
22 between about 100 kHz and 125 kHz, 1/8  $\mu$ s resolution) to determine fine  
23 variations in the complex channel response.  
24  
25

**LIST OF CLAIMS / AMENDMENTS**

Please amend claims 1, 13-16, 18-24, and 26-39 as shown herein.

Claims 1-95 are pending and are listed following:

1. **(currently amended)** A method comprising:  
identifying at least one multipath transmission delay within a  
reverse path data signal received from a receiving device;  
determining at least one forward path pre-equalization  
parameter based on said at least one transmission delay; and  
modifying a forward path data signal that is to be transmitted  
to the receiving device based on said at least one forward path  
pre-equalization parameter.
2. **(original)** The method as recited in Claim 1, further comprising:  
receiving said reverse path data signal over at least one  
reverse transmission path.
3. **(original)** The method as recited in Claim 2, further comprising:  
transmitting said modified forward path data signal over at  
least one forward transmission path.

- 1 4. (original) The method as recited in Claim 1, wherein said reverse  
2 path data signal includes at least one type of data selected from a  
3 group of different types of data comprising Orthogonal Frequency  
4 Division Multiplexing (OFDM) data and Quadrature Phase Shift  
5 Keying (QPSK) data.
- 6  
7 5. (original) The method as recited in Claim 1, wherein said  
8 modified forward path data signal includes at least one type of data  
9 selected from a group of different types of data comprising  
10 Orthogonal Frequency Division Multiplexing (OFDM) data and  
11 Quadrature Phase Shift Keying (QPSK) data.
- 12  
13 6. (original) The method as recited in Claim 5, wherein said  
14 modified forward path data signal includes sub-carrier pre-equalized  
15 OFDM data.
- 16  
17 7. (original) The method as recited in Claim 6, further comprising:  
18 generating corresponding Quadrature Phase Shift Keying  
19 (QPSK) modulation values based on said sub-carrier pre-equalized  
20 OFDM data.
- 21  
22  
23  
24  
25

1       8.    (original)   The method as recited in Claim 4, wherein identifying  
2           said at least one multipath transmission delay includes:

3                 identifying at least one multipath transmission delay spread  
4                 that is greater than a guard interval.

5  
6       9.    (original)   The method as recited in Claim 1, wherein said reverse  
7           path data signal includes identifiable training data.

8  
9       10.   (original)   The method as recited in Claim 9, further comprising:  
10                 comparing said received identifiable training data to a local  
11                 version of said training data to identify said at least one multipath  
12                 transmission delay within said reverse path data signal.

13  
14       11.   (original)   The method as recited in Claim 3, wherein modifying  
15           said forward path data signal based on at least one forward path  
16           pre-equalization parameter further includes:

17                 selectively inverting and applying a measured channel  
18                 response to said forward path data signal to significantly reduce  
19                 subsequent induced deleterious channel response changes to said  
20                 modified forward path data signal during transmission over said at  
21                 least one forward transmission path.

1 12. (original) The method as recited in Claim 3, wherein said at least  
2 one reverse transmission path is substantially reciprocal to said at  
3 least one forward transmission path.

4  
5 13. (currently amended) The method as recited in Claim 1,  
6 wherein identifying said at least one multipath transmission delay,  
7 determining said at least one forward path pre-equalization  
8 parameter, and modifying said forward path data signal are  
9 performed by a first transmitting device.

10  
11 14. (currently amended) The method as recited in Claim 13,  
12 wherein said first transmitting device includes a base station device  
13 that is operatively configurable for use in a wireless communication  
14 system.

15  
16 15. (currently amended) The method as recited in Claim 13,  
17 further comprising:

18 using at least one first transmitting device receive antenna  
19 operatively coupled to said first transmitting device to receive said  
20 reverse path data signal over at least one reverse transmission path  
21 from ~~a second~~ the receiving device.  
22  
23  
24  
25

1       **16. (currently amended)**     The method as recited in Claim 15,  
2       wherein said ~~second~~ receiving device includes a customer premise  
3       equipment (CPE) device that is operatively configurable for use in a  
4       wireless communication system.

5  
6       **17. (original)**     The method as recited in Claim 16, wherein said CPE  
7       device includes at least one device selected from a group of devices  
8       comprising a computer, a portable computer, a personal digital  
9       assistant (PDA), and a mobile communication device.

10  
11       **18. (currently amended)**     The method as recited in Claim 15,  
12       wherein said at least one ~~first~~ transmitting device receive antenna  
13       includes at least one type of antenna selected from a group of  
14       suitable types of antennas comprising at least one omnidirectional  
15       type of antenna, at least one beam type of antenna, at least one  
16       phased array type of antenna, and at least one adaptive antenna.

17  
18       **19. (currently amended)**     The method as recited in Claim 15,  
19       wherein said ~~first~~ transmitting device is operatively coupled to a  
20       plurality of first device receive antennas.  
21  
22  
23  
24  
25

1       **20. (currently amended)**     The method as recited in Claim 13,  
2       further comprising;

3               receiving said reverse path data signal over at least one  
4       reverse transmission path; and

5               causing said ~~first~~ transmitting device to post equalize at least  
6       a portion of said received reverse path signal.

7  
8       **21. (currently amended)**     The method as recited in Claim 15,  
9       wherein determining said at least one forward path pre-equalization  
10      parameter based on said at least one transmission delay further  
11      includes:

12              determining at least one angle of arrival of said reverse path  
13      data signal with respect to said at least one ~~first~~ transmitting device  
14      receive antenna.

15  
16      **22. (currently amended)**     The method as recited in Claim 15,  
17      further comprising:

18              using at least one ~~second~~ receiving device transmit antenna  
19      operatively coupled to said ~~second~~ receiving device and configured  
20      to transmit said reverse path data signal over said at least one reverse  
21      transmission path to said ~~first~~ transmitting device.

1       23. (currently amended)     The method as recited in Claim 22,  
2       wherein a plurality of ~~second~~ receiving device transmit antennas are  
3       operatively coupled to said ~~second~~ receiving device and configured  
4       to transmit said reverse path data signal over said at least one reverse  
5       transmission path to said ~~first~~ transmitting device.

6  
7       24. (currently amended)     The method as recited in Claim 22,  
8       further comprising:

9               causing said ~~second~~ receiving device to transmit at least two  
10       reverse path data signals over said at least one reverse transmission  
11       path to said ~~first~~ transmitting device.

12  
13       25. (original)     The method as recited in Claim 24, wherein said at  
14       least two reverse path data signals include Orthogonal Frequency-  
15       Division Multiple Access (OFDMA) data.

16  
17       26. (currently amended)     The method as recited in Claim 22,  
18       further comprising:

19               causing said ~~second~~ receiving device to transmit said reverse  
20       path data signal over said at least one reverse transmission path to  
21       said ~~first~~ transmitting device at a bit rate less than about 6 Mbps.

1       **27. (currently amended)**     The method as recited in Claim 22,  
2       further comprising:

3               causing said ~~second~~ receiving device to transmit  
4       corresponding ~~second~~ receiving device transmission power level  
5       information to said ~~first~~ transmitting device; and

6               causing said ~~first~~ transmitting device to adjust at least one  
7       transmission power level associated with said forward path data  
8       signal based on said ~~second~~ receiving device transmission power  
9       level information.

10  
11       **28. (currently amended)**     The method as recited in Claim 13,  
12       further comprising:

13               using at least one ~~first~~ transmitting device transmit antenna  
14       operatively coupled to said ~~first~~ transmitting device to transmit said  
15       modified forward path data signal over at least one forward  
16       transmission path to a ~~second~~ receiving device.

17  
18       **29. (currently amended)**     The method as recited in Claim 28,  
19       wherein said at least one ~~first~~ transmitting device transmit antenna is  
20       operatively configurable to provide transmission diversity when  
21       transmitting said modified forward path data signal.  
22  
23  
24  
25

1       **30. (currently amended)**     The method as recited in Claim 28,  
2       wherein said at least one ~~first~~ transmitting device transmit antenna is  
3       operatively configurable to provide spatial division transmission  
4       when transmitting said modified forward path data signal.

5  
6       **31. (currently amended)**     The method as recited in Claim 28,  
7       wherein said at least one ~~first~~ transmitting device transmit antenna  
8       includes at least one type of antenna selected from a group of  
9       suitable types of antennas comprising at least one omnidirectional  
10      type of antenna, at least one beam type of antenna, at least one  
11      phased array type of antenna, and at least one adaptive antenna.

12  
13      **32. (currently amended)**     The method as recited in Claim 28,  
14      further comprising:

15           setting at least one antenna pointing parameter associated  
16      with said at least one ~~first~~ transmitting device transmit antenna based  
17      on said at least one forward path pre-equalization parameter.

18  
19      **33. (currently amended)**     The method as recited in Claim 28,  
20      further comprising:

21           setting at least one phased array antenna transmission  
22      directing parameter associated with said at least one ~~first~~  
23      transmitting device transmit antenna based on said at least one  
24      forward path pre-equalization parameter.  
25

1  
2 34. (currently amended) The method as recited in Claim 28,  
3 further comprising;

4 selectively transmitting said modified forward path data  
5 signal at one angle with respect to said ~~first~~ transmitting device  
6 transmit antenna.

7  
8 35. (currently amended) The method as recited in Claim 28,  
9 further comprising:

10 selecting said at least one ~~first~~ transmitting device transmit  
11 antenna from a plurality of ~~first~~ transmitting device transmit  
12 antennas that are each operatively coupled to said ~~first~~ transmitting  
13 device.

14  
15 36. (currently amended) The method as recited in Claim 35,  
16 further comprising:

17 selectively transmitting a plurality of beams using two or  
18 more ~~first~~ transmitting device transmit antennas.

19  
20 37. (currently amended) The method as recited in Claim 36,  
21 wherein each of said transmitted plurality of beams is selectively  
22 adjusted in phase and amplitude to reduce multipath affects when  
23 received by said ~~second~~ receiving device.  
24  
25

1       **38. (currently amended)**     The method as recited in Claim 28,  
2       further comprising:

3               using at least one ~~second~~ receiving device receive antenna  
4       operatively coupled to said ~~second~~ receiving device and configured  
5       to receive said modified forward path data signal over said at least  
6       one forward transmission path from said ~~first~~ transmitting device.

7  
8       **39. (currently amended)**     The method as recited in Claim 38,  
9       wherein a plurality of ~~second~~ receiving device receive antennas are  
10      operatively coupled to said ~~second~~ receiving device and configured  
11      to receive said modified forward path data signal over said at least  
12      one forward transmission path from said ~~first~~ transmitting device.

13  
14      **40. (original)**     The method as recited in Claim 1, wherein determining  
15      said at least one forward path pre-equalization parameter based on  
16      said at least one transmission delay further includes:

17              iteratively selectively identifying different forward path  
18      pre-equalization parameters over time to operatively identify and  
19      subsequently ignore aliased multipath delays within said reverse  
20      path data signal.

1       **41. (original)**   The method as recited in Claim 1, wherein determining  
2       said at least one forward path pre-equalization parameter based on  
3       said at least one transmission delay further includes:

4               sub-band equalizing said forward path data signal using  
5       corresponding frequency domain reverse path data.

6  
7       **42. (original)**   The method as recited in Claim 1, wherein modifying  
8       said forward path data signal based on said at least one forward path  
9       pre-equalization parameter further includes:

10              selectively setting different transmission power levels for at  
11       least two Orthogonal Frequency Division Multiplexing (OFDM)  
12       tones in said forward path data signal based on said at least one  
13       forward path pre-equalization parameter.

14  
15       **43. (original)**   A system comprising:

16              a first device operatively configurable to connect to at least a  
17       second device over a wireless communication path, said first device  
18       having logic that is configured to detect a multipath transmission  
19       delay in at least one reverse path data signal transmitted by said  
20       second device, determine at least one forward path pre-equalization  
21       parameter based on said detected multipath transmission delay, and  
22       pre-equalize a forward path data signal that is to be transmitted to  
23       said second device based on said at least one forward path  
24       pre-equalization parameter.  
25

1  
2 **44. (original)** The system as recited in Claim 43, wherein said first  
3 device further comprising:

4 at least one first device antenna; and

5 at least one transceiver operatively coupled to said at least  
6 one first device antenna and said logic, said at least one transceiver  
7 being configurable to receive said reverse path data signal over at  
8 least one reverse transmission path using said at least one first device  
9 antenna and provide said reverse path data signal to said logic, and  
10 transmit said modified forward path data signal from said logic over  
11 at least one forward transmission path.

12  
13 **45. (original)** The system as recited in Claim 43, wherein said  
14 reverse path data signal includes at least one type of data selected  
15 from a group of different types of data comprising Orthogonal  
16 Frequency Division Multiplexing (OFDM) data and Quadrature  
17 Phase Shift Keying (QPSK) data.

18  
19 **46. (original)** The system as recited in Claim 43, wherein said  
20 modified forward path data signal includes at least one type of data  
21 selected from a group of different types of data comprising  
22 Orthogonal Frequency Division Multiplexing (OFDM) data and  
23 Quadrature Phase Shift Keying (QPSK) data.  
24  
25

- 1 47. (original) The system as recited in Claim 46, wherein said  
2 modified forward path data signal includes sub-carrier pre-equalized  
3 OFDM data.
- 4
- 5 48. (original) The system as recited in Claim 47, wherein said logic  
6 is further configured to produce corresponding Quadrature Phase  
7 Shift Keying (QPSK) modulation values based on said sub-carrier  
8 pre-equalized OFDM data.
- 9
- 10 49. (original) The system as recited in Claim 45, wherein said logic  
11 detects said multipath transmission delay by identifying at least one  
12 multipath transmission delay spread that is greater than a guard  
13 interval.
- 14
- 15 50. (original) The system as recited in Claim 43, wherein said  
16 reverse path data signal includes identifiable training data.
- 17
- 18 51. (original) The system as recited in Claim 50, wherein said logic  
19 is further configured to compare said received identifiable training  
20 data to a non-multipath delayed version of said training data to  
21 detect said multipath transmission delay.
- 22
- 23
- 24
- 25

1       **52. (original)**   The system as recited in Claim 44, wherein said logic  
2       is configured to selectively invert and apply a measured channel  
3       response to said forward path data signal to significantly reduce  
4       subsequent induced deleterious channel response changes to said  
5       modified forward path data signal during transmission over said at  
6       least one forward transmission path.

7  
8       **53. (original)**   The system as recited in Claim 44, wherein said at  
9       least one reverse transmission path is substantially reciprocal to said  
10      at least one forward transmission path.

11  
12      **54. (original)**   The system as recited in Claim 43, wherein said first  
13      device includes a base station device that is operatively configurable  
14      for use in a wireless communication system.

15  
16      **55. (original)**   The system as recited in Claim 44, further comprising:  
17                      said second device, in the form of a customer premise  
18      equipment (CPE) device that is operatively configurable for use in a  
19      wireless communication system.

20  
21      **56. (original)**   The system as recited in Claim 55, wherein said CPE  
22      device includes at least one device selected from a group of devices  
23      comprising a computer, a portable computer, a personal digital  
24      assistant (PDA), and a mobile communication device.  
25

- 1 57. (original) The system as recited in Claim 44, wherein said first  
2 device is operatively coupled to a plurality of first device receive  
3 antennas.
- 4
- 5 58. (original) The system as recited in Claim 44, wherein said logic  
6 is configured to post-equalize at least a portion of said received  
7 reverse path signal.
- 8
- 9 59. (original) The system as recited in Claim 44, wherein said logic  
10 is further configured to determine at least one angle of arrival of said  
11 reverse path data signal with respect to said at least one first device  
12 antenna.
- 13
- 14 60. (original) The system as recited in Claim 55, wherein said  
15 second device includes at least one second device antenna that is  
16 operatively configurable to transmit said reverse path data signal  
17 over said at least one reverse transmission path to said first device  
18 and receive said transmitted modified forward path data signal from  
19 said first device over said at least one forward transmission path.
- 20
- 21 61. (original) The system as recited in Claim 60, wherein said  
22 second device includes a plurality of second device antennas that are  
23 operatively configurable to transmit said reverse path data signal  
24 over said at least one reverse transmission path to said first device.  
25

1  
2 62. (original) The system as recited in Claim 60, wherein said  
3 second device is configurable to transmit at least two reverse path  
4 data signals over said at least one reverse transmission path to said  
5 first device.

6  
7 63. (original) The system as recited in Claim 62, wherein said at  
8 least two reverse path data signals include Orthogonal Frequency-  
9 Division Multiple Access (OFDMA) data.

10  
11 64. (original) The system as recited in Claim 60, wherein said  
12 second device is configurable to transmit said reverse path data  
13 signal over said at least one reverse transmission path to said first  
14 device at a bit rate less than about 6 Mbps.

15  
16 65. (original) The system as recited in Claim 60, wherein said  
17 second device is configurable to transmit corresponding second  
18 device transmission power level information to said first device, and  
19 said first device is further configurable to adjust at least one  
20 transmission power level associated with said forward path data  
21 signal based on said second device transmission power level  
22 information.  
23  
24  
25

1 66. (original) The system as recited in Claim 44, wherein said at  
2 least one first device antenna is operatively configurable to provide  
3 transmission diversity when transmitting said modified forward path  
4 data signal.

5  
6 67. (original) The system as recited in Claim 44, wherein said at  
7 least one first device antenna is operatively configurable to provide  
8 spatial division transmission when transmitting said modified  
9 forward path data signal.

10  
11 68. (original) The system as recited in Claim 44, wherein said at  
12 least one first device antenna includes at least one first device  
13 transmit antenna and at least one first device receive antenna.

14  
15 69. (original) The system as recited in Claim 68, wherein said at  
16 least one first device transmit antenna includes at least one type of  
17 antenna selected from a group of suitable types of antennas  
18 comprising at least one omnidirectional type of antenna, at least one  
19 beam type of antenna, at least one phased array type of antenna, and  
20 at least one adaptive antenna.  
21  
22  
23  
24  
25

- 1       70. (original) The system as recited in Claim 68, wherein said at  
2       least one first device receive antenna includes at least one type of  
3       antenna selected from a group of suitable types of antennas  
4       comprising at least one omnidirectional type of antenna, at least one  
5       beam type of antenna, at least one phased array type of antenna, and  
6       at least one adaptive antenna.
- 7
- 8       71. (original) The system as recited in Claim 68, wherein said logic  
9       is further configured to establish at least one antenna pointing  
10      parameter associated with said at least one first device transmit  
11      antenna based on said at least one forward path pre-equalization  
12      parameter.
- 13
- 14      72. (original) The system as recited in Claim 68, wherein said logic  
15      is further configured to establish at least one phased array antenna  
16      transmission directing parameter associated with said at least one  
17      first device transmit antenna based on said at least one forward path  
18      pre-equalization parameter.
- 19
- 20      73. (original) The system as recited in Claim 68, wherein said logic  
21      is further configurable to cause said at least one transceiver to  
22      selectively transmit said modified forward path data signal at one  
23      angle with respect to said at least one first device transmit antenna.
- 24
- 25

1       **74. (original)**   The system as recited in Claim 68, wherein said logic  
2       is further configurable to cause said at least one transceiver to select  
3       said at least one first device transmit antenna from a plurality of first  
4       device transmit antennas that are each operatively coupled to said  
5       first device.

6  
7       **75. (original)**   The system as recited in Claim 74, wherein said logic  
8       is further configurable to cause said at least one transceiver to  
9       selectively transmit a plurality of beams using two or more first  
10      device transmit antennas.

11  
12      **76. (original)**   The system as recited in Claim 75, wherein each of  
13      said transmitted plurality of beams is selectively adjusted in phase  
14      and amplitude to reduce multipath affects when received by said  
15      second device.

16  
17      **77. (original)**   The system as recited in Claim 60, wherein said at  
18      least one second device antenna includes at least one second device  
19      transmit antenna and at least one second device receive antenna.  
20  
21  
22  
23  
24  
25

1 78. (original) The system as recited in Claim 77, wherein said  
2 second device includes a plurality of second device receive antennas  
3 that are configurable to receive said transmitted modified forward  
4 path data signal over said at least one forward transmission path  
5 from said first device.

6  
7 79. (original) The system as recited in Claim 43, wherein said logic  
8 is further configurable to iteratively selectively test different forward  
9 path pre-equalization parameters over time such that aliased  
10 multipath delays within said reverse path data signal are identifiable.

11  
12 80. (original) The system as recited in Claim 43, wherein said logic  
13 is configured to provide sub-band equalizing of said forward path  
14 data signal using corresponding frequency domain reverse path data.

15  
16 81. (original) The system as recited in Claim 43, wherein said logic  
17 is further configurable to cause said transceiver to selectively  
18 establish different transmission power levels for at least two  
19 Orthogonal Frequency Division Multiplexing (OFDM) tones in said  
20 forward path data signal based on said at least one forward path pre-  
21 equalization parameter.

1       **82. (original)**   An apparatus comprising:

2                   an Orthogonal Frequency Division Multiplexing (OFDM)  
3                   processor configured to receive coded data and output corresponding  
4                   OFDM data;

5                   a pre-equalizer operatively coupled to said OFDM processor  
6                   and configured to receive said OFDM data and output pre-equalized  
7                   OFDM data based on gathered reverse link data;

8                   at least one antenna; and

9                   a transceiver operatively coupled to said pre-equalizer and  
10                  said at least one antenna, said transceiver being configured to receive  
11                  said pre-equalized OFDM data from said pre-equalizer and apply a  
12                  corresponding transmittable forward link data signal to said at least  
13                  one antenna.

14  
15       **83. (original)**   The apparatus as recited in Claim 82, wherein said  
16                   transceiver is configurable to receive a transmitted reverse link data  
17                   signal using said at least one antenna and output corresponding  
18                   reverse link data, and further comprising:

19                  reverse link logic operatively coupled to said at least one  
20                  antenna and said operatively coupled to said at least one first device  
21                  antenna, said reverse link logic being configured to detect at least  
22                  one multipath induced delay in said reverse link data and provide  
23                  associated said gathered reverse link data to said pre-equalizer.

1       **84. (original)** The apparatus as recited in Claim 82, wherein said  
2       pre-equalized OFDM data includes sub-carrier pre-equalized OFDM  
3       data.

4  
5       **85. (original)** The apparatus as recited in Claim 82, wherein said  
6       reverse link logic detects said at least one multipath induced delay  
7       by identifying at least one transmission delay spread that is greater  
8       than a guard interval.

9  
10       **86. (original)** The apparatus as recited in Claim 83, wherein said  
11       reverse link data signal includes identifiable training data.

12  
13       **87. (original)** The apparatus as recited in Claim 86, wherein said  
14       reverse link logic is further configured to compare said received  
15       identifiable training data to a non-delayed version of said training  
16       data to detect said at least one transmission delay.

17  
18       **88. (original)** The apparatus as recited in Claim 83, wherein said  
19       pre-equalizer is configured to selectively invert and apply a  
20       measured channel response to said OFDM data.  
21  
22  
23  
24  
25

1 89. (original) The apparatus as recited in Claim 83, wherein a  
2 reverse transmission path carrying said transmitted reverse link data  
3 signal towards said antenna is at least substantially reciprocal to a  
4 forward transmission path carrying said transmittable forward link  
5 data signal away from said at least one antenna.

6  
7 90. (original) The apparatus as recited in Claim 82, wherein said  
8 apparatus includes a base station device suitable for use in a wireless  
9 communication system.

10  
11 91. (original) The apparatus as recited in Claim 82, wherein said at  
12 least one antenna is operatively configurable to provide transmission  
13 diversity.

14  
15 92. (original) The apparatus as recited in Claim 82, wherein said at  
16 least one antenna is operatively configurable to provide spatial  
17 division.

18  
19 93. (original) The apparatus as recited in Claim 82, wherein said at  
20 least one antenna includes at least one transmit antenna and at least  
21 one receive antenna.  
22  
23  
24  
25

1       **94. (original)**   The apparatus as recited in Claim 93, wherein said at  
2       least one transmit antenna includes at least one type of antenna  
3       selected from a group of suitable types of antennas comprising at  
4       least one omnidirectional type of antenna, at least one beam type of  
5       antenna, at least one phased array type of antenna, and at least one  
6       adaptive antenna.

7  
8       **95. (original)**   The apparatus as recited in Claim 93, wherein said at  
9       least one receive antenna includes at least one type of antenna  
10      selected from a group of suitable types of antennas comprising at  
11      least one omnidirectional type of antenna, at least one beam type of  
12      antenna, at least one phased array type of antenna, and at least one  
13      adaptive antenna.

**REMARKS**

Applicant respectfully requests reconsideration and allowance of the subject application. Claims 1-95 are pending, of which claims 1, 13-16, 18-24, and 26-39 have been amended.

**35 U.S.C. §103 Claim Rejections**

**A.** Claims 1, 13-15, 22-25, 28, 43, and 54 are rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 6,870,515 to Kitchener et al. (hereinafter, "Kitchener"), in view of U.S. Patent Publication No. 2003/0058929 to Cox et al. (hereinafter, "Cox") (*Office Action* p.2).

**B.** Claims 2-3, 16-17, 44, 55-57, 60-62, 68, and 77-78 are rejected under 35 U.S.C. §103(a) for obviousness over Kitchener in view of Cox, and further in view of U.S. Patent Publication No. 2002/0089927 to Fischer et al. (hereinafter, "Fischer") (*Office Action* p.4).

**C.** Claims 4, 25, 45, and 63 are rejected under 35 U.S.C. §103(a) for obviousness over Kitchener in view of Cox, and further in view of U.S. Patent Publication No. 2002/0065047 to Moose (hereinafter, "Moose") (*Office Action* p.7).

**D.** Claims 5-6 and 46-47 are rejected under 35 U.S.C. §103(a) for obviousness over Kitchener in view of Cox, and further in view of U.S. Patent No. 6,377,819 to Gesbert (hereinafter, "Gesbert") (*Office Action* p.8).

**E.** Claims 7 and 48 are rejected under 35 U.S.C. §103(a) for obviousness over Kitchener in view of Cox and Gesbert, and further in view of

1 U.S. Patent Publication No. 2002/0165626 to Hammons, Jr. et al. (hereinafter,  
2 "Hammons") (*Office Action* p.9).

3 F. Claims 8 and 49 are rejected under 35 U.S.C. §103(a) for  
4 obviousness over Kitchener in view of Cox, and further in view of U.S. Patent No.  
5 6,912,247 to Miyashita et al. (hereinafter, "Miyashita") (*Office Action* p.10).

6 G. Claims 9 and 50 are rejected under 35 U.S.C. §103(a) for  
7 obviousness over Kitchener in view of Cox, and further in view of U.S. Patent No.  
8 5,930,267 to Daneshrad et al. (hereinafter, "Daneshrad") (*Office Action* p.11).

9 H. Claims 10 and 51 are rejected under 35 U.S.C. §103(a) for  
10 obviousness over Kitchener in view of Cox and Daneshrad, and further in view of  
11 U.S. Patent No. 6,052,412 to Ruether et al. (hereinafter, "Ruether") (*Office Action*  
12 p.11).

13 I. Claims 11 and 52 are rejected under 35 U.S.C. §103(a) for  
14 obviousness over Kitchener in view of Cox and Fischer, and further in view of  
15 U.S. Patent No. 6,665,308 to Rakib et al. (hereinafter, "Rakib") (*Office Action*  
16 p.12).

17 J. Claims 12, 53, and 67 are rejected under 35 U.S.C. §103(a) for  
18 obviousness over Kitchener in view of Cox and Fischer, and further in view of  
19 U.S. Patent No. 5,648,955 to Jensen et al. (hereinafter, "Jensen") (*Office Action*  
20 p.13).

21 K. Claim 58 is rejected under 35 U.S.C. §103(a) for obviousness over  
22 Kitchener in view of Cox and Fischer, and further in view of U.S. Patent No.  
23 6,741,643 to McGibney (hereinafter, "McGibney") (*Office Action* p.14).

1        L.     Claims 59, 69-70, and 73 are rejected under 35 U.S.C. §103(a) for  
2 obviousness over Kitchener in view of Cox and Fischer, and further in view of  
3 U.S. Patent Publication No. 2005/0143132 to Proctor, Jr. et al. (hereinafter,  
4 "Proctor") (*Office Action* p.15).

5        M.     Claims 65-66 are rejected under 35 U.S.C. §103(a) for obviousness  
6 over Kitchener in view of Cox and Fischer, and further in view of U.S. Patent  
7 Publication No. 2005/0207334 to Hadad (hereinafter, "Hadad") (*Office Action*  
8 p.17).

9        N.     Claim 71 is rejected under 35 U.S.C. §103(a) for obviousness over  
10 Kitchener in view of Cox and Fischer, and further in view of U.S. Patent  
11 Publication No. 2002/0009058 to Kelly et al. (hereinafter, "Kelly") (*Office Action*  
12 p.18).

13        O.     Claim 72 is rejected under 35 U.S.C. §103(a) for obviousness over  
14 Kitchener in view of Cox and Fischer, and further in view of U.S. Patent No.  
15 6,023,242 to Dixon (hereinafter, "Dixon") (*Office Action* p.19).

16        P.     Claims 74-76 are rejected under 35 U.S.C. §103(a) for obviousness  
17 over Kitchener in view of Cox and Fischer, and further in view of U.S. Patent  
18 Publication No. 6,804,312 to Win et al. (hereinafter, "Win") (*Office Action* p.19).

19        Q.     Claims 40 and 79 are rejected under 35 U.S.C. §103(a) for  
20 obviousness over Kitchener in view of Cox, and further in view of U.S. Patent No.  
21 6,314,147 to Liang et al. (hereinafter, "Liang") (*Office Action* p.20).

22        R.     Claims 41 and 80 are rejected under 35 U.S.C. §103(a) for  
23 obviousness over Kitchener in view of Cox, and further in view of U.S. Patent No.  
24 6,868,377 to Laroche (hereinafter, "Laroche") (*Office Action* p.21).

1        S.     Claims 42 and 81 are rejected under 35 U.S.C. §103(a) for  
2 obviousness over Kitchener in view of Cox, and further in view of U.S. Patent  
3 Publication No. 2002/0191540 to Fujii et al. (hereinafter, "Fujii") (*Office Action*  
4 p.22).

5        T.     Claim 20 is rejected under 35 U.S.C. §103(a) for obviousness over  
6 Kitchener in view of Cox, and further in view of McGibney (*Office Action* p.23).

7        U.     Claims 18, 21, 31, and 34 are rejected under 35 U.S.C. §103(a) for  
8 obviousness over Kitchener in view of Cox, and further in view of Proctor (*Office*  
9 *Action* p.23).

10       V.     Claim 26 is rejected under 35 U.S.C. §103(a) for obviousness over  
11 Kitchener in view of Cox, and further in view of Hammons (*Office Action* p.24).

12       W.     Claims 27 and 29 are rejected under 35 U.S.C. §103(a) for  
13 obviousness over Kitchener in view of Cox, and further in view of Hadad (*Office*  
14 *Action* p.24).

15       X.     Claim 30 is rejected under 35 U.S.C. §103(a) for obviousness over  
16 Kitchener in view of Cox, and further in view of Jensen (*Office Action* p.24).

17       Y.     Claim 32 is rejected under 35 U.S.C. §103(a) for obviousness over  
18 Kitchener in view of Cox, and further in view of Kelly (*Office Action* p.24).

19       Z.     Claim 33 is rejected under 35 U.S.C. §103(a) for obviousness over  
20 Kitchener in view of Cox, and further in view of Dixon (*Office Action* p.25).

21       Z1.    Claims 35-39 are rejected under 35 U.S.C. §103(a) for obviousness  
22 over Kitchener in view of Cox, and further in view of Win (*Office Action* p.25).

23       Z2.    Claim 82 is rejected under 35 U.S.C. §103(a) for obviousness over  
24 U.S. Patent Publication No. 2002/0085118 to Harris et al. (hereinafter, "Harris") in  
25

1 view of U.S. Patent No. 6,031,866 to Oler et al. (hereinafter, "Oler") (*Office*  
2 *Action* p.25).

3 **Z3.** Claims 83 and 90 are rejected under 35 U.S.C. §103(a) for  
4 obviousness over Harris in view of Oler, and further in view of Cox (*Office Action*  
5 p.26).

6 **Z4.** Claim 84 is rejected under 35 U.S.C. §103(a) for obviousness over  
7 Harris in view of Oler, and further in view of Gesbert (*Office Action* p.27).

8 **Z5.** Claim 85 is rejected under 35 U.S.C. §103(a) for obviousness over  
9 Harris in view of Oler, and further in view of Miyashita (*Office Action* p.27).

10 **Z6.** Claim 86 is rejected under 35 U.S.C. §103(a) for obviousness over  
11 Harris in view of Oler, and further in view of Daneshrad (*Office Action* p.27).

12 **Z7.** Claim 84 is rejected under 35 U.S.C. §103(a) for obviousness over  
13 Harris in view of Oler, and further in view of Miyashita (*Office Action* p.27).

14 **Z8.** Claim 87 is rejected under 35 U.S.C. §103(a) for obviousness over  
15 Harris in view of Oler, and further in view of Ruether (*Office Action* p.27).

16 **Z9.** Claim 88 is rejected under 35 U.S.C. §103(a) for obviousness over  
17 Harris in view of Oler, and further in view of Ralob (*Office Action* p.28).

18 **Z10.** Claims 89 and 92 are rejected under 35 U.S.C. §103(a) for  
19 obviousness over Harris in view of Oler, and further in view of Jensen (*Office*  
20 *Action* p.28).

21 **Z12.** Claim 91 is rejected under 35 U.S.C. §103(a) for obviousness over  
22 Harris in view of Oler, and further in view of Haded (*Office Action* p.28).

23 **Z13.** Claim 93 is rejected under 35 U.S.C. §103(a) for obviousness over  
24 Harris in view of Oler, and further in view of Kitchener (*Office Action* p.28).

25

1        **Z14.** Claims 94-95 are rejected under 35 U.S.C. §103(a) for obviousness  
2 over Harris in view of Oler, and further in view of Proctor (*Office Action* p.28).  
3 Applicant respectfully traverses the rejections.

4  
5        The Office rejects independent claims 1 and 43 together over the  
6 Kitchener-Cox combination (*Office Action* p.2 ¶s 4-7; p.3 ¶11). Kitchener is only  
7 cited for a first device connected to a second device over a wireless  
8 communication path (*Office Action* p.2; *Kitchener* col.1, lines 17-21; Fig. 1). As  
9 the Office recognizes, Kitchener does not disclose detecting multipath delay and  
10 adjusting for the delay (*Office Action* p.2).

11  
12        **Claim 43** recites a system comprising a first device operatively  
13 configurable to:

14        connect to at least a second device over a wireless communication path,  
15 said first device having logic that is configured to detect a multipath transmission  
16 delay in at least one reverse path data signal transmitted by said second device,

17        determine at least one forward path pre-equalization parameter based on  
18 said detected multipath transmission delay, and

19        pre-equalize a forward path data signal that is to be transmitted to said  
20 second device based on said at least one forward path pre-equalization parameter.

21  
22        The Office cites to Cox ¶[0029] for equalizer parameters that are developed  
23 based on time delays in a transmitted signal and applied to the equalizer (*Office*  
24 *Action* pp.2-3 ¶6). The Office relies entirely on Cox ¶[0029] as a basis to reject all  
25

1 of the features recited in claim 43, other than Kitchener for "a first device  
2 operatively configurable to connect to at least a second device over a wireless  
3 communication path", as recited in claim 43.

4 Applicant disagrees because Cox is clearly directed to only a receiver  
5 device as stated in the title for an *Adaptive Wireless Communication Receiver* and  
6 "for adaptive processing in a communication system receiver" (Cox, Abstract).  
7 Cox describes that an equalizer controller and a signal properties evaluation  
8 module develop equalizer operating parameters by which an equalizer in the  
9 receiver is configured to compensate for time delays introduced in a signal  
10 transmitted over a wireless medium (Cox ¶[0029]; Fig. 4). The signal properties  
11 are evaluated to determine whether the equalizer can enter a power saving mode  
12 when an incoming signal does not need equalization to conserve power, such as in  
13 a receiver that operates on batteries (Cox Abstract; ¶[0082; Fig. 4).

14 Contrary to only the receiver device in Cox that includes the components  
15 for signal property evaluation, Applicant describes and claims that it is the first  
16 device (i.e., transmitting device) which has the "logic that is configured to detect a  
17 multipath transmission delay in at least one reverse path data signal transmitted by  
18 said second device" (i.e., the receiving device), as described in claim 43. Further,  
19 the first device (i.e., transmitting device) determines the path pre-equalization  
20 parameter, and pre-equalizes the forward path data signal "that is to be transmitted  
21 to said second device based on said at least one forward path pre-equalization  
22 parameter", as recited in claim 43.

23 Cox describes only a receiving device that equalizes a received signal,  
24 whereas Applicant describes and claims that a transmitting device detects a  
25

1 multipath transmission delay in a reverse path data signal, determines a forward  
2 path pre-equalization parameter, and pre-equalizes a forward path data signal that  
3 is to be transmitted.

4 The Office also contends that it would have been obvious to modify the  
5 system of Kitchener (a first device connected to a second device over a wireless  
6 communication path) to develop equalizer parameters based on multipath delay as  
7 taught by Cox. Applicant disagrees that the Kitchener-Cox combination provides  
8 a basis to reject the combination of features recited in independent claims 1 and 43  
9 because modifying a receiving device in Kitchener as described by Cox does not  
10 suggest a transmitting device that detects a multipath transmission delay in a  
11 reverse path data signal, determines a forward path pre-equalization parameter,  
12 and pre-equalizes a forward path data signal that is to be transmitted, as recited in  
13 claim 43.

14 Accordingly, claim 43 along with dependent claims 44-81 are allowable  
15 over the Kitchener-Cox combination for at least these reasons and Applicant  
16 requests that the §103 rejection be withdrawn.

17  
18 Claims 44-81 are allowable by virtue of their dependency upon claim 43  
19 (either directly or indirectly) and the §103 rejections should be withdrawn.  
20 Additionally, some or all of claims 44-81 are allowable over the Kitchener-Cox  
21 combination for independent reasons, and are allowable over the additional  
22 combinations of references described above in the rejections A-S because the  
23 additional references do not address the deficiencies of Kitchener and/or Cox as  
24 described above in the response to the rejection of claim 43.  
25

1  
2 **Claim 1** recites a method comprising:

3 identifying at least one multipath transmission delay within a reverse  
4 path data signal received from a receiving device;

5 determining at least one forward path pre-equalization parameter  
6 based on said at least one transmission delay; and

7 modifying a forward path data signal that is to be transmitted to the  
8 receiving device based on said at least one forward path pre-equalization  
9 parameter.  
10

11 As described above in response to the rejection of claim 43, Kitchener  
12 and/or Cox do not teach or suggest the combination of features recited in claim 1.  
13 Specifically, Cox is only directed to a receiving device that equalizes a received  
14 signal and/or conserves power in the receiving device, whereas Applicant  
15 describes and claims identifying a multipath transmission delay within a reverse  
16 path data signal received from a receiving device, determining a forward path  
17 pre-equalization parameter, and modifying a forward path data signal that is to be  
18 transmitted to the receiving device, as recited in claim 1.

19 Accordingly, claim 1 along with dependent claims 2-42 are allowable over  
20 the Kitchener-Cox combination for at least these reasons and Applicant requests  
21 that the §103 rejection be withdrawn.  
22

23 **Claims 2-42** are allowable by virtue of their dependency upon claim 1  
24 (either directly or indirectly) and the §103 rejections should be withdrawn.  
25

1 Additionally, some or all of claims 2-42 are allowable over the Kitchener-Cox  
2 combination for independent reasons, and are allowable over the additional  
3 combinations of references described above in the rejections A-J and Q-Z1  
4 because the additional references do not address the deficiencies of Kitchener  
5 and/or Cox as described above in the response to the rejections of claims 1 and 43.

6  
7 **Claim 82** recites an apparatus comprising:

8 an Orthogonal Frequency Division Multiplexing (OFDM) processor  
9 configured to receive coded data and output corresponding OFDM data;

10 a pre-equalizer operatively coupled to said OFDM processor and  
11 configured to receive said OFDM data and output pre-equalized OFDM  
12 data based on gathered reverse link data;

13 at least one antenna; and

14 a transceiver operatively coupled to said pre-equalizer and said at  
15 least one antenna, said transceiver being configured to receive said  
16 pre-equalized OFDM data from said pre-equalizer and apply a  
17 corresponding transmittable forward link data signal to said at least one  
18 antenna.

19  
20 The Office rejects independent claim 82 over the Harris-Oler combination  
21 (*Office Action* p.25 ¶s 160-164). However, Harris and/or Oler do not teach or  
22 suggest the combination of features recited in claim 82, such as OFDM data that is  
23 pre-equalized based on gathered reverse link data.

1 The Office cites to Harris ¶s [0018] and [0028] for an OFDM processor that  
2 receives coded data and outputs corresponding OFDM data to be transmitted, and  
3 a pre-equalizer coupled to the OFDM processor to receive the OFDM data and  
4 output pre-equalized OFDM data based on gathered reverse link data (*Office*  
5 *Action* p.25). Applicant disagrees because there is no indication in the cited ¶s of  
6 Harris that the OFDM data is pre-equalized based on gathered reverse link data, as  
7 recited in claim 82.

8 Harris only describes “the use of the pre-equalization of the OFDM signal  
9 at the transmitter” for NTSC signal suppression ¶[0018], and that a “receiver  
10 further includes a decoder that decodes the single binary data stream according to  
11 forward error correction coding included in the binary data stream” ¶[0028].  
12 Again, there is no indication in Harris that OFDM data is pre-equalized based on  
13 gathered reverse link data, as recited in claim 82.

14 The Office recognizes that Harris does not describe an antenna, and cites to  
15 Oler col.5, lines 12-32 and Fig. 1 for an antenna and a transceiver (*Office*  
16 *Action* p.26). However, there is no indication in the cited section of Oler that the  
17 transceiver receives pre-equalized OFDM data from a pre-equalizer, as recited in  
18 claim 82. Additionally, Applicant disagrees that Oler would be combined with  
19 Harris because the references are “in the same field of endeavor” as the Office  
20 contends (*Office Action* p.26 ¶163). Harris is directed to embedding an OFDM  
21 modulated data signal into a composite video signal (*Harris Title*), whereas Oler is  
22 directed to a duplex decision feedback equalization system (*Oler Title*). There is  
23 no motivation to combine Oler with Harris to reject the features of claim 82.  
24  
25

1 Accordingly, claim 82 along with dependent claims 83-95 are allowable  
2 over the Harris-Oler combination for at least these reasons and Applicant requests  
3 that the §103 rejection be withdrawn.

4  
5 Claims 83-95 are allowable by virtue of their dependency upon claim 82  
6 (either directly or indirectly) and the §103 rejections should be withdrawn.  
7 Additionally, some or all of claims 83-95 are allowable over the Harris-Oler  
8 combination for independent reasons, and are allowable over the additional  
9 combinations of references described above in the rejections Z3-Z14 because the  
10 additional references do not address the deficiencies of Harris and/or Oler as  
11 described above in the response to the rejection of claim 82.

12  
13 Conclusion

14 Pending claims 1-95 are in condition for allowance and Applicant  
15 respectfully requests issuance of the subject application. If any issues remain that  
16 preclude issuance of the application, the Examiner is urged to contact the  
17 undersigned attorney before issuing a subsequent Action.

18  
19 Respectfully Submitted,

20  
21 Dated: June 13, 2006

22 By: 

23 David A. Morasch  
24 Lee & Hayes, PLLC  
25 Reg. No. 42,905  
(509) 324-9256 x 210

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| PATENT APPLICATION FEE DETERMINATION RECORD                               |                                                                                                                                                                                                                               |              |                                    |               | Application or Docket Number<br><b>10/131864</b> |                     |           |                     |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------|---------------|--------------------------------------------------|---------------------|-----------|---------------------|
| Substitute for Form PTO-875                                               |                                                                                                                                                                                                                               |              |                                    |               |                                                  |                     |           |                     |
| APPLICATION AS FILED - PART I                                             |                                                                                                                                                                                                                               |              |                                    |               | SMALL ENTITY OR OTHER THAN SMALL ENTITY          |                     |           |                     |
| (Column 1)                                                                |                                                                                                                                                                                                                               | (Column 2)   |                                    |               |                                                  |                     |           |                     |
| FOR                                                                       | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA |                                    | RATE (\$)     | FEE (\$)                                         | RATE (\$)           | FEE (\$)  |                     |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                |                                                                                                                                                                                                                               |              |                                    |               |                                                  |                     |           |                     |
| SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                               |                                                                                                                                                                                                                               |              |                                    |               |                                                  |                     |           |                     |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                          |                                                                                                                                                                                                                               |              |                                    |               |                                                  |                     |           |                     |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                          | minus 20 =                                                                                                                                                                                                                    | *            |                                    | X =           |                                                  | X =                 |           |                     |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                    | minus 3 =                                                                                                                                                                                                                     | *            |                                    | X =           |                                                  | X =                 |           |                     |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                  | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |              |                                    |               |                                                  |                     |           |                     |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                         |                                                                                                                                                                                                                               |              |                                    |               |                                                  |                     |           |                     |
| * If the difference in column 1 is less than zero, enter "0" in column 2. |                                                                                                                                                                                                                               |              |                                    | TOTAL         |                                                  | TOTAL               |           |                     |
| APPLICATION AS AMENDED - PART II                                          |                                                                                                                                                                                                                               |              |                                    |               | SMALL ENTITY OR OTHER THAN SMALL ENTITY          |                     |           |                     |
| (Column 1)                                                                |                                                                                                                                                                                                                               | (Column 2)   |                                    | (Column 3)    |                                                  |                     |           |                     |
| AMENDMENT A                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              |              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$)                                        | ADDITIONAL FEE (\$) | RATE (\$) | ADDITIONAL FEE (\$) |
|                                                                           | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | * 95         | Minus                              | ** 95         | =                                                | 0                   | X =       |                     |
|                                                                           | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | * 3          | Minus                              | *** 3         | =                                                | 0                   | X =       |                     |
|                                                                           | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |              |                                    |               |                                                  |                     |           |                     |
|                                                                           | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |              |                                    |               |                                                  |                     |           |                     |
| TOTAL ADD'L FEE                                                           |                                                                                                                                                                                                                               |              |                                    |               |                                                  | TOTAL ADD'L FEE     |           |                     |
| AMENDMENT B                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              |              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE (\$)                                        | ADDITIONAL FEE (\$) | RATE (\$) | ADDITIONAL FEE (\$) |
|                                                                           | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | *            | Minus                              | **            | =                                                |                     | X =       |                     |
|                                                                           | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | *            | Minus                              | ***           | =                                                |                     | X =       |                     |
|                                                                           | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |              |                                    |               |                                                  |                     |           |                     |
|                                                                           | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |              |                                    |               |                                                  |                     |           |                     |
| TOTAL ADD'L FEE                                                           |                                                                                                                                                                                                                               |              |                                    |               |                                                  | TOTAL ADD'L FEE     |           |                     |

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

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

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| APPLICATION NO.                                                         | FILING DATE | FIRST NAMED INVENTOR  | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-------------------------------------------------------------------------|-------------|-----------------------|---------------------|------------------|
| 10/131,864                                                              | 04/25/2002  | William J. Crilly JR. | MN1-001US           | 8941             |
| 29150                                                                   | 7590        | 12/13/2005            | EXAMINER            |                  |
| LEE & HAYES, PLLC<br>421 W. RIVERSIDE AVE, STE 500<br>SPOKANE, WA 99201 |             |                       | ANGELO, CAROLINE J  |                  |
|                                                                         |             |                       | ART UNIT            | PAPER NUMBER     |
|                                                                         |             |                       | 2637                |                  |

DATE MAILED: 12/13/2005

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

|                              |                                                                                                         |                                           |  |
|------------------------------|---------------------------------------------------------------------------------------------------------|-------------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/131,864                                                                    | <b>Applicant(s)</b><br>CRILLY, WILLIAM J. |  |
|                              | <b>Examiner</b><br>Caroline Angelo                                                                      | <b>Art Unit</b><br>2637                   |  |
|                              | -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address -- |                                           |  |

**Period for Reply**

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

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

**Status**

1) ☒ Responsive to communication(s) filed on 25 April 2005.

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) 1-95 is/are pending in the application.

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

5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

6) ☒ Claim(s) 1-95 is/are rejected.

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

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

**Application Papers**

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

10) ☒ The drawing(s) filed on 25 April 2005 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) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)<br>2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)<br>3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____. | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____.<br>5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)<br>6) <input type="checkbox"/> Other: _____. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**DETAILED ACTION**

***Drawings***

1. The drawings filed on April 25, 2002 are accepted.

***Claim Rejections - 35 USC § 103***

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

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

3. Claims 1, 13-15, 22-25, 28, 43, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener et al. (US 6,870, 515 B2) in view of Cox et al. (US 2003/0058929 A1).
4. Regarding claim 43, Kitchener discloses a system comprising a first device operatively configured to connect to at least a second device over a wireless communication path (column 1, lines 17-21 and figure 1).
5. However, Kitchener is silent about detecting multipath delay and adjusting for the delay.
6. In the same field of endeavor, however, Cox discloses a system comprising said first device having logic that is configured to detect a multipath transmission delay in at least one reverse path data signal transmitted by said second device, determine at least one forward path pre-equalization parameter based on said detected multipath transmission delay, and pre-equalize a forward path data signal that is to be transmitted to said second device based on said at least one forward path pre-equalization

parameter (paragraph 29, equalizer parameters are developed based on time delays in a transmitted signal and applied to the equalizer).

7. It would have been obvious to one having ordinary skill in the art at the time of the invention to develop equalizer parameters based on multipath delay as taught by Cox in the system of Kitchener because Cox compensates for time delays introduced in a signal transmitted over a wireless medium.

8. As to claim 54, Kitchener is silent about a base station.

9. In the same field of endeavor, however, Cox discloses a system wherein the first device includes a base station device that is operatively configurable for use in a wireless communications system (paragraph 44 and figure 1, a base station and mobile station comprise the communications system).

10. It would have been obvious to one having ordinary skill in the art at the time of the invention to include a base station as taught by Cox in the system of Kitchener because Cox compensates for time delays introduced in a signal transmitted over a wireless medium.

11. As to claims 1 and 13, claims 1 and 13 are method claims corresponding to apparatus claim 1 and recite substantially the same limitations, and therefore are similarly analyzed as apparatus claim 1 above.

12. As to claim 14, claim 14 is a method claim corresponding to apparatus claim 54 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 54 above.

13. As to claim 15, claim 15 is a method claim corresponding to apparatus claim 57 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 57 below.

14. As to claims 22-25, claims 22-25 are method claims corresponding to apparatus claims 60-63 and recite substantially the same limitations, and therefore are similarly analyzed as apparatus claims 60-63 below.

15. As to claim 28, claim 28 is a method claim corresponding to apparatus claim 57 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 57 below.

16. Claims 2-3, 16-17, 44, 55-57, 60-62, 68, and 77-78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Fischer et al. (US 2002/0089927 A1).

17. Regarding claim 44, Kitchener is silent about a first device antenna.

18. In the same field of endeavor, however, Fischer discloses a device comprising at least one first device antenna, and at least one transceiver operatively coupled to said at least one first device antenna and said logic, said at least one transceiver being configurable to receive said reverse path data signal over at least one reverse transmission path using at least one first device antenna and provide said reverse path data signal to said logic, and transmit said modified forward path data signal from said logic over at least one forward transmission path. (paragraph 43 and figure 1, elements 103, 104, 112, and 113, the transceiver 103 is coupled to logic 112 and 113 and antenna 104 for transmitting and receiving).

19. It would have been obvious to one having ordinary skill in the art at the time of the invention to use an antenna as taught by Fischer in the system of Kitchener because Fischer implements wireless communication devices that effectively utilize the wireless medium to establish and maintain successful wireless communications for many applications.

20. As to claim 55, Kitchener discloses a system further comprising said second device, in the form of a customer premise equipment (CPE) device that is operatively configurable for use in a wireless communication system (column 11, lines 12-19 and figure 16, element 161).

21. As to claim 56, Kitchener discloses a system wherein said CPE device includes at least one device selected from a group of devices comprising a computer, a portable computer, a personal digital assistant (PDA), and a mobile communication device (column 2, lines 43-47, a PDA, mobile phone, or other device is used).

22. As to claim 57, Kitchener discloses a system wherein said first device is operatively coupled to a plurality of first device receive antennas (column 1, lines 17-20 and figure 1, elements 12 and 13, a plurality of antennas at the receiver).

23. As to claim 60, Kitchener discloses a system wherein said second device includes at least one second device antenna that is operatively configurable to transmit said reverse path data signal over said at least one reverse transmission path to said first device and receive said transmitted modified forward path data signal from said first device over said at least one forward transmission path (paragraph 43 and figure 1,

elements 103, 104, 112, and 113, a transceiver 103 is coupled to logic 112 and 113 and antenna 104 for transmitting and receiving).

24. As to claim 61, Kitchener discloses a system wherein said second device includes a plurality of second device antennas that are operatively configurable to transmit said reverse path data signal over said at least one reverse transmission path to said first device (column 1, lines 17-20 and figure 1, elements 10 and 11, a plurality or antennas at the transmitter).

25. As to claim 62, Kitchener discloses a system wherein said second device is configurable to transmit at least two reverse path data signals over said at least one reverse transmission path to said first device (column 3, lines 17-20, a plurality of beams or signals are transmitted).

26. As to claim 68, Kitchener is discloses a system wherein said at least one first device antenna includes at least one first device transmit antenna and at least one first device receive antenna (column 3, lines 37-45, a device has transmit and receive antenna elements).

27. As to claim 77, Kitchener discloses a system wherein said at least one second device antenna includes at least one second device transmit antenna and at least one second device receive antenna (column 3, lines 37-45, a device has transmit and receive antenna elements).

28. As to claim 78, Kitchener discloses a system wherein said second device includes a plurality of second device antennas that are configurable to receive said transmitted modified forward path data signal over said at least one forward

transmission path from said first device (column 3, lines 37-45, a device has a plurality of receive antenna elements).

29. As to claims 2-3, claims 2-3 are method claims corresponding to apparatus claim 44 and recite substantially the same limitations, and therefore are similarly analyzed as apparatus claim 44 above.

30. As to claims 16-17, claims 16-17 are method claims corresponding to apparatus claims 55-56 and recite substantially the same limitations, and therefore are similarly analyzed as apparatus claims 55-56 above.

31. Claims 4, 25, 45, and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Moose (US 2002/0065047 A1).

32. Regarding claim 45, Kitchener is silent about the type of reverse path data.

33. In the same field of endeavor, however, Moose discloses a system wherein said reverse path data signal includes at least one type of data selected from a group of different data types comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data (paragraph 38, OFDM data is used).

34. It would have been obvious to one having ordinary skill in the art at the time of the invention to use OFDM or QPSK data as taught by Moose in the system of Kitchener because Moose readily overcomes signal distortion.

35. As to claim 63, Kitchener is silent about multiple OFDM data signals.

36. In the same field of endeavor, however, Moose discloses a system wherein said at least two reverse path data signals include Orthogonal Frequency-Division Multiple Access (OFDMA) data (paragraph 38, OFDM data is used in multiple signals).

37. It would have been obvious to one having ordinary skill in the art at the time of the invention to use OFDMA data as taught by Moose in the system of Kitchener because Moose readily overcomes signal distortion.

38. As to claim 4, claim 4 is a method claim corresponding to apparatus claim 45 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 45 above.

39. As to claim 25, claim 25 is a method claim corresponding to apparatus claim 63 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 63 above.

40. Claims 5-6 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Gesbert et al. (US 6,377,819 B1).

41. Regarding claim 46, Kitchener is silent about the types of data included in the forward path signal.

42. In the same field of endeavor, however, Gesbert discloses a system wherein said modified forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency division Multiplexing (OFDM) data and Quadrature Phase shift Keying (QPSK) data (column 8, lines 44-47, OFDM signals are transmitted).

43. It would have been obvious to one having ordinary skill in the art at the time of the invention to use OFDM or QPSK data as taught by Gesbert in the system of Kitchener because Gesbert allows multiple users to share the same time slot, frequency slot, and code, even in the absence of accurate transmit channel knowledge.

44. As to claim 47, Kitchener is silent about including sub-carrier pre-equalized OFDM data.

45. In the same field of endeavor, however, Gesbert discloses a system wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data (column 8, lines 44-47, sub-carrier OFDM data is broadcasted).

46. It would have been obvious to one having ordinary skill in the art at the time of the invention to include sub-carrier pre-equalized OFDM data as taught by Gesbert in the system of Kitchener because Gesbert allows multiple users to share the same time slot, frequency slot, and code, even in the absence of accurate transmit channel knowledge.

47. As to claims 5-6, claims 5-6 are method claims corresponding to apparatus claims 46-47 and recite substantially the same limitations, and therefore are similarly analyzed as apparatus claims 46-47 above.

48. Claims 7 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Gesbert and further in view of Hammons, JR, et al. (US 2002/0165626 A1).

49. Regarding claim 48, Kitchener is silent about producing QPSK values.

50. In the same field of endeavor, however, Hammons discloses a system wherein said logic is further configured to produce corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data (paragraph 104, OFDM with QPSK sub-carrier modulation is utilized).

51. It would have been obvious to one having ordinary skill in the art at the time of the invention to produce QPSK modulation values as taught by Hammons in the system of Kitchener because Hammons enhances system reliability and throughput in a multiple antenna system.

52. As to claim 7, claim 7 is a method claim corresponding to apparatus claim 48 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 48 above.

53. Claims 8 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Miyashita et al. (US 6,912,247 B2).

54. Regarding claim 49, Kitchener is silent about identifying delay.

55. In the same field of endeavor, however, Miyashita discloses a system wherein said logic detects said multipath transmission delay by identifying at least one multipath transmission delay spread that is greater than a guard interval (column 7, lines 22-24).

56. It would have been obvious to one having ordinary skill in the art at the time of the invention to detect delay as taught by Miyashita in the system of Kitchener because Miyashita removes signal defects and makes it easy to maintain high quality data transmission.

57. As to claim 8, claim 8 is a method claim corresponding to apparatus claim 49 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 49 above.

58. Claims 9 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Daneshrad et al. (US 5,930,267).

59. Regarding claim 50, Kitchener is silent about the use of training data.

60. In the same field of endeavor, however, Daneshrad discloses a system wherein said reverse path data signal includes identifiable training data (column 2, lines 52-57, training data is received).

61. It would have been obvious to one having ordinary skill in the art at the time of the invention to use training data as taught by Daneshrad in the system of Kitchener because Daneshrad reduces the total amount of time require to transmit synchronization information.

62. As to claim 9, claim 9 is a method claim corresponding to apparatus claim 50 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 50 above.

63. Claims 10 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable Kitchener in view of Cox and Daneshrad and further in view of Ruether et al. (US 6,052,412).

64. Regarding claim 51, Kitchener is silent about comparing the received training data to a non-delayed version.

65. In the same field of endeavor, however, Ruether discloses a system wherein said logic is further configured to compare said received identifiable training data to a non-multipath delayed version of said training data to detect said multipath transmission delay (column 8, lines 27-33).

66. It would have been obvious to one having ordinary skill in the art at the time of the invention to compare the received training data as taught by Ruether in the system of Kitchener because Ruether is capable of supporting voice, conventional modem, and PCM modem communications.

67. As to claim 10, claim 10 is a method claim corresponding to apparatus claim 51 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 51 above.

68. Claims 11 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Rakib et al. (US 6,665,308 B1).

69. Regarding claim 52, Kitchener is silent about inverting and applying a measured channel response.

70. In the same field of endeavor, however, Rakib discloses a system wherein said logic is configured to selectively invert and apply a measured channel response to said forward path data signal to significantly reduce subsequent induced deleterious channel response changes to said modified forward path data signal during transmission over said at least one forward transmission path (column 8, lines 64-67).

71. It would have been obvious to one having ordinary skill in the art at the time of the invention to invert and apply a channel response as taught by Rakib in the system of Kitchener because Rakib predistorts the transmitted signal so that it arrives undistorted.

72. As to claim 11, claim 11 is a method claim corresponding to apparatus claim 52 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 52 above.

73. Claims 12, 53, and 67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Jensen et al. (US 5,648,955).

74. Regarding claim 53, Kitchener is silent about the reverse and forward transmission paths being reciprocal.

75. In the same field of endeavor, however, Jensen discloses a system wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path (column 11, lines 28-40, paths between the base station and user station are reciprocal).

76. It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize reciprocal paths as taught by Jensen in the system of Kitchener because Jensen provides a simple and flexible over-air protocol for use with a mobile telephone system.

77. Regarding claim 67, Kitchener is silent about providing spatial division transmission.

78. In the same field of endeavor, however, Jensen discloses a system wherein said at least one first device antenna is operatively configurable to provide spatial division transmission when transmitting said modified forward path data signal column 11, lines 34-40, spatial diversity antennas are used at the base station).

79. It would have been obvious to one having ordinary skill in the art at the time of the invention to provide spatial division transmission as taught by Jensen in the system of Kitchener because Jensen provides a simple and flexible over-air protocol for use with a mobile telephone system.

80. As to claim 12, claim 12 is a method claim corresponding to apparatus claim 53 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 53 above.

81. Claim 58 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of McGibney (US 6,741,643 B1).

82. Regarding claim 58, Kitchener is silent about post-equalization.

83. In the same field of endeavor, however, McGibney discloses a system wherein said logic is configured to post-equalize at least a portion of said received reverse path signal (abstract, post-equalization is used).

84. It would have been obvious to one having ordinary skill in the art at the time of the invention to post-equalize the reverse path signal as taught by McGibney in the system of Kitchener because McGibney reduces the effects of frequency selective multipath fading.

85. Claims 59, 69, 70 and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Proctor, JR. et al. (US 2005/0143132 A1).

86. Regarding claim 59, Kitchener is silent about determining the angle of arrival.

87. In the same field of endeavor, however, Proctor discloses a system wherein said logic is further configured to determine at least one angle of arrival of said reverse path data signal with respect to said at least one first device antenna (paragraph 69, an angle of arrival calculation is performed).

88. It would have been obvious to one having ordinary skill in the art at the time of the invention to determine the angle of arrival as taught by Proctor in the system of Kitchener because Proctor provides an inexpensive antenna apparatus for use with a mobile subscriber unit.

89. As to claim 69, Kitchener is silent about the type of transmit antenna used.

90. In the same field of endeavor, however, Proctor discloses a system wherein said at least one first device transmit antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, and at least one adaptive antenna (paragraphs 1, 4, 5, and 19, adaptive, omnidirectional, and beam antennas are used).

91. It would have been obvious to one having ordinary skill in the art at the time of the invention to use the type of antenna taught by Proctor in the system of Kitchener because Proctor provides an inexpensive antenna apparatus for use with a mobile subscriber unit.

92. As to claim 70, Kitchener is silent about the type of receive antenna used.

93. In the same field of endeavor, however, Proctor discloses a system wherein said at least one first device receive antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, and at least one adaptive antenna (paragraphs 1, 4, 5, and 19, adaptive, omnidirectional, and beam antennas are used).

94. It would have been obvious to one having ordinary skill in the art at the time of the invention to use the type of antenna taught by Proctor in the system of Kitchener because Procotor provides an inexpensive antenna apparatus for use with a mobile subscriber unit.

95. Regarding claim 73, Kitchener is silent about selecting the angle of transmission.

96. In the same field of endeavor, however, Procotor discloses a system wherein said logic is further configurable to cause said at least one transceiver to selectively transmit said modified forward path data signal at one angle with respect to said at least one first device transmit antenna (paragraph 17, the transmit antenna angle is selected based on scanning data).

97. It would have been obvious to one having ordinary skill in the art at the time of the invention to select the angle of transmission as taught by Proctor in the system of Kitchener because Procotor provides an inexpensive antenna apparatus for use with a mobile subscriber unit.

98. Claim 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Hammons.

99. Regarding claim 64, Kitchener is silent about the bit rate of transmission.

100. In the same field of endeavor, however, Hammons discloses a system wherein said second device is configurable to transmit said reverse path data signal over said at least one reverse transmission path to said first device at a bit rate less than about 6 Mbps (paragraph 87, transmit antennas transmit at a rate of 1 bps).

101. It would have been obvious to one having ordinary skill in the art at the time of the invention to transmit at less than 6 Mbps as taught by Hammons in the system of Kitchener because Hammons enhances system reliability and throughput in a multiple antenna system.

102. Claims 65-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Hadad (US 2005/0207334 A1).

103. Regarding claim 65, Kitchener is silent about transmitting power level information for adjusting the power level.

104. In the same field of endeavor, however, Hadad discloses a system wherein said second device is configurable to transmit corresponding second device transmission power level information to said first device, and said first device is further configurable to adjust at least one transmission power level associated with said forward path data signal based on said second device transmission power level information paragraph 264, the Subscriber Unit sends power adjustment values to the base station, which makes power adjustments based on the received values).

105. It would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the power level as taught by Hadad in the system of Kitchener because Haded provides superior performance achieved at lower phase noise.

106. As to claim 66, Kitchener is silent about providing transmission diversity.

107. In the same field of endeavor, however, Hadad discloses a system wherein said at least one first device antenna is operatively configurable to provide transmission diversity when transmitting said modified forward path data signal (paragraph 41).

108. It would have been obvious to one having ordinary skill in the art at the time of the invention to provide transmission diversity as taught by Hadad in the system of Kitchener because Haded provides superior performance achieved at lower phase noise.

109. Claim 71 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Kelly et al. (US 2002/0009058 A1).

110. Regarding claim 71, Kitchener is silent about establishing an antenna pointing parameter.

111. In the same field of endeavor, however, Kelly discloses a system wherein said logic is further configured to establish at least one antenna pointing parameter associated with said at least one first device transmit antenna based on said at least one forward path pre-equalization parameter (paragraph 212, an antenna pointing parameter is established based on configuration parameters).

112. It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize a pointing parameter as taught by Kelly in the system of Kitchener because Kelly provides an improved approach for providing access to the Internet over a satellite communication system.

113. Claim 72 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Dixon (US 6,023,242).

114. Regarding claim 72, Kitchener is silent about an antenna directing parameter.

115. In the same field of endeavor, however, Dixon discloses a system wherein said logic is further configured to establish at least one phased array antenna transmission directing parameter associated with said at least one first device transmit antenna based on said at least one forward path pre-equalization parameter (column 25, lines 21-34, phased array antenna steering parameters direct the antenna to the desired position).

116. It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize an antenna directing parameter as taught by Dixon in the system of Kitchener because Dixon facilitates communication between a person located in a remote area and a head office.

117. Claims 74-76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and Fischer and further in view of Win et al. (US 6,804,312 B1).

118. Regarding claim 74, Kitchener is silent about selecting a transmit antenna.

119. In the same field of endeavor, however, Win discloses a system wherein said logic is further configurable to cause said at least one transceiver to select said at least one first device transmit antenna from a plurality of first device transmit antennas that are each operatively coupled to said first device (column 8, lines 38-43, a subset of antennas is selected from a plurality of transmit antennas).

120. It would have been obvious to one having ordinary skill in the art at the time of the invention to select an antenna or antennas as taught by Win in the system of Kitchener because Win provides an advantageous signal-to-noise ratio.

121. As to claim 75, Kitchener discloses a system wherein said logic is further configurable to cause said at least one transceiver to selectively transmit a plurality of beams using two or more first device transmit antennas (column 3, lines 17-20, a plurality of beams or signals are selected and transmitted).

122. As to claim 76, Kitchener is silent about adjusting the phase and amplitude of transmitted beams.

123. In the same field of endeavor, however, Win discloses a system wherein each of said transmitted plurality of beams is selectively adjusted in phase and amplitude to reduce multipath effects when received by said second device (column 8, lines 61-67).

124. It would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the phase and amplitude of transmitted beams as taught by Win in the system of Kitchener because Win provides an advantageous signal-to-noise ratio.

125. Claims 40 and 79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Liang et al. (US 6,314,147 B1).

126. Regarding claim 79, Kitchener is silent about testing the pre-equalization parameters.

127. In the same field of endeavor, however, Liang discloses a system wherein said logic is further configurable to iteratively selectively test different forward path pre-equalization parameters over time such that aliased multipath delays within said reverse path data signal are identifiable (column 10, lines 36-38, testing for multipath delay is performed).

128. It would have been obvious to one having ordinary skill in the art at the time of the invention to selectively test the pre-equalization parameters as taught by Liang in the system of Kitchener because Liang provides improved symbol estimation in the presence of Cci, ISI, and noise.

129. As to claim 40, claim 40 is a method claim corresponding to apparatus claim 79 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 79 above.

130. Claims 41 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Laroche (US 6,868,377 B1).

131. Regarding claim 80, Kitchener is silent about sub-band equalizing the forward path signal.

132. In the same field of endeavor, however, Laroche discloses a system wherein said logic is configured to provide sub-band equalizing of said forward path data signal using corresponding frequency domain reverse path data (column 3, lines 23-26).

133. It would have been obvious to one having ordinary skill in the art at the time of the invention to sub-band equalize as taught by Laroche in the system of Kitchener because Laroche inexpensively and efficiently processes audio and speech signals.

134. As to claim 41, claim 41 is a method claim corresponding to apparatus claim 80 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 80 above.

135. Claims 42 and 81 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Fujii et al. (US 2002/0191540 A1).

136. Regarding claim 81, Kitchener is silent about establishing different transmission power levels.

137. In the same field of endeavor, however, Fujii discloses a system wherein said logic is further configurable to cause said transceiver to selectively establish different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal based on said at least one forward path pre-equalization parameter (paragraph 57, and equalization coefficient or parameter is used to adjust the power control for OFDM tones).

138. It would have been obvious to one having ordinary skill in the art at the time of the invention to establish different power levels as taught by Fujii in the system of Kitchener because Fujii efficiently performs communications between nodes by using a transmission medium that the communication qualities change.

139. As to claim 42, claim 42 is a method claim corresponding to apparatus claim 81 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 81 above.

140. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of McGibney.

141. Regarding claim 20, claim 20 is a method claim corresponding to apparatus claim 58 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 58 above.

142. Claims 18, 21, 31, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Proctor.

143. Regarding claim 18, claim 18 is a method claim corresponding to apparatus claim 70 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 70 above.

144. Regarding claim 21, claim 21 is a method claim corresponding to apparatus claim 59 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 59 above.

145. Regarding claim 31, claim 31 is a method claim corresponding to apparatus claim 69 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 69 above.

146. Regarding claim 34, claim 34 is a method claim corresponding to apparatus claim 73 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 73 above.

147. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Hammons.

148. Regarding claim 26, claim 26 is a method claim corresponding to apparatus claim 64 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 64 above.

149. Claims 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Haded.

150. Regarding claim 27, claim 27 is a method claim corresponding to apparatus claim 65 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 65 above.

151. Regarding claim 29, claim 29 is a method claim corresponding to apparatus claim 66 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 66 above.

152. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Jensen.

153. Regarding claim 30, claim 30 is a method claim corresponding to apparatus claim 67 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 67 above.

154. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Kelly.

155. Regarding claim 32, claim 32 is a method claim corresponding to apparatus claim 71 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 71 above.

156. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Dixon.

157. Regarding claim 33, claim 33 is a method claim corresponding to apparatus claim 72 and recites substantially the same limitations, and therefore is similarly analyzed as apparatus claim 72 above.

158. Claims 35-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitchener in view of Cox and further in view of Win.

159. Regarding claims 35-39, claims 35-39 are method claims corresponding to apparatus claims 74-76 and recite substantially the same limitations, and therefore are similarly analyzed as apparatus claims 74-78 above.

160. Claim 82 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris et al. (US 2002/0085118 A1) in view of Oler et al. (US 6,031,866).

161. Regarding claim 82, Harris discloses an apparatus comprising:

an Orthogonal Frequency division Multiplexing (OFDM) processor configured to receive coded data and output corresponding OFDM data (paragraph 28, received data is decoded, and paragraph 18, OFDM data is transmitted);

a pre-equalizer operatively coupled to said OFDM processor and configured to receive said OFDM data and output pre-equalized OFDM data based on gathered reverse link data (paragraph 18, the OFDM signal is pre-equalized at the transmitter);

162. However, Harris is silent about the presence of an antenna.

163. In the same field of endeavor, however, Oler discloses an apparatus comprising:

at least one antenna (figure 1, element 20); and

a transceiver operatively coupled to said pre-equalizer and said at least one antenna, said transceiver being configured to receive said pre-equalized OFDM data from said pre-equalizer and apply a corresponding transmittable forward link data signal to said at least one antenna (figure 1, elements 10, 16, and 20 and column 5, lines 12-32).

164. It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize an antenna as taught by Oler in the apparatus of Harris because Oler minimizes the overall complexity of equalization.

165. Claims 83 and 90 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Cox.

166. Regarding claim 83, Harris is silent about detecting delay.

167. In the same field of endeavor, however, Cox discloses an apparatus wherein said transceiver is configurable to receive a transmitted reverse link data signal using said at least one antenna and output corresponding reverse link data, and further comprising:

reverse link logic operatively coupled to said at least one antenna and said operatively coupled to at least one first device antenna, said reverse link logic being configured to detect at least one multipath induced delay in said reverse link data and provide associated said gathered reverse link data to said pre-equalizer (paragraph 29,

signal characteristics such as delay are determined and sent to a stage prior to equalization where parameters are developed based on the characteristics).

168. It would have been obvious to one having ordinary skill in the art at the time of the invention to apply delays to a pre-equalizer as taught by Cox in the system of Harris because Cox compensates for time delays introduced in a signal transmitted over a wireless medium.

169. As to claim 90, claim 90 recites substantially the same limitations as claim 54, and therefore is similarly analyzed as claim 54 above.

170. Claim 84 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Gesbert.

171. Regarding claim 84, claim 84 recites substantially the same limitations as claim 47, and therefore is similarly analyzed as claim 47 above.

172. Claim 85 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Miyashita.

173. Regarding claim 85, claim 85 recites substantially the same limitations as claim 49, and therefore is similarly analyzed as claim 49 above.

174. Claim 86 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Daneshrad.

175. Regarding claim 86, claim 86 recites substantially the same limitations as claim 50, and therefore is similarly analyzed as claim 50 above.

176. Claim 87 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and Daneshrad and further in view of Ruether.

177. Regarding claim 87, claim 87 recites substantially the same limitations as claim 51, and therefore is similarly analyzed as claim 51 above.

178. Claim 88 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Rakib.

179. Regarding claim 88, claim 88 recites substantially the same limitations as claim 52, and therefore is similarly analyzed as claim 52 above.

180. Claims 89 and 92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Jensen.

181. Regarding claim 89, claim 89 recites substantially the same limitations as claim 53, and therefore is similarly analyzed as claim 53 above.

182. As to claim 92, claim 92 recites substantially the same limitations as claim 67, and therefore is similarly analyzed as claim 67 above.

183. Claim 91 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Haded.

184. Regarding claim 91, claim 91 recites substantially the same limitations as claim 66, and therefore is similarly analyzed as claim 66 above.

185. Claim 93 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Kitchener.

186. Regarding claim 93, claim 93 recites substantially the same limitations as claim 68, and therefore is similarly analyzed as claim 68 above.

187. Claims 94 and 95 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harris in view of Oler and further in view of Proctor.

188. Regarding claims 94-95, claims 94-95 recite substantially the same limitations as claims 69-70, and therefore are similarly analyzed as claims 69-70 above.

***Other Prior Art Cited***

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

190. Mosebrook et al. (US 5,848,054) discloses a system providing spatial division transmission.

191. Sevaston (US 6,567,040 B1) discloses a system having a phased array antenna transmission directing parameter.

192. Agee et al. (US 2004/0095907 A1) discloses a system which selects a transmit antenna from a plurality of antennas and selectively adjusts a transmitted plurality of beams in phase and amplitude.

193. Schultz (US 6,611,511 B1) discloses a system comprising a phased array type antenna.

194. Kohno et al. (US 6,763,062 B1) discloses a system that selectively adjusts a transmitted plurality of beams in phase and amplitude.

195. Chen et al. (US 2004/0184521 A1) discloses a system wherein received training data is compared to non-delayed training data.

***Contact Information***

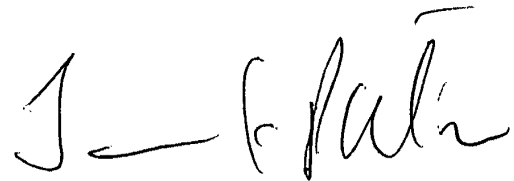
196. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caroline Angelo whose telephone number is 571-272-

8730. The examiner can normally be reached on 8 am - 4:30 pm Monday through Friday.

197. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

198. 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).

CJA

A handwritten signature in black ink, appearing to read "Jay K. Patel". The signature is fluid and cursive, with a horizontal line extending from the "J" and a stylized "Patel" following.

**JAY K. PATEL**  
**SUPERVISORY PATENT EXAMINER**

|                                   |                                       |                                                                  |             |
|-----------------------------------|---------------------------------------|------------------------------------------------------------------|-------------|
| <b>Notice of References Cited</b> | Application/Control No.<br>10/131,864 | Applicant(s)/Patent Under<br>Reexamination<br>CRILLY, WILLIAM J. |             |
|                                   | Examiner<br>Caroline Angelo           | Art Unit<br>2637                                                 | Page 1 of 3 |

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| * | B | US-6,870,515 B2                                  | 03-2005         | Kitchener et al. | 343/853        |
| * | C | US-2002/0089927 A1                               | 07-2002         | Fischer et al.   | 370/229        |
| * | D | US-2002/0065047 A1                               | 05-2002         | Moose, Paul H.   | 455/63         |
| * | E | US-6,377,819 B1                                  | 04-2002         | Gesbert et al.   | 455/562.1      |
| * | F | US-2002/0165626 A1                               | 11-2002         | Hammons et al.   | 700/53         |
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| * | H | US-5,930,267                                     | 07-1999         | Daneshrad et al. | 370/509        |
| * | I | US-6,052,412                                     | 04-2000         | Ruether et al.   | 375/231        |
| * | J | US-6,665,308 B1                                  | 12-2003         | Rakib et al.     | 370/441        |
| * | K | US-5,648,955                                     | 07-1997         | Jensen et al.    | 370/252        |
| * | L | US-6,741,643 B1                                  | 05-2004         | McGibney, Grant  | 375/229        |
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|   | O |                                                  |                 |         |      |                |
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|   | T |                                                  |                 |         |      |                |

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|   | V |                                                                                           |
|   | W |                                                                                           |
|   | X |                                                                                           |

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

|                                   |                                       |                                                                  |             |
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| <b>Notice of References Cited</b> | Application/Control No.<br>10/131,864 | Applicant(s)/Patent Under<br>Reexamination<br>CRILLY, WILLIAM J. |             |
|                                   | Examiner<br>Caroline Angelo           | Art Unit<br>2637                                                 | Page 2 of 3 |

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| * | B | US-2002/0009058 A1                               | 01-2002         | Kelly et al.           | 370/316        |
| * | C | US-6,023,242                                     | 02-2000         | Dixon, Charles Stephen | 342/359        |
| * | D | US-6,804,312 B1                                  | 10-2004         | Win et al.             | 375/347        |
| * | E | US-6,314,147 B1                                  | 11-2001         | Liang et al.           | 375/346        |
| * | F | US-6,868,377 B1                                  | 03-2005         | Laroche, Jean          | 704/205        |
| * | G | US-2002/0191540 A1                               | 12-2002         | Fujii et al.           | 370/229        |
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NON-PATENT DOCUMENTS

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| <div>Index of Claims</div> <div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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| <table><tr><th colspan="2">Claim</th><th 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|          |         |  |                                                                            |  |                                                               |  |                                                              |  | Claim |  | Date                                                |  |  |  |  |  | Final | Original | 12/7/05 |  |  |  |  |  |  |  |  | 1 | √ |  |  |  |  |  |  |  |  | 2 | √ |  |  |  |  |  |  |  |  | 3 | √ |  |  |  |  |  |  |  |  | 4 | √ |  |  |  |  |  |  |  |  | 5 | √ |  |  |  |  |  |  |  |  | 6 | √ |  |  |  |  |  |  |  |  | 7 | √ |  |  |  |  |  |  |  |  | 8 | √ |  |  |  |  |  |  |  |  | 9 | √ |  |  |  |  |  |  |  |  | 10 | √ |  |  |  |  |  |  |  |  | 11 | √ |  |  |  |  |  |  |  |  | 12 | √ |  |  |  |  |  |  |  |  | 13 | √ |  |  |  |  |  |  |  |  | 14 | √ |  |  |  |  |  |  |  |  | 15 | √ |  |  |  |  |  |  |  |  | 16 | √ |  |  |  |  |  |  |  |  | 17 | √ |  |  |  |  |  |  |  |  | 18 | √ |  |  |  |  |  |  |  |  | 19 | √ |  |  |  |  |  |  |  |  | 20 | √ |  |  |  |  |  |  |  |  | 21 | √ |  |  |  |  |  |  |  |  | 22 | √ |  |  |  |  |  |  |  |  | 23 | √ |  |  |  |  |  |  |  |  | 24 | √ |  |  |  |  |  |  |  |  | 25 | √ |  |  |  |  |  |  |  |  | 26 | √ |  |  |  |  |  |  |  |  | 27 | √ |  |  |  |  |  |  |  |  | 28 | √ |  |  |  |  |  |  |  |  | 29 | √ |  |  |  |  |  |  |  |  | 30 | √ |  |  |  |  |  |  |  |  | 31 | √ |  |  |  |  |  |  |  |  | 32 | √ |  |  |  |  |  |  |  |  | 33 | √ |  |  |  |  |  |  |  |  | 34 | √ |  |  |  |  |  |  |  |  | 35 | √ |  |  |  |  |  |  |  |  | 36 | √ |  |  |  |  |  |  |  |  | 37 | √ |  |  |  |  |  |  |  |  | 38 | √ |  |  |  |  |  |  |  |  | 39 | √ |  |  |  |  |  |  |  |  | 40 | √ |  |  |  |  |  |  |  |  | 41 | √ |  |  |  |  |  |  |  |  | 42 | √ |  |  |  |  |  |  |  |  | 43 | √ |  |  |  |  |  |  |  |  | 44 | √ |  |  |  |  |  |  |  |  | 45 | √ |  |  |  |  |  |  |  |  | 46 | √ |  |  |  |  |  |  |  |  | 47 | √ |  |  |  |  |  |  |  |  | 48 | √ |  |  |  |  |  |  |  |  | 49 | √ |  |  |  |  |  |  |  |  | 50 | √ |  |  |  |  |  |  |  | <table><tr><th colspan="2">Claim</th><th colspan="6">Date</th></tr><tr><th>Final</th><th>Original</th><th>12/7/05</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></tr><tr><td></td><td>51</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>52</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>53</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>54</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>55</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>56</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>57</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>58</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>59</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>60</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>61</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>62</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>63</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>64</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>65</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>66</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>67</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>68</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>69</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>70</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>71</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>72</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>73</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>74</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>75</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>76</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>77</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>78</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>79</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>80</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>81</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>82</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>83</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>84</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>85</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>86</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>87</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>88</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>89</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>90</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>91</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>92</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>93</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>94</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>95</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>96</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>97</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>98</td><td></td><td></td><td></td><td></td><td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|  |  |  |  |  |  |  |  |  | Claim |  | Date |  |  |  |  |  | Final | Original | 12/7/05 |  |  |  |  |  |  |  |  | 51 | √ |  |  |  |  |  |  |  |  | 52 | √ |  |  |  |  |  |  |  |  | 53 | √ |  |  |  |  |  |  |  |  | 54 | √ |  |  |  |  |  |  |  |  | 55 | √ |  |  |  |  |  |  |  |  | 56 | √ |  |  |  |  |  |  |  |  | 57 | √ |  |  |  |  |  |  |  |  | 58 | √ |  |  |  |  |  |  |  |  | 59 | √ |  |  |  |  |  |  |  |  | 60 | √ |  |  |  |  |  |  |  |  | 61 | √ |  |  |  |  |  |  |  |  | 62 | √ |  |  |  |  |  |  |  |  | 63 | √ |  |  |  |  |  |  |  |  | 64 | √ |  |  |  |  |  |  |  |  | 65 | √ |  |  |  |  |  |  |  |  | 66 | √ |  |  |  |  |  |  |  |  | 67 | √ |  |  |  |  |  |  |  |  | 68 | √ |  |  |  |  |  |  |  |  | 69 | √ |  |  |  |  |  |  |  |  | 70 | √ |  |  |  |  |  |  |  |  | 71 | √ |  |  |  |  |  |  |  |  | 72 | √ |  |  |  |  |  |  |  |  | 73 | √ |  |  |  |  |  |  |  |  | 74 | √ |  |  |  |  |  |  |  |  | 75 | √ |  |  |  |  |  |  |  |  | 76 | √ |  |  |  |  |  |  |  |  | 77 | √ |  |  |  |  |  |  |  |  | 78 | √ |  |  |  |  |  |  |  |  | 79 | √ |  |  |  |  |  |  |  |  | 80 | √ |  |  |  |  |  |  |  |  | 81 | √ |  |  |  |  |  |  |  |  | 82 | √ |  |  |  |  |  |  |  |  | 83 | √ |  |  |  |  |  |  |  |  | 84 | √ |  |  |  |  |  |  |  |  | 85 | √ |  |  |  |  |  |  |  |  | 86 | √ |  |  |  |  |  |  |  |  | 87 | √ |  |  |  |  |  |  |  |  | 88 | √ |  |  |  |  |  |  |  |  | 89 | √ |  |  |  |  |  |  |  |  | 90 | √ |  |  |  |  |  |  |  |  | 91 | √ |  |  |  |  |  |  |  |  | 92 | √ |  |  |  |  |  |  |  |  | 93 | √ |  |  |  |  |  |  |  |  | 94 | √ |  |  |  |  |  |  |  |  | 95 | √ |  |  |  |  |  |  |  |  | 96 |  |  |  |  |  |  |  |  |  | 97 |  |  |  |  |  |  |  |  |  | 98 |  |  |  |  |  |  |  |  |  | 99 |  |  |  |  |  |  |  |  |  | 100 |  |  |  |  |  |  |  |  | <table><tr><th colspan="2">Claim</th><th 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|  |  |  |  |  |  |  |  |  | Claim |  | Date |  |  |  |  |  | Final | Original |  |  |  |  |  |  |  |  |  | 101 |  |  |  |  |  |  |  |  |  | 102 |  |  |  |  |  |  |  |  |  | 103 |  |  |  |  |  |  |  |  |  | 104 |  |  |  |  |  |  |  |  |  | 105 |  |  |  |  |  |  |  |  |  | 106 |  |  |  |  |  |  |  |  |  | 107 |  |  |  |  |  |  |  |  |  | 108 |  |  |  |  |  |  |  |  |  | 109 |  |  |  |  |  |  |  |  |  | 110 |  |  |  |  |  |  |  |  |  | 111 |  |  |  |  |  |  |  |  |  | 112 |  |  |  |  |  |  |  |  |  | 113 |  |  |  |  |  |  |  |  |  | 114 |  |  |  |  |  |  |  |  |  | 115 |  |  |  |  |  |  |  |  |  | 116 |  |  |  |  |  |  |  |  |  | 117 |  |  |  |  |  |  |  |  |  | 118 |  |  |  |  |  |  |  |  |  | 119 |  |  |  |  |  |  |  |  |  | 120 |  |  |  |  |  |  |  |  |  | 121 |  |  |  |  |  |  |  |  |  | 122 |  |  |  |  |  |  |  |  |  | 123 |  |  |  |  |  |  |  |  |  | 124 |  |  |  |  |  |  |  |  |  | 125 |  |  |  |  |  |  |  |  |  | 126 |  |  |  |  |  |  |  |  |  | 127 |  |  |  |  |  |  |  |  |  | 128 |  |  |  |  |  |  |  |  |  | 129 |  |  |  |  |  |  |  |  |  | 130 |  |  |  |  |  |  |  |  |  | 131 |  |  |  |  |  |  |  |  |  | 132 |  |  |  |  |  |  |  |  |  | 133 |  |  |  |  |  |  |  |  |  | 134 |  |  |  |  |  |  |  |  |  | 135 |  |  |  |  |  |  |  |  |  | 136 |  |  |  |  |  |  |  |  |  | 137 |  |  |  |  |  |  |  |  |  | 138 |  |  |  |  |  |  |  |  |  | 139 |  |  |  |  |  |  |  |  |  | 140 |  |  |  |  |  |  |  |  |  | 141 |  |  |  |  |  |  |  |  |  | 142 |  |  |  |  |  |  |  |  |  | 143 |  |  |  |  |  |  |  |  |  | 144 |  |  |  |  |  |  |  |  |  | 145 |  |  |  |  |  |  |  |  |  | 146 |  |  |  |  |  |  |  |  |  | 147 |  |  |  |  |  |  |  |  |  | 148 |  |  |  |  |  |  |  |  |  | 149 |  |  |  |  |  |  |  |  |  | 150 |  |  |  |  |  |  |  |  |
| Claim                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| SERIAL NUMBER<br>10/131,864                                                                                                                                                                                                                                                                                                  | FILING DATE<br>04/25/2002<br><br>RULE                                                                             | CLASS<br>375              | GROUP ART UNIT<br>2637                                                                                                                                                                                                                       | ATTORNEY<br>DOCKET NO.<br>MN1-001US |
| <b>APPLICANTS</b><br>William J. Crilly JR., Liberty Lake, WA; ✓                                                                                                                                                                                                                                                              |                                                                                                                   |                           |                                                                                                                                                                                                                                              |                                     |
| <b>** CONTINUING DATA *****</b><br>This appln claims benefit of 60/287,163 04/27/2001 ✓                                                                                                                                                                                                                                      |                                                                                                                   |                           |                                                                                                                                                                                                                                              |                                     |
| <b>** FOREIGN APPLICATIONS *****</b> ✓                                                                                                                                                                                                                                                                                       |                                                                                                                   |                           |                                                                                                                                                                                                                                              |                                     |
| <b>IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **</b> ✓<br>** 06/12/2002                                                                                                                                                                                                                                     |                                                                                                                   |                           |                                                                                                                                                                                                                                              |                                     |
| Foreign Priority claimed <input type="checkbox"/> yes <input checked="" type="checkbox"/> no<br>35 USC 119 (a-d) conditions <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after<br>met Allowance<br>Verified and Acknowledged <i>[Signature]</i> CA<br>Examiner's Signature Initials |                                                                                                                   | STATE OR<br>COUNTRY<br>WA | SHEETS<br>DRAWING<br>5                                                                                                                                                                                                                       | TOTAL<br>CLAIMS<br>95               |
|                                                                                                                                                                                                                                                                                                                              |                                                                                                                   |                           | INDEPENDENT<br>CLAIMS<br>3                                                                                                                                                                                                                   |                                     |
| <b>ADDRESS</b><br>29150<br>LEE & HAYES, PLLC<br>421 W. RIVERSIDE AVE, STE 500<br>SPOKANE, WA<br>99201                                                                                                                                                                                                                        |                                                                                                                   |                           |                                                                                                                                                                                                                                              |                                     |
| <b>TITLE</b><br>Multipath communication methods and apparatuses                                                                                                                                                                                                                                                              |                                                                                                                   |                           |                                                                                                                                                                                                                                              |                                     |
| FILING FEE<br><br>RECEIVED<br>1045                                                                                                                                                                                                                                                                                           | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: |                           | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees ( Filing )<br><input type="checkbox"/> 1.17 Fees ( Processing Ext. of time )<br><input type="checkbox"/> 1.18 Fees ( Issue )<br><input type="checkbox"/> Other _____ |                                     |

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|----------------------------------------------------------------------------------------------------------|--------------------------------|--|------------------------------------------------|--|
| <b>Search Notes</b><br> | <b>Application/Control No.</b> |  | <b>Applicant(s)/Patent under Reexamination</b> |  |
|                                                                                                          | 10/131,864                     |  | CRILLY, WILLIAM J.                             |  |
|                                                                                                          | <b>Examiner</b>                |  | <b>Art Unit</b>                                |  |
|                                                                                                          | Caroline Angelo                |  | 2637                                           |  |

| SEARCHED |          |           |          |
|----------|----------|-----------|----------|
| Class    | Subclass | Date      | Examiner |
| 375      | 267      | 12/7/2005 | CA       |
| 375      | 279      | 12/7/2005 | CA       |
| 375      | 147      | 12/7/2005 | CA       |
| 375      | 150      | 12/7/2005 | CA       |
| 375      | 220      | 12/7/2005 | CA       |
| 375      | 228      | 12/7/2005 | CA       |
| 375      | 229      | 12/7/2005 | CA       |
| 375      | 231      | 12/7/2005 | CA       |
| 375      | 346      | 12/7/2005 | CA       |
| 375      | 347      | 12/7/2005 | CA       |
| 370      | 203      | 12/7/2005 | CA       |
| 370      | 226      | 12/7/2005 | CA       |
| 370      | 229      | 12/7/2005 | CA       |
| 370      | 252      | 12/7/2005 | CA       |

| INTERFERENCE SEARCHED |          |      |          |
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| Class                 | Subclass | Date | Examiner |
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| SEARCH NOTES<br>(INCLUDING SEARCH STRATEGY) |           |      |
|---------------------------------------------|-----------|------|
|                                             | DATE      | EXMR |
| inventor search                             | 12/7/2005 | CA   |
| EAST                                        | 12/7/2005 | CA   |
| NPL                                         | 12/7/2005 | CA   |
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| Ref # | Hits   | Search Query                                                                                             | DBs                                                               | Default Operator | Plurals | Time Stamp       |
|-------|--------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------|---------|------------------|
| S1    | 2      | multi\$path and delay and (reverse adj path) and (forward adj path) and (pre\$equaliz\$5 same parameter) | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2005/11/30 16:11 |
| S6    | 6      | multi\$path and delay and (reverse adj path) and (forward adj path) and (\$3equaliz\$5 same parameter)   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2005/11/30 16:27 |
| S7    | 25169  | multi\$path                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2005/11/30 16:28 |
| S8    | 821464 | delay                                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2005/11/30 16:28 |
| S9    | 4315   | (reverse adj path)                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2005/11/30 16:30 |
| S10   | 9      | S7 same S8 same S9                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2005/11/30 16:44 |
| S11   | 130    | S7 and (S8 same (\$3equaliz\$5 with (parameter or factor)))                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2005/11/30 16:46 |
| S12   | 2      | ("2003/0058929").URPN.                                                                                   | USPAT                                                             | OR               | ON      | 2005/11/30 18:24 |
| S13   | 8      | (wireless adj communication adj path) and (first adj device) and (second adj device)                     | USPAT                                                             | OR               | ON      | 2005/11/30 18:29 |
| S14   | 531    | guard adj interval                                                                                       | USPAT                                                             | OR               | ON      | 2005/11/30 18:29 |
| S15   | 0      | elay with S14                                                                                            | USPAT                                                             | OR               | ON      | 2005/11/30 18:29 |
| S16   | 88     | delay with S14                                                                                           | USPAT                                                             | OR               | ON      | 2005/11/30 18:30 |

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|     |      |                                                                                                        |                                                                   |    |    |                  |
|-----|------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S17 | 59   | S16 and multipath                                                                                      | USPAT                                                             | OR | ON | 2005/11/30 18:30 |
| S18 | 2125 | (first adj (device or transceiver)) and antenna and transceiver                                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 10:24 |
| S19 | 367  | (first adj (device or transceiver)) and antenna and transceiver and multipath                          | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 10:56 |
| S20 | 73   | (first adj (device)) and (second adj device) and antenna and transceiver and multipath                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 12:49 |
| S21 | 485  | ((two-way or bidirectional) adj communication) and antenna and transceiver and multipath               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 12:50 |
| S22 | 308  | ((two-way or bidirectional) adj communication) and (antenna same transceiver) and multipath            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 12:51 |
| S23 | 229  | ((two-way or bidirectional) adj communication) and (antenna with transceiver) and multipath            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 12:51 |
| S24 | 5    | ((two-way or bidirectional) adj communication) and (antenna with transceiver with logic) and multipath | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 12:55 |
| S25 | 0    | (transceiver with (ofdm) with subcarrier ) same as equalizer                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 12:56 |

|     |        |                                                                 |                                                                   |    |    |                  |
|-----|--------|-----------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S26 | 0      | (transceiver with (ofdm) with sub\$carrier ) same \$3equaliz\$5 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 12:57 |
| S27 | 27     | (transceiver same (ofdm) same sub\$carrier ) and \$3equaliz\$5  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 15:53 |
| S28 | 5427   | received with training                                          | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 15:53 |
| S29 | 302    | received with (training adj data)                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 15:54 |
| S30 | 0      | S29 and mutlipath                                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 15:54 |
| S31 | 49     | S29 and multipath                                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 15:54 |
| S32 | 2      | "5930267".pn.                                                   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/01 17:05 |
| S33 | 105786 | wireless adj communication                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/02 10:35 |

|     |        |                                                                                                  |                                                                   |    |    |                  |
|-----|--------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S34 | 13035  | cpe or (customer adj premise adj equipment)                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/02 10:41 |
| S35 | 802    | S33 and S34                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/02 10:41 |
| S36 | 108210 | antenna with ((transmit\$3 or transmission) and (receiv\$3 or reception))                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/02 10:44 |
| S37 | 255    | S35 and S36                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/02 10:43 |
| S38 | 7661   | antenna with ((transmit\$3 or transmission) and (receiv\$3 or reception)) with plurality         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/02 10:44 |
| S39 | 30     | S35 and S38                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/02 10:44 |
| S40 | 6      | ("5691727"   "6067053"   "6144711"   "6211841"   "6317098"   "6697643").PN. OR ("6870515").URPN. | US-PGPUB;<br>USPAT;<br>USOCR                                      | OR | ON | 2005/12/02 13:57 |
| S41 | 8656   | (select\$3 or choos\$3) with antenna with transmi\$5                                             | US-PGPUB;<br>USPAT;<br>USOCR                                      | OR | ON | 2005/12/02 17:09 |
| S42 | 1010   | adjust\$3 with phase with amplitude with transmi\$5                                              | US-PGPUB;<br>USPAT;<br>USOCR                                      | OR | ON | 2005/12/02 14:15 |
| S43 | 102    | S41 and S42                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR                                      | OR | ON | 2005/12/02 15:59 |
| S44 | 3      | S43 and ofdm                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR                                      | OR | ON | 2005/12/02 14:15 |

|     |     |                                                                                                                                                                                                                                                                                                                                            |                              |    |    |                  |
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| S45 | 40  | S43 and multipath                                                                                                                                                                                                                                                                                                                          | US-PGPUB;<br>USPAT;<br>USOCR | OR | ON | 2005/12/02 16:00 |
| S46 | 730 | ((select\$3 or choos\$3) adj antenna)<br>with transmi\$5                                                                                                                                                                                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR | OR | ON | 2005/12/02 17:10 |
| S47 | 13  | S46 and S42                                                                                                                                                                                                                                                                                                                                | US-PGPUB;<br>USPAT;<br>USOCR | OR | ON | 2005/12/02 17:10 |
| S48 | 15  | (US-20020065047-\$ or<br>US-20020089927-\$ or<br>US-20020165626-\$ or<br>US-20020181438-\$ or<br>US-20030058929-\$ or<br>US-20040095907-\$ or<br>US-20050207334-\$ or<br>US-20050207477-\$).did. or<br>(US-5848054-\$ or US-5930267-\$ or<br>US-6377819-\$ or US-6763062-\$ or<br>US-6804312-\$ or US-6870515-\$ or<br>US-6912247-\$).did. | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 10:20 |
| S49 | 15  | (US-20020065047-\$ or<br>US-20020089927-\$ or<br>US-20020165626-\$ or<br>US-20020181438-\$ or<br>US-20030058929-\$ or<br>US-20040095907-\$ or<br>US-20050207334-\$ or<br>US-20050207477-\$).did. or<br>(US-5848054-\$ or US-5930267-\$ or<br>US-6377819-\$ or US-6763062-\$ or<br>US-6804312-\$ or US-6870515-\$ or<br>US-6912247-\$).did. | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 10:20 |
| S50 | 6   | ofdm and S48                                                                                                                                                                                                                                                                                                                               | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 12:08 |
| S51 | 6   | \$bps and S48                                                                                                                                                                                                                                                                                                                              | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 12:38 |
| S52 | 13  | power and S48                                                                                                                                                                                                                                                                                                                              | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 14:13 |
| S53 | 1   | "5306967".pn.                                                                                                                                                                                                                                                                                                                              | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 14:14 |
| S54 | 8   | S48 and diversity                                                                                                                                                                                                                                                                                                                          | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 16:16 |
| S55 | 938 | arrival with angle with antenna                                                                                                                                                                                                                                                                                                            | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 16:16 |
| S56 | 359 | S55 and multipath                                                                                                                                                                                                                                                                                                                          | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 16:16 |
| S57 | 34  | S56 and bidirectional                                                                                                                                                                                                                                                                                                                      | US-PGPUB;<br>USPAT           | OR | ON | 2005/12/05 16:25 |

|     |      |                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                   |    |    |                  |
|-----|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S58 | 3607 | reciprocal with paths                                                                                                                                                                                                                                                                                                                                                                                                        | US-PGPUB;<br>USPAT                                                | OR | ON | 2005/12/05 16:25 |
| S59 | 79   | multipath and communication and<br>S58                                                                                                                                                                                                                                                                                                                                                                                       | US-PGPUB;<br>USPAT                                                | OR | ON | 2005/12/05 16:25 |
| S60 | 25   | multipath and post\$equaliz\$5                                                                                                                                                                                                                                                                                                                                                                                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/05 17:24 |
| S61 | 1    | invert with apply with (channel adj2<br>response)                                                                                                                                                                                                                                                                                                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/05 17:25 |
| S62 | 45   | invert with (channel adj2 response)                                                                                                                                                                                                                                                                                                                                                                                          | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/05 17:25 |
| S63 | 19   | (US-20020065047-\$ or<br>US-20020089927-\$ or<br>US-20020165626-\$ or<br>US-20020181438-\$ or<br>US-20030058929-\$ or<br>US-20040095907-\$ or<br>US-20050143132-\$ or<br>US-20050207334-\$ or<br>US-20050207477-\$).did. or<br>(US-5648955-\$ or US-5848054-\$ or<br>US-5930267-\$ or US-6377819-\$ or<br>US-6665308-\$ or US-6741643-\$ or<br>US-6763062-\$ or US-6804312-\$ or<br>US-6870515-\$ or US-6912247-\$).<br>did. | US-PGPUB;<br>USPAT                                                | OR | ON | 2005/12/06 09:38 |
| S64 | 19   | (US-20020065047-\$ or<br>US-20020089927-\$ or<br>US-20020165626-\$ or<br>US-20020181438-\$ or<br>US-20030058929-\$ or<br>US-20040095907-\$ or<br>US-20050143132-\$ or<br>US-20050207334-\$ or<br>US-20050207477-\$).did. or<br>(US-5648955-\$ or US-5848054-\$ or<br>US-5930267-\$ or US-6377819-\$ or<br>US-6665308-\$ or US-6741643-\$ or<br>US-6763062-\$ or US-6804312-\$ or<br>US-6870515-\$ or US-6912247-\$).<br>did. | US-PGPUB;<br>USPAT                                                | OR | ON | 2005/12/06 09:38 |

|     |     |                                                                                   |                                                                   |    |    |                  |
|-----|-----|-----------------------------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S65 | 1   | S64 and (phased adj array)                                                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 09:40 |
| S66 | 76  | (phased adj array) with antenna<br>with parameter                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 09:43 |
| S67 | 17  | (phased adj array) with antenna<br>with parameter with (steer\$3 or<br>direct\$3) | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 09:43 |
| S68 | 1   | antenna with pointing with<br>parameter with \$3equaliz\$5                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 10:38 |
| S69 | 2   | antenna same pointing same<br>parameter same \$3equaliz\$5                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 10:40 |
| S70 | 10  | pointing same parameter same<br>\$3equaliz\$5                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:11 |
| S71 | 262 | pointing same parameter same<br>antenna                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:14 |
| S72 | 102 | (pointing with parameter) with<br>antenna                                         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:14 |

|     |      |                                                                                             |                                                                   |    |    |                  |
|-----|------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S73 | 35   | (pointing adj2 parameter) with antenna                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:16 |
| S74 | 1    | S73 and equalizer                                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:16 |
| S75 | 1    | S72 and equalizer                                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:16 |
| S76 | 1    | (pointing adj2 parameter) and (\$3equaliz\$5 adj2 parameter)                                | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:22 |
| S77 | 10   | (point\$3 adj2 parameter) and (\$3equaliz\$5 adj2 parameter)                                | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:22 |
| S78 | 4848 | receive with antenna with (omnidirectional or beam\$3 or (phased adj array) or adaptive)    | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:53 |
| S79 | 1    | receive with antenna with (omnidirectional and beam\$3 and (phased adj array) and adaptive) | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:52 |
| S80 | 4    | receive with antenna with (omnidirectional and beam\$3 and (phased adj array))              | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:52 |

|     |        |                                                                                                     |                                                                   |    |    |                  |
|-----|--------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S81 | 3      | receive with antenna with (omnidirectional or beam\$3 or (phased adj array) or adaptive) and S63    | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 12:53 |
| S82 | 6      | receiv\$3 with antenna with (omnidirectional or beam\$3 or (phased adj array) or adaptive) and S63  | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 13:24 |
| S83 | 4      | transmi\$3 with antenna with (omnidirectional or beam\$3 or (phased adj array) or adaptive) and S63 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 13:25 |
| S84 | 4      | transmi\$5 with antenna with (omnidirectional or beam\$3 or (phased adj array) or adaptive) and S63 | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 14:05 |
| S85 | 131511 | training                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 14:09 |
| S86 | 1718   | training with delay\$3                                                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 14:10 |
| S87 | 88     | training with delay\$3 with compar\$4                                                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 14:10 |

|     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                   |    |    |                  |
|-----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S88 | 25    | (US-20020065047-\$ or<br>US-20020089927-\$ or<br>US-20020165626-\$ or<br>US-20020181438-\$ or<br>US-20030058929-\$ or<br>US-20040095907-\$ or<br>US-20050143132-\$ or<br>US-20050207334-\$ or<br>US-20050207477-\$ or<br>US-20020009058-\$ or<br>US-20040184521-\$).did. or<br>(US-5648955-\$ or US-5848054-\$ or<br>US-5930267-\$ or US-6377819-\$ or<br>US-6665308-\$ or US-6741643-\$ or<br>US-6763062-\$ or US-6804312-\$ or<br>US-6870515-\$ or US-6912247-\$ or<br>US-6611511-\$ or US-6567040-\$ or<br>US-6023242-\$ or US-6052412-\$).<br>did. | US-PGPUB;<br>USPAT                                                | OR | ON | 2005/12/06 14:52 |
| S89 | 26690 | "27" and (base adj station)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 14:53 |
| S90 | 13    | S88 and (base adj station)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:13 |
| S91 | 2     | test adj parameter adj delay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:14 |
| S92 | 534   | test with parameter with delay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:14 |
| S93 | 6     | S92 and multipath                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:21 |

|     |     |                                                  |                                                                   |    |    |                  |
|-----|-----|--------------------------------------------------|-------------------------------------------------------------------|----|----|------------------|
| S94 | 18  | sub\$band adj equaliz\$3                         | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:37 |
| S95 | 371 | (power with parameter) same<br>(tones or ofdm)   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:38 |
| S96 | 194 | (power with parameter) with (tones<br>or ofdm)   | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:38 |
| S97 | 2   | (power with parameter) with (tones<br>with ofdm) | US-PGPUB;<br>USPAT;<br>USOCR;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2005/12/06 15:38 |

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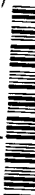
**UTILITY  
PATENT APPLICATION  
TRANSMITTAL**

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

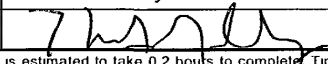
|                        |                                                          |
|------------------------|----------------------------------------------------------|
| Attorney Docket No.    | MN1-001US                                                |
| First Inventor         | William J. Crilly, Jr.                                   |
| Title                  | Improved Multipath Communication Methods And Apparatuses |
| Express Mail Label No. |                                                          |

j1036 U.S. PTO

10/131864



04/25/02

| APPLICATION ELEMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                     | ADDRESS TO:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| See MPEP chapter 600 concerning utility patent application contents.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                     | Assistant Commissioner for Patents<br>Box Patent Application<br>Washington, DC 20231                                                                                                                                                                                                                                                                                                                                                                                                                   |           |
| <p>1. <input checked="" type="checkbox"/> Fee Transmittal Form (e.g., PTO/SB/17)<br/>(Submit an original and a duplicate for fee processing)</p> <p>2. <input type="checkbox"/> Applicant claims small entity status.<br/>See 37 CFR 1.27</p> <p>3. <input checked="" type="checkbox"/> Specification [Total Pages 56]<br/>(preferred arrangement set forth below)<br/>- Descriptive title of the invention<br/>- Cross Reference to Related Applications<br/>- Statement Regarding Fed sponsored R &amp; D<br/>- Reference to sequence listing, a table,<br/>or a computer program listing appendix<br/>- Background of the Invention<br/>- Brief Summary of the Invention<br/>- Brief Description of the Drawings (if filed)<br/>- Detailed Description<br/>- Claim(s)<br/>- Abstract of the Disclosure</p> <p>4. <input checked="" type="checkbox"/> Drawing(s) (35 U.S.C. 113) [Total Sheets 5]</p> <p>5. Oath or Declaration [Total Pages 3]<br/>a. <input checked="" type="checkbox"/> Newly executed (original or copy)<br/>Copy from a prior application (37 CFR 1.63 (d))<br/>(for continuation/divisional with Box 18 completed)<br/>b. <input type="checkbox"/> <b>DELETION OF INVENTOR(S)</b><br/>Signed statement attached deleting inventor(s)<br/>named in the prior application, see 37 CFR<br/>1.63(d)(2) and 1.33(b)</p> <p>6. <input type="checkbox"/> Application Data Sheet. See 37 CFR 1.76</p> |                                                                                     | <p>7. <input type="checkbox"/> CD-ROM or CD-R in duplicate, large table or<br/>Computer Program (Appendix)</p> <p>8. Nucleotide and/or Amino Acid Sequence Submission<br/>(if applicable, all necessary)<br/>a. <input type="checkbox"/> Computer Readable Form (CRF)<br/>b. Specification Sequence Listing on.<br/>i. <input type="checkbox"/> CD-ROM or CD-R (2 copies), or<br/>ii. <input type="checkbox"/> paper<br/>c. <input type="checkbox"/> Statements verifying identity of above copies</p> |           |
| <b>ACCOMPANYING APPLICATION PARTS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |
| <p>9. <input checked="" type="checkbox"/> Assignment Papers (cover sheet &amp; document(s))</p> <p>10. <input type="checkbox"/> 37 CFR 3.73(b) Statement <input checked="" type="checkbox"/> Power of Attorney<br/>(when there is an assignee)</p> <p>11. <input type="checkbox"/> English Translation Document (if applicable)</p> <p>12. <input type="checkbox"/> Information Disclosure Statement (IDS)/PTO-1449 <input type="checkbox"/> Copies of IDS Citations</p> <p>13. <input type="checkbox"/> Preliminary Amendment</p> <p>14. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503)<br/>(Should be specifically itemized)</p> <p>15. <input type="checkbox"/> Certified Copy of Priority Document(s)<br/>(if foreign priority is claimed)</p> <p>16. <input type="checkbox"/> Nonpublication Request under 35 U.S.C. 122<br/>(b)(2)(B)(i). Applicant must attach form PTO/SB/35<br/>or its equivalent.</p> <p>17. <input type="checkbox"/> Other: _____</p>                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |
| <p>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:</p> <p><input type="checkbox"/> Continuation <input type="checkbox"/> Divisional <input type="checkbox"/> Continuation-in-part (CIP) of prior application No. _____</p> <p>Prior application information: Examiner _____ Group Art Unit _____</p> <p>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.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |
| <b>19. CORRESPONDENCE ADDRESS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |
| <p><input checked="" type="checkbox"/> Customer Number or Bar Code Label  (Insert Customer Number or Bar Code Label here) or <input type="checkbox"/> Correspondence address below</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |
| Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                     | 29150                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |
| Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                     | PATENT & TRADEMARK OFFICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | State                                                                               | Zip Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |
| Country                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Telephone                                                                           | Fax                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |
| Name (Print/Type)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Thomas A. Jolly                                                                     | Registration No. (Attorney/Agent)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 39,241    |
| Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 4-25-2002 |

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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|                                                                                                                                                                                            |  |                          |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------|------------------------|
| <h1 style="text-align: center;">FEE TRANSMITTAL</h1> <h2 style="text-align: center;">for FY 2002</h2> <p style="text-align: center;"><i>Patent fees are subject to annual revision</i></p> |  | <b>Complete if Known</b> |                        |
|                                                                                                                                                                                            |  | Application Number       |                        |
|                                                                                                                                                                                            |  | Filing Date              |                        |
|                                                                                                                                                                                            |  | First Named Inventor     | William J. Crilly, Jr. |
|                                                                                                                                                                                            |  | Examiner Name            |                        |
|                                                                                                                                                                                            |  | Group Art Unit           |                        |
| TOTAL AMOUNT OF PAYMENT                                                                                                                                                                    |  | (\$ 1,085.00)            |                        |
|                                                                                                                                                                                            |  | Attorney Docket No.      | MN1-001US              |

| <b>METHOD OF PAYMENT</b><br>1. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to<br>Deposit Account Number: 12-0769<br>Deposit Account Name: Lee & Hayes, PLLC<br><input type="checkbox"/> Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17<br><input type="checkbox"/> Applicant claims small entity status See 37 CFR 1.27<br>2. <input type="checkbox"/> Payment Enclosed:<br><input type="checkbox"/> Check <input type="checkbox"/> Credit card <input type="checkbox"/> Money Order <input type="checkbox"/> Other                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   | <b>FEE CALCULATION (continued)</b><br><b>3. ADDITIONAL FEES</b> <table border="1"> <thead> <tr> <th>Fee Code</th> <th>Large Entity (\$)</th> <th>Small Entity (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>105</td><td>130</td><td>205</td><td>65</td><td>Surcharge - late filing fee or oath</td><td></td></tr> <tr><td>127</td><td>50</td><td>227</td><td>25</td><td>Surcharge - late provisional filing fee or cover sheet</td><td></td></tr> <tr><td>139</td><td>130</td><td>139</td><td>130</td><td>Non-English specification</td><td></td></tr> <tr><td>147</td><td>2,520</td><td>147</td><td>2,520</td><td>For filing a request for ex parte reexamination</td><td></td></tr> <tr><td>112</td><td>920*</td><td>112</td><td>920*</td><td>Requesting publication of SIR prior to Examiner action</td><td></td></tr> <tr><td>113</td><td>1,840*</td><td>113</td><td>1,840*</td><td>Requesting publication of SIR after Examiner action</td><td></td></tr> <tr><td>115</td><td>110</td><td>215</td><td>55</td><td>Extension for reply within first month</td><td></td></tr> <tr><td>116</td><td>400</td><td>216</td><td>200</td><td>Extension for reply within second month</td><td></td></tr> <tr><td>117</td><td>920</td><td>217</td><td>460</td><td>Extension for reply within third month</td><td></td></tr> <tr><td>118</td><td>1,440</td><td>218</td><td>720</td><td>Extension for reply within fourth month</td><td></td></tr> <tr><td>128</td><td>1,960</td><td>228</td><td>980</td><td>Extension for reply within fifth month</td><td></td></tr> <tr><td>119</td><td>320</td><td>219</td><td>160</td><td>Notice of Appeal</td><td></td></tr> <tr><td>120</td><td>320</td><td>220</td><td>160</td><td>Filing a brief in support of an appeal</td><td></td></tr> <tr><td>121</td><td>280</td><td>221</td><td>140</td><td>Request for oral hearing</td><td></td></tr> <tr><td>138</td><td>1,510</td><td>138</td><td>1,510</td><td>Petition to institute a public use proceeding</td><td></td></tr> <tr><td>140</td><td>110</td><td>240</td><td>55</td><td>Petition to revive - unavoidable</td><td></td></tr> <tr><td>141</td><td>1,280</td><td>241</td><td>640</td><td>Petition to revive - unintentional</td><td></td></tr> <tr><td>142</td><td>1,280</td><td>242</td><td>640</td><td>Utility issue fee (or reissue)</td><td></td></tr> <tr><td>143</td><td>460</td><td>243</td><td>230</td><td>Design issue fee</td><td></td></tr> <tr><td>144</td><td>620</td><td>244</td><td>310</td><td>Plant issue fee</td><td></td></tr> <tr><td>122</td><td>130</td><td>122</td><td>130</td><td>Petitions to the Commissioner</td><td></td></tr> <tr><td>123</td><td>50</td><td>123</td><td>50</td><td>Processing fee under 37 CFR 1.17(q)</td><td></td></tr> <tr><td>126</td><td>180</td><td>126</td><td>180</td><td>Submission of Information Disclosure Stmt</td><td></td></tr> <tr><td>581</td><td>40</td><td>581</td><td>40</td><td>Recording each patent assignment per property (times number of properties)</td><td>40</td></tr> <tr><td>146</td><td>740</td><td>246</td><td>370</td><td>Filing a submission after final rejection (37 CFR § 1.129(a))</td><td></td></tr> <tr><td>149</td><td>740</td><td>249</td><td>370</td><td>For each additional invention to be examined (37 CFR § 1.129(b))</td><td></td></tr> <tr><td>179</td><td>740</td><td>279</td><td>370</td><td>Request for Continued Examination (RCE)</td><td></td></tr> <tr><td>169</td><td>900</td><td>169</td><td>900</td><td>Request for expedited examination of a design application</td><td></td></tr> <tr><td colspan="5">Other fee (specify) _____</td></tr> <tr> <td colspan="4">SUBTOTAL (3)</td> <td>(\$ 40.00)</td> </tr> </tbody> </table> |                 | Fee Code                                                                   | Large Entity (\$) | Small Entity (\$) | 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 ex parte 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) _____ |  |  |  |  | SUBTOTAL (3) |  |  |  | (\$ 40.00) |
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| Fee Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Large Entity (\$) | Small Entity (\$)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Fee Description | Fee Paid                                                                   |                   |                   |                 |          |     |     |     |                    |                                     |     |     |     |     |                   |                                                        |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 127                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 139                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| 147                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 112                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 113                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 115                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 116                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 118                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 128                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 119                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 126                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 146                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 149                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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                                  |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| <b>FEE CALCULATION</b><br><b>1. BASIC FILING FEE</b> <table border="1"> <thead> <tr> <th>Large Entity</th> <th>Small Entity</th> <th>Fee Code (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>101</td><td>740</td><td>201</td><td>370</td><td>Utility filing fee</td><td>370</td></tr> <tr><td>106</td><td>330</td><td>206</td><td>165</td><td>Design filing fee</td><td></td></tr> <tr><td>107</td><td>510</td><td>207</td><td>255</td><td>Plant filing fee</td><td></td></tr> <tr><td>108</td><td>740</td><td>208</td><td>370</td><td>Reissue filing fee</td><td></td></tr> <tr><td>114</td><td>160</td><td>214</td><td>80</td><td>Provisional filing fee</td><td></td></tr> <tr><td colspan="5">SUBTOTAL (1)</td><td>(\$ 370)</td></tr> </tbody> </table> <b>2. EXTRA CLAIM FEES</b> <table border="1"> <thead> <tr> <th>Total Claims</th> <th>Extra Claims</th> <th>Fee from below</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>95</td><td>-20** = 75</td><td>9</td><td>675</td></tr> <tr><td>3</td><td>-3** = 0</td><td>42</td><td>0</td></tr> <tr><td colspan="4">Multiple Dependent</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Large Entity</th> <th>Small Entity</th> <th>Fee Code (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>103</td><td>18</td><td>203</td><td>9</td><td>Claims in excess of 20</td><td></td></tr> <tr><td>102</td><td>84</td><td>202</td><td>42</td><td>Independent claims in excess of 3</td><td></td></tr> <tr><td>104</td><td>280</td><td>204</td><td>140</td><td>Multiple dependent claim, if not paid</td><td></td></tr> <tr><td>109</td><td>84</td><td>209</td><td>42</td><td>** Reissue independent claims over original patent</td><td></td></tr> <tr><td>110</td><td>18</td><td>210</td><td>9</td><td>** Reissue claims in excess of 20 and over original patent</td><td></td></tr> <tr><td colspan="5">SUBTOTAL (2)</td><td>(\$ 675.00)</td></tr> </tbody> </table> <p>**or number previously paid, if greater. For Reissues, see above</p> |                   | Large Entity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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              | 107 | 510 | 207 | 255 | Plant filing fee |                           | 108 | 740 | 208   | 370 | Reissue filing fee |                                                 | 114 | 160 | 214  | 80  | Provisional filing fee |                                                        | SUBTOTAL (1) |     |        |     |        | (\$ 370)                                            | Total Claims | Extra Claims | Fee from below | Fee Paid | 95 | -20** = 75                             | 9 | 675 | 3   | -3** = 0 | 42  | 0                                       | Multiple Dependent |     |     |     | Large Entity | Small Entity                           | Fee Code (\$) | Fee (\$) | Fee Description | Fee Paid | 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) |                                               |  |     |     | (\$ 675.00) | SUBTOTAL (3) (\$ 40.00) |                                  |  |     |       |     |     |                                    |  |     |       |     |     |                                |  |     |     |     |     |                  |  |     |     |     |     |                 |  |     |     |     |     |                               |  |     |    |     |    |                                     |  |     |     |     |     |                                           |  |     |    |     |    |                                                                            |    |     |     |     |     |                                                               |  |     |     |   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| 101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| 109                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 42              | ** Reissue independent claims over original patent                         |                   |                   |                 |          |     |     |     |                    |                                     |     |     |     |     |                   |                                                        |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                 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| 110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9               | ** Reissue claims in excess of 20 and over original patent                 |                   |                   |                 |          |     |     |     |                    |                                     |     |     |     |     |                   |                                                        |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |              |                                        |               |          |                 |          |     |                                         |     |     |                        |     |     |                                        |     |     |                                   |     |     |                  |     |     |                                       |     |     |                                        |     |     |                                                    |     |     |                          |     |     |                                                            |     |              |                                               |  |     |     |             |                         |                                  |  |     |       |     |     |                                    |  |     |       |     |     |                                |  |     |     |     |     |                  |  |     |     |     |     |                 |  |     |     |     |     |                               |  |     |    |     |    |                                     |  |     |     |     |     |                                           |  |     |    |     |    |                                                                            |    |     |     |     |     |                                                              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| SUBTOTAL (2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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|                     |                |                                  |                |
|---------------------|----------------|----------------------------------|----------------|
| <b>SUBMITTED BY</b> |                | <b>Complete (if applicable)</b>  |                |
| Name (Print/Type)   | Thomas A Jolly | Registration No (Attorney/Agent) | 39,241         |
| Signature           |                | Telephone                        | (509) 324-9256 |
|                     |                | Date                             | 8/25/2002      |

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**UTILITY  
PATENT APPLICATION  
TRANSMITTAL**

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

|                        |                                                          |
|------------------------|----------------------------------------------------------|
| Attorney Docket No.    | MN1-001US                                                |
| First Inventor         | William J. Crilly, Jr.                                   |
| Title                  | Improved Multipath Communication Methods And Apparatuses |
| Express Mail Label No. |                                                          |

**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 **56**]  
(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 **5**]
5. Oath or Declaration [Total Pages **3**]
  - a. ☒ Newly executed (original or copy)  
Copy from a prior application (37 CFR 1.63 (d))  
(for continuation/divisional with Box 18 completed)
  - b. ☐ **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. \_\_\_\_\_  
Prior application information: Examiner \_\_\_\_\_ Group Art Unit \_\_\_\_\_

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**

|                                                                       |           |          |                                                       |
|-----------------------------------------------------------------------|-----------|----------|-------------------------------------------------------|
| <input checked="" type="checkbox"/> Customer Number or Bar Code Label |           | or       | <input type="checkbox"/> Correspondence address below |
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| Address                                                               |           |          |                                                       |
| City                                                                  | State     | Zip Code |                                                       |
| Country                                                               | Telephone | Fax      |                                                       |

|                   |                 |                                   |           |
|-------------------|-----------------|-----------------------------------|-----------|
| Name (Print/Type) | Thomas A. Jolly | Registration No. (Attorney/Agent) | 39,241    |
| Signature         |                 | Date                              | 4-25-2002 |

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|                                                                                                                                                                                            |  |                          |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------|------------------------|
| <h1 style="text-align: center;">FEE TRANSMITTAL</h1> <h2 style="text-align: center;">for FY 2002</h2> <p style="text-align: center;"><i>Patent fees are subject to annual revision</i></p> |  | <b>Complete if Known</b> |                        |
|                                                                                                                                                                                            |  | Application Number       |                        |
|                                                                                                                                                                                            |  | Filing Date              |                        |
|                                                                                                                                                                                            |  | First Named Inventor     | William J. Crilly, Jr. |
|                                                                                                                                                                                            |  | Examiner Name            |                        |
|                                                                                                                                                                                            |  | Group Art Unit           |                        |
| TOTAL AMOUNT OF PAYMENT                                                                                                                                                                    |  | (\$ 1,085.00)            |                        |
|                                                                                                                                                                                            |  | Attorney Docket No.      | MN1-001US              |

| <b>METHOD OF PAYMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   | <b>FEE CALCULATION (continued)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       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| <p>1. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to</p> <p>Deposit Account Number: 12-0769</p> <p>Deposit Account Name: Lee &amp; Hayes, PLLC</p> <p><input checked="" type="checkbox"/> Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17</p> <p><input type="checkbox"/> Applicant claims small entity status See 37 CFR 1.27</p> <p>2. <input type="checkbox"/> Payment Enclosed:</p> <p><input type="checkbox"/> Check <input type="checkbox"/> Credit card <input type="checkbox"/> Money Order <input type="checkbox"/> Other</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   | <p>3. ADDITIONAL FEES</p> <table border="1"> <thead> <tr> <th>Fee Code</th> <th>Large Entity (\$)</th> <th>Small Entity (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>105</td><td>130</td><td>205</td><td>65</td><td>Surcharge - late filing fee or oath</td><td></td></tr> <tr><td>127</td><td>50</td><td>227</td><td>25</td><td>Surcharge - late provisional filing fee or cover sheet</td><td></td></tr> <tr><td>139</td><td>130</td><td>139</td><td>130</td><td>Non-English specification</td><td></td></tr> <tr><td>147</td><td>2,520</td><td>147</td><td>2,520</td><td>For filing a request for ex parte reexamination</td><td></td></tr> <tr><td>112</td><td>920*</td><td>112</td><td>920*</td><td>Requesting publication of SIR prior to Examiner action</td><td></td></tr> <tr><td>113</td><td>1,840*</td><td>113</td><td>1,840*</td><td>Requesting publication of SIR after Examiner action</td><td></td></tr> <tr><td>115</td><td>110</td><td>215</td><td>55</td><td>Extension for reply within first month</td><td></td></tr> <tr><td>116</td><td>400</td><td>216</td><td>200</td><td>Extension for reply within second month</td><td></td></tr> <tr><td>117</td><td>920</td><td>217</td><td>460</td><td>Extension for reply within third month</td><td></td></tr> <tr><td>118</td><td>1,440</td><td>218</td><td>720</td><td>Extension for reply within fourth month</td><td></td></tr> <tr><td>128</td><td>1,960</td><td>228</td><td>980</td><td>Extension for reply within fifth month</td><td></td></tr> <tr><td>119</td><td>320</td><td>219</td><td>160</td><td>Notice of Appeal</td><td></td></tr> <tr><td>120</td><td>320</td><td>220</td><td>160</td><td>Filing a brief in support of an appeal</td><td></td></tr> <tr><td>121</td><td>280</td><td>221</td><td>140</td><td>Request for oral hearing</td><td></td></tr> <tr><td>138</td><td>1,510</td><td>138</td><td>1,510</td><td>Petition to institute a public use proceeding</td><td></td></tr> <tr><td>140</td><td>110</td><td>240</td><td>55</td><td>Petition to revive - unavoidable</td><td></td></tr> <tr><td>141</td><td>1,280</td><td>241</td><td>640</td><td>Petition to revive - unintentional</td><td></td></tr> <tr><td>142</td><td>1,280</td><td>242</td><td>640</td><td>Utility issue fee (or reissue)</td><td></td></tr> <tr><td>143</td><td>460</td><td>243</td><td>230</td><td>Design issue fee</td><td></td></tr> <tr><td>144</td><td>620</td><td>244</td><td>310</td><td>Plant issue fee</td><td></td></tr> <tr><td>122</td><td>130</td><td>122</td><td>130</td><td>Petitions to the Commissioner</td><td></td></tr> <tr><td>123</td><td>50</td><td>123</td><td>50</td><td>Processing fee under 37 CFR 1.17(q)</td><td></td></tr> <tr><td>126</td><td>180</td><td>126</td><td>180</td><td>Submission of Information Disclosure Stmt</td><td></td></tr> <tr><td>581</td><td>40</td><td>581</td><td>40</td><td>Recording each patent assignment per property (times number of properties)</td><td>40</td></tr> <tr><td>146</td><td>740</td><td>246</td><td>370</td><td>Filing a submission after final rejection (37 CFR § 1.129(a))</td><td></td></tr> <tr><td>149</td><td>740</td><td>249</td><td>370</td><td>For each additional invention to be examined (37 CFR § 1.129(b))</td><td></td></tr> <tr><td>179</td><td>740</td><td>279</td><td>370</td><td>Request for Continued Examination (RCE)</td><td></td></tr> <tr><td>169</td><td>900</td><td>169</td><td>900</td><td>Request for expedited examination of a design application</td><td></td></tr> <tr><td colspan="5">Other fee (specify) _____</td></tr> <tr> <td colspan="4">SUBTOTAL (3)</td> <td>(\$ 40.00)</td> </tr> </tbody> </table> |                 | Fee Code                                                                   | Large Entity (\$) | Small Entity (\$) | 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 ex parte 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) _____ |  |  |  |  | SUBTOTAL (3) |  |  |  | (\$ 40.00) |
| Fee Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Large Entity (\$) | Small Entity (\$)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| 105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| 127                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| 139                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| 147                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
| 112                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 920*            | Requesting publication of SIR prior to Examiner action                     |                   |                   |                 |          |     |     |     |                    |                                     |     |     |     |     |                   |                                                        |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
| 113                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
| 115                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 55              | Extension for reply within first month                                     |                   |                   |                 |          |     |     |     |                    |                                     |     |     |     |     |                   |                                                        |     |     |     |     |                  |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
| 116                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
| 117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
| 118                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| 128                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| 581                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| 146                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| SUBTOTAL (3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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 |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
| <p><b>1. BASIC FILING FEE</b></p> <table border="1"> <thead> <tr> <th>Large Entity</th> <th>Small Entity</th> <th>Fee Code (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>101</td><td>740</td><td>201</td><td>370</td><td>Utility filing fee</td><td>370</td></tr> <tr><td>106</td><td>330</td><td>206</td><td>165</td><td>Design filing fee</td><td></td></tr> <tr><td>107</td><td>510</td><td>207</td><td>255</td><td>Plant filing fee</td><td></td></tr> <tr><td>108</td><td>740</td><td>208</td><td>370</td><td>Reissue filing fee</td><td></td></tr> <tr><td>114</td><td>160</td><td>214</td><td>80</td><td>Provisional filing fee</td><td></td></tr> <tr><td colspan="5">SUBTOTAL (1)</td><td>(\$ 370)</td></tr> </tbody> </table> <p><b>2. EXTRA CLAIM FEES</b></p> <table border="1"> <thead> <tr> <th>Total Claims</th> <th>Extra Claims</th> <th>Fee from below</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>95</td><td>-20** = 75</td><td>9</td><td>675</td></tr> <tr><td>3</td><td>-3** = 0</td><td>42</td><td>0</td></tr> <tr><td colspan="4">Multiple Dependent</td></tr> </tbody> </table> <p><b>Large Entity Small Entity</b></p> <table border="1"> <thead> <tr> <th>Fee Code (\$)</th> <th>Fee (\$)</th> <th>Fee Code (\$)</th> <th>Fee (\$)</th> <th>Fee Description</th> </tr> </thead> <tbody> <tr><td>103</td><td>18</td><td>203</td><td>9</td><td>Claims in excess of 20</td></tr> <tr><td>102</td><td>84</td><td>202</td><td>42</td><td>Independent claims in excess of 3</td></tr> <tr><td>104</td><td>280</td><td>204</td><td>140</td><td>Multiple dependent claim, if not paid</td></tr> <tr><td>109</td><td>84</td><td>209</td><td>42</td><td>** Reissue independent claims over original patent</td></tr> <tr><td>110</td><td>18</td><td>210</td><td>9</td><td>** Reissue claims in excess of 20 and over original patent</td></tr> <tr><td colspan="5">SUBTOTAL (2)</td><td>(\$ 675.00)</td></tr> </tbody> </table> <p>**or number previously paid, if greater. For Reissues, see above</p> |                   | Large Entity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Small Entity    | Fee Code (\$)                                                              | Fee (\$)          | 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)                                            | Total Claims | Extra Claims | Fee from below | Fee Paid | 95 | -20** = 75                             | 9 | 675 | 3   | -3** = 0 | 42  | 0                                       | Multiple Dependent |     |     |     | Fee Code (\$) | Fee (\$)                               | Fee Code (\$) | Fee (\$) | 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) |                          |  |     |       | (\$ 675.00) | <p><b>3. SUBTOTALS</b></p> <p>Subtotal (1) + Subtotal (2) + Subtotal (3) = (\$ 1,085.00)</p> |                                               |  |     |     |     |    |                                  |  |     |       |     |     |                                    |  |     |       |     |     |                                |  |     |     |     |     |                  |  |     |     |     |     |                 |  |     |     |     |     |                               |  |     |    |     |    |                                     |  |     |     |     |     |                                           |  |     |    |     |    |                                                                            |    |     |     |     |     |                                                               |  |     |     |     |     |                                                                  |  |     |     |     |     |                                         |  |     |     |     |     |                                                           |  |                           |  |  |  |  |              |  |  |  |            |
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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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 |                           |     |     |       |     |                    |                                                 |     |     |      |     |                        |                                                        |              |     |        |     |        |                                                     |              |              |                |          |    |                                        |   |     |     |          |     |                                         |                    |     |     |     |               |                                        |               |          |                 |     |     |                                         |   |                        |       |     |     |                                        |                                   |     |     |     |     |                                       |     |     |     |     |                                                    |                           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| <b>SUBMITTED BY</b> |                | <b>Complete (if applicable)</b>  |                |
| Name (Print/Type)   | Thomas A Jolly | Registration No (Attorney/Agent) | 39,241         |
| Signature           |                | Telephone                        | (509) 324-9256 |
|                     |                | Date                             | 8/25/2002      |

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

**Improved Multipath Communication Methods And  
Apparatuses**

Inventor:  
William J. Crilly, Jr.

ATTORNEY'S DOCKET NO. MN1-001US

## Improved Multipath Communication Methods And Apparatuses

### RELATED APPLICATIONS

This application is related to and hereby claims priority to provisional Patent Application Serial Number 60/287,163, filed April 27, 2001, and titled "Improved Multipath Communication Methods And Arrangements", and which is included herein by reference.

### TECHNICAL FIELD

This invention relates to data communications, and more particularly to wireless communication systems, apparatuses and related methods that support wireless communication in a multipath signal propagation environment.

### BACKGROUND

Computers and other like devices can be interconnected in a variety of ways to allow data to be communicated between them. One of the most common ways to provide such data communication is through a wired network. Wired networks, such as, e.g., wide area networks (WANs) and local area networks (LANs) tend to have a high bandwidth and therefore can be configured to carry digital data at high data rates. One obvious drawback to wired networks is that a user's movement is constrained since the computer needs to be physically connected to the network. Thus, for example, a user of a portable computer will need to remain near to a wired network junction to stay connected to the wired network.

1       An alternative to wired networks is a wireless network that is configured to  
2 support similar data communications but in a more accommodating manner. Here,  
3 the user of a portable device will be free to move around a region that is supported  
4 by the wireless network. A well known example of a wireless network is a cellular  
5 telephone network. Indeed, in the past, cellular telephone modems have proven  
6 popular for use with portable laptop computers and other like devices, despite their  
7 relatively low bandwidth.

8       In the future it is expected that higher bandwidth wireless networks will  
9 become more popular, especially in creating metropolitan area networks (MANs)  
10 in which users, i.e., subscribers, have the ability to freely move their portable  
11 communicating devices around within a coverage area. However, as the  
12 subscribers move about freely there will not always be a clear or otherwise  
13 unobstructed communication path between a transmitting network resource and  
14 the receiving device. For example, one or more buildings, roadways, bridges, or  
15 other man-made objects may interfere with the transmission of signals in the  
16 wireless network. So too may non-manmade objects, such as, e.g., mountains,  
17 hills, valleys, trees, etc., reduce the effectiveness of the wireless network.

18       For these and other reasons, there is need for improved methods and  
19 apparatuses that can support wireless communications within such varying  
20 environments.

## 21 **SUMMARY**

22  
23       In accordance with certain aspects of the present invention, improved  
24 packet switched wireless data communication systems, networks, apparatuses, and  
25 related methods are provided.

1       The above stated needs and/or others are satisfied, for example, by a  
2 method in accordance with certain exemplary implementations of the present  
3 invention that includes identifying at least one multipath transmission delay within  
4 a reverse path data signal, determining at least one forward path pre-equalization  
5 parameter based on the transmission delay, and modifying a forward path data  
6 signal based on the forward path pre-equalization parameter.

7       In certain further implementations, the method also includes receiving the  
8 reverse path data signal over at least one reverse transmission path and  
9 transmitting the modified forward path data signal over at least one forward  
10 transmission path. Here, it is preferred that the reverse transmission path be  
11 substantially reciprocal to the forward transmission path, for example, at a given  
12 moment in time between a base station device and a consumer premise equipment  
13 device.

14       The reverse link transmission is essentially used to help characterize the  
15 multipath delays that may exist between the communicating devices. As such, in  
16 certain implementations the reverse path data signal includes a training sequence  
17 or other like known/substantially-known data that can be analyzed to detect  
18 transmission delays, especially delays that extend beyond established guard  
19 intervals.

20       In accordance with certain other implementations, such pre-equalization  
21 techniques can be advantageously combined, for example, with antenna  
22 arrangements that support transmission diversity, spatial division transmission,  
23 and/or other like techniques.  
24  
25

## **BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is a block diagram depicting a communication system operating in a multipath environment, in accordance with certain exemplary implementations of the present invention.

Fig. 2 is a block diagram depicting certain functional blocks within a base station device and a CPE device, for example, as shown in Fig. 1, in accordance with certain exemplary implementations of the present invention.

Fig. 3 is a block diagram depicting certain functions within a transceiver functional block, for example, as shown in Fig. 2, in accordance with certain exemplary implementations of the present invention.

Fig. 4 is a graph depicting the magnitude of selected cross-correlation time samples illustrating, for example, that the multipath environment has caused certain delays with a transmitted signal, in accordance with certain exemplary implementations of the present invention.

Fig. 5 is a graph depicting the phase of a transmitted signal as received by various antenna elements within an antenna array, in accordance with certain exemplary implementations of the present invention.

Fig. 6 is a graph depicting the results of certain calculations showing the Fourier transform magnitude/delay for various FFT bins, in accordance with certain exemplary implementations of the present invention.

Fig. 7 is an illustrative diagram showing data that can be transmitted from the CPE device to the base station device to help characterize the multipath communication environment, in accordance with certain exemplary implementations of the present invention.

1 Fig. 8 is an illustrative diagram further showing data that can be transmitted  
2 from the CPE device to the base station device to help characterize the multipath  
3 communication environment, in accordance with certain exemplary  
4 implementations of the present invention.

5 Fig. 9 is a block diagram depicting a frequency domain based pre-equalizer  
6 process suitable for use in a pre-equalization function, for example, as in Fig. 3, in  
7 accordance with certain exemplary implementations of the present invention.

## 8 9 10 **DETAILED DESCRIPTION**

### 11 **Multipath Propagation Delays:**

12  
13 Wireless communication systems often operate under conditions that lead  
14 to multipath propagation of transmitted signals. Multipath propagation is  
15 primarily the result of reflections and diffraction from objects in the coverage area  
16 of the transmitting and receiving antennas.

17 High data rate communication systems may be subject to detrimental  
18 intersymbol interference caused by such multipath propagation or fading. As the  
19 symbol rate increases, for example, multipath fading from one symbol affects the  
20 next symbol, making it difficult, if not impossible, for the receiver to identify the  
21 desired (next) symbol and therefore determine its information content.

22 Multipath fading may be observed by examining the frequency domain  
23 characteristics of the communication channel. Here, for example, multipath  
24 fading will often cause the channel transfer function to have frequency-dependent  
25 responses that alter the amplitude and phase modulation content of a received

1 signal. Symbols having high information content may therefore be difficult to  
2 separately identify. This can be true even for small amplitude and/or phase shifts  
3 that exist across the modulation bandwidth of the signal.

4  
5 Traditional Modulation Techniques For Dealing With Multipath Propagation

6 Delays:

7 Various modulation techniques have been used independently and/or in  
8 combination to ameliorate or avoid intersymbol interference.

9 By way of example, certain modulation techniques include equalization  
10 techniques at the receiving node. Such equalization techniques are usually  
11 designed to calculate a channel correction in the time and/or frequency domain,  
12 and in response significantly correct for any associated multipath fading. Correct  
13 symbol identification decisions may also be used to estimate the channel at  
14 subsequent times. One of the drawbacks to this solution is that it places an  
15 additional burden on the receiving node to provide such equalization capabilities.

16 Additionally such equalization techniques are usually limited by their  
17 capability to estimate and correct the channel. However, some difficulty may be  
18 caused by the changing nature of the multipath channel. For example, the  
19 computation of multipath propagation correction parameters that is made at a  
20 receiver may need to be repeated if/when the channel changes in some way.  
21 Examples of dynamic multipath propagation changes include the movement of the  
22 receiver/antenna, trees moving in the wind, nearby vehicular traffic, etc. Such  
23 changes may have time scales ranging from a few milliseconds to a few seconds,  
24 depending on environmental conditions. Unfortunately, implementing such  
25 complex equalization techniques in a receiver may not always be feasible.

1 Other modulation techniques that have been developed include the use of  
2 Orthogonal Frequency Division Multiplexing (OFDM) to significantly increase  
3 the symbol time. This prevents a delayed symbol from deleteriously effecting a  
4 subsequent symbol. Basically, OFDM operates by coding a series of bits into a set  
5 of modulated orthogonal sub-carriers, thus producing a symbol to be transmitted.  
6 The transmitted OFDM symbol typically includes a guard interval (GI) that  
7 contains a cyclic extension of the basic symbol. When a GI is employed, it is  
8 typically designed to be longer than the expected multipath propagation delay  
9 spread of the channel.

10 OFDM is usually generated using an inverse fast Fourier transform (IFFT)  
11 process. Consequently, OFDM is then received using a fast Fourier transform  
12 (FFT) process. Techniques that establish the correct timing of FFT blocks and  
13 channel correction techniques for the GI based on the multipath fading are well  
14 known. One common technique, for example, is to use a complex correction value  
15 for each OFDM sub-carrier. The magnitude of the complex correction value can  
16 be obtained from the inverse of the sub-carrier magnitude, and the phase can be  
17 determined from a linear regression of the phase of pilot sub-carriers and other  
18 signals in training symbols.

19 One of the drawbacks to the OFDM GI is that the system may still be  
20 susceptible to multipath delays that are beyond the GI.

21 In still other systems, spread spectrum techniques may be used to encode a  
22 bit into a long coded sequence having a narrow autocorrelation function. A spread  
23 spectrum receiver would then include, for example, a RAKE receiver with cross  
24 correlators, which are configured to identify and handle individual multipath  
25

1 signals arriving at the receiver. Such spread spectrum techniques, however, may  
2 not prove to be economically viable solutions in every situation.

3 Other modulation techniques that can reduce the affects of multipath delays  
4 on a communication system include ideas such as rapidly changing channels to  
5 produce an adequate signal at a different time. For example, see "Multicarrier  
6 Modulation For Data Transmission: An Idea Whose Time Has Come" by John A.  
7 C. Bingham, published in *IEEE Communications Magazine*, May 1990.

8 In general, the various techniques described above utilize time and/or  
9 frequency diversity to overcome potential multipath transmission problems. The  
10 corresponding modulation systems, therefore, tend to spread a given amount of  
11 information over a band of frequencies or in time to provide improved  
12 performance within the multipath environment.

13  
14 Traditional Antenna Techniques For Dealing With Multipath Propagation Delays:

15 In addition to the above techniques, various antenna designs may be used to  
16 further ameliorate the effects of multipath propagation and fading. Certain  
17 systems, for example, employ what is commonly referred to as spatial division  
18 techniques. Here, transmitting antennas having narrow beam widths are employed  
19 to reduce multipath propagation caused by reflections from various objects by not  
20 illuminating those objects in the first place. Thus, usually only local diffraction  
21 and retro-reflection from objects more directly behind the receiving antenna, for  
22 example, remain to produce multipath fading.

23 Similarly, a receiving antenna with a narrow beam width may also help to  
24 reduce some remaining multipath fading. Here, however, one disadvantage is that  
25 the intended receiving node must determine or otherwise be specifically

1 configured to receive signals from a direct path while avoiding certain multipath  
2 propagation signals.

3 Spatial division techniques may be performed with single or multielement  
4 transmitting and/or receiving antennas. Some multielement antennas, for example,  
5 are also referred to as phased array antennas.

6 Multielement transmitting antennas are advantageous for several reasons.  
7 For example, multielement transmitting antennas distribute required average  
8 signal power over a number of separate low power amplifiers, which tends to  
9 reduce the complexity of each of the associated power amplifiers.

10 Furthermore, multielement transmitting and receiving antennas often have  
11 the advantage of reducing or eliminating antenna pointing requirements. Phased  
12 arrays, for example, are capable of providing flexible antenna patterns and  
13 simultaneously transmitting and receiving in several directions using the same  
14 antenna aperture. Due to this flexibility and the other advantages, phased arrays  
15 are very helpful in the reception and amelioration of signals that are affected by  
16 multipath fading.

17 Antenna spatial diversity is yet another subset of antenna techniques used  
18 to reduce the effects of multipath fading. Here, for example, multiple transmitting  
19 antennas that are physically spaced apart, e.g., by more than a wavelength, have  
20 the ability to produce different amplitude and phase shifts over the frequency band  
21 that is used. Computations based on the received signals from the antennas may  
22 be used to establish one or more paths between the transmitting and receiving  
23 sites. In addition, the signal-to-noise ratio (SNR) may be improved by combining  
24 signal paths coherently, and/or errors reduced in multiple post-detection decoders.  
25 Coherent combining techniques basically overlap spatial division techniques,

1 because coherent combining enhances antenna patterns in some directions and  
2 minimizes the pattern in other directions.

3 Indeed, antenna processing techniques may also be employed to actually  
4 take advantage of multipath propagation. By way of example, in an extension of  
5 the spatial diversity techniques, multiple transmitting antennas having physical  
6 spacing of more than a few wavelengths may be used to illuminate scattering areas  
7 with slightly different wave fronts. As such, the separate transmit signals diffract  
8 or reflect off the illuminated areas and are picked up by a receiver antenna array.

9 In effect, the scattering regions become somewhat poor, yet at times very  
10 large, pseudo-lenses that can be intentionally illuminated by the distant  
11 transmitting antennas. A large pseudo-lens has the ability to resolve closely  
12 spaced distant points, as determined by the Aires Disk of the effective pseudo-lens  
13 aperture. Receiver signal processing may then act to correct the phase and  
14 amplitude errors of such large pseudo-lenses.

15 Thus, in one example, a number of separate possible paths between the  
16 transmitter and receiver may be determined by the rank of a matrix establishing  
17 the paths between the transmitter and receiver antennas. This ranking may be  
18 determined by the richness of the scattering paths and the number of receiving and  
19 transmitting antennas. When the ranking is high, it is often possible to provide  
20 high spectral efficiency as measured in bits per second per Hz.

21 The antenna signal processing techniques described above are limited,  
22 however, by a fundamental capability of the average-power-limited transmitter to  
23 adequately transmit the signals to the receiver. Here, Shannon's Capacity  
24 Theorem determines the bit rate capacity of each of the effective multipath  
25 channels between the transmitter and receiver. For example, in a multipath

1 channel with equal-amplitude direct and reflecting paths, an identical minimum  
2 SNR is required for each received path. Hence, adequate received signal power  
3 needs to be available to maintain the SNR above this minimum value.

4 The SNR may be improved by increasing the average transmitter power, by  
5 directing greater power at the receiver and at the scattering object, and/or by  
6 gathering more power at the receiver, e.g., by using a larger receiver antenna  
7 aperture. In the case of a larger receiver antenna aperture, a multielement large  
8 aperture receive antenna may be used in combination with signal processing to  
9 separately extract data from each multipath propagation. At the transmitting site,  
10 single element antennas or multielement transmit antennas with array signal  
11 processing may be used to direct power in specific directions.

12  
13 Conclusion Regarding Such Traditional Techniques:

14 Although the various techniques described above greatly improve the  
15 capacity of a wireless system/network to carry information, there are remaining  
16 difficulties.

17 By way of example, channel equalization of high symbol rate systems  
18 typically requires many taps in a transversal filter, and/or requires long IFFT/FFTs  
19 to be calculated.

20 Another example relates to the use of a GI or the like. Low symbol rate  
21 systems, such as, e.g., OFDM symbols, can be very robust for a pre-determined  
22 multipath delay spread by providing an appropriate guard interval (e.g., a guard  
23 interval that is longer than the longest expected multipath delay spread).  
24 However, such potentially long GIs essentially set the time duration of the FFT  
25 processing step in OFDM. Thus, a long GI tends to reduce capacity. A long FFT

1 processing tends to increase latency. Long FFTs also usually require data to be  
2 placed in large blocks, and/or zero-padded, which adds overhead.

3 Spread spectrum systems, such as those described above, tend to lose the  
4 orthogonality of sequences when multipath fading is present, thereby reducing the  
5 capacity of the system.

6 While transmit spatial division antenna processing is sometimes capable of  
7 eliminating highly-delayed multipath fading, it may not be capable of eliminating  
8 retro-reflected multipath fading.

9 Spatial receive diversity techniques usually increase the reliability, and  
10 potentially the capacity of the channel. However, spatial diversity techniques have  
11 the disadvantage that significant antenna signal processing is required at the  
12 receiver. Indeed, such receive antenna signal processing usually requires separate  
13 receive antennas and receivers for each path.

14 Consequently, none of the various techniques provide a simple and cost  
15 effective solution to multipath fading. For this reason, it may be advantageous to  
16 combine a plurality of these techniques and/or others within one system. For  
17 example, the combination of OFDM and other techniques has been shown, see,  
18 e.g., United States Patent No. 5,282,222, and/or United States Patent No.  
19 5,029,184.

20 The Wi-LAN transmitter described by United States Patent No. 5,282,222  
21 uses a measurement of the differential channel amplitude and estimates the  
22 differential channel phase based on the assumption of a minimum phase multipath  
23 characteristic. A training signal and GI are not required. However, multiple point  
24 channel equalization is not possible within a single OFDM sub-channel. This  
25 limits the maximum delay spread to approximately the symbol duration.

1 The OFDM equalizer in the receiver taught by United States Patent No.  
2 5,029,184 requires two symbols to be transmitted per desired symbol.

3 Note that the above-described techniques/systems do not provide  
4 equalization for a large delay spread when the radio chipsets and associated  
5 physical layer standards do not include amelioration of these long delay spreads.

6 In accordance with certain aspects of the present invention, improved  
7 methods, apparatuses and systems are provided to overcome these and/or other  
8 shortcomings of conventional wireless systems/networks.

9  
10 Introducing Novel Pre-Equalization Techniques:

11 As signal processing costs are reduced, techniques involving greater  
12 computation are usually preferred over those requiring more transmitter power.  
13 Furthermore, as part of a design process it is usually preferred that any required  
14 additional processing complexity be implemented at the node/location which is  
15 least subject to complexity restrictions, such as a base station or the like in a  
16 wireless communication system/network. With these and/or other design  
17 considerations in mind, in accordance with certain aspects of the present invention  
18 equalization techniques are provided for use at a transmitting node and configured  
19 to perform pre-equalization that substantially reduces unwanted effects associated  
20 with multipath fading, including retro-reflected propagation delays. Such pre-  
21 equalization techniques are discussed in greater detail in later sections.

22 As is well known, many materials are electromagnetically isotropic, which  
23 is a property resulting from symmetry in their associated permittivity and  
24 permeability tensors. The Lorentz Reciprocity Theorem applies to such materials.  
25 Refraction and dielectric reflection from materials therefore often show

1 reciprocity, or equivalence of forward and reverse channel characteristics.  
2 Diffraction and reflection are inherently reciprocal due to the minimal media  
3 affecting the electromagnetic wave. Thus, reciprocity can be used to determine  
4 channel characteristics that are used while pre-equalizing a transmitted path. The  
5 use of a reciprocal channel is very useful, for example, when Time Division  
6 Duplex (TDD) channels are implemented.

7 In accordance with certain implementations of the present invention, a  
8 wireless system/network is provided which is capable of operating in a multipath  
9 environment. For example, improved methods and apparatuses are provided for  
10 use in the wireless system/network to significantly minimize the complexity of  
11 signal processing required at the receiving node. Here, the receiving node may  
12 include a single receive antenna or multiple receive antennas.

13 As described above, some conventional techniques use OFDM signal  
14 sequences to correct for multipath effects due to multipath delay spread shorter  
15 than the guard interval. A new wireless system/network is described herein, which  
16 uses a novel combination of new and known techniques to further improve  
17 multipath propagation delay handling and to also reduce the complexity of signal  
18 processing required at the receiver.

19 Although several OFDM-based system examples are provided herein, it  
20 should be recognized that the various methods and apparatuses are fully  
21 adaptable/applicable to other communication protocols, standards, schemes, and/or  
22 systems. Moreover, such pre-equalization and like methods and apparatuses may  
23 also be advantageously combined with other existing techniques to improve  
24 communication within a multipath environment.  
25

1 With this in mind, in certain exemplary implementations a signal  
2 processing technique combines or otherwise includes transmitter antenna spatial  
3 division processing, antenna diversity processing, and/or receiver OFDM sub-  
4 carrier equalization, with OFDM pre-equalization. The exemplary OFDM pre-  
5 equalization technique basically acts within the frequency band of OFDM sub-  
6 carriers to pre-equalize the multipath channel to handle multipath delay spread  
7 greater than the delay protection provided by conventional OFDM signal  
8 processing techniques, such as, e.g., the OFDM GI. Thus, the receiver can still  
9 correct multipath effects that are less than the GI.

10 The pre-equalization techniques use training sequences, which are  
11 contained within a reverse link received OFDM burst, to specifically adjust  
12 associated transmission signals/parameters applied to subsequent OFDM  
13 transmissions back towards that particular node. In accordance with certain  
14 implementations, for example, the training sequences may or may not be part of  
15 the header and equalization sequences provided for in a conventional chipset or  
16 standard. Furthermore, in certain implementations substantially fewer OFDM  
17 symbols may be transmitted, than may be in more traditional systems.

18  
19 An Exemplary Multipath Environment:

20 Reference is now made to Fig. 1, which is a block diagram depicting an  
21 exemplary communication system 100 operating in a multipath environment.  
22 Here, a base station device 102 is configured to exchange data with at least one  
23 customer premise equipment (CPE) device 104 through an antenna 108 and over a  
24 wireless communication link. Base station device 102 is further operatively  
25 configured to send and receive data via one or more networks 106. In this manner,

1 data can be received through network 106 by base station 102, and then forwarded  
2 over a wireless communication link to CPE device 104 using antenna 108.  
3 Likewise, in reverse order, CPE device 104 can transmit data over a wireless  
4 communication link to base station device 102 through antenna 108, and base  
5 station 102 may then forward the received data to other device via network 106.

6 As illustrated in this example, a transmission 109, which is generated by  
7 base station device 102, is emitted from antenna 108. Transmission 109 takes a  
8 direct path to CPE device 104. However, given the physical surroundings,  
9 transmission 109 radiates and is reflected or diffused, for example, by one or more  
10 objects 110 that are closer to antenna 109. This causes a multipath propagation  
11 signal 111 to be directed towards CPE device 104. Similarly, some of the  
12 electromagnetic energy in transmission 109 can be retro-reflected back towards  
13 CPE device 104, as multipath propagation signal 115, by one or more objects 114  
14 located further away from antenna 109. Other types of multipath propagation  
15 signals may also be created by various other objects within the coverage field of  
16 transmission 109.

17 CPE device 104 is representative of any type of device that may be capable  
18 of sending and receiving data over a wireless communication link. By way of  
19 example, CPE device 104 may include a computer, a portable computer, a personal  
20 digital assistant (PDA), a mobile communication device, such as, e.g., a mobile  
21 telephone or other like handheld device.

22  
23 Exemplary Base Station and CPE Nodes:

24 Fig. 2 is a block diagram depicting functional units within base station  
25 device 102 and CPE device 104, in accordance with certain exemplary

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1 mechanisms associated with the functionality of CPE device 104. Thus, for  
2 example, in certain implementations CPE device 104 includes a computer or like  
3 computing device. As such, CPE mechanism(s) 210 may take the form of a  
4 processor that is coupled to memory and operatively configured to perform  
5 functions in accord with one or more computer instructional programs, e.g.,  
6 application programs. In still other implementations, CPE device 1-4 may include  
7 a mobile telephone, in which case, CPE mechanism(s) 210 may include a signal  
8 processor and other circuitry for converting digital audio data into an applicable  
9 analog audio signal and converting an analog audio signal into corresponding  
10 digital data.

11 Logic 212 is provided in this example to represent any applicable additional  
12 logic/circuitry that may be used to implement the all or part of the methods and  
13 apparatuses of the present invention. In certain implementations, logic 212 may  
14 be incorporated in transceiver 208. For this reason, logic 212 is depicted within a  
15 dashed line box.

16  
17 Providing A Pre-Equalization Capability At An Exemplary Base Station Node:

18 Attention is now drawn to the block diagram in Fig. 3, which depicts  
19 exemplary functions provided within in transceiver 204, in accordance with  
20 certain implementations of the present invention.

21 Fig. 3 is a functional block diagram, wherein a set of coded data to be  
22 transmitted from base station device 102 to CPE device 104 is further prepared,  
23 pre-equalized and eventually transmitted. Here, for example, a set of coded data  
24 may comprise ninety-six bits of binary data, which is applied in pairs to (or  
25 otherwise processed by) OFDM processing block 302.

1 In this example, OFDM processing block 302 is configured to generate  
2 corresponding Quadrature Phase Shift Keying (QPSK) modulation values for each  
3 of forty-eight OFDM sub-carriers. These OFDM modulated sub-carriers may, for  
4 example, be output by an OFDM IFFT (not shown). The OFDM modulated sub-  
5 carriers are then provided to a pre-equalization block 304.

6 Pre-equalization block 304 is configured to modify one or more of the  
7 OFDM modulated sub-carriers based on information from a reverse link  
8 processing block 308. Reverse link processing block 308 is basically configured  
9 to identify multipath propagation delays and/or problems for packets transmitted  
10 from CPE device 104 to base station device 102. One exemplary way to recognize  
11 multipath delays is to have CPE device 104 transmit a known sequence of  
12 data/tones. The received signal can then be compared or contrasted with the  
13 known sequence and differences detected, the differences being at least partially  
14 associated with the multipath communication environment. The differences, or  
15 information derived from such differences can then be used within pre-  
16 equalization block 304 to modify, in some manner, as applicable, the OFDM  
17 modulated sub-carriers. The modified OFDM modulated sub-carriers are then  
18 provided to antenna processing block 306, wherein they are further processed and  
19 eventually transmitted using one or more antennas 108.

20 Those skilled in the art will recognize that reverse link processing block  
21 308 and pre-equalization block 304 may be implemented in a variety of ways. In  
22 certain exemplary implementations, for example, reverse link processing block  
23 308 may include a tapped transversal filter, or FFT/multipliers/IFFT filter of  
24 length on the order of the longest expected multipath delay. The complex  
25 coefficients of the tapped filter, or the complex multiplier values, may be derived

1 from the complex cross-correlation of the known OFDM signal sequences and the  
2 sequences received from the reverse path signal 310.

3 The result of a sample cross-correlation output is shown in Fig. 4, which  
4 shows a graph 400 illustrating the magnitude of cross-correlation time samples  
5 plotted as line 402. Here, the period covered by an exemplary OFDM GI is also  
6 depicted. Line 402 illustrates that a multipath delay spread that is greater than the  
7 OFDM guard interval should be used.

8 Thus, pre-equalization block 304 may be configured, in this example, to  
9 invert the measured channel response so that the pre-equalization and the actual  
10 subsequently induced channel response errors substantially cancel out. As a result,  
11 transceiver 208 in the receiving CPE device will receive a signal that is essentially  
12 significantly free of troublesome multipath signals that are longer than the GI.  
13 Transceiver 208, therefore, will be able to reproduce and output the set of coded  
14 data, perhaps only with correctable errors. Such errors can be overcome/corrected  
15 by further employing error control coding techniques, such as, e.g., CRC and other  
16 like techniques.

17 In certain systems, it may be likely that the reverse link bursts transmitted  
18 to base station device 102 fall below the noise level in the full bandwidth of the  
19 system. However, header signals, e.g., SIGNAL and pre-SIGNAL headers in  
20 IEEE 802.11a can be detected at lower levels. For example, the cross-correlation  
21 of the known header with signals received on two phased arrays would usually  
22 allow for improved sensitivity detection. This detection may be necessary for pre-  
23 equalization of the channel and for diversity summing to take place. An OFDM  
24 signal, for example IEEE 802.11a, may be detected at lower levels by using cross-  
25 correlation with a known PILOT tone sequence. If fewer pilots are transmitted,

1 then power may be concentrated in the pilots (provided, regulatory limitations are  
2 not exceeded). The offset of the cross correlation of known headers is to reduce  
3 the effective bandwidth, essentially establishing an effect similar to a RAKE  
4 receiver receiving a direct sequence waveform.

5 Continuing with this example, the subsequent multipath estimate can then  
6 be used to estimate antenna pointing and/or determine the near-optimal summation  
7 of signals received by the two phased array antennas. The base station device 102  
8 produces a directed signal to CPE device 104 using substantially the same antenna  
9 and pre-equalized settings/parameters. If TDD is used, then the channel can be  
10 assumed to be reciprocal for durations (coherence time) of approximately 10 ms.  
11 The 10 ms duration can be determined in a fixed wireless system by passing  
12 vehicles, moving people, blowing trees, and/or other interruptions nearby or  
13 within the communication path/region.

14 An important aspect in certain implementations is that no attempt need be  
15 made to pre-equalize multipath delays less than the provided GI of the OFDM  
16 signal. Only those multipath signals that have an impact on the signal through  
17 OFDM inter symbol interference need be pre-equalized for at base station 102.  
18 Moreover, base station 102 can be further configured to post equalize the signals  
19 received from CPE device 104 based on the results of the reverse link processing.

20 The presence of fewer tones in the header and pilots potentially complicates  
21 the process of determining pre/post –equalization channel coefficients and/or other  
22 like parameters. This is due, for example, to the inadequate resolution in  
23 frequency, and thus inversely in time, which leads to aliasing as described in later  
24 sections.  
25

1       The typical GI used in an OFDM system is usually only a small portion of  
2       the overall symbol time. For example, an OFDM symbol time of ten  
3       microseconds results from a sixty-four subcarrier OFDM system operating in a 6.4  
4       MHz bandwidth. Thus, in this example, a GI may be chosen to be one  
5       microsecond to reduce overhead.

6       The delay spread is the time difference between the first and last arriving  
7       (significant) multipath propagated signal. In this example, the first and last  
8       arriving multipaths must arrive within one microsecond of each other to allow for  
9       successful conventional OFDM reception. As mentioned, however, some retro-  
10      reflected multipath propagated signals may produce delays that exceed this GI.  
11      For example, retro-reflected signals propagating from an object 114 (see Fig. 1)  
12      located at a distance of about one km behind the receiving CPE device 104 will  
13      result in an approximate 6.6 microsecond delay spread. Thus, the resulting  
14      composite signal cannot be handled by a conventional OFDM transceiver using a  
15      one microsecond GI.

16      When a phased array antenna 108 is used at the base station node to further  
17      ameliorate the effect of multipath, antenna element coefficients may be determined  
18      by evaluating, for example, the discrete Fourier transform (DFT) of the signals  
19      received on the elements of the phased array.

20      Referring next to graph 500 in Fig. 5, the effect of a direct and multipath  
21      signal can be seen by line 502, which plots the received signal phase for various  
22      numbered antenna elements.

23      After computation, for example, using an FFT to derive the angular  
24      distribution of the received signals, and cross-correlated the signals with known  
25      sequences, the delay and angle of arrival of the direct and multipath signal may be

1 determined. Graph 600 in Fig. 6 shows the results of such calculations in the form  
2 of plotted lines 602 and 604 corresponding to the Fourier transform  
3 magnitude/delay for various FFT bins. Also shown is the corresponding delay  
4 period covered by a traditional GI 606.

5 In some situations the direct and multipath signals may be combined to  
6 actually improve the signal-to-noise ratio (SNR). However, in the exemplary  
7 situation shown in Fig. 6, the additional delay of a multipath signal 604 exceeds  
8 the GI used in the OFDM modulation. Knowing that the channel is essentially  
9 reciprocal allows a pre-equalization of the signals to be applied to the phased array  
10 during subsequent forward path transmissions from base station device 102 to  
11 CPE device 104. Alternatively, the pre-equalized signals may be applied at only  
12 one angle. In this case, pre-equalization may not be desired/necessary. In some  
13 cases two delays, in the same direction, may be determined in the cross-  
14 correlation/reverse link processing, as a result of retro-reflected multipath  
15 propagation. In which case, pre-equalization can then be employed to  
16 substantially correct the channel.

17 In those systems where only a few transmit antennas are used, transmit  
18 antenna diversity and like techniques may also be implemented in place of phased  
19 array transmission/processing.

20 For example, reverse link processing block 308 can be configured to  
21 determine or otherwise identify the best antenna to be used for reception based on  
22 measurements of the reverse link. Here, SNR, cross-correlation of the known  
23 sequences, or other measurements may be made. As multipath propagated signals  
24 longer in duration than the guard interval may be present, a determination can be  
25 made as to which antenna to select for the transmission of the pre-equalized

1 signals. Thus, the combination of pre-equalization and diversity help to reduce the  
2 multipath signals at CPE device 104 to a level that allows the detection of user  
3 data, perhaps with correctable errors.

4 In accordance with certain further aspects of the present invention, transmit  
5 diversity may be implemented using simultaneous transmission of coded user data  
6 on diversity antennas. In systems where many transmit elements are used,  
7 transmit antenna diversity may be implemented in combination with phased array  
8 processing.

9 For example, base station device 102 may be configured to generate two  
10 simultaneous beams illuminating separate areas of a multipath environment. The  
11 transmit signals applied to the two antennas can be selectively adjusted in phase  
12 and amplitude to produce a signal at CPE device 104 that is substantially free of  
13 multipath propagated signals greater in delay than the GI. If a strong composite  
14 signal is received still containing a relatively large delay spread, then pre-  
15 equalization techniques may be applied by base station device 102, thereby driving  
16 the two beams to ameliorate the long delay spread of one or both of the multipaths.  
17 The system may further be configured to include antenna patterns other than a  
18 dual beam approach. For example, the transmitted pattern may be determined by  
19 an incident reverse path power pattern.

20 As an example of known headers that may be used to support training  
21 sequences, can be found in the IEEE 802.11a standard. IEEE 802.11a provides  
22 short and long sequences totaling a duration of about 8  $\mu$ s. The 8  $\mu$ s may be used  
23 to ascertain delay spread to approximately 8  $\mu$ s delay. The known sequences have  
24 sufficient low frequency energy per burst (here, low being between about 100 kHz  
25

1 and 125 kHz, 1/8  $\mu$ s resolution) to determine fine variations in the complex  
2 channel response.

3 As described, traditional OFDM systems rely on the GI to eliminate  
4 multipath effects during transmission of the tones in the OFDM signal. Longer  
5 delays require longer GIs. The techniques shown here use the long and short  
6 sequences to perform channel estimation, and decision feedback equalization,  
7 following the headers to equalize the channel for delays that are greater than  $1/\Delta f$ ,  
8 where  $\Delta f$  is the subcarrier (in OFDM) spacing.

9  
10 Some Exemplary Training Sequences:

11 As described, CPE device 104 is configured to transmit a signal or signals  
12 back to base station device 102 over the reverse link transmission path. One or  
13 more of these transmissions may include training sequences that are designed to  
14 allow reverse link processing block 308 (see Fig. 3) to determine what if any  
15 changes need to be made in pre-equalizing the signals transmitted on the forward  
16 link transmission path from base station device 102 to CPE device 104.

17 The training sequences preferably include either substantially known or  
18 perfectly known training sequences. The training sequences in certain  
19 implementations, for example, may be included in the data or payload section of  
20 the OFDM symbols. In other implementations, known portions of a header or  
21 preamble may be used as the training sequence. The resulting training sequence  
22 signals may take a number of modulated forms, such as, e.g., spread spectrum  
23 signals, OFDMA signals, or other like signals.

24 One exemplary implementation includes a training sequence within a  
25 physical layer PDU in an IEEE 802.11(a) system as illustrated in Fig. 7. Here, a

1 frame 700 includes a preamble portion 702, a signal portion 704, and a payload  
2 portion 706. Payload portion 706 includes a training sequence 708 in the form of  
3 OFDM data/symbols. Preferably, training sequence 708 is adequately long  
4 enough to serve its purpose for the intended system and the OFDM data/symbols  
5 are not repeated.

6 An illustrative waterfall representation is shown in Fig. 8. Here, power,  
7 time and frequency are plotted in a first graph 802 along with a corresponding  
8 constellation map (Q-I) in a second graph 804 illustrating the trajectory of the  
9 training sequence for an exemplary 16 QAM system. Here, the training sequence  
10 includes unique symbols identified by blocks 806 lettered A, B, C, D, E, F, G, and  
11 H, for example.

#### 12 13 Exemplary Techniques For Dealing With Aliasing:

14 As described earlier, aliasing may occur, for example, when too few  
15 symbols are transmitted. Aliasing may be dealt with by estimating on which  
16 aliased signal set the delay that needs to be pre/post-equalized actually exists, and  
17 making corrections accordingly. Thus, for example, if several potential aliased  
18 delays are found and in amongst them lies the actual delay to be pre/post –  
19 equalized against, then an iterative procedure can be followed wherein guesses are  
20 made, parameters set, and signals pre-equalized and transmitted. When the correct  
21 (actual) signal set is found and attempted to be equalized, then CPE device 104  
22 will successfully receive the transmission and reply accordingly. If after  
23 transmitting a pre-equalized signal no reply (e.g., an acknowledgement) is  
24 received then it can be assumed that the signal set that was selected is only an  
25 aliased signal set. Subsequent transmission attempts with other selected signal

sets (or regions) being pre-equalized can then be made. Preferably error correction techniques will also be employed to help CPE device 104 to process the transmitted signals.

Exemplary Low Bandwidth Reverse Link:

In accordance with certain further aspects of the present invention, it was recognized that in certain implementations it may be possible to use an IEEE 802.11a transmission on the reverse link to base station device 102 at a bit rate much less than the minimum 6 Mbps in the current standard. This may prove useful, for example, when CPE device 104 operates at much lower power levels than base station device 102 (which may operate at 1 watt, for example). Here, a slower speed reverse link may actually work better anyway due to shadow fading or otherwise poor link budget.

Thus, CPE device 104 can be configured to selectively make changes to the transmission process by backing out the effects of an interleaver, a FEC convolutional coder, and/or scrambler that may be included, for example, within transceiver 208. Furthermore, the same or other logic within CPE device 104 may be configured to force a constant phase shift, e.g., QPSK symbol over a long number of OFDM symbols, e.g., 16. Within transceiver 204 of base station device 102, the GI can then be removed and a long FFT performed on the compressed time interval due to GI removal. The long FFT length may be, e.g.,  $16 \times 64$  point = 1024 point, wherein the bandwidth is 1/16 of the 64 point FFT, resulting in an SNR improvement of about 16, i.e.,  $10 \log 16 = 12.04$  dB.

The systems above may be used with any OFDM modulated CPE devices. For example, by allowing for a slow phase rotation during the 16 symbol interval,

1 OFDMA may be implemented. This would allow for more than one reverse link  
2 to be present at a time, thereby improving the reverse link capacity. If QAM  
3 modulation is used, for example, as opposed to QPSK, then slower phase rotation  
4 may be used. This would allow more of the 16 bins per 64 bins to be used. The  
5 data is provided in the tones in the usual way, but with a different phase, amplitude  
6 (QAM) per tone (of the 64 tones). This coding can be performed, for example, by  
7 applicable computer instructions within the logic of CPE device 104. This allows  
8 for the applicable power control, QAM modulation mapping and virtually all other  
9 “normal” operations to appear in the resulting modulation. This provides the  
10 ability to deploy IEEE 802.11a, for example, client devices and subsequently  
11 provide infrastructure that is capable of receiving the weak reverse link signals  
12 from such client devices.

13  
14 Exemplary Frequency Domain Pre-Equalization Techniques:

15 In accordance with certain further implementations of the present invention,  
16 the pre-equalization techniques described herein may, for example, take advantage  
17 of frequency domain equalization techniques such as those described by Van  
18 Acker, et al., in an article titled “Per Tone Equalization For DMT-Based Systems”,  
19 as published in *IEEE Transactions On Communications*, Vol. 49, No. 1, January  
20 2001, and which is incorporated herein by reference. Van Acker et al., teach that a  
21 receiver can benefit from certain frequency domain equalization techniques.

22 Here, the Van Acker et al. equalization techniques are adapted for use in  
23 pre-equalizing signals in the transmitting portion of a base station or like  
24 device/node. An example of a frequency domain based pre-equalizer process 900  
25

1 suitable for use in pre-equalization process 304 (see Fig. 3) is shown in the block  
2 diagram of Fig. 9.

3 In this example, frequency domain based pre-equalizer process 900 is  
4 shown to include, within the base station device transceiver, a pre-equalization  
5 processing block 304' having its output coupled to an antenna processing block  
6 306, similar to that shown in Fig. 3. Here, however, pre-equalization processing  
7 block 304' includes several FFTs and IFFTs that are arranged to allow equalization  
8 parameters to be operatively applied to signals transformed from the time domain  
9 to a corresponding frequency domain. More particularly, several FFTs 902 are  
10 provided to receive signals that are to be transmitted. FFTs 902 convert these time  
11 domain signals, each of which is associated with a particular OFDM tone, into  
12 corresponding frequency domain signals. The outputs from FFTs 902 are  
13 provided to a scaling process 908 (or other like process) along with the  
14 desired/calculated channel coefficients or like parameters from a reverse link  
15 processing block 308 (not shown). Scaling process 908 modifies each tone as  
16 needed in accordance with the measured/estimated channel characteristics.

17 The scaled signals output by scaling process 908 are still frequency domain  
18 signals. To convert the scaled signals back in to a corresponding time domain, the  
19 scaled signals are then input to IFFTs 904. IFFTs 904 convert the scaled signals  
20 into corresponding time domain scaled signals. These time domain scaled signals  
21 are then selectively input to a longer (e.g., 64 input/output) FFT 906 that is used to  
22 complete the sub-band frequency domain equalization. In this illustrative  
23 diagram, each input to FFT 906 is switched such that it selects one of the time  
24 domain scaled signals output by an IFFT 904. The 64 selected scaled tone signals  
25

1 output by IFFT 904 are then provided to antenna processing block 306 for further  
2 processing and eventual transmission.

3 During transmission, the multipath environment alters the transmitted  
4 signals as represented by a summation process 912 that includes channel noise, for  
5 example, within the transmitted signals. The environmentally modified signals are  
6 received by the transceiver in the CPE device, wherein the signals may be stored  
7 in a memory device 914 and then provided to an FFT 916. Here, FFT 916 would  
8 be a longer (e.g., 64 input/output) FFT configured to process/convert the received  
9 signals. For example, FFT 916 can provide a one point FIR correction for each  
10 received tone signal.

11 In this implementation, the frequency domain processing provided above  
12 essentially acts a sub-band equalizer in the transmitting node (here, the base  
13 station device). The GI and other one point FIR correction is then provided in the  
14 receiver (here, the CPE device). Another aspect of this type of system is that  
15 power may be set to be equal in each of the sub-bands, allowing regulatory rules,  
16 such as FCC rules, to be satisfied. In this manner, the power may be substantially  
17 flattened over the spectrum.

18  
19 Using Reduced Spectral Power Density Transmissions:

20 The power in each sub-carrier in the above example may be held  
21 substantially constant. A modification to the system involves the determination of  
22 a worst case path loss over the OFDM tones, for example, through the use of  
23 reciprocal measurements. Then the highest allowed power spectral density for that  
24 particular sub-carrier is used, while the power spectral density for other tones is  
25 reduced to allow the other tones to sustain the same level of QAM, QPSK, BPSK,

1 etc. By reducing the power of the other tones, an improvement may be had with  
2 respect to the capacity of the system as a result of lower interference being  
3 generated. Thus, for example, doing so could allow the power amplifier to carry  
4 additional channels for the same PEP level.

5 The requisite power spectral density needed to establish a level of QAM  
6 can be determined, for example, by path loss estimation and the knowledge of the  
7 reverse link power level transmitted on the reverse link. Thus, logic operating on  
8 the CPE device may assist in the determination.

9 One exemplary method involves establishing a reverse link, having the  
10 CPE device provide information to the base station device regarding the power  
11 levels being used on the reverse link. Next, reciprocal path loss measurements are  
12 made by the base station device and a link budget for a particular QAM level is  
13 determined. Then variations in channel path loss can be used to set/reset  
14 minimum/maximum power levels for a particular QAM level, e.g., 16 QAM.

15 Sub-carrier/channel equalization is then provided by the base station device  
16 and the signals are transmitted to the CPE device. The CPE device then performs  
17 single point FIR equalization to decode the QAM (e.g., 16 QAM) tones. Then a  
18 decoder process corrects the errors caused, for example, by the tones that are  
19 below the QAM threshold.

20  
21 Further Extensions Of The Above Methods and Apparatuses:

22 As described and shown, cross-correlation processing, FFT processing and  
23 filtering may be implemented in a variety of ways. For example, it is possible to  
24 combine OFDM FFT processing and pre-equalization filtering. Cross-correlation  
25 may be best performed in the frequency domain using the previously calculated

1 DFTs of the known OFDM signal sequences. The resulting calculations reduce to  
2 the calculation of a single FFT and a set of multiplications. Many other signal  
3 processing techniques may also be used.

4 Other implementations of this invention may be derived from the disclosed  
5 contents herein. By way of example, a practitioner may implement a high data  
6 rate communication system using separately calculated multipaths, with all of the  
7 paths transmitting on the same frequency. Another implementation may use  
8 receiver OFDM channel equalization for delays greater than the guard interval,  
9 thus improving performance.

10 In still other implementations, a reverse channel quality indicator, and/or  
11 the measured forward channel impulse response, may be transmitted on the  
12 reverse path when channel reciprocity is not available. Such a system may be  
13 useful when Frequency Division Duplex or Half Frequency Division Duplex is  
14 used.

15 In Frequency Division Duplex systems, short training signals may be  
16 periodically transmitted using Time Division Duplex on each of the frequencies  
17 used for Frequency Division Duplex. Multiple RF signals, operating on the same  
18 and different frequencies, may also be simultaneously transmitted and received.  
19 Furthermore, the operation of the described wireless system on the forward path  
20 may be similarly implemented in a wireless system on the reverse path.

21  
22 An example of channel measurement and correction:

23 Certain exemplary 64-point FFT OFDM systems have a first tone measured  
24 on the reverse link to have a normalized amplitude slope from about 0.4 to about  
25 0.25 and a phase shift from about 10 to about 100 degrees. The measurement can

1 be performed using a 256-point FFT, for example. As such, eight samples are  
2 available to determine channel characteristics. Pre-equalization, for example, can  
3 then be applied on the forward link in the frequency domain using a 2.5 to 4  
4 normalized amplitude and -10 to -100 degree slope across the eight frequency  
5 domain samples. A second OFDM tone can be calculated in a similar way.

#### 6 7 Conclusion

8 Although some preferred implementations of the various methods and  
9 arrangements of the present invention have been illustrated in the accompanying  
10 Drawings and described in the foregoing Detailed Description, it will be  
11 understood that the invention is not limited to the exemplary implementations  
12 disclosed, but is capable of numerous rearrangements, modifications and  
13 substitutions without departing from the spirit of the invention as set forth and  
14 defined by the following claims.

**CLAIMS**

What is claimed is:

1. A method comprising:
  - identifying at least one multipath transmission delay within a reverse path data signal;
  - determining at least one forward path pre-equalization parameter based on said at least one transmission delay; and
  - modifying a forward path data signal based on said at least one forward path pre-equalization parameter.
2. The method as recited in Claim 1, further comprising:
  - receiving said reverse path data signal over at least one reverse transmission path.
3. The method as recited in Claim 2, further comprising:
  - transmitting said modified forward path data signal over at least one forward transmission path.
4. The method as recited in Claim 1, wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.

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5. The method as recited in Claim 1, wherein said modified forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.
6. The method as recited in Claim 5, wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data.
7. The method as recited in Claim 6, further comprising:  
generating corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data.
8. The method as recited in Claim 4, wherein identifying said at least one multipath transmission delay includes:  
identifying at least one multipath transmission delay spread that is greater than a guard interval.
9. The method as recited in Claim 1, wherein said reverse path data signal includes identifiable training data.

- 1 10. The method as recited in Claim 9, further comprising:  
2 comparing said received identifiable training data to a local  
3 version of said training data to identify said at least one multipath  
4 transmission delay within said reverse path data signal.  
5
- 6 11. The method as recited in Claim 3, wherein modifying said forward  
7 path data signal based on at least one forward path pre-equalization  
8 parameter further includes:  
9 selectively inverting and applying a measured channel  
10 response to said forward path data signal to significantly reduce  
11 subsequent induced deleterious channel response changes to said  
12 modified forward path data signal during transmission over said at  
13 least one forward transmission path.  
14
- 15 12. The method as recited in Claim 3, wherein said at least one reverse  
16 transmission path is substantially reciprocal to said at least one  
17 forward transmission path.  
18
- 19 13. The method as recited in Claim 1, wherein identifying said at least  
20 one multipath transmission delay, determining said at least one  
21 forward path pre-equalization parameter, and modifying said  
22 forward path data signal are performed by a first device.  
23  
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25

- 1 14. The method as recited in Claim 13, wherein said first device  
2 includes a base station device that is operatively configurable for use  
3 in a wireless communication system.  
4
- 5 15. The method as recited in Claim 13, further comprising:  
6 using at least one first device receive antenna operatively  
7 coupled to said first device to receive said reverse path data signal  
8 over at least one reverse transmission path from a second device.  
9
- 10 16. The method as recited in Claim 15, wherein said second device  
11 includes a customer premise equipment (CPE) device that is  
12 operatively configurable for use in a wireless communication  
13 system.  
14
- 15 17. The method as recited in Claim 16, wherein said CPE device  
16 includes at least one device selected from a group of devices  
17 comprising a computer, a portable computer, a personal digital  
18 assistant (PDA), and a mobile communication device.  
19
- 20 18. The method as recited in Claim 15, wherein said at least one first  
21 device receive antenna includes at least one type of antenna selected  
22 from a group of suitable types of antennas comprising at least one  
23 omnidirectional type of antenna, at least one beam type of antenna,  
24 at least one phased array type of antenna, and at least one adaptive  
25 antenna.

1  
2 19. The method as recited in Claim 15, wherein said first device is  
3 operatively coupled to a plurality of first device receive antennas.

4  
5 20. The method as recited in Claim 13, further comprising;  
6 receiving said reverse path data signal over at least one  
7 reverse transmission path; and  
8 causing said first device to post equalize at least a portion of  
9 said received reverse path signal.

10  
11 21. The method as recited in Claim 15, wherein determining said at least  
12 one forward path pre-equalization parameter based on said at least  
13 one transmission delay further includes:  
14 determining at least one angle of arrival of said reverse path  
15 data signal with respect to said at least one first device receive  
16 antenna.

17  
18 22. The method as recited in Claim 15, further comprising:  
19 using at least one second device transmit antenna operatively  
20 coupled to said second device and configured to transmit said  
21 reverse path data signal over said at least one reverse transmission  
22 path to said first device.  
23  
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25

- 1 23. The method as recited in Claim 22, wherein a plurality of second  
2 device transmit antennas are operatively coupled to said second  
3 device and configured to transmit said reverse path data signal over  
4 said at least one reverse transmission path to said first device.  
5  
6 24. The method as recited in Claim 22, further comprising:  
7 causing said second device to transmit at least two reverse  
8 path data signals over said at least one reverse transmission path to  
9 said first device.  
10  
11 25. The method as recited in Claim 24, wherein said at least two reverse  
12 path data signals include Orthogonal Frequency-Division Multiple  
13 Access (OFDMA) data.  
14  
15 26. The method as recited in Claim 22, further comprising:  
16 causing said second device to transmit said reverse path data  
17 signal over said at least one reverse transmission path to said first  
18 device at a bit rate less than about 6 Mbps.  
19  
20 27. The method as recited in Claim 22, further comprising:  
21 causing said second device to transmit corresponding second  
22 device transmission power level information to said first device; and  
23 causing said first device to adjust at least one transmission  
24 power level associated with said forward path data signal based on  
25 said second device transmission power level information.

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28. The method as recited in Claim 13, further comprising:  
using at least one first device transmit antenna operatively coupled to said first device to transmit said modified forward path data signal over at least one forward transmission path to a second device.
29. The method as recited in Claim 28, wherein said at least one first device transmit antenna is operatively configurable to provide transmission diversity when transmitting said modified forward path data signal.
30. The method as recited in Claim 28, wherein said at least one first device transmit antenna is operatively configurable to provide spatial division transmission when transmitting said modified forward path data signal.
31. The method as recited in Claim 28, wherein said at least one first device transmit antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

- 1 32. The method as recited in Claim 28, further comprising:  
2 setting at least one antenna pointing parameter associated  
3 with said at least one first device transmit antenna based on said at  
4 least one forward path pre-equalization parameter.  
5
- 6 33. The method as recited in Claim 28, further comprising:  
7 setting at least one phased array antenna transmission  
8 directing parameter associated with said at least one first device  
9 transmit antenna based on said at least one forward path pre-  
10 equalization parameter.  
11
- 12 34. The method as recited in Claim 28, further comprising;  
13 selectively transmitting said modified forward path data  
14 signal at one angle with respect to said first device transmit antenna.  
15
- 16 35. The method as recited in Claim 28, further comprising:  
17 selecting said at least one first device transmit antenna from a  
18 plurality of first device transmit antennas that are each operatively  
19 coupled to said first device.  
20
- 21 36. The method as recited in Claim 35, further comprising:  
22 selectively transmitting a plurality of beams using two or  
23 more first device transmit antennas.  
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1 41. The method as recited in Claim 1, wherein determining said at least  
2 one forward path pre-equalization parameter based on said at least  
3 one transmission delay further includes:

4 sub-band equalizing said forward path data signal using  
5 corresponding frequency domain reverse path data.  
6

7 42. The method as recited in Claim 1, wherein modifying said forward  
8 path data signal based on said at least one forward path pre-  
9 equalization parameter further includes:

10 selectively setting different transmission power levels for at  
11 least two Orthogonal Frequency Division Multiplexing (OFDM)  
12 tones in said forward path data signal based on said at least one  
13 forward path pre-equalization parameter.  
14

15 43. A system comprising:

16 a first device operatively configurable to connect to at least a  
17 second device over a wireless communication path, said first device  
18 having logic that is configured to detect a multipath transmission  
19 delay in at least one reverse path data signal transmitted by said  
20 second device, determine at least one forward path pre-equalization  
21 parameter based on said detected multipath transmission delay, and  
22 pre-equalize a forward path data signal that is to be transmitted to  
23 said second device based on said at least one forward path pre-  
24 equalization parameter.  
25

- 1 44. The system as recited in Claim 43, wherein said first device further  
2 comprising:  
3 at least one first device antenna; and  
4 at least one transceiver operatively coupled to said at least  
5 one first device antenna and said logic, said at least one transceiver  
6 being configurable to receive said reverse path data signal over at  
7 least one reverse transmission path using said at least one first device  
8 antenna and provide said reverse path data signal to said logic, and  
9 transmit said modified forward path data signal from said logic over  
10 at least one forward transmission path.  
11
- 12 45. The system as recited in Claim 43, wherein said reverse path data  
13 signal includes at least one type of data selected from a group of  
14 different types of data comprising Orthogonal Frequency Division  
15 Multiplexing (OFDM) data and Quadrature Phase Shift Keying  
16 (QPSK) data.  
17
- 18 46. The system as recited in Claim 43, wherein said modified forward  
19 path data signal includes at least one type of data selected from a  
20 group of different types of data comprising Orthogonal Frequency  
21 Division Multiplexing (OFDM) data and Quadrature Phase Shift  
22 Keying (QPSK) data.  
23
- 24 47. The system as recited in Claim 46, wherein said modified forward  
25 path data signal includes sub-carrier pre-equalized OFDM data.

- 1  
2 48. The system as recited in Claim 47, wherein said logic is further  
3 configured to produce corresponding Quadrature Phase Shift Keying  
4 (QPSK) modulation values based on said sub-carrier pre-equalized  
5 OFDM data.  
6  
7 49. The system as recited in Claim 45, wherein said logic detects said  
8 multipath transmission delay by identifying at least one multipath  
9 transmission delay spread that is greater than a guard interval.  
10  
11 50. The system as recited in Claim 43, wherein said reverse path data  
12 signal includes identifiable training data.  
13  
14 51. The system as recited in Claim 50, wherein said logic is further  
15 configured to compare said received identifiable training data to a  
16 non-multipath delayed version of said training data to detect said  
17 multipath transmission delay.  
18  
19 52. The system as recited in Claim 44, wherein said logic is configured  
20 to selectively invert and apply a measured channel response to said  
21 forward path data signal to significantly reduce subsequent induced  
22 deleterious channel response changes to said modified forward path  
23 data signal during transmission over said at least one forward  
24 transmission path.  
25

- 1 53. The system as recited in Claim 44, wherein said at least one reverse  
2 transmission path is substantially reciprocal to said at least one  
3 forward transmission path.  
4
- 5 54. The system as recited in Claim 43, wherein said first device includes  
6 a base station device that is operatively configurable for use in a  
7 wireless communication system.  
8
- 9 55. The system as recited in Claim 44, further comprising:  
10 said second device, in the form of a customer premise  
11 equipment (CPE) device that is operatively configurable for use in a  
12 wireless communication system.  
13
- 14 56. The system as recited in Claim 55, wherein said CPE device  
15 includes at least one device selected from a group of devices  
16 comprising a computer, a portable computer, a personal digital  
17 assistant (PDA), and a mobile communication device.  
18
- 19 57. The system as recited in Claim 44, wherein said first device is  
20 operatively coupled to a plurality of first device receive antennas.  
21
- 22 58. The system as recited in Claim 44, wherein said logic is configured  
23 to post-equalize at least a portion of said received reverse path  
24 signal.  
25

- 1 59. The system as recited in Claim 44, wherein said logic is further  
2 configured to determine at least one angle of arrival of said reverse  
3 path data signal with respect to said at least one first device antenna.  
4
- 5 60. The system as recited in Claim 55, wherein said second device  
6 includes at least one second device antenna that is operatively  
7 configurable to transmit said reverse path data signal over said at  
8 least one reverse transmission path to said first device and receive  
9 said transmitted modified forward path data signal from said first  
10 device over said at least one forward transmission path.  
11
- 12 61. The system as recited in Claim 60, wherein said second device  
13 includes a plurality of second device antennas that are operatively  
14 configurable to transmit said reverse path data signal over said at  
15 least one reverse transmission path to said first device.  
16
- 17 62. The system as recited in Claim 60, wherein said second device is  
18 configurable to transmit at least two reverse path data signals over  
19 said at least one reverse transmission path to said first device.  
20
- 21 63. The system as recited in Claim 62, wherein said at least two reverse  
22 path data signals include Orthogonal Frequency-Division Multiple  
23 Access (OFDMA) data.  
24  
25

- 1 64. The system as recited in Claim 60, wherein said second device is  
2 configurable to transmit said reverse path data signal over said at  
3 least one reverse transmission path to said first device at a bit rate  
4 less than about 6 Mbps.  
5
- 6 65. The system as recited in Claim 60, wherein said second device is  
7 configurable to transmit corresponding second device transmission  
8 power level information to said first device, and said first device is  
9 further configurable to adjust at least one transmission power level  
10 associated with said forward path data signal based on said second  
11 device transmission power level information.  
12
- 13 66. The system as recited in Claim 44, wherein said at least one first  
14 device antenna is operatively configurable to provide transmission  
15 diversity when transmitting said modified forward path data signal.  
16
- 17 67. The system as recited in Claim 44, wherein said at least one first  
18 device antenna is operatively configurable to provide spatial division  
19 transmission when transmitting said modified forward path data  
20 signal.  
21
- 22 68. The system as recited in Claim 44, wherein said at least one first  
23 device antenna includes at least one first device transmit antenna and  
24 at least one first device receive antenna.  
25

- 1 69. The system as recited in Claim 68, wherein said at least one first  
2 device transmit antenna includes at least one type of antenna  
3 selected from a group of suitable types of antennas comprising at  
4 least one omnidirectional type of antenna, at least one beam type of  
5 antenna, at least one phased array type of antenna, and at least one  
6 adaptive antenna.
- 7
- 8 70. The system as recited in Claim 68, wherein said at least one first  
9 device receive antenna includes at least one type of antenna selected  
10 from a group of suitable types of antennas comprising at least one  
11 omnidirectional type of antenna, at least one beam type of antenna,  
12 at least one phased array type of antenna, and at least one adaptive  
13 antenna.
- 14
- 15 71. The system as recited in Claim 68, wherein said logic is further  
16 configured to establish at least one antenna pointing parameter  
17 associated with said at least one first device transmit antenna based  
18 on said at least one forward path pre-equalization parameter.
- 19
- 20 72. The system as recited in Claim 68, wherein said logic is further  
21 configured to establish at least one phased array antenna  
22 transmission directing parameter associated with said at least one  
23 first device transmit antenna based on said at least one forward path  
24 pre-equalization parameter.
- 25

- 1 73. The system as recited in Claim 68, wherein said logic is further  
2 configurable to cause said at least one transceiver to selectively  
3 transmit said modified forward path data signal at one angle with  
4 respect to said at least one first device transmit antenna.  
5  
6 74. The system as recited in Claim 68, wherein said logic is further  
7 configurable to cause said at least one transceiver to select said at  
8 least one first device transmit antenna from a plurality of first device  
9 transmit antennas that are each operatively coupled to said first  
10 device.  
11  
12 75. The system as recited in Claim 74, wherein said logic is further  
13 configurable to cause said at least one transceiver to selectively  
14 transmit a plurality of beams using two or more first device transmit  
15 antennas.  
16  
17 76. The system as recited in Claim 75, wherein each of said transmitted  
18 plurality of beams is selectively adjusted in phase and amplitude to  
19 reduce multipath affects when received by said second device.  
20  
21 77. The system as recited in Claim 60, wherein said at least one second  
22 device antenna includes at least one second device transmit antenna  
23 and at least one second device receive antenna.  
24  
25

- 1 78. The system as recited in Claim 77, wherein said second device  
2 includes a plurality of second device receive antennas that are  
3 configurable to receive said transmitted modified forward path data  
4 signal over said at least one forward transmission path from said first  
5 device.  
6
- 7 79. The system as recited in Claim 43, wherein said logic is further  
8 configurable to iteratively selectively test different forward path pre-  
9 equalization parameters over time such that aliased multipath delays  
10 within said reverse path data signal are identifiable.  
11
- 12 80. The system as recited in Claim 43, wherein said logic is configured  
13 to provide sub-band equalizing of said forward path data signal  
14 using corresponding frequency domain reverse path data.  
15
- 16 81. The system as recited in Claim 43, wherein said logic is further  
17 configurable to cause said transceiver to selectively establish  
18 different transmission power levels for at least two Orthogonal  
19 Frequency Division Multiplexing (OFDM) tones in said forward  
20 path data signal based on said at least one forward path pre-  
21 equalization parameter.  
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- 1 82. An apparatus comprising:
  - 2 an Orthogonal Frequency Division Multiplexing (OFDM)
  - 3 processor configured to receive coded data and output corresponding
  - 4 OFDM data;
  - 5 a pre-equalizer operatively coupled to said OFDM processor
  - 6 and configured to receive said OFDM data and output pre-equalized
  - 7 OFDM data based on gathered reverse link data;
  - 8 at least one antenna; and
  - 9 a transceiver operatively coupled to said pre-equalizer and
  - 10 said at least one antenna, said transceiver being configured to receive
  - 11 said pre-equalized OFDM data from said pre-equalizer and apply a
  - 12 corresponding transmittable forward link data signal to said at least
  - 13 one antenna.
- 14
- 15 83. The apparatus as recited in Claim 82, wherein said transceiver is
- 16 configurable to receive a transmitted reverse link data signal using
- 17 said at least one antenna and output corresponding reverse link data,
- 18 and further comprising:
  - 19 reverse link logic operatively coupled to said at least one
  - 20 antenna and said operatively coupled to said at least one first device
  - 21 antenna, said reverse link logic being configured to detect at least
  - 22 one multipath induced delay in said reverse link data and provide
  - 23 associated said gathered reverse link data to said pre-equalizer.
  - 24
  - 25

- Lee & Hayes, PLLC*

1  
2 90. The apparatus as recited in Claim 82, wherein said apparatus  
3 includes a base station device suitable for use in a wireless  
4 communication system.

5  
6 91. The apparatus as recited in Claim 82, wherein said at least one  
7 antenna is operatively configurable to provide transmission diversity.

8  
9 92. The apparatus as recited in Claim 82, wherein said at least one  
10 antenna is operatively configurable to provide spatial division.

11  
12 93. The apparatus as recited in Claim 82, wherein said at least one  
13 antenna includes at least one transmit antenna and at least one  
14 receive antenna.

15  
16 94. The apparatus as recited in Claim 93, wherein said at least one  
17 transmit antenna includes at least one type of antenna selected from  
18 a group of suitable types of antennas comprising at least one  
19 omnidirectional type of antenna, at least one beam type of antenna,  
20 at least one phased array type of antenna, and at least one adaptive  
21 antenna.  
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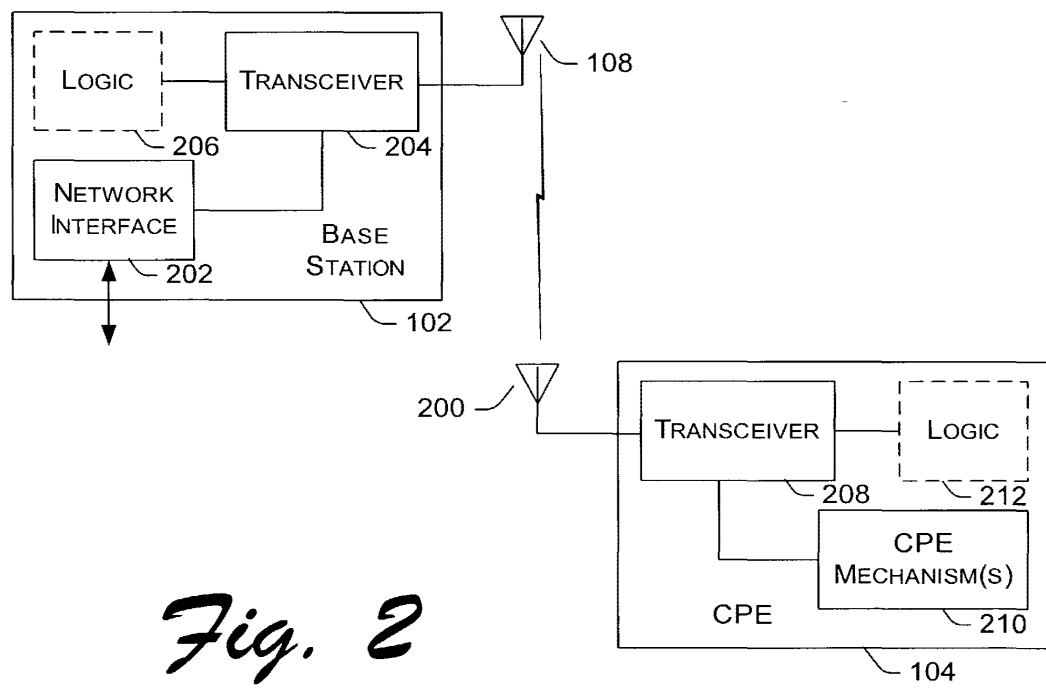
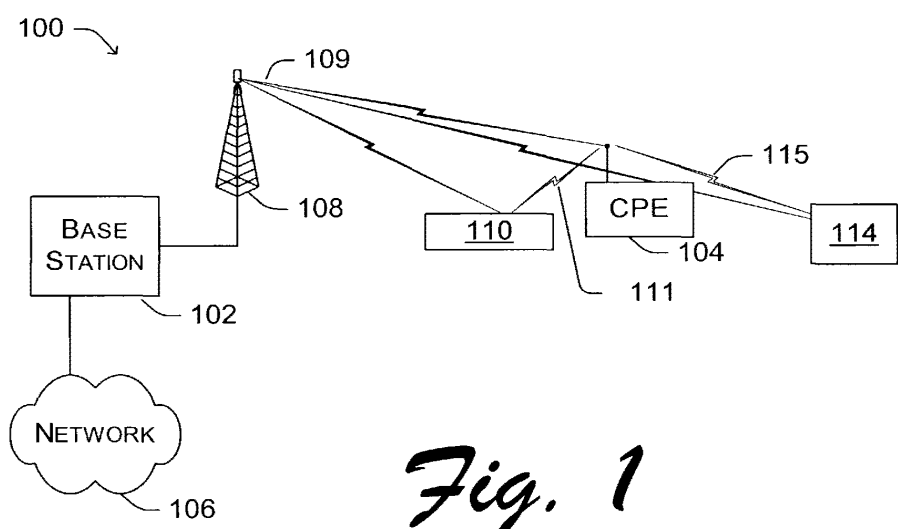
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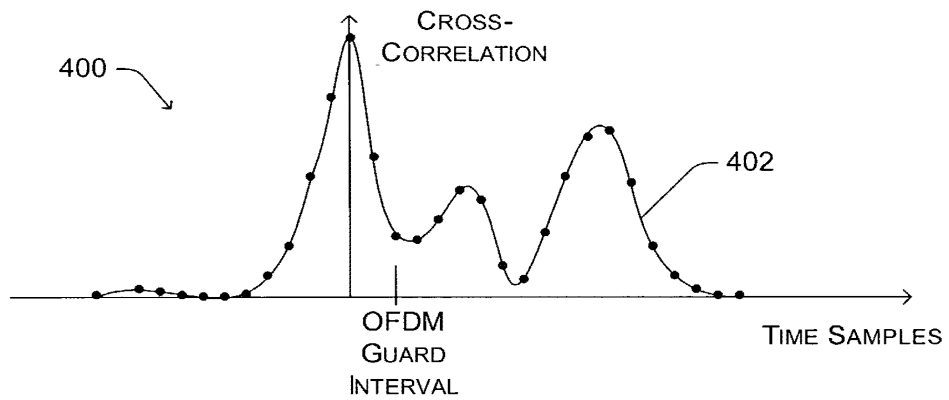
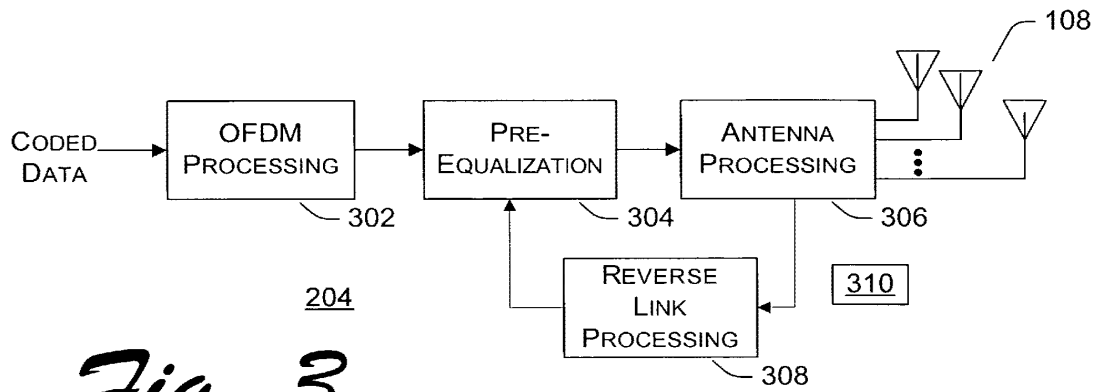
95. The apparatus as recited in Claim 93, wherein said at least one receive antenna includes at least one type of antenna selected from a group of suitable types of antennas comprising at least one omnidirectional type of antenna, at least one beam type of antenna, at least one phased array type of antenna, and at least one adaptive antenna.

1  
2 **ABSTRACT**

3       Methods, apparatuses and systems are provided for identifying at least one  
4       multipath transmission delay within a reverse path data signal, determining at least  
5       one forward path pre-equalization parameter based on the transmission delay, and  
6       modifying a forward path data signal based on the forward path pre-equalization  
7       parameter. A reverse link transmission is used to help characterize the multipath  
8       delays that may exist between communicating devices. The reverse path data  
9       signal can include a training sequence or other like known/substantially-known  
10      data that can be analyzed to detect transmission delays, especially delays that  
11      extend beyond established guard intervals. Such pre-equalization techniques can  
12      be advantageously combined, for example, with antenna arrangements that support  
13      transmission diversity, spatial division transmission, and/or other like techniques.

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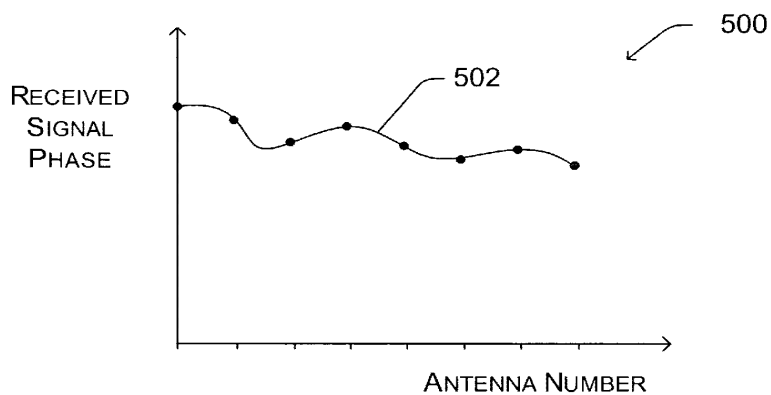


Fig. 5

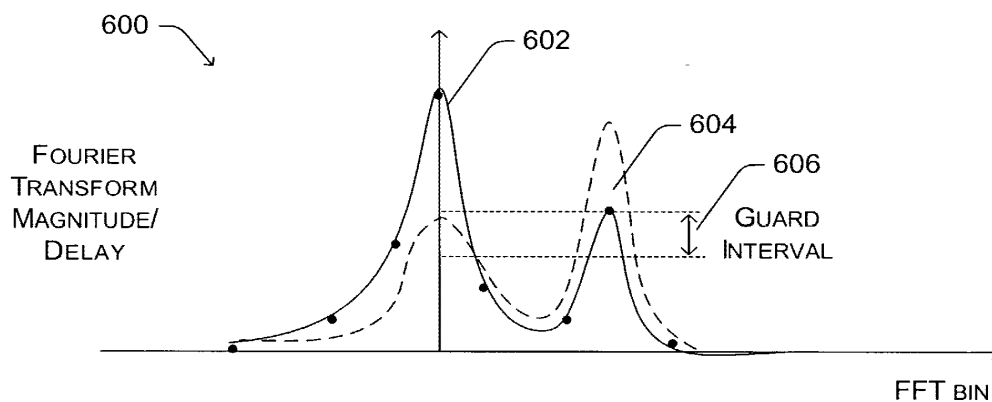


Fig. 6

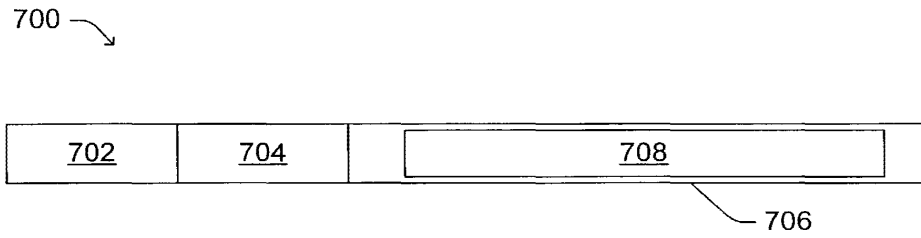


*Fig. 7*

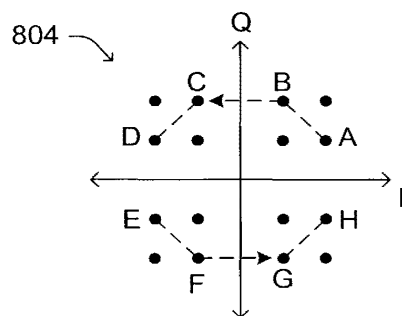
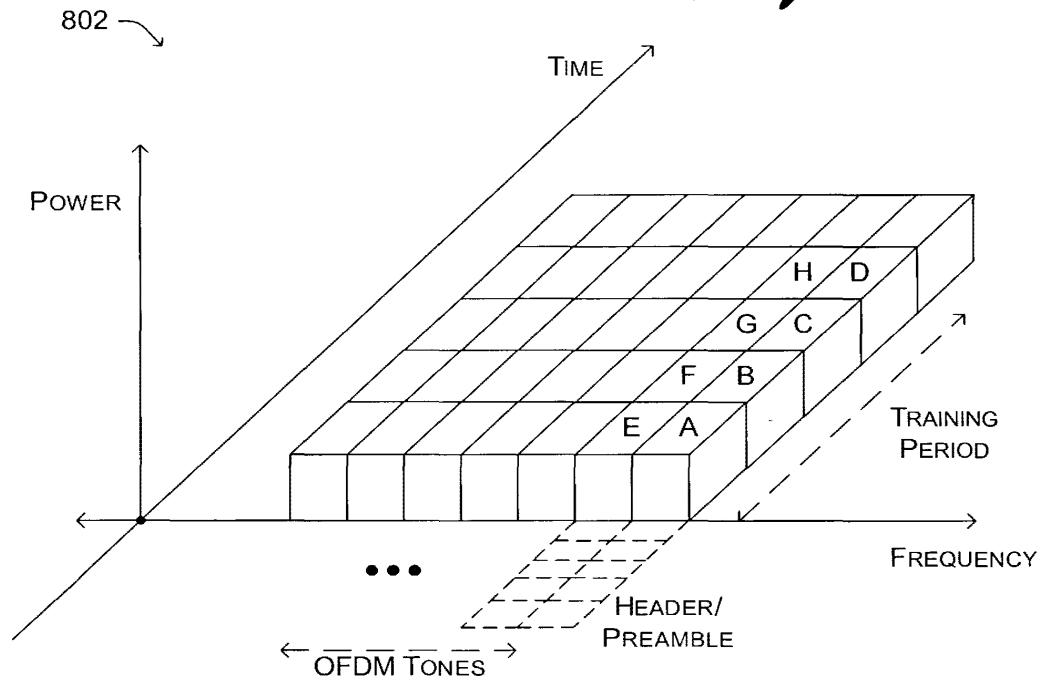


*Fig. 8*

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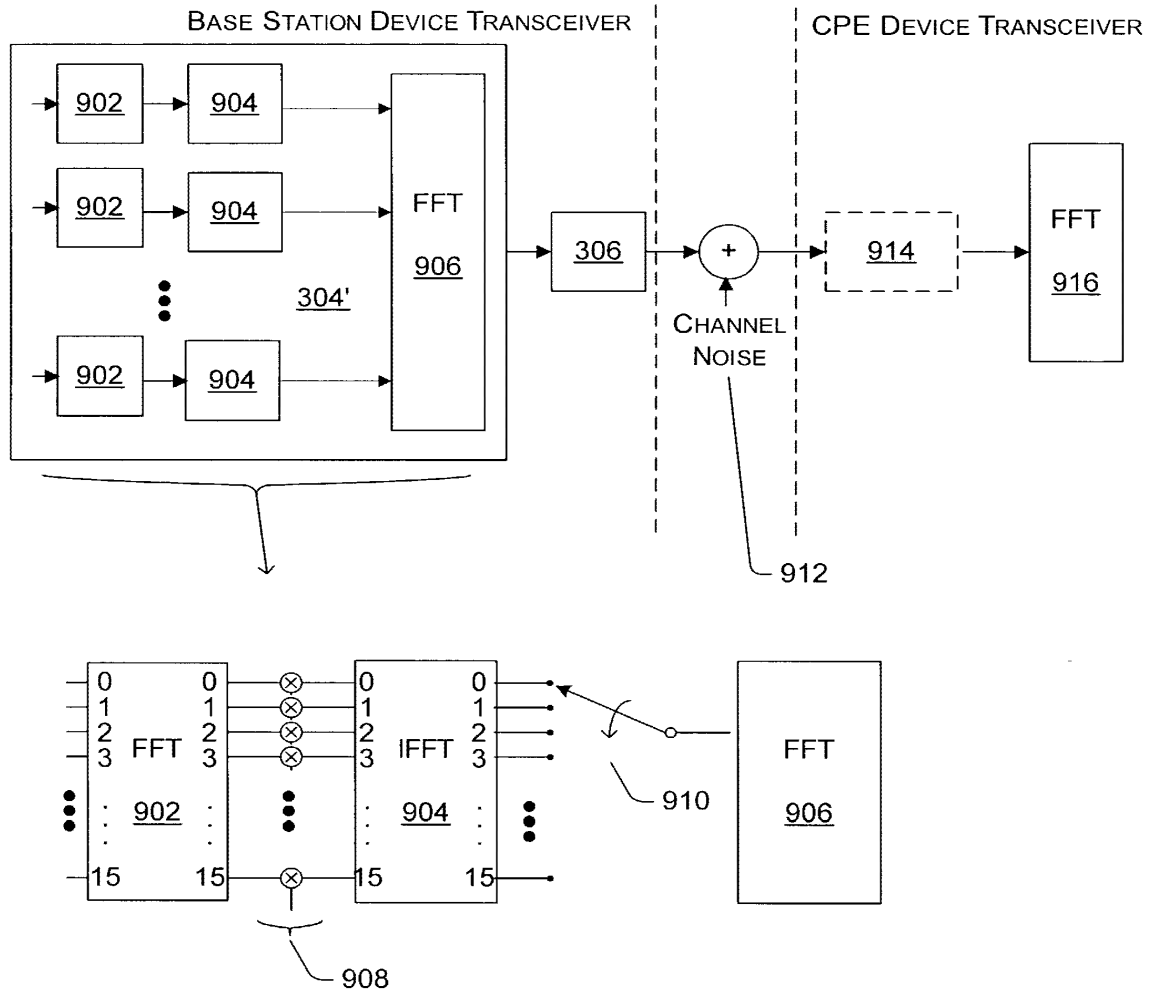


Fig. 9

1                   **IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

2   Inventorship.....Crilly Jr.  
 3   Applicant .....Mabuhay Networks, Inc.  
 4   Attorney's Docket No. ....MN1-001US  
 5   Title: Improved Multipath Communication Methods And Apparatuses

6                   **DECLARATION FOR PATENT APPLICATION**

7                   As a below named inventor, I hereby declare that:

8                   My residence, post office address and citizenship are as stated below next to  
 9                   my name.

10                  I believe I am the original, first and sole inventor (if only one name is listed  
 11                  below) or an original, first and joint inventor (if plural names are listed below) of the  
 12                  subject matter which is claimed and for which a patent is sought on the invention  
 13                  entitled "Wireless Packet Switched Communication Systems And Networks Using  
 14                  Adaptively Steered Antenna Arrays," the specification of which is attached hereto.

15                  I have reviewed and understand the content of the above-identified  
 16                  specification, including the claims.

17                  I hereby claim benefit under 35 U.S.C. 119(e) of United States Provisional  
 18                  Application 60/287,163, filed April 27, 2001.

19                  I acknowledge the duty to disclose information which is material to the  
 20                  examination of this application in accordance with Title 37, Code of Federal  
 21                  Regulations, § 1.56(a).

22                  PRIOR FOREIGN APPLICATIONS: no applications for foreign patents or  
 23                  inventor's certificates have been filed prior to the date of execution of this  
 24                  declaration.  
 25

**Power of Attorney**

I appoint the following attorneys to prosecute this application and transact all future business in the Patent and Trademark Office connected with this application: Lewis C. Lee, Reg. No. 34,656; Daniel L. Hayes, Reg. No. 34,618; Allan T. Sponseller, Reg. 38,318; James R. Banowsky, Reg. No. 37,773; Lance R. Sadler, Reg. No. 38,605; Thomas A. Jolly, Reg. No. 39,241; Kasey C. Christie, Reg. No. 40,559; Nathan R. Rieth, Reg. No. 44,302; Brian G. Hart, Reg. No. 44,421; David S. Thompson, Reg. No. 37,954; Paul W. Mitchell, Reg. No. 44,453; Bradley K. DeSandro, Reg. No. 34,521; Brian J. Pangrle, Reg. No. 42,973; David A. Morasch, Reg. No. 42,905; Robert R. Axenfeld, Reg. No. 37,276; Keith W. Saunders, Reg. No. 41,462; Kayla D. Brant, Reg. No. 46,57; and Michael G. Smith, Reg. No. 45,368.

Send correspondence to: **Customer No. 29150**



Direct telephone calls to: Thomas A. Jolly (509) 324-9256.

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

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Full name of inventor:

William J. Crilly Jr.

Inventor's Signature

William J. Crilly Jr. Date: April 25, 2002

Residence:

Liberty Lake, Washington

Citizenship:

USA

Post Office Address:

23825 E. 2<sup>nd</sup> Avenue Court  
Liberty Lake WA 99019

PATENT APPLICATION SERIAL NO. \_\_\_\_\_

U.S. DEPARTMENT OF COMMERCE  
PATENT AND TRADEMARK OFFICE  
FEE RECORD SHEET

04/29/2002 MWOLDER1 00000050 120769 10131864

|           |           |
|-----------|-----------|
| 01 FC:201 | 370.00 CH |
| 02 FC:203 | 675.00 CH |

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

MNI-00105

## CLAIMS AS FILED - PART I

|                                                           | (Column 1)      | (Column 2)   |
|-----------------------------------------------------------|-----------------|--------------|
| TOTAL CLAIMS                                              | 95              |              |
| FOR                                                       | NUMBER FILED    | NUMBER EXTRA |
| TOTAL CHARGEABLE CLAIMS                                   | 95 minus 20 = * | 75           |
| INDEPENDENT CLAIMS                                        | 3 minus 3 = *   | 0            |
| MULTIPLE DEPENDENT CLAIM PRESENT <input type="checkbox"/> |                 |              |

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

SMALL ENTITY  
TYPE ☐

OR  
OTHER THAN  
SMALL ENTITY

| RATE      | FEE    |
|-----------|--------|
| BASIC FEE | 370.00 |
| X\$ 9=    | 675    |
| X42=      |        |
| +140=     |        |
| TOTAL     | 1045   |

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

## 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 <input type="checkbox"/> |                                    |               |

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 |                |

|             | (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 <input type="checkbox"/> |                                    |               |

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

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

|             | (Column 1)                                                              | (Column 2)                         | (Column 3)    |
|-------------|-------------------------------------------------------------------------|------------------------------------|---------------|
| AMENDMENT C | CLAIMS REMAINING AFTER AMENDMENT                                        | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |
|             | Total *                                                                 | Minus **                           | =             |
|             | Independent *                                                           | Minus ***                          | =             |
|             | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <input type="checkbox"/> |                                    |               |

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

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

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."

\*\*\*If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

| <b>CLAIMS ONLY</b> |          |      |                        |      |                        |      | SERIAL NO.   | FILING DATE |
|--------------------|----------|------|------------------------|------|------------------------|------|--------------|-------------|
|                    |          |      |                        |      |                        |      | APPLICANT(S) |             |
| CLAIMS             |          |      |                        |      |                        |      |              |             |
|                    | AS FILED |      | AFTER<br>1st AMENDMENT |      | AFTER<br>2nd AMENDMENT |      |              |             |
|                    | IND.     | DEP. | IND.                   | DEP. | IND.                   | DEP. |              |             |
| 1                  |          |      |                        |      |                        |      |              |             |
| 2                  |          |      |                        |      |                        |      |              |             |
| 3                  |          |      |                        |      |                        |      |              |             |
| 4                  |          |      |                        |      |                        |      |              |             |
| 5                  |          |      |                        |      |                        |      |              |             |
| 6                  |          |      |                        |      |                        |      |              |             |
| 7                  |          |      |                        |      |                        |      |              |             |
| 8                  |          |      |                        |      |                        |      |              |             |
| 9                  |          |      |                        |      |                        |      |              |             |
| 10                 |          |      |                        |      |                        |      |              |             |
| 11                 |          |      |                        |      |                        |      |              |             |
| 12                 |          |      |                        |      |                        |      |              |             |
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| 14                 |          |      |                        |      |                        |      |              |             |
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| 20                 |          |      |                        |      |                        |      |              |             |
| 21                 |          |      |                        |      |                        |      |              |             |
| 22                 |          |      |                        |      |                        |      |              |             |
| 23                 |          |      |                        |      |                        |      |              |             |
| 24                 |          |      |                        |      |                        |      |              |             |
| 25                 |          |      |                        |      |                        |      |              |             |
| 26                 |          |      |                        |      |                        |      |              |             |
| 27                 |          |      |                        |      |                        |      |              |             |
| 28                 |          |      |                        |      |                        |      |              |             |
| 29                 |          |      |                        |      |                        |      |              |             |
| 30                 |          |      |                        |      |                        |      |              |             |
| 31                 |          |      |                        |      |                        |      |              |             |
| 32                 |          |      |                        |      |                        |      |              |             |
| 33                 |          |      |                        |      |                        |      |              |             |
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| 36                 |          |      |                        |      |                        |      |              |             |
| 37                 |          |      |                        |      |                        |      |              |             |
| 38                 |          |      |                        |      |                        |      |              |             |
| 39                 |          |      |                        |      |                        |      |              |             |
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| 41                 |          |      |                        |      |                        |      |              |             |
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| 44                 |          |      |                        |      |                        |      |              |             |
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| 46                 |          |      |                        |      |                        |      |              |             |
| 47                 |          |      |                        |      |                        |      |              |             |
| 48                 |          |      |                        |      |                        |      |              |             |
| 49                 |          |      |                        |      |                        |      |              |             |
| 50                 |          |      |                        |      |                        |      |              |             |
| TOTAL IND.         | 5        |      |                        |      |                        |      |              |             |
| TOTAL DEP.         | 87       |      |                        |      |                        |      |              |             |
| TOTAL CLAIMS       | 92       |      |                        |      |                        |      |              |             |

|              | *    |      | *    |      | *    |      |
|--------------|------|------|------|------|------|------|
|              | IND. | DEP. | IND. | DEP. | IND. | DEP. |
| 51           |      |      |      |      |      |      |
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| 99           |      |      |      |      |      |      |
| 100          |      |      |      |      |      |      |
| TOTAL IND.   |      |      |      |      |      |      |
| TOTAL DEP.   |      |      |      |      |      |      |
| TOTAL CLAIMS |      |      |      |      |      |      |

\* MAY BE USED FOR ADDITIONAL CLAIMS OR ADMENDMENTS

FORM PTO-2022 (1-98)

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