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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 11/27/2023

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER	
ABELSON, RONALD B	

ART UNIT	PAPER NUMBER
2419	

MAIL DATE	DELIVERY MODE
11/27/2023	PAPER

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

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

Samsung Exhibit 1023, Page 1 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re Application of	:	
Shattil, Steve J.	:	
Application No. 10/145,854	:	DECISION ON PETITION
Filed: 14 May 2002	:	
For CARRIER INTERFEROMETRY NETWORKS	:	

The above-identified application was forwarded to the Office of Petitions for review of the papers. A review of the record reveals that the above-captioned application was erroneously issued as U.S. Patent No. 10,673,758.

BACKGROUND

The present application was filed on May 14, 2002.

Prosecution led to the issuing of a Notice Allowance and Fee(s) Due and a Notice of Allowability on February 25, 2009. The Notice of Allowance and Fee(s) Due indicated that the $755 issue fee and the $300 publication fee were due on May 26, 2009, or the application would be regarded as abandoned.

On May 28, 2009, an untimely payment of the issue fee and publication fee was received, and a notice of abandonment was issued on June 24, 2009.

On July 15, 2009, a petition under 37 CFR 1.181 to withdraw the holding of abandonment of the application was received.

A decision dismissing the petition under 37 CFR 1.181 to withdraw the abandonment was issued on June 21, 2010.

An ePetition to revive the application under 37 CFR 1.137(a) was filed April 9, 2020. The ePetition was automatically granted in a decision issued the same day.

A corrected decision on the petition filed April 9, 2020 under 37 CFR 1.137(a) was issued on April 23, 2020. The decision of April 23, 2023 dismissed the petition under 37 CFR 1.137(a) and indicated that the application remained abandoned.

On May 13, 2020, an issue notification was issued indicating that patent 10,673,758 would issue on June 2, 2020.

On June 2, 2020, a patent-like document was published.

DISCUSSION

Failure to pay the required issue fee and publication fee prior to the expiration of the three-month statutory period provided in a Notice of Allowance will result in the abandonment of an application. *See* 35 U.S.C. 151(b). As explained above, the USPTO record indicates that applicant did not submit payment of the required issue fee and publication fee prior to the deadline for payment, and as a result, the application became abandoned on May 27, 2009.

An ePetition to revive under 37 CFR 1.137(a) was filed on April 9, 2020. A decision automatically granting the ePetition to revive under 37 CFR 1.137(a) was issued the same day by the Patents Electronic Filing System. A corrected decision issued on April 23, 2020, vacating the decision automatically granted on April 9, 2020. The decision issued on April 23, 2020, dismissed the petition under 1.137(a) and requested additional information regarding the delay in filing a grantable petition[1]. No response to the decision of April 23, 2020, has been received. Therefore, this application remains abandoned.

Since this application is abandoned, no patent has issued. The following errata will be published in the Official Gazette:

> "All references to Patent No. 10,673,758 to Steve J. Shattil of Boulder, CO for CARRIER INTERFEROMETRY NETWORKS appearing in the Official Gazette of June 2, 2020, should be deleted since no patent was granted."

Further correspondence with respect to this matter should be delivered through one of the following mediums:

By mail: Mail Stop PETITIONS
Commissioner for Patents
Post Office Box 1450
Alexandria, VA 22313-1450

By hand: Customer Service Window
Mail Stop Petitions

[1] The USPTO requires additional information concerning whether a delay in seeking the revival of an abandoned application was unintentional where the petition to revive was filed more than two years after the date the application became abandoned. See Clarification of the Practice for Requiring Additional Information in Petitions Filed in Patent Applications and Patents Based on Unintentional Delay, 85 FR 12222 (March 2, 2020). Therefore, additional information that provides an explanation of the circumstances surrounding the delay that establishes the entire delay was unintentional is required.

Randolph Building
40l Dulany Street
Alexandria, VA 22314

By fax: (571) 273-8300
ATTN: Office of Petitions

By internet: Patents Electronic Filing System[2]

Any questions concerning this matter may be directed to Jacob F Bétit at (571) 272-4075.

/Jacob F Bétit/
Jacob F Bétit
Deputy Director
Office of Petitions

[2] https://www.uspto.gov/patents/apply (for help using Patents Electronic Filing System call the Patent Electronic Business Center at (866) 217-9197).

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 10,673,758 B2
APPLICATION NO. : 10/145854
DATED : June 2, 2020
INVENTOR(S) : Steve Shattil

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Drawings

Please amend FIG. 7 as indicated in the attached Drawing Sheet 7.

In the Specification

Column 14, Line 28, please amend "k/f_2" to read "k/f_s".

Column 14, Line 31, please amend "$f(\varphi) = \{ e^{j\theta 1}, e^{j\theta 2}, \ldots, e^{j\theta N} \} = \{ e^{j0}, e^{j2\pi k/N}, \ldots, e^{j(N-1)\cdot 2\pi k/N} \}$" to read "$f(\varphi) = \{e^{j\varphi 1}, e^{j\varphi 2}, \ldots, e^{j\varphi N}\} = \{e^{j0}, e^{j2\pi k/N}, \ldots, e^{j(N-1)\cdot 2\pi k/N} \}$".

Column 14, Line 40, please amend "$(N-1)//f_s$" to read "$(N-1)/f_s$".

Column 14, Line 45, please amend "$(N-1)//f_s$" to read "$(N-1)/f_s$".

Signed and Sealed this
Twenty-fourth Day of November, 2020

Andrei Iancu
Director of the United States Patent and Trademark Office

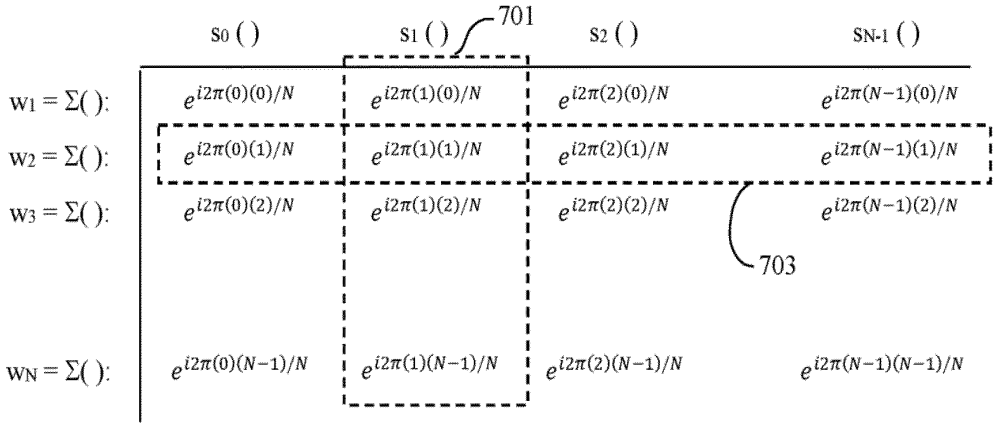

S0 ( )
S1 ( )
701
S2 ( )
SN-1 ( )
W1 = Σ( ):
W2 = Σ( ):
W3 = Σ( ):
WN = Σ( ):
$e^{i2\pi(0)(0)/N}$
$e^{i2\pi(1)(0)/N}$
$e^{i2\pi(2)(0)/N}$
$e^{i2\pi(N-1)(0)/N}$
$e^{i2\pi(0)(1)/N}$
$e^{i2\pi(1)(1)/N}$
$e^{i2\pi(2)(1)/N}$
$e^{i2\pi(N-1)(1)/N}$
$e^{i2\pi(0)(2)/N}$
$e^{i2\pi(1)(2)/N}$
$e^{i2\pi(2)(2)/N}$
$e^{i2\pi(N-1)(2)/N}$
703
$e^{i2\pi(0)(N-1)/N}$
$e^{i2\pi(1)(N-1)/N}$
$e^{i2\pi(2)(N-1)/N}$
$e^{i2\pi(N-1)(N-1)/N}$

FIG. 7

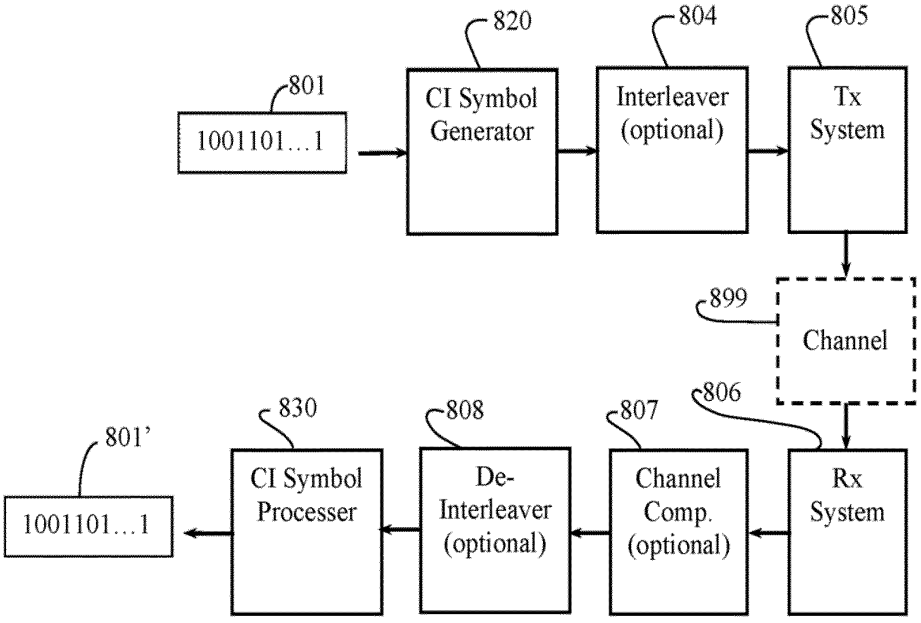

801
1001101…1
820
CI Symbol Generator
804
Interleaver (optional)
805
Tx System
899
Channel
806
Rx System
807
Channel Comp. (optional)
808
De-Interleaver (optional)
830
CI Symbol Processer
801'
1001101…1

FIG. 8A

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 10/22/2020

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER	
ABELSON, RONALD B	

ART UNIT	PAPER NUMBER
2419	

MAIL DATE	DELIVERY MODE
10/22/2020	PAPER

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
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P.O. Box 1450
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Patent No.: 10673758
Issue Date: 06/02/2020
Appl. No.: 10/145,854
Filed: 05/14/2002

PART (A) RESPONSE FOR CERTIFICATES OF CORRECTION

This is a decision on the Certificate of Correction request filed 06 October 2020.

The request for issuance of Certificate of Correction for the above-identified correction(s) under the provisions of 37 CFR 1.322 and/or 1.323 is hereby:

(Check one)
☑ Approved ☐ Approved in Part ☐ Denied

Comments: ____

PART (B) PETITION UNDER 37 CFR 1.324 OR 37 CFR 1.48

☐ This is a decision on the petition filed ____ to correct inventorship under 37 CFR 1.324.

☐ This is a decision on the request under 37 CFR 1.48, petition filed ____. In view of the fact that the patent has already issued, the request under 37 CFR 1.48 has been treated as a petition to correct inventorship under 37 CFR 1.324.

The petition is hereby: ☐ Granted ☐ Dismissed

Comment: ____

The patented filed is being forwarded to Certificate of Corrections Branch for issuance of a certificate naming only the actual inventor or inventors.

/AYAZ R SHEIKH/
Supervisory Patent Examiner, Art Unit 2476
Technology Center 2400
Phone: (571)272-3795

Certificates of Correction Branch email: CustomerServiceCoC@uspto.gov CoC Central Phone Number: (703) 756-1814

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Patent No.: 10673758
Issue Date: 06/02/2020
Appl. No.: 10/145,854
Filed: 05/14/2002

PART (A) RESPONSE FOR CERTIFICATES OF CORRECTION

This is a decision on the Certificate of Correction request filed 06 October 2020.

The request for issuance of Certificate of Correction for the above-identified correction(s) under the provisions of 37 CFR 1.322 and/or 1.323 is hereby:

(Check one)
☑ Approved ☐ Approved in Part ☐ Denied

Comments: ____

PART (B) PETITION UNDER 37 CFR 1.324 OR 37 CFR 1.48

☐ This is a decision on the petition filed ____ to correct inventorship under 37 CFR 1.324.

☐ This is a decision on the request under 37 CFR 1.48, petition filed ____. In view of the fact that the patent has already issued, the request under 37 CFR 1.48 has been treated as a petition to correct inventorship under 37 CFR 1.324.

The petition is hereby: ☐ Granted ☐ Dismissed

Comment: ____

The patented filed is being forwarded to Certificate of Corrections Branch for issuance of a certificate naming only the actual inventor or inventors.

/AYAZ R SHEIKH/
Supervisory Patent Examiner, Art Unit 2476
Technology Center 2400
Phone: (571)272-3795

Certificates of Correction Branch email: CustomerServiceCoC@uspto.gov CoC Central Phone Number: (703) 756-1814

Docket No. CINET 01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Letters Patent of:
Steve Shattil Confirmation No. 6398
Patent No. 10,673,758
Issued 6/2/2020
For: Carrier Interferometry Networks

REQUEST FOR CERTIFICATE OF CORRECTION PURSUANT TO 37 CFR 1.323

Attention: Certificate of Corrections Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Upon reviewing the above-identified patent, Patentee noted typographical errors which should be corrected.

In the Drawings:

In FIG. 7, in the exponential of each matrix element, please amend the denominator "(N-1)" to read "N", as shown in the attached Replacement Drawing sheet 7 (clean and marked-up versions).

In the Specification:

Col. 14, line 28, please amend "k/f_2" to read "k/f_s".

Col. 14, line 31, please amend "$f(\varphi) = \{e^{j\theta 1}, e^{j\theta 2}, \ldots, e^{j\theta N}\} = \{e^{j0}, e^{j2\pi k/N}, \ldots, e^{j(N-1)\cdot 2\pi k/N}\}$" to read "$f(\varphi) = \{e^{j\varphi 1}, e^{j\varphi 2}, \ldots, e^{j\varphi N}\} = \{e^{j0}, e^{j2\pi k/N}, \ldots, e^{j(N-1)\cdot 2\pi k/N}\}$".

Samsung Exhibit 1023, Page 10 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Col. 14, line 40, please amend "(N-1)//f_s" to read "(N-1)/f_s".

Col. 14, line 45, please amend "(N-1)//f_s" to read "(N-1)/f_s".

The errors were found in the application as filed by applicant. The fee set forth in 37 CFR 1.20(a) accompanies this letter.

The errors now sought to be corrected are inadvertent typographical errors of which does not involve new matter or require reexamination.

Transmitted herewith is a proposed Certificate of Correction effecting such amendment. Patentee respectfully solicits the granting of the requested Certificate of Correction.

Respectfully submitted,

/Steven J Shattil/

Steven J. Shattil, Reg. No. 40,170
P.O. Box 17355
Boulder, CO 80308-0355
(720) 234-4351

PTO/SB/44 (09-07)
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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10,673,758

APPLICATION NO.: 10/145,854

ISSUE DATE : June 2, 2020

INVENTOR(S) : Shattil; Steve

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Col. 14, line 28, please amend "k/f_2" to read "k/f_s".

Col. 14, line 31, please amend "$f(\varphi) = \{e^{j\theta 1}, e^{j\theta 2}, \ldots, e^{j\theta N}\} = \{e^{j0}, e^{j2\pi k/N}, \ldots, e^{j(N-1)\cdot 2\pi k/N}\}$" to read "$f(\varphi) = \{e^{j\varphi 1}, e^{j\varphi 2}, \ldots, e^{j\varphi N}\} = \{e^{j0}, e^{j2\pi k/N}, \ldots, e^{j(N-1)\cdot 2\pi k/N}\}$".

Col. 14, line 40, please amend "$(N-1)//f_s$" to read "$(N-1)/f_s$".

Col. 14, line 45, please amend "$(N-1)//f_s$" to read "$(N-1)/f_s$".

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

Steven J Shattil
PO Box 17355, Boulder, CO 80308

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

PTO/SB/44 (09-07)
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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10,673,758

APPLICATION NO.: 10/145,854

ISSUE DATE : June 2, 2020

INVENTOR(S) : Shattil; Steve

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Drawings:

Please amend FIG. 7 as indicated in the attached clean and marked-up versions of Drawing Sheet 7.

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

Steven J Shattil
PO Box 17355, Boulder, CO 80308

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, 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.

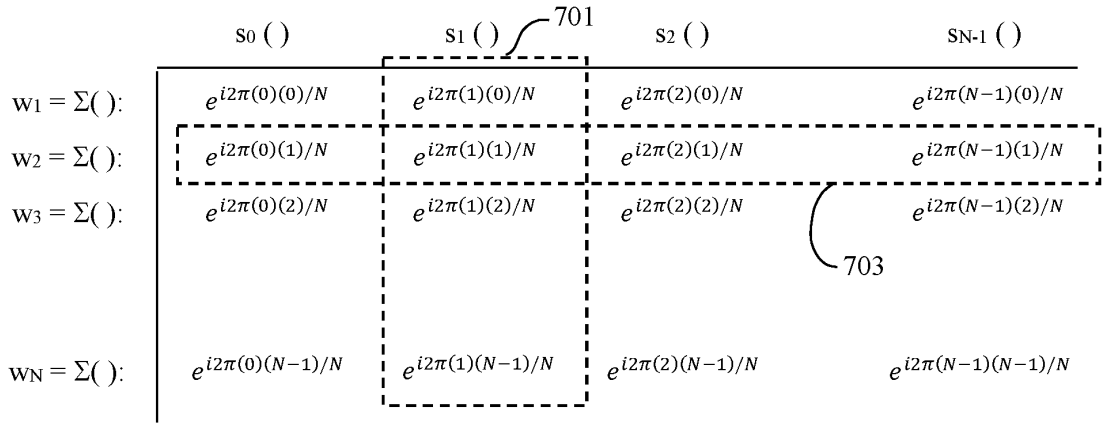

s0 ( )
s1 ( )
701
s2 ( )
sN-1 ( )
w1 = Σ( ):
w2 = Σ( ):
w3 = Σ( ):
wN = Σ( ):
$e^{i2\pi(0)(0)/N}$
$e^{i2\pi(1)(0)/N}$
$e^{i2\pi(2)(0)/N}$
$e^{i2\pi(N-1)(0)/N}$
$e^{i2\pi(0)(1)/N}$
$e^{i2\pi(1)(1)/N}$
$e^{i2\pi(2)(1)/N}$
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$e^{i2\pi(2)(2)/N}$
$e^{i2\pi(N-1)(2)/N}$
703
$e^{i2\pi(0)(N-1)/N}$
$e^{i2\pi(1)(N-1)/N}$
$e^{i2\pi(2)(N-1)/N}$
$e^{i2\pi(N-1)(N-1)/N}$

FIG. 7

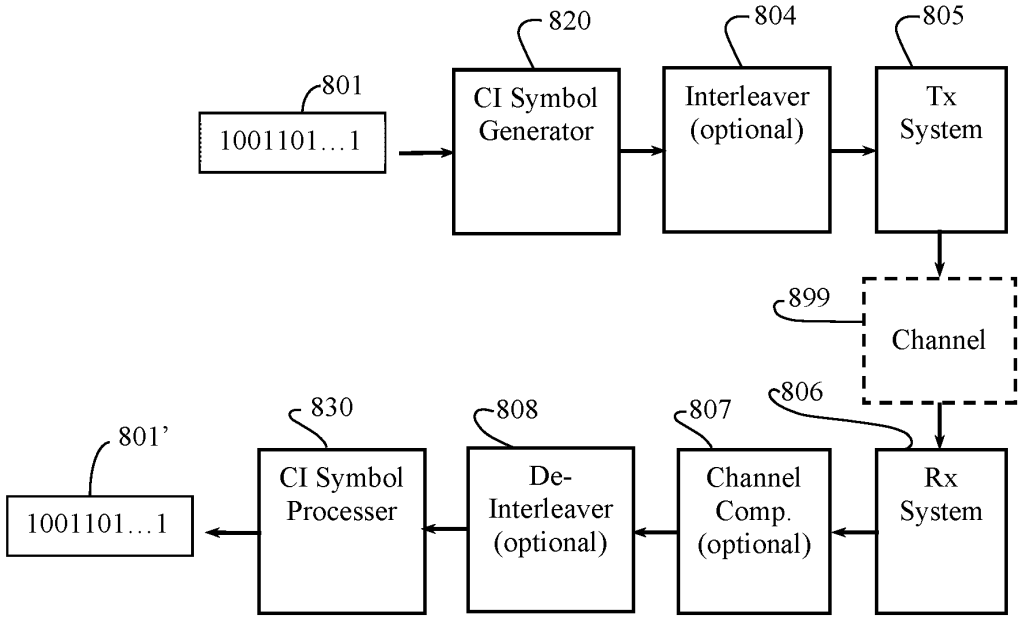

801
1001101…1
820
CI Symbol Generator
804
Interleaver (optional)
805
Tx System
899
Channel
806
807
Channel Comp. (optional)
808
De-Interleaver (optional)
830
CI Symbol Processer
801'
1001101…1
Rx System

FIG. 8A

Amended Marked Up

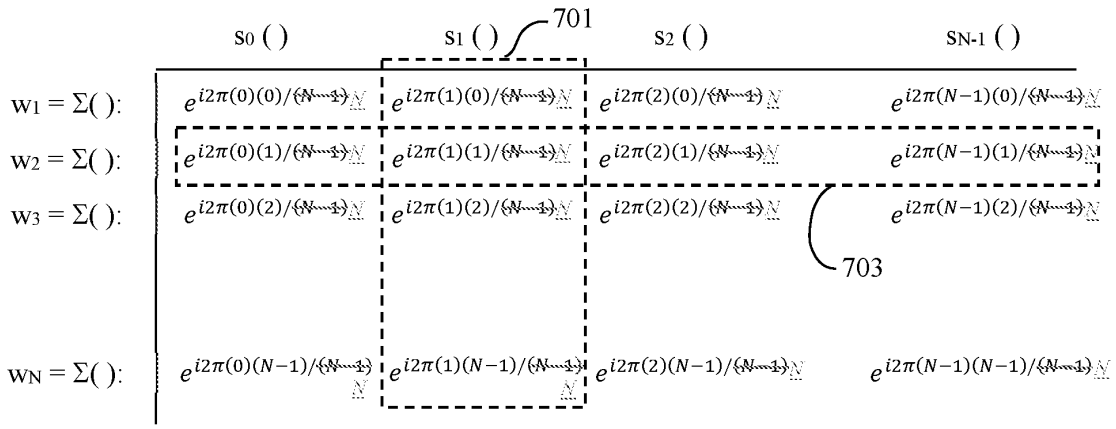


FIG. 7 (Amended)

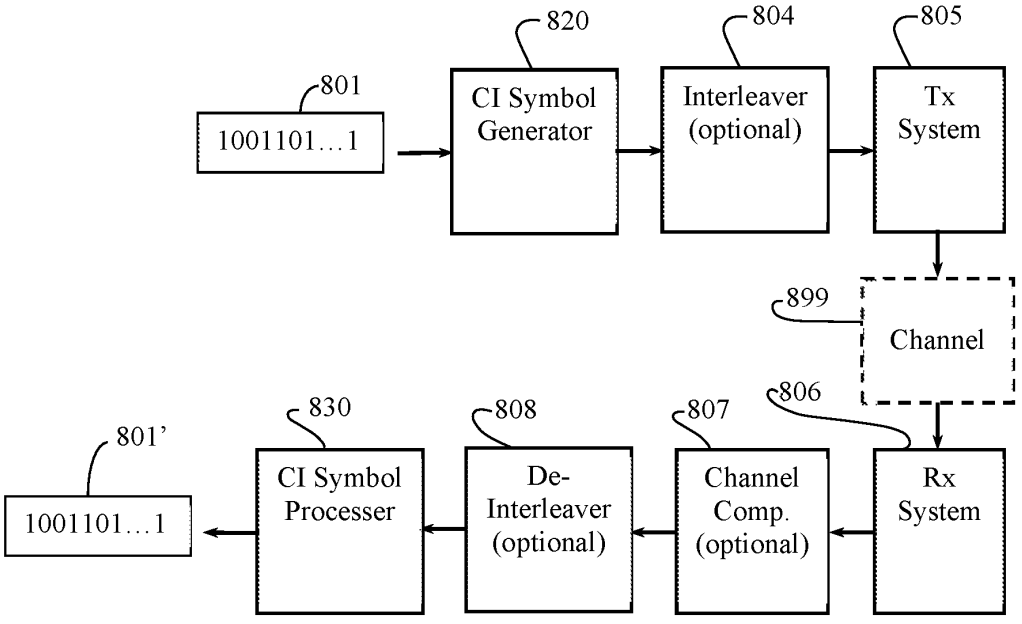


FIG. 8A

6	Fee Worksheet (SB06)	fee-info.pdf	29553 c25e4d6a0d816febf675e5c070c48e93e0600728	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	864218	

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.

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	06/02/2020	10673758	CINET 01	6398

7590 05/13/2020

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

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 5804 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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

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

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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

Steve J. Shattil, Boulder, CO;

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

Issue Classification CPC	Application ID
	10145854
Document Date: 5/5/2020	**Document Code: IIFW**

APPLICATION_ID	CPC	TYPE	VERSION
10145854	H04L 47/10	F	20130101

UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 04/23/2020

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER	
ABELSON, RONALD B	

ART UNIT	PAPER NUMBER
2419	

MAIL DATE	DELIVERY MODE
04/23/2020	PAPER

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UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re application of	:	
Shattil	:	
Application No. 10/145,854	:	NOTICE VACATING PETITION
Filed: May 14, 2002	:	
Attorney Docket No. CINET01	:	

The purpose of this notice is to advise you that the decision automatically granted by Electronic Filing System (EFS) on April 9, 2020, is hereby **VACATED** for the reasons indicated below:

The record discloses the following:

- A Notice of Allowance and Fee(s) Due was mailed on February 25, 2009, which set a Non-Extendable Statutory Period for reply of three (3) months.
- The issue and publication fees were paid on May 28, 2009.
- A Notice of Abandonment was mailed on June 24, 2009, indicating that the application was abandoned for failure to timely pay the issue fee. The issue fee was due, on, or before, Tuesday, May 26, 2009[1].
- On July 15, 2009, a communication was filed request withdrawal of the holding of abandonment, The communication was treated as a petition under 37 CFR 1.181 requesting withdrawal of the holding of abandonment and dismissed by a decision mailed on June 21, 2010.
- On April 9, 2020, a Petition for Revival Of An Application For Patent Abandoned Unintentionally Under 37 CFR 1.137(a) was filed by the Electronic Filing System (EFS) and automatically granted by EFS on April 9, 2020. The petition was accompanied by the petition fee under 37 CFR 1.17(m) of $1,000.00.

Effective December 1, 1997, the provisions of 37 CFR 1.137(b) now provide that where the delay in reply was unintentional, a petition may be filed to revive an abandoned application pursuant to 37 CFR 1.137(a). A grantable petition pursuant to 37 CFR 1.137(a) must, pursuant to 37 CFR 1.137(b), be accompanied by:

(1) The reply required to the outstanding Office action or notice, unless previously filed;
(2) The petition fee as set forth in § 1.17(m);
(3) Any terminal disclaimer (and fee as set forth in § 1.20(d)) required pursuant to paragraph (d) of this section; and
(4) A statement that the entire delay in filing the required reply from the due date for the reply until the filing of a grantable petition pursuant to this section was unintentional. The

[1] It is noted that Monday, May 25, 2009, was a federal holiday. See 37 CFR 1.6.

> Director may require additional information where there is a question whether the delay was unintentional. The instant petition does not satisfy the requirements of item (3) above.

The petition does not satisfy 37 CFR 1.137(b)(4). Petitioner submitted the required statement of unintentional delay. However, this petition to revive the abandoned application under 37 CFR 1.137(a) was filed more than two years after the date of abandonment.

The USPTO requires additional information concerning whether a delay in seeking the revival of an abandoned application was unintentional where the petition to revive was filed more than two years after the date the application became abandoned. *See Clarification of the Practice for Requiring Additional Information in Petitions Filed in Patent Applications and Patents Based on Unintentional Delay*, 85 FR 12222 (March 2, 2020). Therefore, additional information that provides an explanation of the circumstances surrounding the delay that establishes the entire delay was unintentional is required.

The USPTO is concerned with three periods of delay. Petitioner is reminded the burden of proof to establish that the delay from the due date for the reply until the filing of a grantable petition was unintentional within the meaning of 35 U.S.C. 27 and 37 CFR 1.137 rests with the petitioner. *See* MPEP 711.03(c)(II)(F).

The first period of delay petitioner must address on renewed petition is the delay in filing the reply that originally resulted in the abandonment of this application. Petitioner must explain the delay between when the reply was due and when the reply was filed.

The second period of delay petitioner must address on renewed petition is the delay in filing the initial petition pursuant to 37 CFR 1.137(a). Petitioner must explain why this initial petition was not filed until April 9, 2020.

The third period of delay petitioner must address on renewed petition is the delay in filing a *grantable* petition pursuant to 37 CFR 1.137(a).

When addressing each of these three periods of delay, petitioner is reminded that where the petitioner deliberately permits an application to become abandoned (*e.g.*, due to a conclusion the claims are unpatentable, a rejection in an Office action cannot be overcome, or the invention lacks sufficient commercial value to justify continued prosecution), the abandonment of such application is considered to be a deliberately chosen course of action, and the resulting delay cannot be considered as "unintentional" within the meaning of 37 CFR 1.137. *See In re Application of G*, 11 USPQ2d 1378, 1380 (Comm'r Pat. 1989). Similarly, an intentional course of action is not rendered unintentional when, upon reconsideration, the applicant changes his or her mind as to the course of action that should have been taken. *See In re Maldague*, 10 USPQ2d 1477, 1478 (Comm'r Pat. 1988). Petitioner's failure to carry the burden of proof to establish that the "entire" delay was "unintentional" may lead to the denial of a petition under 37 CFR 1.137, regardless of the circumstances that originally resulted in the abandonment of the application.

Petitioner should note that the party whose delay is relevant is the party having the right or authority to file the response in the above identified application. When the applicant assigns the entire right, title, and interest in an invention to a third party (and thus does not retain any legal or equitable interest in the invention), the applicant's delay is irrelevant in evaluating whether the delay was unintentional. *See Kim v. Quigg*, 718 F. Supp. 1280, 1284, 12 USPQ2d 1604, 1607-08 (E.D. Va. 1989). *See* MPEP

711.03(c)(II)(C)-(F) for additional guidance on the information required to establish that the entire delay was unintentional.

In view of the above, the petition automatically granted by EFS on April 9, 2020, is vacated and the application remains ABANDONED.

A response to this letter must be submitted within TWO (2) MONTHS from the mail date of this decision. Extensions of time under 37 CFR 1.136(a) are permitted. The petition should include a cover letter entitled "Renewed Petition under 37 CFR 1.137(a)." This is not a final agency action within the meaning of 5 U.S.C. § 704.

Further correspondence with respect to this matter should be delivered through one of the following mediums:

By mail:	Mail Stop PETITIONS Commissioner for Patents Post Office Box 1450 Alexandria, VA 22313-1450
By hand:	Customer Service Window Mail Stop Petitions Randolph Building 40l Dulany Street Alexandria, VA 22314
By fax:	(571) 273-8300 ATTN: Office of Petitions
By internet:	EFS-Web www.uspto.gov/ebc/efs_help.html (for help using EFS-Web call the Patent Electronic Business Center at (866) 217-9197)

Any questions concerning this matter may be directed to the undersigned at (571) 272-3222.

/KENYA A THORNTON MCLAUGHLIN/
Attorney Advisor, OPET

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/64 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(a)
Application Number	10145854
Filing Date	14-May-2002
First Named Inventor	Steve Shattil
Art Unit	2419
Examiner Name	RONALD ABELSON
Attorney Docket Number	CINET 01
Title	CARRIER INTERFEROMETRY NETWORKS

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the office notice or action plus any extensions of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:
(1) Petition fee;
(2) Reply and/or issue fee;
(3) Terminal disclaimer with disclaimer fee – required for all utility and plant applications filed before June 8, 1995; and for all design applications;
(4) Statement that the entire delay was unintentional.

Petition Fee

- (◉) Small Entity
- (◯) Micro Entity
- (◯) Regular Undiscounted

Issue Fee and Publication Fee :

Issue Fee and Publication Fee are not due.

☒ Issue Fee Transmittal is attached

Drawing corrections and/ or other deficiencies.

◉ Drawing corrections and/ or other deficiencies are not required ○ I certify, in accordance with 37 CFR 1.4.(d)(4), that drawing corrections and/ or other deficiencies have previously been filed on ○ Drawing corrections and/ or other deficiencies are attached. ☒ STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(a) was unintentional.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ○ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application. ○ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity. ◉ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this e-petition.	
Signature	/Steve Shattil/
Name	Steve Shattil

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)

7590 02/25/2009

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

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.

Steven J Shattil	(Depositor's name)
/Steven J Shattil/	(Signature)
4/9/2020	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

TITLE OF INVENTION: CARRIER INTERFEROMETRY NETWORKS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	05/26/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
ABELSON, RONALD B	2419	370-208000

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 Steven J Shattil
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: Genghiscomm Holdings, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Boulder, CO

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 /Steven J Shattil/ Date 4/9/2020

Typed or printed name Steven J Shattil Registration No. 40170

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

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

Electronic Patent Application Fee Transmittal

Application Number:	10145854
Filing Date:	14-May-2002
Title of Invention:	CARRIER INTERFEROMETRY NETWORKS
First Named Inventor/Applicant Name:	Steve J. Shattil
Filer:	Steven J Shattil
Attorney Docket Number:	CINET 01

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
PET. REVIVE ABANDON APP, DELAY PYMT-RESP	2453	1	1000	1000
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Decision Date : April 9, 2020

In re Application of :

Steve Shattil

Application No : 10145854

Filed : 14-May-2002

Attorney Docket No : CINET 01

DECISION ON PETITION

UNDER CFR 1.137(a)

This is an electronic decision on the petition under 37 CFR 1.137(a), filed April 9, 2020 , to revive the above-identified application.

The petition is **GRANTED.**

The above-identified application became abandoned for failure to reply in a timely manner to the Notice of Allowance and Issue Fee(s) Due. The date of abandonment is the day after the expiration date of the period set for reply in the Notice.

The electronic petition satisfies the conditions for revival pursuant to the provisions of 37 CFR 1.137(a) in that (1) the reply in the form of payment of the Issue Fee and the Publication Fee (if necessary); (2) the petition fee as set forth in 37 CFR 1.17 (m); (3) the drawing correction and/or other deficiencies (if necessary); and (4) the required statement of unintentional delay have been received. Accordingly, the Issue Fee payment is accepted as having been unintentionally delayed.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being directed to the Office of Data Management.

Office of Petitions

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

STEVEN J SHATTIL
P.O. BOX 17355
BOULDER CO 80308-0355

MAILED

JUN 2 1 2010

OFFICE OF PETITIONS

In re Application of :
Shattil, Steve J. :
Application No. 10/145,854 : ON PETITION
Filed: May 14, 2002 :
Attorney Docket No. CINET 01 :

This is a decision on the petition, filed July 15, 2009, which is being treated as a petition under 37 CFR 1.181, requesting withdrawal of the holding of abandonment in the above-identified application.

The petition is **DISMISSED**.

This application was held abandoned for failure to timely respond to the Notice of Allowance, mailed February 25, 2009, which set a three (3) month statutory period for reply. Accordingly, a reply was due on or before May 26, 2009. A Notice of Abandonment was mailed June 24, 2009.

A response was received by the USPTO on May 28, 2009. Petitioner contends that the reply was timely since it was mailed via Express Mail in accordance with 37 CFR 1.10 on May 26, 2009. As stated in 37 CFR 1.10(a), any correspondence received by the USPTO that was delivered by the "Express Mail Post Office to Addressee" service of the United States Postal Service (USPS) will be considered filed with the USPTO on the date of deposit with the USPS.

After further review of the instant petition, it does not appear the reply received on May 28, 2009 was mailed via the USPS Express Mail service, but rather, the USPS Priority Mail service. Both the USPS Postal Service Delivery Confirmation Receipt and the USPS Track & Confirm receipt provided by petitioner reflect Priority Mail service. In order for the reply to be considered filed on the date of deposit with the USPS as discussed in 37 CFR 1.10, the Express Mail service must be utilized.

Accordingly, as the reply received on May 28, 2009 was after the period for reply set forth in the Notice of Allowance, the instant application was properly abandoned.

ALTERNATIVE VENUE

Petitioner is strongly encouraged to consider filing a petition under 37 CFR 1.137(b) to revive an unintentionally abandoned application instead of filing a renewed petition under 37 CFR 1.181.

A grantable petition pursuant to 37 CFR 1.137(b) must be accompanied by:

(1) The reply required to the outstanding Office action, unless previously filed;

(2) The petition fee as set forth in 37 CFR 1.17(m), **$810.00 for a small entity**;

(3) A statement that the entire delay in filing the required reply from the due date for the reply until the filing of a grantable petition was unintentional. The Director may require additional information where there is a question whether the delay was unintentional.

Further correspondence with respect to this matter should be addressed as follows:

By mail: Mail Stop PETITIONS
Commissioner for Patents
Post Office Box 1450
Alexandria, VA 22313-1450

By hand: Customer Window located at:

U.S. Patent and Trademark Office
Customer Service Window Randolph Building
401 Dulany Street
Alexandria, VA 22314

By fax: (571) 273-8300
ATTN: Office of Petitions

Any questions concerning this matter may be directed to the undersigned at (571) 272-3206.

Liana Walsh
Petitions Examiner
Office of Petitions

OIPE IAP9 JUL 15 2009 PATENT & TRADEMARK OFFICE

Petition Under 37 CFR 1.181(a) to Withdraw Holding of Abandonment

Commissioner of Patents
Mail Stop Petition
PO Box 1450
Alexandria, Virginia 22313-1450

Appn. Number: 10/145,854
Filing Date: 05/14/2002
Examiner: Ronald Abelson
G.A.U.: 2616
Atty. Docket No. CINET 01

Mailed 2009, July 10

Dear Sir:

In response to the Notice of Abandonment mailed on 06/24/2008, Applicant submits herewith a Petition to the Director under 37 CFR 1.181(a) to withdraw the holding of abandonment in view of Rule § 1.10 Filing of correspondence by "Express Mail," Section (a) of the Appendix R Patent Rules of the Manual of Patent Examining Procedure.

Samsung Exhibit 1023, Page 32 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

1. The Notice of Abandonment mailed on 06/24/2009 states that the application was abandoned in view of Applicant's failure to timely pay the required issue fee and publication fee within the statutory period of three months from the mailing date of the Notice of Allowance.
2. The Notice of Abandonment shows that the issue fee and publication fee were received in the USPTO on 05/28/2009.
3. The Notice of Allowance mailed on 02/25/2009 set a due date of 05/26/2009.
4. Applicant mailed the issue fee and publication fee by United States Postal Service Express Mail with Delivery Confirmation on the due date of 05/26/2009, as required by § 1.10 Filing of correspondence by "Express Mail," Section (a), Paragraph (1) of the Appendix R Patent Rules of the Manual of Patent Examining Procedure:

   (1) Any correspondence received by the U.S. Patent and Trademark Office (USPTO) that was delivered by the "Express Mail Post Office to Addressee" service of the United States Postal Service (USPS) will be considered filed with the USPTO on the date of deposit with the USPS.

5. The Date of Deposit with the USPS is shown by official USPS notation (a postmarked USPS Delivery Confirmation receipt included herewith) on the due date of 05/26/2009, as required by § 1.10 Filing of correspondence by "Express Mail," Section (a), Paragraph (2) of the Appendix R Patent Rules of the Manual of Patent Examining Procedure:

   (2) The date of deposit with USPS is shown by the "date in" on the "Express Mail" label or other official USPS notation.

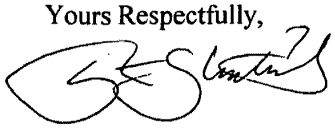
6. The Applicant requests that the Director review the timeliness of Applicant's payment of the issue fee and publication fee in view of Rule § 1.10 Filing of correspondence by "Express Mail."

7. The Applicant requests that the Director accord Applicant's payment of the issue fee and publication fee a payment date of 05/26/2009, in accordance with Section (a) of Rule § 1.10 Filing of correspondence by "Express Mail."

Samsung Exhibit 1023, Page 33 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

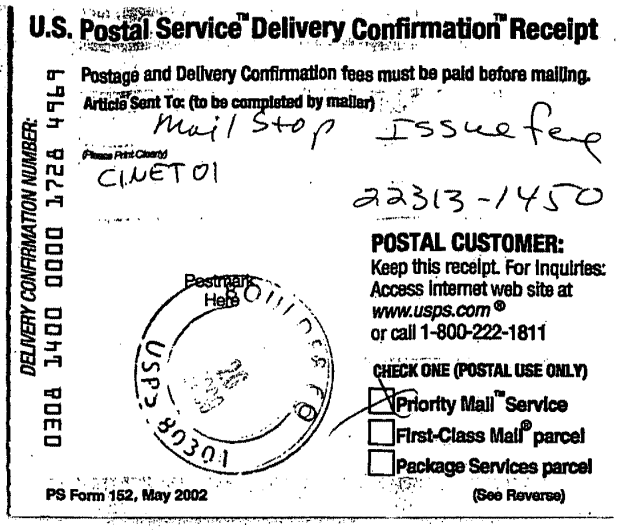
8. The Applicant requests that the Director withdraw the holding of abandonment of Applicant's patent application.

Yours Respectfully,



Steve J. Shattil
P.O. Box 17355
Boulder, CO 80308-0355
(720) 234-4351

Samsung Exhibit 1023, Page 34 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899



U.S. Postal Service™ Delivery Confirmation™ Receipt

Postage and Delivery Confirmation fees must be paid before mailing.

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CLNET01

22313-1450

DELIVERY CONFIRMATION NUMBER: 0308 1400 0000 1728 4964

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- [ ] First-Class Mail® parcel
- [ ] Package Services parcel

PS Form 152, May 2002

(See Reverse)

Track & Confirm

Search Results

Label/Receipt Number: **0308 1400 0000 1728 4969**
Class: **Priority Mail®**
Service(s): **Delivery Confirmation™**
Status: **Delivered**

Your item was delivered at 12:20 PM on May 28, 2009 in ALEXANDRIA, VA 22313.

Detailed Results:

- **Delivered, May 28, 2009, 12:20 pm, ALEXANDRIA, VA 22313**
- **Arrival at Unit, May 28, 2009, 11:39 am, ALEXANDRIA, VA 22301**
- **Processed through Sort Facility, May 28, 2009, 3:47 am, ZIP Code 20199**
- **Acceptance, May 26, 2009, 5:46 pm, BOULDER, CO 80301**

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Doc Code: TRAN.LET

Document Description: Transmittal Letter

IFW DAC

OIPE IAP29 JUL 16 2009 PATENT & TRADEMARK OFFICE

PTO/SB/21 (06-09)
Approved for use through 07/31/2009. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission	6

Application Number	10/145,854
Filing Date	05/14/2002
First Named Inventor	Shattil
Art Unit	2616
Examiner Name	Ronald Abelson
Attorney Docket Number	CINET 01

OIPE IAP29 JUL 16 2009 PATENT & TRADEMARK OFFICE

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☑ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please Identify below):

Remarks

Petition Under 37 CFR 1.181(a) to Withdraw Holding of Abandonment

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature			
Printed name	Steven J Shattil		
Date	07/10/2009	Reg. No.	40,170

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:

Signature			
Typed or printed name	Steven J Shattil	Date	07/10/2009

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 06/24/2009

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2419	
MAIL DATE	DELIVERY MODE
06/24/2009	PAPER

Notice of Abandonment

This application is abandoned in view of:

1. ☐ The applicant's failure to timely file a proper reply to the Office letter mailed on _____.
   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the period for reply (including a total extension of ____ month(s)) which expired on _____.
   (b) ☐ A proposed reply was received on _____, but it does not constitute a proper reply under 37 CFR 1.113(a) to the final rejection. (A proper reply under 37 CFR 1.113 to a final rejection consists only of:
   (1) a timely filed amendment which places the application in condition for allowance;
   (2) a timely filed Notice of Appeal (with appeal fee);
   (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114).
   (c) ☐ A reply was received on _____ but it does not constitute a proper reply, or a bona fide attempt at a proper reply, to the non final rejection. See 37 CFR 1.85(a) and 1.111. (See explanation in box e below).
   (d) ☐ No reply has been received.
2. ☒ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
   (a) ☒ The issue fee and publication fee, if applicable, was received on 5/28/09 (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
   (b) ☐ The submitted fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____.
   The publication fee, if required by 37 CFR 1.18(d) , is $_____.
   (c) ☐ The issue fee and publication fee, if applicable, has not been recieved.
3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
   (a) ☐ Proposed corrected drawings were received on _____ (with a Certificate of Mailing or Trasmission dated _____), which is after the expiration of the period for reply.
   (b) ☐ No corrected drawing have been received.
4. ☐ The letter of express abandonment which is signed by the attorney or agent of record, the assignee of the entire interest, or all of the applicants.
5. ☐ The letter of express abandonment which is signed by an attorney or agent (acting in a representative capacity under 37 CFR 1.34(a)) upon the filling of a continuing application.
6. ☐ The decision by the Board of Patent Appeals and Interference rendered on _____ and because the period for seeking court review of the decision has expired and there are no allowed claims.
7. ☐ The reason(s) below:

Petitions to revive under 37 CFR 1.137(a) or (b), or request to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

Telephone inquiries should be directed to the Office of Data Management at (571) 272-4200.

Patent Publication Branch
Office of Data Management

FORM PTO-ABN0 (Rev. 08/07)

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)

7590 02/25/2009

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

05/29/2009 HDEMESS2 00000006 10145854

01 FC:2501 755.00 OP
02 FC:1504 300.00 OP

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.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

TITLE OF INVENTION: CARRIER INTERFEROMETRY NETWORKS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	05/26/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
ABELSON, RONALD B	2419	370-208000

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 Steven J Shattil
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 May 25, 2009

Typed or printed name Steven J Shattil 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.

Samsung Exhibit 1023, Page 39 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 02/25/2009

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2419	

DATE MAILED: 02/25/2009

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

TITLE OF INVENTION: CARRIER INTERFEROMETRY NETWORKS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	05/26/2009

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.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Samsung Exhibit 1023, Page 40 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

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)

7590 02/25/2009

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

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.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

TITLE OF INVENTION: CARRIER INTERFEROMETRY NETWORKS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$755	$300	$0	$1055	05/26/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
ABELSON, RONALD B	2419	370-208000

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.

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UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 02/25/2009

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2419	

DATE MAILED: 02/25/2009

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 653 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 653 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.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Notice of Allowability	Application No.	Applicant(s)	
	10/145,854	SHATTIL, STEVE J.	
	Examiner	Art Unit	
	RONALD ABELSON	2419	

-- 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 *1/8/09*.

2. ☒ The allowed claim(s) is/are *1-22,25, and 30-46; renumbered as 1-40*.

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

/Ronald Abelson/
Primary Examiner, Art Unit 2419

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10145854	SHATTIL, STEVE J.
	Examiner	**Art Unit**
	RONALD ABELSON	2619

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

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/15/2008	02/18/2009							
1	1	=	=							
2	2	=	=							
3	3	=	=							
4	4	=	=							
5	5	=	=							
6	6	=	=							
7	7	=	=							
8	8	=	=							
9	9	=	=							
10	10	=	=							
11	11	=	=							
12	12	=	=							
13	13	=	=							
14	14	=	=							
15	15	=	=							
16	16	=	=							
17	17	=	=							
18	18	=	=							
19	19	=	=							
20	20	✓	=							
21	21	✓	=							
22	22	✓	=							
	23	O	-							
	24	O	-							
23	25	✓	=							
	26	✓	-							
	27	✓	-							
	28	✓	-							
	29	✓	-							
24	30	=	=							
25	31	=	=							
26	32	=	=							
27	33	=	=							
28	34	=	=							
29	35	=	=							
30	36	=	=							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10145854	SHATTIL, STEVE J.
	Examiner	**Art Unit**
	RONALD ABELSON	2619

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

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/15/2008	02/18/2009							
31	37	=	=							
32	38	=	=							
33	39	=	=							
34	40	=	=							
35	41	=	=							
36	42	=	=							
37	43	=	=							
38	44	=	=							
39	45	=	=							
40	46	=	=							
	47	-								
	48	-								
	49	-								
	50	-								
	51	-								
	52	-								
	53	-								
	54	-								
	55	-								
	56	-								
	57	✓								

Issue Classification	Application/Control No. 10/145,854	Applicant(s)/Patent under Reexamination SHATTIL, STEVE J.
	Examiner RONALD ABELSON	Art Unit 2419

ISSUE CLASSIFICATION

ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
370	208	H	04	J	11	/00				/	
CROSS REFERENCES		H	04	B	7	/216				/	
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)										
370	335 342 441					/				/	
						/				/	
						/				/	
						/				/	
						/				/	

(Assistant Examiner) (Date)

(Legal Instruments Examiner) (Date)

/Ronald Abelson

(Primary Examiner) (Date)

Total Claims Allowed: 40

O.G. Print Claim(s)	O.G. Print Fig.
1	8A

☒ **Claims renumbered in the same order as presented by applicant** ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	25	31		61		91		121		151		181
2	2	26	32		62		92		122		152		182
3	3	27	33		63		93		123		153		183
4	4	28	34		64		94		124		154		184
5	5	29	35		65		95		125		155		185
6	6	30	36		66		96		126		156		186
7	7	31	37		67		97		127		157		187
8	8	32	38		68		98		128		158		188
9	9	33	39		69		99		129		159		189
10	10	34	40		70		100		130		160		190
11	11	35	41		71		101		131		161		191
12	12	36	42		72		102		132		162		192
13	13	37	43		73		103		133		163		193
14	14	38	44		74		104		134		164		194
15	15	39	45		75		105		135		165		195
16	16	40	46		76		106		136		166		196
17	17		47		77		107		137		167		197
18	18		48		78		108		138		168		198
19	19		49		79		109		139		169		199
20	20		50		80		110		140		170		200
21	21		51		81		111		141		171		201
22	22		52		82		112		142		172		202
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	24		54		84		114		144		174		204
23	25		55		85		115		145		175		205
	26		56		86		116		146		176		206
	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
24	30		60		90		120		150		180		210

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Commissioner of Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Appn. Number: 10/145,854
Filing Date: 05/14/2002
Examiner: Ronald Abelson
G.A.U.: 2616
Atty. Docket No. CINET 01

Mailed 2009, January 8

Dear Sir:

In response to the Office Letter mailed on 09/09/2008, please amend the application as follows.

PAGE 3/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

Introductory Comments

Claims 1-46 and 57 are pending in the application. Claims 1-19 and 30-46 were allowed. Claims 20-22, 25-29, and 57 were rejected. Claims 23, and 24 were objected to.

PAGE 18/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

Amendments to the Claims

1. (Previously Amended) In a method for communicating by multiple subscribers in an ad-hoc network, each of the multiple subscribers transmitting Carrier Interferometry (CI)-coded communication information in at least one frequency band, the improvement comprising the additional steps of:

   simultaneously transmitting control information with the communication information in at least one frequency band from an initiating subscriber for selectively controlling communications between the multiple subscribers; and,

   modulating the control information by at least one other CI code.

2. (Previously Amended) The method of claim 1 wherein the control information is configured to permit controlling the multiple-access system by initiating one or more of the subscribers as a network control station.
3. (Previously Amended) The method of claim 2 wherein the control information is configured to permit transferring the power control and the time synchronization of the multiple-access system from any one of the subscribers acting as the network control station to any other of the subscribers becoming the network control station.
4. (Original) The method of claim 2 wherein communication by multiple subscribers includes one or more protocols requiring one of the multiple subscribers to initiate communications and become the network control station in a transmit mode for transmitting the communication information and the control information to all other the multiple subscribers being in a receive mode for simultaneously receiving the communication information through an information channel and the control information through a control channel.
5. (Previously Amended) The method of claim 4 further including the step of the network control station to command another of the multiple subscribers to change at least one CI code for the control information.
6. (Previously Amended) The method of claim 3 wherein the control information is configured to include power-control information for providing a predetermined power setting for each of the multiple subscribers.

PAGE 4/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

7. (Previously Amended) The method of claim 5 wherein the network control station is configured to poll each of the other multiple subscribers, receive an acknowledgement back to measure the power received from each of the multiple subscribers, and adjust the power levels for transmission in predetermined increments.
8. (Previously Amended) A method for providing communications for a network of transceivers in a carrier interferometry (CI)-based multiple-access system operating in an ad-hoc network, comprising:

transmitting control information coded by at least a first CI code through a control channel simultaneously with communications information coded by at least a second CI code through a communications channel in at least one frequency band;

identifying the network and at least one of the transceivers using the control information coded with the at least one CI code and restricting communications between the transceivers of the network using the second CI code;

performing transmit/receive operations of the communications information and the control information by each of the transceivers in a predetermined duplexing operation;

controlling the network initially by one of the transceivers, acting as a network control station; and,

transferring control by one of the transceivers as the network control station to another of the transceivers to become the network control station for continuing the power control and the time synchronization over the network.

9. (Previously Amended) The method of claim 8 wherein the step of performing transmit/receive operations of the communications information through the communications channel and the control information through the control channel is performed relative to a duplexing operation of a set of duplexing operations including TDD, FDD, CDD, PDD, CI-PDD, CPD, OPDD, QPDD, and CTDD.
10. (Previously Amended) The method of claim 8 wherein the step of initiating control over the network further includes a step of enabling the network control station to command another of the transceivers to change the CI code for the control information.

PAGE 5/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

11. (Original) The method of claim 8 wherein the control information includes power control information for allowing the network control station to set a predetermined power setting for each of the transceivers to assure that those of the transceivers transmitting close to the network control station do not overwhelm any other of the transceivers transmitting far away from the network control station.
12. (Previously Amended) The method of claim 8 wherein the network control station polls each of the other the transceivers and receives an acknowledgement back to measure the power received from each of the transceivers and adjusts the power levels for transmission in predetermined increments.
13. (Previously Amended) The method of claim 8 further comprising a step of conversational-mode communications with the transceivers having receivers with CI decoders in parallel for permitting the network control station to simultaneously receive transmissions from more than one of the transceivers and respond to each of the more than one of the transceivers with individual transmissions.
14. (Previously Amended) The method of claim 8 further comprising a step of simultaneous transmission of voice and data by assigning different CI codes for voice and data on the communications channel and providing the transceivers with receivers having at least three decoders for discriminating voice communications, data communications, and control channel communications.
15. (Previously Amended) A method for providing personal communications for a network of transceivers in a multiple-access system operating in an ad-hoc network by means of simultaneously transmitting communications information through a communications channel with control information through a control channel between at least two transceivers, the method comprising the steps of:

coding the transmission of each of the communication information through the communications channel and control information through the control channel with different carrier interferometry (CI) codes to enable restricting communications between at least two of the transceivers, each of the different CI codes being capable of identifying the network and at least one of the transceivers;

PAGE 6/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

performing transmit and receive operations by each of the transceivers in a time division duplex manner with discrete time slots within at least one frequency band;

controlling the network by one of the transceivers, acting as a network control station for setting the network control station in a transmit mode and all other of the transceivers in a receive mode in at least a first of the discrete time slots;

operating in a transmit mode by the network control station and operating in a receive mode by all other of the transceivers in at least a second of the discrete time slots for transmitting the communications information through the communications channel and control channel;

responding by at least one of the transceivers to the communications information and control information transmitted by the network control station; and,

responding by the network control station with the control channel for indicating the type of communication mode for further communications between the network control station and the at least one of the transceivers.

16. (Previously Amended) The method of claim 15 wherein the step of responding by the network control station includes informing the at least one of the transceivers to transmit and all other of the transceivers to receive.

17. (Previously Amended) The method of claim 15 wherein the step of responding to the at least one of the transceivers by the network control station includes informing the one of the transceivers to transmit so as to restrict communications between the network control station and the one of the transceivers.

18. (Original) The method of claim 15 wherein a collision of transmissions caused by a plurality of transceivers attempting to transmit in the same time slot is resolved by the plurality of transceivers retrying transmissions and one of the plurality of transceivers transmitting in an earlier time slot than the other of the plurality of transceivers.

19. (Previously Amended) The method of claim 15 wherein the step of responding by the network control station includes all other the transceivers acknowledging the control channel.

PAGE 7/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

20. (Currently Amended) A carrier interferometry (CI)-coded communications system including a plurality of transceivers, each of the transceivers including:

at least one CI coder coupled to each transceiver, the at least one CI coder configured for providing at least one CI-coded information signal ~~for transmission~~ in a transmitted waveform, wherein the transmitted waveform includes at least one tag waveform, the at least one tag waveform including at least one of information comprising type of coding of the transmitted waveform, information comprising type of data in the transmitted waveform, and information for decoding the transmitted waveform ~~at least one frequency band~~; and

at least one CI decoder coupled to each transceiver, the at least one CI decoder configured for decoding at least one received transmitted waveform.

21. (Previously Amended) The communication system recited in claim 20 wherein the at least one coder and the at least one decoder corresponding to at least one of the transceivers operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

22. (Previously Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform include at least one address, and the decoder is configured to route the signal with respect to the at least one address.

23. (Cancelled).

24. (Cancelled).

25. (Previously Amended) The communication system recited in claim 20 wherein each transceiver further comprises at least one antenna including an RF front end configured to receive and transmit signals.

26. (Cancelled).

27. (Cancelled).

28. (Cancelled).

29. (Cancelled).

30. (Previously Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are

PAGE 8/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

routed through other nodes in the network, communicating in the network using multi-address messaging, including:

constructing at a source node a multi-address message containing coded information whereby spreading codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and

transmitting the multi-address message in at least one frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next node, wherein transmitting comprises decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission.

31. (Previously Amended) The method of claim 30, wherein constructing further includes:

for at least one network address, inserting in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and

for each extended address in the network header, including in the extended address the basic network address of the destination node corresponding to the network address and information for forwarding the multi-address message to the another network.

32. (Previously Amended) The method of claim 30, further comprising:

receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and

routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

33. (Previously Amended) The method of claim 30, wherein constructing further includes:

PAGE 9/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

Samsung Exhibit 1023, Page 54 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

for each network address in the network header, inserting in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

34. (Previously Amended) The method of claim 30, wherein constructing further includes, for each network address in the network header:

inserting in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

35. (Previously Amended) The method of claim 30, wherein the multi-address message comprises a sequence of message frames each containing a network header, wherein the constructing step further includes:

inserting a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence; and

inserting an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

36. (Previously Amended) The method of claim 30, wherein the constructing step includes inserting the network address of the source node in a network header.

37. (Previously Amended) The method of claim 30, wherein constructing step further includes:

PAGE 10/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

inserting in the network header a precedence field indicating a relative precedence of the multi-address message, and

restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

38. (Previously Amended) The method of claim 30, wherein the constructing step further includes:

inserting in a network header a security field indicating a relative security level of the multi-address message, and

restricting message traffic at a node as a function of the security level identified in the network header of each message.

39. (Previously Amended) The method of claim 30, further comprising:

acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node,

retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

40. (Original) The method of claim 30, wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

41. (Original) The method of claim 30, initiates a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

42. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message in a point-to-point mode.

PAGE 11/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

43. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message in a broadcast mode.

44. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message over a waveguide.

45. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message in at least one transmission mode including a full-duplex communication mode and a half-duplex communication mode.

46. (Previously Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, the method of communicating in the network including:

constructing at a source node at least one multi-address message containing coded information employing spreading codes that identify at least one communication path between the source node and at least one destination node, and

transmitting the at least one multi-address message in at least one frequency band via at least one common intervening node, wherein transmitting comprises decoding received transmissions at the at least one common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission.

47. (Cancelled)

48. (Cancelled)

49. (Cancelled)

50. (Cancelled)

51. (Cancelled)

52. (Cancelled)

53. (Cancelled)

54. (Cancelled)

55. (Cancelled)

56. (Cancelled)

57. (Cancelled)

PAGE 12/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

Remarks: Claim Amendments

Independent Claim 20 was amended to include the limitations of Dependent Claims 23 and 24. The Examiner indicated that Claims 23 and 24 included allowable subject matter, but were objected to because they were dependent upon a rejected base claim (Independent Claim 20). The amended Independent Claim 20 and its corresponding dependent claims should be allowable because they contain allowable subject matter recited in Claims 23 and 24.

Claims 23, 24, 26-29, and 57 were cancelled.

PAGE 13/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

Samsung Exhibit 1023, Page 58 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Remarks: Examination Report

1. Sections 1-4 and 8, 9 of the Examination Report.

Claim 20, 21, 22, and 25 were rejected under 35 U.S.C. 103(a).

Independent Claim 20 was amended to include the limitations recited in Dependent Claims 23 and 24, which the Examiner indicated as including Allowable Subject Matter. Since Claim 20 is effectively Claim 23 and Claim 24 rewritten in independent form and including all the limitations of the base claim (Claim 20), Applicant contends that the amended Claim 20 contains the Allowable Subject Matter indicated by the Examiner in the Office Letter, and thus, should be allowable. Furthermore, the Dependent Claims 21, 22, and 25 should be Allowable because they are dependent on the amended Independent Claim 20, and thus, include all of the limitations of Claim 20.

2. Sections 5-7 and 9 of the Examination Report.

Claims 26-29 were rejected under 35 U.S.C. 103(a).

Claims 26-29 were cancelled.

3. Sections 10 and 11 of the Examination Report.

Claim 57 was rejected under 35 U.S.C. 103(a).

Claims 57 was cancelled.

4. Section 12 of the Examination Report.

Applicant's arguments with respect to Claims 20-22, 25-29, and 57 were moot in view of the new grounds for rejection.

Applicant's amendment of Claim 20 and cancellation of Claims 26-29 and 57 remedy the new grounds for rejection.

PAGE 14/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

5. Section 13 of the Examination Report.

Claims 1-19 and 30-46 were allowed.

6. Section 14 of the Examination Report.

Claims 23 and 24 were objected to as being dependent upon a rejected base claim (Independent Claim 20) but would be allowable if rewritten in independent form including all of the limitations of the base claim.

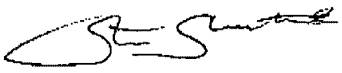
The base Claim 20 was amended to include all the limitations recited in Claims 23 and 24. Since the amended Claim 20 is effectively the rewritten independent form of Claims 23 and 24, the amended Claim 20 (and all of its dependent claims) should be considered allowable.

PAGE 15/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

Conclusion

The Applicant submits that every effort has been made to address the Examiner's objections and that the Application is now in condition to proceed to grant.

Yours Respectfully,



Steve J. Shattil
P.O. Box 17355
Boulder, CO 80308-0355
(720) 234-4351

PAGE 16/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

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Application Number	10/145,854
Filing Date	05/14/2002
First Named Inventor	Shattil, Steven
Art Unit	2618
Examiner Name	Ronald Abelson
Attorney Docket Number	CINET 01

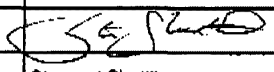
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- ☐ Certified Copy of Priority Document(s)
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- ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
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- ☐ Licensing-related Papers
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- ☑ Other Enclosure(s) (please identify below):
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Remarks

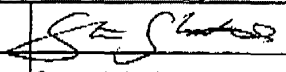
Response to Office letter mailed on 09/09/2008

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name			
Signature			
Printed name	Steven J Shattil		
Date	January 8, 2009	Reg. No.	40,170

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Typed or printed name	Steven J Shattil	Date	January 8, 2009

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and1.14. This collection is estimated to 2 hours 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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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) **FY 2009** *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) CINET 01
Application Number 10/145,854	Filed 05/14/2002
For Carrier Interferometry Networks	
Art Unit 2616	Examiner Ronald Abelson

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☑ One month (37 CFR 1.17(a)(1))	$130	$65	$ 65
☐ Two months (37 CFR 1.17(a)(2))	$490	$245	$
☐ Three months (37 CFR 1.17(a)(3))	$1110	$555	$
☐ Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐ Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☑ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

01/09/2009 VBUI11 00000051 10145854
01 FC:2251 65.00 OP

☑ Payment by credit card. Form PTO-2038 is attached.

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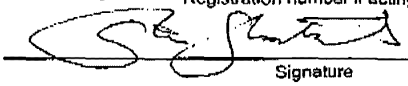
I am the

☑ 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).

☐ attorney or agent of record. Registration Number _____

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____



Signature — January 8, 2009 — Date

Steve Shattil — Typed or printed name

720-234-4351 — Telephone Number

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

☐ Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PAGE 2/18 * RCVD AT 1/8/2009 6:01:25 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/34 * DNIS:2738300 * CSID:8282326947 * DURATION (mm-ss):03-14

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PO Box 1450
Alexandria, Virginia 22313-1450

Appn. Number: 10/145,854
Filing Date: 05/14/2002
Examiner: Ronald Abelson
G.A.U.: 2616
Atty. Docket No. CINET 01

Mailed 2009, January 8

Dear Sir:

In response to the Office Letter mailed on 09/09/2008, please amend the application as follows.

PAGE 4/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Introductory Comments

Claims 1-46 and 57 are pending in the application. Claims 1-19 and 30-46 were allowed. Claims 20-22, 25-29, and 57 were rejected. Claims 23, and 24 were objected to.

PAGE 5/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Samsung Exhibit 1023, Page 65 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Amendments to the Claims

1. (Previously Amended) In a method for communicating by multiple subscribers in an ad-hoc network, each of the multiple subscribers transmitting Carrier Interferometry (CI)-coded communication information in at least one frequency band, the improvement comprising the additional steps of:

simultaneously transmitting control information with the communication information in at least one frequency band from an initiating subscriber for selectively controlling communications between the multiple subscribers; and,

modulating the control information by at least one other CI code.

2. (Previously Amended) The method of claim 1 wherein the control information is configured to permit controlling the multiple-access system by initiating one or more of the subscribers as a network control station.
3. (Previously Amended) The method of claim 2 wherein the control information is configured to permit transferring the power control and the time synchronization of the multiple-access system from any one of the subscribers acting as the network control station to any other of the subscribers becoming the network control station.
4. (Original) The method of claim 2 wherein communication by multiple subscribers includes one or more protocols requiring one of the multiple subscribers to initiate communications and become the network control station in a transmit mode for transmitting the communication information and the control information to all other the multiple subscribers being in a receive mode for simultaneously receiving the communication information through an information channel and the control information through a control channel.
5. (Previously Amended) The method of claim 4 further including the step of the network control station to command another of the multiple subscribers to change at least one CI code for the control information.
6. (Previously Amended) The method of claim 3 wherein the control information is configured to include power-control information for providing a predetermined power setting for each of the multiple subscribers.

PAGE 6/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Samsung Exhibit 1023, Page 66 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

7. (Previously Amended) The method of claim 5 wherein the network control station is configured to poll each of the other multiple subscribers, receive an acknowledgement back to measure the power received from each of the multiple subscribers, and adjust the power levels for transmission in predetermined increments.

8. (Previously Amended) A method for providing communications for a network of transceivers in a carrier interferometry (CI)-based multiple-access system operating in an ad-hoc network, comprising:

transmitting control information coded by at least a first CI code through a control channel simultaneously with communications information coded by at least a second CI code through a communications channel in at least one frequency band;

identifying the network and at least one of the transceivers using the control information coded with the at least one CI code and restricting communications between the transceivers of the network using the second CI code;

performing transmit/receive operations of the communications information and the control information by each of the transceivers in a predetermined duplexing operation;

controlling the network initially by one of the transceivers, acting as a network control station; and,

transferring control by one of the transceivers as the network control station to another of the transceivers to become the network control station for continuing the power control and the time synchronization over the network.

9. (Previously Amended) The method of claim 8 wherein the step of performing transmit/receive operations of the communications information through the communications channel and the control information through the control channel is performed relative to a duplexing operation of a set of duplexing operations including TDD, FDD, CDD, PDD, CI-PDD, CPD, OPDD, QPDD, and CTDD.

10. (Previously Amended) The method of claim 8 wherein the step of initiating control over the network further includes a step of enabling the network control station to command another of the transceivers to change the CI code for the control information.

PAGE 7/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Samsung Exhibit 1023, Page 67 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

11. (Original) The method of claim 8 wherein the control information includes power control information for allowing the network control station to set a predetermined power setting for each of the transceivers to assure that those of the transceivers transmitting close to the network control station do not overwhelm any other of the transceivers transmitting far away from the network control station.

12. (Previously Amended) The method of claim 8 wherein the network control station polls each of the other the transceivers and receives an acknowledgement back to measure the power received from each of the transceivers and adjusts the power levels for transmission in predetermined increments.

13. (Previously Amended) The method of claim 8 further comprising a step of conversational-mode communications with the transceivers having receivers with CI decoders in parallel for permitting the network control station to simultaneously receive transmissions from more than one of the transceivers and respond to each of the more than one of the transceivers with individual transmissions.

14. (Previously Amended) The method of claim 8 further comprising a step of simultaneous transmission of voice and data by assigning different CI codes for voice and data on the communications channel and providing the transceivers with receivers having at least three decoders for discriminating voice communications, data communications, and control channel communications.

15. (Previously Amended) A method for providing personal communications for a network of transceivers in a multiple-access system operating in an ad-hoc network by means of simultaneously transmitting communications information through a communications channel with control information through a control channel between at least two transceivers, the method comprising the steps of:

coding the transmission of each of the communication information through the communications channel and control information through the control channel with different carrier interferometry (CI) codes to enable restricting communications between at least two of the transceivers, each of the different CI codes being capable of identifying the network and at least one of the transceivers;

PAGE 8/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

performing transmit and receive operations by each of the transceivers in a time division duplex manner with discrete time slots within at least one frequency band;

controlling the network by one of the transceivers, acting as a network control station for setting the network control station in a transmit mode and all other of the transceivers in a receive mode in at least a first of the discrete time slots;

operating in a transmit mode by the network control station and operating in a receive mode by all other of the transceivers in at least a second of the discrete time slots for transmitting the communications information through the communications channel and control channel;

responding by at least one of the transceivers to the communications information and control information transmitted by the network control station; and,

responding by the network control station with the control channel for indicating the type of communication mode for further communications between the network control station and the at least one of the transceivers.

16. (Previously Amended) The method of claim 15 wherein the step of responding by the network control station includes informing the at least one of the transceivers to transmit and all other of the transceivers to receive.

17. (Previously Amended) The method of claim 15 wherein the step of responding to the at least one of the transceivers by the network control station includes informing the one of the transceivers to transmit so as to restrict communications between the network control station and the one of the transceivers.

18. (Original) The method of claim 15 wherein a collision of transmissions caused by a plurality of transceivers attempting to transmit in the same time slot is resolved by the plurality of transceivers retrying transmissions and one of the plurality of transceivers transmitting in an earlier time slot than the other of the plurality of transceivers.

19. (Previously Amended) The method of claim 15 wherein the step of responding by the network control station includes all other the transceivers acknowledging the control channel.

PAGE 9/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

20. (Currently Amended) A carrier interferometry (CI)-coded communications system including a plurality of transceivers, each of the transceivers including:

at least one CI coder coupled to each transceiver, the at least one CI coder configured for providing at least one CI-coded information signal ~~for transmission~~ in a transmitted waveform, wherein the transmitted waveform includes at least one tag waveform, the at least one tag waveform including at least one of information comprising type of coding of the transmitted waveform, information comprising type of data in the transmitted waveform, and information for decoding the transmitted waveform ~~at least one frequency band~~; and

at least one CI decoder coupled to each transceiver, the at least one CI decoder configured for decoding at least one received transmitted waveform.

21. (Previously Amended) The communication system recited in claim 20 wherein the at least one coder and the at least one decoder corresponding to at least one of the transceivers operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

22. (Previously Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform include at least one address, and the decoder is configured to route the signal with respect to the at least one address.

23. (Cancelled).

24. (Cancelled).

25. (Previously Amended) The communication system recited in claim 20 wherein each transceiver further comprises at least one antenna including an RF front end configured to receive and transmit signals.

26. (Cancelled).

27. (Cancelled).

28. (Cancelled).

29. (Cancelled).

30. (Previously Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are

PAGE 10/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

routed through other nodes in the network, communicating in the network using multi-address messaging, including:

constructing at a source node a multi-address message containing coded information whereby spreading codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and

transmitting the multi-address message in at least one frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next node, wherein transmitting comprises decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission.

31. (Previously Amended) The method of claim 30, wherein constructing further includes:

for at least one network address, inserting in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and

for each extended address in the network header, including in the extended address the basic network address of the destination node corresponding to the network address and information for forwarding the multi-address message to the another network.

32. (Previously Amended) The method of claim 30, further comprising:

receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and

routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

33. (Previously Amended) The method of claim 30, wherein constructing further includes:

PAGE 11/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Samsung Exhibit 1023, Page 71 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

for each network address in the network header, inserting in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

34. (Previously Amended) The method of claim 30, wherein constructing further includes, for each network address in the network header:

inserting in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

35. (Previously Amended) The method of claim 30, wherein the multi-address message comprises a sequence of message frames each containing a network header, wherein the constructing step further includes:

inserting a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence; and

inserting an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

36. (Previously Amended) The method of claim 30, wherein the constructing step includes inserting the network address of the source node in a network header.

37. (Previously Amended) The method of claim 30, wherein constructing step further includes

PAGE 12/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Samsung Exhibit 1023, Page 72 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

inserting in the network header a precedence field indicating a relative precedence of the multi-address message, and

restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

38. (Previously Amended) The method of claim 30, wherein the constructing step further includes

inserting in a network header a security field indicating a relative security level of the multi-address message, and

restricting message traffic at a node as a function of the security level identified in the network header of each message.

39. (Previously Amended) The method of claim 30, further comprising:

acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node

retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

40. (Original) The method of claim 30, wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

41. (Original) The method of claim 30, initiates a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

42. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message in a point-to-point mode.

PAGE 13/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Samsung Exhibit 1023, Page 73 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

43. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message in a broadcast mode.

44. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message over a waveguide.

45. (Previously Amended) The method of claim 30, wherein the transmitting step includes transmitting the multi-address message in at least one transmission mode including a full-duplex communication mode and a half-duplex communication mode.

46. (Previously Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, the method of communicating in the network including:

constructing at a source node at least one multi-address message containing coded information employing spreading codes that identify at least one communication path between the source node and at least one destination node, and

transmitting the at least one multi-address message in at least one frequency band via at least one common intervening node, wherein transmitting comprises decoding received transmissions at the at least one common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission.

47. (Cancelled)

48. (Cancelled)

49. (Cancelled)

50. (Cancelled)

51. (Cancelled)

52. (Cancelled)

53. (Cancelled)

54. (Cancelled)

55. (Cancelled)

56. (Cancelled)

57. (Cancelled)

PAGE 14/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Remarks: Claim Amendments

Independent Claim 20 was amended to include the limitations of Dependent Claims 23 and 24. The Examiner indicated that Claims 23 and 24 included allowable subject matter, but were objected to because they were dependent upon a rejected base claim (Independent Claim 20). The amended Independent Claim 20 and its corresponding dependent claims should be allowable because they contain allowable subject matter recited in Claims 23 and 24.

Claims 23, 24, 26-29, and 57 were cancelled.

PAGE 15/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Samsung Exhibit 1023, Page 75 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Remarks: Examination Report

1. Sections 1-4 and 8, 9 of the Examination Report.

Claim 20, 21, 22, and 25 were rejected under 35 U.S.C. 103(a).

Independent Claim 20 was amended to include the limitations recited in Dependent Claims 23 and 24, which the Examiner indicated as including Allowable Subject Matter. Since Claim 20 is effectively Claim 23 and Claim 24 rewritten in independent form and including all the limitations of the base claim (Claim 20), Applicant contends that the amended Claim 20 contains the Allowable Subject Matter indicated by the Examiner in the Office Letter, and thus, should be allowable. Furthermore, the Dependent Claims 21, 22, and 25 should be Allowable because they are dependent on the amended Independent Claim 20, and thus, include all of the limitations of Claim 20.

2. Sections 5-7 and 9 of the Examination Report.

Claims 26-29 were rejected under 35 U.S.C. 103(a).

Claims 26-29 were cancelled.

3. Sections 10 and 11 of the Examination Report.

Claim 57 was rejected under 35 U.S.C. 103(a).

Claims 57 was cancelled.

4. Section 12 of the Examination Report.

Applicant's arguments with respect to Claims 20-22, 25-29, and 57 were moot in view of the new grounds for rejection.

Applicant's amendment of Claim 20 and cancellation of Claims 26-29 and 57 remedy the new grounds for rejection.

PAGE 16/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

5. Section 13 of the Examination Report.

Claims 1-19 and 30-46 were allowed.

6. Section 14 of the Examination Report.

Claims 23 and 24 were objected to as being dependent upon a rejected base claim (Independent Claim 20) but would be allowable if rewritten in independent form including all of the limitations of the base claim.

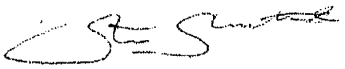
The base Claim 20 was amended to include all the limitations recited in Claims 23 and 24. Since the amended Claim 20 is effectively the rewritten independent form of Claims 23 and 24, the amended Claim 20 (and all of its dependent claims) should be considered allowable.

PAGE 17/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

Conclusion

The Applicant submits that every effort has been made to address the Examiner's objections and that the Application is now in condition to proceed to grant.

Yours Respectfully,



Steve J. Shattil
P.O. Box 17355
Boulder, CO 80308-0355
(720) 234-4351

PAGE 18/18 * RCVD AT 1/8/2009 5:30:18 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/19 * DNIS:2738300 * CSID:18282326947 * DURATION (mm-ss):09-58

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 09/09/2008

Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2619	

MAIL DATE	DELIVERY MODE
09/09/2008	PAPER

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

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

Office Action Summary	Application No.	Applicant(s)	
	10/145,854	SHATTIL, STEVE J.	
	Examiner	Art Unit	
	RONALD ABELSON	2619	

-- 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 *05 May 2008*.

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) *1-46 and 57* is/are pending in the application.

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

5)☒ Claim(s) *1-19 and 30-46* is/are allowed.

6)☒ Claim(s) *20-22,25-29 and 57* is/are rejected.

7)☒ Claim(s) *23 and 24* 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 *5/14/02* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

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

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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

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

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

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

Attachment(s)

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

Claim Rejections - 35 USC § 103

1. 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 negatived by the manner in which the invention was made.

2. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Natarajan.

Regarding claim 20, Natarjan teaches a CI coder for providing at least one CI-coded information signal for transmission in at least one frequency band (fig. 1); at least one CI decoder for decoding at least one received transmitted waveform (fig. 4).

Although Natarajan is silent on a transceiver comprising the Ci coder and CI decoder, it would have been obvious to one of ordinary skill in the art, to modify the system of Natarjan by incorporating both the coder and decoder in a single device since transceivers are well known in the art. This modification would benefit the system by allowing a single device the ability

to transmit and receive information.

3. Claims 21 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natarajan as applied to claim 20 above, and further in view of Sikina.

Natarajan is silent on simultaneous transmission and reception of the CI coded information.

Sikina teaches simultaneous transmission and reception of the information (fig. 1, col. 5 lines 34-36).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Natarajan by simultaneous transmission and reception of the CI coded information, as suggested by Sikina. This modification would benefit the system by allowing for simultaneous transmission and reception.

4. Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Natarajan as applied to claim 20 above, and further in view of Darnell (US 6,266,702).

Natarajan is silent on at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform include at least one address and

the decoder is configured to route the signal with respect to the at least one address.

Darnell teaches routing a coded signal with respect to an address (fig. 2, col. 6 lines 17-20).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Natarajan by at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform include at least one address and the decoder is configured to route the signal with respect to the at least one address, as suggested by Darnell. This modification would benefit the system since placing routing information in the header is a proven, reliable method for routing.

5. Claim 26 rejected under 35 U.S.C. 103(a) as being unpatentable over Natarjan in view of Sikina (US 6,507,319).

Regarding claim 26, Natarjan teaches a CI coder for providing at least one CI-coded information signal for transmission in at least one frequency band (fig. 1); at least

one CI decoder for decoding at least one received transmitted waveform (fig. 4).

Although Natarajan is silent on a transceiver comprising the Ci coder and CI decoder, it would have been obvious to one of ordinary skill in the art, to modify the system of Natarjan by incorporating both the coder and decoder in a single device since transceivers are well known in the art. This modification would benefit the system by allowing a single device the ability to transmit and receive information.

6. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Natarjan and Sikina as applied to claim 26 above, and further in view of Sikina.

The combination is silent on simultaneous transmission and reception of the CI coded information.

Sikina teaches simultaneous transmission and reception of the information (fig. 1, col. 5 lines 34-36).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Natarajan by simultaneous transmission and reception of the CI coded information, as suggested by Sikina. This modification would

benefit the system by allowing for simultaneous transmission and reception.

7. Claim 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Natarjan and Sikina as applied to claim 26 above, and further in view of Petrick (US 5,712,870).

Fattouche is silent on the CI decoder includes a preamble detector adapted to detect a preamble, as specified in claim 28; wherein the CI coder includes a preamble generator adapted to generate at least one preamble, as specified in claim 29.

Petrick, like Fattouche, teaches spread spectrum. Furthermore, Petrick teaches spread spectrum messages containing a preamble used for synchronization (col. 2 lines 8-11).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Fattouche by including in the CI decoder includes a preamble detector adapted to detect a preamble and including in the CI coder includes a preamble generator adapted to generate at least one preamble, as suggested by Petrick. This modification can be performed according to known standards for the preamble in spread spectrum systems. This modification would benefit the system by providing for synchronization (Petrick: col. 2 lines 8-11).

8. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu.

Regarding claim 20, Wu teaches a CI coder for providing at least one CI-coded information signal for transmission in at least one frequency band (fig. 1); at least one CI decoder for decoding at least one received transmitted waveform (fig. 2a,2b).

Although Wu is silent on a transceiver comprising the Ci coder and CI decoder, it would have been obvious to one of ordinary skill in the art, to modify the system of Wu by incorporating both the coder and decoder in a single device since transceivers are well known in the art. This modification would benefit the system by allowing a single device the ability to transmit and receive information.

9. Claims 21, 22, and 25-29 are rejected with respect to primary reference Wu for identical reasons as shown above with respect to Natarajan.

10. Claim 57 rejected under 35 U.S.C. 103(a) as being unpatentable over Nallanathan (US 6728295) in view of Natarajan.

Regarding claim 57, Nallanathan teaches a plurality of network transceivers adapted to route communication signals in the network; the network including: at least one central processing unit / base station coupled to the transceivers, the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of components, and combine the components / complementary codes (col. 1 lines 10-25).

Nallanathan is silent on CI coding.

Natarajan teaches CI coding (fig. 1, 3).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Nallanathan by using CI coding, as suggested by Natarajan. This modification would benefit the system since CI coding is an efficient use of bandwidth.

11. Claim 57 rejected under 35 U.S.C. 103(a) as being unpatentable over Nallanathan (US 6728295) in view of Wu.

Regarding claim 57, Nallanathan teaches a plurality of network transceivers adapted to route communication signals in

the network; the network including: at least one central processing unit / base station coupled to the transceivers, the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of components, and combine the components / complementary codes (col. 1 lines 10-25).

Nallanathan is silent on CI coding.

Wu teaches CI coding (fig. 1, 2).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Nallanathan by using CI coding, as suggested by Wu. This modification would benefit the system since CI coding is an efficient use of bandwidth.

Response to Arguments

12. Applicant's arguments with respect to claims 20-22, 25-29, and 57 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

13. Claims 1-19 and 30-46 are allowed.

14. Claims 23 and 24 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.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONALD ABELSON whose telephone number is (571)272-3165. The examiner can normally be reached on M-F.

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.

Ronald Abelson
Primary Examiner
Art Unit 2619

***

/Ronald Abelson/
Primary Examiner, Art Unit 2619

Notice of References Cited	Application/Control No. 10/145,854	Applicant(s)/Patent Under Reexamination SHATTIL, STEVE J.	
	Examiner RONALD ABELSON	Art Unit 2619	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,266,702 B1	07-2001	Darnell et al.	709/236
*	B	US-6,507,319 B2	01-2003	Sikina, Thomas V.	343/757
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Wu, MMSE Frequency Combining for CI/DS-CDMA, IEEE, 2000, pg. 103-106
	V	Natarajan, Throughput Enhancement in TDMA through Carrier Interferometry Pulse Shaping, IEEE, 2000, pg. 1799-1803
	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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IN THE US PATENT AND TM OFFICE

Commissioner of Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Appn. Number: 10/145,854
Filing Date: 05/14/2002
Examiner: Ronald Abelson
G.A.U.: 2616
Atty. Docket No. CINET 01

Mailed 2008, April 30
Boulder, CO 80303

Dear Sir:

In response to the Notice of Non-Compliant Amendment mailed on 03/26/2008, please enter the corrected amendment as follows.

Samsung Exhibit 1023, Page 93 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Introductory Comments

Claims 1-57 are pending in the application. Claims 20-22, 25-46, and 57 were rejected. Claims 1-19, 23, and 24 were objected to.

Samsung Exhibit 1023, Page 94 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Amendments to the Claims

1. (Currently Amended) In a method for communicating by multiple subscribers in an ad-hoc network ~~without a base station~~, each of the multiple subscribers transmitting ~~adapted to transmit CI~~Carrier Interferometry (CI)-coded communication information in at least one frequency band, the improvement comprising the additional steps of:

   ~~providing for~~ simultaneously transmitting control information with the communication information in at least one frequency band from an initiating subscriber for selectively controlling communications between the multiple subscribers; and,

   ~~providing for~~ modulating the control information by at least one other CI code.

2. (Currently Amended) The method of claim 1 wherein the control information is ~~adapted~~ configured to permit controlling the multiple-access system by initiating one or more of the subscribers as a network control station.

3. (Currently Amended) The method of claim 2 wherein the control information is ~~adapted~~ configured to permit transferring the power control and the time synchronization of the multiple-access system from any one of the subscribers acting as the network control station to any other of the subscribers becoming the network control station.

4. (Original) The method of claim 2 wherein communication by multiple subscribers includes one or more protocols requiring one of the multiple subscribers to initiate communications and become the network control station in a transmit mode for transmitting the communication information and the control information to all other the multiple subscribers being in a receive mode for simultaneously receiving the communication information through an information channel and the control information through a control channel.

5. (Currently Amended) The method of claim 4 further including the step of ~~providing for~~ the network control station to command another of the multiple subscribers to change at least one CI code for the control information.

Samsung Exhibit 1023, Page 95 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

6. (Currently Amended) The method of claim 3 wherein the control information is ~~adapted~~ configured to include power-control information for providing a predetermined power setting for each of the multiple subscribers.

7. (Currently Amended) The method of claim 5 wherein the network control station is ~~adapted~~ configured to poll each of the other multiple subscribers, receive an acknowledgement back to measure the power received from each of the multiple subscribers, and adjust the power levels for transmission in predetermined increments.

8. (Currently Amended) A method for providing communications for a network of transceivers in a carrier interferometry (CI)-based multiple-access system operating in an ad-hoc network ~~without a base station~~, comprising:

~~providing for~~ transmitting control information coded by at least a first CI code through a control channel simultaneously with communications information coded by at least a second CI code through a communications channel in at least one frequency band;

~~providing for~~ identifying the network and at least one of the transceivers using the control information coded with the at least one CI code and restricting communications between the transceivers of the network using the second CI code;

~~providing for~~ performing transmit/receive operations of the communications information and the control information by each of the transceivers in a predetermined duplexing operation;

~~providing for~~ controlling the network initially by one of the transceivers, acting as a network control station; and,

~~providing for~~ transferring control by one of the transceivers as the network control station to another of the transceivers to become the network control station for continuing the power control and the time synchronization over the network.

9. (Currently Amended) The method of claim 8 wherein the step of ~~providing for~~ performing transmit/receive operations of the communications information through the communications channel and the control information through the control channel is performed relative to a duplexing operation of a set of duplexing operations including TDD, FDD, CDD, PDD, CI-PDD, CPD, OPDD, QPDD, and CTDD.

Samsung Exhibit 1023, Page 96 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

10. (Currently Amended) The method of claim 8 wherein the step of initiating control over the network further includes ~~the~~ a step of ~~providing for~~ enabling the network control station to command another of the transceivers to change the CI code for the control information.

11. (Original) The method of claim 8 wherein the control information includes power control information for allowing the network control station to set a predetermined power setting for each of the transceivers to assure that those of the transceivers transmitting close to the network control station do not overwhelm any other of the transceivers transmitting far away from the network control station.

12. (Currently Amended) The method of claim 8 wherein the network control station ~~is adapted to~~ polls each of the other the transceivers and receives an acknowledgement back to measure the power received from each of the transceivers and adjusts the power levels for transmission in predetermined increments.

13. (Currently Amended) The method of claim 8 further comprising a step of ~~providing for~~ conversational-mode communications with the transceivers having receivers with CI decoders in parallel for permitting the network control station to simultaneously receive transmissions from more than one of the transceivers and respond to each of the more than one of the transceivers with individual transmissions.

14. (Currently Amended) The method of claim 8 further comprising a step of ~~providing for~~ simultaneous transmission of voice and data by assigning different CI codes for voice and data on the communications channel and providing the transceivers with receivers having at least three decoders for discriminating voice communications, data communications, and control channel communications.

15. (Currently Amended) A method for providing personal communications for a network of transceivers in a multiple-access system operating in an ad-hoc network ~~without a base station~~ by means of simultaneously transmitting communications information through a communications channel with control information through a control channel between at least two transceivers, the method comprising the steps of:

~~providing for~~ coding the transmission of each of the communication information through the communications channel and control information through the control channel with different carrier interferometry (CI) codes to enable

Samsung Exhibit 1023, Page 97 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

restricting communications between at least two of the transceivers, each of the different CI codes being capable of identifying the network and at least one of the transceivers;

~~providing for~~ performing transmit and receive operations by each of the transceivers in a time division duplex manner with discrete time slots within at least one frequency band;

~~providing for~~ controlling the network by one of the transceivers, acting as a network control station for setting the network control station in a transmit mode and all other of the transceivers in a receive mode in at least a first of the discrete time slots;

~~providing for~~ operating in a transmit mode by the network control station and operating in a receive mode by all other of the transceivers in at least a second of the discrete time slots for transmitting the communications information through the communications channel and control channel;

~~providing for~~ responding by at least one of the transceivers to the communications information and control information transmitted by the network control station; and,

~~providing for~~ responding by the network control station with the control channel for indicating the type of communication mode for further communications between the network control station and the at least one of the transceivers.

16. (Currently Amended) The method of claim 15 wherein the step of ~~providing for~~ responding by the network control station includes informing the at least one of the transceivers to transmit and all other of the transceivers to receive.

17. (Currently Amended) The method of claim 15 wherein the step of ~~providing for~~ responding to the at least one of the transceivers by the network control station includes informing the one of the transceivers to transmit so as to restrict communications between the network control station and the one of the transceivers.

18. (Original) The method of claim 15 wherein a collision of transmissions caused by a plurality of transceivers attempting to transmit in the same time slot is resolved by the

Samsung Exhibit 1023, Page 98 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

plurality of transceivers retrying transmissions and one of the plurality of transceivers transmitting in an earlier time slot than the other of the plurality of transceivers.

19. (Currently Amended) The method of claim 15 wherein the step of ~~providing for~~ responding by the network control station includes all other the transceivers acknowledging the control channel.

20. (Currently Amended) A carrier interferometry (CI)-coded communications system including a plurality of transceivers, each of the transceivers including:

at least one CI coder coupled to each transceiver, the at least one CI coder ~~adapted to provide~~ for providing at least one CI-coded information signal for transmission in at least one frequency band;

at least one CI decoder coupled to each transceiver, the at least one CI decoder ~~adapted to decode~~ for decoding at least one received transmitted waveform.

21. (Currently Amended) The communication system recited in claim 20 wherein the at least one coder and the at least one decoder corresponding to at least one of the transceivers ~~are adapted to~~ operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

22. (Currently Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform ~~is adapted to~~ include at least one address, and the decoder is ~~adapted~~ configured to route the signal with respect to the at least one address.

23. (Currently Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform ~~is adapted to~~ include at least one tag waveform indicative of the coding provided to the at least one transmitted waveform.

24. (Currently Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform ~~is adapted to~~ include at least one tag waveform for identifying the type of data contained in the transmitted waveform and further includes decoding information necessary to decode information in the transmitted waveform.

Samsung Exhibit 1023, Page 99 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

25. (Currently Amended) The communication system recited in claim 20 wherein each transceiver further comprises at least one antenna including an RF front end ~~adapted~~ configured to receive and transmit signals.

26. (Currently Amended) A transceiver ~~adapted~~ configured to receive a first carrier interferometry (CI)-coded transmitted signal and transmit simultaneously another CI-coded signal, the transceiver including:

an RF front end ~~adapted~~ configured to perform at least one transceiving function in at least one frequency band, the at least one transceiving function including receiving at least one transmitted signal and transmitting at least one signal,

a CI decoder coupled to the RF front end, the CI decoder ~~adapted~~ configured to decode at least one received transmitted signal,

a CI coder coupled to the RF front end, the CI coder ~~adapted~~ configured to provide CI coding to at least one information signal for transmission, the CI coder providing unique CI coding with respect to CI codes of the at least one received signal to enable simultaneous transmission and reception of CI coded information.

27. (Original) The transceiver recited in claim 26 wherein the RF front end includes at least one antenna for receiving and transmitting signals.

28. (Currently Amended) The transceiver recited in claim 26 wherein the CI decoder includes a preamble detector ~~adapted~~ configured to detect a preamble.

29. (Currently Amended) The transceiver recited in claim 26 wherein the CI coder includes a preamble generator ~~adapted~~ configured to generate at least one preamble.

30. (Currently Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, ~~an improved method of~~ communicating in the network using multi-address messaging, including:

~~providing for~~ constructing at a source node a multi-address message containing coded information whereby spreading codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and

Samsung Exhibit 1023, Page 100 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

~~providing for~~ transmitting the multi-address message in at least one frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next ~~common intervening~~ node, wherein transmitting comprises decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission.

31. (Currently Amended) The method of claim 30, wherein ~~providing for~~ constructing further includes:

for at least one network address, ~~providing for insertion~~ inserting in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and

for each extended address in the network header, ~~providing for inclusion~~ including in the extended address the basic network address of the destination node corresponding to the network address and information for forwarding the multi-address message to the another network.

32. (Currently Amended) The method of claim 30, further comprising:

~~providing for~~ receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and

~~providing for~~ routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

33. (Currently Amended) The method of claim 30, wherein ~~providing for~~ constructing further includes:

for each network address in the network header, ~~providing for insertion~~ inserting in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

Samsung Exhibit 1023, Page 101 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

34. (Currently Amended) The method of claim 30, wherein ~~providing for~~ constructing further includes, for each network address in the network header:

~~providing for insertion~~ inserting in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

~~providing for insertion~~ inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

~~providing for insertion~~ inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

35. (Currently Amended) The method of claim 30, wherein the multi-address message comprises a sequence of message frames each containing a network header, wherein the constructing step further includes:

~~providing for insertion~~ inserting ~~of~~ a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence; and

~~providing for insertion~~ inserting ~~of~~ an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

36. (Currently Amended) The method of claim 30, wherein the constructing step includes ~~providing for insertion of~~ inserting the network address of the source node in a network header.

37. (Currently Amended) The method of claim 30, wherein constructing step further includes:

~~providing for insertion~~ inserting in the network header a precedence field indicating a relative precedence of the multi-address message, and

Samsung Exhibit 1023, Page 102 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

~~providing for restriction~~ restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

38. (Currently Amended) The method of claim 30, wherein the constructing step further includes:

~~providing for~~ inserting in a network header a security field indicating a relative security level of the multi-address message, and

~~providing for~~ restricting message traffic at a node as a function of the security level identified in the network header of each message.

39. (Currently Amended) The method of claim 30, further comprising:

~~providing for~~ acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node,

~~providing for~~ retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

~~providing for~~ repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

40. (Original) The method of claim 30, wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

41. (Original) The method of claim 30, initiates a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

42. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message in a point-to-point mode.

43. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message in a broadcast mode.

Samsung Exhibit 1023, Page 103 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

44. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message over a waveguide.

45. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message in at least one transmission mode including a full-duplex communication mode and a half-duplex communication mode.

46. (Currently Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, ~~an improved~~ the method of communicating in the network including:

~~providing for~~ constructing at a source node at least one multi-address message containing coded information employing spreading codes that identify at least one communication path between the source node and at least one destination node, and

~~providing for transmission of~~ transmitting the at least one multi-address message in at least one frequency band via at least one common intervening node, wherein transmitting comprises decoding received transmissions at the at least one common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission..

47. (Cancelled)

48. (Cancelled)

49. (Cancelled)

50. (Cancelled)

51. (Cancelled)

52. (Cancelled)

53. (Cancelled)

54. (Cancelled)

55. (Cancelled)

56. (Cancelled)

Samsung Exhibit 1023, Page 104 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

57. (Currently Amended) In a communication network of a plurality of network transceivers ~~adapted~~ configured to route communication signals in the network, the network including:

at least one central processing unit coupled to the transceivers, the at least one central processing unit ~~adapted~~ configured to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of carrier interferometry (CI) components, and combine the CI components for generating a data output.

Samsung Exhibit 1023, Page 105 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Remarks: Claim Amendments

Claims 1-3, 5, 6, 8, 9, 12-17, 19-24, 26, 28-35, 37-39, 46, and 57 were amended to correct the informalities noted by the Examiner.

Claims 30 and 46 were amended to include the limitation "wherein transmitting comprises decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission."

The claimed subject matter in Claims 30 and 46 is illustrated in FIG. 11A, which illustrates a CI transceiver adapted to perform routing. A bank of decoders 1112 decodes received signals that are to be retransmitted. The decoded signals are processed in a signal processor 1113, which produces a data output (such as shown with respect to signal processor 1103), which is encoded for transmission by a bank of coders 1115 (P.47, line 28- P.48, line 5 of the originally filed specification).

Samsung Exhibit 1023, Page 106 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Remarks: Examination Report

1. Section 1 of the Examination Report.

Claims 1-3, 5, 6, 8, 9, 12-17, 19-24, 26, 28-35, 37-39, 46, and 57 were objected to based on informalities noted by the Examiner.

Claims 1-3, 5, 6, 8, 9, 12-17, 19-24, 26, 28-35, 37-39, 46, and 57 were amended to correct the informalities noted by the Examiner.

2. Sections 2 and 3 of the Examination Report.

Claim 57 was rejected under 35 U.S.C. 101 for lacking recitation of a practical application.

Claim 57 was amended to recite the generating of a data output as a practical application of combining the CI components.

3. Sections 4 and 5 of the Examination Report.

Claims 20, and 25-27 were rejected under 35 U.S.C. 102(a) as being anticipated by Fattouche (U.S. 6,320,897). Specifically, the Examiner states that Fattouche teaches a CI coder and CI decoder, with respect to the mention of polyphase codes. However, the polyphase codes taught by Fattouche are quite different than CI codes.

For example, Fattouche (Col. 16, line 40- Col. 7, line 7) describes polyphase codes with codelengths restricted to values that are squares of integers. This results from concatenating rows of terms in a $\sqrt{M}\times\sqrt{M}$ matrix. However, CI codes have no length restrictions, and therefore, they can be any length.

The polyphase codes described by Fattouche differ from CI codes in other ways as well. For example, the current application (page 4, lines 6-8) describes adaptations of CI to conventional multicarrier protocols (such as OFDM and MC-CDMA), which eliminates the high peak-to-average-power ratios (PAPR) associated with conventional multicarrier

Samsung Exhibit 1023, Page 107 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

protocols. This feature of CI codes is well known, such as illustrated by the following published papers:

D. A. Wiegandt, C. R. Nassar and Z. Wu: "Overcoming peak-to-average power ratio issues in OFDM via Carrier Interferometry Codes." IEEE Vehicular Tech. Conf. (VTC2001), Atlantic City, NJ, pp. 660--663, 2001.

B. Natarajan and C.R. Nassar, "Crest factor reduction in MC-CDMA employing carrier interferometry codes", EURASIP Journal on Wireless Communications and Networking, 2004.

K. Anwar, et al., "Large code set for PAPR reduction of OFDM signals and capacity increasing in MC-CDMA system." Proc. of the 2006 Int. Conf. on Comm. and Mobile Comp., Vancouver, British Columbia, Canada, Pages: 887 – 892.

G. Wunder and K. G. Paterson, "Crest-factor analysis of carrier interferometry MC-CDMA and OFDM systems" IEEE Int. Symp. on Inform. Theory (ISIT), Chicago, July 2004.

HE Jian-hui, QUAN Zi-yi, MEN Ai-dong, "PAPR Reduction in OFDM Systems with Large Number of Sub-Carriers by Carrier Interferometry Approaches", Vol.11, No.4, Dec.2004

However, the polyphase codes shown by Fattouche fail to provide the PAPR reduction that can be realized using CI codes. Since the characteristics of CI codes are quite different from the characteristics of the polyphase codes taught by Fattouche, Fattouche does not teach CI codes. Consequently, Fattouche fails to teach a CI coder or a CI decoder, such as recited in the independent claim 20 and the dependent claims 25-27. Therefore, Applicant requests reconsideration of the rejection of Claims 20 and 25-27.

4. Section 6 of the Examination Report.

Claim 57 was rejected under 35 U.S.C. 102(e) as being anticipated by Nallanathan (U.S. 6,728,295). Specifically, the Examiner states that Nallanathan teaches decomposing a signal into CI components and recombining the CI components.

While Nallanathan employs a perfect reconstruction filter bank, the spreading codes produced are not CI codes, not are they even polyphase codes. Rather, Nallanathan (Col.

Samsung Exhibit 1023, Page 108 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

3, lines 43-59) describes the use of Walsh code generators and Walsh-Hadamard matrices, which employ binary values. The resulting codes do not have the PAPR benefits nor the flexibility of code lengths of CI codes.

5. Section 7 of the Examination Report.

Claim 57 was rejected under 35 U.S.C. 102(e) as being anticipated by Popovic (U.S. 6,567,482). Specifically, the Examiner states that Popovic teaches decomposing a signal into CI components and recombining the CI components.

Popovic (Col. 5, line 66 – Col. 6, line 3) describes binary sequences with a length restriction that is a power of 2: "polyphase complementary sequences of length $L=2^N$." Popovic (Col. 10, line 24 – col. 11, line 4) shows construction of complementary sequences, which differ quite substantially from CI codes in that they do not have the PAPR benefits nor the flexibility of code lengths of CI codes.

6. Sections 8 and 9 of the Examination Report.

Claims 30 and 46 were rejected under 35 U.S.C. 103(a) as being unpatentable over Sautter (U.S. 7,031,309) in view of Startup (U.S. 5,940,379).

Sautter teaches an addressing technique in which a multi-address message is constructed with routing information in the header. Layer 3 of the OSI model provides for routing the transmission and comprises determining each route based on addresses in the header of the transmission. However, Sautter is silent on decoding or demodulating received signals at each intermediary node for producing a data output, followed by re-encoding the data for retransmission to other nodes.

Startup, which describes spreading the data with codes used for identifying network addresses, is also silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission.

Samsung Exhibit 1023, Page 109 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Applicant submits that the step of transmitting recited in the Currently Amended independent claims 30 and 46, wherein transmitting comprises decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission, constitutes non-obvious subject matter that is neither disclosed nor anticipated by the relied-upon prior-art references.

Since neither Sautter nor Startup mentions the above-recited novel subject matter, the combination of Sautter and Startup should not render the independent claims 30 and 46 as obvious under 35 U.S.C. 103(a).

Startup does not show decoding and signal processing the received signals at each intermediate node to produce a data output signal. Rather, an Nth intermediary node employs only the Nth intermediary code to decode the received signal, which produces a spread spectrum signal – not a data output signal. In order to produce the data output signal at the intermediary node, all the codes encoding the received signal (or the complex conjugates of all those codes) need to be used to decode the received signal. However, this is clearly not the case in Startup. Instead, only the destination node produces the data output signal (i.e., message information).

"In step 518, the code for the Nth intermediary node is used to decode the spread spectrum signal." (Startup col. 11, lines 56-57)

"In step 524, the destination node receives and decodes the spread spectrum signal into message information using the destination code for this particular node." (Startup, col. 12, lines 15-17).

Since Startup fails to employ full decoding followed by signal processing to produce a data output (and subsequent re-encoding and retransmission) at the intermediate nodes, noise and distortion resulting from channel propagation between nodes and circuitry in each intermediate node are allowed to accumulate along each hop to an intermediate node.

Samsung Exhibit 1023, Page 110 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

7. Sections 10 and 11 of the Examination Report.

Dependent Claim 21 was rejected under 35 U.S.C. 103(a) as being unpatentable over Fattouche in view of Guo. Dependent Claim 22 was rejected under 35 U.S.C. 103(a) as being unpatentable over Fattouche in view of Startup.

Dependent Claims 21 and 22 include all of the limitations of Independent Claim 20. Applicant holds that the recitation of a CI coder and a CI decoder in Claim 20 is novel and non-obvious over Fattouche, and neither Guo nor Startup describes a CI coder and a CI decoder. Therefore, the combination of Fattouche and Guo fails to teach the CI coder and CI decoder in Claim 21, and the combination of Fattouche and Startup fails to teach the CI coder and CI decoder in Claim 22. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claims 21 and 22 under 35 U.S.C. 103(a).

8. Section 12 of the Examination Report.

Dependent Claims 28 and 29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Fattouche in view of Petrick.

Dependent Claims 28 and 29 include all of the limitations of Independent Claim 26. Applicant holds that the recitation of a CI coder and a CI decoder in Claim 26 is novel and non-obvious over Fattouche. Furthermore, Petrick does not describe a CI coder and a CI decoder. Therefore, the combination of Fattouche and Petrick fails to teach the CI coder and CI decoder in Claims 28 and 29. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claims 28 and 29 under 35 U.S.C. 103(a).

9. Section 13 of the Examination Report.

Dependent Claims 31-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Sautter (U.S. 6,233,248).

Samsung Exhibit 1023, Page 111 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Dependent Claims 31-34 include all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Sautter (U.S. 6,233,248) is also silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, and Sautter (U.S. 6,233,248) fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claims 31-34. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claims 31-34 under 35 U.S.C. 103(a).

10. Section 14 of the Examination Report.

Dependent Claim 35 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Blum and Kejriwal.

Dependent Claim 35 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, both Blum and Kejriwal are silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, Blum, and Kejriwal fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 35. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 35 under 35 U.S.C. 103(a).

11. Section 15 of the Examination Report.

Dependent Claim 36 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Gable.

Samsung Exhibit 1023, Page 112 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Dependent Claim 36 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Gable is silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, and Gable fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 36. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 36 under 35 U.S.C. 103(a).

12. Section 16 of the Examination Report.

Dependent Claim 37 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Scott and Fan.

Dependent Claim 37 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, both Scott and Fan are silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, Scott, and Fan fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 37. Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 37 under 35 U.S.C. 103(a).

13. Section 17 of the Examination Report.

Dependent Claim 38 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Noehring.

Dependent Claim 38 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data

Samsung Exhibit 1023, Page 113 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Noehring is silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, and Noehring fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 38. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 38 under 35 U.S.C. 103(a).

14. Section 18 of the Examination Report.

Dependent Claim 39 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Yim.

Dependent Claim 39 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Yim is silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, and Yim fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 39. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 39 under 35 U.S.C. 103(a).

15. Section 19 of the Examination Report.

Dependent Claim 40 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Bennett.

Dependent Claim 40 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Bennett is silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter,

Samsung Exhibit 1023, Page 114 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Startup, and Bennett fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 40. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 40 under 35 U.S.C. 103(a).

16. Section 20 of the Examination Report.

Dependent Claim 41 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Shaffer.

Dependent Claim 41 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Shaffer is silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, and Shaffer fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 41. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 41 under 35 U.S.C. 103(a).

17. Section 21 of the Examination Report.

Dependent Claims 42, 43, and 45 were rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Shaffer.

Each of the Dependent Claims 42, 43, and 45 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Shaffer is silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, and Shaffer fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claims 42, 43,

Samsung Exhibit 1023, Page 115 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

and 45. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claims 42, 43, and 45 under 35 U.S.C. 103(a).

18. Section 22 of the Examination Report.

Dependent Claim 44 was rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup, and further in view of Arend.

Dependent Claim 44 includes all of the limitations of Independent Claim 30. Applicant holds that the recitation of "decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission" is novel and non-obvious over the combination of Sautter and Startup. Furthermore, Arend is silent on decoding received signals at the intermediary nodes and re-encoding the data for retransmission. Therefore, the combination of Sautter, Startup, and Shaffer fails to teach the novel step recited in Independent Claim 30 and thus, the Dependent Claim 44. Therefore, Applicant requests that the Examiner reconsider the rejection of the Dependent Claim 44 under 35 U.S.C. 103(a).

19. Section 23 of the Examination Report.

Applicant's arguments in the last response were considered, but are moot in view of the new grounds of rejection.

20. Section 24 of the Examination Report.

Claims 1-19 were objected to due to reasons listed above. Those reasons are acknowledged and amendments to the claims are made to correct the informalities noted by the Examiner.

21. Section 25 of the Examination Report.

Claims 23 and 24 were objected to as being dependent upon a rejected base claim (Claim 20). Applicant has argued that the base claim is patentable over the cited prior art.

Samsung Exhibit 1023, Page 116 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Conclusion

The Prior Art of Record has been reviewed and is considered by the Applicant to be inconsequential with respect to the claimed invention. The Applicant submits that every effort has been made to address the Examiner's objections and that the Application is now in condition to proceed to grant.

Yours Respectfully,



Steve J. Shattil
P.O. Box 17355
Boulder, CO 80308-0355
(720) 234-4351

Samsung Exhibit 1023, Page 117 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Notice of Non-Compliant Amendment (37 CFR 1.121)	Application No. 10/145,854	Applicant(s) SHATTIL, STEVE J.	
		Art Unit 2800	

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

The amendment document filed on *03 July, 2007* is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
  - ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other _____.
- ☐ 2. Abstract:
  - ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other _____.
- ☐ 3. Amendments to the drawings:
  - ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other _____.
- ☒ 4. Amendments to the claims:
  - ☒ A. A complete listing of all of the claims is not present.
  - ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☐ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☐ E. Other: _____.
- ☐ 5. Other (e.g., the amendment is unsigned or not signed in accordance with 37 CFR 1.4): For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714.

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance, or a drawing submission (only) If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted.

2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the correction, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a Quayle action. If any of above boxes 1 to 4 are checked, the correction required is only the corrected section of the non-compliant amendment in compliance with 37 CFR 1.121.

   Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.
   Failure to timely respond to this notice will result in:
   Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
   Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Legal Instruments Examiner (LIE), if applicable Tammy Acree Telephone No: 571-272-7017

Notice of Non-Compliant Amendment (37 CFR 1.121)	Application No. 10/145,854	Applicant(s) SHATTIL, STEVE J.	
		Art Unit 2800	

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

The amendment document filed on *03 July, 2007* is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
  - ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other _____.
- ☐ 2. Abstract:
  - ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other _____.
- ☐ 3. Amendments to the drawings:
  - ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other _____.
- ☒ 4. Amendments to the claims:
  - ☒ A. A complete listing of all of the claims is not present.
  - ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☐ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☐ E. Other: _____.
- ☐ 5. Other (e.g., the amendment is unsigned or not signed in accordance with 37 CFR 1.4): For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714.

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance, or a drawing submission (only) If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted.

2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the correction, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a Quayle action. If any of above boxes 1 to 4 are checked, the correction required is only the corrected section of the non-compliant amendment in compliance with 37 CFR 1.121.

   Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.
   Failure to timely respond to this notice will result in:
   Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
   Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Legal Instruments Examiner (LIE), if applicable Tammy Acree Telephone No: 571-272-7017

Samsung Exhibit 1023, Page 119 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

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Commissioner of Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Appn. Number: 10/145,854
Filing Date: 05/14/2002
Examiner: Ronald Abelson
G.A.U.: 2616
Atty. Docket No. CINET 01

Mailed 2007, June 8
Boulder, CO 80303

Dear Sir:

In response to the Office Letter mailed on 04/09/2007, please amend the application as follows.

PAGE 1/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

page 12 cut-off

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Introductory Comments

Claims 1-57 are pending in the application. Claims 20-22, 25-46, and 57 were rejected. Claims 1-19, 23, and 24 were objected to.

PAGE 2/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 121 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

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Amendments to the Claims

1. (Currently Amended) In a method for communicating by multiple subscribers in an ad-hoc network ~~without a base station~~, each of the multiple subscribers transmitting ~~adapted to transmit CI~~Carrier Interferometry (CI)-coded communication information in at least one frequency band, the improvement comprising the additional steps of:

   ~~providing for~~ simultaneously transmitting control information with the communication information in at least one frequency band from an initiating subscriber for selectively controlling communications between the multiple subscribers; and,

   ~~providing for~~ modulating the control information by at least one other CI code.

2. (Currently Amended) The method of claim 1 wherein the control information is ~~adapted~~ configured to permit controlling the multiple-access system by initiating one or more of the subscribers as a network control station.

3. (Currently Amended) The method of claim 2 wherein the control information is ~~adapted~~ configured to permit transferring the power control and the time synchronization of the multiple-access system from any one of the subscribers acting as the network control station to any other of the subscribers becoming the network control station.

4. (Original) The method of claim 2 wherein communication by multiple subscribers includes one or more protocols requiring one of the multiple subscribers to initiate communications and become the network control station in a transmit mode for transmitting the communication information and the control information to all other the multiple subscribers being in a receive mode for simultaneously receiving the communication information through an information channel and the control information through a control channel.

5. (Currently Amended) The method of claim 4 further including the step of ~~providing for~~ the network control station to command another of the multiple subscribers to change at least one CI code for the control information.

PAGE 3/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 122 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

6. (Currently Amended) The method of claim 3 wherein the control information is ~~adapted~~ configured to include power-control information for providing a predetermined power setting for each of the multiple subscribers.
7. (Currently Amended) The method of claim 5 wherein the network control station is ~~adapted~~ configured to poll each of the other multiple subscribers, receive an acknowledgement back to measure the power received from each of the multiple subscribers, and adjust the power levels for transmission in predetermined increments.
8. (Currently Amended) A method for providing communications for a network of transceivers in a carrier interferometry (CI)-based multiple-access system operating in an ad-hoc network ~~without a base station~~, comprising:

~~providing for~~ transmitting control information coded by at least a first CI code through a control channel simultaneously with communications information coded by at least a second CI code through a communications channel in at least one frequency band;

~~providing for~~ identifying the network and at least one of the transceivers using the control information coded with the at least one CI code and restricting communications between the transceivers of the network using the second CI code;

~~providing for~~ performing transmit/receive operations of the communications information and the control information by each of the transceivers in a predetermined duplexing operation;

~~providing for~~ controlling the network initially by one of the transceivers, acting as a network control station; and,

~~providing for~~ transferring control by one of the transceivers as the network control station to another of the transceivers to become the network control station for continuing the power control and the time synchronization over the network.

9. (Currently Amended) The method of claim 8 wherein the step of ~~providing for~~ performing transmit/receive operations of the communications information through the communications channel and the control information through the control channel is performed relative to a duplexing operation of a set of duplexing operations including TDD, FDD, CDD, PDD, CI-PDD, CPD, OPDD, QPDD, and CTDD.

PAGE 4/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 123 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

10. (Currently Amended) The method of claim 8 wherein the step of initiating control over the network further includes ~~the~~ a step of ~~providing for~~ enabling the network control station to command another of the transceivers to change the CI code for the control information.

11. (Original) The method of claim 8 wherein the control information includes power control information for allowing the network control station to set a predetermined power setting for each of the transceivers to assure that those of the transceivers transmitting close to the network control station do not overwhelm any other of the transceivers transmitting far away from the network control station.

12. (Currently Amended) The method of claim 8 wherein the network control station ~~is adapted to~~ polls each of the other the transceivers and receives an acknowledgement back to measure the power received from each of the transceivers and adjusts the power levels for transmission in predetermined increments.

13. (Currently Amended) The method of claim 8 further comprising a step of ~~providing for~~ conversational-mode communications with the transceivers having receivers with CI decoders in parallel for permitting the network control station to simultaneously receive transmissions from more than one of the transceivers and respond to each of the more than one of the transceivers with individual transmissions.

14. (Currently Amended) The method of claim 8 further comprising a step of ~~providing for~~ simultaneous transmission of voice and data by assigning different CI codes for voice and data on the communications channel and providing the transceivers with receivers having at least three decoders for discriminating voice communications, data communications, and control channel communications.

15. (Currently Amended) A method for providing personal communications for a network of transceivers in a multiple-access system operating in an ad-hoc network ~~without a base station~~ by means of simultaneously transmitting communications information through a communications channel with control information through a control channel between at least two transceivers, the method comprising the steps of:

~~providing for~~ coding the transmission of each of the communication information through the communications channel and control information through the control channel with different carrier interferometry (CI) codes to enable

PAGE 5/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 124 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

restricting communications between at least two of the transceivers, each of the different CI codes being capable of identifying the network and at least one of the transceivers;

~~providing for~~ performing transmit and receive operations by each of the transceivers in a time division duplex manner with discrete time slots within at least one frequency band;

~~providing for~~ controlling the network by one of the transceivers, acting as a network control station for setting the network control station in a transmit mode and all other of the transceivers in a receive mode in at least a first of the discrete time slots;

~~providing for~~ operating in a transmit mode by the network control station and operating in a receive mode by all other of the transceivers in at least a second of the discrete time slots for transmitting the communications information through the communications channel and control channel;

~~providing for~~ responding by at least one of the transceivers to the communications information and control information transmitted by the network control station; and,

~~providing for~~ responding by the network control station with the control channel for indicating the type of communication mode for further communications between the network control station and the at least one of the transceivers.

16. (Currently Amended) The method of claim 15 wherein the step of ~~providing for~~ responding by the network control station includes informing the at least one of the transceivers to transmit and all other of the transceivers to receive.

17. (Currently Amended) The method of claim 15 wherein the step of ~~providing for~~ responding to the at least one of the transceivers by the network control station includes informing the one of the transceivers to transmit so as to restrict communications between the network control station and the one of the transceivers.

18. (Original) The method of claim 15 wherein a collision of transmissions caused by a plurality of transceivers attempting to transmit in the same time slot is resolved by the

PAGE 6/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 125 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

plurality of transceivers retrying transmissions and one of the plurality of transceivers transmitting in an earlier time slot than the other of the plurality of transceivers.

19. (Currently Amended) The method of claim 15 wherein the step of ~~providing for~~ responding by the network control station includes all other the transceivers acknowledging the control channel.

20. (Currently Amended) A carrier interferometry (CI)-coded communications system including a plurality of transceivers, each of the transceivers including:

at least one CI coder coupled to each transceiver, the at least one CI coder ~~adapted to provide~~ for providing at least one CI-coded information signal for transmission in at least one frequency band;

at least one CI decoder coupled to each transceiver, the at least one CI decoder ~~adapted to decode~~ for decoding at least one received transmitted waveform.

21. (Currently Amended) The communication system recited in claim 20 wherein the at least one coder and the at least one decoder corresponding to at least one of the transceivers ~~are adapted to~~ operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

22. (Currently Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform ~~is adapted to~~ include at least one address, and the decoder is ~~adapted~~ configured to route the signal with respect to the at least one address.

23. (Currently Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform ~~is adapted to~~ include at least one tag waveform indicative of the coding provided to the at least one transmitted waveform.

24. (Currently Amended) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform ~~is adapted to~~ include at least one tag waveform for identifying the type of data contained in the transmitted waveform and further includes decoding information necessary to decode information in the transmitted waveform.

PAGE 7/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 126 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

25. (Currently Amended) The communication system recited in claim 20 wherein each transceiver further comprises at least one antenna including an RF front end ~~adapted~~ configured to receive and transmit signals.

26. (Currently Amended) A transceiver ~~adapted~~ configured to receive a first carrier interferometry (CI)-coded transmitted signal and transmit simultaneously another CI-coded signal, the transceiver including:

an RF front end ~~adapted~~ configured to perform at least one transceiving function in at least one frequency band, the at least one transceiving function including receiving at least one transmitted signal and transmitting at least one signal,

a CI decoder coupled to the RF front end, the CI decoder ~~adapted~~ configured to decode at least one received transmitted signal,

a CI coder coupled to the RF front end, the CI coder ~~adapted~~ configured to provide CI coding to at least one information signal for transmission, the CI coder providing unique CI coding with respect to CI codes of the at least one received signal to enable simultaneous transmission and reception of CI coded information.

27. (Original) The transceiver recited in claim 26 wherein the RF front end includes at least one antenna for receiving and transmitting signals.

28. (Currently Amended) The transceiver recited in claim 26 wherein the CI decoder includes a preamble detector ~~adapted~~ configured to detect a preamble.

29. (Currently Amended) The transceiver recited in claim 26 wherein the CI coder includes a preamble generator ~~adapted~~ configured to generate at least one preamble.

30. (Currently Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, ~~an improved method of~~ communicating in the network using multi-address messaging, including:

~~providing for~~ constructing at a source node a multi-address message containing coded information whereby spreading codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and

PAGE 8/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 127 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

~~providing for~~ transmitting the multi-address message in at least one frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next ~~common intervening~~ node, wherein transmitting comprises decoding received transmissions at each common intervening node, performing signal processing to generate a data output, and re-encoding the data output for retransmission.

31. (Currently Amended) The method of claim 30, wherein ~~providing for~~ constructing further includes:

for at least one network address, ~~providing for insertion~~ inserting in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and

for each extended address in the network header, ~~providing for inclusion~~ including in the extended address the basic network address of the destination node corresponding to the network address and information for forwarding the multi-address message to the another network.

32. (Currently Amended) The method of claim 30, further comprising:

~~providing for~~ receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and

~~providing for~~ routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

33. (Currently Amended) The method of claim 30, wherein ~~providing for~~ constructing further includes:

for each network address in the network header, ~~providing for insertion~~ inserting in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

PAGE 9/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

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34. (Currently Amended) The method of claim 30, wherein ~~providing for~~ constructing further includes, for each network address in the network header:

~~providing for insertion~~ inserting in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

~~providing for insertion~~ inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

~~providing for insertion~~ inserting in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

35. (Currently Amended) The method of claim 30, wherein the multi-address message comprises a sequence of message frames each containing a network header, wherein the constructing step further includes:

~~providing for insertion~~ inserting ~~of~~ a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence; and

~~providing for insertion~~ inserting ~~of~~ an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

36. (Currently Amended) The method of claim 30, wherein the constructing step includes ~~providing for insertion of~~ inserting the network address of the source node in a network header.

37. (Currently Amended) The method of claim 30, wherein constructing step further includes:

~~providing for insertion~~ inserting in the network header a precedence field indicating a relative precedence of the multi-address message, and

PAGE 10/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

~~providing for restriction~~ restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

38. (Currently Amended) The method of claim 30, wherein the constructing step further includes:

~~providing for~~ inserting in a network header a security field indicating a relative security level of the multi-address message, and

~~providing for~~ restricting message traffic at a node as a function of the security level identified in the network header of each message.

39. (Currently Amended) The method of claim 30, further comprising:

~~providing for~~ acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node,

~~providing for~~ retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

~~providing for~~ repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

40. (Original) The method of claim 30, wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

41. (Original) The method of claim 30, initiates a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

42. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message in a point-to-point mode.

43. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message in a broadcast mode.

PAGE 11/12 * RCVD AT 7/3/2007 3:56:41 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-5/16 * DNIS:2738300 * CSID:303 449 7805 * DURATION (mm-ss):02-46

Samsung Exhibit 1023, Page 130 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

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JUL 0 3 2007

44. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message over a waveguide.

45. (Currently Amended) The method of claim 30, wherein the transmitting step includes ~~providing for~~ transmitting the multi-address message in at least one transmission mode including a full-duplex communication mode and a half-duplex communication mode.

46. (Currently Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network [illegible]

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

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Steven J. Shattil
15 S. 33rd Street
Boulder, CO 80305

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2616	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/09/2007	PAPER

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

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

Office Action Summary	Application No.	Applicant(s)	
	10/145,854	SHATTIL, STEVE J.	
	Examiner	Art Unit	
	Ronald Abelson	2616	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 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 *23 February 2007*.

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) *1-46 and 57* 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) *20-22,25-46 and 57* is/are rejected.

7)☒ Claim(s) *1-19, 23, and 24* 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 *14 May 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

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

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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

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

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

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

Attachment(s)

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

Claim Objections

1. Claims 1-3, 5, 6, 8, 9, 12–17, 19-24, 26, 28–35, 37-39, 46, and 57 are objected to because of the following informalities: the terms "adapted to" and "providing for" must be removed. Appropriate correction is required. Regarding claim 1, the term "adapted to transmit" could be changed to "transmitting" and "providing for simultaneously" could be changed to "simultaneously".

Claim 1 line 2, "CI" should be changed to "carrier interferometry CI".

Claim 1 line 2, "without a base station" should be changed to "in an adhoc network".

Claim 8 line 2, "CI" should be changed to "carrier interferometry CI".

Claim 8 line 2, "without a base station" should be changed to "in an adhoc network".

Claim 15 line 2, "without a base station" should be changed to "in an adhoc network".

Claim 15 line 8, "CI" should be changed to "carrier interferometry CI".

Claim 20 line 1, "A" should be changed to "A carrier interferometry CI coded".

Claim 26 line 1, "CI" should be changed to "carrier interferometry CI".

Claim 30 line 6, "codes" should be changed to "spreading codes".

Claim 46 line 6, "codes" should be changed to "spreading codes".

Claim 57 line 5, "CI" should be changed to "carrier interferometry CI".

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. Claim 57 is rejected under 35 U.S.C. 101 because the claimed invention lacks patentable utility. The claims are directed to a computer-related invention and consist solely of software operations without a claimed practical application. Claims 57 falls in the statutory category method and are covered under the judicial exception: software algorithm. Therefore, a practical application must be claimed.

Claim Rejections - 35 USC § 102

4. 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 -
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claim 20 and 25-27 are rejected under 35 U.S.C. 102(a) as being anticipated by Fattouche (US 6,320,897).

Regarding claims 20 and 26, Fattouche teaches at least one CI coder coupled to each transceiver, the at least one CI coder adapted to provide at least one CI-coded information signal for transmission in at least one frequency band (polyphase codes, col. 20 lines 15-21, 32-36).

Fattouche teaches at least one CI decoder coupled to each transceiver, the at least one CI decoder adapted to decode at least one received transmitted waveform (col. 20 lines 49-51).

Regarding claim 25 and 27, at least one antenna including an RF front end adapted to receive and transmit signals (polyphase codes, col. 20 lines 15-21, 32-36).

(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.

6. Claim 57 is rejected under 35 U.S.C. 102(e) as being anticipated Nallanathan (US 6728295).

Regarding claim 57, Nallanathan teaches a plurality of network transceivers adapted to route communication signals in

the network; the network including: at least one central processing unit / base station coupled to the transceivers, the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of CI components, and combine the CI components / complementary codes (col. 1 lines 10-25).

7. Claim 57 is rejected under 35 U.S.C. 102(e) as being anticipated by Popovic (US 6,567,482).

Regarding claim 57, Popovic teaches a plurality of network transceivers adapted to route communication signals in the network; the network including: at least one central processing unit / base station coupled to the transceivers, the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of CI components, and combine the CI components / complementary codes (col. 28 line 56 - col. 29 line 8, Golay sequences, col. 29 lines 16-17).

Claim Rejections - 35 USC § 103

8. 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 negatived by the manner in which the invention was made.

9. Claims 30 and 46 rejected under 35 U.S.C. 103(a) as being unpatentable over Sautter (US 7,031,309) in view of Startup (US 5,940,379).

Regarding claims 30 and 46, Sautter teaches providing for constructing at a source node a multi-address message containing coded information, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and providing for transmitting the multi-address message in at least one frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next common intervening node (abstract).

Sautter is silent on codes identify network addresses of a plurality of destination nodes.

Startup teaches codes identify network addresses of a plurality of destination nodes (abstract, data spread using the destination code for that destination node, abstract).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Sautter by routing using the spreading codes of the destination nodes, as shown by Startup. This modification can be performed in software. This modification would benefit the system since a single code could be used for both routing and demodulation.

10. Claim 21 rejected under 35 U.S.C. 103(a) as being unpatentable over Fattouche as applied to claim 20 above, and further in view of Guo (6,389,034).

Fattouche is silent on the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

Guo teaches the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to

receive any transmitted waveform while simultaneously transmitting another waveform (full duplex, col. 3 lines 55-60).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Fattouche by modifying the transceivers to transmit in full duplex. This modification can be performed according to the teachings of Guo. This modification would benefit the system by allowing for the simultaneous transmission and reception of data.

11. Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Fattouche as applied to claim 20 above, and further in view of Startup.

Fattouche is silent on at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one address and the decoder is adapted to route the signal with respect to the at least one address.

Startup teaches a method for at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one address and the decoder is adapted to route the signal with respect to the at least one address (abstract, data spread using the destination code for that destination node, abstract).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Fattouche by routing using the spreading codes of the destination nodes, as shown by Startup. This modification can be performed in software. This modification would benefit the system since a single code could be used for both routing and demodulation.

12. Claim 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fattouche as applied to claim 26 above, and further in view of Petrick (US 5,712,870).

Fattouche is silent on the CI decoder includes a preamble detector adapted to detect a preamble, as specified in claim 28; wherein the CI coder includes a preamble generator adapted to generate at least one preamble, as specified in claim 29.

Petrick, like Fattouche, teaches spread spectrum. Furthermore, Petrick teaches spread spectrum messages containing a preamble used for synchronization (col. 2 lines 8-11).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Fattouche by including in the CI decoder includes a preamble detector adapted to detect a preamble and including in the CI coder includes a preamble generator adapted to generate at least one preamble, as suggested by Petrick. This modification can be performed

according to known standards for the preamble in spread spectrum systems. This modification would benefit the system by providing for synchronization (Petrick: col. 2 lines 8-11).

13. Claims 31 - 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Sautter (US 6,233,248).

Regarding claim 31, the combination is silent on for at least one network address, providing for insertion in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and for each extended address in the network header, providing for inclusion in the extended address the basic network address of the destination node corresponding to the network address mad information for forwarding the multi-address message to the another network.

Sautter teaches for at least one network address, providing for insertion in a network header an extend field indicating whether the network address is a basic network address or an

extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and for each extended address in the network header, providing for inclusion in the extended address the basic network address of the destination node corresponding to the network address mad information for forwarding the multi-address message to the another network (col. 41 lines 35 - 47).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by providing for insertion in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and for each extended address in the network header, providing for inclusion in the extended address the basic network address of the destination node corresponding to the network address mad information for forwarding the multi-address message to the another network, as shown by Sautter. This modification can be performed in software. This modification would benefit the system by providing for both basic and extended network addressing.

Regarding claim 32, the combination is silent on providing for receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and providing for routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

Sautter teaches providing for receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and providing for routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node (col. 41 lines 47-55).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by providing for receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and providing for routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node, as shown by Sautter. This modification can be performed in software. This modification

would benefit the system by providing for both basic and extended network addressing.

Regarding claim 33, the combination is silent on for each network address in the network header, providing for insertion in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

Sautter teaches providing for insertion in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable (col. 41 lines 58-63).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by providing for insertion in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable, as shown by Sautter. This modification can be performed in software. This modification would benefit the system by informing the routing device of the last destination address.

Regarding claim 34, the combination is silent on

providing for insertion in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

providing for insertion ha the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

Sautter teaches providing for insertion in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

providing for insertion ha the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address (col. 41 lines 58 - col. 42 line 15).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by performing the steps of providing above, as shown by Sautter. This modification can be performed in software. This modification would benefit the system by providing for fields indicating whether an acknowledgment is required.

14. Claim 35 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Blum (US 7,155,255) and Kejriwal (US 6,704,794).

The combination is silent on providing for insertion of a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence.

Blum teaches providing for insertion of a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence (fig. 2 box 205, col. 3 lines 1-5).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by including within the packet header a frame sequence number, as shown by Blum. This modification can be performed in software. This modification would benefit the system by providing a method for quick location of the message.

The combination is silent on providing for insertion of an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

Kejriwal teaches providing for insertion of an end of message field in the network header of each message frame

indicating whether the message frame is the last in the message (EOP field, col. 7 lines 38-42).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by including within the packet header a end of frame field, as shown by Kejriwal. This modification can be performed in software. This modification would benefit the system by providing information of the end of the message is a variable length frame.

15. Claim 36 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Gable (US 4,550,402).

The combination is silent on providing for insertion of the network address of the source node in a network header.

Gable teaches insertion of the network address of the source node in a network header (abstract).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by insertion of the network address of the source node in a network header, as shown by Gable. This modification can be performed in software. This modification would benefit the system by

informing the destination where the packet originated.

16. Claim 37 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Scott (US 6,650,645) and Fan (US 5,412,648).

The combination is silent on providing for restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

Scott teaches providing for restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node (col. 3 lines 10-16).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by providing priority to packets of higher priority in times of congestion, as shown by Scott. This modification can be

performed in software. This modification would benefit the system by reducing transmission times for the higher priority traffic.

The combination is silent on providing for insertion in the network header a precedence field indicating a relative precedence of the multi-address message.

Fan teaches providing for insertion in the network header a precedence field indicating a relative precedence a message (col. 3 lines 1-5).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by providing for insertion in the network header a precedence field indicating a relative precedence a message, as shown by Fan. This modification can be performed in software. This modification would benefit the system by informing devices of the priority it should give to the message.

17. Claim 38 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Noehring (US 7,194,766).

The combination is silent on providing for inserting in a network header a security field indicating a relative security level of the multi-address message, and providing for restricting message traffic at a node as a function of the security level identified in the network header of each message.

Noehring teaches on providing for inserting in a network header a security field indicating a relative security level of a message, and providing for restricting message traffic at a node as a function of the security level identified in the network header of each message (col. 20 lines 22-29).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by inserting a security field in the header of the packet, as shown by Noehring. This modification can be performed in software. This modification would benefit the system by ensuring that the message is not transmitted to locations that are not allowed to receive the message.

18. Claim 39 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Yim (US 20030206527).

The combination is silent on providing for acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node,

providing for retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

providing for repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

Yim teaches providing for acknowledging receipt of a message at a destination node by sending an acknowledgement message from the destination node to the source node (ack, [0085]);

providing for retransmitting a message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message (retransmit when ACK not received with a time-period, [0085]);

providing for repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted (repeated until maximum Resend Count reached, [0085]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by acknowledging receipt of the multi-address messages according to the ACK algorithm of Yim. This modification can be performed in software. This modification would benefit the system by increasing the probability that messages will be received at their destinations.

19. Claim 40 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Bennett (US 7,149,211).

The combination is silent on the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

Bennett teaches encapsulating a message having a protocol different from the protocol of the encapsulator (IP message encapsulated with ATM, col. 9 lines 55-60).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by encapsulating messages of different protocols, as shown by Bennett. This modification can be performed in software. This modification would benefit the system by allowing for messages to be transported along different layers of the OSI model.

20. Claim 41 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Shaffer (US 6,236,642).

The combination is silent on initiating a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

Shaffer teaches initiating a re-routing process responsive to failure of a message to reach its destination node (col. 1 lines 37-43).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by rerouting if the message does not reach its destination node, as shown by Shaffer. This modification can be performed in software. This modification would benefit the system by increasing the probability that a message will reach its

intended destination.

21. Claim 42, 43, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Shaffer (US 6,236,642).

Regarding claim 42, the combination is silent on transmitting the multi-address message in a point-to-point mode.

Shaffer teaches transmitting the multi-address message in a point-to-point mode (col. 43 lines 5-7).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by transmitting the multi-address message in a point-to-point mode, as shown by Shaffer. This modification can be performed in software. This modification would benefit the system since point-to-point mode transmission is a proven reliable method for transmitting messages.

Regarding claim 43, the combination is silent on transmitting the multi-address message in a broadcast mode.

Shaffer teaches transmitting the multi-address message in a broadcast mode (col. 43 lines 8-10).

Therefore it would have been obvious to one of ordinary

skill in the art, to modify the system of the combination by transmitting the multi-address message in a broadcast mode, as shown by Shaffer. This modification can be performed in software. This modification would benefit the system since broadcast mode transmission allows multiple users to receive information via only a single message.

Regarding claim 45, the combination is silent on transmitting the multi-address message in a full-duplex mode.

Shaffer teaches transmitting the multi-address message in a full-duplex mode (col. 44 lines 4-6).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by transmitting the multi-address message in a full-duplex mode, as shown by Shaffer. This modification can be performed according to the teachings of Shaffer. This modification would benefit the system by allowing for simultaneous reception and transmission.

22. Claim 44 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Startup as applied to claim 30 above, and further in view of Arend (US 6,980,768).

The combination is silent on transmitting the multi-address

message over a waveguide.

Arend teaches transmitting a message over a waveguide (col. 6 lines 63-67).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by transmitting the multi-address message using a waveguide, as shown by Arend. This modification can be performed according to the teachings of Arend. This modification would benefit the system by allowing the message to be transmitted within a building (Arend: col. 6 lines 63-67).

Response to Arguments

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

Allowable Subject Matter

24. Claims 1-19 objected to for reasons listed above.

25. Claims 23 and 24 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.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ronald Abelson whose telephone number is (571) 272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chi Pham can be reached on (571) 272-3179. 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.

Ronald Abelson
Examiner
Art Unit 2616

***

Notice of References Cited	Application/Control No. 10/145,854	Applicant(s)/Patent Under Reexamination SHATTIL, STEVE J.	
	Examiner Ronald Abelson	Art Unit 2616	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,320,897 B1	11-2001	Fattouche et al.	375/130
*	B	US-6,728,295 B1	04-2004	Nallanathan et al.	375/140
*	C	US-6,567,482 B1	05-2003	Popovic', Branislav M.	375/343
*	D	US-7,031,309 B1	04-2006	Sautter et al.	370/392
*	E	US-5,940,379 A	08-1999	Startup et al.	370/320
*	F	US-6,389,034 B1	05-2002	Guo et al.	370/441
*	G	US-5,712,870	01-1998	Petrick, Al	375/147
*	H	US-6,233,248 B1	05-2001	Sautter et al.	370/465
*	I	US-7,155,255 B2	12-2006	Blum et al.	455/560
*	J	US-6,704,794 B1	03-2004	Kejriwal et al.	709/236
*	K	US-4,550,402	10-1985	Gable et al.	370/438
*	L	US-6,650,645 B2	11-2003	Scott et al.	370/395.71
*	M	US-5,412,648 A	05-1995	Fan, Ruixue	370/414

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
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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.

Samsung Exhibit 1023, Page 162 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Notice of References Cited	Application/Control No. 10/145,854	Applicant(s)/Patent Under Reexamination SHATTIL, STEVE J.	
	Examiner Ronald Abelson	Art Unit 2616	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,194,766 B2	03-2007	Noehring et al.	726/13
*	B	US-2003/0206527 A1	11-2003	Yim, Ting Shing	370/238
*	C	US-7,149,211 B2	12-2006	Bennett et al.	370/357
*	D	US-6,236,642 B1	05-2001	Shaffer et al.	370/237
*	E	US-6,980,768 B2	12-2005	Arend et al.	455/3.01
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
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	M	US-			

FOREIGN PATENT DOCUMENTS

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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.

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
10/145,854	SHATTIL, STEVE J.	
Examiner	**Art Unit**	
Ronald Abelson	2616	

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
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East database 370/335, 342, 310, 441 370/203, 204, 206-209 370/237 370/390	3/13/07 3/29/07 3/30/07 3/30/07	RA RA RA RA

Samsung Exhibit 1023, Page 164 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/145,854	SHATTIL, STEVE J.
Examiner	**Art Unit**
Ronald Abelson	2616

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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Claim		Date
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Samsung Exhibit 1023, Page 165 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

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PO Box 1450
Alexandria, Virginia 22313-1450

Appn. Number: 10/145,854
Filing Date: 05/14/2002
Examiner: Ronald Abelson
G.A.U.: 2616
Atty. Docket No. CINET 01
571-273-8300

Mailed 2007, February 23
Boulder, CO 80303

Dear Sir:

In response to the Office Letter mailed on 11/27/2006, please amend the application as follows.

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PAGE 2/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

Samsung Exhibit 1023, Page 166 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Introductory Comments

Claims 1-57 are pending in the application. Claims 1-19 and 28-46 were allowed. Claims 20-22, 25-27, and 57 were rejected. Claims 23 and 24 were objected to. Please cancel non-elected claims 47-56.

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PAGE 3/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

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Amendments to the Claims

1. (Previously Amended) In a method for communicating by multiple subscribers without a base station, each of the multiple subscribers adapted to transmit CI-coded communication information in at least one frequency band, the improvement comprising the additional steps of:

providing for simultaneously transmitting control information with the communication information in at least one frequency band from an initiating subscriber for selectively controlling communications between the multiple subscribers; and,

providing for modulating the control information by at least one other CI code.

2. (Original) The method of claim 1 wherein the control information is adapted to permit controlling the multiple-access system by initiating one or more of the subscribers as a network control station.
3. (Original) The method of claim 2 wherein the control information is adapted to permit transferring the power control and the time synchronization of the multiple-access system from any one of the subscribers acting as the network control station to any other of the subscribers becoming the network control station.
4. (Original) The method of claim 2 wherein communication by multiple subscribers includes one or more protocols requiring one of the multiple subscribers to initiate communications and become the network control station in a transmit mode for transmitting the communication information and the control information to all other the multiple subscribers being in a receive mode for simultaneously receiving the communication information through an information channel and the control information through a control channel.
5. (Original) The method of claim 4 further including the step of providing for the network control station to command another of the multiple subscribers to change at least one CI code for the control information.
6. (Original) The method of claim 3 wherein the control information is adapted to include power-control information for providing a predetermined power setting for each of the multiple subscribers.

PAGE 4/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

7. (Original) The method of claim 5 wherein the network control station is adapted to poll each of the other multiple subscribers, receive an acknowledgement back to measure the power received from each of the multiple subscribers, and adjust the power levels for transmission in predetermined increments.

8. (Previously Amended) A method for providing communications for a network of transceivers in a CI-based multiple-access system operating without a base station, comprising:

providing for transmitting control information coded by at least a first CI code through a control channel simultaneously with communications information coded by at least a second CI code through a communications channel in at least one frequency band;

providing for identifying the network and at least one of the transceivers using the control information coded with the at least one CI code and restricting communications between the transceivers of the network using the second CI code;

providing for performing transmit/receive operations of the communications information and the control information by each of the transceivers in a predetermined duplexing operation;

providing for controlling the network initially by one of the transceivers, acting as a network control station; and,

providing for transferring control by one of the transceivers as the network control station to another of the transceivers to become the network control station for continuing the power control and the time synchronization over the network.

9. (Original) The method of claim 8 wherein the step of providing for performing transmit/receive operations of the communications information through the communications channel and the control information through the control channel is performed relative to a duplexing operation of a set of duplexing operations including TDD, FDD, CDD, PDD, CI-PDD, CPD, OPDD, QPDD, and CTDD.

10. (Original) The method of claim 8 wherein the step of initiating control over the network further includes the step of providing for the network control station to

PAGE 5/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

command another of the transceivers to change the CI code for the control information.

11. (Original) The method of claim 8 wherein the control information includes power control information for allowing the network control station to set a predetermined power setting for each of the transceivers to assure that those of the transceivers transmitting close to the network control station do not overwhelm any other of the transceivers transmitting far away from the network control station.
12. (Original) The method of claim 8 wherein the network control station is adapted to poll each of the other the transceivers and receive an acknowledgement back to measure the power received from each of the transceivers and adjust the power levels for transmission in predetermined increments.
13. (Original) The method of claim 8 further comprising a step of providing for conversational-mode communications with the transceivers having receivers with CI decoders in parallel for permitting the network control station to simultaneously receive transmissions from more than one of the transceivers and respond to each of the more than one of the transceivers with individual transmissions.
14. (Original) The method of claim 8 further comprising a step of providing for simultaneous transmission of voice and data by assigning different CI codes for voice and data on the communications channel and providing the transceivers with receivers having at least three decoders for discriminating voice communications, data communications, and control channel communications.
15. (Previously Amended) A method for providing personal communications for a network of transceivers in a multiple-access system operating without a base station by means of simultaneously transmitting communications information through a communications channel with control information through a control channel between at least two transceivers, the method comprising the steps of:

providing for coding the transmission of each of the communication information through the communications channel and control information through the control channel with different CI codes to enable restricting communications between at least two of the transceivers, each of the different CI codes being capable of identifying the network and at least one of the transceivers;

PAGE 6/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

providing for performing transmit and receive operations by each of the transceivers in a time division duplex manner with discrete time slots within at least one frequency band;

providing for controlling the network by one of the transceivers, acting as a network control station for setting the network control station in a transmit mode and all other of the transceivers in a receive mode in at least a first of the discrete time slots;

providing for operating in a transmit mode by the network control station and operating in a receive mode by all other of the transceivers in at least a second of the discrete time slots for transmitting the communications information through the communications channel and control channel;

providing for responding by at least one of the transceivers to the communications information and control information transmitted by the network control station; and,

providing for responding by the network control station with the control channel for indicating the type of communication mode for further communications between the network control station and the at least one of the transceivers.

16. (Original) The method of claim 15 wherein the step of providing for responding by the network control station includes informing the at least one of the transceivers to transmit and all other of the transceivers to receive.

17. (Original) The method of claim 15 wherein the step of providing for responding to the at least one of the transceivers by the network control station includes informing the one of the transceivers to transmit so as to restrict communications between the network control station and the one of the transceivers.

18. (Original) The method of claim 15 wherein a collision of transmissions caused by a plurality of transceivers attempting to transmit in the same time slot is resolved by the plurality of transceivers retrying transmissions and one of the plurality of transceivers transmitting in an earlier time slot than the other of the plurality of transceivers.

PAGE 7/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

19. (Original) The method of claim 15 wherein the step of providing for responding by the network control station includes all other the transceivers acknowledging the control channel.

20. (Previously Amended) A communications system including a plurality of transceivers, each of the transceivers including:

at least one CI coder coupled to each transceiver, the at least one CI coder adapted to provide at least one CI-coded information signal for transmission in at least one frequency band;

at least one CI decoder coupled to each transceiver, the at least one CI decoder adapted to decode at least one received transmitted waveform. .

21. (Original) The communication system recited in claim 20 wherein the at least one coder and the at least one decoder corresponding to at least one of the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

22. (Original) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one address and the decoder is adapted to route the signal with respect to the at least one address.

23. (Original) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one tag waveform indicative of the coding provided to the at least one transmitted waveform.

24. (Original) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one tag waveform for identifying the type of data contained in the transmitted waveform and further includes decoding information necessary to decode information in the transmitted waveform.

25. (Original) The communication system recited in claim 20 wherein each transceiver further comprises at least one antenna including an RF front end adapted to receive and transmit signals.

PAGE 8/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

26. (Previously Amended) A transceiver adapted to receive a first CI-coded transmitted signal and transmit simultaneously another CI-coded signal, the transceiver including:

an RF front end adapted to perform at least one transceiving function in at least one frequency band, the at least one transceiving function including receiving at least one transmitted signal and transmitting at least one signal,

a CI decoder coupled to the RF front end, the CI decoder adapted to decode at least one received transmitted signal,

a CI coder coupled to the RF front end, the CI coder adapted to provide CI coding to at least one information signal for transmission, the CI coder providing unique CI coding with respect to CI codes of the at least one received signal to enable simultaneous transmission and reception of CI coded information.

27. (Original) The transceiver recited in claim 26 wherein the RF front end includes at least one antenna for receiving and transmitting signals.

28. (Original) The transceiver recited in claim 26 wherein the CI decoder includes a preamble detector adapted to detect a preamble.

29. (Original) The transceiver recited in claim 26 wherein the CI coder includes a preamble generator adapted to generate at least one preamble.

30. (Previously Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, an improved method of communicating in the network using multi-address messaging including:

providing for constructing at a source node a multi-address message containing coded information whereby codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and

providing for transmitting the multi-address message in at least one frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next common intervening node.

PAGE 9/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

Samsung Exhibit 1023, Page 173 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

31. (Original) The method of claim 30, wherein providing for constructing further includes:

for at least one network address, providing for insertion in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and

for each extended address in the network header, providing for inclusion in the extended address the basic network address of the destination node corresponding to the network address and information for forwarding the multi-address message to the another network.

32. (Original) The method of claim 30, further comprising:

providing for receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and

providing for routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

33. (Original) The method of claim 30, wherein providing for constructing further includes:

for each network address in the network header, providing for insertion in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

34. (Original) The method of claim 30, wherein providing for constructing further includes, for each network address in the network header:

providing for insertion in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node

PAGE 10/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

35. (Original) The method of claim 30, wherein the multi-address message comprises a sequence of message frames each containing a network header, wherein the constructing step further includes:

providing for insertion of a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence; and

providing for insertion of an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

36. (Original) The method of claim 30, wherein the constructing step includes providing for insertion of the network address of the source node in a network header.

37. (Original) The method of claim 30, wherein constructing step further includes:

providing for insertion in the network header a precedence field indicating a relative precedence of the multi-address message, and

providing for restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

38. (Original) The method of claim 30, wherein the constructing step further includes:

providing for inserting in a network header a security field indicating a relative security level of the multi-address message, and

providing for restricting message traffic at a node as a function of the security level identified in the network header of each message.

39. (Original) The method of claim 30, further comprising:

PAGE 11/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

Samsung Exhibit 1023, Page 175 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

providing for acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node,

providing for retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

providing for repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

40. (Original) The method of claim 30, wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

41. (Original) The method of claim 30, initiates a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

42. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in a point-to-point mode.

43. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in a broadcast mode.

44. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message over a waveguide.

45. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in at least one transmission mode including a full-duplex communication mode and a half-duplex communication mode.

46. (Previously Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, an improved method of communicating in the network including:

providing for constructing at a source node at least one multi-address message containing coded information employing codes that identify at least one

PAGE 12/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

communication path between the source node and at least one destination node, and

providing for transmission of the at least one multi-address message in at least one frequency band.

47. (Cancelled)

48. (Cancelled)

49. (Cancelled)

50. (Cancelled)

51. (Cancelled)

52. (Cancelled)

53. (Cancelled)

54. (Cancelled)

55. (Cancelled)

56. (Cancelled)

57. (Original) In a communication network of a plurality of network transceivers adapted to route communication signals in the network, the network including:

at least one central processing unit coupled to the transceivers, the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of CI components, and combine the CI components.

PAGE 13/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

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Remarks: Examination Report

1. Claims 20, 25-27, and 57 was rejected under 35 U.S.C. 102(a) as being anticipated by Natarajan (High-Performance MC-CDMA Via Carrier Interferometry Codes).
2. Claim 21 was rejected under 35 U.S.C. 103(a) in view of Natarajan and Guo (US 6,389,034).
3. Claim 22 was rejected under 35 U.S.C. 103(a) in view of Natarajan, and Sauter (US 6,233,248).

4. **Relied-Upon Reference Natarajan (High-Performance MC-CDMA Via Carrier Interferometry Codes) Should be Disqualified as Prior Art**

In particular, the basis for rejection citing 35 U.S.C. 102(a) states that a person shall be entitled to a patent unless the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention by the applicant for patent.

The applicant, who is named as a co-author of the relied-upon Natarajan reference, attests to be the inventor of the subject matter in Natarajan relied upon by the Examiner to reject claims 20, 25-27, and 57 under 35 U.S.C. 102(a). Therefore, the relied-upon Natarajan reference should be disqualified as prior art under 35 U.S.C. 102(a).

If the relied-upon Natarajan reference should be disqualified as prior art, then claims 20, 25-27, and 57 should be found patentable under 35 U.S.C. 102(a).

Furthermore, since the rejections of claims 21 and 22 under 35 U.S.C. 103(a) rely upon Natarajan, if Natarajan is disqualified as prior art, neither the Guo and Sauter references disclose the coder and decoder recited in the independent claim 20, which both claims 21 and 22 recite. Thus claims 21 and 22 should be found patentable under 35 U.S.C. 103(a).

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PAGE 14/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

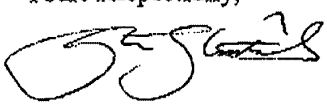
Samsung Exhibit 1023, Page 178 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

6. Claims 23 and 24 were objected to as being dependent on 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.
7. If Applicant's arguments with respect to the independent claim 20 are considered by the USPTO to be persuasive, then claims 23 and 24 should be found allowable.
8. The non-elected claims 47-56 were cancelled.

9. Conclusion

The Prior Art of Record has been reviewed and is considered by the Applicant to be inconsequential with respect to the claimed invention. The Applicant submits that every effort has been made to address the Examiner's objections and that the Application is now in condition to proceed to grant.

Yours Respectfully,



Steve J. Shattil
P.O. Box 17355
Boulder, CO 80308-0355
(720) 234-4351

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PAGE 15/16 * RCVD AT 2/23/2007 2:24:20 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/37 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-50

Samsung Exhibit 1023, Page 179 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

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Rule 131 affidavit

February 23, 2007

Applicant hereby submits an oath and declaration to establish invention of the subject matter of the rejected claims in Appl. No. 10/145,854, filed 5/14/2002, prior to the effective date (November 2001) of the Natarajan reference (High-Performance MC-CDMA Via Carrier Interferometry Codes) on which the rejections are based.

Specifically, Applicant's invention shown in U.S. Pat. No. 7,076,168, filed October 31, 2000 from a provisional application 60/163,141 filed November 2, 1999 discloses each of the components cited in Natarajan and relied upon by the Examiner to reject claims 20-22, 25-27, and 57. For example, Figure 3 in Natarajan showing such components was first illustrated in Figure 3F of 7,076,168. The Applicant contributed this figure and its associated descriptions to the Natarajan reference, of which Applicant is a co-author.



Steve J Shattil

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 11/27/2006

Steven J. Shattil
15 S. 33rd Street
Boulder, CO 80305

EXAMINER	
ABELSON, RONALD B	

ART UNIT	PAPER NUMBER
2616	

DATE MAILED: 11/27/2006

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

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/145,854	SHATTIL, STEVE J.	
	Examiner	Art Unit	
	Ronald Abelson	2616	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 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 *27 September 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) *1-46 and 57* is/are pending in the application.

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

5)☒ Claim(s) *1-19 and 28-46* is/are allowed.

6)☒ Claim(s) *20-22,25-27 and 57* is/are rejected.

7)☒ Claim(s) *23 and 24* 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 *5/14/2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

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

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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

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

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

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

Attachment(s)

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

Samsung Exhibit 1023, Page 182 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Claim Rejections - 35 USC § 102

1. 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 -
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 20, 25-27, and 57 rejected under 35 U.S.C. 102(a) as being anticipated by Natarajan (High Performance MC-CDMA Via Carrier Interferometry Codes).

Regarding claim 57, Natarajan teaches at least one central processing unit coupled to the transceivers (fig. 3, Section III pg. 1346-1347), the at least one central processing unit adapted to receive signals received by each of the transceivers (fig. 3: see received signal r(t)), decompose each transceiver's received signals into a plurality of CI components (fig. 3, see components r_i), and combine the CI components (fig. 3: Combiner).

Regarding claim 20, Natarajan teaches at least one CI coder coupled to each transceiver, the at least one CI coder adapted to provide at least one CI-coded information signal for

transmission in at least one frequency band (fig. 1, Section II pg. 1345-1346); at least one CI decoder coupled to each transceiver, the at least one CI decoder adapted to decode at least one received transmitted waveform (fig. 3, Section III pg. 1346-1347).

Regarding claim 26, Natarajan teaches an RF front end adapted to perform at least one transceiving function in at least one frequency band, the at least one transceiving function including receiving at least one transmitted signal and transmitting at least one signal (MC-CDMA, mobile wireless, abstract).

Natarajan teaches a CI decoder coupled to the RF front end, the CI decoder adapted to decode at least one received transmitted signal (fig. 3, Section III pg. 1346-1347).

Natarajan teaches a CI coder coupled to the RF front end, the CI coder adapted to provide CI coding to at least one information signal for transmission, the CI coder providing unique CI coding with respect to CI codes of the at least one received signal to enable simultaneous transmission and reception of CI coded information (fig. 1, Section II pg. 1345-1346).

Regarding claims 25 and 27, Natarajan teaches each transceiver further comprises at least one antenna including an RF front end adapted to receive and transmit signals (MC-CDMA, mobile wireless, abstract).

Claim Rejections - 35 USC § 103

3. 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 negatived by the manner in which the invention was made.

4. Claim 21 rejected under 35 U.S.C. 103(a) as being unpatentable over Natarajan as applied to claim 20 above, and further in view of Guo (US 6,389,034).

Regarding claim 21, although Natarajan teaches a coder and decoder, the reference is silent on the at least one coder and the at least one decoder corresponding to at least one of the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

Guo, like Natarajan teaches a MC-CDMA (col. 3 lines 7-10). Furthermore, Guo teaches the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform (full duplex, col. 3 lines 55-60).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Natarajan by modifying the transceivers to transmit in full duplex. This modification can be performed by organizing the reverse link and forward link channels in pairs (Natarajan: col. 3 lines 55-60). This modification would benefit the system by allowing for the simultaneous transmission and reception of data.

5. Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Natarajan as applied to claim 20 above, and further in view of Sautter (US 6,233,248).

Natarajan is silent on at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one address and the decoder is adapted to route the signal with respect to the at least one address.

Sautter teaches multi-address capability (col. 2 lines 33-43).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Natarajan by transmitting destination addresses according to the teachings of Sautter. This modification can be performed in software. This modification would benefit the system by allowing for multi-addressed messaging.

Response to Arguments

6. Applicant's arguments with respect to claims 20-22, 25-27, and 57 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ronald Abelson whose telephone number is (571) 272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chi Pham can be reached on (571) 272-3179. 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.

Ronald Abelson
Examiner
Art Unit 2616

***

Notice of References Cited	Application/Control No. 10/145,854	Applicant(s)/Patent Under Reexamination SHATTIL, STEVE J.	
	Examiner Ronald Abelson	Art Unit 2616	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,389,034 B1	05-2002	Guo et al.	370/441
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
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	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Balasubramaniam Natarajan, High-Performance MC-CDMA Via Carrier Interferometry Codes, November 2001, IEEE Transactions on Vehicular Technology, pg. 1344-1353
	V	David Wiegandt, Overcoming Peak-To-Average Power Ratio Issues in OFDM Via Carrier Interferometry Codes, 2001, IEEE, pg. 660-663
	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.

Samsung Exhibit 1023, Page 189 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899



In The United States Patent and Trademark Office

Mailed September 25, 2006

Commissioner of Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Appn. Number: 10/145,854
Filing Date: 05/14/2002
Examiner: Ronald Abelson
G.A.U.: 2616
Atty. Docket No. CINET 01

Sir:

In response to the Office Letter mailed on 04/27/2006, please file the following enclosed amendment.

Samsung Exhibit 1023, Page 190 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Amendments to the Claims

1. (Currently Amended) In a method for communicating by multiple subscribers without a base station, each of the multiple subscribers adapted to transmit CI-coded communication information in at least one ~~unlicensed~~ frequency band, the improvement comprising the additional steps of:

providing for simultaneously transmitting control information with the communication information in at least one ~~unlicensed~~ frequency band from an initiating subscriber for selectively controlling communications between the multiple subscribers; and,

providing for modulating the control information by at least one other CI code.

2. (Original) The method of claim 1 wherein the control information is adapted to permit controlling the multiple-access system by initiating one or more of the subscribers as a network control station.
3. (Original) The method of claim 2 wherein the control information is adapted to permit transferring the power control and the time synchronization of the multiple-access system from any one of the subscribers acting as the network control station to any other of the subscribers becoming the network control station.
4. (Original) The method of claim 2 wherein communication by multiple subscribers includes one or more protocols requiring one of the multiple subscribers to initiate communications and become the network control station in a transmit mode for transmitting the communication information and the control information to all other the multiple subscribers being in a receive mode for simultaneously receiving the communication information through an information channel and the control information through a control channel.
5. (Original) The method of claim 4 further including the step of providing for the network control station to command another of the multiple subscribers to change at least one CI code for the control information.

Samsung Exhibit 1023, Page 191 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

6. (Original) The method of claim 3 wherein the control information is adapted to include power-control information for providing a predetermined power setting for each of the multiple subscribers.
7. (Original) The method of claim 5 wherein the network control station is adapted to poll each of the other multiple subscribers, receive an acknowledgement back to measure the power received from each of the multiple subscribers, and adjust the power levels for transmission in predetermined increments.
8. (Currently Amended) A method for providing communications for a network of transceivers in a CI-based multiple-access system operating without a base station, comprising:

providing for transmitting control information coded by at least a first CI code through a control channel simultaneously with communications information coded by at least a second CI code through a communications channel in at least one ~~unlicensed~~ frequency band;

providing for identifying the network and at least one of the transceivers using the control information coded with the at least one CI code and restricting communications between the transceivers of the network using the second CI code;

providing for performing transmit/receive operations of the communications information and the control information by each of the transceivers in a predetermined duplexing operation;

providing for controlling the network initially by one of the transceivers, acting as a network control station; and,

providing for transferring control by one of the transceivers as the network control station to another of the transceivers to become the network control station for continuing the power control and the time synchronization over the network.
9. (Original) The method of claim 8 wherein the step of providing for performing transmit/receive operations of the communications information through the communications channel and the control information through the control channel is performed relative to a duplexing operation of a set of duplexing operations including TDD, FDD, CDD, PDD, CI-PDD, CPD, OPDD, QPDD, and CTDD.

Samsung Exhibit 1023, Page 192 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

10. (Original) The method of claim 8 wherein the step of initiating control over the network further includes the step of providing for the network control station to command another of the transceivers to change the CI code for the control information.

11. (Original) The method of claim 8 wherein the control information includes power control information for allowing the network control station to set a predetermined power setting for each of the transceivers to assure that those of the transceivers transmitting close to the network control station do not overwhelm any other of the transceivers transmitting far away from the network control station.

12. (Original) The method of claim 8 wherein the network control station is adapted to poll each of the other the transceivers and receive an acknowledgement back to measure the power received from each of the transceivers and adjust the power levels for transmission in predetermined increments.

13. (Original) The method of claim 8 further comprising a step of providing for conversational-mode communications with the transceivers having receivers with CI decoders in parallel for permitting the network control station to simultaneously receive transmissions from more than one of the transceivers and respond to each of the more than one of the transceivers with individual transmissions.

14. (Original) The method of claim 8 further comprising a step of providing for simultaneous transmission of voice and data by assigning different CI codes for voice and data on the communications channel and providing the transceivers with receivers having at least three decoders for discriminating voice communications, data communications, and control channel communications.

15. (Currently Amended) A method for providing personal communications for a network of transceivers in a multiple-access system operating without a base station by means of simultaneously transmitting communications information through a communications channel with control information through a control channel between at least two transceivers, the method comprising the steps of:

providing for coding the transmission of each of the communication information through the communications channel and control information through the control channel with different CI codes to enable restricting communications

Samsung Exhibit 1023, Page 193 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

between at least two of the transceivers, each of the different CI codes being capable of identifying the network and at least one of the transceivers;

providing for performing transmit and receive operations by each of the transceivers in a time division duplex manner with discrete time slots within at least one ~~unlicensed~~ frequency band;

providing for controlling the network by one of the transceivers, acting as a network control station for setting the network control station in a transmit mode and all other of the transceivers in a receive mode in at least a first of the discrete time slots;

providing for operating in a transmit mode by the network control station and operating in a receive mode by all other of the transceivers in at least a second of the discrete time slots for transmitting the communications information through the communications channel and control channel;

providing for responding by at least one of the transceivers to the communications information and control information transmitted by the network control station; and,

providing for responding by the network control station with the control channel for indicating the type of communication mode for further communications between the network control station and the at least one of the transceivers.

16. (Original) The method of claim 15 wherein the step of providing for responding by the network control station includes informing the at least one of the transceivers to transmit and all other of the transceivers to receive.

17. (Original) The method of claim 15 wherein the step of providing for responding to the at least one of the transceivers by the network control station includes informing the one of the transceivers to transmit so as to restrict communications between the network control station and the one of the transceivers.

18. (Original) The method of claim 15 wherein a collision of transmissions caused by a plurality of transceivers attempting to transmit in the same time slot is resolved by the plurality of transceivers retrying transmissions and one of the plurality of transceivers transmitting in an earlier time slot than the other of the plurality of transceivers.

Samsung Exhibit 1023, Page 194 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

19. (Original) The method of claim 15 wherein the step of providing for responding by the network control station includes all other the transceivers acknowledging the control channel.

20. (Currently Amended) A communications system including a plurality of transceivers, each of the transceivers including:

at least one CI coder coupled to each transceiver, the at least one CI coder adapted to provide at least one CI-coded information signal for transmission in at least one ~~unlicensed~~ frequency band;

at least one CI decoder coupled to each transceiver, the at least one CI decoder adapted to decode at least one received transmitted waveform.

21. (Original) The communication system recited in claim 20 wherein the at least one coder and the at least one decoder corresponding to at least one of the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

22. (Original) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one address and the decoder is adapted to route the signal with respect to the at least one address.

23. (Original) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one tag waveform indicative of the coding provided to the at least one transmitted waveform.

24. (Original) The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one tag waveform for identifying the type of data contained in the transmitted waveform and further includes decoding information necessary to decode information in the transmitted waveform.

25. (Original) The communication system recited in claim 20 wherein each transceiver further comprises at least one antenna including an RF front end adapted to receive and transmit signals.

Samsung Exhibit 1023, Page 195 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

26. (Currently Amended) A transceiver adapted to receive a first CI-coded transmitted signal and transmit simultaneously another CI-coded signal, the transceiver including:

an RF front end adapted to perform at least one transceiving function in at least one ~~unlicensed~~ frequency band, the at least one transceiving function including receiving at least one transmitted signal and transmitting at least one signal,

a CI decoder coupled to the RF front end, the CI decoder adapted to decode at least one received transmitted signal,

a CI coder coupled to the RF front end, the CI coder adapted to provide CI coding to at least one information signal for transmission, the CI coder providing unique CI coding with respect to CI codes of the at least one received signal to enable simultaneous transmission and reception of CI coded information.

27. (Original) The transceiver recited in claim 26 wherein the RF front end includes at least one antenna for receiving and transmitting signals.

28. (Original) The transceiver recited in claim 26 wherein the CI decoder includes a preamble detector adapted to detect a preamble.

29. (Original) The transceiver recited in claim 26 wherein the CI coder includes a preamble generator adapted to generate at least one preamble.

30. (Currently Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, an improved method of communicating in the network using multi-address messaging including:

providing for constructing at a source node a multi-address message containing coded information whereby ~~the~~ codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and

providing for transmitting the multi-address message in at least one ~~unlicensed~~ frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message

Samsung Exhibit 1023, Page 196 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

along the common path from each common intervening node to a next common intervening node.

31. (Original) The method of claim 30, wherein providing for constructing further includes:

for at least one network address, providing for insertion in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and

for each extended address in the network header, providing for inclusion in the extended address the basic network address of the destination node corresponding to the network address and information for forwarding the multi-address message to the another network.

32. (Original) The method of claim 30, further comprising:

providing for receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and

providing for routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

33. (Original) The method of claim 30, wherein providing for constructing further includes:

for each network address in the network header, providing for insertion in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

34. (Original) The method of claim 30, wherein providing for constructing further includes, for each network address in the network header:

providing for insertion in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

Samsung Exhibit 1023, Page 197 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

35. (Original) The method of claim 30, wherein the multi-address message comprises a sequence of message frames each containing a network header, wherein the constructing step further includes:

providing for insertion of a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence; and

providing for insertion of an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

36. (Original) The method of claim 30, wherein the constructing step includes providing for insertion of the network address of the source node in a network header.

37. (Original) The method of claim 30, wherein constructing step further includes:

providing for insertion in the network header a precedence field indicating a relative precedence of the multi-address message, and

providing for restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

38. (Original) The method of claim 30, wherein the constructing step further includes:

providing for inserting in a network header a security field indicating a relative security level of the multi-address message, and

Samsung Exhibit 1023, Page 198 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

providing for restricting message traffic at a node as a function of the security level identified in the network header of each message.

39. (Original) The method of claim 30, further comprising:

providing for acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node,

providing for retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

providing for repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

40. (Original) The method of claim 30, wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

41. (Original) The method of claim 30, initiates a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

42. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in a point-to-point mode.

43. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in a broadcast mode.

44. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message over a waveguide.

45. (Original) The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in at least one transmission mode including a full-duplex communication mode and a half-duplex communication mode.

46. (Currently Amended) In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are

Samsung Exhibit 1023, Page 199 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

routed through other nodes in the network, an improved method of communicating in the network including:

providing for constructing at a source node at least one multi-address message containing coded information employing codes that ~~whereby the codes~~ identify at least one communication path between the source node and at least one destination node, and

providing for transmission of the at least one multi-address message in at least one ~~unlicensed~~ frequency band.

47. (Withdrawn) A transceiver adapted to route communication signals in a network, the transceiver including:

a first decoder system adapted to decode at least one received signal addressed to the transceiver,

a second decoder system adapted to decode at least one received signal addressed to at least one other transceiver,

a coding system adapted to encode the at least one received signal addressed to the at least one other transceiver to generate at least one coded signal, and

a transmission system coupled to the coding system, the transmission system adapted to transmit the at least one coded signal in at least one unlicensed frequency band.

48. (Withdrawn) The transceiver recited in claim 47 further including a signal processor coupled between the coding system and the transmission system, the signal processor adapted to perform at least one signal-processing operation to the at least one coded signal.

49. (Withdrawn) In a communication network, a transceiver adapted to route communication signals in the network, the transceiver including:

a receiver adapted to receive at least one transmitted signal in at least one unlicensed frequency band and duplicate at least one received signal to generate a first received signal and a second received signal,

a decoder system coupled to the receiver, the decoder system adapted to receive the first received signal and provide decoding of at least one signal addressed to the transceiver, and

Samsung Exhibit 1023, Page 200 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

a transmitter coupled to the receiver, the transmitter adapted to process the second received signal for transmission in at least one unlicensed frequency band.

50. (Withdrawn) The transceiver recited in claim 49 further including a signal processor coupled between the receiver and the transmitter, the signal processor adapted to process the second received signal.

51. (Withdrawn) In a communication network, a transceiver adapted to route communication signals in the network, the transceiver including:

a decoder system adapted to provide decoding to at least one received signal to produce at least one decoded signal,

a signal processor coupled to the decoder, the signal processor adapted to extract and process information addressed to the transceiver, and

a transmitter coupled to the decoder system, the transmitter adapted to process the at least one decoded signal for transmission in at least one unlicensed frequency band.

52. (Withdrawn) The transceiver recited in claim 51 further including a second signal processor coupled between the decoder system and the transmitter, the second signal processor adapted to process the at least one decoded signal prior to transmission.

53. (Withdrawn) In a communication network, a plurality of network transceivers adapted to route communication signals in the network, the network including:

at least one central processing unit coupled to the transceivers and adapted to perform channel estimation from signals received by the transceivers and generate array-processing weights for transmission and reception of signals by the transceivers.

54. (Withdrawn) The communication network recited in claim 53 wherein the at least one central processing unit is adapted to weight and combine signals received from the transceivers.

55. (Withdrawn) The communication network recited in claim 53 wherein the at least one central processing unit is adapted to weight signals conveyed to the transceivers for transmission.

Samsung Exhibit 1023, Page 201 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

56. (Withdrawn) The communication network recited in claim 53 wherein the at least one central processing unit is adapted to convey one or more array-processing weights to each of the transceivers.

57. (Original) In a communication network of a plurality of network transceivers adapted to route communication signals in the network, the network including:

at least one central processing unit coupled to the transceivers, the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of CI components, and combine the CI components.

Samsung Exhibit 1023, Page 202 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

General Remarks

Claims 1-57 are pending in the application. Claims 47-56 were withdrawn from consideration. Claims 1-19 and 26-29 were allowed. Claims 20-22, 25, 30, 35-46, and 57 were rejected. Claims 23, 24, and 31-34 were objected to.

In a telephone conversation with the Examiner on April 25, 2006, the Applicant made a provisional election to prosecute the invention of Group I, claims 1-46 and 57.

Samsung Exhibit 1023, Page 203 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

Remarks: Examination Report

1. Claim 57 was rejected under 35 U.S.C. 102(a) as being anticipated by Shattil (US 20020034191).
2. Claims 20 and 25 were rejected under 35 U.S.C. 103(a) in view of Shattil and Brockman (US 20030133469).
3. Claim 21 was rejected under 35 U.S.C. 103(a) in view of Shattil, Brockman, and Ramachandran (US 6,674,999).
4. Claim 22 was rejected under 35 U.S.C. 103(a) in view of Shattil, Brockman, and Sautter (US 6,233,248).

5. Relied-Upon Reference Shattil (US 20020034191) Should be Disqualified as Prior Art

In particular, the basis for rejection citing 35 U.S.C. 102(a) states that a person shall be entitled to a patent unless the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention by the applicant for patent.

The basis for rejection citing 35 U.S.C. 103(a) states that a patent may not be obtained 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 of invention to a person having ordinary skill in the art to which the subject matter pertains.

6. The cited reference US 20020034191 was derived from the inventor of this application

The cited reference US 20020034191 was derived from the inventor of this application and is thus not the invention "by another."

Samsung Exhibit 1023, Page 204 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

7. ***Relied-Upon Reference Shattil (US 20020034191) Should be Disqualified as Prior Art under 35 U.S.C. 102(a) and 103(a)***

The burden of establishing that subject matter is disqualified as prior art is placed on applicant once the examiner has established a *prima facie* case of obviousness based on the subject matter.

8. MPEP 706.02(l)(2) Establishing Common Ownership

In order to be disqualified as prior art under 35 U.S.C. 103, the subject matter which would other-wise be prior art to the claimed invention and the claimed invention must be commonly owned at the time the claimed invention was made. See MPEP § 706.02(l) for 35 U.S.C. 102(f)/103 or 35 U.S.C. 102(g)/103 prior art disqualified under 35 U.S.C. 103(c). See MPEP § 706.02(l)(1) for 35 U.S.C. 102(e)/103 prior art disqualified under 35 U.S.C. 103(c).

9. MPEP 706.02(l)(2) Establishing Common Ownership

Section II

The following statement is sufficient evidence to establish common ownership of, or an obligation for assignment to, the same person(s) or organizations(s):

Applications and references (whether patents, patent applications, patent application publications, etc.) will be considered by the examiner to be owned by, or subject to an obligation of assignment to the same person, at the time the invention was made, if the applicant(s) or an attorney or agent of record makes a statement to the effect that the application and the reference were, at the time the invention was made, owned by, or subject to an obligation of assignment to, the same person.

See "Guidelines Setting Forth a Modified Policy Concerning the Evidence of Common Ownership, or an Obligation of Assignment to the Same Person, as Required by 35 U.S.C. 103(c)," 1241 O.G. 96 (December 26, 2000). The applicant(s) or the representative(s) of record have the best knowledge of the ownership of their application(s) and reference(s), and their statement of such is sufficient evidence because of their paramount obligation of candor and good faith to the USPTO.

Samsung Exhibit 1023, Page 205 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

The statement concerning common ownership should be clear and conspicuous (e.g., on a separate piece of paper or in a separately labeled section) in order to ensure that the examiner quickly notices the statement.

For example, an attorney or agent of record receives an Office action for Application X in which all the claims are rejected under **35 U.S.C. 103(a)** using Patent A in view of Patent B wherein Patent A is only available as prior art under 35 U.S.C. 102(e), (f), and/or (g). In her response to the Office action, the attorney or agent of record for Application X states, in a clear and conspicuous manner, that:

> "Application X and Patent A were, at the time the invention of Application X was made, owned by Company Z."

This statement alone is sufficient evidence to disqualify Patent A from being used in a rejection under **35 U.S.C. 103(a)** against the claims of Application X.

10. **Application 10/145,854** ***and US*** 20020034191 ***were, at the time the invention of application 10/145,854 was made, owned by a common entity***

Application 10/145,854 and US 20020034191 were, at the time the invention of Application 10/145,854 was made, subject to an obligation of assignment to and owned by GenghisComm LLC.

11. Claims 30, 35, 37-40, 42, 43, 45, and 46 were rejected under 35 U.S.C. 103(a) in view of the combination of Sautter and Brockman.

12. The combination of Sautter and Brockman fails to show coded information (e.g., a coded data payload) whereby codes used to encode the information provide for addressing the message.

Specifically, Sautter describes a user protocol consisting of layers 4, 3, and 2 of the seven layer OSI/ISO model (col. 4, lines 58-59), whereas the coding employed in the "coded

Samsung Exhibit 1023, Page 206 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

information" recited in the claimed invention resembles multiple-access coding, and is a layer 1 (i.e., physical layer) user protocol.

Furthermore, the multi-address message described in Sautter contains a network header that separately identifies network addresses of a plurality of destination nodes (col. 5, lines 18-54, and claim 1). Sautter does not show codes applied to the information (i.e., the data payload) that provide for addressing.

13. Claims 23, 24, and 31-34 were objected to as being dependent on 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.
14. If Applicant's arguments with respect to the independent claims 20 and 30 are considered by the USPTO to be persuasive, then claims 23, 24, and 31-34 should be found allowable.

Samsung Exhibit 1023, Page 207 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

15. Conclusion

The Prior Art of Record has been reviewed and is considered by the Applicant to be inconsequential with respect to the claimed invention. The Applicant submits that every effort has been made to address the Examiner's objections and that the Application is now in condition to proceed to grant.

Yours Respectfully,



Steve J. Shattil
15 S. 33rd St
Boulder, CO 80305
(720) 234-4351

Samsung Exhibit 1023, Page 208 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/145,854	05/14/2002	Steve J. Shattil	CINET 01	6398

7590 04/27/2006

Steven J. Shattil
15 S. 33rd Street
Boulder, CO 80305

EXAMINER	
ABELSON, RONALD B	
ART UNIT	PAPER NUMBER
2616	

DATE MAILED: 04/27/2006

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

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/145,854	SHATTIL, STEVE J.	
	Examiner	Art Unit	
	Ronald Abelson	2616	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 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 *14 May 2002*.

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) *1-57* is/are pending in the application.

4a) Of the above claim(s) *47-56* is/are withdrawn from consideration.

5)☒ Claim(s) *1-19 and 26-29* is/are allowed.

6)☒ Claim(s) *20-22,25,30,35-46 and 57* is/are rejected.

7)☒ Claim(s) *23,24 and 31-34* 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 *14 May 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

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

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

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

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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

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

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

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

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1. Election/Restriction

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

I. Claims 1-46 and 57, drawn to a method of providing a network for transmission of coded information using multiple access techniques, class 370 subclass 335.

II. Claims 47-56, drawn to the details of a transceiver class 455, subclass 73.

3. The inventions are distinct, each from the other because: invention I pertains to providing a network for transmission of coded information using multiple access techniques while invention II is the details of a transceiver.

4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

5. Because these inventions are distinct for the reasons given above and the search required for Group I is not required for

Group II, restriction for examination purposes as indicated is proper.

6. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

7. During a telephone conversation with Mr. Steve Shattil on April 25, 2006, a provisional election was made without traverse to prosecute the invention of Group I, claims 1-46 and 57. Affirmation of this election must be made by applicant in replying to this Office action. Claims 47-56 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

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

Claim Rejections - 35 USC § 102

9. 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 -
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

10. Claim 57 is rejected under 35 U.S.C. 102(a) as being anticipated by Shattil (US 20020034191).

Shattil teaches at least one central processing unit (fig. 67A) coupled to the transceivers (fig. 67A boxes 405a - 405N-1: note units receive a signal and transmit a signal to box 415), the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of CI components, and combine the CI components (CI-CDMA signal, [0640-0642]).

Claim Rejections - 35 USC § 103

11. 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 negatived by the manner in which the invention was made.

12. Claims 20 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shattil (US 20020034191) in view of Brockmann (20030133469).

Regarding claim 20, Shattil teaches a communications system including a plurality of transceivers (figs. 63A, 63B, 63C, [0625-0629]), each of the transceivers (63A-E box 504: note transmitter shown) including: at least one Cl coder (fig. 63A-C, box 502, [0627]) coupled to each transceiver, the at least one Cl coder adapted to provide at least one Cl-coded information signal (fig. 63A-E, box 503) for transmission in at least one frequency band.

Shattil teaches at least one Cl decoder coupled to each transceiver, the at least one Cl decoder adapted to decode at least one received transmitted waveform (fig.72 box 2402, [0661]).

Shattil is silent on transmission in at least one unlicensed frequency band.

Brockmann teaches transmitting over an unlicensed frequency band (802.11, [0003]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Shattil by transmitting in the 802.11 frequency band. This modification can be performed by modifying the transmitter to transmit in this frequency band. This modification would benefit the system since given the frequency band is unlicensed, any provider can operate in this band.

Regarding claim 25, each transceiver further comprises at least one antenna including an R.F front end adapted to receive and transmit signals (fig. 63A-E box 504, fig. 72 box 2, fig. 67A: antenna is to the left of Chip receivers).

13. Claim 21 rejected under 35 U.S.C. 103(a) as being

unpatentable over the combination of Shattil and Brockmann as applied to claim 20 above, and further in view of Ramachandran (US 6,674,999).

Although it is well known that carrier interferometry may be adapted to multicarrier protocols such as OFDM and CDMA (applicant: g. 4 lines 6-7), the combination is silent on the at least one coder and the at least one decoder corresponding to at least one of the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

Ramachandran teaches a system wherein at least one coder and the at least one decoder corresponding to at least one of the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform (full duplex systems like IS-95, CDMA, WCDMA).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination of Shattil and Brockmann by adapting the transceivers to transmit and receive in the full duplex mode. This modification can be performed by transmitting and receiving on different frequencies. This modification would benefit the system by

allowing for data to be transmitted and received simultaneously.

14. Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shattil and Brockmann as applied to claim 20 above, and further in view of Sautter (US 6,233,248).

The combination is silent on at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one address and the decoder is adapted to route the signal with respect to the at least one address.

Sautter teaches multi-address capability (col. 2 lines 33-43).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination by transmitting destination addresses according to the teachings of Sautter. This modification can be performed in software. This modification would benefit the system by allowing for multi-addressed messaging.

15. Claims 30, 35, 37-40, 42, 43, 45 and 46 rejected under 35 U.S.C. 103(a) as being unpatentable over Sautter (US 6,233,248) in view of Brockmann.

Regarding claims 30 and 46, Sautter teaches providing for constructing at a source node a multi-address message containing coded information / destination addresses whereby the codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and providing for transmitting the multi-address message from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next common intervening node (multi-addressed messages inserted once at the source node, messages routed between nodes going to same next node, col. 2 lines 33-43).

Sautter is silent on transmitting in at least one unlicensed frequency band.

Brockmann teaches transmitting over an unlicensed frequency band (802.11, [0003]).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of Sautter by transmitting in the 802.11 frequency band. This modification can be performed by modifying the transmitter to transmit in this frequency band. This modification would benefit the system since given the frequency band is unlicensed, any provider can operate in this band.

Regarding claim 35, Sautter teaches providing for insertion of a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence (col. 42 lines 20-22) and providing for insertion of an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message (col. 42 lines 23-25).

Regarding claim 37, Sautter teaches providing for insertion in the network header a precedence field indicating a relative precedence of the multi-address message (col. 29 lines 7-11), and providing for restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative

precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node (col. 32 lines 49-53).

Regarding claim 38, Sautter teaches providing for inserting in a network header a security field indicating a relative security level of the multi-address message (col. 29 lines 7-11), and providing for restricting message traffic at a node as a function of the security level identified in the network header of each message (col. 42 lines 48-50).

Regarding claim 39, Sautter teaches providing for acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node (col. 42 lines 53-55).

Sautter teaches providing for retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message (col. 42 lines 56-60).

Sautter teaches providing for repeating the retransmitting step until either an acknowledgement message is received from

the destination node or a predetermined maximum number of retransmissions have been attempted (col. 42 lines 61-64).

Regarding claim 40, Sautter teaches wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message (col. 42 lines 65-67).

Regarding claim 42, Sautter teaches providing for transmitting the multi-address message in a point-to-point mode (col. 43 lines 5-7).

Regarding claim 43, Sautter teaches providing for transmitting the multi-address message in a broadcast mode (col. 43 lines 8-10).

Regarding claim 45, Sautter teaches providing for transmitting the multi-address message in at least a full-duplex and half-duplex communication mode (col. 2 lines 33-43).

16. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Brockmann as applied to claim 30 above, and further in view of Newton.

The combination is silent on waveguides.

Newton teaches waveguides (pg. 837-838).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination of Sautter and Brockmann by transmitting waveguides. This modification can be performed by adhering standards for the communication system used. This modification would benefit the system since waveguides permit transmission in one or more modes (Newton).

17. Claim 36 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Brockmann as applied to claim 30 above, and further in view of Huang (US 4,700,341).

The combination is silent on insertion of a network address of the source node in a network header.

Huang teaches insertion of a network address of the source node in a network header (col. 1 lines 58-62).

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination of Sautter and Brockmann by inserting the source address in the packet header. This modification can be performed in software. This modification would benefit the system by allowing the

intermediate and destination nodes to know where the packet originated from.

18. Claim 41 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sautter and Brockmann as applied to claim 30 above, and further in view of Paatela (US 6,944,168).

Although the combination teaches multi-address messaging, the combination is silent on initiating a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

Paatela teaches initiating a re-routing process responsive to failure of a message to reach its destination node.

Therefore it would have been obvious to one of ordinary skill in the art, to modify the system of the combination of Sautter and Brockmann by incorporating the rerouting algorithm of Paatela. This modification can be performed in software. This modification would benefit the system by increasing the probability that a packet will reach its intended destination.

Allowable Subject Matter

19. Claims 1-19 and 26-29 allowed.

20. Claims 23,24 and 31-34 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.

Prior Art of Record

21. Liu (5,943,332) teaches transmitting control information from an initiating subscriber for selectively controlling communications between the multiple subscribers (fig. 3 box 309, CDMA radio broadcasts SID/NID signal, col. 7 lines 3-6).

Shattil providing for modulating the ***communication*** information by at least one other C1 code ([0019]).

Conclusion

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ronald

Abelson whose telephone number is (571) 272-3165. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chi Pham can be reached on (571) 272-3179. 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).

Ronald Abelson
Examiner
Art Unit 2616

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CHI PHAM
SUPERVISORY PATENT EXAM
4/26/05

Notice of References Cited	Application/Control No. 10/145,854	Applicant(s)/Patent Under Reexamination SHATTIL, STEVE J.	
	Examiner Ronald Abelson	Art Unit 2616	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,233,248 B1	05-2001	Sautter et al.	370/465
*	B	US-6,944,168	09-2005	Paatela et al.	370/401
*	C	US-2003/0133469 A1	07-2003	Brockmann et al.	370/445
*	D	US-6,674,999 B2	01-2004	Ramachandran, Balasubramanian	455/522
*	E	US-2002/0034191	03-2002	Shattil, Steve J.	370/464
*	F	US-5,943,332	08-1999	Liu et al.	370/342
*	G	US-4,700,341	10-1987	Huang, Zheng F.	370/471
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Newton, Newton's Telecom Dictionary, Oct. 1998, Telecom Books, pg. 836-837.
	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.

Patent Application

of

Steve Shattil

for

CARRIER INTERFEROMETRY NETWORKS

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates to networks of wireless transceivers that implement Carrier Interferometry (CI) and/or CI-based coding.

II. Description of the Related Art

A wideband signal, such as a direct-sequence CDMA (DS-CDMA) signal, transmitted in a multipath environment experiences a frequency-selective fade. If the duration of the data bits is smaller than the multipath delay, the received signal experiences inter-symbol interference resulting from delayed replicas of earlier bits arriving at the receiver.

Improved DS-CDMA systems use interference cancellation to increase capacity; however, the required signal-processing effort is proportional to at least the cube of the bandwidth. Furthermore, DS-CDMA is susceptible to near-far interference, and its long

pseudo-noise (PN) codes require long acquisition times. For these reasons, Orthogonal Frequency Division Multiplexing (OFDM) has been merged with DS-CDMA.

In multicarrier CDMA (MC-CDMA), a spreading sequence is converted from serial to parallel. Each chip in the sequence modulates a different carrier frequency. Thus, the resulting signal has a PN-coded structure in the frequency domain, and the processing gain is equal to the number of carriers.

In multi-tone CDMA, or multicarrier DS-CDMA, the available spectrum is divided into a number of equal-width frequency bands used to transmit a narrowband direct-sequence waveform. In U.S. Pat. No. 5,504,775, binary CDMA code symbols are applied to individual carriers in an OFDM system. U.S. Pat. Nos. 5,521,937, 5,960,032, and 6,097,712 describe multicarrier DSSS systems having direct-sequence coding on each subcarrier.

U.S. Pat. No. 5,955,992, PCT Pat. Appl. No. PCT/US99/02838, and U.S. Pat. Pub. No. 2002034191 describe CI, which is a multicarrier protocol implemented with polyphase codes. These polyphase codes may be used for multiple access, spread spectrum, channel coding, or encryption, as described in U.S. Provisional Appl. 60/259,433, filed 12/31/2000. Multiple carriers are redundantly modulated with data streams that are orthogonalized by virtue of different sets of phases encoding each data stream. Interferometry of the carriers provides the means to orthogonalize the data streams, whether the carriers are combined or processed separately. Weights applied to the carriers shape the carrier superpositions, thus, allowing CI signals to appear as single-carrier waveforms, such as Time Division Multiple Access (TDMA) or DS-CDMA signals.

Adaptive antenna arrays may be implemented with DS-CDMA communications to provide significant improvements in range extension, interference reduction, and system capacity. To identify a particular user, a DS-CDMA system demodulates Walsh codes after converting the received signal from analog radio frequency (RF) to digital. Therefore, an adaptive antenna array requires information about the user codes, or it needs to demodulate many different incoming RF signals to track mobile users. These methods are complex processes that are more difficult to implement than tracking users in non-CDMA systems. Furthermore, the wideband nature of DS-CDMA signals restricts

the effectiveness of beam forming, interference nulling, spatial interferometry multiplexing, and other techniques employed by adaptive antenna arrays.

U.S. Patent Application entitled "CI Multiple Input, Multiple Output," filed on 11/22/2000, describes applications of multiple-input, multiple-output processing (such as antenna-array processing) to CI signals. CI processing allows wideband single-carrier signals, such as DS-CDMA transmissions, to be processed as a plurality of narrowband components. This simplifies array processing by facilitating beam forming, null steering, space-frequency processing, as well as other adaptive array processing techniques.

U.S. Pat. No. 4,901,307 introduces the concept of marginal isolation, which is another method of exploiting spatial division multiplexing in communication networks. Since cellular implementations of DS-CDMA are typically interference limited, even small reductions in the overall power level of the system allow for increased system capacity.

Ad-hoc networks allow subscriber units to perform base station functions. This allows micro-cell subnetworks, which lowers overall system power levels and improves spectral efficiency. U.S. Pat. No. 5,943,322 describes an adaptable DS-CDMA network that uses a control-signal channel to assign base-station functions (e.g., power control and synchronization) to a subscriber unit. U.S Pat. No. 6,233,248 provides for multi-address transmissions to be sent on common paths between nodes until the paths diverge. U.S. Pat. No. 5,422,952 allows signals for a particular user to be transmitted throughout the entire network. Different transmissions are provided with unique PN codes.

None of the prior-art references describe the use of CI, CI-based protocols, or CI coding in ad-hoc networks. Thus, none of the prior-art references can provide the improved bandwidth efficiency, enhanced power efficiency, increased range, increased throughput, and superior immunity to multipath, jamming, and co-channel interference enabled by the combination of CI and adaptable networks.

SUMMARY OF THE INVENTION

Applications of CI to ad-hoc networking provide substantial performance improvements that can be used for any combination of range extension, transmission-power reduction, increased throughput, and improved bit-error rates. Performance

improvements resulting from frequency-domain processing are particularly useful in ad-hoc networks (as well as in micro-cell networks and networks that employ relays) where interference and multipath typically impede performance. CI pulse shaping also increases throughput (typically characterized as a doubling of throughput), which can be used to increase the number of users, generate higher data rates, and/or provide channel coding.

Adaptations of CI to conventional multicarrier protocols (such as OFDM and MC-CDMA) eliminate the high peak-to-average-power ratios (PAPR) associated with conventional multicarrier protocols. Low PAPR allows low-dynamic-range amplifiers to be used, resulting in substantial cost and power savings.

Conventional codes, such as multiple-access codes, channel codes, spreading codes, etc., may be implemented with CI chip shapes. Alternatively, polyphase codes based on mathematical relationships between CI sub-carriers may be provided.

Applications of CI coding are extended to identifying and addressing network transmissions. CI transceivers are adapted to perform network-control functions. CI coding facilitates routing in ad-hoc and peer-to-peer networks. Networks are adapted to perform array processing with signals received from, and transmitted by, groups of subscriber units. Other applications and embodiments of the invention are apparent from the description of preferred embodiments and the claims that follow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A illustrates a plurality of CI carriers having phase fronts that are aligned at a specific time. The CI carriers combine to generate a plurality of superposition signals that are orthogonal to each other in time.

FIG. 1B illustrates an in-phase superposition of CI carriers of a carrier set that produces a superposition signal corresponding to a sum of the superposition signals shown in FIG. 1A

FIG. 1C illustrates two sets of orthogonal superposition signals. The signals in each set are orthogonal to each other. The signals in a first set are substantially orthogonal to signals in a second set.

FIG. 1D shows a summation of two orthogonal sets of CI signals wherein signals in a first set are quasi-orthogonal to signals in a second set.

FIG. 2A illustrates phase relationships between two orthogonal sinusoidal waveforms that demonstrate a mathematical basis of CI processing.

FIG. 2B illustrates relationships between two orthogonal sinusoidal waveforms.

FIG. 3A illustrates a phase offset of adjacent samples shown in FIG. 2A.

FIG. 3B illustrates a phase offset of adjacent samples shown in FIG. 2B.

FIG. 4A shows samples distributed uniformly around a unit circle in the complex plane.

FIG. 4B shows samples distributed uniformly around a unit circle in the complex plane.

FIG. 4C is a normalized complex-plane representation of samples of a signal having a particular frequency collected at a sampling rate that equals, or is some sub-harmonic frequency of, the signal frequency. Each sample corresponds to an integer number of full rotations in the complex plane.

FIG. 5A shows a set of 16 octonary CI code vectors of length 8.

FIG. 5B shows correlations of the 16 octonary codes shown in FIG. 5A.

FIG. 6A illustrates basic components of a CI-code generator.

FIG. 6B illustrates basic components of a CI transmitter.

FIG. 6C illustrates basic components of a CI decoder.

FIG. 7 illustrates the relationship between basic CI symbol values w_n and data symbols s_n processed with CI code chips to produce the CI symbol values w_n.

FIG. 8A illustrates basic components of a CI coding system and a CI decoding system.

FIG. 8B shows a system diagram of a CI transceiver.

FIG. 9A illustrates a tree network that may be implemented in some aspects of the present invention.

FIG. 9B illustrates a network design that permits a plurality of communication paths to each node.

FIG. 9C illustrates a network design adapted to provide array processing performance advantages.

FIG. 9D illustrates a concentric ring network configuration.

FIG. 9E illustrates a network configuration adapted to the geographic distribution of a plurality of subscribers located along a roadway.

FIG. 9F illustrates a plurality of nodes adapted to route CI code-addressed signals.

FIG. 9G illustrates a simple tree-style CI-based network of the present invention.

FIG. 9H illustrates a simple CI-based network wherein each node can be reached by a plurality of paths.

FIG. 9I illustrates a network characterized by two communication paths to a common destination node.

FIG. 9J illustrates a network having a plurality of crossing communication paths.

FIG. 10A illustrates a multi-level cellular architecture that may be employed by systems and methods of the present invention.

FIG. 10B illustrates three adjacent cells in a cellular network of the present invention.

FIG. 10C shows a cellular architecture of the present invention that includes a plurality of cells and a plurality of base stations located on cell boundaries.

FIG. 10D illustrates a cellular network of the invention including a plurality of cells, a plurality of base stations, and a plurality of subscriber units.

FIG. 11A illustrates a CI transceiver adapted to perform routing.

FIG. 11B illustrates an alternative embodiment of a CI transceiver adapted to perform routing.

FIG. 11C illustrates an alternative embodiment of a CI transceiver adapted to perform routing.

FIG. 11D illustrates a method in which a transceiver in a network is provided with control information that includes information used to generate one or more array-processing weights.

FIG. 11E illustrates a method in which an individual network transceiver is adapted to perform array processing relative to local conditions. The transceiver can be adapted to optimize transmit/receive operations relative to signal quality measured at the transceiver.

FIG. 11F illustrates an array-processing method that employs at least one central processor to provide beam-forming operations across a plurality of spatially distributed

network transceivers. The central processor may direct the network transceivers to apply weights to transmitted and/or received signals. Alternatively, the central processor may perform array processing by providing weights to signals it transmits to, and receives from, network transceivers. The central processor may be adapted to perform various combining operations, including CI combining.

FIG. 12A illustrates a method for providing CI-coded transmissions of information and control signals.

FIG. 12B illustrates a method for managing network control in a CI network by one or more subscriber units adapted to function as base stations.

FIG. 12C illustrates a network-control method of the present invention.

FIG. 12D shows a routing method of the present invention.

FIG. 13A shows a relay method of the present invention.

FIG. 13B illustrates an alternative embodiment of a relay method of the invention.

FIG. 13C illustrates a transceiver processing and routing method of the invention.

FIG. 13D illustrates an alternative transceiver processing and routing method of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The description of the preferred embodiments assumes that the reader has a familiarity with CI described in the following publications, which are incorporated by reference:

1. B. Natarajan, C.R. Nassar, S. Shattil, M. Michelini, "Application of interferometry to MC-CDMA", accepted for publication in IEEE Transactions on Vehicular Technology.
2. C. R Nassar, B. Natarajan, and S. Shattil, "Introduction of carrier interference to spread spectrum multiple access," IEEE Emerging Technologies Symposium, Dallas, Texas, 12-13 Apr 1999.
3. B. Natarajan and C.R. Nassar, "Introducing novel FDD and FDM in MC-CDMA to enhance performance," IEEE Radio and Wireless Conference, Denver, CO, Sept. 10-13, 2000, pp. 29-32.

4. Z. Wu, C. R. Nassar, A. Alagar, and S. Shattil, "Wireless communication system architecture and physical layer design for airport surface management," 2000 IEEE Vehicular Technology Conference, Boston, MA, Sept. 24-28, 2000, pp. 1950-1955.
5. S. Shattil, A. Alagar, Z. Wu and C.R. Nassar, "Wireless communication system design for airport surface management – Part I: Airport ramp measurements at 5.8GHz," 2000 IEEE International Conference on Communications, June 18-22, 2000, New Orleans, pp. 1552-1556.
6. B. Natarajan, C.R. Nassar, and S. Shattil, "Carrier Interferometry TDMA for future generation wireless – Part I: Performance," accepted for publication in IEEE Communications Letters.
7. Z. Wu, C.R. Nassar, and S. Shattil, "Capacity enhanced DS-CDMA via carrier interferometry chip shaping," IEEE 3G Wireless Symposium, May 30 – June 2, 2001, San Francisco, CA.
8. Z. Wu, C.R. Nassar, and S. Shattil, "Frequency diversity performance enhancement in DS-CDMA via carrier interference pulse shaping," The 13th Annual International Conference on Wireless Communications, Calgary, Alberta, Canada, July 7-10, 2001.
9. C.R. Nassar and Z. Wu, "High performance broadband DS-CDMA via carrier interferometry chip shaping," 2000 International Symposium on Advanced Radio Technologies, Boulder, CO, Sept. 6-8, 2000, proceeding available online at http://ntai.its.bldrdoc.gov/meetings/art/index.html.
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14. S.A. Zekevat, C.R. Nassar, and S. Shattil, "Smart antenna spatial sweeping for combined directionality and transmit diversity," accepted for publication in Journal of Communication Networks: Special Issue on Adaptive Antennas for Wireless Communications.
15. S.A. Zekevat, C.R. Nassar, and S. Shattil, "Combined directionality and transmit diversity via smart antenna spatial sweeping," 38th Annual Allerton Conference on Communications, Control, and Computing, Champaign-Urbana, Illinois, Oct. 4-6, 2000.
16. S. Shattil and C.R. Nassar, "Array Control Systems For Multicarrier Protocols Using a Frequency-Shifted Feedback Cavity" IEEE Radio and Wireless Conference, Denver, CO, Aug. 1-4, 1999.
17. C. R. Nassar, et. al., MultiCarrier Technologies for Next Generation Multiple Access, Kluwer Academic Publishers: 2001.

Applications of CI, array processing, spatial interferometry, and related systems and methods are cited in the following patents and patent applications, which are hereby incorporated by reference:

1. U.S. Pat. No. 5,955,992
2. U.S. Pat. No. 6,008,760
3. U.S. Pat. No. 6,211,671
4. U.S. Pat. No. 6,331,837
5. U.S. Pat. No. 6,348,791
6. PCT Appl. No. PCT/US99/02838
7. PCT Appl. No. PCT/US00/18113
8. U.S. Pat. Appl. No. 09/347,182
9. U.S. Pat. Appl. No.09/472,300
10. U.S. Pat. Appl. No.09/433,196
11. U.S. Pat. Appl. No. 09/393,431
12. U.S. Pat. Appl. No. 09/718,851

13. U.S. Pat. Appl. No. 09/703,202
14. U.S. Pat. Appl. No. 10/034,386
15. U.S. Pat. Appl. No. 10/078,774
16. U.S. Pat. Appl. No. 10/131,163
17. U.S. Provisional Pat. Appl. No. 60/163,141
18. U.S. Provisional Pat. Appl. No. 60/219,482
19. U.S. provisional Pat. Appl. No. 60/259,433
20. U.S. provisional Pat. Appl. No. 60/286,850

1. Definitions

Various terms used in the descriptions of CI methods and systems are generally described in this section. The descriptions in this section are provided for illustrative purposes only, and are not limiting. The meaning of these terms will be apparent to persons skilled in the relevant art(s) based on the entirety of the teachings provided herein. These terms may be discussed throughout the specification and the cited references with additional detail.

An address, or network address, as used herein, describes any set of symbols used to identify a particular network node or transceiver. An address may include symbols in a header or other part of a data transmission. An address may correspond to a code used to encode a transmission. In some applications of the invention, an address may specify one or more routes through a network. For example, multiple addresses may indicate one or more preferred paths through the network. Alternatively, a message address may be constructed via some mathematical relationship of node addresses that indicate one or more paths to at least one destination node. In some aspects of the invention, the message address may be changed as the message propagates through the network.

The term carrier signal, or carrier, when used herein, refers to at least one electromagnetic wave having at least one characteristic that may be varied by modulation. Subcarriers may be referred to as carriers. Other wave phenomena, such as acoustic waves, may be used as carriers. Carrier signals may include any type of periodic signal. Carrier signals may include sinusoids, square waves, triangle waves, wavelets, and/or arbitrary waveforms. A carrier signal is capable of carrying information via

modulation. A carrier signal may be modulated or unmodulated. Multicarrier signals may include multi-frequency signals, multi-spatial signals, multi-directional signals, multi-polarization signals, multiple coded signals, multiple sub-space signals, multi-phase-space signals, time-domain (discreet-time) signals, and/or any other set of electromagnetic signals having different orthogonal or quasi-orthogonal values of at least one diversity parameter. A code sequence can be regarded as a carrier signal. A subcarrier may include more than one signal and more than one type of signal.

Channel compensation describes signal processing performed on at least one transmitted and/or received signal according to measured and/or calculated channel fluctuations. Channel compensation may include any of various blind adaptive techniques. Alternatively, channel compensation may employ at least one pilot or training signal to probe the channel. Known signals can be used to compensate for various multipath effects (such as fading and/or inter-symbol interference), mitigate multi-user interference, and/or remove jamming signals. Channel compensation may employ a combination of adaptive and reference-signal processing. Channel compensation may include adaptive channel equalization. Channel compensation in a CI and/or antenna-array system may employ some type of combining.

Channel estimation describes any combination of blind adaptive techniques and reference-signal processing to determine signal distortion resulting from the effects of at least one communication channel. In one example, a pilot symbol is transmitted periodically from a remote transmitter. A local receiver exploits the known transmission time, frequency, polarization, and/or any other diversity-parameter value of at least one pilot symbol to process the transmitted pilot symbol and estimate the distortion caused by the channel environment. On the basis of an estimated value, distortion in the received data symbols is compensated. In some aspects of the invention, a pilot tone may be employed.

CI codes, as used herein, may include basic CI codes or advanced CI codes. CI codes are based on mathematical relationships between CI carriers and phase spaces. CI codes can be used as direct-sequence codes, multicarrier codes (e.g., MC-CDMA), etc. Applications of CI codes can be extended to any application of conventional binary direct sequences, including but not limited to, spread spectrum, multiple access, channel coding,

encryption, anti-jamming, etc. CI codes may be applied across any set of orthogonal or quasi-orthogonal diversity-parameter values or subspaces. Although CI codes can be represented with respect to phase relationships generated by vector precession in the complex plane, the implementation of CI coding can be extended to circular, elliptical, and linear polarizations.

A coder, as used herein, describes any system, device, or algorithm adapted to generate spread-spectrum codes, multiple-access codes, channel codes, encryption codes, multi-level codes, compression codes, hybrid codes, and CI codes. A coder may interleave coded data symbols in one or more diversity-parameter spaces. The coder may provide channel coding to the data symbols. A CI coder, includes any algorithm, device, or system adapted to combine, merge, or otherwise impress at least one data symbol onto a plurality of CI code chips or carriers. The CI encoder may impress each CI code chip onto one or more diversity-parameter values prior to, or after, impressing data symbols onto the CI code. A CI code may be impressed onto at least one intermediate-frequency (IF) carrier. The CI encoder may perform multiplexing. For example, the CI encoder may encode data streams onto different CI codes. The CI encoder may employ other diversity parameters on which to multiplex multiple data streams.

A combiner, as used herein, describes any system, device, and/or algorithm adapted to combine a plurality of signals, samples, or symbol values. A combiner may combine multiple carriers or signal values to generate a superposition signal. A combiner may provide weights to carriers or signal values to generate one or more superposition signals having predetermined characteristics, such as time domain, frequency domain, spatial domain, sub-space domain, and/or other physical characteristics. A combiner may compensate for noise, interference, and/or distortion.

Combining often involves generating weights based on channel estimates. The weights may be adapted relative to some performance measurement, such as probability of error, bit-error rate (BER), signal-to-noise ratio (SNR), signal-to-noise-plus-interference ratio (SNIR), and/or any other signal-quality parameter. Possible combining techniques include equal-gain combining (EGC), orthogonal restoring combining (ORC), and minimum mean squared error combining (MMSEC). Performance measurements

may include any combination of instantaneous and averaged performance measurements. Averaging may be performed over one or more diversity parameters.

A combiner may perform combining in more than one diversity-parameter space. For example, MMSE combining may be performed in the frequency domain to generate a plurality of combined signals that may be processed via EGC in the time domain. Other types of combining, as well as combining in different dimensions, may be performed. Combining may also be performed as a receive-side array-processing technique. Array processing (e.g., spatial combining) may be integrated into other combining operations, such as CI subcarrier combining.

A communication channel, as described herein, typically comprises an RF channel. A communication channel may include any propagation medium and/or path between at least one transmitter and at least one receiver. A communication channel may be natural and/or man-made, including, but not limited to, air, space, wire, cable, waveguide, microstrip, strip-line, optical fiber, and liquid.

A control channel is a communication channel in which control information is transmitted.

Control information, as used herein, includes any information used to set, monitor, identify, adapt, or change communications and/or transceiver operations in a network. Control information may be provided for power control, synchronization, routing, channel assignments, code assignments, addressing, identification, acknowledgment, transfer of network control, etc. Control information may include pilot signals, training symbols, addresses, tags, codes, parity symbols, reference (e.g., timing, phase, power, frequency) signals, and/or transceiver-control signals.

A decoder, as used herein, describes any system, device, or algorithm capable of decoding an encoded information (e.g., data) signal. A decoder typically decodes an encoded signal with respect to one or more reference signals (e.g., codes, decode sequences, code keys, etc.). Decoding may take the form of a correlation process, matched filtering, or any kind of processing (e.g., complementary processing) that extracts at least one desired information signal from the coded signal. In a preferred embodiment, collected samples are phase shifted with respect to at least one code prior to

being summed. In some multicarrier systems, it is impractical to perform matched filtering or correlation. Rather, data symbols are obtained from the output bins of a Fourier transform process. Similarly, other types of transforms or inverse transforms may be performed in a decoder.

A destination node, as used herein, describes a network transceiver selected to receive at least one communication signal. A destination node may describe a local destination node within a particular network. Alternatively, a destination node may describe the final destination(s) of at least one particular transmission.

The term diversity-parameter, as used herein, describes at least one signal characteristic that enables a signal to be distinguished from another signal. Examples of diversity parameters include, but are not limited to, amplitude, spatial gain distribution, directionality, energy, power, linear polarization direction, circular/elliptical polarization direction, circular/elliptical polarization rotation rate, mode, frequency, time, code, phase, coherence length, and phase space. Diversity parameters may include proportions of two or more diversity-parameter values. Diversity parameters may include any combination of unique signal characteristics. Diversity parameters may include diversity-parameter subspaces, such as spatial sub-spaces. A common diversity parameter, as used herein, is a range of at least one diversity-parameter value into which electromagnetic signals may be mapped.

Duplexing, as used herein, describes any processing technique adapted to separate transmitted and received signals. Various multiple-access techniques may be adapted to perform duplexing. Time-division duplexing (TDD) may be provided with respect to orthogonal time-domain slots. In CI-based protocols, TDD may be provided with respect to time-domain characteristics of multicarrier superposition signals and/or time-offset coding applied to CI. Frequency-division duplexing (FDD) provides for separation of signals characterized by different frequency bands. The multicarrier structure of CI enables FDD. Even spread-spectrum protocols, such as DS-CDMA, may benefit from CI-enabled FDD without the reduced frequency-diversity benefits inherent in conventional FDD. Code division duplexing (CDD) may be provided.

CI phase-division duplexing (CI-PDD) describes the separation of multicarrier signals having different phase spaces. Transmitted and received CI signals may be

separated due to the orthogonality (or quasi-orthogonality) of the phase spaces. One application of CI-PDD involves applying a matched filter to desired received components to remove the effects of transmitted signals (as well as undesired received signals). Cancellation may be used to electromagnetically isolate receivers from transmitters that use the same time and frequency bands for transmission. Some of these cancellation techniques are described in U.S. Pat. No. 6,348,791, which is incorporated by reference. Polarization division duplexing includes orthogonal polarization duplexing (OPDD) and quasi-orthogonal polarization duplexing (QPDD). OPDD is a well-known method of using orthogonal polarizations to double channel capacity. For example, linear polarized antennas may be oriented perpendicular to each other to provide isolation. OPDD involves using known ratios of co-channel interference to cancel the interfering signals. Circular polarization duplexing (CPD) may employ opposite polarization spins. CPD may employ orthogonal polarization frequencies. OPDD, QPDD, and CPD may employ three-dimensional (i.e., x-y-z axis) polarizations

Coherence time division duplexing (CTDD) may be used to remove interfering signals having different time offsets. In CTDD, an information signal modulated onto a wideband signal is transmitted along with a decode signal. A predetermined time offset between the modulated and decode signals allows a receiver to extract the information signal without any knowledge of the wideband signal. In CI-based signals, a time offset corresponds to a vector of phase offsets corresponding to the CI sub-carriers. Wideband signals, such as additive white Gaussian noise, chaotic signals, pseudo-random signals, etc., may be provided (or closely approximated) by a predetermined weighted set of CI sub-carriers. Orthogonal CTDD pertains to time-offset differences between transmitted and received signals that exceed the inverse of the coherence bandwidth of the signals. Quasi-orthogonal CTDD occurs when the time-offset differences between desired receive signals and interfering transmissions do not exceed the inverse coherence bandwidth of the signals. This causes overlap interference in the matched-filter output. The overlap interference may be removed via cancellation.

An information signal, as used herein, describes one or more signals that convey some form of useful information via magnitude, phase, frequency, polarization, mode, direction, and/or some signal property derived therefrom. CI-based information signals

may include any type of communication signal, such as, but not limited to, voice, data, and text. Information signals may include any of various types of remote-sensing signals, such as radar signals, Lidar signals, spectroscopy signals of various types (e.g., absorption, scatter, luminescence, resonant, emission, harmonic, intermodulation, etc.), probing signals, and imaging signals (e.g., X-ray, gamma-ray, ultrasound, seismic survey, acoustic, sonar, optical, pulse radio, spread spectrum, etc.). Any information signal may be considered to be a CI-based signal if it is processed via CI signal-processing techniques. Thus, a received non-CI signal may be converted into a CI signal by decomposing the received signal into orthogonal sub-carrier components.

The term modulation, as used herein, refers to any method of impressing a signal (such as an information signal, a code signal, and/or a sub-carrier) onto an electromagnetic signal. Modulation describes the adjustment of one or more physical signal characteristics with respect to an information signal. Modulation may be combined with spreading. Signals, such as analog and/or digital information signals, may be impressed onto one or more carrier signals via any combination of modulation techniques, including, but not limited to, amplitude modulation, phase modulation, frequency modulation, pulse modulation, and/or polarization modulation. Pulse modulation (such as CI-pulse modulation) may include Pulse-Amplitude Modulation (PAM), pulse-code modulation, pulse-frequency modulation, pulse-position modulation, and/or pulse-width modulation.

CI signal generation sometimes includes modulation, PAM, Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Quadrature Amplitude Modulation (QAM). Coded modulation, such as trellis-code modulation, may be performed. Data symbols may be modulated onto a code sequence, such as a multiple-access code, a spreading code, an encryption code, a channel code, etc. A code sequence may include digital and/or analog signals. Examples of code sequences include direct-sequence codes, MC-CDMA codes, CI codes, CI/DS-CDMA codes, frequency-hopping codes, chirp codes, coherence-multiplexing codes, sub-channel codes, and code length division multiplexing codes. Some types of modulation can include the formation of code-chip values, continuous-code values, and/or code-chip sequences based on data-symbol values. Data symbols may be input to a code-generation process.

A network control station (also referred to as a base station) is any network transceiver adapted to perform network control operations, such as communication control, power control, synchronization, assignment of operating parameters to other network transceivers, spectrum management, load balancing, network configuration, code assignment, channel selection, performance monitoring, performance optimization, routing, authentication, verification, channel estimation, etc.

A network transceiver is any transceiver adapted to operate in a network. A network transceiver may include a base station, access point, relay, router, and/or subscriber unit.

A receiver, as used herein, includes any system, device, or process that employs any combination of detection and estimation. Detection is the task of determining if a predetermined signal is present in an observation. Estimation is the task of obtaining or determining values of one or more signal parameters. A receiver may perform various signal-processing operations, including, but not limited to, filtering, channel selection, A/D conversion, AGC, timing recovery, carrier acquisition, carrier recovery, bandwidth adjustment, sample-rate adjustment, matched filtering, soft-decision quantization, array processing, error detection, error correction, amplification, decoding, DC-signal removal, equalization, combining, spectral shaping, noise-bandwidth control, spectral translation, amplifier linearization, de-interleaving, in-phase/quadrature-phase gain and phase balancing, etc.

An RF front end describes any device or system adapted to convert baseband or IF signals to RF for transmission. An RF front end may be adapted to receive and convert RF signals to baseband or IF. An RF front end may be adapted to perform RF, IF, and/or baseband signal processing to prepare a received RF signal for IF or baseband processing. Similarly, RF, IF, and/or baseband processing may be provided to prepare a baseband or IF signal for coupling into an RF communication channel. An RF front end may perform array processing.

A source node is a transceiver in a network from which a transmission originates. A source node may be defined relative to a given network. For example, although a base station may receive a transmission and retransmit the information into a given network,

the base station may be regarded as the source node relative to the given network. Alternatively, the source of the information may be identified as the source node.

A subscriber, or subscriber unit, as used herein, is a transceiver that is capable of acting as an information source and/or an information sink in a network. A subscriber is typically provided with communication services from at least one network. A subscriber typically communicates communication information with other subscribers. However, this communication information may be routed through other subscribers or non-subscriber devices. Thus, a subscriber is typically provided with at least one communication link to at least one other transceiver, such as a base station, access point, relay, router, and/or another subscriber.

A subspace, as used herein, describes a signal space that can include a plurality of signals having at least one common diversity parameter value (or range of values) and, preferably, is characterized by some means to separate at least one of the signals from at least one other of the signals. For example, each of a plurality of signals sharing the same frequency band, but transmitted by a different transmitter element characterized by some unique physical property (i.e., diversity-parameter value), may be characterized as a sub-space signal. Preferably, a plurality of receiving antennas are adapted to produce a plurality of algebraically unique combinations of the transmitted signals. Accordingly, algorithms and/or processors are provided to separate at least one desired signal from at least one interfering signal.

A transmitter, as used herein, includes any system, device, or process adapted to couple one or more signals into at least one communication channel. A transmitter may perform one or more signal-processing operations to prepare the signal for propagation in a channel. For example, transmitter-side signal processing may include D/A conversion, frequency up-conversion, filtering, spreading, predistortion, and/or array processing.

A CI transmitter may be implemented via any of many different techniques. The present invention anticipates design variations of CI-based transmitters. A CI/DS-CDMA transmitter, as well as any other CI transmitter, is characterized by the signals generated. In particular, a CI/DS-CDMA transmitter is any device, system, or algorithm capable of impressing information onto a plurality of carriers and adjusting (e.g., weighting) the carriers to provide a superposition signal having predetermined time-domain

characteristics. Such time-domain characteristics may include a signal resembling a direct-sequence code.

An unlicensed frequency band refers to any frequency band that is allocated for unlicensed use by the Federal Communications Commission or an equivalent national or international regulatory organization. For example, unlicensed frequency bands for wireless LAN are specified in the IEEE 802.11 standards.

2. Introduction to Carrier Interferometry

Various aspects of the present invention are based on CI. Other aspects of the invention are particularly applicable to CI methods and systems. There are too many variations, permutations, and specific implementations of CI to describe in this introduction. Accordingly, the descriptions and examples of CI described herein are not intended to limit the scope of how CI is defined, but rather to illustrate a few of the many ways that the present invention may be implemented. Descriptions of CI are also intended to clarify some of the aspects and embodiments of the present invention.

Inter-symbol interference occurs when a reflected signal travels a distance sufficiently greater than the distance traversed by a line-of-sight signal so as to cause a delay greater than the duration of a data symbol. CI avoids inter-symbol interference by transmitting data symbols on narrowband carriers. Multipath fading occurs when a narrowband signal traverses two paths having a half-cycle phase difference. CI avoids the problem of multipath fading by transmitting each data symbol on multiple carriers that are adequately separated with respect to frequency or some other diversity parameter. Redundant modulation typically reduces bandwidth efficiency. CI avoids the problem of reduced bandwidth efficiency by modulating up to $2N$ data symbols on each of N carriers. Increased interference on one or more carriers typically increases probability of error. CI avoids the problem of increased interference and probability of error by exploiting interferometry to orthogonalize data symbols modulated on the same carriers. Thus, CI achieves higher throughput with better signal quality than any other multiple-access protocol.

FIG. 1A illustrates a basic form of CI in which a plurality of CI carrier sets 105A, 105B, and 105C each have phase fronts aligned at a specific time t_1, t_2, and t_3,

respectively. A plurality of superposition signals 110A, 110B, and 110C result from a summation of each carrier set 105A, 105B, and 105C, respectively. The superposition signal 110A illustrates a pulse envelope centered at time t_1. All of the carriers 105A are in-phase at time t_1 and thus, combine constructively. The superposition signal 110A has a maximum magnitude at time t_1. At other times (e.g., times t_2 and t_3), the carriers in carrier set 105A combine destructively, resulting in low or undetectable signal levels.

In CI, the individual signal components 105A, 105B, and 105C contributing to a CI pulse 110A, 110B, and 110C, respectively, or information symbol s_n have an extended duration T_s relative to the pulse width T_{pulse}. The extended symbol duration T_s (i.e., the duration of component waveforms corresponding to a symbol s_n) reduces spectral sidelobes associated with the transmitted information symbol s_n. The extended waveform shape can be overlapped with extended waveforms associated with other symbols $s_{n'}$ ($n' \neq n$). Naturally, interference will occur between the waveforms associated with different data symbols. However, CI coding can be employed to provide orthogonality (or quasi-orthogonality) between the composite waveforms (i.e., the data symbols s_n).

Although multicarrier-based CI signals (such as signals 110A, 110B, and 110C) can resemble sinc-shaped pulses, which are orthogonalized by time-domain pulse positioning, it is important to note that multicarrier-based CI signals are composed of multicarrier (e.g., multi-frequency) components and are typically processed (e.g., generated and/or decomposed) in the frequency domain.

The signal 110A results from an addition of N carriers that have a uniform frequency separation f_s. FIG. 1A illustrates a simple case of rectangular (i.e., non-tapered) windowing of the carrier amplitudes. The CI carriers are uniformly spaced in frequency $f_n = f_o + nf_s$, where f_o is some zero or non-zero offset frequency, f_s is a non-zero shift frequency, and n is some integer or set of integers. A superposition CI signal, such as signal 110A, is expressed by:

$$e(t) = \sum_{n=1}^{N} e^{i[(\omega_c + n\omega_s)t + n\Delta\phi]},$$

and has a magnitude of:

$$|e(t)| = \left| \frac{\sin(N(\omega_s t + \Delta\phi)/2)}{\sin((\omega_s t + \Delta\phi)/2)} \right|.$$

The CI signals are periodic with period $1/f_s$ for an odd number of carriers N and with period $2/f_s$ for an even number of carriers N. The main lobe has a duration $2/Nf_s$ and each of the N-2 side lobes has a duration $1/Nf_s$. The amplitude $A(l)$ of the lth side lobe with respect to the main lobe amplitude is:

$$A(l) = \frac{1}{N \sin(\pi(l+1/2)/N)}$$

Applying a phase shift of $n\Delta\phi_k$ to each nth carrier shifts the CI envelope in time by $\Delta t = \Delta\phi_k/2\pi f_s$. Therefore, N signals can be positioned orthogonally in time. The phase shifts can provide necessary phase relationships to create the desired timing of the information signal received by at least one receiver (not shown).

The cross correlation between users is:

$$R_{cc}(\tau) = \frac{1}{2f_s} \frac{\sin(N2\pi f_s \tau/2)}{\sin(2\pi f_s \tau/2)} \cos((N-1)2\pi f_s \tau/2),$$

where τ is the time shift between envelopes. Zeros occur at: k/Nf_s, $k = 1,2,...,N$-1 and at $(2k\text{-}1)/2(N\text{-}1)f_s$, $k = 1,2,...,N$-1. CI can support N orthogonal users (or channels). If additional users or signals need to be accommodated, CI provides N-1 additional positions to place signals.

A CI signal centered at time τ is orthogonal to the CI signal centered at time t_1 whenever the difference between τ and t_1 is $\Delta t = k/Nf_s$, $k = 1,2,...,N\text{-}1$. This enables CI waveforms to represent information symbols located sequentially in time without creating inter-symbol interference. The superposition signal 110D shown in FIG. 1B represents a sum of the orthogonally positioned superposition signals 110A, 110B, and 110C.

An offset in the time domain corresponds to linearly increasing phase offsets in the frequency domain. A CI signal with a time offset $\tau = k/Nf_s$ is equivalent to a CI carrier set with carriers 1 to N having phase offsets:

$$\{\phi_1, \phi_2, ..., \phi_N\} = \{0, 2\pi k/N, 2 \cdot 2\pi k/N, ..., (N\text{-}1) \cdot 2\pi k/N\}.$$

Orthogonality between CI signals can be understood as an appropriate time separation $\tau \in \{k/f_s, k = 1, 2, ..., N\text{-}1\}$ between superposition signals, or as carriers of each carrier set coded with a different polyphase spreading sequence:

$$f(\phi) = \{e^{j\theta 1}, e^{j\theta 2}, ..., e^{j\theta N}\} = \{e^{j0}, e^{j2\pi k/N}, ..., e^{j(N-1)\cdot 2\pi k/N}\}$$

with respect to values of $k=0, 1, ..., N\text{-}1$.

A set of quasi-orthogonal signals can be determined from non-orthogonal time offsets that minimize the mean-squared value of the interference between the quasi-orthogonal signals. This criteria is satisfied by multiples of a time-offset value $\Delta t = 1/(2Nf_s)$. FIG. 1C shows a first set of N orthogonal signals 110D represented in time by:

$$\{t_1, t_2, \ldots, t_{N-1}\} = \{1/f_s, 2/f_s, \ldots, (N-1)/f_s\}.$$

A second set of N orthogonal signals 110D' is represented in time by:

$$\{t'_1, t'_2, \ldots, t'_{N-1}\} = 1/(2Nf_s) + \{1/f_s, 2/f_s, \ldots, (N-1)/f_s\}.$$

The first set of signals 110D is quasi-orthogonal to the second set 110D' and results in a minimal amount of interference, as shown in FIG. 1D.

This result can also be expressed in terms of carrier phase offsets using the equivalence between shifts in the time domain and phase offsets in the frequency domain. A first set of N orthogonal signals is represented in phase by N complex spreading codes:

$$f_1(\phi) = \{e^{j\phi 1}, e^{j\phi 2}, \ldots, e^{j\phi N}\} = \{e^{j0}, e^{j2\pi k/N}, \ldots, e^{j(N-1)\cdot 2\pi k/N}\}$$

A second set of N orthogonal signals is represented in phase by N complex spreading codes:

$$f_2(\phi) = \{e^{j\phi' 1}, e^{j\phi' 2}, \ldots, e^{j\phi N}\} = \{e^{j(0+\Delta\phi)}, e^{j(2\pi k/N+\Delta\phi)}, \ldots, e^{j((N-1)\cdot 2\pi k/N+\Delta\phi)}\}$$

where $\Delta\phi = \pi/N$.

The superposition signal 110D in FIG. 1B can be thought of as a superposition of complex-weighted carriers in a carrier set 105D or a sum of the superposition signals 110A, 110B, and 110C. The carrier set 105D represents a sum of the carrier sets 105A, 105B, and 105C. The complex amplitudes of carrier set 105D can be characterized by a complex-weight vector $w = [w_1, w_2, \ldots, w_N]$. Each value w_n of the weight vector w corresponds to a particular carrier frequency f_n. The values w_n can be derived from a complex addition of carriers in the carrier sets 105A, 105B, and 105C. The values w_n can be derived from summing complex numbers representing the magnitude and phase of each carrier in the carrier sets 105A, 105B, and 105C.

CI signals demonstrate both excellent frequency resolution and excellent time resolution. A CI signal is composed of multiple narrowband carriers that allow it to be resolved into its frequency components. When observed in the time domain, a basic CI signal is very narrow, enabling it to be easily separated from other CI signals and to resolve the channel's multipath profiles.

Because the period and width of the pulse envelope depends on the amplitudes, relative phases, and frequency separation of the CI carriers, the frequency of each carrier may be changed without affecting the pulse envelope as long as the amplitudes, relative phases, and frequency separation are preserved. Thus, frequency hopping and frequency shifting of the carriers does not affect the temporal characteristics of the superposition signal, such as superposition signal 110A. Tapering the amplitude distribution of the CI carriers broadens the main-lobe width and reduces the amplitude of the side lobes.

A CI signal has a number of carrier signals that may each have a bandwidth that is less than the coherence bandwidth of the communication channel. The coherence bandwidth is the bandwidth limit in which correlated fading occurs. The total bandwidth of the CI signal preferably exceeds the coherence bandwidth.

CI carriers corresponding to any particular user, channel, or data symbol may be spaced in frequency by large amounts to achieve a large system bandwidth relative to the coherence bandwidth. In this case, CI uses frequency to achieve uncorrelated fading. However, any diversity parameter or combination of diversity parameters may be used to achieve uncorrelated fading over the system bandwidth, or even between individual carriers.

The system bandwidth of a group of CI carriers may be selected relative to the coherence bandwidth of one or more subchannels, such as spatial sub-channels. Carriers that are closely spaced in frequency may have uncorrelated fading if they are transmitted from different locations or have different degrees of directivity. CI carriers transmitted from different locations may have different fades over each spatial sub-channel and therefore, can benefit from diversity combining at a receiver (not shown).

Phase shifts applied to an nth carrier to separate a kth channel from adjacent channels are given by:

$$\phi_{kn} = \pi k n f_s(\Delta t) + \phi^o_{kn} = \pi k n/N + \phi^o_{kn}$$

where ϕ^o_{kn} is an initial phase-offset corresponding to the nth carrier and the kth channel. The values of Δt depend on whether the channel spacing is orthogonal or quasi-orthogonal.

Although FIG. 1A and FIG. 1B illustrate an in-phase superposition of carrier signals, this example can be extended to other superpositions of CI. For example, the

time offset Δt (and the corresponding carrier phase shifts ϕ_{kn}) for adjacent channels may be applied to CI implementations that do not have in-phase superpositions. The time offsets Δt (and thus, the phase shifts ϕ_{kn}) derived in this case are also relevant to CI implementations that process the received carriers separately. When each carrier is processed separately, phase-offset coding (in addition to the phase offsets ϕ_{kn} used to separate channels) may be used to reduce or minimize the peak of the superposition signal.

The carrier sets 105A, 105B, and 105C have phase offsets corresponding to a pulse-width duration. However, any type of orthogonal (e.g., non-overlapping) or quasi-orthogonal (e.g., overlapping) spacing may be provided. Carrier sets having quasi-orthogonal (or non-orthogonal) spacing may be processed with multi-user (or multi-channel) detection techniques or with any other type of interference-suppression technique.

FIG. 1A and FIG. 1B illustrate several levels of signal decomposition that reduce a complex time-domain signal into simple components. The time-domain pulses may be scaled and positioned to produce a predetermined time-domain signal indicative of an information signal, coding, and at least one transmission protocol. Multiple frequency components may be weighted to produce an information signal having predetermined time-domain characteristics. Similarly, multiple frequency components that comprise the pulses may be selected and weighted to impart predetermined characteristics to the pulses. The scale of the components selected for signal processing can be selected to provide a desired granularity for the information architecture.

Modulation of the pulses, the carriers, or both may be performed over the duration of the signals shown in FIG. 1A and FIG. 1B. Carrier modulation may be performed over a pulse-repetition period, a pulse duration, or any multiple or fraction of either. In some cases, guard intervals, guard bands, and/or cyclic prefixes may be provided to CI signals.

3. CI Codes

CI codes, as used herein, may include basic CI codes or advanced CI codes. CI codes are based on phase relationships between orthogonal carriers, such as illustrated by samples 220 to 225 shown in FIG. 2A.

Basic CI codes of the present invention can be derived from phase relationships between orthogonal carrier frequencies. FIG. 2A illustrates first and second orthogonal sinusoidal waveforms 201 and 202. Each waveform 201 and 202 has an integer number of wavelengths over a particular symbol interval T_s. The first waveform 201 frequency f_1 is six cycles per symbol interval T_s. The second waveform 102 frequency f_2 is five cycles per symbol interval T_s.

The samples 220 to 225 of waveform 202 are selected at intervals of Δt_1 corresponding to periods 210 to 215 of waveform 201 over a symbol interval $T_s = 6\Delta t_1$. In this case, the waveforms 201 and 202 are aligned in phase at times $t = 0$ and $t = T_s$. At $t = \Delta t_1$, sample 221 occurs at 5/6 of waveform 202 period Δt_2. Each sample 220 to 225 can be represented by a value on a unit circle in the complex plane. For example, FIG. 3A shows a complex-plane representation of samples 220 and 221.

Since the sampling frequency f_1 exceeds the frequency f_2 of the sampled waveform 202, the phase shift of each successive sample 220 to 225 falls short of a full cycle of waveform 202. The waveforms 201 and 202 are orthogonal due to selection of an appropriate symbol interval T_s that causes the samples 220 to 225 to be distributed uniformly across the unit circle in the complex plane, as illustrated by FIG. 4A. The sample values 220 to 225 cancel when they are summed.

FIG. 2B illustrates a first waveform 201 sampled at intervals 230 to 235 relative to a sampling frequency f_2 of a second waveform 202. A symbol interval is expressed by $T_s = 5\Delta t_2$. Each sample 240 to 244 corresponds to a phase shift that is greater than a full cycle of waveform 201, as illustrated by FIG. 3B. The orthogonality of the waveforms 201 and 202 ensures that the samples 240 to 244 are distributed uniformly around the unit circle in the complex plane, as shown in FIG. 4B. Samples 240 to 244 collected over a symbol interval T_s cancel when summed.

FIG. 4C shows a normalized complex-plane representation of samples (collected at a sampling rate $f_{sample} = f_n$) of a desired waveform having a frequency f_n. Since $f_{sample} = f_n$, the samples always occur on the same part of the unit circle in the complex plane. Thus, the samples sum constructively. In this example, the samples occur at the peaks of the desired waveform and thus, occur on the real axis in the complex plane. The number of samples N_s per symbol interval T_s is expressed by:

$$N_s = f_{sample} T_s = (f_o + nf_s)/f_s$$

The number of samples per waveform period ($1/f_n$) is 1.

Nearby waveform frequencies $f_{n\pm n'}$ can be expressed as: $f_{n\pm n'} = f_o + (n\pm n')f_s$. The number of samples per period of a nearby waveform can be expressed as:

$$N_{n\pm n'} = \frac{f_{n\pm n'}}{f_{sample}} = 1 \pm \frac{n' f_s}{(f_o + nf_s)}$$

In the complex plane, the sampled values shift by an amount:

$$\phi_{n\pm n'} = \pm \frac{n' f_s}{(f_o + nf_s)} 2\pi \text{ radians}$$

N_s samples collected throughout the symbol interval T_s are distributed uniformly on a unit circle in the normalized complex plane unless $f_{n\pm n'}$ is an integer multiple of f_n. The case in which $f_{n\pm n'} = mf_n$ (where m is some integer) can be avoided by appropriately frequency converting the received signal(s) and/or the sampling rate to ensure that the vector sum of the samples is zero.

CI codes can be used as direct-sequence codes, multicarrier codes (e.g., MC-CDMA), etc. Applications of CI codes can be extended to any application of conventional binary direct sequence codes, including, but not limited to, spread spectrum, multiple access, channel coding, encryption, and interference mitigation. CI codes may be applied across any set of orthogonal or quasi-orthogonal diversity-parameter values or subspaces.

Basic CI codes can be generated from phase relationships indicated by vector precession in the complex plane, such as shown in FIG. 4A. CI coding can be applied to circular, elliptical, and linear polarization. CI polarization codes may be based on vector precession in a two- or three-dimensional polarization plane. Advanced CI codes may be based on basic CI polarization codes. Similarly, vector rotation in a plane or a higher-dimension field of orthogonal bases may be used to generate basic and/or advanced CI codes. The basic family of CI codes is generated from an MxM matrix of elements having phases ϕ_{mn} described by:

$$\phi_{mn} = 2\pi mn/M + 2\pi f_o m/f_s M,$$

where m and n are row and column indices, respectively. M may have any positive integer value. The second term in ϕ_{mn} is an optional phase shift applied to all terms in a row. The phase-shift ϕ_{mn} may correspond to a carrier frequency offset f_o and a sub-carrier separation f_s. A basic CI code c_m of length N can include a row or column vector consisting of terms:

$$c_m = e^{im\phi'} \sum_{n=0}^{N-1} e^{imn\phi} \hat{n}$$

where $\phi = 2\pi/M$ and $\phi' = 2\pi f_o/f_s M$.

Some of the CI codes are complex-conjugate pairs. For example, correlations between CI codes are expressed by the following relationship:

$$corr_{m,m'} = \left(\frac{1}{M}\right) e^{i(m+m')\phi'} \sum_{n=o}^{M-1} e^{in(m+m')\phi}$$

The correlations are non-zero for $(m+m') = M$.

CI codes may have polyphase and/or multi-magnitude values. A CI code set may include one or more binary code vectors corresponding to at least one conventional binary-phase code. In the case where CI codes include complex-valued chips, the real and imaginary parts may be impressed upon different orthogonal parameters. For example, a magnitude corresponding to a real value may be modulated on an in-phase carrier component, whereas a corresponding imaginary value may be modulated on a quadrature-phase carrier component.

Orthogonal components may include, but are not limited to, perpendicular linear polarizations, left-hand and right-hand circular or elliptical polarizations, orthogonal polarization-spin frequencies, subspaces (e.g., spatial, directional, temporal, phase, polarization, etc.), orthogonal frequencies, orthogonal time intervals, direct-sequence codes, etc. Modulation may include phase modulation, amplitude modulation, frequency modulation, polarization modulation, time-offset modulation, or any combination thereof.

Phase shifts corresponding to CI code chips may be impressed upon a single carrier or onto multiple carriers. In one embodiment, phase shifts are impressed relative to a transmitted or locally generated reference phase. In another embodiment, differential phase modulation (DPM) is employed. In one embodiment, DPM is employed on a single carrier. In another embodiment, DPM is applied to a multicarrier transmission protocol.

In one embodiment, each phase shift is conveyed as a phase differential between at least two carriers.

CI codes may be applied to ordinary direct-sequence (e.g., DSSS or DS-CDMA), MC-CDMA, OFDM, coded OFDM, Discreet Multitone, Wavelength Division Multiplexing (WDM), ultra-dense WDM, Multi-tone CDMA, Multi-code spread spectrum, or any of the CI protocols. In the case where CI codes are used in a multicarrier transmission protocol, phase-shift coding may be accomplished in any of several ways. Each carrier may be phase shifted with respect to each chip of a CI code chip sequence. Each carrier may be modulated with respect to any single-carrier modulation scheme. Each carrier may be modulated with one or more CI code chip encoded subcarriers. Each carrier may be provided with at least two diversity parameters that are modulated to convey real and imaginary parts of CI codes chips.

Multicarrier signals may be defined by any set of substantially orthogonal diversity-parameter values. These diversity parameters may include, without limitation, frequency, phase space, polarization (including linear, circular, elliptical) in two or three dimensions, mode, code (e.g., DS and/or CI), time, any type of subspace, and any combination thereof.

Advanced CI codes can involve one or more types of processing applied to basic CI codes. Some examples of advanced CI codes include matrices resulting from processing basic CI codes with a Hadamard-Walsh matrix, matrices derived from Hadamard-Walsh/CI matrices, and expanded CI matrices based on Hadamard-Walsh matrix expansion.

The basic CI codes can be combined (with each other or with other direct-sequence codes) to form other families of polyphase and/or poly-magnitude CI codes. In any set of CI codes, the chip sequences may be truncated, appended, rearranged, concatenated, etc., to generate orthogonal or quasi-orthogonal chip sequences. Codes of similar or different lengths may be concatenated. Different chip sequences may be combined in such a way that at least one chip sequence is interleaved with chips from at least one other code.

CI code vectors may be multiplied by other code vectors including, but not limited to, direct-sequence codes, complementary codes, and/or other CI codes. Groups

of CI code chips may be modulated (scaled and/or shifted) with respect to other code chips. A CI code may be overlayed with a long code, a Hadamard-Walsh code, a Barker code, a Gold code, a Kasami code, a Golay code, a CI code, or some other code. CI coding may include multiple levels of coding wherein at least one set of code chips modulates at least one other set of code chips.

Basic CI codes form an orthonormal basis. New orthonormal bases can be generated by linearly combining CI codes of a particular length. More advanced permutations of CI codes may also be provided to form orthonormal bases. The orthonormal bases may be multiplied by code chips of other sequences, such as Hadamard-Walsh, Gold, CI, etc.

Data symbols may be mapped to CI codes to provide channel coding. For the purpose of mapping, bi-orthogonal CI codes may be generated by including a code set multiplied by the value –1. CI codes may be used to generate trans-orthogonal (e.g., simplex) codes. Quasi-orthogonal mapping may be performed by phase shifting or scaling the CI codes. A second set of orthogonal CI codes may be generated by rotating the phase of a first code set by $\pi/2$, thus providing in-phase and quadrature CI codes.

CI-coded symbols may be decoded by correlating a coded signal with a complex-conjugate code. A received signal may be processed with an FIR filter having coefficients set appropriately to decode a desired signal. The received signal may be sampled and summed. Optionally, samples of the received signal may be weighted prior to being summed to compensate for any of various effects, such as channel distortions, transmitter-side encoding (e.g., to reduce PAPR), jamming, etc. Weighting may be performed with respect to one or more optimization processes in which weights are adjusted with respect to at least one measurement, such as signal to noise, signal to noise plus interference, probability of error, BER, received signal power, etc.

The received signal may be phase shifted with respect to chip phases of a decoding signal. If a received signal includes multiple samples per chip interval, the chip samples may be time shifted with respect to the chip phases of the decoding signal. The samples corresponding to each chip may be cyclically shifted with respect to a decode chip sequence. Subsequent processing, such as sampling, adding, comparison, and/or

decision making (hard and/or soft) may be performed to evaluate data symbols measured after the decoding process.

FIG. 5A shows a set of 16 octonary code vectors C(n) resulting from multiplying an 8x8 basic CI code matrix CI_{8x8} by rows of an 8x8 Hadamard-Walsh matrix HW_{8x8}. An 8x8 matrix resulting from a product of a matrix CI_{8x8} by a row of matrix HW_{8x8} includes two binary-phase 8-chip codes (which correspond to rows of matrix HW_{8x8}), two quaternary-phase code vectors, and four octonary-phase code vectors including two complex-conjugate pairs. The 16 code vectors C(n) are selected from octonary-phase vectors in matrices resulting from products of vectors of HW_{8x8} with CI code matrix CI_{8x8}.

FIG. 5B shows auto correlations and cross correlations of the 16 octonary codes C(n) shown in FIG. 5A. The correlation relationships may be used to choose orthogonal or quasi-orthogonal code sets from the codes C(n). For example, the codes C(1), C(1)*, C(2), C(2)*, C(4), C(4)*, C(7), and C(7)* form an orthogonal eight-code set. The code pair {C(1), C(1)*} has zero cross correlation with C(2), C(2)*, C(4), $C(4)^*$, C(7), and $C(7)^*$ and thus, can be used with these codes to provide orthogonal code sets. Code C(1) has a non-zero cross correlation with codes $C(1)^*$, C(5), and $C(6)^*$. Thus, an orthogonal set may include codes C(1) and C(5), and exclude codes $C(1)^*$ and $C(6)^*$. The codes C(3), $C(3)^*$, C(5), $C(5)^*$, C(6), $C(6)^*$, C(7), and $C(7)^*$ form another orthogonal eight-code set. Codes C(7), C(3), C(8), C(4), C(1), C(5), C(2), and C(6) form yet another orthogonal eight-code set. Many other code sets, including quasi-orthogonal codes, are possible.

Orthogonal and quasi-orthogonal code sets may be implemented separately or simultaneously. Code sets may include combinations of different M-ary polyphase codes. An M-ary code set may include codes with a code length (i.e., number of code chips) that is less than or greater than M. Code sets may include numbers of codes that are less than or greater than the code lengths. Code sets may include same-length and/or different-length codes.

Although basic CI codes and one family of advanced CI codes are described herein, many other implementations of coding based on CI are clearly anticipated. CI code sets may be selected or manipulated to provide cross-correlation values that are shifted by $\pi/2$. CI codes may be used to generate bi-orthogonal and/or trans-orthogonal

CI code sets. CI codes may include linear combinations of other CI codes. CI codes may be derived from Hadamard-Walsh matrix expansion, code concatenation, code interleaving, code superposition, and/or weighted code superposition wherein weights are applied to one or more code chips. A CI code may include at least one set of CI matrix elements, such as a row, a column, a diagonal, and/or matrix elements selected with respect to some predetermined pattern.

CI code chips may be cyclically shifted, swapped, or otherwise re-ordered. CI codes may be implemented as multi-level codes with one or more codes that are not necessarily CI codes. Multiple codes including at least one CI code may be interleaved. CI codes may be interleaved with same length or different length codes. CI codes may be implemented in block coding, convolutional coding, turbo coding, any other form of channel coding, encryption, multiple-access coding, spread-spectrum coding, peak-power mitigation, etc. CI codes may be implemented with orthogonal coding, quasi-orthogonal coding, bi-orthogonal coding, trans-orthogonal coding, or any combination thereof.

CI codes may be generated by convolving at least one set of CI codes with at least one other set of codes, including one or more of the following: CI codes, binary direct-sequence codes, channel codes, spreading codes, multiple-access codes, etc. CI codes may be provided with one or more parity-check symbols formed from linear combinations of data symbols and/or code chips.

FIG. 6A illustrates basic components of a CI-code generator 603. A CI-symbol generator 609 generates a plurality of CI symbols that are coupled to a symbol combiner 610. The symbol combiner 610 groups the CI symbols to generate one or more CI codes.

A CI-symbol generator, such as the CI-symbol generator 609, includes any algorithm, system, or device adapted to generate a plurality of CI symbols. CI symbols may include basic CI symbols. CI symbols may be discreet-valued or continuous-valued numbers or functions. CI symbols may be values derived from at least one invertible transform function, such as a Fourier transform, a Laplace transform, a Walsh transform, a wavelet transform, etc. CI symbols may include linear combinations of other CI symbols, linear combinations of CI symbols with other code symbols, CI symbols modulated with code sequences from a predetermined code set including one or more of the following: spread-spectrum codes, multiple-access codes, channel codes, encryption

codes, multi-level codes, compression codes, hybrid codes, invertible-transform codes, and CI codes.

A CI symbol combiner, such as the symbol combiner 610, includes any algorithm, system, or device adapted to group CI symbols to generate at least one CI chip sequence. A symbol combiner may append, concatenate, interleave, shift, puncture, or re-order one or more symbol sets. A symbol combiner may combine CI symbols with other symbols. A symbol combiner may provide a CI chips sequence with at least one parity-check symbol.

FIG. 6B illustrates a CI transmitter adapted to generate at least one CI-coded information signal. A CI encoder 600 encodes at least one input information signal relative to at least one CI code produced by a CI code generator 603. CI coded information signals are optionally coupled to a transmission system 602 that may include a pre-transmission processor (not shown).

FIG. 6C illustrates basic components of a CI decoder that include a CI code generator 603 and a coherent combiner 605 adapted to decode at least one CI-encoded signal with respect to at least one code generated by the CI code generator 603. Optionally, the decoder may be coupled to a front-end receiver processor 604 that provides the at least one CI-encoded signal to the decoder.

Channel coding provides signal transformations that are designed to improve communication performance by enabling transmitted signals to better withstand the effects of various channel impairments (e.g., noise, fading, interference). CI channel coding may include waveform coding and/or structured sequences. CI waveform coding (such as M-ary signaling, orthogonal coding, bi-orthogonal coding, trans-orthogonal coding, etc.) transforms waveforms to make them less subject to error. CI-structured sequences transform a data sequence into one or more sequences having structured redundancy. Redundant bits are used for detecting and/or correcting errors.

CI coding may include replacing a data set with an orthogonal codeword set. In one embodiment, a CI coder may multiplex multiple coded data symbols together by providing an orthogonal codeword set. A CI codeword set may be selected in which each codeword vector has zero projection onto all other CI codeword vectors except for its complex conjugate. A decoder may include multiple matched filters (or equivalent

systems or algorithms) that output zero unless a corresponding encoded data symbol is received.

FIG. 7 illustrates a relationship between CI symbol values w_n and data symbols s_n. CI code chip values are arranged in columns with respect to phase spaces, such as phase space (column) 701. A phase space may be analogous to a pulse position. The phase spaces (e.g., pulse positions) may be orthogonal or quasi-orthogonal. Thus, the number of CI symbols w_n may differ from the maximum number of data symbols s_n. Each data symbol value s_n is impressed upon a phase space such that each set of CI code chip values in that phase space expresses the value of the corresponding data symbol s_n. Each code chip value is analogous to a complex weight applied to a particular CI carrier. A superposition of these carriers produces a CI waveform (e.g., pulse) bearing the data symbol value s_n.

A CI superposition waveform bearing multiple data-symbol/pulse-position characteristics can be created by applying weights to CI carriers that correspond to sums of carrier weights for each data-symbol/pulse-position. Similarly, each CI symbol, such as symbol w_2, corresponds to a summed row of data-bearing CI code chips, such as row 703. The code chips may be transmitted over multiple time intervals, carrier frequencies, polarizations, and/or other orthogonal diversity parameter values.

Decoding may include any appropriate inverse of the coding operation represented by FIG. 7. For example, to extract an nth data-symbol value s_n from a vector of received CI symbol values $\boldsymbol{w}$, the complex conjugate of a vector of the nth phase space (or CI code) values $\underline{w_n}$ may be correlated with the received CI symbol vector $\boldsymbol{w}$. Equivalent decoding processes may be performed. The decoding process may be performed with respect to one or more combining techniques, such as, but not limited to, MMSE, EGC, maximum likelihood combining, or any combination thereof. Decoding may include turbo decoding.

FIG. 8A illustrates basic components of a CI coding system and a CI decoding system. A data symbol stream 801 is processed by a CI symbol generator 820 that outputs a plurality of CI symbol values w_n representing a coded version of the data symbols s_n. The symbols w_n may be interleaved by an optional interleaver 804 prior to being prepared for transmission into a communication channel 899 by a pre-transmission processor (not

shown) in a transmission system 805. The symbols w_n are typically multiplexed onto one or more diversity-parameter spaces prior to transmission.

A receiver system 806 couples transmitted signals from the channel 899, and a front-end receiver processor (not shown) performs any necessary processing, such as filtering, amplification, demultiplexing, de-spreading, decoding, and/or beam forming, prior to outputting an IF or baseband digital signal. Optionally, channel compensation 807 may be performed to mitigate effects of channel distortion and/or interference. Any necessary de-interleaving processes 808 may be performed prior to processing by a CI symbol decoder 830. The decoder 830 processes received CI symbols w'_n to produce data-symbol estimates 801'. The data-symbol estimates 801' may be output to additional signal-processing systems (not shown).

The CI Symbol Generator 820 converts a predetermined number of input data symbols s_n to a plurality of CI code symbols w_n. This conversion may involve summing information-modulated CI code chips. A first step in a CI symbol generation process may include generating code chips and/or acquiring code chips stored in memory or received from an input data stream. Code chips may be generated from a reduced set (e.g., an orthonormal basis) of code chips or code vectors.

A second step in a CI symbol generation process involves impressing at least one data symbol s_n onto at least one set of code chips. The code chips may be multiplied, phase shifted, modulated, or otherwise impressed with data symbol values s_n. The code chips may represent a phase space, such as a pulse position. Optionally, the code chips may be provided with phase offsets, such as for crest-factor reduction or encryption.

A third step in a CI symbol generation process involves combining the code chips to produce one or more CI code symbols w_n. FIG. 7 illustrates how rows of information-modulated CI code chips are summed to produce CI code symbols w_n. Predistortion may be provided applying channel-compensation weights to the CI code symbols w_n.

The decoder 830 processes received CI symbols w'_n to produce data-symbol estimates 801'. A first step in a CI decoding method includes generating code chips and/or acquiring code chips stored in memory or received from an input data stream. Code chips may be generated from a set of orthonormal codes or a subset of chips comprising one or more orthonormal codes.

A second step in a CI signal processing method includes combining or correlating at least one vector of the code chips with a vector of the received data symbols w'_n. A correlation process may include a scalar multiplication between the code chip vector and the received data symbol vector followed by combining (e.g., integrating) the products. Another embodiment of correlation includes adding together selected samples over a predetermined symbol interval T_s. Additional processing may be performed to produce estimates of the transmitted data symbols.

The decoder 830 may perform various types of combining, such as weighted combining as part of an MMSE, EGC, maximal likelihood, or any other performance-based optimization process. The decoder 830 may perform channel compensation. The decoder 830 may include a front-end receiver processor (not shown).

The bandwidth requirements for bi-orthogonal CI codes are half of the requirements for comparable orthogonal codes. Bi-orthogonal codes have slightly better performance over orthogonal codes because antipodal signal vectors have better distance properties than orthogonal signals. Trans-orthogonal (e.g., simplex) codes, when compared to orthogonal and bi-orthogonal codes, require the minimum SNR for a particular symbol error rate. Channel codes may be overlaid onto multiple-access codes. Depending on the processing gain of the multiple-access codes, channel coding may not require additional bandwidth.

FIG. 8B shows a system diagram of a CI transceiver. An information source 851 provides data symbols to a CI coder/interleaver 852. A modulator 853 modulates the coded symbols onto one or more carriers that are transmitted by a transmitter 805 into a communication channel 899. The channel 899 may be characterized by AWGN and/or multipath. Other channel distortions may be considered. A receiver 806 couples the transmitted signals out of the channel 899. A demodulator 863 retrieves symbols from the received signal. A CI decoder/de-interleaver 862 decodes (and de-interleaves, if necessary) the received symbols into information symbols that are optionally processed in an information processor or sink 861.

In one embodiment, the coder 852 maps data symbols to CI code words using a look-up table. In another embodiment, the CI code words are generated with respect to each data symbol. Codeword generation may be performed with a CI code generation

matrix G. CI codes of a given set of CI code words may be constructed from a combination of linearly independent code vectors that form the CI code generation matrix G.

Although code generation is described with respect to basic CI codes, orthonormal basis vectors and a corresponding CI code generation matrix may be constructed for advanced CI codes. Each code in a basic CI code set can be defined by a different number of full rotations in the complex plain. For example, an orthonormal basis for a set of $N = 64$ basic CI codes can be defined by the CI code generation matrix:

$$G = \begin{bmatrix} C(rotations = 1) \\ C(rotations = 2) \\ C(rotations = 4) \\ C(rotations = 8) \\ C(rotations = 16) \\ C(rotations = 32) \end{bmatrix}$$

where $C(rotations = m)$, $m = 0,1,\ldots,N\text{-}1$, is a code vector corresponding to:

$$C(m) = e^{im\phi'}\left(1, e^{im\phi}, e^{i2m\phi}, \ldots, e^{i(N-1)m\phi}\right)$$

Since this basic CI code set is totally defined by G, the coder 852 needs to store only k rows of G instead of 2^k vectors of the CI code matrix. Furthermore, since the first half of each row vector $C(m)$ of G is the same as the second half (except $C(1)$'s first and second halves differ by a factor of -1), the coder 852 and decoder 862 need only store one half of each row vector $C(m)$.

A CI receiver may perform error detection using any of several techniques. Symmetry relationships between the first and second halves of a received code can be exploited to determine whether an error occurred. Other relationships between code symbols may be used to provide error detection and/or correction. For example, adjacent CI code symbols (except for the all-ones code) are typically not identical. Depending on the code, the values of adjacent code symbols change in a predetermined way. For example, adjacent code chips of an mth basic code $C(m)$ differ by $e^{im\phi}$.

A parity-check matrix H (defined by the equation, $GH^T = 0$) can be used to test whether a received vector is a member of a codeword set. The decoder 862, upon detecting an error, may perform forward error correction and/or request a retransmission.

Preferably, the decoder 862 estimates the transmitted code vector using some optimizing strategy, such as the maximum-likelihood algorithm. The receiver may erase ambiguous signals. The decoder 862 may implement error correction to correct erasures and/or errors.

It is preferable that the coder 852 select codes that maximize the Hamming distance between codes. An advantage of using polyphase codes is that they provide a superior Hamming distance compared to binary codes. For example, $(n,k) = (8,3)$ binary code has an n-tuple space of $2^n = 2^8 = 256$ binary words, of which $2^k = 2^3 = 8$ are code words. An octonary-phase ($m = 8$) (8,3) code has an n-tuple space of $2^{mn} = 2^{64}$ octonary words. The fraction of words that are code words decreases dramatically with increasing values of m. When a small fraction of the n-tuple space is used for code words, a large Hamming distance can be created.

CI codes may be processed as cyclic codes, which are described in many prior-art references, such as B. Sklar, Digital Communications, Fundamentals and Applications, Prentice-Hall, Inc., New Jersey, 1988. For example, components of a CI code vector $C = (C_0, C_1,\ldots, C_{N-1})$ can be treated as coefficients of a polynomial U(X), as follows:

$$U(X) = u_0 + u_1 X + u_2 X^2 + \ldots + u_{N-1} X^{N-1}$$

where $X = e^{i2\pi mk/N}$, where k is the order of the code: $k = 0,1,\ldots,$N-1. Well-known cyclic code processing may then be performed.

4. CI Networks

FIG. 9A illustrates a tree network that may be implemented in aspects of the present invention. Transmissions passed to one or more nodes in the network may be branched off, or routed, to a plurality of nodes. Routing may include processing any combination of network addresses conveyed in headers and network addresses conveyed by codes (e.g., spreading codes, multiple-access codes, channel codes, etc.).

Network addresses may provide routing information and/or directions. For example, multiple addresses may convey one or more paths between a source node and a destination node. Various types of control information may be included in a code. For example, certain codes may convey priority information, identify the type of data payload, and/or otherwise tag the transmission.

FIG. 9B illustrates a network design that permits a plurality of communication paths to each node. Multiple network connections between a source node and a destination node may be provided for redundancy. Alternatively, each path may be selected based on one or more criteria, such as channel conditions and load balancing.

FIG. 9C illustrates a network design adapted to provide array processing performance advantages. A plurality of nodes 926, 927, 902, 920, 921, and 922 are adapted to provide complex-weighted transmissions to at least one destination node, such as nodes 931 and 932. For example, a data sequence addressed to node 931 is routed to nodes 926, 927, 902, 920, 921, and 922, which provide appropriate weights to the data transmission to generate a phase front 941 that converges at the destination node 931. Similarly, appropriate delays or complex weights may be provided to transmissions to produce a coherent phase front 942 that converges at destination node 932. Signals received by the nodes 926, 927, 902, 920, 921, and 922 may be combined with respect to any combining technique, including optimal combining.

Nodes in a wireless network may generate weighted transmissions (or process received signals) to perform various types of array processing. Individual nodes may include one or more transceiver (e.g., antenna) elements. Array-processing operations may include combinations of local and global processing. For example, diversity combining may be performed at each multi-element node and signals from each node may be combined in a central processor to perform sub-space (i.e., directional) processing. Other combinations of local and global processing may be employed.

Array processing may include space-time processing, space-frequency processing, beam forming, null steering, blind-adaptive processing, long baseline interferometry, frequency-diversity interferometry, etc. Array processing may be performed to achieve any combination of sub-space processing (i.e., increased capacity) and diversity benefits (i.e., improved performance). Selection of transmitting and receiving nodes in an array-processing network can be adapted to changing node positions, network loads, throughput requirements, user services, bandwidth availability, frequency-reuse requirements, channel conditions, etc.

FIG. 9D illustrates a concentric ring network configuration in which a base station 900 or access point provides direct or indirect communication links to a plurality of

subscriber units 901 to 935 arranged in a plurality of concentric-ring regions 951 to 953. Subscriber units 901 to 906 in region 951 are adapted to route signals to one or more subscriber units 921 to 935 in one or more regions, such as region 953. Similarly, subscriber units 911 to 918 in region 952 may be adapted to route signals to subscribers in other regions. In some applications, one or more subscribers may be adapted to route signals to at least one other subscriber in the same region.

Region shapes and sizes may be adapted to numbers of users and/or the geographical distributions of the users. Similarly, regions may be adapted to balance network loads. For example, subscriber power consumption and processing requirements associated with routing signals through subscribers near the base 900 can be mitigated by distributing routing operations over a larger number of subscribers. Thus, subscribers in regions 951 and 952 perform routing associated with a direct transmission from and/or to the base 900. Similarly, the number of subscribers in primary arteries of tree networks (or other networks) can be increased. Routing functions can be assigned to subscribers based on subscriber location, subscriber load, channel conditions, and network load. The network configuration illustrated in FIG. 9D may be integrated with other network architectures, such as tree configurations, or otherwise adapted to geographical distributions of subscribers and other network transceivers.

FIG. 9E illustrates a network configuration adapted to the geographic distribution of a plurality of subscribers 921 to 926 and 931 to 936 located along a roadway. In this case, there are two routing paths 961 and 962 provided by subscriber routing. Network configurations, including transmission paths, may be adapted to subscriber distributions and channel conditions. For example, urban channel environments are typically characterized by a waveguide grid. Thus, routing paths may be provided with a grid architecture in urban areas.

A transmission may include multiple levels of coding intended to be stripped off at each node along a predetermined path to a particular address. FIG. 9F illustrates three nodes 901, 902, and 904. The first node is adapted to decode a one-rotation basic CI code by applying complex-conjugate decoding of the one-rotation code. A basic CI code c_m characterized by m rotations ($m < N$) is expressed by the following equation:

$$c_m = e^{im\phi'} \sum_{n=0}^{N-1} e^{imn2\pi/N} \hat{n}$$

The complex-conjugate decoding essentially unwinds the code. Similarly, nodes 902 and 904 are adapted to decode two-rotation and four-rotation codes, respectively. For simplicity, the rotations are provided in a common predetermined direction.

In one aspect of the invention, each node splits a received signal into at least two signals. At least one of the split signals is decoded at the node to extract any information intended for that node. A node may be associated with one or more addresses, or codes. At least one split signal is passed through the node without any decoding. Thus, node 901 receives signals coded (or addressed) with one code rotation, node 902 receives signals coded (or addressed) with two code rotations, etc.

In another aspect of the invention, a signal input to a node is not split prior to being decoded to extract any signals intended for that node. The decoded signal is then re-encoded with respect to the complex conjugate of the decoding operation. Thus, any unwinding associated with decoding is reversed prior to re-transmission of the coded information signal. Optionally, a node transceiver may cancel or otherwise remove signals addressed to itself prior to re-encoding.

In yet another aspect of the invention, coded transmissions are coded with respect to the intended path(s) to a predetermined address, thus obviating the need for splitting or re-encoding. For example, an information signal addressed to nodes 902 and 904 input to the first node 901 is encoded with a pair of basic CI codes having three rotations and seven rotations, respectively:

$$r_{node901} = \sum_{n=0}^{N-1} \left(s_2(t) e^{i3n2\pi/N} + s_4(t) e^{i7n2\pi/N} \right) \hat{n}$$

Decoding at the first node 901 unwinds the coded signals by one rotation. The decode signal is characterized by C*(1), which is the complex conjugate of code C(1). Thus, node 901 passes a coded information signal to node 902 expressed by two-rotation and six-rotation codes:

$$r_{node902} = \sum_{n=0}^{N-1} \left(s_2(t) e^{i2n2\pi/N} + s_4(t) e^{i6n2\pi/N} \right) \hat{n}$$

A sum of the decoded chips yields zero because there are no input signals coded with a single-rotation code. A sum of the chips generated at node 901 is zero because the non-zero rotations cause the chip values to cancel.

Decoding with decode signal C*(2) at node 902 unwinds the coded signals by two rotations. Thus, a sum of the decoded signal at node 902 coherently combines chip values associated with signal $s_2(t)$ and cancels chip values associated with signal $s_4(t)$. Node 902 produces a coded information signal expressed by:

$$r_{node904} = \sum_{n=0}^{N-1} \left(s_2(t) + s_4(t) e^{i4n2\pi/N} \right) \hat{n}$$

The values $s_2(t)$ may optionally be removed (such as by cancellation, dc-offset removal, etc.) prior to transmission to node 904. A node transceiver at node 902 may ensure non-zero chip values prior to transmission.

Coded signals received by node 904 are processed with a complex-conjugate code C*(4) that unwinds the coded signal by four rotations. The resulting decoded signal is expressed by:

$$r_{node904'} = \sum_{n=0}^{N-1} s_4(t) \hat{n}$$

Decoding and summing the code chips at node 904 coherently combines signal values $s_4(t)$ associated with a four-rotation code C(4).

FIG. 9G illustrates a simple tree-style CI-based network. Nodes 901, 902, and 904 are provided with decode signals corresponding to C*(1), C*(2), and C*(4), respectively. A branch node 903 employs a decode signal C*(3) adapted to decode signals characterized by three rotations in a predetermined direction. A signal addressed with basic CI codes corresponding to rotations of seven, three, and six are input to node 901. Signals output by node 901 to node 902 correspond to rotations of six, two, and five. Node 902 provides a decode signal of C*(2) to its input signal. Thus, the input corresponding to two rotations is decoded and the resulting value is processed at the node 902. The resulting output signal(s) from node 902 is expressed by rotations as four, zero, three. The zero value may characterize a substantially null signal resulting from cancellation of the decoded signal at node 902.

Node 902 may provide a broadcast signal to nodes 903 and 904. Alternatively, node 902 may duplicate the signal four, zero, three and provide a signal to each of the nodes 903 and 904. In some cases, node 902 may be adapted to separate its input signal into a plurality of components relative to addresses. Each component may be forwarded directly to its intended node. In some cases, separate signals may be provided via beam forming. In other cases, some form of multiple access, including header addresses, may be employed.

FIG. 9H illustrates a simple multipath CI-based network. Node 902 is provided with coded signals (expressed in rotations as 2,5,6,3,4). The value two is addressed to node 902. The values five and six are addressed to nodes 903 and 904. A fourth node 906 receives transmissions from nodes 903 and 904. Thus, values three and four characterize paths through nodes 903 and 904, respectively, that are addressed to node 906. Signals received and decoded at node 906 may be combined coherently. Such combining may include optimal combining.

In some aspects of the invention, node 906 may be provided with additional decode values (e.g., C*(5)) to enhance reception. Furthermore, two or more decode values (e.g., C*(6) and C*(5)) may be exploited in appropriate combinations to provide beam forming (or equivalent array processing) operations. Various combining operations may be performed to provide any combination of interference rejection, diversity enhancement, and sub-space processing (i.e., capacity enhancement).

FIG. 9I illustrates a plurality of nodes 901 to 905 and at least two communication paths. A first communication path includes nodes 902, 904 and 905. A second communication path includes nodes 901, 903, and 905. In this case, the two paths illustrate communication to node 5. Alternatively communication paths may be provided indicating communications from node 905.

Signals arriving from the first communication path are encoded with at least one code $c_1(n)$. Similarly, the signals arriving from the second communication path are encoded with at least one code $c_2(n)$. In various applications of the invention, additional communication paths (not shown) may be provided.

The codes $c_1(n)$ and $c_2(n)$ may be address codes or they may include address codes. The codes $c_1(n)$ and $c_2(n)$ may be similar or different. Alternatively, the codes

$c_1(n)$ and $c_2(n)$ may be separate (or different) from address codes. In some cases, address codes may be adapted to provide additional coding or achieve other objectives, such as, but not limited to, encryption, verification, authentication, identification, anti-jamming, and/or diversity benefits.

In one set of embodiments of the invention, redundant information signals or signals providing redundant information are routed along the multiple paths to the destination node 905. This can provide diversity benefits. The codes $c_1(n)$ and $c_2(n)$ may include similar or different channel codes. Signals provided along the multiple paths may be decoded (if necessary) and coherently combined in a receiver at the node 905. Combining may include one or more optimal-combining techniques. The number of transmission paths that are coherently combined is proportional to an effective processing gain of the combining process. Consequently, low-power information-bearing transmissions may be employed over the multiple transmission paths. Signals received from different paths may be processed via soft-decision processing to provide confidence measurements for symbol estimates and/or enhance channel compensation and/or iterative decoding.

In another set of embodiments, each of a plurality of signals routed along different paths to a given node may provide necessary keys (or equivalent information) necessary for decoding. For example, signals routed along a first path may provide a coded information signal to a predetermined destination. Signals routed along a second path to the same destination may provide a decode sequence to decode the coded information signal. The codes $c_1(n)$ and $c_2(n)$ may include codes that are complex conjugates of each other. The first code $c_1(n)$ may include a public key and the second code $c_2(n)$ may include a private key wherein the two codes $c_1(n)$ and $c_2(n)$ contribute the necessary code keys for decoding a coded information signal transmitted along the first and/or second paths, or along a third path. Various pluralities of codes, paths, and/or coded information signals may be employed.

The process of providing multiple decoder keys across multiple transmission paths may be part of an authentication and/or verification process. The codes $c_1(n)$ and $c_2(n)$ may include channel-specific codes that characterize the channel between at least one transceiver and the destination node 905. The codes $c_1(n)$ and $c_2(n)$ may include

channel compensation. Consequently, a channel analysis of received signals at the destination node 905 will indicate the likelihood that the signals were transmitted from known nodes, such as nodes 903 and 904. Similarly, channel analysis may be employed to determine the local source node of a given transmission. The codes $c_1(n)$ and $c_2(n)$ may include beam-forming weights.

In some aspects of the invention, channel estimation may be performed on a signal received from a transceiver attempting to access the network. Various location-finding processes (e.g., direction-of-arrival determination, geo-location tracking, triangulation, etc.) may be implemented to determine the transceiver's location relative to a set or range of allowed locations. In some applications, identification of unauthorized users may be combined with location finding.

FIG. 9J illustrates a node 902 used in a plurality of crossing communication paths. Nodes 901, 902, and 904 are part of a first communication path. Nodes 911, 902, and 913 are part of a second communication path characterized by at least one unique diversity parameter value. In this case, the communication paths are distinguished by different carrier frequencies. Alternatively, communication paths may be differentiated by code, polarization, subspace, time, phase, subspace, or any combination thereof.

Although basic CI codes are illustrated in the exemplary network architectures, other types of codes (including, but not limited to, complex CI codes, Walsh codes, multi-code sets, multi-level (or stacked) codes, and/or codes derived from invertible transforms) may be implemented in the examples shown, as well as in variations, adaptations, permutations, and combinations of the exemplary network architectures. Network address codes may be employed for one or more additional functions, including, but not limited to, spread spectrum, multiple access, channel coding, and encryption. Network designs shown in the figures and described in the specification are intended to convey basic principles and various aspects of the invention. These network designs do not limit the scope of the invention. Consequently, various network designs may be considered as building blocks for complex network architectures.

Network designs and other aspects of the invention may be combined with prior-art network designs, systems, devices, protocols, formats, and/or methods. Such combinations are clearly anticipated and suggested. Aspects and embodiments of the

invention may serve as portions of networks. Network designs, systems, and/or methods of the invention may be adapted to various types of networks, such as long-haul, short-haul, last-mile, local-area, metropolitan-area, sensor, RF-identification, tracking, ad-hoc, mobile radio, personal communication, cellular, airborne, air-ground, and/or satellite networks. Network architectures of the invention may include one or more types of multiple access. Network architectures of the invention may include any combination of addressing, including address codes and packet headers containing addresses.

FIG. 10A illustrates a multi-level cellular architecture that may be employed by systems and methods of the present invention. At least one macro-cell 1021 is subdivided into one or more micro-cells 1031. Various multiple-access techniques may be used to separate communications in different cells. For example, a predetermined code may be provided to transmissions within the macro-cell 1021. Macro-cell codes may be provided for inter-cell multiple access or radio isolation. Micro-cell codes may be provided for intra-cell multiple access. Codes applied to transmissions may implement additional network functions, such as spread spectrum, encryption, authentication, channel coding, addressing, and/or interference mitigation.

In some applications, multi-level codes may be implemented. In some cases, macro-cell codes may provide greater processing gain than the micro-cell codes. For example, macro-cell codes may consist of long codes and micro-cell codes may consist of shorter channel codes and/or multiple-access codes. Either or both micro-cell codes and macro-cell codes may implement CI and/or CI-based coding. Coding may be implemented with, or as part of, array processing.

FIG. 10B illustrates three cells 1021 to 1023 in a cellular network of the present invention. Each cell 1021 to 1023 employs a different long code C_{L1} to C_{L3}, respectively, to differentiate between communications in adjacent cells. Each cell 1021 to 1023 provides intra-cell communications with codes $C_{s1\text{-}N}$ to differentiate between subscriber units in each cell. Coding may include CI and/or CI-based codes. Additional multiple-access techniques may be employed to provide for inter-cell and intra-cell multiple access.

FIG. 10C shows a cellular architecture of the present invention that includes a plurality of cells 1021 to 1025 and a plurality of base stations 1001 to 1005 located on

cell boundaries. The base stations 1001 to 1005 may include spatially sectorized antennas to provide communication to a plurality of cells. For example, base 1002 may be adapted to service users in cells 1021, 1022, and 1023.

The base stations 1001 to 1005 may be adapted to route coded information across multiple cells. For example, coded data and/or control information is routed from base 1002 to base 1003. A coded signal may be duplicated or decomposed for routing to multiple bases or subscriber units. For example, base 1003 transmits coded information to bases 1004 and 1005. In some applications, subscriber units, such as subscriber units 1011 and 1012 may be employed to route information between two or more base stations. In any of the implementations of the invention, transmission paths through a network may be selected based on one or more criteria, including transceiver availability, transceiver locations, network loads, channel conditions, transmission-power requirements, etc.

FIG. 10D illustrates a cellular network of the invention including a plurality of cells 1021 to 1030, a plurality of base stations 1000 to 1009, and a plurality of subscriber units, such as subscriber units 1061 to 1063 and 1071 to 1073. In this case, the bases 1000 to 1009 are located inside each cell 1021 to 1030. Other cellular architectures may be employed.

A base station (e.g., base 1000) may route information directly to other bases (e.g., bases 1001, 1002, 1004, 1005, and 1006). Such direct transmissions paths are indicated by transmission paths 1041 to 1045. A direct transmission path 1046 may be provided to a base (such as base 1009) that is not adjacent to the originating base 1000. A transmission between bases may be routed through intermediate bases. For example, base 1005 acts as a router for transmissions between base 1000 and bases 1007 and 1008. Similarly, subscriber units (such as subscriber units 1071 and 1072 may be employed as routers for communications between bases (e.g., bases 1000 and 1003), between subscribers, and/or between bases and subscribers.

5. CI Routing Systems

FIG. 11A illustrates a CI transceiver adapted to perform routing. Transmitted signals are received by a receiver system 1101 that outputs a baseband or IF signal. The receiver system 1101 performs RF and (optionally) baseband processes typically

performed to convert an RF signal to a baseband or intermediate frequency signal. For example, the receiver system 1101 may perform channel selection, filtering, amplification, frequency conversion, and A/D conversion.

A CI decoder 1102 is adapted to decode the baseband signal relative to one or more address codes intended for the transceiver. The decoder 1102 may select a signal relative to an address in a header prior to decoding. A signal processor 1103 may process the decoded signals prior to producing an output data stream. Signal processing may include one or more signal-processing operations, including, but not limited to, quantization, channel decoding, multiple access decoding, demultiplexing, formatting, demodulation, channel estimation, channel compensation, synchronization, filtering, error detection, error correction, signal-quality analysis, multi-user detection, phase-jitter compensation, frequency-offset correction, time-offset correction, etc.

A control system 1104 is adapted to select, adapt, or otherwise control the operation of one or more transceiver components. For example, channel estimates and/or signal-quality analysis performed by the signal processor 1103 may be processed in the control system 1104 to adapt decoding performed by the decoder 1102. The control system 1104 may provide power-control information to the transmission system 1106. For example, power control may include mitigating the effects of near-far interference. Channel selection may also be performed to mitigate near-far interference. The control system 1104 may provide other types of network control. For example, CI coding may be adapted by the control system 1104.

A CI coder 1105 is adapted to process input data bits to produce a coded signal that is coupled to a transmission system 1106. The transmission system 1106 performs signal-processing operations typically performed to prepare a baseband signal for transmission into a communication channel. The transmission system 1106 may perform one or more processes, including, but not limited to, D/A conversion, modulation, filtering, amplification, frequency conversion, beam forming, etc.

Signals from the receiver system 1101 are coupled to a CI decoder 1112, which may include a bank of CI decoders. The decoder 1112 decodes received signals that are to be retransmitted. The decoded signals are processed in a signal processor 1113. The signal processor 1113 may perform similar signal-processing operations as signal

processor 1103. Additionally, the signal processor 1113 may perform duplication, addressing, signal removal, information insertion, re-routing functions, and/or transmitter 1106 control. Furthermore, the signal processor 1113 may perform pre-processing operations prior to coding in a CI coder 1115. The coder 1115 may include a CI coder bank. A control system 1114 is adapted to select, adapt, or otherwise control the operation of one or more of the transceiver components 1112, 1113, and 1115.

The control system 1114 and the coder 1115 may provide channel-compensation and/or beam-forming weights to the coded symbols. Such weights may be regarded as part of the routing process. Since routing decodes some signals that are not intended for the transceiver, the router components 1112, 1113, 1114, and 1115 are isolated from the rest of the transceiver by a fire wall 1110.

Code division duplexing or cancellation division duplexing may be employed to permit reliable reception while concurrently transmitting. Alternatively, other types of duplexing may be employed. Pseudo-random time, frequency, and/or phase codes are typically used to avoid self-jamming. However, CI codes and CI-based waveforms enable the frequency-domain processing required for optimal performance in a multipath environment while providing data redundancy (i.e., channel coding) needed to mitigate errors. Optionally, additional channel coding (e.g., block, convolutional, TCM, turbo, etc.) may be provided to CI waveforms and/or CI coding.

FIG. 11B illustrates an alternative embodiment of a CI receiver adapted to perform routing. Many of the system components shown in FIG. 11B are similar to components shown in FIG. 11A and thus, are identified by corresponding reference numbers. A portion of the baseband (or IF) signal(s) produced by the receiver system 1101 is optionally processed in a processor 1119 prior to being coupled into the transmission system 1106.

The processor 1119 may perform one or more baseband or IF processes, including, but not limited to, signal shaping, filtering, re-quantization, error detection, error correction, interference mitigation, multi-user detection, amplification, up sampling, down sampling, frequency conversion, D/A conversion, AGC, symbol remapping, etc. The processor 1119 may be adapted to perform routing functions. In some applications, the processor 1119 may perform signal duplication, addressing, signal deletion, signal

insertion, signal monitoring, address adjustment, re-routing, request retransmission, update header information, and/or insert or adjust control information.

FIG. 11C illustrates a CI transceiver adapted to decode received signals intended for the transceiver and partially decode and route signals intended for one or more other transceivers. System components shown in FIG. 11C are similar to components shown in FIG. 11B, as indicated by similar reference numbers.

The CI decoder 1103 applies one or more decode signals to the received baseband signal. If the received baseband signal is coded with one or more codes including complex conjugates of the one or more decode signals, a sum of decoded baseband symbols over a code period combines coherently. The combined symbols have a value associated with one or more information signals. The combined symbols may be provided as a data output after one or more optional signal-processing operations.

Symbols generated by the CI decoder 1103 are optionally processed in processor 1119 prior to being coupled to a transmission system 1106 for re-transmission. CI-encoded signals not corresponding to complex conjugates of at least one of the decode signals (i.e., not intended for the transceiver) contribute a substantially zero value to the combined symbols. The processor 1119 may be adapted to remove one or more signal components intended for the transceiver. Since the signals intended for the transceiver provide a dc offset to the individual symbols generated by the CI decoder 1106, these signals may be removed by filtering, cancellation, or some other dc-removal process.

6. CI Routing and Control Methods

FIG. 11D illustrates a method whereby a transceiver in a network is provided with control information 1151 that includes information used to generate one or more array-processing weights 1153. Array processing 1153 may be integrated into one or more transceiving functions 1153, such as transmitting, receiving, routing, and/or relay operations.

A subscriber unit (or any other network transceiver) may be adapted to provide a directional or otherwise adaptable beam pattern. A beam pattern may be considered to include any type of array processing, including, but not limited to, space-frequency processing, space-time processing, spatial interferometry, null steering, diversity

combining, spatial sweeping, and/or direction-of-arrival processing. A network transceiver, such as a subscriber unit, may act as an antenna element in an array including other network transceivers. Thus, a network transceiver may provide one or more weights to its transmitted and/or received signals as part of a larger array-processing scheme. Similarly, each antenna element of a multi-element network transceiver may be regarded as a transceiver element in a larger array. Each transceiver element may be provided with weights as part of a larger array-processing scheme. Array processing may be performed relative to one or more operational characteristics and/or objectives.

Array processing may depend on one or more network parameters, such as relative location of each destination address, relative location of each transmission source, interference characteristics (e.g., origin of interference, time-domain characteristics, frequency-domain characteristics, polarization, power, etc.), channel characteristics (e.g., multipath, Doppler, etc.), link priority, link security, spectrum management, power control, and network loads. Array processing may depend on the locations of one or more network transceivers, such as relays, routers, access points, base stations, and other subscriber units. Array processing may be adapted relative to changing locations of other network transceivers, changing operational configurations, interference, frequency-reuse plans, channel conditions, power-control specifications, performance measurements (e.g., BER, probability of error, SNR, SNIR, etc.), subscriber services, information type, modulation, formatting, channel selection, multiple-access protocol, frequency band, channel bandwidth, as well as any other Physical Layer and/or MAC Layer configurations.

FIG. 11E illustrates a method in which individual network transceivers are adapted to perform array processing relative to local conditions. A channel-estimation step 1150 provides a characterization of the propagation environment to better optimize array processing 1152 and/or CI processing. Any combination of sub-space processing (i.e., capacity enhancement) and diversity combining (i.e., signal-quality enhancement) may be performed. Array processing 1152 may be integrated into a transceiver-operations step 1153.

FIG. 11F illustrates an array-processing method that employs at least one central processor to provide beam-forming operations across a plurality of spatially distributed

network transceivers. Signals received by the distributed network transceivers are coupled to the central processor, which performs channel estimation 1160 to characterize one or more communication channels. Various operational characteristics and/or objectives (e.g., network parameters) are evaluated 1161. The evaluation 1161 can affect calculations of array-processing weights in a step 1162 that provides control information to a plurality of network transceivers. Alternatively, the step of providing control information 1162 may include applications of array-processing weights to signals received from and/or transmitted to the network transceivers by the central processor.

FIG. 12A illustrates a method for providing CI-coded transmissions of information and control signals. The method described in FIG. 12A may be performed by a subscriber unit acting as a base station in a CI network. A CI code generation process 1201 provides CI codes and/or CI-based codes for at least one information signal and at least one control signal. A control signal may provide for one or more control functions, such as, but not limited to, power control, synchronization, code assignments, priority assignments, link assignments, channel assignments, duplexing control, training-signal generation, notice of transfer of control responsibilities, and request acknowledgement. Coding processes 1202 and 1203 encode the information signal(s) and control signal(s), respectively. A transmission process 1204 provides for transmission of the coded signals.

FIG. 12B illustrates a method for managing network control in a CI network by one or more subscriber units adapted to function as base stations. A CI transceiver acting as a base station transmits CI-coded information and control signals in a transmission step 1210. In a network identification and communication restriction step 1211, CI codes can be used, at least in part, to address the communication and control channels. CI codes can be allocated to restrict communications between transceivers permitted to operate in the network. CI codes can also be used to identify a radio network and each of the radio devices, as well as the type of communications being transmitted.

A duplexing step 1212 provides for management of transmission and reception. Various types of duplexing may be employed, such as time-division duplexing, frequency-division duplexing, code-division duplexing, polarization-division duplexing, etc. A CI transceiver may include a plurality of CI decoders in parallel to allow reception of more than one signal simultaneously. Similarly, transmission of coded signals may be

performed simultaneously with reception when the transmitted CI codes differ from the code of the received signal. Furthermore, different CI codes may be used to encode transmissions to differentiate types of transmitted signals.

A network-control step 1213 indicates that at least one of the subscriber units becomes a network control station. A network control station initiates communications and maintains power control and time synchronization of the network in the same manner that a base station would normally function. A transfer step provides for transfer of network control from at least one subscriber to at least one other subscriber. The network control station can voluntarily transfer, or be commanded to transfer, power control and time synchronization of the network to any other radio in the network.

FIG. 12C illustrates a network-control method of the present invention. A CI coding step 1221 provides different CI codes (such as may be used to spread a signal) to information and control signals. A network control station may provide time-division duplexing 1222 to regulate transmission and reception. A network-control step 1223 provides for network control by the network control station. Network control 1223 can include various operations, including, but not limited to, synchronization, power control, code assignment, channel assignments, channel coding, transmission-path selection, load balancing, and spectrum management.

FIG. 12D shows a routing method of the present invention. A coding step 1231 provides a multi-address, CI-coded signal for transmission in a transmission step 1232. The addresses may be provided by any combination of CI coding and header addressing. Transmitted signals may be routed via one or more paths through a network. A duplication step 1233 is provided when transmission paths through a node diverge. Duplicated signals are transmitted along their respective paths.

In the methods and systems of the present invention, an address may include any combination of coding and header information. A header typically includes fields that provide control information, information-processing directives, waveform identification, network identification, and/or other information for enabling and facilitating network control and information processing. Tags are typically included in a header of a transmission. An information signal may be provided with one or more tags identifying

the type of transmitted information, the amount of information, coding, number of addresses, routing information, and/or any other processing or payload information.

Header fields may include frame-sequence numbers, precedence, security, and end-of-message fields. A header may include a field indicating whether an acknowledgment is required from the destination node. Acknowledgments may be requested upon receipt, reading, and/or printing of received information. An extend field may identify whether an address is an extended network address usable when the destination node corresponding to the network address has moved from one network to another network. Information may be included in the header for forwarding a message to the other network. Information may be provided for updating routing tables maintained at a node. An end-of-routing field may be provided for indicating whether a network address is the last address in a multi-address network header. Tags and/or address information may be included in a preamble of a transmission.

FIG. 13A shows a relay method of the present invention. Received signals are decoded in a decoding step 1301 at each node. The decoding step 1301 may involve applying a code to a received signal corresponding to the complex conjugate of the node's address code. A processing step 1302 processes information signals coded with the node's address code. Processing 1302 may include summing the decoded symbols and performing hard and/or soft decisions. Information signals addressed to the node provide a dc offset to the symbols of the decoded signal. This offset may optionally be removed 1303 prior to transmitting 1305 the resulting decoded signals.

FIG. 13B illustrates an alternative embodiment of a relay method of the invention. Some of the steps in the relay method shown in FIG. 13B are similar to the steps shown in FIG. 13A, as indicated by similar reference numbers. A reverse-decoding step 1304 provided between steps 1303 and 1305 applies the complex conjugate of any codes applied to the received signals in the decoding step 1302.

FIG. 13C illustrates a transceiver processing and routing method of the invention. A decoding step 1301 processes received signals with at least one complex-conjugate code corresponding to at least one address code associated with the transceiver address and/or one or more predetermined addresses. Decoding 1301 may include one or more decoding processes, such as channel decoding, multiple-access decoding, spread-

spectrum decoding, and decryption. The decoding step 1301 may optionally include a level-detect function (not shown) to verify that a received signal is present prior to decoding.

A processing step 1302 is adapted to provide one or more signal-processing steps to the decoded signals. The processing step 1302 may estimate the values of information or control signals impressed onto address codes corresponding to one or more complex-conjugate codes provided in the decoding step 1301. For example, an adding step (not shown) may provide for coherent combining of addressed information symbols. A decision step (not shown) may follow the adding step (not shown). If any signal values are present, they may be passed to an optional error detection/correction step 1311.

Error detection/correction 1311 may employ parity checks, trellis demodulation, convolutional decoding, block decoding, and/or any other channel decoding or error-checking technique. Errors may be corrected via receiver-side processing. Alternatively, error detection may initiate a request for re-transmission. Error detection/correction 1311 may include re-quantization, channel estimation, channel compensation, predistortion of transmissions, multi-user detection, and/or optimal combining. Error detection/correction 1311 may include decision processing, including hard decisions and/or soft decisions. Decision processing may include iterative feedback processing, such as turbo decoding.

The signal values may be provided to an optional system-function step 1312. Confidence measures from soft-decision processes may be used to adapt receiver parameters (e.g., the processing step 1302), such as to optimize reception. Similarly, received control information may be used to adjust receiver parameters. System functions 1312 may include AGC, adapting filter parameters, adjusting quantization constellations, and/or changing sampling parameters. System functions may also include removing symbols or values associated with one or more predetermined addresses from the input signal values.

The signal values may be provided to an optional network-function step 1313. Network functions 1313 may be selected or adapted relative to received control information. Network functions 1313 may include routing, addressing, power control, synchronization, request re-transmission, multiple-access control, channel selection, authentication, verification, identification, link-priority assignments, load balancing,

Exhibit 1023 - Page 280 of 312

spectrum management, and/or error processing. Network functions 1313 may include adding, removing, and/or changing system control information.

Data and control information are re-encoded in a coding step 1304. Re-encoding 1304 may include the application of one or more codes, including address codes, multiple-access codes, spreading codes, channel codes, and encryption. Coded signals are processed for transmission into a communication channel in a transmission step 1305.

FIG. 13D illustrates a transceiver processing and routing method of the invention. A received signal is duplicated in a duplication step 1300. At least one duplicated signal is coupled into a decoding step 1321 that applies a complex-conjugate code to the received signal. The complex-conjugate code is related to the address code of the transceiver. The decoded signal is processed in a processing step 1322 to extract or otherwise estimate information values addressed to the transceiver.

At least one of the duplicated signals is input to a secure procedure 1310. For example, the at least one duplicated signal is passed through a fire wall (not shown). A decoding step 1316 provides for decoding signals addressed to one or more destinations other than the current transceiver. A processing step 1318 is adapted to provide one or more signal-processing steps to the decoded signals. The processing step 1318 may estimate the values of information or control signals impressed onto address codes corresponding to the complex-conjugate code(s) provided in the decoding step 1310.

Processed signals may be coupled to one or more optional processing steps, including error detection/correction 1311, system function 1312, and network function 1313 steps. The processed signals are encoded 1314 prior to being transmitted 1305. Similarly, data input to the transceiver is encoded 1324 prior to being transmitted 1305.

7. Scope of the Invention

In the preferred embodiments, several kinds of addressing, coding, and routing are demonstrated to provide a basic understanding of applications of CI processing in ad-hoc and peer-to-peer networks. With respect to this understanding, many aspects of this invention may vary.

For illustrative purposes, flowcharts and signal diagrams represent the operation of the invention. It should be understood, however, that the use of flowcharts and diagrams is for illustrative purposes only, and is not limiting. For example, the invention

is not limited to the operational embodiments represented by the flowcharts. The invention is not limited to specific network architectures shown in the drawings. Instead, alternative operational embodiments and network architectures will be apparent to persons skilled in the relevant art(s) based on the discussion contained herein. Also, the use of flowcharts and diagrams should not be interpreted as limiting the invention to discrete or digital operation.

In practice, as will be appreciated by persons skilled in the relevant art(s) based on the discussion herein, the invention can be achieved via discrete or continuous operation, or a combination thereof. Furthermore, the flow of control represented by the flowcharts is provided for illustrative purposes only. As will be appreciated by persons skilled in the relevant art(s), other operational control flows are within the scope and spirit of the present invention.

Exemplary structural embodiments for implementing the methods of the invention are also described. It should be understood that the invention is not limited to the particular embodiments described herein. Alternate embodiments (equivalents, extensions, variations, deviations, combinations, etc.) of the methods and structural embodiments of the invention and the related art will be apparent to persons skilled in the relevant arts based on the teachings contained herein. The invention is intended and adapted to include such alternate embodiments. Such equivalents, extensions, variations, deviations, combinations, etc., are within the scope and spirit of the present invention.

Signal processing with respect to sinusoidal oscillating signals are described herein. Those skilled in the art will recognize that other types of periodic oscillating signals that can be used, including, but not limited to, sinusoids, square waves, triangle waves, wavelets, repetitive noise waveforms, pseudo-noise signals, and arbitrary waveforms.

The foregoing discussion and the claims that follow describe the preferred embodiments of the present invention. With respect to the claims, it should be understood that changes can be made without departing from the essence of the invention. To the extent such changes embody the essence of the present invention, each naturally falls within the breadth of protection encompassed by this patent. This is particularly true for

the present invention because its basic concepts and understandings are fundamental in nature and can be broadly applied.

Patent Application

Claims

1. In a method for communicating by multiple subscribers without a base station, each of the multiple subscribers adapted to transmit CI-coded communication information in at least one unlicensed frequency band, the improvement comprising the additional steps of:

providing for simultaneously transmitting control information with the communication information in at least one unlicensed frequency band from an initiating subscriber for selectively controlling communications between the multiple subscribers; and,

providing for modulating the control information by at least one other CI code.

2. The method of claim 1 wherein the control information is adapted to permit controlling the multiple-access system by initiating one or more of the subscribers as a network control station.
3. The method of claim 2 wherein the control information is adapted to permit transferring the power control and the time synchronization of the multiple-access system from any one of the subscribers acting as the network control station to any other of the subscribers becoming the network control station.
4. The method of claim 2 wherein communication by multiple subscribers includes one or more protocols requiring one of the multiple subscribers to initiate communications and become the network control station in a transmit mode for transmitting the communication information and the control information to all other the multiple subscribers being in a receive mode for simultaneously receiving the communication information through an information channel and the control information through a control channel.
5. The method of claim 4 further including the step of providing for the network control station to command another of the multiple subscribers to change at least one CI code for the control information.

6. The method of claim 3 wherein the control information is adapted to include power-control information for providing a predetermined power setting for each of the multiple subscribers.
7. The method of claim 5 wherein the network control station is adapted to poll each of the other multiple subscribers, receive an acknowledgement back to measure the power received from each of the multiple subscribers, and adjust the power levels for transmission in predetermined increments.
8. A method for providing communications for a network of transceivers in a CI-based multiple-access system operating without a base station, comprising:

providing for transmitting control information coded by at least a first CI code through a control channel simultaneously with communications information coded by at least a second CI code through a communications channel in at least one unlicensed frequency band;

providing for identifying the network and at least one of the transceivers using the control information coded with the at least one CI code and restricting communications between the transceivers of the network using the second CI code;

providing for performing transmit/receive operations of the communications information and the control information by each of the transceivers in a predetermined duplexing operation;

providing for controlling the network initially by one of the transceivers, acting as a network control station; and,

providing for transferring control by one of the transceivers as the network control station to another of the transceivers to become the network control station for continuing the power control and the time synchronization over the network.

9. The method of claim 8 wherein the step of providing for performing transmit/receive operations of the communications information through the communications channel and the control information through the control channel is performed relative to a duplexing operation of a set of duplexing operations including TDD, FDD, CDD, PDD, CI-PDD, CPD, OPDD, QPDD, and CTDD.

10. The method of claim 8 wherein the step of initiating control over the network further includes the step of providing for the network control station to command another of the transceivers to change the CI code for the control information.
11. The method of claim 8 wherein the control information includes power control information for allowing the network control station to set a predetermined power setting for each of the transceivers to assure that those of the transceivers transmitting close to the network control station do not overwhelm any other of the transceivers transmitting far away from the network control station.
12. The method of claim 8 wherein the network control station is adapted to poll each of the other the transceivers and receive an acknowledgement back to measure the power received from each of the transceivers and adjust the power levels for transmission in predetermined increments.
13. The method of claim 8 further comprising a step of providing for conversational-mode communications with the transceivers having receivers with CI decoders in parallel for permitting the network control station to simultaneously receive transmissions from more than one of the transceivers and respond to each of the more than one of the transceivers with individual transmissions.
14. The method of claim 8 further comprising a step of providing for simultaneous transmission of voice and data by assigning different CI codes for voice and data on the communications channel and providing the transceivers with receivers having at least three decoders for discriminating voice communications, data communications, and control channel communications.
15. A method for providing personal communications for a network of transceivers in a multiple-access system operating without a base station by means of simultaneously transmitting communications information through a communications channel with control information through a control channel between at least two transceivers, the method comprising the steps of:

providing for coding the transmission of each of the communication information through the communications channel and control information through the control channel with different CI codes to enable restricting communications

between at least two of the transceivers, each of the different CI codes being capable of identifying the network and at least one of the transceivers;

providing for performing transmit and receive operations by each of the transceivers in a time division duplex manner with discrete time slots within at least one unlicensed frequency band;

providing for controlling the network by one of the transceivers, acting as a network control station for setting the network control station in a transmit mode and all other of the transceivers in a receive mode in at least a first of the discrete time slots;

providing for operating in a transmit mode by the network control station and operating in a receive mode by all other of the transceivers in at least a second of the discrete time slots for transmitting the communications information through the communications channel and control channel;

providing for responding by at least one of the transceivers to the communications information and control information transmitted by the network control station; and,

providing for responding by the network control station with the control channel for indicating the type of communication mode for further communications between the network control station and the at least one of the transceivers.

16. The method of claim 15 wherein the step of providing for responding by the network control station includes informing the at least one of the transceivers to transmit and all other of the transceivers to receive.

17. The method of claim 15 wherein the step of providing for responding to the at least one of the transceivers by the network control station includes informing the one of the transceivers to transmit so as to restrict communications between the network control station and the one of the transceivers.

18. The method of claim 15 wherein a collision of transmissions caused by a plurality of transceivers attempting to transmit in the same time slot is resolved by the plurality of transceivers retrying transmissions and one of the plurality of transceivers transmitting in an earlier time slot than the other of the plurality of transceivers.

19. The method of claim 15 wherein the step of providing for responding by the network control station includes all other the transceivers acknowledging the control channel.

20. A communications system including a plurality of transceivers, each of the transceivers including:

at least one CI coder coupled to each transceiver, the at least one CI coder adapted to provide at least one CI-coded information signal for transmission in at least one unlicensed frequency band;

at least one CI decoder coupled to each transceiver, the at least one CI decoder adapted to decode at least one received transmitted waveform.

21. The communication system recited in claim 20 wherein the at least one coder and the at least one decoder corresponding to at least one of the transceivers are adapted to operate simultaneously for allowing the at least one transceiver to receive any transmitted waveform while simultaneously transmitting another waveform.

22. The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one address and the decoder is adapted to route the signal with respect to the at least one address.

23. The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one tag waveform indicative of the coding provided to the at least one transmitted waveform.

24. The system recited in claim 20 wherein at least one of the at least one transmitted CI-coded information signal and the at least one received transmitted waveform is adapted to include at least one tag waveform for identifying the type of data contained in the transmitted waveform and further includes decoding information necessary to decode information in the transmitted waveform.

25. The communication system recited in claim 20 wherein each transceiver further comprises at least one antenna including an RF front end adapted to receive and transmit signals.

26. A transceiver adapted to receive a first CI-coded transmitted signal and transmit simultaneously another CI-coded signal, the transceiver including:

an RF front end adapted to perform at least one transceiving function in at least one unlicensed frequency band, the at least one transceiving function including receiving at least one transmitted signal and transmitting at least one signal,

a CI decoder coupled to the RF front end, the CI decoder adapted to decode at least one received transmitted signal,

a CI coder coupled to the RF front end, the CI coder adapted to provide CI coding to at least one information signal for transmission, the CI coder providing unique CI coding with respect to CI codes of the at least one received signal to enable simultaneous transmission and reception of CI coded information.

27. The transceiver recited in claim 26 wherein the RF front end includes at least one antenna for receiving and transmitting signals.

28. The transceiver recited in claim 26 wherein the CI decoder includes a preamble detector adapted to detect a preamble.

29. The transceiver recited in claim 26 wherein the CI coder includes a preamble generator adapted to generate at least one preamble.

30. In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, an improved method of communicating in the network using multi-address messaging including:

providing for constructing at a source node a multi-address message containing coded information whereby the codes identify network addresses of a plurality of destination nodes, wherein communication paths between the source node and the destination nodes traverse a common path routed through at least one common intervening node; and

providing for transmitting the multi-address message in at least one unlicensed frequency band from the source node to the destination nodes in accordance with the network addresses by transmitting a single copy of the multi-address message along the common path from each common intervening node to a next common intervening node.

31. The method of claim 30, wherein providing for constructing further includes:

for at least one network address, providing for insertion in a network header an extend field indicating whether the network address is a basic network address or an extended network address usable when the destination node corresponding to the network address has moved from a first network to another network; and

for each extended address in the network header, providing for inclusion in the extended address the basic network address of the destination node corresponding to the network address and information for forwarding the multi-address message to the another network.

32. The method of claim 30, further comprising:

providing for receiving the multi-address message at a node and, for each network address, determining whether the network address is a basic network address or an extended network address; and

providing for routing the multi-address message to a next node in accordance with the network address and routing tables maintained by the node.

33. The method of claim 30, wherein providing for constructing further includes:

for each network address in the network header, providing for insertion in a network header an end-of-routing field indicating whether the network address is the last address in the network header such that the number of destination network addresses in the network header is variable.

34. The method of claim 30, wherein providing for constructing further includes, for each network address in the network header:

providing for insertion in a network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is received by the destination node;

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node corresponding to the network address when the multi-address message is read at the destination node corresponding to the network address; and

providing for insertion in the network header, on a per-destination basis, a field indicating whether an acknowledgment is required from the destination node

corresponding to the network address when the multi-address message is printed at the destination node corresponding to the network address.

35. The method of claim 30, wherein the multi-address message comprises a sequence of message frames each containing a network header, wherein the constructing step further includes:

providing for insertion of a frame sequence number in the network header of each message frame indicating a position of the message frame in the sequence; and

providing for insertion of an end of message field in the network header of each message frame indicating whether the message frame is the last in the multi-address message.

36. The method of claim 30, wherein the constructing step includes providing for insertion of the network address of the source node in a network header.

37. The method of claim 30, wherein constructing step further includes:

providing for insertion in the network header a precedence field indicating a relative precedence of the multi-address message, and

providing for restricting message traffic at a node when message traffic congestion occurs at the node, wherein message traffic restriction is performed with respect to the relative precedence identified in the network header of each message such that higher precedence messages are delivered to the node and lower precedence messages are not delivered to the node.

38. The method of claim 30, wherein the constructing step further includes:

providing for inserting in a network header a security field indicating a relative security level of the multi-address message, and

providing for restricting message traffic at a node as a function of the security level identified in the network header of each message.

39. The method of claim 30, further comprising:

providing for acknowledging receipt of a multi-address message at a destination node by sending an acknowledgement message from the destination node to the source node,

providing for retransmitting the multi-address message to a destination node when the source node does not receive an acknowledgement message from the destination node after a predetermined period of time after transmission of the multi-address message;

providing for repeating the retransmitting step until either an acknowledgement message is received from the destination node or a predetermined maximum number of retransmissions have been attempted.

40. The method of claim 30, wherein the multi-address message includes an encapsulated message having a protocol different from a protocol of the multi-address message.

41. The method of claim 30, initiates a re-routing process responsive to failure of the multi-address message to reach one or more destination nodes.

42. The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in a point-to-point mode.

43. The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in a broadcast mode.

44. The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message over a waveguide.

45. The method of claim 30, wherein the transmitting step includes providing for transmitting the multi-address message in at least one transmission mode including a full-duplex communication mode and a half-duplex communication mode.

46. In a communication network including a plurality of communication nodes, wherein messages transmitted between certain nodes are routed through other nodes in the network, an improved method of communicating in the network including:

providing for constructing at a source node at least one multi-address message containing coded information whereby the codes identify at least one communication path between the source node and at least one destination node, and

providing for transmission of the at least one multi-address message in at least one unlicensed frequency band.

47. A transceiver adapted to route communication signals in a network, the transceiver including:

a first decoder system adapted to decode at least one received signal addressed to the transceiver,

a second decoder system adapted to decode at least one received signal addressed to at least one other transceiver,

a coding system adapted to encode the at least one received signal addressed to the at least one other transceiver to generate at least one coded signal, and

a transmission system coupled to the coding system, the transmission system adapted to transmit the at least one coded signal in at least one unlicensed frequency band.

48. The transceiver recited in claim 47 further including a signal processor coupled between the coding system and the transmission system, the signal processor adapted to perform at least one signal-processing operation to the at least one coded signal.

49. In a communication network, a transceiver adapted to route communication signals in the network, the transceiver including:

a receiver adapted to receive at least one transmitted signal in at least one unlicensed frequency band and duplicate at least one received signal to generate a first received signal and a second received signal,

a decoder system coupled to the receiver, the decoder system adapted to receive the first received signal and provide decoding of at least one signal addressed to the transceiver, and

a transmitter coupled to the receiver, the transmitter adapted to process the second received signal for transmission in at least one unlicensed frequency band.

50. The transceiver recited in claim 49 further including a signal processor coupled between the receiver and the transmitter, the signal processor adapted to process the second received signal.

51. In a communication network, a transceiver adapted to route communication signals in the network, the transceiver including:

a decoder system adapted to provide decoding to at least one received signal to produce at least one decoded signal,

a signal processor coupled to the decoder, the signal processor adapted to extract and process information addressed to the transceiver, and

a transmitter coupled to the decoder system, the transmitter adapted to process the at least one decoded signal for transmission in at least one unlicensed frequency band.

52. The transceiver recited in claim 51 further including a second signal processor coupled between the decoder system and the transmitter, the second signal processor adapted to process the at least one decoded signal prior to transmission.

53. In a communication network, a plurality of network transceivers adapted to route communication signals in the network, the network including:

at least one central processing unit coupled to the transceivers and adapted to perform channel estimation from signals received by the transceivers and generate array-processing weights for transmission and reception of signals by the transceivers.

54. The communication network recited in claim 53 wherein the at least one central processing unit is adapted to weight and combine signals received from the transceivers.

55. The communication network recited in claim 53 wherein the at least one central processing unit is adapted to weight signals conveyed to the transceivers for transmission.

56. The communication network recited in claim 53 wherein the at least one central processing unit is adapted to convey one or more array-processing weights to each of the transceivers.

57. In a communication network of a plurality of network transceivers adapted to route communication signals in the network, the network including:

at least one central processing unit coupled to the transceivers, the at least one central processing unit adapted to receive signals received by each of the transceivers, decompose each transceiver's received signals into a plurality of CI components, and combine the CI components.

ABSTRACT

Applications of CI processing to ad-hoc and peer-to-peer networking significantly improve throughput, network capacity, range, power efficiency, and spectral efficiency. CI-based subscriber units perform network-control functions to optimize network performance relative to channel conditions, network loads, and subscriber services. CI codes are used to identify and address network transmissions. Channel characteristics of communication links are employed to encode, address, and authenticate network transmissions. CI transceivers used as relays and routers employ unique characteristics of transmission paths to code and decode network transmissions. A central processor is adapted to perform array processing with signals received from, and transmitted by, a plurality of subscriber units in a wireless network.

Samsung Exhibit 1023, Page 295 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899

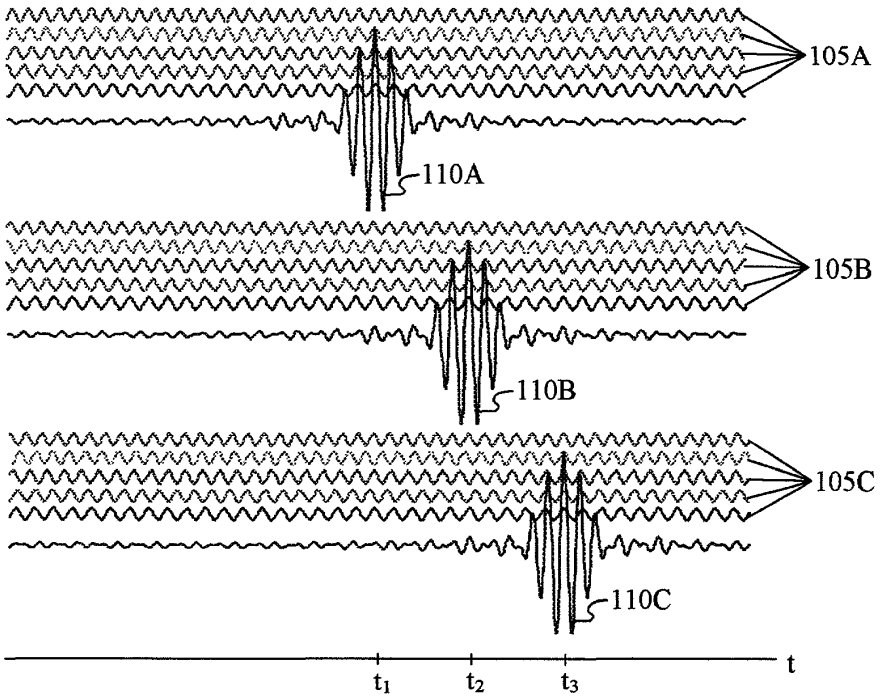


FIG. 1A

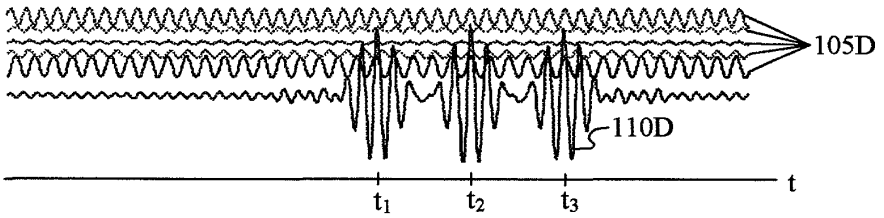


FIG. 1B

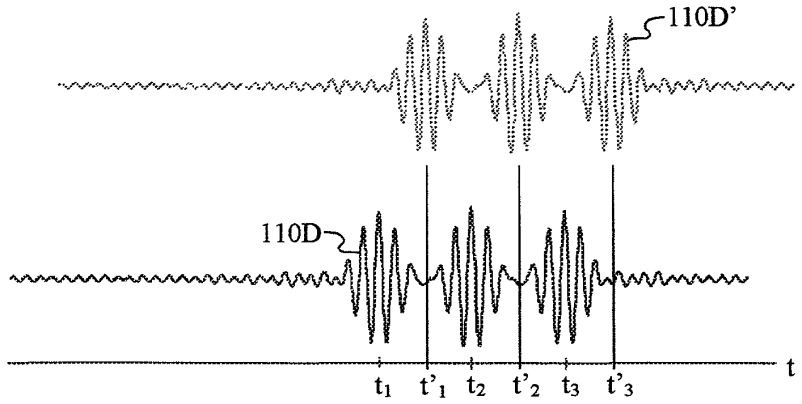


FIG. 1C

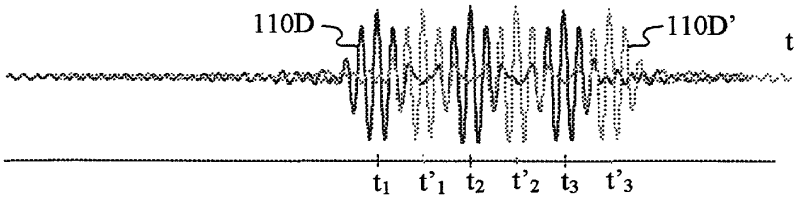


FIG. 1D

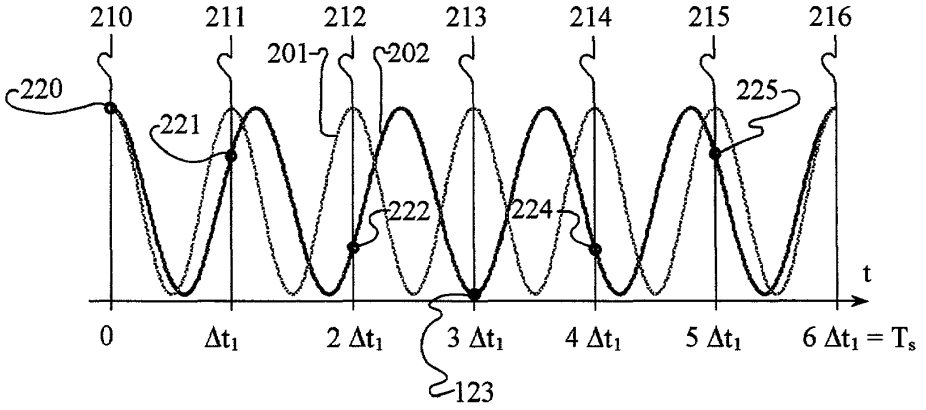


FIG. 2A

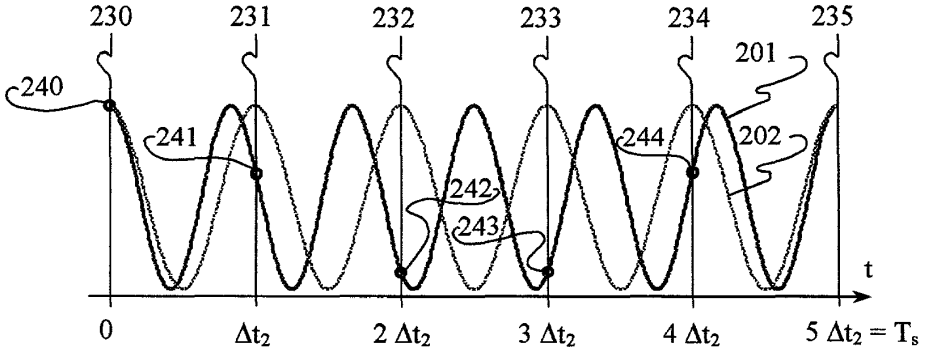


FIG. 2B

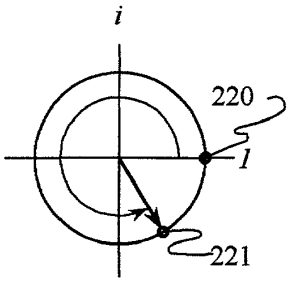


FIG. 3A

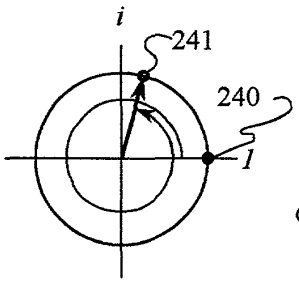


FIG. 3B

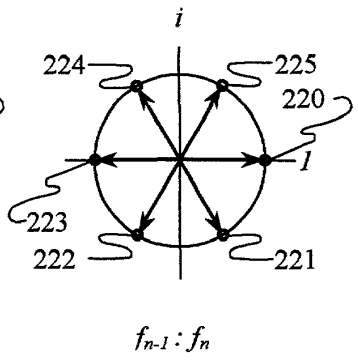
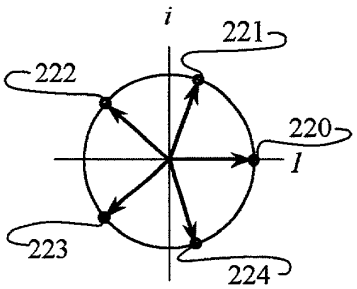


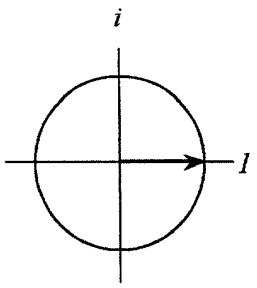
FIG. 4A

Samsung Exhibit 1023, Page 298 of 312
Samsung Electronics Co., Ltd. et al. v. Genghiscomm Holdings LLC
IPR2025-00899



$f_{n+1} : f_n$

FIG. 4B



$f_n : f_n$

FIG. 4C

$C(1) = [1\ (1+i)/\sqrt{2}\ i\ (-1+i)/\sqrt{2}\ -1\ (-1-i)/\sqrt{2}\ -i\ (1-i)/\sqrt{2}];$

$C(1)^* = [1\ (1-i)/\sqrt{2}\ -i\ (-1-i)/\sqrt{2}\ -1\ (-1+i)/\sqrt{2}\ i\ (1+i)/\sqrt{2}];$

$C(2) = [1\ (-1+i)/\sqrt{2}\ -i\ (1+i)/\sqrt{2}\ -1\ (1-i)/\sqrt{2}\ i\ (-1-i)/\sqrt{2}];$

$C(2)^* = [1\ (-1-i)/\sqrt{2}\ i\ (1-i)/\sqrt{2}\ -1\ (1+i)/\sqrt{2}\ -i\ (-1+i)/\sqrt{2}];$

$C(3) = [1\ (1+i)/\sqrt{2}\ i\ (-1+i)/\sqrt{2}\ 1\ (1+i)/\sqrt{2}\ i\ (-1+i)/\sqrt{2}];$

$C(3)^* = [1\ (1-i)/\sqrt{2}\ -i\ (-1-i)/\sqrt{2}\ 1\ (1-i)/\sqrt{2}\ -i\ (-1-i)/\sqrt{2}];$

$C(4) = [1\ (-1+i)/\sqrt{2}\ i\ (-1-i)/\sqrt{2}\ 1\ (-1+i)/\sqrt{2}\ i\ (-1-i)/\sqrt{2}];$

$C(4)^* = [1\ (-1-i)/\sqrt{2}\ -i\ (-1+i)/\sqrt{2}\ 1\ (-1-i)/\sqrt{2}\ -i\ (-1+i)/\sqrt{2}];$

$C(5) = [1\ (-1-i)/\sqrt{2}\ -i\ (-1+i)/\sqrt{2}\ -1\ (1+i)/\sqrt{2}\ i\ (1-i)/\sqrt{2}];$

$C(5)^* = [1\ (-1+i)/\sqrt{2}\ i\ (-1-i)/\sqrt{2}\ -1\ (1-i)/\sqrt{2}\ -i\ (1+i)/\sqrt{2}];$

$C(6) = [1\ (1-i)/\sqrt{2}\ i\ (1+i)/\sqrt{2}\ -1\ (-1+i)/\sqrt{2}\ -i\ (-1-i)/\sqrt{2}];$

$C(6)^* = [1\ (1+i)/\sqrt{2}\ -i\ (1-i)/\sqrt{2}\ -1\ (-1-i)/\sqrt{2}\ i\ (-1+i)/\sqrt{2}];$

$C(7) = [1\ (1+i)/\sqrt{2}\ -i\ (1-i)/\sqrt{2}\ 1\ (1+i)/\sqrt{2}\ -i\ (1-i)/\sqrt{2}];$

$C(7)^* = [1\ (1-i)/\sqrt{2}\ i\ (1+i)/\sqrt{2}\ 1\ (1-i)/\sqrt{2}\ i\ (1+i)/\sqrt{2}];$

$C(8) = [1\ (-1+i)/\sqrt{2}\ -i\ (1+i)/\sqrt{2}\ 1\ (-1+i)/\sqrt{2}\ -i\ (1+i)/\sqrt{2}];$

$C(8)^* = [1\ (-1-i)/\sqrt{2}\ i\ (1-i)/\sqrt{2}\ 1\ (-1-i)/\sqrt{2}\ i\ (1-i)/\sqrt{2}];$

FIG. 5A

	C(1)	C(1)*	C(2)	C(2)*	C(3)	C(3)*	C(4)	C(4)*	C(5)	C(5)*	C(6)	C(6)*	C(7)	C(7)*	C(8)	C(8)*
CI(1)	0	8	0	0	0	0	0	0	4-4i	0	0	4+4i	0	0	0	0
CI(1)*	8	0	0	0	0	0	0	0	0	4+4i	4-4i	0	0	0	0	0
CI(2)	0	0	0	8	0	0	0	0	0	4-4i	4+4i	0	0	0	0	0
CI(2)*	0	0	8	0	0	0	0	0	4+4i	0	0	4-4i	0	0	0	0
CI(3)	0	0	0	0	0	8	0	4-4i	0	0	0	0	4+4i	0	0	0
CI(3)*	0	0	0	0	8	0	4+4i	0	0	0	0	0	0	4-4i	0	0
CI(4)	0	0	0	0	0	4+4i	0	8	0	0	0	0	0	0	4-4i	0
CI(4)*	0	0	0	0	4-4i	0	8	0	0	0	0	0	0	0	0	4+4i
CI(5)	4-4i	0	0	4+4i	0	0	0	0	0	8	0	0	0	0	0	0
CI(5)*	0	4+4i	4-4i	0	0	0	0	0	8	0	0	0	0	0	0	0
CI(6)	0	4-4i	4+4i	0	0	0	0	0	0	0	0	8	0	0	0	0
CI(6)*	4+4i	0	0	4-4i	0	0	0	0	0	0	8	0	0	0	0	0
CI(7)	0	0	0	0	4+4i	0	0	0	0	0	0	0	0	8	0	4-4i
CI(7)*	0	0	0	0	0	4-4i	0	0	0	0	0	0	8	0	4+4i	0
CI(8)	0	0	0	0	0	0	4-4i	0	0	0	0	0	0	4+4i	0	8
CI(8)*	0	0	0	0	0	0	0	4+4i	0	0	0	0	4-4i	0	8	0

FIG. 5B

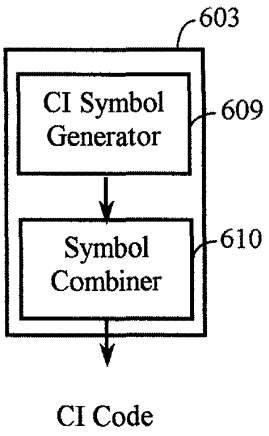


FIG. 6A

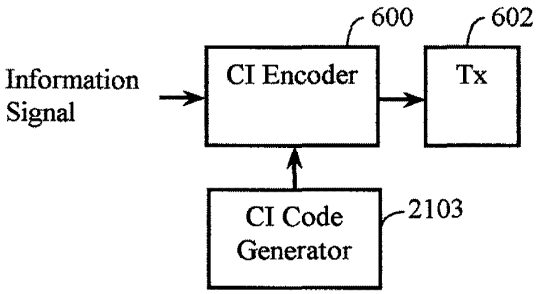


FIG. 6B

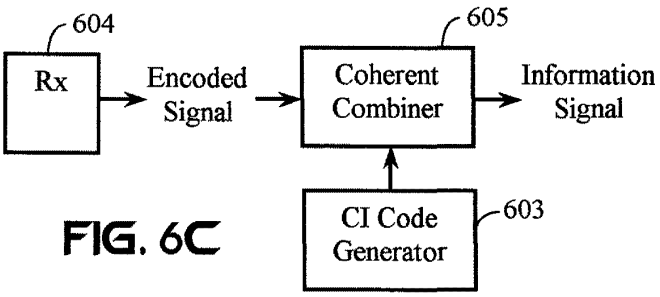


FIG. 6C

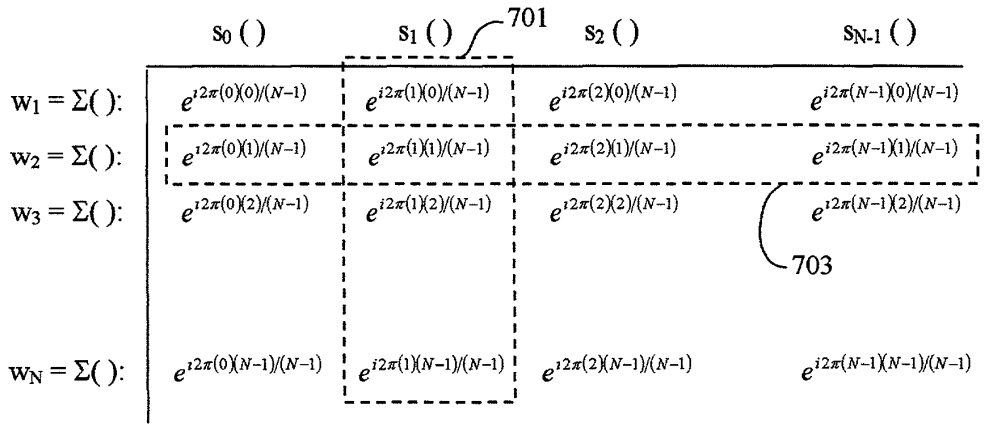

s_0 ( )
s_1 ( )
701
s_2 ( )
s_{N-1} ( )
$w_1 = \Sigma( )$:
$w_2 = \Sigma( )$:
$w_3 = \Sigma( )$:
$w_N = \Sigma( )$:
$e^{i2\pi(0)(0)/(N-1)}$
$e^{i2\pi(1)(0)/(N-1)}$
$e^{i2\pi(2)(0)/(N-1)}$
$e^{i2\pi(N-1)(0)/(N-1)}$
$e^{i2\pi(0)(1)/(N-1)}$
$e^{i2\pi(1)(1)/(N-1)}$
$e^{i2\pi(2)(1)/(N-1)}$
$e^{i2\pi(N-1)(1)/(N-1)}$
$e^{i2\pi(0)(2)/(N-1)}$
$e^{i2\pi(1)(2)/(N-1)}$
$e^{i2\pi(2)(2)/(N-1)}$
$e^{i2\pi(N-1)(2)/(N-1)}$
703
$e^{i2\pi(0)(N-1)/(N-1)}$
$e^{i2\pi(1)(N-1)/(N-1)}$
$e^{i2\pi(2)(N-1)/(N-1)}$
$e^{i2\pi(N-1)(N-1)/(N-1)}$

FIG. 7

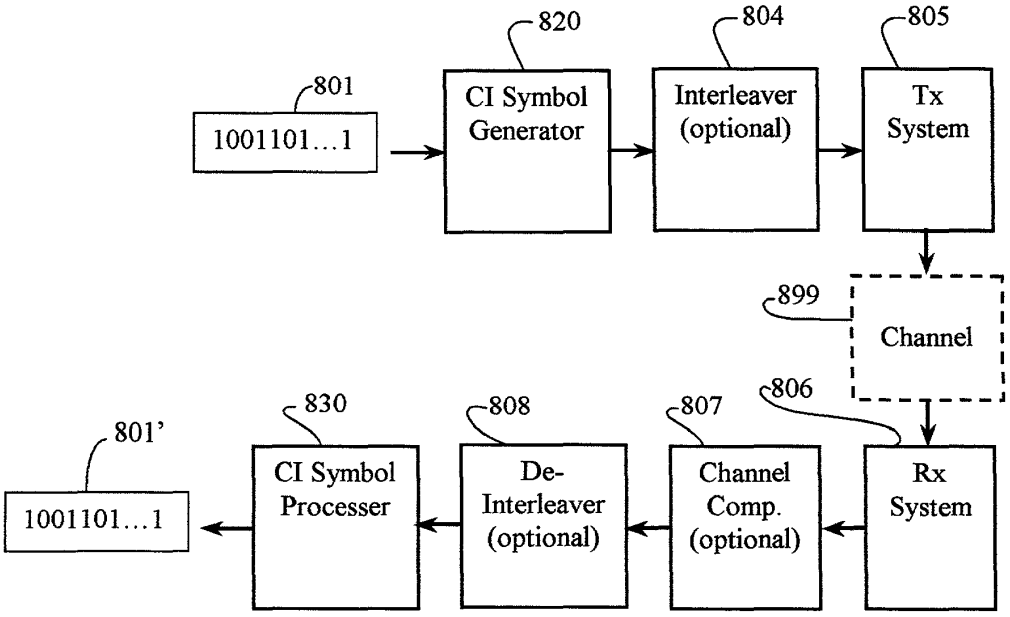

801
1001101...1
820
CI Symbol Generator
804
Interleaver (optional)
805
Tx System
899
Channel
806
Rx System
807
Channel Comp. (optional)
808
De-Interleaver (optional)
830
CI Symbol Processer
801'
1001101...1

FIG. 8A

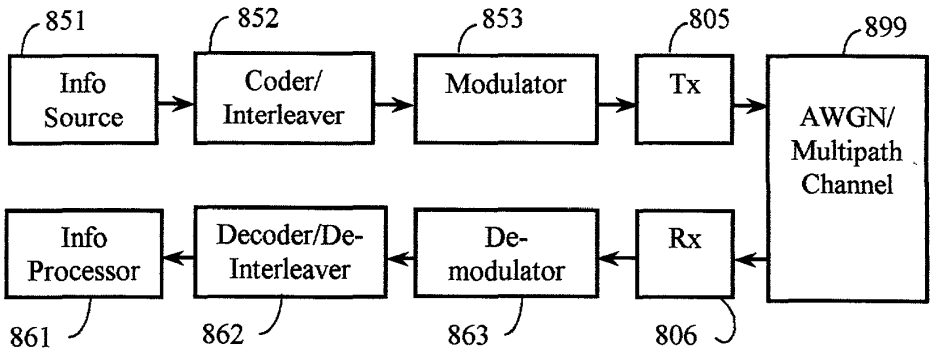

851
852
853
805
899
Info Source
Coder/ Interleaver
Modulator
Tx
AWGN/ Multipath Channel
Info Processor
Decoder/De-Interleaver
De-modulator
Rx
861
862
863
806

FIG. 8B

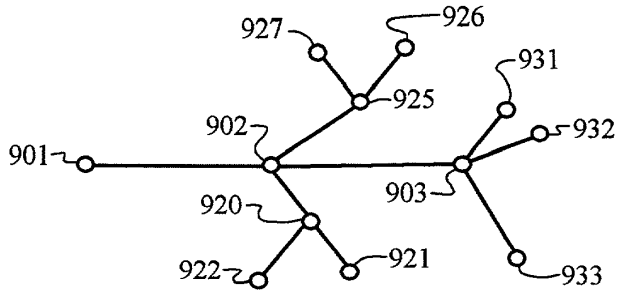


FIG. 9A

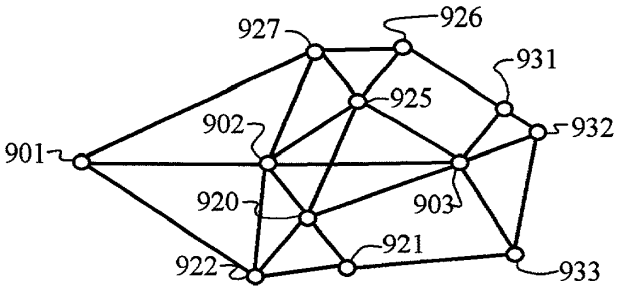


FIG. 9B

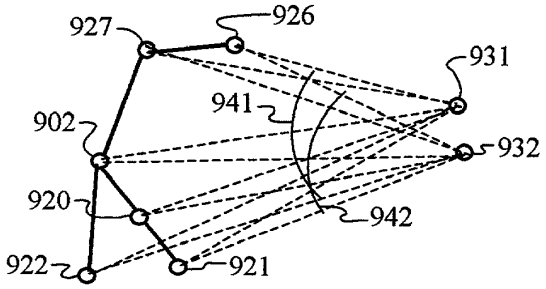


FIG. 9C

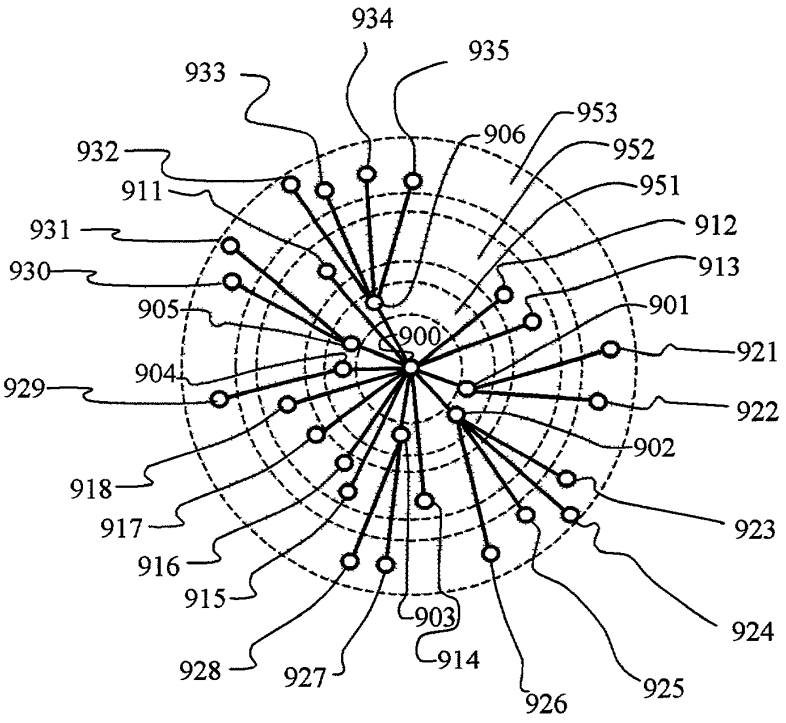

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925

FIG. 9D

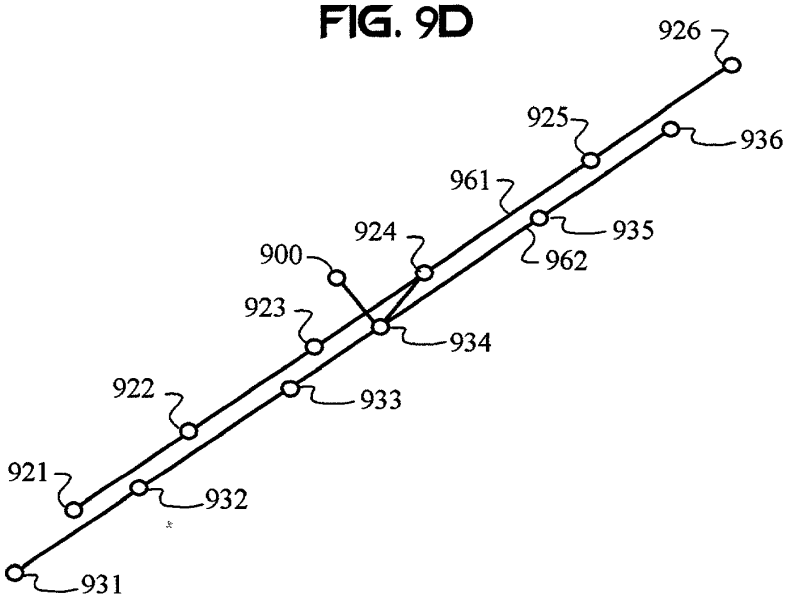

926
925
936
961
924
935
900
962
923
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922
933
921
932
931

FIG. 9E

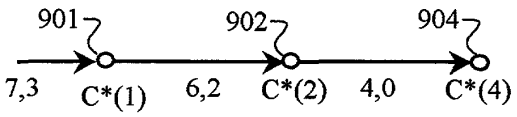


FIG. 9F

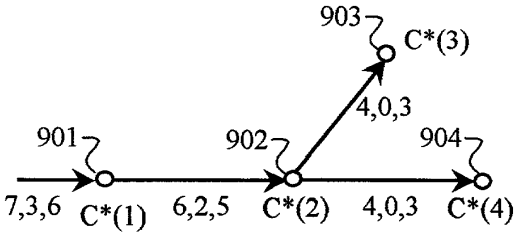


FIG. 9G

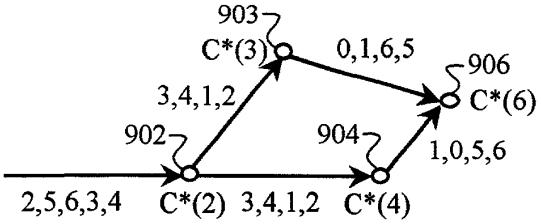


FIG. 9H

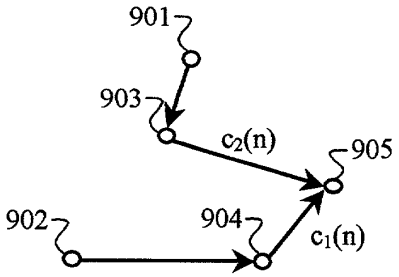


FIG. 9I

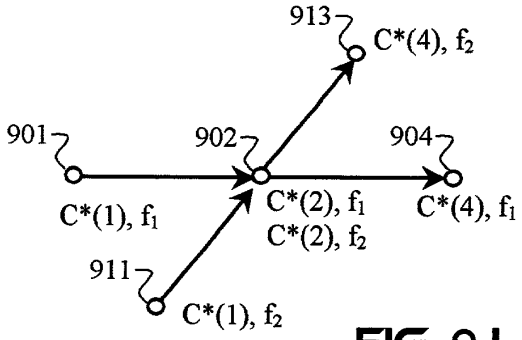


FIG. 9J

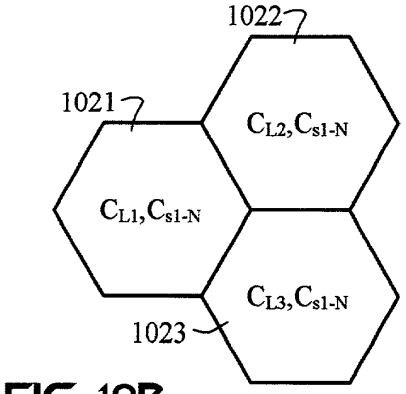


FIG. 10B

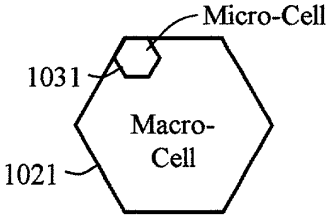


FIG. 10A

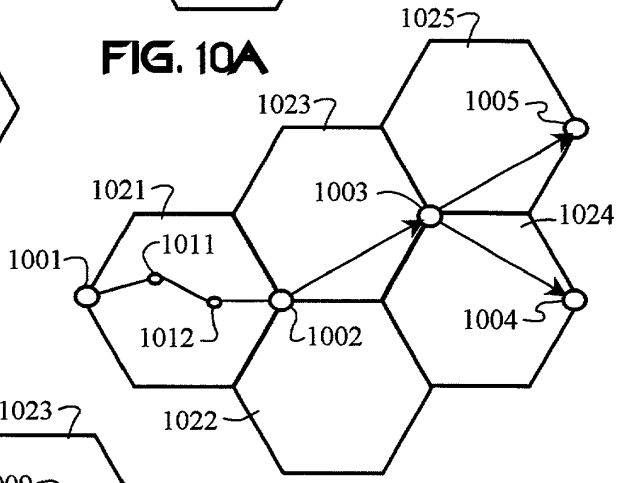


FIG. 10C

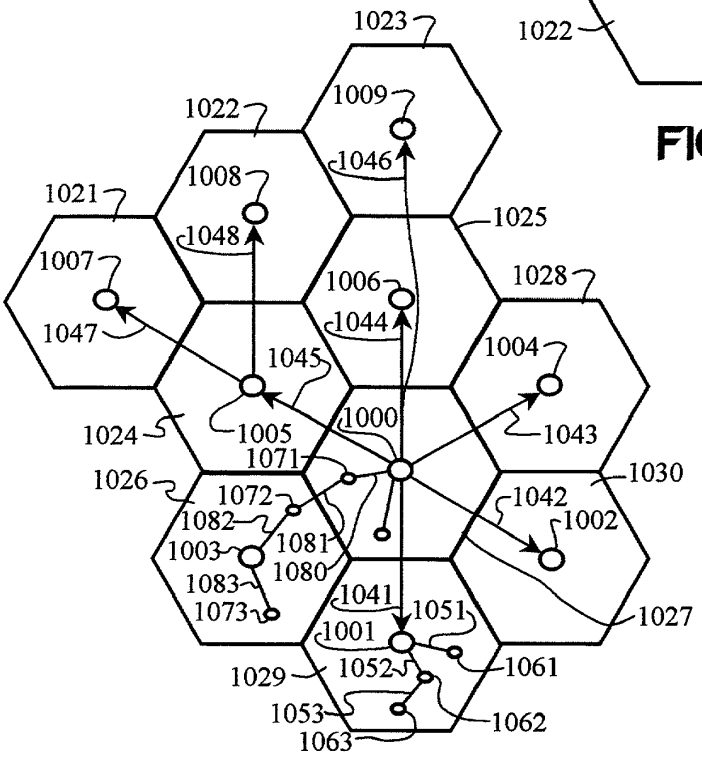


FIG. 10D

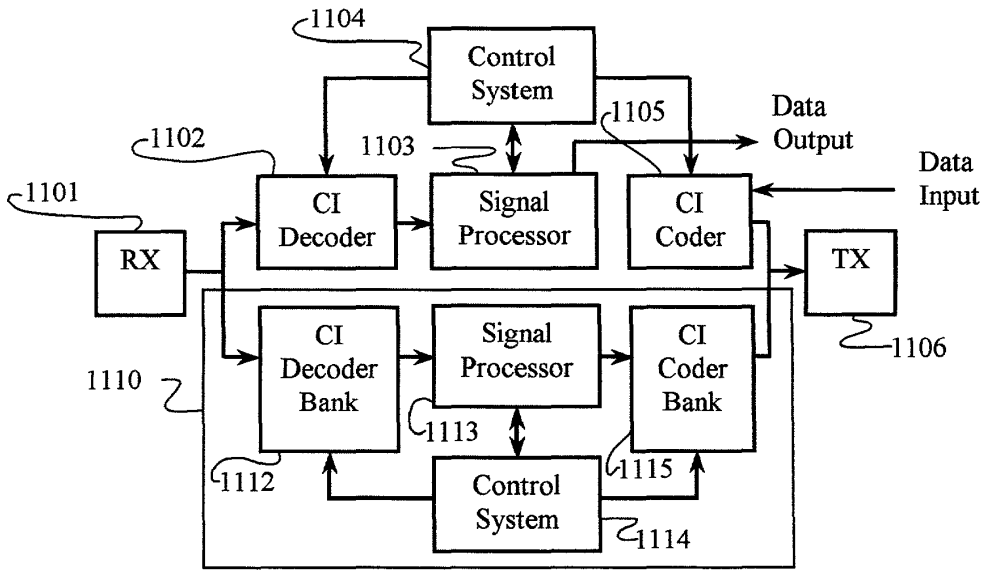


FIG. 11A

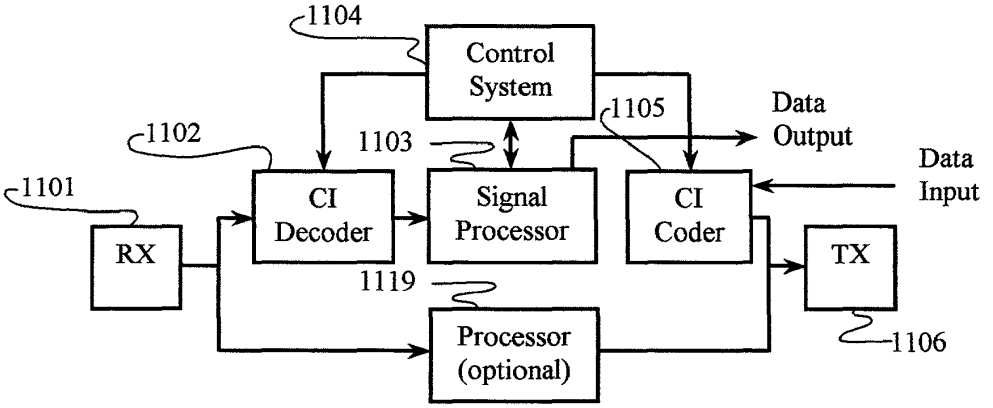


FIG. 11B

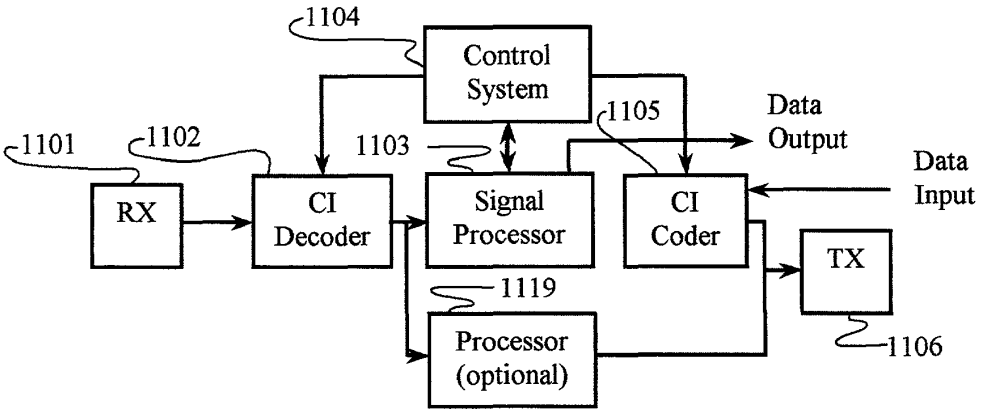


FIG. 11C

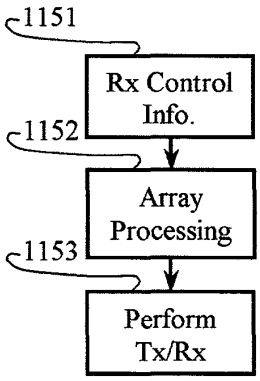


FIG. 11D

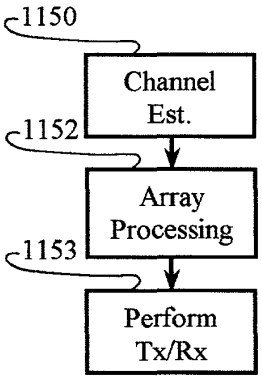


FIG. 11E

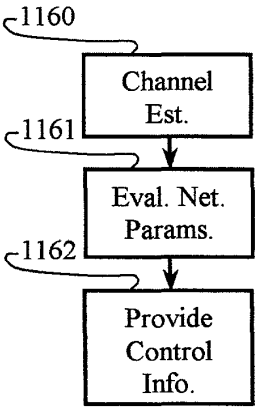


FIG. 11F

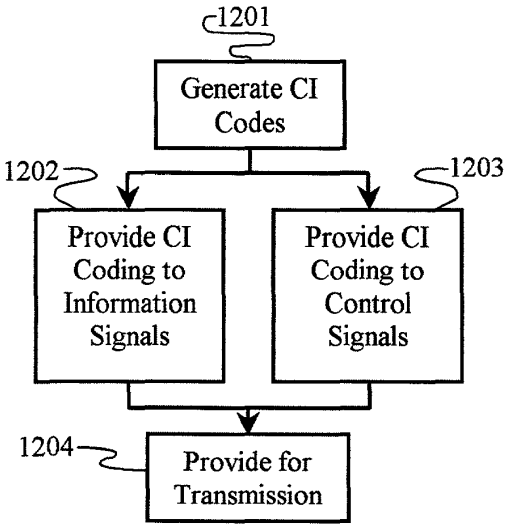


FIG. 12A

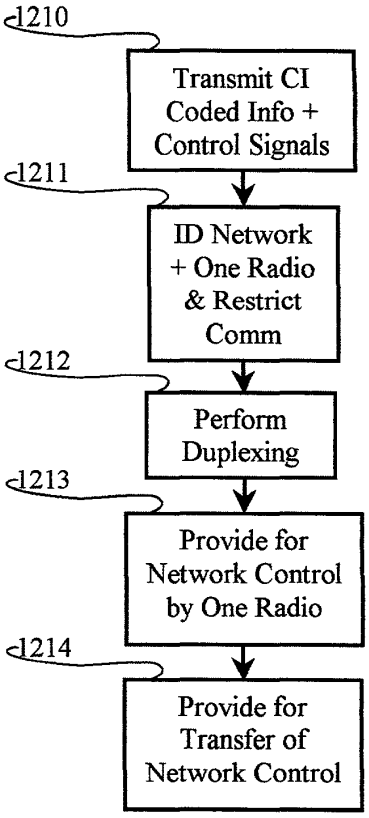


FIG. 12B

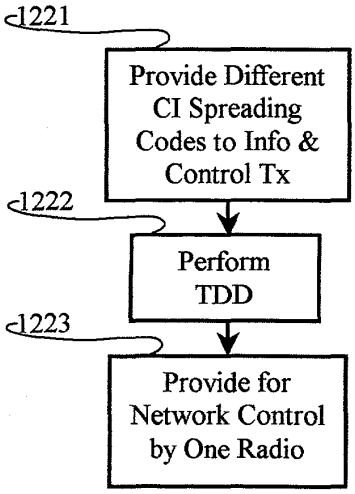


FIG. 12C

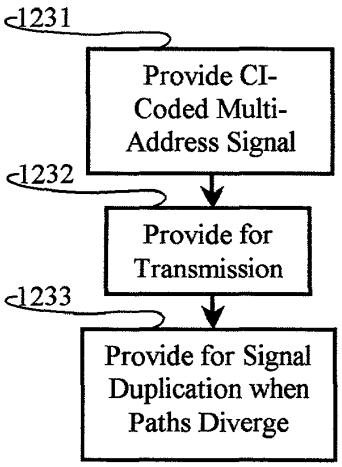


FIG. 12D

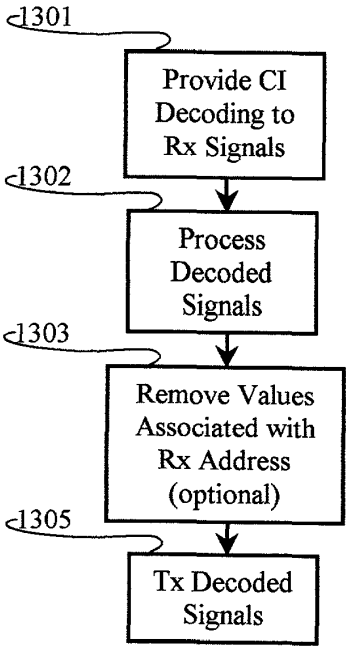


FIG. 13A

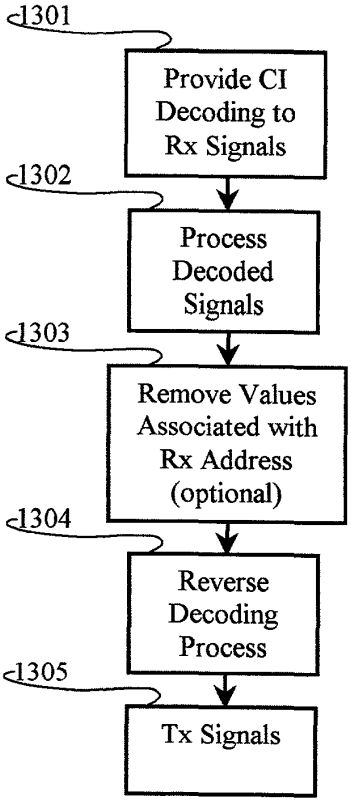


FIG. 13B

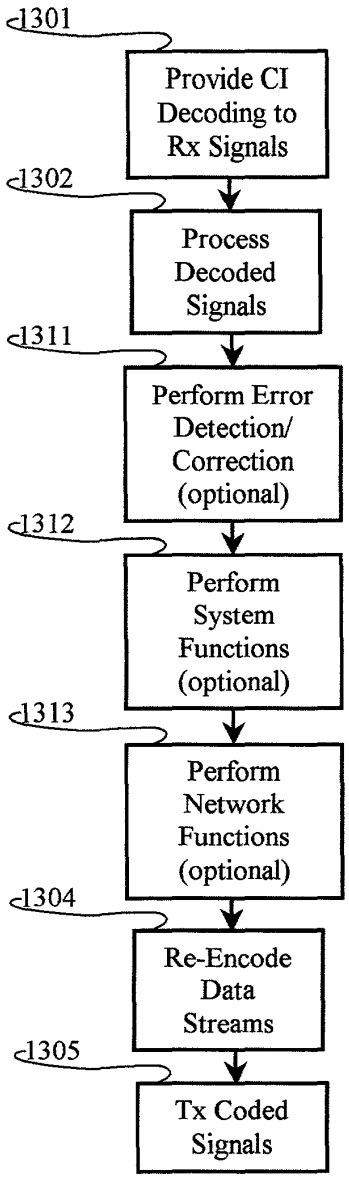


FIG. 13C

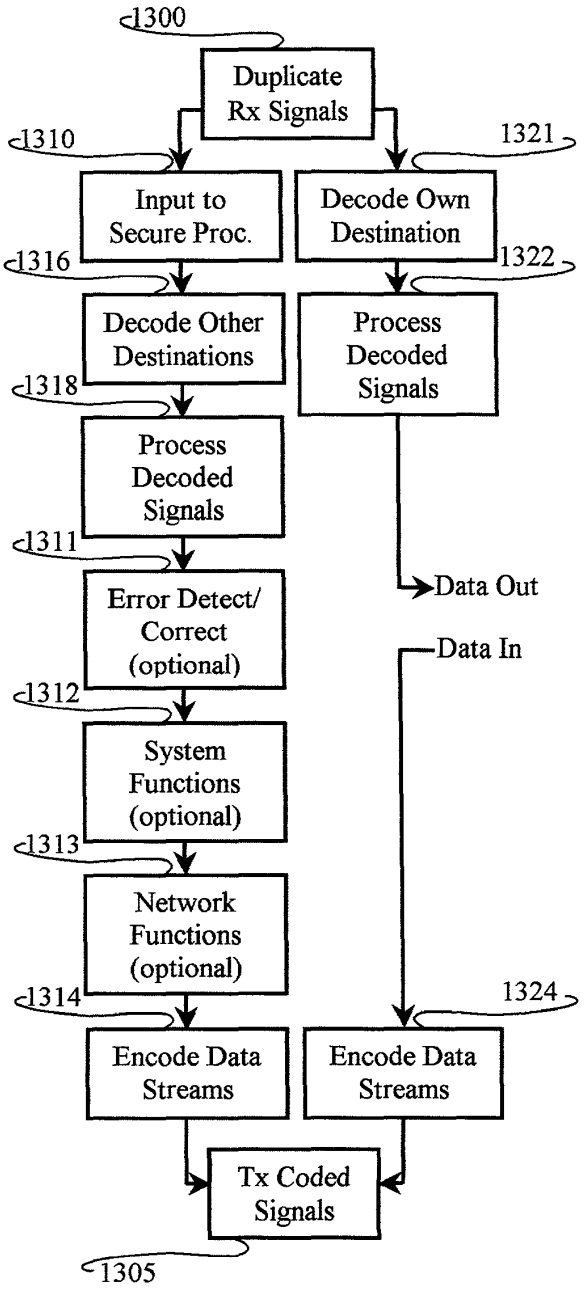


FIG. 13D