

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10,644,916 B1
APPLICATION NO. : 16/199221
DATED : May 5, 2020
INVENTOR(S) : Steve Shattil

Page 1 of 1

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

In the Specification

Column 1, Line 8, before:

-- Ser. No. 15/489,664 --

Insert the following:

-- Ser. No. 15/642,850, filed on Jul. 6, 2017, now Pat. No. 10,015,034, which is a Continuation of U.S. patent application --

Signed and Sealed this
Second Day of November, 2021



Drew Hirshfeld
*Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office*

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

Page 1 of 1

PATENT NO. : 10,644,916

APPLICATION NO.: 16/199,221

ISSUE DATE : May 5, 2020

INVENTOR(S) : Steve Shattil

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Insert the following

-- Ser. No. 15/642,850, filed on Jul. 6, 2017, now Pat. No. 10,015,034, which is a Continuation of U.S. patent application --

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.

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Number: 16/199,221

Patent Number: 10,644,916

Filing Date: 26-NOV-2018

Inventor: Shattil

Title: "Spreading and Precoding in OFDM"

Atty. Docket No. CBF-000.C8

CERTIFICATE OF CORRECTION

Commissioner for Patents

Office of Data Management Attention: Certificates of Correction Branch

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir:

Upon reviewing the above-identified patent, Patentee noted a mistake of a clerical or typographical nature which should be corrected. The mistake occurred in good faith, and its correction does not involve such changes in the patent as would constitute new matter or would require re-examination. The requested correction does not change the Related U.S. Application Data in the above-identified patent.

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Respectfully submitted,

/Steven J Shattil/

Steven J. Shattil, Reg. No. 40,170

P.O. Box 17355

Boulder, CO 80308-0355

(720) 234-4351

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Page 1 of 1

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In the Specification

Column 1, Line 17:
-- 9,042,333 --
Should be changed to:
-- 8,750,264 --

Signed and Sealed this
Seventeenth Day of August, 2021



Drew Hirshfeld
*Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
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Patent Number: 10,644,916

Filing Date: 26-NOV-2018

Inventor: Shattil

Title: "Spreading and Precoding in OFDM"

Atty. Docket No. CBF-000.C8

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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

NOTICE OF ALLOWANCE AND FEE(S) DUE

74284 7590 03/23/2020
Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

EXAMINER

LO, DIANE LEE

ART UNIT

PAPER NUMBER

2466

DATE MAILED: 03/23/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/199,221	11/26/2018	Steve Shattil	CBF-000.C8	6600

TITLE OF INVENTION: Spreading and Precoding in OFDM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0.00	\$0.00	\$500	06/23/2020

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

74284 7590 03/23/2020
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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/199,221	11/26/2018	Steve Shattil	CBF-000.C8	6600

TITLE OF INVENTION: Spreading and Precoding in OFDM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$500	\$0.00	\$0.00	\$500	06/23/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
LO, DIANE LEE	2466	370-329000

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 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

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

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

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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

- ☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

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

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

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

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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74284	7590	03/23/2020	EXAMINER	
Steven J Shattil P.O. Box 17355 Boulder, CO 80308-0355			LO, DIANE LEE	
			ART UNIT	PAPER NUMBER
			2466	
DATE MAILED: 03/23/2020				

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

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.** Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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Notice of Allowability	Application No. 16/199,221	Applicant(s) Shattil, Steve	
	Examiner DIANE L LO	Art Unit 2466	AIA (FITF) Status No

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

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

1. ☒ This communication is responsive to amendment received 03/11/2020.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 27-54. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
* Certified copies not received: _____.

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

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

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

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

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____. 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	5. ☐ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
---	--

/DIANE L LO/ Primary Examiner, Art Unit 2466	
---	--

REASONS FOR ALLOWANCE

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

The terminal disclaimer overcomes the double patenting rejection.

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

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANE LEE LO whose telephone number is (571)270-1952. The examiner can normally be reached on Monday - Friday 8 am - 5 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Faruk Hamza can be reached on (571)272-7969. 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 <https://ppair-my.uspto.gov/pair/PrivatePair>. 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.

/DIANE L LO/
Primary Examiner, Art Unit 2466

<i>Index of Claims</i> 	Application/Control No. 16/199,221	Applicant(s)/Patent Under Reexamination Shattil, Steve
	Examiner DIANE L LO	Art Unit 2466

✓	Rejected
=	Allowed

-	Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant					☐ CPA		☒ T.D.		☐ R.1.47	
CLAIM		DATE								
Final	Original	02/28/2020	03/17/2020							
1	27	✓	=							
2	28	✓	=							
3	29	✓	=							
4	30	✓	=							
5	31	✓	=							
6	32	✓	=							
7	33	✓	=							
8	34	✓	=							
9	35	✓	=							
10	36	✓	=							
11	37	✓	=							
12	38	✓	=							
13	39	✓	=							
14	40	✓	=							
15	41	✓	=							
16	42	✓	=							
17	43	✓	=							
18	44	✓	=							
19	45	✓	=							
20	46	✓	=							
21	47	✓	=							
22	48	✓	=							
23	49	✓	=							
24	50	✓	=							
25	51	✓	=							
26	52	✓	=							
27	53	✓	=							
28	54	✓	=							

Docket No. CBF-000.C8

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Docket No.: CBF-000.C8

Steve Shattil

Confirmation No.: 6600

Application No.: 16/199,221

Group Art Unit: 2466

Filed: 11/26/2018

Examiner: LO, DIANE LEE

For: **SPREADING AND PRECODING IN OFDM**

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

OFFICE ACTION RESPONSE

Sir:

This letter is responsive to the Office Letter mailed on 12/04/2019.

The **Claims** of Record are begin on page 2.

Remarks begin on page 7.

CLAIMS

The following is a complete list of all claims in this application.

Claims 1 – 26 (Cancelled).

27. (Currently Amended) A computer program product, comprising a non-transitory computer-readable medium ~~hardware storage device~~ having computer readable program code stored therein, said program code containing instructions executable by one or more processors of a computer system to implement a method comprising:
- performing a first discrete Fourier transform (DFT) on a received spread-Orthogonal Frequency Division Multiplexing (OFDM) signal to produce a demodulated signal; and
 - performing a second DFT on the demodulated signal to produce decoded data symbols, wherein the second DFT is an inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
28. (Previously Presented) The computer program product recited in Claim 27, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
29. (Previously Presented) The computer program product recited in Claim 27, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.
30. (Previously Presented) The computer program product recited in Claim 27, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.

31. (Previously Presented) The computer program product recited in Claim 27, wherein said program code further contains instructions executable by one or more processors of the computer system for equalizing the demodulated signal.
32. (Previously Presented) The computer program product recited in Claim 27, wherein said program code further contains instructions executable by one or more processors of the computer system for removing a cyclic prefix from the received spread-OFDM signal.
33. (Previously Presented) The computer program product recited in Claim 27, wherein said program code further contains instructions executable by one or more processors of the computer system for generating at least one of hard decisions and soft decisions for estimates of the decoded data symbols.
34. (Previously Presented) A method, comprising:
 performing a first discrete Fourier transform (DFT) on a received spread-Orthogonal Frequency Division Multiplexing (OFDM) signal to produce a demodulated signal; and
 performing a second DFT on the demodulated signal to produce decoded data symbols, wherein the second DFT is an inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
35. (Previously Presented) The method recited in Claim 34, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
36. (Previously Presented) The method recited in Claim 34, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.
37. (Previously Presented) The method recited in Claim 34, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.

38. (Previously Presented) The method recited in Claim 34, further comprising equalizing the demodulated signal.
39. (Previously Presented) The method recited in Claim 34, further comprising removing a cyclic prefix from the received spread-OFDM signal.
40. (Previously Presented) The method recited in Claim 34, further comprising generating at least one of hard decisions and soft decisions for estimates of the decoded data symbols.
41. (Previously Presented) An apparatus comprising:
a processor; and
a memory coupled to the processor, the memory including a set of instructions stored therein and executable by the processor to:
perform a first discrete Fourier transform (DFT) on a received spread-Orthogonal Frequency Division Multiplexing (OFDM) signal to produce a demodulated signal; and
perform a second DFT on the demodulated signal to produce decoded data symbols, wherein the second DFT is an inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
42. (Previously Presented) The apparatus recited in Claim 41, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
43. (Previously Presented) The apparatus recited in Claim 41, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.
44. (Previously Presented) The apparatus recited in Claim 41, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous

subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.

45. (Previously Presented) The apparatus recited in Claim 41, wherein the memory further includes a set of instructions stored therein and executable by the processor to equalize the demodulated signal.
46. (Previously Presented) The apparatus recited in Claim 41, wherein the memory further includes a set of instructions stored therein and executable by the processor to remove a cyclic prefix from the received spread-OFDM signal.
47. (Previously Presented) The apparatus recited in Claim 41, wherein the memory further includes a set of instructions stored therein and executable by the processor to generate at least one of hard decisions and soft decisions for estimates of the decoded data symbols.
48. (Previously Presented) An apparatus, comprising
- a first discrete Fourier transform (DFT) to demodulate coded data symbols modulated on OFDM subcarriers of a received Orthogonal Frequency Division Multiplexing (OFDM) signal; and
 - a second DFT to decode the coded data symbols for generating decoded data symbols, wherein the second DFT performs the inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
49. (Previously Presented) The apparatus recited in Claim 48, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
50. (Previously Presented) The apparatus recited in Claim 48, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.

51. (Previously Presented) The apparatus recited in Claim 48, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.
52. (Previously Presented) The apparatus recited in Claim 48, further comprising an equalizer coupled between the first DFT and the second DFT and configured to equalize the demodulated signal.
53. (Previously Presented) The apparatus recited in Claim 48, further comprising a cyclic prefix remover to remove a cyclic prefix from the received spread-OFDM signal.
54. (Previously Presented) The apparatus recited in Claim 48, further comprising a decision processor to generate at least one of hard decisions and soft decisions for estimates of the decoded data symbols.

REMARKS

Claims 27-33 were rejected under 35 U.S.C. 101 as being directed to non-statutory subject matter. Claim 27 was amended to recite “—non-transitory computer-readable medium—” as prescribed in M.P.E.P. 2601.1, which is indicated in the Examination Report.

Claims 27-54 were rejected on the ground of nonstatutory double patenting in regards to U.S. Pat. No. 10,211,892.

An eTerminal Disclaimer was filed in compliance with 37 CFR 1.321(c) or 1.321(d) to overcome this rejection.

Applicant respectfully contends that no issue of new matter has been added by this amendment.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Reply is respectfully requested.

Respectfully Submitted,

/Steven J Shattil/

Steven Shattil
Reg. No. 40,170

720-234-4351

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	16199221		
Filing Date	26-Nov-2018		
First Named Inventor	Steve Shattil		
Attorney Docket Number	CBF-000.C8		
Title of Invention	Spreading and Precoding in OFDM		
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.			
Owner		Percent Interest	
Genghiscomm Holdings, LLC		100%	
The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s) 10211892 as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later: - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. ☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.			

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status:	
☒ Small Entity ☐ Micro Entity ☐ Regular Undiscounted	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES	
I certify, in accordance with 37 CFR 1.4(d)(4) that I am:	
☐ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number _____	
☒ 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 request	
Signature	/Steve Shattil/
Name	Steve Shattil

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

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16199221

Filing Date: 26-Nov-2018

Applicant/Patent under Reexamination: Shattil

Electronic Terminal Disclaimer filed on March 11, 2020

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

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

U.S. Patent and Trademark Office



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.
16/199,221	11/26/2018	Steve Shattil	CBF-000.C8	6600
74284	7590	03/02/2020	EXAMINER	
Steven J Shattil P.O. Box 17355 Boulder, CO 80308-0355			LO, DIANE LEE	
			ART UNIT	PAPER NUMBER
			2466	
			MAIL DATE	DELIVERY MODE
			03/02/2020	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.

DETAILED ACTION

This is response to Application 16/199,221 filed on 11/26/2018 in which claims 27-54 are presented for examination.

Claim Rejections - 35 USC § 101

1. 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.

2. Claims 27-33 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claim 27-33 recites a *computer program product* comprising a series of steps or acts to be performed by a computer. The claim is directed to software per se.

Computer programs claimed as computer listings per se, i.e., the descriptions or expressions of the programs are not physical "things". They are neither computer components nor statutory processes, as they are not "acts" being performed. Such claimed computer programs do not define any structural and functional interrelationships between the computer program and other claimed elements of a computer, which permit the computer program's functionality to be realized.

M.P.E.P. 2601.1 Section I states, "Since a computer program is merely a set of instructions capable of being executed by a computer, the computer program itself is not a process and USPTO personnel should treat a claim for a computer program,

without the [non-transitory] computer-readable medium needed to realize the computer program's functionality, as nonstatutory functional descriptive material."

Double Patenting

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

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

2. Claim 27 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 10,211,892.

Claims 28-33 are rejected because they depend on rejected independent claim 27 above.

3. Claim 34 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 10,211,892.

Claims 35-40 are rejected because they depend on rejected independent claim 34 above.

4. Claim 41 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 10,211,892.

Claims 42-47 are rejected because they depend on rejected independent claim 41 above.

5. Claim 48 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 10,211,892.

Claims 49-54 are rejected because they depend on rejected independent claim 48 above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANE LEE LO whose telephone number is (571)270-1952. The examiner can normally be reached on Monday - Friday 8 am - 5 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Faruk Hamza can be reached on (571)272-7969. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Application/Control Number:16/199,221
Art Unit:2466

Page6

/DIANE L LO/
Primary Examiner, Art Unit 2466

<i>Notice of References Cited</i>	Application/Control No. 16/199,221		Applicant(s)/Patent Under Reexamination Shattil, Steve	
	Examiner DIANE L LO		Art Unit 2466	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-10211892-B2	02-2019	Shattil; Steve	H04B7/026	1/1
	B					
	C					
	D					
	E					
	F					
	G					
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	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20200227

<i>Index of Claims</i> 	Application/Control No. 16/199,221	Applicant(s)/Patent Under Reexamination Shattil, Steve
	Examiner DIANE L LO	Art Unit 2466

✓	Rejected
=	Allowed

-	Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	02/28/2020								
	27	✓								
	28	✓								
	29	✓								
	30	✓								
	31	✓								
	32	✓								
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	53	✓								
	54	✓								



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/199,221	11/26/2018		1415	CBF-000.C8	28	4

CONFIRMATION NO. 6600

FILING RECEIPT



CC000000104459098

74284
Steven J Shattil
P.O. Box 17355
Boulder, CO 80308-0355

Date Mailed: 12/17/2018

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

Inventor(s)

Steve Shattil, Cheyenne, WY;

Applicant(s)

Genghiscomm Holdings, LLC, Boulder, CO;

Assignment For Published Patent Application

Genghiscomm Holdings, LLC, Boulder, CO

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 16/027,191 07/03/2018
which is a CON of 15/642,850 07/06/2017 PAT 10015034
which is a CON of 15/489,664 04/17/2017 PAT 9800448
which is a CON of 15/149,382 05/09/2016 PAT 9628231
which is a CIP of 14/727,769 06/01/2015
which is a CON of 14/276,309 05/13/2014 PAT 9048897
which is a CON of 12/545,572 08/21/2009 PAT 8750264
which is a DIV of 11/187,107 07/22/2005 PAT 8670390
which claims benefit of 60/598,187 08/02/2004
and is a CIP of 10/145,854 05/14/2002 ABN

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

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Projected Publication Date: Request for Non-Publication Acknowledged

Non-Publication Request: Yes

Early Publication Request: No

**** SMALL ENTITY ****

Title

Spreading and Precoding in OFDM

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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

Title of Invention	Spreading and Precoding in OFDM
-------------------------------	---------------------------------

As the below named inventor, I hereby declare that:

This declaration is directed to: ☒ The attached application, or
☐ United States application or PCT international application number _____
filed on _____.

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

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

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

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LEGAL NAME OF INVENTOR

Inventor: Steve J Shattil Date (Optional) : 11/25/2018
Signature: /Steve J Shattil/

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

CLAIMS

1. A transmitter configured to reside in a User Equipment (UE), comprising
 - a discrete Fourier transform (DFT) spreader configured to spread a block of original data symbols with a DFT-based spreading matrix to produce a plurality of spread data symbols;
 - a subcarrier mapper responsive to channel-dependent scheduling that assigns a set of uplink orthogonal frequency division multiplex (OFDM) subcarriers to the UE based on favorable channel conditions between the UE and at least one wireless wide area network (WWAN) access terminal, the subcarrier mapper configured to map each non-zero spread data symbol to one of the set of uplink OFDM subcarriers; and
 - an inverse-DFT configured to modulate the plurality of spread data symbols onto the set of uplink OFDM subcarriers to generate a spread-OFDM signal for transmission into the WWAN;wherein at least one of the DFT spreader and the subcarrier mapper configures the spread data symbols to provide the spread-OFDM signal with a low PAPR.
2. The transmitter recited in Claim 1, wherein the low PAPR equals a PAPR corresponding to a single-carrier signal.
3. The transmitter recited in Claim 1, wherein the uplink OFDM subcarriers comprise at least one of contiguous subcarriers and non-contiguous subcarriers.
4. The transmitter recited in Claim 1, wherein the DFT spreader is configured to perform a fast transform algorithm.
5. The transmitter recited in Claim 1, wherein the DFT spreader is configured to provide the spread-OFDM signal with an orthogonal code space.
6. The transmitter recited in Claim 1, wherein the DFT spreader comprises a precoder configured to provide at least one of pre-coding, pre-equalization, and pulse shaping to the spread-OFDM signal.
7. A transmitter comprising a processor; and a memory coupled to the processor, the memory including instructions stored therein and executable by the processor to:

spread a block of original data symbols with a discrete Fourier transform (DFT)-based spreading matrix to produce a plurality of spread data symbols;

responsive to channel-dependent scheduling that assigns a set of uplink orthogonal frequency division multiplex (OFDM) subcarriers to the UE based on favorable channel conditions between the transmitter and at least one wireless wide area network (WWAN) access terminal, map each non-zero spread data symbol to one of the set of uplink OFDM subcarriers; and

modulate the plurality of spread data symbols onto the set of uplink OFDM subcarriers to generate a spread-OFDM signal for transmission into the WWAN;

wherein at least one of the DFT-based spreading matrix and the plurality of spread data symbols is configured to provide the spread-OFDM signal with a low PAPR.

8. The transmitter recited in Claim 7, wherein the low PAPR equals a PAPR corresponding to a single-carrier signal.
9. The transmitter recited in Claim 7, wherein the uplink OFDM subcarriers comprise at least one of contiguous subcarriers and non-contiguous subcarriers.
10. The transmitter recited in Claim 7, wherein the block of original data symbols is spread using a fast transform algorithm.
11. The transmitter recited in Claim 7, wherein the DFT-based spreading matrix is configured to provide the spread-OFDM signal with an orthogonal code space.
12. The transmitter recited in Claim 7, wherein the DFT-based spreading matrix is configured to provide for at least one of pre-coding, pre-equalization, and pulse shaping to the spread-OFDM signal.
13. A transmitter configured to reside in a User Equipment (UE), comprising
 - a discrete Fourier transform (DFT) spreader configured to spread a block of original data symbols with a DFT-based spreading matrix to produce a plurality of spread data symbols;
 - a subcarrier mapper responsive to scheduling that assigns a set of uplink orthogonal frequency division multiplex (OFDM) subcarriers to the UE, the subcarrier mapper

- configured to map each non-zero spread data symbol to one of the set of uplink OFDM subcarriers; and
- an inverse-DFT configured to modulate the plurality of spread data symbols onto the set of uplink OFDM subcarriers to generate a spread-OFDM signal for transmission into a wireless wide area network (WWAN);
- wherein at least one of the DFT spreader and the subcarrier mapper configures the spread data symbols to provide the spread-OFDM signal with a low PAPR.
14. The transmitter recited in Claim 13, wherein the DFT spreader is configured to operate as at least one of the inverse-DFT and a DFT demodulator used for demodulating received OFDM signals.
15. The transmitter recited in Claim 13, wherein the low PAPR equals a PAPR corresponding to a single-carrier signal.
16. The transmitter recited in Claim 13, wherein the uplink OFDM subcarriers comprise at least one of contiguous subcarriers and non-contiguous subcarriers.
17. The transmitter recited in Claim 13, wherein the DFT spreader is configured to perform a fast transform algorithm.
18. The transmitter recited in Claim 13, wherein the DFT spreader is configured to provide the spread-OFDM signal with an orthogonal code space.
19. The transmitter recited in Claim 13, wherein the DFT spreader comprises a precoder configured to provide at least one of pre-coding, pre-equalization, and pulse shaping to the spread-OFDM signal.
20. A transmitter comprising a processor; and a memory coupled to the processor, the memory including instructions stored therein and executable by the processor to:
- spread a block of original data symbols with a discrete Fourier transform (DFT)-based spreading matrix to produce a plurality of spread data symbols;
- responsive to channel-dependent scheduling that assigns a set of uplink orthogonal frequency division multiplex (OFDM) subcarriers to the UE, map each non-zero spread data symbol to one of the set of uplink OFDM subcarriers; and

modulate the plurality of spread data symbols onto the set of uplink OFDM subcarriers to generate a spread-OFDM signal for transmission into a wireless wide area network (WWAN);

wherein at least one of the DFT-based spreading matrix and the plurality of spread data symbols is configured to provide the spread-OFDM signal with a low PAPR.

21. The transmitter recited in Claim 20, wherein the instructions executable by the processor to spread the original data symbols is configured to at least one of modulate the plurality of spread data symbols onto the set of uplink OFDM subcarriers and demodulate a received OFDM signal.
22. The transmitter recited in Claim 20, wherein the low PAPR equals a PAPR corresponding to a single-carrier signal.
23. The transmitter recited in Claim 20, wherein the uplink OFDM subcarriers comprise at least one of contiguous subcarriers and non-contiguous subcarriers.
24. The transmitter recited in Claim 20, wherein the plurality of spread data symbols is generated using a fast transform algorithm.
25. The transmitter recited in Claim 20, wherein the DFT-based spreading matrix is configured to provide the spread-OFDM signal with an orthogonal code space.
26. The transmitter recited in Claim 20, wherein the DFT-based spreading matrix is configured to provide at least one of pre-coding, pre-equalization, and pulse shaping to the spread-OFDM signal.

Abstract

An OFDM transmitter spreads original data symbols with a complex-valued spreading matrix derived from a discrete Fourier transform. Spread data symbols are mapped to OFDM subcarriers. Spreading and mapping are configured to produce a transmitted spread-OFDM signal with a low peak-to-average power ratio (PAPR) and orthogonal code spaces. In MIMO systems, the complex-valued spreading matrix can comprise a MIMO precoding matrix, and the code spaces can comprise MIMO subspaces. In Cooperative-MIMO, a combination of low code-space cross correlation and low PAPR can be achieved.

Docket No. CBF-000.C8

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Docket No.: CBF-000.C8

Steve Shattil

Confirmation No.:

Application No.:

Group Art Unit:

Filed: 11/26/2018

Examiner:

For: **SPREADING AND PRECODING IN OFDM**

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

PRELIMINARY AMENDMENT

Sir:

Prior to examination on the merits, please amend the above-identified application as follows.

Amendments to the Specification begin on page 2.

Amendments to the Claims are reflected in the listing of claims which begins on page 4.

Remarks begin on page 14.

AMENDMENTS TO THE SPECIFICATION

Please AMEND the first heading under the title of the invention on page 1 as follows.

-- CROSS REFERENCE TO PRIOR RELATED APPLICATIONS --

Please DELETE the first paragraph of the specification under the first heading on page 1 that that begins with "This application is a Continuation In Part of U.S. Pat. Appl. 14/727,769..." and ends with "...in their entirety."

Please ADD the following first paragraph of the specification under the amended first heading on page 1 as follows.

-- This application is a Continuation of U.S. Pat. Appl. No. 16/027,191, filed July 3, 2018, which is a Continuation of U.S. Pat. Appl. No. 15/489,664, filed April 17, 2017, now U.S. Pat. No. 9,800,448, which is a Continuation of U.S. Pat. Appl. No. 15/149,382, filed May 9, 2016, now U.S. Pat. No. 9,628,231, which is a Continuation-in-Part of U.S. Pat. Appl. No. 14/727,769, filed June 1, 2015, which is a Continuation of U.S. Pat. Appl. No. 14/276,309, filed May 13, 2014, now U.S. Pat. No. 9,048,897, which is a Continuation of U.S. Pat. Appl. No. 12/545,572, filed August 21, 2009, now U.S. Pat. No. 9,042,333, which is a Divisional of U.S. Pat. Appl. No. 11/187,107, filed on July 22, 2005, now U.S. Pat. No. 8,670,390, which claims priority to Provisional Appl. No. 60/598,187, filed August 2, 2004 and is a Continuation In Part of U.S. Pat. Appl. No.

Docket No. CBF-000.C8

10/145,854, filed on May 14, 2002, all of which are hereby incorporated by reference in their entireties and all of which this application claims priority under at least 35 U.S.C. 120 and/or any other applicable provision in Title 35 of the United States Code. --

AMENDMENTS TO THE CLAIMS

Please **CANCEL** claims 1 - 26 without prejudice or disclaimer.

Please **ADD** new claims 27 - 54 as follows.

The following is a complete list of all claims in this application.

Claims 1 – 26 (Cancelled).

27. (New) A computer program product, comprising a computer readable hardware storage device having computer readable program code stored therein, said program code containing instructions executable by one or more processors of a computer system to implement a method comprising:
- performing a first discrete Fourier transform (DFT) on a received spread-Orthogonal Frequency Division Multiplexing (OFDM) signal to produce a demodulated signal; and
 - performing a second DFT on the demodulated signal to produce decoded data symbols, wherein the second DFT is an inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
28. (New) The computer program product recited in Claim 27, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
29. (New) The computer program product recited in Claim 27, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.
30. (New) The computer program product recited in Claim 27, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous

subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.

31. (New) The computer program product recited in Claim 27, wherein said program code further contains instructions executable by one or more processors of the computer system for equalizing the demodulated signal.
32. (New) The computer program product recited in Claim 27, wherein said program code further contains instructions executable by one or more processors of the computer system for removing a cyclic prefix from the received spread-OFDM signal.
33. (New) The computer program product recited in Claim 27, wherein said program code further contains instructions executable by one or more processors of the computer system for generating at least one of hard decisions and soft decisions for estimates of the decoded data symbols.
34. (New) A method, comprising:
 - performing a first discrete Fourier transform (DFT) on a received spread-Orthogonal Frequency Division Multiplexing (OFDM) signal to produce a demodulated signal; and
 - performing a second DFT on the demodulated signal to produce decoded data symbols, wherein the second DFT is an inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
35. (New) The method recited in Claim 34, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
36. (New) The method recited in Claim 34, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.

37. (New) The method recited in Claim 34, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.
38. (New) The method recited in Claim 34, further comprising equalizing the demodulated signal.
39. (New) The method recited in Claim 34, further comprising removing a cyclic prefix from the received spread-OFDM signal.
40. (New) The method recited in Claim 34, further comprising generating at least one of hard decisions and soft decisions for estimates of the decoded data symbols.
41. (New) An apparatus comprising:
a processor; and
a memory coupled to the processor, the memory including a set of instructions stored therein and executable by the processor to:
perform a first discrete Fourier transform (DFT) on a received spread-Orthogonal Frequency Division Multiplexing (OFDM) signal to produce a demodulated signal; and
perform a second DFT on the demodulated signal to produce decoded data symbols, wherein the second DFT is an inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
42. (New) The apparatus recited in Claim 41, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
43. (New) The apparatus recited in Claim 41, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.

44. (New) The apparatus recited in Claim 41, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.
45. (New) The apparatus recited in Claim 41, wherein the memory further includes a set of instructions stored therein and executable by the processor to equalize the demodulated signal.
46. (New) The apparatus recited in Claim 41, wherein the memory further includes a set of instructions stored therein and executable by the processor to remove a cyclic prefix from the received spread-OFDM signal.
47. (New) The apparatus recited in Claim 41, wherein the memory further includes a set of instructions stored therein and executable by the processor to generate at least one of hard decisions and soft decisions for estimates of the decoded data symbols.
48. (New) An apparatus, comprising
 a first discrete Fourier transform (DFT) to demodulate coded data symbols modulated on OFDM subcarriers of a received Orthogonal Frequency Division Multiplexing (OFDM) signal; and
 a second DFT to decode the coded data symbols for generating decoded data symbols, wherein the second DFT performs the inverse of a DFT employed by a transmitter to spread data symbols across OFDM subcarriers.
49. (New) The apparatus recited in Claim 48, wherein the DFT employed by the transmitter reduces peak-to-average power of the spread-OFDM signal.
50. (New) The apparatus recited in Claim 48, wherein at least one of the first DFT and the second DFT comprises a fast Fourier transform.

51. (New) The apparatus recited in Claim 48, wherein the first DFT is configured to demodulate at least one of a spread-OFDM signal having contiguous subcarrier frequencies and a spread-OFDM signal having non-contiguous subcarrier frequencies.
52. (New) The apparatus recited in Claim 48, further comprising an equalizer coupled between the first DFT and the second DFT and configured to equalize the demodulated signal.
53. (New) The apparatus recited in Claim 48, further comprising a cyclic prefix remover to remove a cyclic prefix from the received spread-OFDM signal.
54. (New) The apparatus recited in Claim 48, further comprising a decision processor to generate at least one of hard decisions and soft decisions for estimates of the decoded data symbols.

REMARKS

By this amendment, claims 1 - 26 are cancelled and claims 27 - 54 are newly added. Accordingly, claims 27 - 54 are currently pending in this application. Applicant respectfully contends that no issue of new matter has been added by this amendment.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Reply is respectfully requested.

Respectfully Submitted,

/Steven J Shattil/

Steven Shattil
Reg. No. 40,170

720-234-4351