



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,006	10/13/2015	9160466	2014074 / RA309C1C1C1C1C1	6296

78408 7590 09/23/2015
MARC P. SCHUYLER / Rambus
P.O. BOX 2535
SARATOGA, CA 95070

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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

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

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

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

Craig E. Hampel, Los Altos, CA;
Rambus Inc., Sunnyvale, CA;
Frederick A. Ware, Los Altos Hills, CA;
Richard E. Perego, Thornton, 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.

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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.
14/535006	11/06/2014	Craig E. Hampel	2014074/RA309C1C1C1C1C1	6296

TITLE OF INVENTION:

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	960	0	0	960	09/21/2015
EXAMINER		ART UNIT	CLASS-SUBCLASS			

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, 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 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)

Rambus Inc.

Sunnyvale, California (USA)

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 /Marc P. Schuyler/

Date 09/09/2015

Typed or printed name Marc P. Schuyler

Registration No. 35675

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.

Privacy Act Statement

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

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

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

Electronic Patent Application Fee Transmittal				
Application Number:		14535006		
Filing Date:		06-Nov-2014		
Title of Invention:		Periodic Calibration For Communication Channels By Drift Tracking		
First Named Inventor/Applicant Name:		Craig E. Hampel		
Filer:		Marc Philip Schuyler		
Attorney Docket Number:		2014074 / RA309C1C1C1C1C1		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt

EFS ID:	23446329
Application Number:	14535006
International Application Number:	
Confirmation Number:	6296
Title of Invention:	Periodic Calibration For Communication Channels By Drift Tracking
First Named Inventor/Applicant Name:	Craig E. Hampel
Customer Number:	78408
Filer:	Marc Philip Schuyler
Filer Authorized By:	
Attorney Docket Number:	2014074 / RA309C1C1C1C1C1
Receipt Date:	09-SEP-2015
Filing Date:	06-NOV-2014
Time Stamp:	18:19:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$960
RAM confirmation Number	5254
Deposit Account	
Authorized User	

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

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	ptol85b-2015-09-09-RA309.pdf	72383	no	2
			36d086f71da3e598d61333209a13c748		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30637	no	2
			7e7bf3c1d9ed53e548505506fb1dff3d6c60a7ef		
Warnings:					
Information:					
Total Files Size (in bytes):			103020		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

78408 7590 06/19/2015
MARC P. SCHUYLER / Rambus
P.O. BOX 2535
SARATOGA, CA 95070

EXAMINER

WANG, TED M

ART UNIT

PAPER NUMBER

2633

DATE MAILED: 06/19/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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14/535,006

11/06/2014

Craig E. Hampel

2014074 /
RA309C1C1C1C1C1

6296

TITLE OF INVENTION: Periodic Calibration For Communication Channels By Drift Tracking

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	09/21/2015

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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

78408 7590 06/19/2015
MARC P. SCHUYLER / Rambus
P.O. BOX 2535
SARATOGA, CA 95070

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.
14/535,006	11/06/2014	Craig E. Hampel	2014074 / RA309C1C1C1C1C1	6296

TITLE OF INVENTION: Periodic Calibration For Communication Channels By Drift Tracking

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	09/21/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
WANG, TED M	2633	375-224000

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, 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 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 credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

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

NOTE: Absent a valid certification of Micro Entity Status (see 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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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,006	11/06/2014	Craig E. Hampel	2014074 / RA309C1C1C1C1C1	6296
78408	7590	06/19/2015	EXAMINER	
MARC P. SCHUYLER / Rambus P.O. BOX 2535 SARATOGA, CA 95070			WANG, TED M	
			ART UNIT	PAPER NUMBER

2633

DATE MAILED: 06/19/2015

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 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.

Privacy Act Statement

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

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

Notice of Allowability	Application No. 14/535,006	Applicant(s) HAMPEL ET AL.	
	Examiner TED WANG	Art Unit 2633	AIA (First Inventor to File) Status No

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

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

- 1. ☒ This communication is responsive to 5/20/2015 TD.
☐ 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 3-21. 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 _____.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

Terminal Disclaimer

2. The terminal disclaimer filed on 5/20/2015 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US 8,929,424 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Allowable Subject Matter

3. Claims 3-21 are allowed.
4. 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

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ted M. Wang whose telephone number is (571) 272-3053. The examiner can normally be reached on M-F, 7:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sam Ahn can be reached on 571-272-3044. 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).

/Ted M Wang/
Primary Examiner, Art Unit 2633

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**INFORMATION DISCLOSURE
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(Use as many sheets as necessary)

Sheet 1

of 11

Complete if Known

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
/T.W./	1	US- 3155102	11-03-1964	Niederer, Jr. et al.	Entire Document
/T.W./	2	US- 3638121	01-25-1972	Spilker, Jr., James J.	Entire Document
/T.W./	3	US- 3922491	11-25-1975	Bjork et al.	Entire Document
/T.W./	4	US- 4384354	05-17-1983	Crawford et al.	Entire Document
/T.W./	5	US- 4648133	03-03-1987	Vilnrotter, Victor	Entire Document
/T.W./	6	US- 5111208	05-05-1992	Lopez, A.R.	Entire Document
/T.W./	7	US- 5122978	06-16-1992	Merrill, John	Entire Document
/T.W./	8	US- 5243626	09-07-1993	Devon et al.	Entire Document
/T.W./	9	US- 5265211	11-23-1993	Amini et al.	Entire Document
/T.W./	10	US- 5329489-A	07-12-1994	Diefendorff, Keith E.	Entire Document
/T.W./	11	US- 5436908	07-25-1995	Fluker et al.	Entire Document
/T.W./	12	US- 5485490	01-16-1996	Leung et al.	Entire Document
/T.W./	13	US- 5485602	01-16-1996	Ledbetter, Jr. et al	Entire Document
/T.W./	14	US- 5511091	04-23-1996	Saito, Naritoshi	Entire Document
/T.W./	15	US- 5523760	06-04-1996	McEwan, Thomas	Entire Document
/T.W./	16	US- 5541967	07-30-1996	Gluska et al.	Entire Document
/T.W./	17	US- 5548146	08-20-1996	Kuroda et al.	Entire Document
/T.W./	18	US- 5554945	09-10-1996	Lee et al.	Entire Document
/T.W./	19	US- 5621913	04-15-1997	Tuttle et al.	Entire Document

FOREIGN PATENT DOCUMENTS

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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
/T.W./	1	JP-2000-035831-A2	02-02-2000	Masaharu, Mizuno	Entire Document	✓
/T.W./	2	WO-2001-16954-A	03-08-2001	Yoo et al.	Entire Document	

Examiner
Signature

/Ted Wang/

Date
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06/15/2015

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STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Sheet **2**of **11****Complete if Known**

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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/T.W./	20	US- 5671376	09-23-1997	Bucher et al.	Entire Document
/T.W./	21	US- 5684966	11-04-1997	Gafford et al.	Entire Document
/T.W./	22	US- 5742798	04-21-1998	Goldrian, Gottfried	Entire Document
/T.W./	23	US- 5771356	06-23-1998	Leger et al	Entire Document
/T.W./	24	US- 5778436	07-07-1998	Kedem et al.	Entire Document
/T.W./	25	US- 5859881	01-12-1999	Ferraiolo et al.	Entire Document
/T.W./	26	US- 6047346	04-04-2000	Lau et al.	Entire Document
/T.W./	27	US- 6163570	12-19-2000	Olafsson, Sverrir	Entire Document
/T.W./	28	US- 6173345-B1	01-09-2001	Stevens, William	Entire Document
/T.W./	29	US- 6219384-B1	04-17-2001	Kliza et al.	Entire Document
/T.W./	30	US- 6243776	06-05-2001	Lattimore et al.	Entire Document
/T.W./	31	US- 6282210-B1	08-28-2001	Rapport et al.	Entire Document
/T.W./	32	US- 6321282-B1	11-20-2001	Horowitz et al.	Entire Document
/T.W./	33	US- 6359931-B1	03-19-2002	Perino et al.	Entire Document
/T.W./	34	US- 6369652-B1	04-09-2002	Nguyen et al.	Entire Document
/T.W./	35	US- 6377640-B2	04-23-2002	Trans, Francois	Entire Document
/T.W./	36	US- 6396329-B1	05-28-2002	Zerbe, Jared	Entire Document
/T.W./	37	US- 6421389-B1	07-16-2002	Jett et al.	Entire Document
/T.W./	38	US- 6434081-B1	08-13-2002	Johnson et al.	Entire Document

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Signature

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Sheet **3**of **11****Complete if Known**

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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		Number-Kind Code ² (if known)			
/T.W./	39	US- 6442644-B1	08-27-2002	Gustavson et al.	Entire Document
/T.W./	40	US- 6448815-B1	09-10-2002	Talbot et al.	Entire Document
/T.W./	41	US- 6463392-B1	10-08-2002	Nygaard et al.	Entire Document
/T.W./	42	US- 6469555-B1	10-22-2002	Lau et al.	Entire Document
/T.W./	43	US- 6473439-B1	10-29-2002	Zerbe et al.	Entire Document
/T.W./	44	US- 6484232-B2	11-19-2002	Olarig et al.	Entire Document
/T.W./	45	US- 6510503-B2	01-21-2003	Gillingham et al.	Entire Document
/T.W./	46	US- 6539072-B1	03-25-2003	Donnelly et al.	Entire Document
/T.W./	47	US- 6556934-B2	04-29-2003	Higashide, Koichi	Entire Document
/T.W./	48	US- 6560716-B1	05-06-2003	Gasparik et al.	Entire Document
/T.W./	49	US- 6606350-B2	08-12-2003	Dress, Jr. et al.	Entire Document
/T.W./	50	US- 6606576-B2	08-12-2003	Sessions, D.C.	Entire Document
/T.W./	51	US- 6639957	10-02-2003	Cahill-O'Brien et al.	Entire Document
/T.W./	52	US- 6643787-B1	11-04-2003	Zerbe et al.	Entire Document
/T.W./	53	US- 6657468-B1	12-02-2003	Best et al.	Entire Document
/T.W./	54	US- 6662305-B1	12-09-2003	Salmon et al.	Entire Document
/T.W./	55	US- 6690741-B1	02-10-2004	Larrick, Jr. et al.	Entire Document
/T.W./	56	US- 6691214	02-10-2004	Li et al.	Entire Document
/T.W./	57	US- 6693918-B1	02-17-2004	Dallabetta et al.	Entire Document

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Sheet 4

of 11

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/T.W./	58	US- 6717992-B2	04-06-2004	Cowie et al.	Entire Document
/T.W./	59	US- 6735709-B1	05-11-2004	Lee et al.	Entire Document
/T.W./	60	US- 6751696	06-15-2004	Farmwald et al.	Entire Document
/T.W./	61	US- 6873939	03-29-2005	Zerbe et al.	Entire Document
/T.W./	62	US- 6889357-B1	05-03-2005	Keeth et al.	Entire Document
/T.W./	63	US- 6920540-B2	07-19-2005	Hampel et al.	Entire Document
/T.W./	64	US- 7072355	07-04-2006	Kizer, Jade	Entire Document
/T.W./	65	US- 7099424-B1	08-29-2006	Chang et al.	Entire Document
/T.W./	66	US- 7119549	10-10-2006	Lee et al.	Entire Document
/T.W./	67	US- 7137048	11-14-2006	Zerbe et al.	Entire Document
/T.W./	68	US- 7196979	03-27-2007	Kadlec et al.	Entire Document
/T.W./	69	US- 7535933	05-19-2009	Zerbe et al.	Entire Document
/T.W./	70	US- 6181166 B1	01-30-2001	Krishnamurthy et al.	Entire Document
/T.W./	71	US- 6457089 B1	09-24-2002	Robbins et al.	Entire Document
/T.W./	72	US- 6480026 B2	11-12-2002	Andrews et al	Entire Document
/T.W./	73	US- 6725304 B2	04-20-2004	Arimilli et al	Entire Document
/T.W./	74	US- 2001-0048382-A1	12-06-2001	Low et al.	Entire Document
/T.W./	75	US- 2001-0053175-A1	12-20-2001	Hector et al.	Entire Document
/T.W./	76	US- 2001-0056332-A1	12-27-2001	Abrosimov et al.	Entire Document

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Sheet 5

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/T.W./	77	US- 2002-0054648-A1	05-09-2002	Krummrich et al.	Entire Document
/T.W./	78	US- 2002-0066001-A1	05-30-2002	Olarig et al.	Entire Document
/T.W./	79	US- 2002-0072870-A1	06-13-2002	Adam et al.	Entire Document
/T.W./	80	US- 2002-0138224-A1	09-26-2002	Sessions, D.C.	Entire Document
/T.W./	81	US- 2002-0149824-A1	10-17-2002	Beaulieu et al.	Entire Document
/T.W./	82	US- 2002-0184461	12-05-2002	Zumkehr, John	Entire Document
/T.W./	83	US- 2003-0026399-A1	02-06-2003	Carlson, Arthur	Entire Document
/T.W./	84	US- 2003-0063597-A1	04-03-2003	Suzuki, Mitsuhiro	Entire Document
/T.W./	85	US- 2003-0065465-A1	04-03-2003	Johnson et al.	Entire Document
/T.W./	86	US- 2003-0065845-A1	04-03-2003	Riley, Dwight	Entire Document
/T.W./	87	US- 2003-0117864-A1	06-26-2003	Hampel et al.	Entire Document
/T.W./	88	US- 2003-0131160	07-10-2003	Hampel et al.	Entire Document
/T.W./	89	US- 2003-0146800-A1	08-07-2003	Dvorak, Mark	Entire Document
/T.W./	90	US- 2003-0149991-A1	08-07-2003	Reidhead et al.	Entire Document
/T.W./	91	US- 2003-0158994-A1	08-21-2003	Moy, Andrew	Entire Document
/T.W./	92	US- 2003-0198212-A1	10-23-2003	Hector et al.	Entire Document
/T.W./	93	US- 2003-0198308-A1	10-23-2003	Hector et al.	Entire Document
/T.W./	94	US- 2003-0221061-A1	11-27-2003	El-Batal et al.	Entire Document
/T.W./	95	US- 2004-0032354-A1	02-19-2004	Knobel et al.	Entire Document

FOREIGN PATENT DOCUMENTS

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Sheet 6

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Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

U. S. PATENT DOCUMENTS

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		Number-Kind Code ² (if known)			
/T.W./	96	US- 2004-0054830-A1	03-18-2004	Craft et al.	Entire Document
/T.W./	97	US- 2004-0057500-A1	03-25-2004	Balachandran et al.	Entire Document
/T.W./	98	US- 2004-0199674	10-07-2004	Brinkhus, Hartmut	Entire Document
/T.W./	99	US- 2004-0217881-A1	11-04-2004	Pedyash et al.	Entire Document
/T.W./	100	US- 2004-0260858	12-23-2004	Primrose, Donald R.	Entire Document
/T.W./	101	US- 2005-0081942-A1	04-21-2005	Schwane et al.	Entire Document
/T.W./	102	US- 2005-0163202-A1	07-28-2005	Hampel et al.	Entire Document
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Sheet 7 of 11

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/T.W./	1	"Draft Standard for a High-Speed Memory Interface (SyncLink)," Draft 0.99 IEEE P1596.7-199X, pp. 1-56 (1996), MICROPROCESSOR and MICROCOMPUTER STANDARDS SUBCOMMITTEE of the IEEE COMPUTER SOCIETY. 66 pages	
/T.W./	2	BANU et al., "TA 6.4: A 660Mb/s CMOS Clock Recovery Circuit with Instantaneous Locking for NRZ Data and Burst-Mode Transmission," IEEE International Solid State Circuits Conference, 1993, pp. 102-103, 270. 4 pages	
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Sheet 8

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/T.W./	11	ELDERING et al., "Digital Burst Mode Clock Recovery Technique for Fiber-Optic Systems," Journal of Lightwave Technology, Vol. 12, No. 2, February 1994, pp. 271-279. 12 pages	
/T.W./	12	EP Examination Report dated November 6, 2007 in EP Application No. 05706081.6. 5 pages	
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/T.W./	14	EP Response dated May 25, 2010 to the Official Communication dated January 15, 2010 re EP Application No. 05711891.1, Includes New Claims 1-24 (Highlighted and Clear Copies) and New Description Pages 3, 3a, 3b. 30 pages	
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/T.W./	16	GILLINGHAM et al., "SLDRAM: High Performance Open-Standard Memory," IEEE Micro, November/December 1997, pp. 29-39, Vol. 17, No. 6, Institute of Electrical and Electronics Engineers, Inc., Los Alamitos, California. 11 pages	
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Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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/T.W./	21	KIM et al., "An 800Mbps Multi-Channel CMOS Serial Link with 3x Oversampling," IEEE 1995 Custom Integrated Circuits Conference, pp. 22.7.1-22.7.4. 4 pages	
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/T.W./	30	Rambus, Inc., "RDRAM Direct Rambus Clock Generator," April 2002. 22 pages	

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		Filing Date	06 November 2014		
		First Named Inventor	Craig E. Hampel		
		Art Unit	2633		
		Examiner Name	Wang, Ted M.		
Sheet	10	of	11	Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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/T.W./	31	RaSer™ X Product Brief, "Highly Flexible 10 Gbps Backplane Serial Link Interface," Copyright 2003, Rambus, Inc. 2 pages	
/T.W./	32	RDRAM® Overview, "High Performance Memory Interface Solution," Copyright 2003, Rambus, Inc. 4 pages	
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/T.W./	34	SLDRAM Inc., "SLD4M18DR400 4 MEG X 18 SLDRAM: 400 Mb/s/pin SLDRAM 4 M x 18 SLDRAM Pipelined, Eight Bank, 2.5 V Operation," July 9, 1998. 69 pages	
/T.W./	35	Supplementary EP Search Report dated April 17, 2007 in EP Application No. 05706081.6. 3 pages	
/T.W./	36	TW Office Action dated May 11, 2011 re TW Application No. 094101310. 13 pages	✓
/T.W./	37	TW Response dated August 12, 2011 to the Office Action dated May 11, 2011 re TW Application No. 94101310. 30 pages	✓
/T.W./	38	WIDMER et al., "A DC-Balanced, Partitioned-Block, 8B/10B Transmission Code," IBM J. Res. Develop., Vol. 27, No. 5, September 1983, pp. 440-451. 12 pages	
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/T.W./	40	YANG, Chih-Kong Ken, "Design of High-Speed Serial Links in CMOS," Technical Report No. CSL-TR-98-775, December 1998, pp. 1-182. 94 pages	

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/T.W./	41	Yellowstone Technology Brief, "High Performance Memory Interface Technology," Copyright 2003, Rambus, Inc. 2 pages	
/T.W./	42	ZERBE, Jared, U.S. Application No. 09/776,550 filed February 2, 2001, re "Method and Apparatus for Evaluating and Calibrating a Signaling System" Application and Figures as Filed. 62 pages	
/T.W./	43	ZERBE, Jared, U.S. Application No. 09/976,170 filed October 21, 2001, re "Method and Apparatus for Evaluating and Optimizing a Signaling System" Application and Figures as Filed. 98 pages	

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Search Notes 	Application/Control No. 14535006	Applicant(s)/Patent Under Reexamination HAMPEL ET AL.
	Examiner TED WANG	Art Unit 2633

CPC- SEARCHED		
Symbol	Date	Examiner
H04L1/20.cpc. H04L1/24.cpc. H04B3/46.cpc. H04L7/004.cpc. H04L7/043.cpc. H04L7/10.cpc. H04L27/00.cpc. H04B17/00.cpc. H04B17/0062.cpc.	6/15/2015	TW

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST - USPGPUB, USPAT, USOCR, EPO, JPO, DERWENT, IBM_TDB, see attached search report	6/15/2015	TW
ODP- searched and reviewed from PALM and EAST	6/15/2015	TW
google- "during initialization" "first calibration" "periodically" "constrained" "drift" "temperature" "time period" "shorter"	6/15/2015	TW
IEEEExplor - (((("Authors":Hampel Craig) OR "Authors":Ware Frederick) OR "Authors":Perego Richard)	6/15/2015	TW
IEEEExplor- (((("initialization" "periodically" "drift" "temperature") AND "time period" "shorter") AND "calibration")	6/15/2015	TW

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
H04L	7/004, 7/043, 7/10, 27/00	6/15/2015	TW
H04B	17/00, 17/0062	6/15/2015	TW

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Patent US20090034669 - Periodic calibration for ... - Google

https://www.google.com.ar/patents/US20090034669

Google

Periodic calibration for communication channels by drift tracking ... in response to drift tracking, updating the data eye timing point, and communicating data ...

Patent US8644419 - Periodic calibration for communication ...

www.google.com/patents/US8644419

Google

Feb 4, 2014 - a second calibration operation to perform drift tracking using the data eye timing point, the second calibration operation identifying drift ...

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Patent US20150063433 - Periodic Calibration For ... - Google

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subjecting the receive component to a first calibration during initialization to ... for drift attributable to change in at least one of operating voltage or temperature; and ... second calibration is constrained to occur during a time period that is shorter ... The method of claim 3 , wherein periodically subjecting includes calculating ...

Patent US20150063433 - Periodic Calibration For ... - Google

www.google.com/patents/US20150063433 Google ▾

Mar 5, 2015 - A method and system that provides for execution of a first calibration ... to a first calibration during initialization to identify an initial value for ... constrained to occur during a time period that is shorter than a time period of the first calibration. ... drift attributable to change in at least one of voltage or temperature, ...

08929424

www.uspto.gov/.../US08929424-... United States Patent and Trademark Office ▾

Periodic calibration for communication channels by drift tracking ... performing a first calibration during initialization to identify an initial value for a parameter ... periodically performing a second calibration to update an existing value of the ... to occur during a time period that is shorter than a time period of the first calibration.

[PDF] View/Open - Lakehead University

lurepository.lakeheadu.ca:8080/bitstream/.../MikkelsenL2012m-1b.pdf?...4

Figure 4.1: Temperature (°C), salinity (psu) and density (kg/m3) overlay the ashrock within a poorly constrained time interval, up to 300 million The first calibration method is based on adjusting the rate of groundwater inflow The prediction by Model 3A is only 2 years longer than Model 2A and 7 years shorter than

Temperature Calibration

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Year

Single YearRange

FromTo

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Affiliation

Publication Title

Conference Location

Standard Status

☒ PulseSync: An Efficient and Scalable Clock Synchronization Protocol

Lenzen, C.; Sommer, P.; Wattenhofer, R.
Networking, IEEE/ACM Transactions on
Year: 2015, Volume: 23, Issue: 3
Pages: 717 - 727, DOI: 10.1109/TNET.2014.2309805

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☒ IEEE Standard for information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications - Redline

IEEE Std 802.11-2012 (Revision of IEEE Std 802.11-2007) - Redline
Year: 2012
Pages: 1 - 5229

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☒ Nonlinear sensorless cooling control for a peltier actuated aluminum plate thermal system

Takahashi, K.; Deng, M.
Advanced Mechatronic Systems (ICAMEchS), 2013 International Conference on
Year: 2013
Pages: 1 - 715, DOI: 10.1109/ICAMEchS.2013.6681839

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☒ ISO/IEC/IEEE International Standard for Ethernet

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Terms

packet
fec
arbitration
channel
link
encapsulation
lan
bpsk
iso
bridge
optical fiber
mp
emi
ber

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ISO/IEC/IEEE 8802-3:2014(E)
Year: 2014
Pages: 1 - 3754, DOI: 10.1109/IEEESTD.2014.6781545
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- IEEE Draft Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
IEEE P802.11-REVmc/D3.0, June 2014 (Revision of IEEE Std 802.11-2012 as amended by IEEE Std 802.11ae-2012, IEEE Std 802.11aa-2012, IEEE Std 802.11ad-2012, IEEE Std 802.11ac-2013, and IEEE Std 802.11af-2013)
Year: 2014
Pages: 1 - 3701
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Year: 2004
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Year: 2012
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Year: 2005, Volume: Section5

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Year: 2012

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Pages: 1 - 200

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Year: 2006

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Cited by: Patents (4)
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 **IEEE Standard for information technology--Telecommunications and information exchange between systems--Local and metropolitan area networks-- Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications - Section Three** 

IEEE Std 802.3-2005 (Revision of IEEE Std 802.3-2002 including all approved amendments)
Year: 2005, Volume: Section3
Pages: 1 - 387, DOI: 10.1109/IEEESTD.2005.243260
IEEE Standards

 Abstract

 (3423
Kb)



 **IEEE Standard for Ethernet - Section 3** 

IEEE Std 802.3-2012 (Revision to IEEE Std 802.3-2008)
Year: 2012
Pages: 1 - 0, DOI: 10.1109/IEEESTD.2012.6419737
IEEE Standards

 Abstract

 (12190
Kb)



 **IEEE Draft Standard for Ethernet - Section 3** 

IEEE P802.3_D3.1, April 2012 (Revision of IEEE Std 802.3-2008)
Year: 2012
Pages: 1 - 0
IEEE Standards

 Abstract

 (5258
Kb)



Systems and Architectures 

Mitola, J.; Zvonar, Z.
Software Radio Technologies:Selected Readings
Year: 2001
Pages: 223 - 350, DOI: 10.1109/9780470546444.ch3
Wiley-IEEE Press eBook Chapters

 Abstract



Hardware Considerations 

Lapante, P.
Real-Time Systems Design and Analysis
Year: 2004
Pages: 23 - 72, DOI: 10.1002/0471648299.ch2
Wiley-IEEE Press eBook Chapters

Abstract 

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Displaying Results 1-8 of 8 for (((“Authors”:Hampel Craig) OR “Authors”:Ware Frederick) OR “Authors”:Perego Richard)

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Content Type

☒ Conference Publications (7)

☐ Journals & Magazines (1)

Year

Single Year | Range

From: | To:

Author

Affiliation

Publication Title

Conference Location

☒ Improving Power and Data Efficiency with Threaded Memory Modules

Ware, F.A.; Hampel, C.

Computer Design, 2006. ICCD 2006. International Conference on

Year: 2006

Pages: 417 - 424, DOI: 10.1109/ICCD.2006.4380850

Cited by: Papers (13)

IEEE Conference Publications

Abstract | HTML | (4919 Kb)

☒ 64 bit monolithic floating point processors

Ware, F.; McAllister, W.H.; Carlson, J.R.; Sun, D.K.; Vlach, R.J.

Solid-State Circuits, IEEE Journal of

Year: 1982, Volume: 17, Issue: 5

Pages: 898 - 907, DOI: 10.1109/JSSC.1982.1051837

Cited by: Papers (11) | Patents (39)

IEEE Journals & Magazines

Abstract | (1604 Kb)

☒ Design of a high-speed arithmetic datapath

Birman, M.; Chu, G.; Hu, L.; McLeod, J.; Bedard, N.; Ware, F.; Torban, L.; Lim, C.M.

Computer Design: VLSI in Computers and Processors, 1988. ICCD '88., Proceedings of the 1988 IEEE International Conference on

Year: 1988

Standards Dictionary Terms

Browse

Pages: 214 - 215, DOI: 10.1109/ICCD.1988.25693

Cited by: Papers (8) | Patents (18)

IEEE Conference Publications

 Abstract

 (228 Kb)



 **Embedded stereoscopic 3D camera system for mobile platforms** 

Aguirre, A.; Batur, A.U.; Hewes, G.; Pekkucuksen, I.; Venkatraman, N.; Ware, F.; Buyue Zhang

Acoustics, Speech and Signal Processing (ICASSP), 2012 IEEE International Conference on

Year: 2012

Pages: 1705 - 1708, DOI: 10.1109/ICASSP.2012.6288226

IEEE Conference Publications

 Abstract

 (i.html)

 (254 Kb)



 **A 64b floating point processor** 

Ware, F.

Solid-State Circuits Conference. Digest of Technical Papers. 1982 IEEE International

Year: 1982, Volume: XXV

Pages: 24 - 25, DOI: 10.1109/ISSCC.1982.1156327

Cited by: Patents (1)

IEEE Conference Publications

 Abstract

 (705 Kb)



 **A high-speed 32 bit IEEE floating-point chip set for digital signal processing** 

Bob Woo; Lyon Lin; Ware, F.

Acoustics, Speech, and Signal Processing, IEEE International Conference on ICASSP '84.

Year: 1984, Volume: 9

Pages: 680 - 683, DOI: 10.1109/ICASSP.1984.1172306

Cited by: Papers (3)

IEEE Conference Publications

 Abstract

 (192 Kb)



 **Pseudo-differential signaling scheme based on 4b/6b multiwire code** 

Dan Oh; Ware, F.; Woopoung Kim; Joong-Ho Kim; Wilson, J.; Lei Luo; Kizer, J.; Schmitt, R.; Chuck Yuan; Eble, J.

Electrical Performance of Electronic Packaging, 2008 IEEE-EPEP

Year: 2008

Pages: 29 - 32, DOI: 10.1109/EPEP.2008.4675668

Cited by: Papers (4)

IEEE Conference Publications

 Abstract

 (i.html)

 (5503 Kb)



The Weitek 64-bit Floating-point Datapath Unit

Bedard, N.; Birman, M.; Chu, G.; Hu, L.; Lim, C.M.; McLeod, J.; Torban, L.; Ware, F.

Signals, Systems and Computers, 1988. Twenty-Second Asilomar Conference on

Year: 1988, Volume: 2

Pages: 898 - 902, DOI: 10.1109/ACSSC.1988.754679

Cited by: Patents (5)

IEEE Conference Publications

Abstract

(328 Kb)

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	168	initiali\$6 same calibrat\$3 and eye same point and drift\$3 same (track\$3 or temperature)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 10:30
L2	14	periodical\$2 with calibrat\$3 and mesochronous with memory and eye same tim\$3 with point and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 10:31
L3	204	calibrat\$3 and eye same point and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 10:32
L5	7	drift\$3 same track\$3 and initiali\$6 with calibrat\$3 and eye with tim\$3 with point	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 10:35
L9	4	initializ\$5 with calibrat\$3 and periodic\$4 with drift\$3 and time adj1 period with short\$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 10:43
L10	3	initializ\$5 with calibrat\$3 and periodic\$4 with drift\$3 and (first or second) with calibrat\$3 with time adj1 period with short\$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 10:44
L11	14	initializ\$5 with calibrat\$3 and periodic\$4 with (drift\$3 or chang\$3) and (first or second) with calibrat\$3 with time adj1 period with short\$2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 10:45
S26	21	"3155102"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:05
S163	910	(Hampel adj3 Craig) (Ware adj3 Frederick) (Perego adj3 Richard)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:11
S164	87	calibrat\$3 and operation\$3 and data with eye same point and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:12

S165	92	calibrat\$3 and data with eye same point and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:13
S166	204	calibrat\$3 and eye same point and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:13
S167	66	calibrat\$3 and eye same tim\$3 with point and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:14
S168	23	calibrat\$3 and eye same tim\$3 with point and periodic\$4 with drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:15
S169	14	mesochronous with memory and drift\$3 with track\$3 and calibrat\$3 and eye with point	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:19
S170	25201	H04L1/20.cpc. H04L1/24.cpc. H04B3/46.cpc. H04L7/004.cpc. H04L7/043.cpc. H04L7/10.cpc. H04L27/00.cpc. H04B17/00.cpc. H04B17/0062.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/06/15 08:27
S171	6	S170 and calibrat\$3 and eye same point and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:27
S172	29	S170 and calibrat\$3 and data with eye and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:28
S174	15	initializ\$5 with calibrat\$3 and eye same tim\$3 with point and periodic\$4 with drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:42
S175	2	initializ\$5 with calibrat\$3 and eye same tim\$3 with point and periodic\$4 with drift\$3 with temperature	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:43
S177	1	14/535,006	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/06/15 08:53
S178	11	10/766,761	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/15 08:54

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S88	2	10/766,761	USPAT; UPAD	OR	ON	2011/06/03 15:13
S89	261	((Hampel with Craig) or (Ware with Frederick) or (Perego with Richard))	USPAT; UPAD	OR	ON	2011/06/03 15:13
S90	5	S89 and calibrat\$3 same data adj3 eye same (tim\$3 or diagram or initial or initializ\$5 or begin\$4)	USPAT; UPAD	OR	ON	2011/06/03 15:14
S141	1	12/173,530	US-PGPUB; USPAT; UPAD	OR	ON	2012/02/09 21:44

6/ 15/ 2015 11:00:09 AM
C:\ Users\ twang\ Documents\ EAST\ Workspaces\ 14535006.wsp

Issue Classification 	Application/Control No. 14535006	Applicant(s)/Patent Under Reexamination HAMPEL ET AL.	
	Examiner TED WANG	Art Unit 2633	

CPC						
Symbol					Type	Version
H04B		17		0062	F	2013-01-01
H04L		7		0004	I	2013-01-01
H04L		7		043	I	2013-01-01
H04L		7		10	I	2013-01-01
H04L		27		00	I	2013-01-01
H04B		17		00	I	2013-01-01
						
						
						
						
						
						
						
						
						

CPC Combination Sets					
Symbol		Type	Set	Ranking	Version
					
					

NONE		Total Claims Allowed:	
(Assistant Examiner)		19	
(Date)			
/TED WANG/	06/15/2015	O.G. Print Claim(s)	O.G. Print Figure
Primary Examiner.Art Unit 2633		3	10
(Primary Examiner)	(Date)		

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	14535006		
Filing Date	06-Nov-2014		
First Named Inventor	Craig Hampel		
Attorney Docket Number	2014074 / RA309C1C1C1C1C1		
Title of Invention	Periodic Calibration For Communication Channels By Drift Tracking		
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☐ 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.	
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Signature	/Marc Schuyler/
Name	Marc Schuyler

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

Electronic Patent Application Fee Transmittal

Application Number:	14535006			
Filing Date:	06-Nov-2014			
Title of Invention:	Periodic Calibration For Communication Channels By Drift Tracking			
First Named Inventor/Applicant Name:	Craig E. Hampel			
Filer:	Marc Philip Schuyler			
Attorney Docket Number:	2014074 / RA309C1C1C1C1C1			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Statutory or Terminal Disclaimer	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

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

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 14535006

Filing Date: 06-Nov-2014

Applicant/Patent under Reexamination: Hampel et al.

Electronic Terminal Disclaimer filed on May 20, 2015

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

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

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Electronic Acknowledgement Receipt

EFS ID:	22408322
Application Number:	14535006
International Application Number:	
Confirmation Number:	6296
Title of Invention:	Periodic Calibration For Communication Channels By Drift Tracking
First Named Inventor/Applicant Name:	Craig E. Hampel
Customer Number:	78408
Filer:	Marc Philip Schuyler
Filer Authorized By:	
Attorney Docket Number:	2014074 / RA309C1C1C1C1C1
Receipt Date:	20-MAY-2015
Filing Date:	06-NOV-2014
Time Stamp:	20:57:41
Application Type:	Utility under 35 USC 111(a)

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			45ac270e23d337ad9637b0fe663385f4c768fb7e		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30578	no	2
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent App. Serial No.:	14/535006	Filing Date:	11/06/2014
Confirmation:	6296	Publication No.:	NYP
First Named Inventor:	Craig E. Hampel.	GAU:	2633
Title:	Periodic Calibration For Communications Channels By Drift Tracking	Examiner:	Wang, Ted M
		Docket:	2014074 / RA309C1C1C1C1C1US

RESPONSE TO OFFICE ACTION MAILED 02/26/2015

REMARKS

In the Office Action mailed February 26, 2015, the Examiner rejected claims 3-11 and 19-21 for alleged violation of the written description requirement (35 USC §112, first paragraph), because the Examiner claims that the concept of a "digital signal" was not reasonably conveyed by the specification; the Examiner also rejected claims 12-18 over USP 8929424 for alleged double patenting.

Applicant respectfully requests reconsideration of both grounds of rejection, and notes that this response is accompanied by a terminal disclaimer. The terminal disclaimer submission should moot the double patenting rejection.

As to the rejection for alleged written description requirement violation, Applicant submits this rejection is clear error; Applicant respectfully requests reconsideration. This is to say, the specification clearly describes to one of ordinary skill in the art that the original specification as filed is directed to processing of a digital signal, and also that Applicant's embodiments would be practiced using a "digital signal." The support provided by the originally filed specification is clearly adequate to satisfy the written description requirement.

In this regard, MPEP 2163 articulates the standards for written description requirement satisfaction:

"An applicant shows possession of the claimed invention by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. *Lockwood v. Amer. Airlines, Inc.*, 107 F.3d 1565, 1572, 41 USPQ2d 1961, 1966 (Fed. Cir. 1997). Possession may be shown in a variety of ways including description of an actual reduction to practice, or by showing that the invention was "ready for patenting" such as by the disclosure of drawings or structural chemical formulas that show that the invention was complete, or by describing distinguishing identifying characteristics sufficient to show that the applicant was in possession of the claimed invention. See, e.g., *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 68, 119 S.Ct. 304, 312, 48 USPQ2d 1641, 1647 (1998); *Eli Lilly*, 119 F.3d at 1568, 43 USPQ2d at 1406; *Amgen, Inc. v. Chugai Pharm.*, 927 F.2d 1200, 1206, 18 USPQ2d 1016, 1021 (Fed. Cir. 1991) (one must define a compound by "whatever characteristics sufficiently distinguish it"). [MPEP 2163.I]

Further, MPEP 2163.I also makes clear that there is no "in haec verba" requirement, i.e., Applicant is not required to use "the same words" in the claims as used in the specification, and may use any language Applicant desires as long as one skilled in art would understand that Applicant was in possession of the invention. As clearly also stated by MPEP 2163.II.

"What is conventional or well known to one of ordinary skill in the art need not be disclosed in detail. See *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d at 1384, 231 USPQ at 94. See also *Capon v. Eshhar*, 418 F.3d 1349, 1357, 76 USPQ2d 1078, 1085 (Fed. Cir. 2005) ("The 'written description' requirement must be applied in the context of the particular invention and the state of the knowledge.... As each field evolves, the balance also evolves between what is known and what is added by each inventive contribution."). If a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met. See, e.g., *Vas-Cath*, 935 F.2d at 1563, 19 USPQ2d at 1116; *Martin v. Johnson*, 454 F.2d 746, 751, 172 USPQ 391, 395 (CCPA 1972) (stating "the description need not be in *ipsis verbis* [i.e., "in the same words"] to be sufficient")."

Finally, MPEP 2163.III clearly sets forth the Examiner's burden in rejecting a claim for alleged written description violation:

"A description as filed is presumed to be adequate, unless or until sufficient evidence or reasoning to the contrary has been presented by the examiner to rebut the presumption. See, e.g., *In re Marzocchi*, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971). The examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description. The examiner has the initial burden of presenting by a preponderance of evidence why a person skilled in the art would not recognize in an applicant's disclosure a description of the invention defined by the claims. *Wertheim*, 541 F.2d at 263, 191 USPQ at 97. In rejecting a claim, the examiner must set forth express findings of fact regarding the above analysis which support the lack of written description conclusion. These findings should:

- (A) Identify the claim limitation at issue; and
- (B) Establish a *prima facie* case by providing reasons why a person skilled in the art at the time the application was filed would not have recognized that the inventor was in possession of the invention as claimed in view of the disclosure of the application as filed. A general allegation of "unpredictability in the art" is not a sufficient reason to support a rejection for lack of adequate written description."

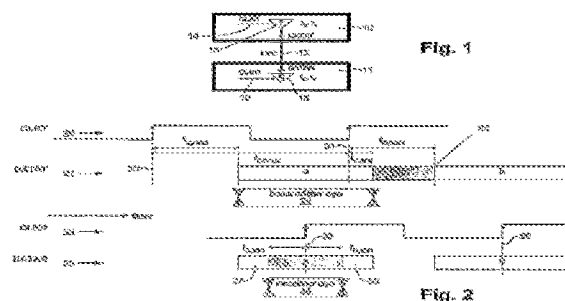
As very clearly articulated, an Examiner is forbidden from rejecting claims without a reasonable, articulated basis for believing that one skilled in the art would fail to recognize Applicant possessed the invention at the time of filing.

Applicant believes that the outstanding rejection both very clearly fails to satisfy the Examiner's burden, and is unsupportable on its face.

First, as to burden, in the Office Action, the Examiner offers no explanation at all as to why one skilled in the art would question Applicant's possession of a "digital signal." That is, the Office Action simply contains a conclusory statement (with no supporting rationale) that "a digital signal" "was not described in the specification in such a way as to reasonably convey to one skilled in the art that the

inventor... had possession of the claimed invention." This unsupported statement very clearly fails to satisfy the MPEP's requirement set forth above as to the Examiner's burden of proof.

Secondly, the Examiner's assertion is factually false. The present application, at its original filing, clearly relates to transmission of a signal over a communications channel where digital values are transmitted at discrete points in time according to a clock signal. This would clearly be recognized by one skilled in the art as a "digital signal." Applicant notes that there is no in haec verba requirement, and because a digital signal is clearly the subject of the specification, there clearly is no basis for questioning written description requirement satisfaction. For example, FIGS. 1 and 2 as originally filed are reproduced below.



As immediate observation of these figures makes clear, Applicant's embodiments relate to a system where a transmitter transmits bits "a" and "b" each during a respective "receiver eye" and where each of the transmission and sampling of the signal are timed according to a respective clock, e.g., CLKT and CLKR. Further, the specification is replete with references to "BITS" and "BYTES" as being what is transmitted from the transmitter to the receiver (see, e.g., Col. 4, lines 64-67 and Col. 5, lines 29-31 of USPT 7400670). These references clearly demonstrate beyond any doubt whatsoever that Applicant was in the possession of a "digital signal" at the time the original specification as filed, i.e., one skilled in the art would clearly immediately interpret this specification as directed to processing of a digital signal.

Thus, it is respectfully submitted that (a) the rejection is clearly defective, i.e., the Examiner has clearly not offered any rationale (legitimate or otherwise) as to why one skilled in the art would supposedly think that Applicant was not in possession of "a digital signal" at the time of original

specification filing, and (b) in contradistinction to the Examiner's position, and as shown above, the subject matter of the specification as originally filed is clearly directed to a digital signal and would be "immediately and clearly" so interpreted by one of ordinary skill in the art.

In short, Applicant submits that this rejection cannot be sustained and respectfully its requests withdrawal.

In view of the concurrent terminal disclaimer submission, Applicant respectfully submits that this application is in condition for allowance. If it would be helpful for the Examiner to discuss the subject matter of the claims or positions taken by this paper, the Examiner is respectfully invited to call Applicant's attorney at (408) 655-6375.

Respectfully submitted,

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Electronic Acknowledgement Receipt

EFS ID:	22408310
Application Number:	14535006
International Application Number:	
Confirmation Number:	6296
Title of Invention:	Periodic Calibration For Communication Channels By Drift Tracking
First Named Inventor/Applicant Name:	Craig E. Hampel
Customer Number:	78408
Filer:	Marc Philip Schuyler
Filer Authorized By:	
Attorney Docket Number:	2014074 / RA309C1C1C1C1C1
Receipt Date:	20-MAY-2015
Filing Date:	06-NOV-2014
Time Stamp:	20:51:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	RA309C1C1C1C1C1US-Resp-To-2015-02-26-OfficeAction.pdf	107725 ea634c5a905ffc42c613d6a5da626a8a03d35532	no	5

Warnings:

Information:

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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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/535,006	11/06/2014	Craig E. Hampel	2014074 / RA309C1C1C1C1
78408 MARC P. SCHUYLER / Rambus P.O. BOX 2535 SARATOGA, CA 95070			CONFIRMATION NO. 6296 PUBLICATION NOTICE  *OC000000073784903*

Title:Periodic Calibration For Communication Channels By Drift Tracking

Publication No.US-2015-0063433-A1

Publication Date:03/05/2015

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,006	11/06/2014	Craig E. Hampel	2014074 / RA309C1C1C1C1C1	6296
78408	7590	02/26/2015	EXAMINER	
MARC P. SCHUYLER / Rambus			WANG, TED M	
P.O. BOX 2535				
SARATOGA, CA 95070				
			ART UNIT	PAPER NUMBER
			2633	
			MAIL DATE	DELIVERY MODE
			02/26/2015	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. 14/535,006	Applicant(s) HAMPEL ET AL.	
	Examiner TED WANG	Art Unit 2633	AIA (First Inventor to File) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS 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 11/06/2014.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 3-21 is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) _____ is/are allowed.
- 7) ☒ Claim(s) 3-21 is/are rejected.
- 8) ☐ Claim(s) _____ is/are objected to.
- 9) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

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

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 11/6/2014 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

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

Certified copies:

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

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

Attachment(s)

- | | |
|--|---|
| 1) ☒ Notice of References Cited (PTO-892) | 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date _____ | 4) ☐ Other: _____ |

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

Preliminary Amendment

2. The preliminary amendment filed on 11/6/2014 has been entered.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

(a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), first paragraph:
The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 3-11 and 19-21 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

- The claims 3 and 19 contain subject matter, the imitation of "a digital signal", which was not described in the specification in such a way as to reasonably

convey to one skilled in the relevant art that the inventor(s), at the time the parent application was filed (10/766,761), had possession of the claimed invention.

Double Patenting

5. 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>.

6. Claims 12-18 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 10-16 of U.S. Patent No. 8,929,424. Although the conflicting claims are not identical, they are not patentably distinct from each other because the broader application claim would have been obvious in view of the narrower issued claim.

7. Claim 9 of U.S. Patent No. 8,929,424 and instant application recites the limitations—

U.S. Patent No. 8,929,424	Instant Application
Claim 10 A receive component for use in a signaling system, in which a transmit component and the receive component are to communicate data across a channel, the receive component comprising:	Claim 1 2 A system, comprising: a receive component, the receive component having circuitry to receive data communicated across a channel by a transmit component;
receiver circuitry to perform at system initialization a first calibration, the first calibration to identify an initial value for a parameter affecting proper reception by the receiver circuitry of the data communicated across the channel, and	the receive component to perform at system initialization a first calibration, the first calibration to identify an initial value for a parameter affecting proper reception by the circuitry of the data communicated across the channel, and
perform thereafter on a periodic basis a second calibration, the second calibration to update an existing value of the parameter for drift attributable to change in at least one of voltage or	perform on a periodic basis a second calibration, the second calibration to update an existing value of the parameter for drift attributable to change in at least one of voltage or

temperature; and wherein the receive component is to apply the existing value when receiving the data communicated across the channel, and the second calibration is constrained to be performed during a time period that is shorter than a time period of the first calibration.	temperature, wherein a time duration of the second calibration is constrained to be shorter than a time duration of the first calibration; and
circuitry to store the existing value of the parameter, the existing value of the parameter dependent on the initial value and any updates from the second calibration;	circuitry to store the existing value of the parameter, the existing value of the parameter dependent on the initial value and any updates from the second calibration.

It has been held that the omission of an element and its function is an obvious expedient if the remaining elements perform the same functions as before. See *In re Karlson*, 136 USPQ 184 (CCPA 1963). Also note *Ex parte Rainu*, 168 USPQ 375 (BdPatApp&Int 1970); omission of a reference element whose function is not needed would be obvious to one skilled in the art.

Conclusion

8. Reference(s) US 7,042,914 are cited because they are put pertinent to the calibration circuitry in a receiver. However, none of references teach detailed connection as recited in claim.

9. Examiner's Note: Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicants. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicants in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ted M. Wang whose telephone number is 571-272-3053. The examiner can normally be reached on M-F, 7:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sam Ahn can be reached on 571-272-3044. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2633

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).

/Ted M Wang/
Primary Examiner, Art Unit 2633

Notice of References Cited	Application/Control No. 14/535,006		Applicant(s)/Patent Under Reexamination HAMPEL ET AL.	
	Examiner TED WANG		Art Unit 2633	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,042,914	05-2006	Zerbe et al.	370/516
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

<i>Index of Claims</i> 	Application/Control No. 14535006	Applicant(s)/Patent Under Reexamination HAMPEL ET AL.
	Examiner TED WANG	Art Unit 2633

✓	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	02/17/2015														
	1	-														
	2	-														
	3	✓														
	4	✓														
	5	✓														
	6	✓														
	7	✓														
	8	✓														
	9	✓														
	10	✓														
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	15	✓														
	16	✓														
	17	✓														
	18	✓														
	19	✓														
	20	✓														
	21	✓														

Search Notes 	Application/Control No. 14535006	Applicant(s)/Patent Under Reexamination HAMPEL ET AL.
	Examiner TED WANG	Art Unit 2633

CPC- SEARCHED		
Symbol	Date	Examiner
H04L1/20, H04L1/24	2/17/2015	TW

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST - USPGPUB, USPAT, USOCR, EPO, JPO, DERWENT, IBM_TDB, see attached search report	2/17/2015	TW
ODP- searched and reviewed from PALM and EAST	2/17/2015	TW

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

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	805	"3155102" "3638121" "3922491" "4384354" "4648133" "5111208" "5122978" "5243626" "5265211" "5329489" "5436908" "5485490" "5485602" "5511091" "5523760" "5541967" "5548146"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:56
L2	2229	"5671376" "5684966" "5742798" "5771356" "5778436" "5859881" "6047346" "6163570" "6173345" "6219384" "6243776" "6282210" "6321282" "6359931" "6369652" "6377640" "6396329" "6442644" "6448815" "6463392" "6469555" "6473439" "6484232" "6510503" "6539072" "6556934" "6560716" "6606350" "6606576" "6639957" "6643787" "6657468" "6662305" "6690741" "6717992" "6735709" "6751696" "6873939" "6889357" "6920540" "7072355" "7099424" "7119549" "7137048" "7196979" "7535933" "6181166" "6457089" "6480026" "6725304" "20010048382" "20010053175" "20010056332" "20020054648" "20020066001" "20020072870" "20020138224" "20020149824" "20020184461" "20030026399" "20030063597" "20030065465" "20030065845" "20030117864" "20030131160" "20030146800" "20030149991" "20030158994" "20030198212" "20030198308" "20040054830" "20040057500" "20040199674" "20040217881" "20040260858" "20050081942" "20050163202"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 08:00
L3	887	(Hampel adj3 Graig) (Ware adj3 Frederick) (Perego adj3 Richard)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 08:01
L4	25	1 and L3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 08:01
L5	159	2 and L3	US-PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2015/02/17 08:01

			DERWENT; IBM_TDB			
L7	3810	H04L1/24.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/02/17 08:26
L8	2132	calibrat\$3 and operation\$3 and (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 08:26
L9	198	L8 and L7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 08:26
S1	2	"20020054648"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 09:55
S3	1	10/766,761	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/09/27 07:58
S5	1	S3 and calibrat\$3 and operation\$3 and (initial or begin\$4) and sequence and drift\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:02
S6	105	"5111208" "6163570" "6173345" "6434081" "6484232" "6560716" "6606576" "6662305" "6889357" "20030149991" "20040217881" "20050163202"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:02
S7	11	S6 and calibrat\$3 and operation\$3 and (initial or begin\$4) and sequence and drift\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:42
S8	11	S6 and calibrat\$3 and operation\$3 and (initial or initializ\$5 or begin\$4) and sequence and drift\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:45
S9	14	"5548146"	US-PGPUB; USPAT; USOCR;	OR	ON	2007/06/20 10:45

			EPO; JPO; DERWENT; IBM_TDB			
S10	60	"6377640"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:45
S11	5	S6 and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:55
S12	3	S10 and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:48
S13	3	S9 and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:12
S14	51	("20010056332" "20020072870" "20020138224" "20020149824" "20030026399" "20030149991" "20050071707" "20050163202" "3155102" "3638121" "3922491" "4384354" "4648133" "5111208" "5122978" "5243626" "5436908" "5485490" "5511091" "5523760" "5554945" "5621913" "5742798" "5859881" "6047346" "6163570" "6219384" "6282210" "6321282" "6359931" "6369652" "6396329" "6421389" "6434081" "6442644" "6448815" "6463392" "6469555" "6473439" "6480946" "6510503" "6539072" "6556934" "6606350" "6606576" "6643787" "6657468" "7031221").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/06/20 10:47
S15	2	"7159136"	US-PGPUB; USPAT; USOCR	OR	ON	2007/06/20 10:47
S16	1	S14 and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:48
S17	14	communication adj1 link and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3 same operat\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:52

S18	101	calibrat\$3 same operat\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3 same operat\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:53
S19	61	calibrat\$3 with (operat\$3 same (initial or initializ\$5 or begin\$4)) and drift\$3 with track\$3 same operat\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 11:18
S20	96	calibrat\$3 with (operat\$3 and (initial or initializ\$5 or begin\$4)) and drift\$3 with track\$3 same operat\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:13
S21	48	calibrat\$3 with (operat\$3 same (initial or initializ\$5 or begin\$4)) and drift\$3 with track\$3 same operat\$3 and communication	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 11:14
S22	35	(calibrat\$3 with (operat\$3 same (initial or initializ\$5 or begin\$4)) and drift\$3 with track\$3 same operat\$3) with (value or parameter) and communication	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 10:55
S23	13	S21 not S22	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 11:14
S24	13	S19 not S21	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 11:24
S25	48	S20 not S21	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:05
S26	21	"3155102"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:05
S27	4	S26 and calibrat\$3 and operation\$3 and (initial or begin\$4) and sequence and drift\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:07

S28	2	"20030026399"	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:07
S29	0	S28 and calibrat\$3 and operation\$3 and (initial or begin\$4) and sequence and drift\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:07
S31	2	"20010053175"	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:09
S32	0	S31 and calibrat\$3 and operation\$3 and (initial or begin\$4) and sequence and drift\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:12
S33	538	"6717992" "6690741" "6657468" "6606350" "6421389" "6369652" "5742798" "5621913" "5554945" "5523760" "5511091" "5485490" "5243626" "4648133" "3922491" "3638121"	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:11
S34	63	S33 and calibrat\$3 and operation\$3 and (initial or begin\$4) and sequence and drift\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:40
S35	12	S33 and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:40
S36	5	S33 and calibrat\$3 with (operat\$3 and (initial or initializ\$5 or begin\$4)) and drift\$3 with track\$3 same operat\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:13
S37	7	S35 not S36	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:13
S38	51	S34 not S35	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:35

S39	58	"6321282"	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:36
S40	52	("20010053187" "20020084857" "20020140472" "5206881" "5554945" "5614855" "5635995" "5684421" "5731727" "5742798" "5852378" "5880612" "5883533" "5889423" "5892981" "5920518" "5940608" "5940609" "5945862" "5946244" "5963502" "6011732" "6016282" "6026050" "6026051" "6029250" "6029252" "6031788" "6043717" "6047346" "6085284" "6101197" "6101612" "6104228" "6108795" "6125157" "6133773" "6198356" "6255912" "6304116" "6321282" "6373308" "6437619" "6469555" "6470060" "6483360" "6504438" "6566924" "6580305" "6696875" "6759881" "6784714").PN.	US- PGPUB; USPAT; USOCR	OR	ON	2007/06/20 13:37
S41	2	S40 and S34	US- PGPUB; USPAT; USOCR	OR	ON	2007/06/20 13:37
S42	29	S39 and calibrat\$3 and operation\$3 and (initial or begin\$4) and sequence and drift\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:40
S43	14	S39 and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 14:10
S44	5	10/278,478	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 13:43
S45	432	((Hampel with Craig) or (Ware with Frederick) or (Perego with Richard))	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 14:09
S46	26	S45 and calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 14:20
S47	30	S45 and calibrat\$3 and operation\$3 and (initial or initializ\$5 or begin\$4) and drift\$3 same track\$3	US- PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2007/06/20 14:21

			DERWENT; IBM_TDB			
S48	4	S47 not S46	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 14:21
S49	1	"7119549" and calibrat\$3 same tim\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:36
S50	0	"7119549" and calibrat\$3 same tim\$3 with point	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:36
S51	0	"7119549" and calibrat\$3 same tim\$3 with (point\$3 or delay\$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:36
S52	1	"7119549" and calibrat\$3 same tim\$3 and (point\$3 or delay\$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:40
S53	1	"20050163202" and driv\$3 with tim\$3 adj2 point and receiv\$3 with tim\$3 adj2 point	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:54
S55	1592	375/219.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:54
S56	211	calibrat\$3 same operation\$3 same (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:56
S57	886	calibrat\$3 and operation\$3 and (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/06/20 15:56
S58	6	S55 and S57	US-PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2007/06/20 15:56

			DERWENT; IBM_TDB			
S59	0	11/754,107	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/09/27 07:57
S60	1	10/766,761	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/09/27 07:58
S61	620	calibrat\$3 and operation\$3 and drift\$3 with track\$3 same tim\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:10
S62	1017	calibrat\$3 and operation\$3 and (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:12
S63	481	((Hampel with Craig) or (Ware with Frederick) or (Perego with Richard))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:13
S64	34	S63 and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:15
S65	45	"5541967" "6691214" "6735709"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:16
S66	6	"20020066001" "20020184461" "20030065465"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:17
S67	0	S65 and drift\$3 with track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:20
S68	1699	375/219.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2008/03/17 09:22

			DERWENT; IBM_TDB			
S70	7	S68 and S62	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:22
S71	491	S62 not S61	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:22
S72	1434	375/224.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:23
S73	1	S72 and S62	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:23
S74	750	324/601.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:23
S75	1	S74 and S62	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:23
S76	892	369/44.27.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:24
S77	5	S76 and S62	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:24
S78	8	(calibrat\$3 and operation\$3 and drift\$3 with track\$3 same tim\$3).clm.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/03/17 09:42
S79	0	(calibrat\$3 and operation\$3 and (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3).clm.	US-PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2008/03/17 09:42

			DERWENT; IBM_TDB			
S80	4	calibrat\$3 same data adj3 eye same (tim\$3 or diagram or initial or initializ\$5 or begin\$4) same (drift\$3 or shift\$3 or offset\$4) same track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 10:01
S81	38	calibrat\$3 same data adj3 eye same (tim\$3 or diagram or initial or initializ\$5 or begin\$4) same (drift\$3 or shift\$3 or offset\$4) same (track\$3 or adjust\$4 or updat\$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 10:05
S82	34	S81 not S80	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 10:05
S83	128	"6643787"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 12:52
S84	384	"6469555" "6484232" "6539072" "6556934" "6606576" "6643787" "6657468" "6662305" "6691214" "6735709" "6873939" "6889357" "6920540" "7072355" "7099424" "7119549" "7196979"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 15:07
S85	39	S84 and calibrat\$3 same data adj3 eye same (tim\$3 or diagram or initial or initializ\$5 or begin\$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 15:07
S86	690	((Hampel with Craig) or (Ware with Frederick) or (Perego with Richard))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 15:11
S87	15	S86 and calibrat\$3 same data adj3 eye same (tim\$3 or diagram or initial or initializ\$5 or begin\$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/06/03 15:11
S91	5	10/766,761	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:05
S92	741	((Hampel with Craig) or (Ware with Frederick) or (Perego with Richard))	US-PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2012/01/14 10:06

			DERWENT; IBM_TDB			
S93	1	S91 and calibrat\$3 same data adj3 eye same drift\$3 same track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:08
S94	9	calibrat\$3 same data adj3 eye same drift\$3 same track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:08
S95	57	(calibrat\$3 or correct\$3 or compensat\$3) same data adj3 eye and drift\$3 same track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:10
S96	22	"6639957"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:13
S97	3	"20030131160"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:13
S99	1	"20030131160" and data with eye and track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:14
S101	977	calibrat\$3 and operation\$3 and drift\$3 with track\$3 same tim\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:16
S102	121	calibrat\$3 and operation\$3 and drift\$3 with track\$3 same tim\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:16
S103	2754	375/219.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:17
S105	0	S96 and eye and track\$3	US-PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2012/01/14 10:18

			DERWENT; IBM_TDB			
S107	2149	375/224.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:20
S109	964	324/601.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:21
S111	1014	369/44.27.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:21
S113	5	S103 and (calibrat\$3 or correct\$3 or compensat\$3) and drift\$3 with track\$3 same tim\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:22
S114	4	S107 and (calibrat\$3 or correct\$3 or compensat\$3) and drift\$3 with track\$3 same tim\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:23
S115	2	S109 and (calibrat\$3 or correct\$3 or compensat\$3) and drift\$3 with track\$3 same tim\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:23
S116	2	S111 and (calibrat\$3 or correct\$3 or compensat\$3) and drift\$3 with track\$3 same tim\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:24
S117	23	"5541967"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:42
S118	2	S117 and (calibrat\$3 or correct\$3 or compensat\$3) and drift\$3 with track\$3 same tim\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/01/14 10:43
S119	1	12/173,530	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2012/02/09 21:44

			EPO; JPO; DERWENT; IBM_TDB			
S120	746	(Hampel with Craig) (Ware with Frederick) (Perego with Richard)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:45
S123	50	S120 and drift\$3 same track\$3 and calibrat\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:46
S124	49	S120 and drift\$3 with track\$3 and calibrat\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:46
S125	26	S120 and drift\$3 with track\$3 and calibrat\$3 and data with eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:47
S126	75	memory and drift\$3 with track\$3 and calibrat\$3 and data with eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:52
S127	205	memory and drift\$3 with track\$3 and calibrat\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:52
S128	99	drift\$3 with track\$3 and calibrat\$3 and data with eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:53
S130	124	calibrat\$3 and eye and drift\$3 with track\$3 same tim\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:54
S132	490	drift\$3 same track\$3 and calibrat\$3 and eye	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:56
S133	2780	375/219.cds.	US-PGPUB; USPAT; USOCR;	OR	ON	2012/02/09 21:57

			EPO; JPO; DERWENT; IBM_TDB			
S134	5	S133 and S132	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:57
S135	1016	369/44.27.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:59
S136	968	324/601.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 21:59
S137	2178	375/224.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 22:00
S138	2	S135 and S132	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 22:00
S139	2	S136 and S132	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 22:00
S140	5	S137 and S132	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 22:00
S142	2	(drift\$3 same track\$3 and calibrat\$3 and eye).CLM.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/02/09 23:12
S143	0	14/535,006	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/02/17 07:15
S144	6	12/173,530	US-PGPUB; USPAT;	OR	ON	2015/02/17 07:17

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S145	10	10/766,761	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:39
S146	5	S145 and digital	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:40
S147	12111	H04L1/20.cpc.	US- PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/02/17 07:44
S148	3810	H04L1/24.cpc.	US- PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/02/17 07:44
S149	2132	calibrat\$3 and operation\$3 and (initial or initializ\$5 or begin\$4) and drift\$3 with track\$3	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:44
S150	0	S149 and S147	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:44
S152	887	(Hampel adj3 Craig) (Ware adj3 Frederick) (Perego adj3 Richard)	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:45
S153	86	S149 and S152	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:45
S154	25	S153 and digital	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/02/17 07:45

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CONFIRMATION NO. 6296

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
14/535,006	11/06/2014	375	2633	2014074 / RA309C1C1C1C1C1		
APPLICANTS Rambus Inc., Sunnyvale, CA, Assignee (with 37 CFR 1.172 Interest); INVENTORS Craig E. Hampel, Los Altos, CA; Frederick A. Ware, Los Altos Hills, CA; Richard E. Perego, Thornton, CO; ** CONTINUING DATA ***** This application is a CON of 14/145,966 01/01/2014 PAT 8929424 which is a CON of 13/452,543 04/20/2012 PAT 8644419 which is a CON of 12/173,530 07/15/2008 PAT 8165187 which is a CON of 11/754,107 05/25/2007 PAT 7400671 which is a CON of 10/766,761 01/28/2004 PAT 7400670 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 11/21/2014						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/TED M WANG/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 13	TOTAL CLAIMS 19	INDEPENDENT CLAIMS 3
ADDRESS MARC P. SCHUYLER / Rambus P.O. BOX 2535 SARATOGA, CA 95070 UNITED STATES						
TITLE Periodic Calibration For Communication Channels By Drift Tracking						
FILING FEE RECEIVED 1600	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

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Sheet 1

of 11

Complete if Known

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	1	US- 3155102	11-03-1964	Niederer, Jr. et al.	Entire Document
	2	US- 3638121	01-25-1972	Spilker, Jr., James J.	Entire Document
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	8	US- 5243626	09-07-1993	Devon et al.	Entire Document
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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
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	2	WO-2001-16954-A	03-08-2001	Yoo et al.	Entire Document	

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STATEMENT BY APPLICANT**

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Sheet **2** of **11****Complete if Known**

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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	21	US- 5684966	11-04-1997	Gafford et al.	Entire Document
	22	US- 5742798	04-21-1998	Goldrian, Gottfried	Entire Document
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Signature

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Date
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STATEMENT BY APPLICANT**

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Sheet **3** of **11****Complete if Known**

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

U. S. PATENT DOCUMENTS

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Sheet 4

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Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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Sheet 5

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Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
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Sheet	6
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Of	11
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Application Number

14/535.006

Filing Date

06 November 2014

First Named Inventor

Craig E. Hampel

Art Unit

2633

Examiner Name

Wang, Ted M.

Attorney Docket Number

RA309.C1C1C1C1C1.US (2014074)

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[illegible]Examiner
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/Ted Wand/

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7

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	1	"Draft Standard for a High-Speed Memory Interface (SyncLink)," Draft 0.99 IEEE P1596.7-199X, pp. 1-56 (1996), MICROPROCESSOR and MICROCOMPUTER STANDARDS SUBCOMMITTEE of the IEEE COMPUTER SOCIETY. 66 pages	
	2	BANU et al., "TA 6.4: A 660Mb/s CMOS Clock Recovery Circuit with Instantaneous Locking for NRZ Data and Burst-Mode Transmission," IEEE International Solid State Circuits Conference, 1993, pp. 102-103, 270. 4 pages	
	3	CERISOLA et al., "CORD - a WDM Optical Network: Control Mechanism Using Subcarrier Multiplexing and Novel Synchronization Solutions," 1995 IEEE International Conference, Vol. 1, 18-22 June 1995, pp. 261-265. 6 pages	
	4	CHANG et al., "A 2 Gb/s Asymmetric Serial Link for High-Bandwidth Packet Switches," Hot Interconnects V, Stanford University, August 1997. 9 pages	
	5	CHANG, Kun-Yung, "Design of a CMOS Asymmetric Serial Link," A Dissertation Submitted to the Department of Electrical Engineering and the Committee on Graduate Studies of Stanford University, August 1999. 133 pages	
	6	DALLY et al., "Digital Systems Engineering," Cambridge University Press, 1998, pp. 447-449. 3 pages	
	7	DANIELE et al., "Principle and Motivations of UWB Technology for High Data Rate WPAN Applications," SOC 2003. 4 pages	
	8	DANIELE, Norbert, "Ultra Wide Band Principles and Applications for Wireless Communications," CEA-LETI Annual Review, 25-26 June 2002. 23 pages	
	9	EIA/JEDEC Standard No. 8-6 (EIA/JESD8-6), "High Speed Transceiver Logic (HSTL) A 1.5 V Output Buffer Supply Voltage Based Interface Standard for Digital Integrated Circuits," August 1995. 16 pages	
	10	EIA/JEDEC Standard No. 8-B (JESD8-B), "Interface Standard for Nominal 3 V/3.3 V Supply Digital Integrated Circuits," September 1999. 10 pages	

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	11	ELDERING et al., "Digital Burst Mode Clock Recovery Technique for Fiber-Optic Systems," Journal of Lightwave Technology, Vol. 12, No. 2, February 1994, pp. 271-279. 12 pages	
	12	EP Examination Report dated November 6, 2007 in EP Application No. 05706081.6. 5 pages	
	13	EP Office Action dated January 15, 2010 re EP Application No. 05711891.1. 5 pages	
	14	EP Response dated May 25, 2010 to the Official Communication dated January 15, 2010 re EP Application No. 05711891.1, Includes New Claims 1-24 (Highlighted and Clear Copies) and New Description Pages 3, 3a, 3b. 30 pages	
	15	EP Supplementary Search Report dated December 18, 2007 in EP Patent Application No. 05711891.1. 3 pages	
	16	GILLINGHAM et al., "SLDRAM: High Performance Open-Standard Memory," IEEE Micro, November/December 1997, pp. 29-39, Vol. 17, No. 6, Institute of Electrical and Electronics Engineers, Inc., Los Alamitos, California. 11 pages	
	17	GILLINGHAM, Peter, "SLDRAM Architectural and Functional Overview," SLDRAM Consortium, August 29, 1997, pp. 1-14. 14 pages	
	18	HU et al., "A Monolithic 480 Mb/s Parallel AGC/Decision/Clock-Recovery Circuit in 1.2-um CMOS," IEEE Journal of Solid-State Circuits, Vol. 28, No. 12, December 1993, pp. 1314-1320. 8 pages	
	19	INTEL Corporation, "How to Measure RDRAM System Clock Jitter," Application Note AP-667, June 1999, pp. 1-15. 15 pages	
	20	JEDEC Standard (JESD8-16), "Bus Interconnect Logic (BIC) for 1.2 Volts," April 2004. 15 pages	

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	21	KIM et al., "An 800Mbps Multi-Channel CMOS Serial Link with 3x Oversampling," IEEE 1995 Custom Integrated Circuits Conference, pp. 22.7.1-22.7.4. 4 pages	
	22	LEE et al., "TP 15.3: A 90mW 4Gb/s Equalized I/O Circuit with Input Offset Cancellation," IEEE International Solid-State Circuits Conference, February 8, 2000, pp. 252-253. 2 pages	
	23	LEWIS, Dave, "Easy-to-Use LVDS Serdes for the Serdes Neophyte," National Semiconductor, June 16, 2003. 5 pages	
	24	NAKAMURA et al., "A 6 Gbps CMOS Phase Detecting DEMUX Module Using Half-Frequency Clock," 1998 Symposium on VLSI Circuits Digest of Technical Papers, pp. 196-197. 2 pages	
	25	NAKASE et al., "Source-Synchronization and Timing Vernier Techniques for 1.2 GB/s SDRAM Interface," IEEE Journal of Solid-State Circuits, Vol. 34, No. 4, April 1999, pp. 494-501. 8 pages	
	26	PARIS et al., "WP 24.3: A 800 MB/s 72 Mb SDRAM with Digitally-Calibrated DLL," ISSCC, 0-7803-5129-0/99, Slide Supplement, IEEE, 1999. 10 pages	
	27	POULTON et al., "A Tracking Clock Recovery Receiver for 4Gb/s Signaling," Hot Interconnects '97, August 21-23, 1997, Palo Alto, CA, pp. 1-13. 14 pages	
	28	Rambus Inc., "Direct Rambus Long Channel Design Guide," 2000. 48 pages	
	29	Rambus Inc., "Direct Rambus Short Channel Layout Guide," Version 0.95, August 2001. 52 pages	
	30	Rambus, Inc., "RDRAM Direct Rambus Clock Generator," April 2002. 22 pages	

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	31	RaSer™ X Product Brief, "Highly Flexible 10 Gbps Backplane Serial Link Interface," Copyright 2003, Rambus, Inc. 2 pages	
	32	RDRAM® Overview, "High Performance Memory Interface Solution," Copyright 2003, Rambus, Inc. 4 pages	
	33	Redwood Technology Brief, "High Performance Parallel Bus Interface Technology," Copyright 2003, Rambus, Inc. 2 pages	
	34	SLDRAM Inc., "SLD4M18DR400 4 MEG X 18 SLDRAM: 400 Mb/s/pin SLDRAM 4 M x 18 SLDRAM Pipelined, Eight Bank, 2.5 V Operation," July 9, 1998. 69 pages	
	35	Supplementary EP Search Report dated April 17, 2007 in EP Application No. 05706081.6. 3 pages	
	36	TW Office Action dated May 11, 2011 re TW Application No. 094101310. 13 pages	✓
	37	TW Response dated August 12, 2011 to the Office Action dated May 11, 2011 re TW Application No. 94101310. 30 pages	✓
	38	WIDMER et al., "A DC-Balanced, Partitioned-Block, 8B/10B Transmission Code," IBM J. Res. Develop., Vol. 27, No. 5, September 1983, pp. 440-451. 12 pages	
	39	WIN et al., "Impulse Radio: How It Works," IEEE Communications Letters 2, Vol. 2, February 1998, pp. 36-38. 3 pages	
	40	YANG, Chih-Kong Ken, "Design of High-Speed Serial Links in CMOS," Technical Report No. CSL-TR-98-775, December 1998, pp. 1-182. 94 pages	

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	41	Yellowstone Technology Brief, "High Performance Memory Interface Technology," Copyright 2003, Rambus, Inc. 2 pages	
	42	ZERBE, Jared, U.S. Application No. 09/776,550 filed February 2, 2001, re "Method and Apparatus for Evaluating and Calibrating a Signaling System" Application and Figures as Filed. 62 pages	
	43	ZERBE, Jared, U.S. Application No. 09/976,170 filed October 21, 2001, re "Method and Apparatus for Evaluating and Optimizing a Signaling System" Application and Figures as Filed. 98 pages	

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U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	1	US- 3155102	11-03-1964	Niederer, Jr. et al.	Entire Document
	2	US- 3638121	01-25-1972	Spilker, Jr., James J.	Entire Document
	3	US- 3922491	11-25-1975	Bjork et al.	Entire Document
	4	US- 4384354	05-17-1983	Crawford et al.	Entire Document
	5	US- 4648133	03-03-1987	Vilnrotter, Victor	Entire Document
	6	US- 5111208	05-05-1992	Lopez, A.R.	Entire Document
	7	US- 5122978	06-16-1992	Merrill, John	Entire Document
	8	US- 5243626	09-07-1993	Devon et al.	Entire Document
	9	US- 5265211	11-23-1993	Amini et al.	Entire Document
	10	US- 5329489-A	07-12-1994	Diefendorff, Keith E.	Entire Document
	11	US- 5436908	07-25-1995	Fluker et al.	Entire Document
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	15	US- 5523760	06-04-1996	McEwan, Thomas	Entire Document
	16	US- 5541967	07-30-1996	Gluska et al.	Entire Document
	17	US- 5548146	08-20-1996	Kuroda et al.	Entire Document
	18	US- 5554945	09-10-1996	Lee et al.	Entire Document
	19	US- 5621913	04-15-1997	Tuttle et al.	Entire Document

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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	1	JP-2000-035831-A2	02-02-2000	Masaharu, Mizuno	Entire Document	✓
	2	WO-2001-16954-A	03-08-2001	Yoo et al.	Entire Document	

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Sheet **2**of **11****Complete if Known**

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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		Number-Kind Code ² (if known)			
	20	US- 5671376	09-23-1997	Bucher et al.	Entire Document
	21	US- 5684966	11-04-1997	Gafford et al.	Entire Document
	22	US- 5742798	04-21-1998	Goldrian, Gottfried	Entire Document
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	37	US- 6421389-B1	07-16-2002	Jett et al.	Entire Document
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Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
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Sheet 4

of 11

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Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

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Sheet 5

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Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
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Sheet 6

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Sheet

7

of

11

NON PATENT LITERATURE DOCUMENTS

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¹ Applicant's unique citation designation number (optional). ² Applicant is to place a check mark here if English language Translation is attached.This collection of information is required by 37 CFR 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 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, 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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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Complete if Known

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

Sheet 8

of

11

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	11	ELDERING et al., "Digital Burst Mode Clock Recovery Technique for Fiber-Optic Systems," Journal of Lightwave Technology, Vol. 12, No. 2, February 1994, pp. 271-279. 12 pages	
	12	EP Examination Report dated November 6, 2007 in EP Application No. 05706081.6. 5 pages	
	13	EP Office Action dated January 15, 2010 re EP Application No. 05711891.1. 5 pages	
	14	EP Response dated May 25, 2010 to the Official Communication dated January 15, 2010 re EP Application No. 05711891.1, Includes New Claims 1-24 (Highlighted and Clear Copies) and New Description Pages 3, 3a, 3b. 30 pages	
	15	EP Supplementary Search Report dated December 18, 2007 in EP Patent Application No. 05711891.1. 3 pages	
	16	GILLINGHAM et al., "SLDRAM: High Performance Open-Standard Memory," IEEE Micro, November/December 1997, pp. 29-39, Vol. 17, No. 6, Institute of Electrical and Electronics Engineers, Inc., Los Alamitos, California. 11 pages	
	17	GILLINGHAM, Peter, "SLDRAM Architectural and Functional Overview," SLDRAM Consortium, August 29, 1997, pp. 1-14. 14 pages	
	18	HU et al., "A Monolithic 480 Mb/s Parallel AGC/Decision/Clock-Recovery Circuit in 1.2-um CMOS," IEEE Journal of Solid-State Circuits, Vol. 28, No. 12, December 1993, pp. 1314-1320. 8 pages	
	19	INTEL Corporation, "How to Measure RDRAM System Clock Jitter," Application Note AP-667, June 1999, pp. 1-15. 15 pages	
	20	JEDEC Standard (JESD8-16), "Bus Interconnect Logic (BIC) for 1.2 Volts," April 2004. 15 pages	

Examiner
SignatureDate
Considered

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Application Number	14/535,006
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Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

Sheet **9** of **11****NON PATENT LITERATURE DOCUMENTS**

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	21	KIM et al., "An 800Mbps Multi-Channel CMOS Serial Link with 3x Oversampling," IEEE 1995 Custom Integrated Circuits Conference, pp. 22.7.1-22.7.4. 4 pages	
	22	LEE et al., "TP 15.3: A 90mW 4Gb/s Equalized I/O Circuit with Input Offset Cancellation," IEEE International Solid-State Circuits Conference, February 8, 2000, pp. 252-253. 2 pages	
	23	LEWIS, Dave, "Easy-to-Use LVDS Serdes for the Serdes Neophyte," National Semiconductor, June 16, 2003. 5 pages	
	24	NAKAMURA et al., "A 6 Gbps CMOS Phase Detecting DEMUX Module Using Half-Frequency Clock," 1998 Symposium on VLSI Circuits Digest of Technical Papers, pp. 196-197. 2 pages	
	25	NAKASE et al., "Source-Synchronization and Timing Vernier Techniques for 1.2 GB/s SDRAM Interface," IEEE Journal of Solid-State Circuits, Vol. 34, No. 4, April 1999, pp. 494-501. 8 pages	
	26	PARIS et al., "WP 24.3: A 800 MB/s 72 Mb SDRAM with Digitally-Calibrated DLL," ISSCC, 0-7803-5129-0/99, Slide Supplement, IEEE, 1999. 10 pages	
	27	POULTON et al., "A Tracking Clock Recovery Receiver for 4Gb/s Signaling," Hot Interconnects '97, August 21-23, 1997, Palo Alto, CA, pp. 1-13. 14 pages	
	28	Rambus Inc., "Direct Rambus Long Channel Design Guide," 2000. 48 pages	
	29	Rambus Inc., "Direct Rambus Short Channel Layout Guide," Version 0.95, August 2001. 52 pages	
	30	Rambus, Inc., "RDRAM Direct Rambus Clock Generator," April 2002. 22 pages	

Examiner Signature		Date Considered	
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(Use as many sheets as necessary)

Complete if Known

Application Number	14/535,006
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First Named Inventor	Craig E. Hampel
Art Unit	2633
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Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

Sheet 10

of

11

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	31	RaSer™ X Product Brief, "Highly Flexible 10 Gbps Backplane Serial Link Interface," Copyright 2003, Rambus, Inc. 2 pages	
	32	RDRAM® Overview, "High Performance Memory Interface Solution," Copyright 2003, Rambus, Inc. 4 pages	
	33	Redwood Technology Brief, "High Performance Parallel Bus Interface Technology," Copyright 2003, Rambus, Inc. 2 pages	
	34	SLDRAM Inc., "SLD4M18DR400 4 MEG X 18 SLDRAM: 400 Mb/s/pin SLDRAM 4 M x 18 SLDRAM Pipelined, Eight Bank, 2.5 V Operation," July 9, 1998. 69 pages	
	35	Supplementary EP Search Report dated April 17, 2007 in EP Application No. 05706081.6. 3 pages	
	36	TW Office Action dated May 11, 2011 re TW Application No. 094101310. 13 pages	✓
	37	TW Response dated August 12, 2011 to the Office Action dated May 11, 2011 re TW Application No. 94101310. 30 pages	✓
	38	WIDMER et al., "A DC-Balanced, Partitioned-Block, 8B/10B Transmission Code," IBM J. Res. Develop., Vol. 27, No. 5, September 1983, pp. 440-451. 12 pages	
	39	WIN et al., "Impulse Radio: How It Works," IEEE Communications Letters 2, Vol. 2, February 1998, pp. 36-38. 3 pages	
	40	YANG, Chih-Kong Ken, "Design of High-Speed Serial Links in CMOS," Technical Report No. CSL-TR-98-775, December 1998, pp. 1-182. 94 pages	

Examiner
SignatureDate
Considered

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT***(Use as many sheets as necessary)***Complete if Known**

Application Number	14/535,006
Filing Date	06 November 2014
First Named Inventor	Craig E. Hampel
Art Unit	2633
Examiner Name	Wang, Ted M.
Attorney Docket Number	RA309.C1C1C1C1C1.US (2014074)

Sheet 11 of 11

NON PATENT LITERATURE DOCUMENTS

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	41	Yellowstone Technology Brief, "High Performance Memory Interface Technology," Copyright 2003, Rambus, Inc. 2 pages	
	42	ZERBE, Jared, U.S. Application No. 09/776,550 filed February 2, 2001, re "Method and Apparatus for Evaluating and Calibrating a Signaling System" Application and Figures as Filed. 62 pages	
	43	ZERBE, Jared, U.S. Application No. 09/976,170 filed October 21, 2001, re "Method and Apparatus for Evaluating and Optimizing a Signaling System" Application and Figures as Filed. 98 pages	

Examiner Signature		Date Considered	
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Privacy Act Statement

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

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

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

Electronic Acknowledgement Receipt

EFS ID:	21508229
Application Number:	14535006
International Application Number:	
Confirmation Number:	6296
Title of Invention:	Periodic Calibration For Communication Channels By Drift Tracking
First Named Inventor/Applicant Name:	Craig E. Hampel
Customer Number:	78408
Filer:	Jose Gabriel Moniz/Dorothy Levin
Filer Authorized By:	Jose Gabriel Moniz
Attorney Docket Number:	2014074 / RA309C1C1C1C1C1
Receipt Date:	16-FEB-2015
Filing Date:	06-NOV-2014
Time Stamp:	14:53:30
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	RA309_C1C1C1C1C1_US_Transmittal.pdf	64699 3ec011c9896ebbbd14db3f6f62ee8d4c2d3bfb1d	no	3

Warnings:

Information:

2	Information Disclosure Statement (IDS) Form (SB08)	RA309_C1C1C1C1C1_US_IDS. pdf	2011002 35655e83d3005d175c820e395cd4b1e57fb763bf	no	12
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
Total Files Size (in bytes):				2075701	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: Craig E. Hampel, et al.
Application No.: 14/535,006
Filing Date: 06 November 2014
Title: PERIODIC CALIBRATION FOR COMMUNICATION
CHANNELS BY DRIFT TRACKING
Examiner: Ted M. Wang
Group Art Unit: 2633
Confirmation No.: 6296
In-House Docket No.: RA309.C1C1C1C1C1.US
Attorney Docket No.: 2014074

INFORMATION DISCLOSURE STATEMENT A
Under 37 CFR §§ 1.56 and 1.97-98

Pursuant to the provisions of 37 C.F.R. §§1.56 and 1.97-98, enclosed herewith is modified form PTO/SB/08A listing references for consideration by the Examiner.

The filing of this Information Disclosure Statement shall not be construed as a representation regarding the completeness of the list of references, or that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or that a search has been made, or as an admission that the information listed is, or may be considered to be, material to patentability, or that no other material information exists, and shall not be construed as an admission against interest in any manner.

This Information Disclosure Statement is being filed:

- ☒ within three months of the filing date of the application, or date of entry into the national stage of an international application, or before the mailing date of a first office action on the merits, whichever event last occurred;
- ☐ before the mailing of a first official action after the filing of a request for continued examination (RCE) under 37 C.F.R. §1.114;
- ☐ after three months of the filing date of this national application or the date of entry of the national stage in an international application, or after the mailing date of the first official action on the merits, whichever event last

occurred, but before the mailing date of the first to occur of either: (1) a final action under 37 C.F.R. §1.113; or (2) an action that otherwise closes prosecution in the application, and:

☐ Authorization is hereby given to Charge Deposit Account No. 505066 for the fee of \$180.00 under 37 C.F.R. §1.17(p) for submission of this Information Disclosure Statement under 37 C.F.R. §1.97(c); OR

☐ Applicant certifies pursuant to 37 C.F.R. §1.97(e) that:

☐ each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Statement; OR

☐ no item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated under 37 C.F.R. §1.56(c) more than three months prior to the filing of this Statement;

☐ on or before the payment of the issue fee but after the mailing date of the first to occur of either: (1) a final action under 37 C.F.R. §1.113; (2) a notice of allowance under 37 C.F.R. §1.311; or (3) an action that otherwise closes prosecution in the application, and:

☐ Applicant certifies pursuant to 37 C.F.R. §1.97(e) that:

☐ each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Statement; OR

☐ no item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated under 37 C.F.R. §1.56(c) more than three months prior to the filing of this Statement;

AND

☐ attached hereto is the fee set forth under 37 C.F.R. §1.17(p) for submission of this Information Disclosure Statement under 37

C.F.R. §1.97(d); OR

☐ after the payment of the issue fee. Applicant requests that the information contained in this Information Disclosure Statement be placed in the file according to 37 C.F.R. §1.97(i), although the information may not be considered by the USPTO.

☒ This application relies, under 35 U.S.C. § 120, on the earlier filing date of prior application No. 14/145,966, filed on 01 January 2014, and the references cited therein are hereby referenced, but are not required to be provided in this application under 37 C.F.R. §1.98(d).

☒ In accordance with 37 C.F.R. §§1.97 and 1.98, and in compliance with the duty of disclosure set forth in 37 C.F.R. §1.56, applicant submits attached Form PTO/SB/08a (EFS-Web) for consideration and request the references cited therein be made of record by the U.S. Patent and Trademark Office in the above-captioned application.

Consideration of the foregoing plus the prompt return of a copy of the enclosed Form SB/08A with the Examiner's initials in the left column in accordance with MPEP §609 are respectfully requested.

Respectfully submitted,

Dated 2/16/2015

/Jose G. Moniz/

Jose G. Moniz, Reg. No.: 50,192
Rambus Inc.
1050 Enterprise Way, Suite 700
Sunnyvale, CA 94089
Tel.: (408) 462-8000
Fax: (408) 462-8001



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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
14/535,006	11/06/2014		1600	2014074 / RA309C1C1C1C1C1	19	3

CONFIRMATION NO. 6296

78408
MARC P. SCHUYLER / Rambus
P.O. BOX 2535
SARATOGA, CA 95070

FILING RECEIPT



Date Mailed: 11/24/2014

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)

Craig E. Hampel, Los Altos, CA;
Frederick A. Ware, Los Altos Hills, CA;
Richard E. Perego, Thornton, CO;

Applicant(s)

Rambus Inc., Sunnyvale, CA

Power of Attorney: The patent practitioners associated with Customer Number 78408

Domestic Priority data as claimed by applicant

This application is a CON of 14/145,966 01/01/2014
which is a CON of 13/452,543 04/20/2012 PAT 8644419
which is a CON of 12/173,530 07/15/2008 PAT 8165187
which is a CON of 11/754,107 05/25/2007 PAT 7400671
which is a CON of 10/766,761 01/28/2004 PAT 7400670

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

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

If Required, Foreign Filing License Granted: 11/21/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/535,006**

Projected Publication Date: 03/05/2015

Non-Publication Request: No

Early Publication Request: No
Title

Periodic Calibration For Communication Channels By Drift Tracking

Preliminary Class

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

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LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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NOT GRANTED

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 14/535,006				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	600			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720			
TOTAL CLAIMS (37 CFR 1.16(j))	19	minus 20 = *			OR	x 80 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *				x 420 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	1600			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent App. Serial No.:	<i>Unknown (Con of 14/145966)</i>	Filing Date:	<i>Herewith</i>
Confirmation:	<i>unknown</i>	Publication No.:	<i>NYP</i>
First Named Inventor:	<i>Craig E. Hampel.</i>	GAU:	<i>Unknown</i>
Title:	<i>Periodic Calibration For Communications Channels By Drift Tracking</i>	Examiner:	<i>Unknown</i>
		Docket:	<i>2014074 / RA309C1C1C1C1C1US</i>

PRELIMINARY AMENDMENT

Contemporaneous with filing, please enter this preliminary amendment.

In The Specification.

Please amend the paragraph [0001] of the specification as set forth below.

"[0001] The present application is a continuation of co-pending U.S. patent application Ser. No. 14/145966, filed 1 Jan. 2014; which application is a continuation of U.S. patent application Ser. No. 13/452,543, filed 20 Apr. 2012, U.S. Pat. No. 8,644,419; which application is a continuation of U.S. patent application Ser. No. 12/173,530, filed 15 Jul. 2008, U.S. Pat. No. 8,165,187; which application is a continuation of U.S. patent application Ser. No. 11/754,107, filed 25 May 2007, U.S. Pat. No. 7,400,671; which is a continuation of U.S. patent application Ser. No. 10/766,761, filed 28 Jan. 2004, ~~entitled PERIODIC CALIBRATION FOR COMMUNICATION CHANNELS BY DRIFT TRACKING~~, U.S. Pat. No. 7,400,670; which prior applications are each entitled PERIODIC CALIBRATION FOR COMMUNICATION CHANNELS BY DRIFT TRACKING and are each incorporated herein by reference."

In The Claims.

Please amend the claims as set forth below. This listing replaces all prior listings of claims.

1-2. (Canceled)

3. (New) A method of operation in a system that includes a receive component having circuitry to receive a digital signal, the method comprising:

subjecting the receive component to a first calibration during initialization to identify an initial value for a parameter affecting proper reception by the circuitry of the receive component of data communicated across a channel as part of the digital signal;

periodically subjecting the receive component to a second calibration to update an existing value of the parameter for drift attributable to change in at least one of operating voltage or temperature; and

wherein the existing value is dependent on the initial value and wherein the second calibration is constrained to occur during a time period that is shorter than a time period of the first calibration.

4. (New) The method of claim 3, wherein periodically subjecting includes calculating an interval and repeatedly (a) performing the second calibration at each expiration of the interval and (b) resetting the interval.

5. (New) The method of claim 3, wherein the parameter is a voltage level for a comparator.

6. (New) The method of claim 3, wherein the parameter is a link termination resistance.

7. (New) The method of claim 3, wherein the parameter is a driver strength.

8. (New) The method of claim 3, wherein the second calibration uses less resources of the channel than the first calibration.

9. (New) The method of claim 3, wherein subjecting the receive component to the first calibration comprises receiving a first set of operations at the circuitry to exhaustively determine the initial value of the parameter, and wherein periodically subjecting the receive component to the second calibration comprises receiving a second set of operations at the circuitry to update the existing value if a desired value of the parameter has drifted from the existing value by more than a delta value.

10. (New) The method of claim 3, wherein periodically subjecting the receive component to the second calibration comprises suspending transmit and receive operations of the circuitry of the receive component.

11. (New) The method of claim 10, wherein subjecting the receive component to the first calibration comprises receiving at the circuitry a first pattern transmitted by a transmit component and comparing, in the receive component, the first pattern with a first expected pattern, and wherein periodically subjecting the receive component to the second calibration comprises receiving at the circuitry a second pattern transmitted by the transmit component and comparing in the receive component the second pattern with a second expected pattern.

12. (New) A system, comprising:

a receive component, the receive component having circuitry to receive data communicated across a channel by a transmit component;

the receive component to

perform at system initialization a first calibration, the first calibration to identify an initial value for a parameter affecting proper reception by the circuitry of the data communicated across the channel, and

perform on a periodic basis a second calibration, the second calibration to update an existing value of the parameter for drift attributable to change in at least one of voltage or temperature, wherein a time duration of the second calibration is constrained to be shorter than a time duration of the first calibration; and

circuitry to store the existing value of the parameter, the existing value of the parameter dependent on the initial value and any updates from the second calibration.

13. (New) The system of claim 12, wherein the second calibration is to be performed at expiration of an interval of time, at which time the circuitry is to suspend receive operations.

14. (New) The system of claim 13, wherein passage of the interval of time is to be tracked by the transmit component and the second calibration is to be initiated by the transmit component.

15. (New) The system of claim 12, wherein the parameter is a link termination resistance.

16. (New) The system of claim 12, wherein the parameter is a driver strength for a driver of the receive component.

17. (New) The system of claim 12, wherein the receive component is to perform, responsive to the second calibration, one of an increment operation or a decrement operation upon the existing value if a desired value of the parameter has drifted from the existing value by more than a delta value.

18. (New) The system of claim 12, further comprising circuitry to store a first expected pattern and a second expected pattern, and circuitry to compare the first expected pattern with a pattern received from the transmit component in association with the first calibration, and to compare the second expected pattern with a pattern received from the transmit component in association with the second calibration.

19. (New) A system, comprising:

circuitry to store an existing value representative of at least one of a termination resistance and a driver strength to be applied in association with data communicated across a channel;

circuitry to perform a first calibration at system initialization, to identify a first value to be initially applied as the existing value, the first calibration to be performed during a first calibration interval prior to normal system operation; and

circuitry to periodically perform a second calibration, to update the existing value;

wherein the existing value is initially set and periodically updated responsive to the first calibration and the second calibration, respectively, and wherein the second calibration is constrained to be performed during a time period that is shorter than a time period of the first calibration; and

wherein the system further comprises a receive component, the at least one to be applied to permit proper reception of a digital signal to be communicated across a communications channel.

20. (New) The system of claim 19, wherein the circuitry to perform the second calibration is, responsive to the second calibration, to perform one of an increment operation or a decrement operation upon the existing value if the desired value has drifted from the existing value by more than a delta value relative to an existing value.

21. (New) The system of claim 20, further comprising circuitry to store a first expected pattern and a second expected pattern, and circuitry to compare the first expected pattern with a pattern received from an external component in association with the first calibration, and to compare the second expected pattern with a pattern received from the external component in association with the second calibration.

REMARKS

It is believed this entry is made as a matter of right.

If it would be helpful for the Examiner to discuss the subject matter of the claims or positions taken by this paper, the Examiner is respectfully invited to call Applicant's attorney at (408) 655-6375.

Respectfully submitted,

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Saratoga, CA 95070
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marc@schuylerlawgroup.com

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Periodic Calibration For Communications Channels By Drift Tracking		
First Named Inventor/Applicant Name:		Craig E. Hampel		
Filer:		Marc Philip Schuyler		
Attorney Docket Number:		2014074 / RA309C1C1C1C1C1		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1600

Electronic Acknowledgement Receipt	
EFS ID:	20630085
Application Number:	14535006
International Application Number:	
Confirmation Number:	6296
Title of Invention:	Periodic Calibration For Communications Channels By Drift Tracking
First Named Inventor/Applicant Name:	Craig E. Hampel
Customer Number:	78408
Filer:	Marc Philip Schuyler
Filer Authorized By:	
Attorney Docket Number:	2014074 / RA309C1C1C1C1C1
Receipt Date:	06-NOV-2014
Filing Date:	
Time Stamp:	17:23:15
Application Type:	Utility under 35 USC 111(a)

Payment information:	
Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 1600
RAM confirmation Number	4033
Deposit Account	
Authorized User	

File Listing:				
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part (.zip) / Pages

1	Assignee showing of ownership per 37 CFR 3.73.	1-aia0096-AssnStatement-RA309C1C1C1C1C1US.pdf	118087	no	3
			05057ca9a6e2deab3235898be1014383e2a fd06		
Warnings:					
Information:					
2	Drawings-only black and white line drawings	2-Spec-Dwg-RA309C1C1C1C1C1US--2014-10-27.pdf	5488920	no	48
			d9deae8037978f2cc176e4670672505e910 a7159		
Warnings:					
Information:					
3	Power of Attorney	4-2011-07-22-Rambus-General-POA-Customer-No-78408.pdf	369569	no	1
			c41e0c2b4c551970e1e8517c946c243151d e941f		
Warnings:					
Information:					
4	Application Data Sheet	5-aia0014-ADS-RA309C1C1C1C1C1US.pdf	1396860	no	6
			5214f59ec729f780535bc161bc23f27e5d73 b9e7		
Warnings:					
Information:					
5	Assignee showing of ownership per 37 CFR 3.73.	6-Assignment-RA309.pdf	1862893	no	3
			c55c31ad7c6bbda154991d69496ba979609 ef3fe		
Warnings:					
Information:					
6	Oath or Declaration filed	7-RA309C1C1C1C1C1US-Declaration.pdf	340764	no	3
			f3cb398d60d9a36bfb2d6c007986a899cb2 d1488		
Warnings:					
Information:					
7	Preliminary Amendment	3-RA309C1C1C1C1C1US-PAM-2014-11-06.pdf	73803	no	7
			78027fb025401b2c23c5f3d77be9d4bae54 1fbdd		
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	32928	no	2
			0d99ed3a02fdea9291fe75d529b7e21e6ad 3705c		
Warnings:					
Information:					
Total Files Size (in bytes):			9683824		

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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.

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: Rambus Inc.Application No./Patent No.: unknown (con of 14/145966) Filed/Issue Date: HerewithTitled: Periodic Calibration For Communication Channels By Drift TrackingRambus Inc., a Corporation

(Name of Assignee)

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

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

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

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

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

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

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

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

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 014945, Frame 0044, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:
1. From: _____ To: _____
- The document was recorded in the United States Patent and Trademark Office at
- Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
- The document was recorded in the United States Patent and Trademark Office at
- Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

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

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

Silicon Motion Inc. Ex. 1003, Page 142
Silicon Motion Inc. v. K. Mizra LLC, IPR2024-01240

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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

4. From: _____ To: _____

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

5. From: _____ To: _____

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

6. From: _____ To: _____

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

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

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

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

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

/Marc Schuyler/

2014-10-27

Signature

Date

Marc Schuyler

35675

Printed or Typed Name

Title or Registration Number

Privacy Act Statement

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

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

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

**PERIODIC CALIBRATION FOR COMMUNICATION CHANNELS BY DRIFT
TRACKING**

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CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a continuation of co-pending United States Patent
10 Application No. 12/173,530 filed 15 July 2008, U.S Patent No. 8,165,187; which
application is a continuation of United States Patent Application No. 11/754,107, filed 25
May 2007, U.S. Patent No. 7,400,671; which is a continuation of United States Patent
Application No. 10/766,761, filed 28 January 2004, entitled PERIODIC CALIBRATION
FOR COMMUNICATION CHANNELS BY DRIFT TRACKING, U.S. Patent No.
15 7,400,670; which prior applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to the calibration of communication channel
20 parameters in systems, including mesochronous systems, in which two (or more)
components communicate via an interconnection link; and to the calibration needed to
account for drift of conditions related to such parameters during operation of the
communication channels.

25 Description of Related Art

[0002] In mesochronous communication channels, typically a reference clock
provides frequency and phase information to the two components at either end of the
link. A transmitter on one component and a receiver on another component each connect
to the link. The transmitter and receiver operate in different clock domains, which have
30 an arbitrary (but fixed) phase relationship to the reference clock. The phase relationship
between transmitter and receiver is chosen so that the propagation delay seen by a signal
wavefront passing from the transmitter to the receiver will not contribute to the timing
budget for signaling rate. Instead, the signaling rate is determined primarily by the drive
window of the transmitter and the sample window of the receiver. The signaling rate will

also be affected by a variety of second order effects. This system is clocked in a mesochronous fashion, with the components locked to specific phases relative to the reference clock, and with the drive timing point and sample timing point of each link fixed to the phase values that maximize the signaling rate.

5 **[0003]** These fixed phase values may be determined in a number of ways. A sideband link may accompany a data link (or links), permitting phase information to be passed between transmitter and receiver. Alternatively, an initialization process may be invoked when the system is first given power, and the proper phase values determined by setting a transmitter drive timing point, and executing a calibration sequence that includes
10 passing a calibration pattern or calibration patterns across the actual link to the receiver, and adjusting the receiver sample timing point until the data is successfully sampled at the receiver. Once the drive timing point and sample timing point of each link have been fixed, the system is permitted to start normal operations. The calibration sequences used to establish proper phase values on initialization are designed to provide reliable results
15 over a wide variety of environmental conditions, and a wide variety of operating conditions on the communication link. To provide reliable results, the calibration sequences pass a calibration pattern or calibration patterns that include lots of data and take quite a long time.

[0004] The calibration sequences use patterns with long or numerous codes designed
20 to find the worst-case leading edge and the worst-case trailing edge of a passing region for a parameter subject of the calibration, such as drive timing points and sample timing points discussed above. The edge values are a function of many system parameters including for example silicon processing variations, and packaging parameters such as crosstalk, terminal resistance accuracy, system board impedance, module impedance,
25 trace lengths, connector locations, and so on. In addition to the uncertainty of these variables, the patterns necessary to create worst-case inter-symbol interference or resonance can be very long, and are difficult to predict. In order to deal with the uncertainty of which patterns will generate the leading or trailing edge of the worst-case passing region, many systems use a brute force approach to calibration sequences, using
30 sequences with very long calibration patterns. For example, one brute force approach is based on the use of a pseudorandom bit sequence PRBS, which consists of a long, fairly

random pattern, to attempt to determine the passing region. Other systems utilize many initialization patterns that are hundreds of bits long to present the worst-case pattern for a given configuration, and attempt to cover all possible conditions.

[0005] The use of long, complex patterns is generally adequate if the calibration sequence is run infrequently. For example, if the algorithm is run only during an initial system bring up, the length of the calibration pattern is not generally critical. However, during normal operation, system conditions will change. Ambient temperature, component temperature, supply voltages, and reference voltages will drift from their initial values. Also, spread spectrum clock systems intentionally shift the clock frequency to meet emission standards. As the conditions drift, the optimal timing points of the transmitter and receiver and other parameters will change.

[0006] Although the calibration sequences can be run periodically to adjust for drift, the length and complexity of the patterns and the algorithms used in the sequences interfere with mission-critical operations of the system. Primarily, the long calibration sequences with patterns having long or numerous codes require storage, access to the input/output circuits and interconnect, and processing resources in order to complete a calibration sequence. During this recalibration time, the system is unavailable to the application. This creates at least two significant problems. First, performance is reduced, in general. Second, many applications can tolerate only minimum latency addition without under or over running their streaming data.

[0007] It is desirable to provide techniques to compensate for the condition drift, and provide improvements in system and component design to permit these techniques to be utilized.

SUMMARY OF THE INVENTION

[0008] The present invention takes advantage of a discovery that long-term drift in timing, voltage or other parameters of a communication channel caused for example by temperature change, can be largely independent of the calibration pattern utilized to compute the operation value of the parameter. In other words, drift in a particular parameter can be tracked without using patterns based on long and/or numerous codes required for determining an optimal operation value for the parameter. Rather, a simpler

calibration sequence can be applied to track drift of the particular parameter during operation of the device. The simpler calibration sequence used to track drift of the parameter utilizes less of the resources of the communication channel (that is, it occupies the link, transmitter and receiver for less time) than the more exhaustive initial calibration sequence. Changes in the parameter based on computations that arise from the use of a simpler calibration sequence are used to adjust the operation value that was created using the more exhaustive initial sequence. Herein, the operation value is the value, or a function of the value, of the parameter usually used during normal operation of the communication channel.

[0009] Accordingly, the present invention provides a system and method for calibrating an operation value for a parameter of a communication channel, which allows for optimizing the operation value of the parameter, while efficiently accounting for drift of properties of the channel. A method for calibrating a communication channel, including a first component having a transmitter, a second component having a receiver, and a communication link coupling the first and second components, the communication channel having a parameter with an operation value determined by calibration, comprises establishing an operation value for a parameter of the communication channel; executing a drift calibration sequence, from time to time, to determine a drift value for the parameter of the communication channel, wherein drift calibration sequence comprises an algorithm different than used to establish the operation value; and updating the operation value in response to the drift value. In embodiments of the invention, the operation value is established by executing a first calibration sequence to set the operation value of the parameter of the communication channel, and wherein the drift calibration sequence utilizes less resources of the communication channel than the first calibration sequence. The first calibration sequence is executed, such as upon initialization of a system, to establish the operation value, which utilizes an algorithm that the designer intends to be exhaustive so that a suitable operation value can be determined for most conditions in which the system is designed to operate. A second calibration sequence is executed to determine a drift value in the parameter, and to update the operation value in response to the drift value. The second calibration sequence is executed from time to time during normal operation of the communication channel, and

utilizes less resources of the communication channel than does the first calibration sequence. In one embodiment, the first calibration sequence for measurement of the operation value utilizes a long calibration pattern, such a data set including a code or codes which includes more than 200 bits, a code greater than 30 bytes, and a code based
 5 on a pseudorandom bit sequence having a length of $2^N - 1$ bits, where N is equal to or greater than 7. The second calibration sequence utilizes a short calibration pattern, such as a fixed code less than 130 bits, such as less than or equal to 16 bytes, and for example as short as 2 bytes long. Thus in embodiments of the invention, the first calibration sequence utilizes many relatively short codes, or combinations of relatively short and
 10 longer codes, while the second calibration sequence uses one short code, or a few short codes where the total number of bits used in the second sequence is substantially less than the total number of bits used in the first sequence.

[0010] A calibration sequence, in some embodiments, includes a plurality of calibration cycles. The calibration cycles include de-coupling, logically using software
 15 or physically using switches, the normal signal source from the transmitter and supplying a calibration pattern in its place. The calibration pattern is transmitted on the link using the transmitter on the first component. After transmitting the calibration pattern, the normal signal source is re-coupled to the transmitter. The calibration pattern is received from the communication link using the receiver on the second component. The received
 20 calibration pattern is analyzed, by comparing it to an expected calibration pattern. The comparison indicates a number of errors in the received calibration pattern, which are used to indicate whether the value of the parameter used during the calibration sequence allows successful operation of the communication channel. A calibrated value of a parameter, or drift of a previously established parameter, of the communication channel
 25 is determined in response to the analysis of the received calibration pattern or patterns.

[0011] Some embodiments of the invention comprise a calibration method, based on the first and second calibration sequences as discussed above, wherein said second calibration sequence includes

- adjusting the parameter to a first edge value;
- 30 transmitting calibration patterns on the communication link
- using the transmitter on the first component;

receiving the calibration patterns on the communication link
using the receiver on the second component;

determining whether the received calibration patterns indicate
that a new edge value is met, and if not, returning to the adjusting to
iteratively execute a next calibration cycle, and if a new edge value
is met, then saving data indicating drift of the first edge value; and
then

adjusting the parameter to a second edge value;

transmitting calibration patterns on the communication link
using the transmitter on the first component;

receiving the calibration patterns on the communication link
using the receiver on the second component;

determining whether the received calibration patterns indicate
that a new edge value is met, and if not, returning to the adjusting to
iteratively execute a next calibration cycle, and if a new edge value
is met, then saving data indicating drift of the second edge value;
and

determining the drift for the parameter in response to a function
of the drift of the first and second edge values.

[0012] In some embodiments of the invention, the second calibration sequence
measures only one of the first and second edge values, or other value related to the
operation value, and determines the drift for the parameter in response to a function of the
one measured value.

[0013] Methods according to some embodiments of the invention comprise

executing a first calibration sequence;

the first calibration sequence including iteratively adjusting a
value of a first edge parameter, transmitting a long calibration
pattern using the transmitter on the first component, receiving the
long calibration pattern using the receiver on the second component,
and analyzing the received long calibration pattern to determine a
value for the first edge parameter;

the first calibration sequence also including iteratively adjusting a value of a second edge parameter, transmitting a long calibration pattern using the transmitter on the first component, receiving the long calibration pattern using the receiver on the second component, and analyzing the received long calibration pattern to determine a value for the second edge parameter; and

as a result of the first calibration sequence, determining said operation value for the parameter based on the function of the first and second edge parameters;

executing a second calibration sequence;

the second calibration sequence including iteratively adjusting a value of a first edge parameter, transmitting a short calibration pattern using the transmitter on the first component, receiving the short calibration pattern using the receiver on the second component, and analyzing the received short calibration pattern to determine a value for the first edge value;

the second calibration sequence also including iteratively adjusting a value of a second edge parameter, transmitting a short calibration pattern using the transmitter on the first component, receiving the short calibration pattern using the receiver on the second component, and analyzing the received short calibration pattern to determine a value for the second edge value; and

as a result of the second calibration sequence, determining said drift for the parameter based on the function of the first and second edge parameters; and

updating said operation value based on said drift, wherein the long calibration patterns have lengths of at least 30 bytes, and the short calibration patterns have lengths of 16 bytes, or less.

[0014] Other aspects and advantages of the present invention can be seen on review of the drawings, the detailed description and the claims, which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Fig. 1 is a simplified diagram of two components interconnected by a communication channel.

[0016] Fig. 2 is a timing diagram illustrating timing parameters for a communication channel like that shown in Fig. 1.

[0017] Fig. 3 illustrates an embodiment of the present invention where both a transmitter drive point and a receiver sample point are adjustable.

[0018] Fig. 4 illustrates an embodiment of the present invention where only a receiver sample point is adjustable.

[0019] Fig. 5 illustrates an embodiment of the present invention where only a transmitter drive point is adjustable.

[0020] Fig. 6 is a chart illustrating measurement of an operation value and measurement of drift for a transmit clock parameter TX of a communication channel using long and short calibration patterns.

[0021] Fig. 7 is a chart illustrating measurement of an operation value and measurement of drift for a receive clock parameter RX of a communication channel using long and short calibration patterns.

[0022] Fig. 8 is a flow chart illustrating calibration steps for a transmitter on a unidirectional link for a transmitter drive point.

[0023] Fig. 9 illustrates timing for iteration steps for calibrating a transmitter drive point.

[0024] Fig. 10 is a flow chart illustrating calibration steps for a receiver on a unidirectional link for a sample point.

[0025] Fig. 11 illustrates timing for iteration steps for calibrating a receiver sample point.

[0026] Fig. 12 illustrates an embodiment of the present invention where transmitter drive points and receiver sample points on components of a bidirectional link are adjustable.

[0027] Fig. 13 illustrates an embodiment of the present invention where receiver sample points on components of a bidirectional link are adjustable.

[0028] Fig. 14 illustrates an embodiment of the present invention where both components have adjustable transmitter drive points.

[0029] Fig. 15 illustrates an embodiment of the present invention where a transmitter drive point and a receiver sample point of only one component on a bidirectional link are adjustable.

[0030] Fig. 16 is a flow chart illustrating calibration steps for a transmitter drive point for a bidirectional link.

[0031] Fig. 17 is a flow chart illustrating calibration steps for a receiver sample point for a bidirectional link.

[0032] Fig. 18 illustrates an embodiment of the present invention where a transmitter drive point and a receiver sample point of one component on a bidirectional link are adjustable with a plurality of parameter sets, and wherein the bidirectional link is coupled to a plurality of other components corresponding to the plurality of parameter sets.

DETAILED DESCRIPTION

[0033] A detailed description of embodiments of the present invention is provided with reference to the Figures.

Transmitter and Receiver Timing Parameters

[0034] Fig. 1 shows two components 10, 11 connected with an interconnection medium, referred to as Link 12. One has a transmitter circuit 13 which drives symbols (bits) on Link 12 typically in response to rising-edge timing events on the internal CLKT signal 14. This series of bits forms signal DATAT. The other component 11 has a receiver circuit 15 which samples symbols (bits) on Link 12 typically in response to rising-edge timing events on the internal CLKR signal 16. This series of bits forms signal DATAR. The DATAT and DATAR signals are related; DATAR is an attenuated, time-delayed copy of DATAT. The attenuation and time-delay occur as the signal wavefronts propagate along the interconnection medium of Link 12. The communication channel comprising transmitter 13, link 12 and receiver 15 can be characterized by a plurality of parameters that have an operation value during normal operation of the channel. Representative parameters of the channel include timing parameters specifying the drive times and sample times, voltage levels for drivers and comparators, resistance

values such as link termination resistances, driver strength, adaptive equalization coefficients, noise cancellation coefficients, parameters that cause overshoot and undershoot of signals such as driver switching power or speed, and so on. These parameters are affected by or contribute to, drifting flight times, output delays for transmitters, receiver mismatches, input delays, and so on.

[0035] Fig. 2 illustrates timing parameters for a mesosynchronous channel, including the transmit clock CLK_T signal 14 on trace 20, the transmitter signal DATA_T on trace 21, the receive clock CLK_R signal 16 on trace 22, and the receiver signal DATA_R on trace 23. The transmitter eye 24 and the receiver eye 25 are also illustrated.

[0036] The transmitter circuit 13 will begin driving a bit (labeled “a”) no later than a time $t_{Q,MAX}$ after a rising edge 30 of CLK_T, and will continue to drive it until at least a time $t_{V,MIN}$ after the next rising edge 31. $t_{Q,MAX}$ and $t_{V,MIN}$ are the primary timing parameters of the transmitter circuit 13. These two values are specified across the full range of operating conditions and processing conditions of the communication channel. As a result, $t_{Q,MAX}$ will be larger than $t_{V,MIN}$, and the difference will represent the dead time or dead band 32 of the transmitter circuit 13. The transmitter dead band 32 ($t_{DEAD,T}$) is the portion of the bit timing window (also called bit time or bit window) that is consumed by the transmitter circuit 13:

$$t_{DEAD,T} = t_{Q,MAX} - t_{V,MIN}$$

[0037] The edges of the timing window around transition 31 can be defined by:

$$t^{-1} + t_{Q,MAX}, \text{ and}$$

$$t + t_{V,MIN},$$

where t^{-1} is transition 30 one clock cycle earlier than the transition 31, and t is the transition 31.

[0038] The receiver circuit 15 will begin sampling a bit (labeled “a”) no earlier than a time $t_{S,MIN}$ before a rising edge 35 (or 36) of CLK_R, and will continue to sample until no later than a time $t_{H,MIN}$ after the rising edge 35. $t_{S,MIN}$ and $t_{H,MIN}$ are the primary timing parameters of the receiver circuit. These two values are specified across the full range of operating conditions and processing conditions of the circuit. The sum of $t_{S,MIN}$ and $t_{H,MIN}$ will represent the dead time or dead band 37, 38 of the receiver. The receiver dead

band 37, 38 ($t_{\text{DEAD,R}}$) is the portion of the bit timing window (also called bit time or bit window) that is consumed by the receiver circuit:

$$t_{\text{DEAD,R}} = t_{\text{S,MIN}} + t_{\text{H,MIN}}$$

[0039] The edges of the timing window around transition 35 can be defined by:

5 $t - t_{\text{S,MIN}}$, and

$t + t_{\text{H,MIN}}$,

where t is transition 35.

[0040] In this example, the bit timing window is one t_{CYCLE} minus the $t_{\text{DEAD,T}}$ and $t_{\text{DEAD,R}}$ values, each of which is about 1/3 of one t_{CYCLE} in this example. The remaining
10 1/3 t_{CYCLE} would account for other uncertainty. Such uncertainty could include, for example, variation in the placement of the rising edges of CLK_T and CLK_R. In some systems, this variation might be specified as part of the $t_{\text{DEAD,T}}$ and $t_{\text{DEAD,R}}$ definition. Other uncertainty could include variation in the propagation delay across the interconnection medium.

15 **Unidirectional Link Alternatives**

[0041] Fig. 3 shows two components 100 (transmit component) and 101 (receive component) connected with an interconnection medium referred to as Link 102. The link is assumed to carry signals in one direction only (unidirectional), so one component 100 has a transmitter circuit 103 coupled to a signal source 110 labeled “normal path,” and
20 one component 101 has a receiver circuit 104 coupled to a destination 111 labeled “normal path”. There are additional circuits present to permit periodic adjustment of the drive point and sample point in between periods of normal system operation. These adjustments compensate for changes in the system operating conditions.

[0042] The transmitter component includes a block 105 labeled “pattern”, which can
25 consist of pattern storage, pattern generation circuitry or both, and which is used as a source of transmit calibration patterns for the first and second calibration sequences used according to the present invention. The first calibration sequence in other embodiments is provided by host software across the “normal” data path, while the second calibration sequence is provided by a “pattern” block in the transmitter, and vice versa. Generally,
30 the pattern source can be the same or different, for the first exhaustive calibration sequence and second drift calibration sequence.

[0043] In the embodiment shown, a multiplexer block 106 labeled “mux,” implemented for example using a logical layer or physical layer switch, enables the transmit calibration pattern set to be driven onto the link by the transmitter circuit. The transmitter drive point can be adjusted by the block 107 labeled “adjust”. A sideband communication channel 113 is shown coupled between the component 101 and the component 100, by which the results of analysis of received calibration patterns at the component 101 are supplied to the adjust block 107 of the component 100.

[0044] The receiver component 101 includes a block 108 labeled “pattern”, which can consist of host software, pattern storage or pattern generation circuitry, and which is used as a source of expected patterns. A block 109 labeled “compare” enables the received pattern set to be compared to the expected pattern set, analyzes the result and causes an adjustment to be made to either the transmitter or receiver. The receiver sample point can be adjusted by the block 112 labeled “adjust”.

[0045] Fig. 4 shows two components 100, 101 connected with a unidirectional link 102, in which components of Fig. 3 are given like reference numerals. In the embodiment of Fig. 4, only the receiver sample point can be adjusted; the transmitter drive point remains fixed during system operation. Thus, there is no adjust block 107 in the component 100, nor is there a need for sideband communication channel 113 of Fig. 4.

[0046] Fig. 5 shows two components 100, 101 connected with a unidirectional link 102, in which components of Fig. 3 are given like reference numerals. In the embodiment of Fig. 5, only the transmitter drive point can be adjusted; the receiver sample point remains fixed during system operation. Thus, there is no adjust block 112 in the component 101 of Fig. 5.

[0047] In general, periodic timing calibration can be performed on all three examples, since timing variations due to condition drift can be compensated at either the transmitter end or the receiver end. In practice, it is cheaper to put the adjustment circuitry at only one end of the link, and not at both ends, so systems of Figs. 4 or 5 would have an advantage. Also, it should be noted that the system of Fig. 4 does not need to communicate information from the “compare” block 109 in the receiver component 101 back to the transmitter component 100, and thus might have implementation benefits over

the system of Fig. 5. In practical applications, it is generally preferable to calibrate the receiver first and then use this setting to perform transmitter calibration. One method of breaking the chicken-and-egg problem is to load a known transmit pattern via a sideband interface to both sides of the channel. Having matching patterns on both sides, we can now perform an receive sample point calibration. Then, after the receiver offset is set to a reliable value, we can perform initial transmit drive point calibration.

[0048] Fig. 6 is a chart illustrating the measured values of a transmit drive timing point parameter using an exhaustive calibration sequence, as compared to the measured values of the same parameter using a short calibration sequence as discussed above. In Fig. 6, the conditions causing drift are plotted on the vertical axis, while the changes in the parameter are plotted on the horizontal axis. In the example illustrated, the condition causing drift is temperature, and the parameter being measured is the phase of the transmit drive point TX. As illustrated, the exhaustive calibration sequence computes edge values TXA and TXB on traces 200 and 201, so that the operation value TX as shown on trace 202 can be computed as a function of the edge values. In this case, the exhaustive calibration sequence utilizes a long calibration pattern including a pseudorandom bit sequence having a length 2^N-1 , where N is at least 7, and N is 15 in one embodiment. Using a long pseudorandom bit sequence, the exhaustive center of the edge values TXA, TXB and the operation value TX are determined. In Fig. 6, the short calibration sequences are used to track drift, where the short sequences comprise a simple two-byte code or set of two byte (16 bit) codes, such as AAAA, 5555 or 0F0F (hexadecimal). As can be seen, the edge values TXAS and TXBS as measured using the short calibration sequences are plotted on traces 203 and 204. The operation value TXS, if it were based simply on the edge values TXAS and TXBS for the short calibration sequences would be on the trace 205. However, as shown in Fig. 6, the relationship between the condition on the vertical axis and the edge values TXAS, TXBS for the short calibration patterns along the horizontal axis has the same slope as the relationship between the condition and the operation value TX determined using the long calibration patterns. As shown in Fig. 6, if at calibration point C1, the operation value is established at TX, the edge value for TXAS determined using the short patterns has the value represented by point 206. At calibration point C2, the edge value TXAS drifts from point

206 on the horizontal axis by a drift value $\Delta TXAS$. Likewise, the operation value TX drifts by a drift value ΔTX . To the extent the slope of trace 202 for the value TX is the same as, or otherwise correlates with, the slope of trace 203 for the value TXAS, the drift value $\Delta TXAS$ can be applied directly to estimate the drift ΔTX , and to update the operation value TX without executing an exhaustive calibration sequence. A similar relationship exists in the graph of Fig. 6, between TXAB and TX, and between TXS and TX. That is the drift of TX is a function of the drift of TXAS alone, TXBS alone, or of a combination of TXAS and TXBS. Thus, by measuring changes in one or both of the edge values of the parameter using a short calibration pattern, and applying those changes to changing the operation value computed using a long calibration pattern, the operational center for the parameter can be adjusted to account for drift utilizing less resources of the communication channel.

[0049] Fig. 7 is a chart illustrating the measured values of a receive sample timing point parameter using an exhaustive calibration sequence, as compared to the measured values of the same parameter using a short calibration sequence. In Fig. 7, the conditions causing drift are plotted on the vertical axis, while the changes in the parameter are plotted on the horizontal axis. In the example illustrated, the condition causing drift is temperature, and the parameter being measured is the phase of the transmit drive point RX. As illustrated, the exhaustive calibration sequence computes edge values RXA and RXB on traces 210 and 211, so that the operation value RX as shown on trace 212 can be computed as a function of the edge values. In this case, the exhaustive calibration sequence utilizes a long calibration pattern including a pseudorandom bit sequence having a length $2^N - 1$, where N is at least 7, and N is 15 in one embodiment. Using a long pseudorandom bit sequence, the exhaustive center of the edge values RXA, RXB and the operation value RX are determined. In Fig. 7, the short calibration sequences are used to track drift, where the short sequences comprise a simple two-byte code or set of two byte (16 bit) codes, such as AAAA, 5555 or 0F0F (hexadecimal). As can be seen, the edge values RXAS and RXBS as measured using the short calibration sequences are plotted on traces 213 and 214. The operation value RXS, if it were based simply on the edge values RXAS and RXBS for the short calibration sequences would be on the trace 215. However, as shown in Fig. 7, the relationship between the condition on the vertical axis

and the edge values RXAS, RXBS for the short calibration patterns along the horizontal axis has the same slope as the relationship between the condition and the operation value RX determined using the long calibration patterns. As shown in Fig. 7, if at calibration point C1, the operation value is established at RX, the edge value for RXAS determined using the short patterns has the value represented by point 216. At calibration point C2, the edge value RXAS drifts from point 216 on the horizontal axis by a drift value $\Delta RXAS$. Likewise, the operation value RX drifts by an drift value ΔRX . To the extent the slope of trace 212 for the value RX is the same as, or otherwise correlates with, the slope of trace 213 for the value RXAS, the drift value $\Delta RXAS$ can be applied directly to estimate the drift ΔRX , and to update the operation value RX without executing an exhaustive calibration sequence. A similar relationship exists in the graph of Fig. 7, between RXAB and RX, and between RXS and RX. That is the drift of RX is a function of the drift of RXAS alone, RXBS alone, or of a combination of RXAS and RXBS.

Thus, by measuring changes in one or both of the edge values of the parameter using a short calibration pattern, and applying those changes to changing the operation value computed using a long calibration pattern, the operational center for the parameter can be adjusted to account for drift utilizing less resources of the communication channel.

[0050] The function of the drift in the edge value measured using the short calibration pattern, and the drift in the operation value using the long calibration pattern in the examples of Fig. 6 and Fig. 7, are linear, or approximately linear. In other examples, the function may be more complex, and/or the value measured using the short patterns may be different than those shown. However, so long as the drift in the value measured using the short calibration pattern, and the drift in the operation value using the long calibration pattern, are correlated, whether causally or not, then the values measured using the short calibration pattern can be applied for adjustment of the operation value of parameter.

[0051] Accordingly, the operation value of the parameter can be established, such as by using an exhaustive calibration routine based on long calibration patterns, during startup or initialization of the system. Adjustments in the operation value due to drift, however, can be made based upon shorter calibration sequences adapted to determine a drift value, such as those based on short calibration patterns. The shorter drift calibration sequences can be executed from time to time, such as on a set periodic basis, when

signaled by an external monitor of the conditions of operation, or at times depending on other conditions of use of the communication channel, without utilizing as much of the resources of the communication channel as are needed for the more exhaustive calibration routine utilized less frequently, such as only during startup.

5 **Calibration Steps for Transmitter for Unidirectional Link**

[0052] Fig. 8 shows calibration steps for the example system shown in Fig. 5.

(Step 300) Execute a first calibration sequence on initialization or other event to establish an operation value for the transmit drive point, based on long calibration patterns or more exhaustive routines.

10 (Step 301) Periodically, or upon an event indicating that a drift measurement is due, suspend transmit and receive operations that are in progress.

(Step 302) Change the drive point of the transmit component from the “TX” operation value (used for normal operations) to either the “TXAS” or “TXBS” edge value (used for drift calibration operations) in the “adjust” block. It may be necessary to impose a settling delay at this step to allow the new drive point to become stable.

15 (Step 303) Change “mux” block of the transmit component so that the “pattern” block input is enabled.

(Step 304) A pattern set is created in the “pattern” block of the transmit component and is transmitted onto the “link” using the TXAS or TXBS drive point.

20 (Step 305) The pattern set is received in the receive component. Note that the sample point of the receiver is fixed relative to the reference clock of the system and is not adjusted.

(Step 306) The received pattern set is compared in the “compare” block to the expected pattern set produced by the “pattern” block in the receive component. The two pattern sets will either match or not match. As a result of this comparison (and possibly other previous comparisons) a pass or fail determination will be made.

25 (Step 307) Adjust either the “TXAS” or “TXBS” edge value in the transmit component as a result of the pass or fail determination. The drift in the “TX” operation value in the transmit component is indicated by a function of the adjusted TXAS and TXBS values.

30 The “TX” value is also adjusted based on that function. This adjustment may only be made after a calibration sequence including transmission of two or more of calibration

patterns has been executed, in order to ensure some level of repeatability. Also, “low pass” filtering may be applied to measurements of drift or of the operation value, to prevent dithering of the operation value.

(Step 308) Change the drive point of the transmitter from the “TXAS” or “TXBS” edge value (used for calibration operations) to new “TX” operation value (used for normal operations) in the “adjust” block of the transmit component. It may be necessary to impose a settling delay at this step to allow the new drive point to become stable.

(Step 309) Change “mux” block of the transmit component so that the “normal path” input is enabled.

10 (Step 310) Resume normal transmit and receive operations.

[0053] The first calibration sequence in one embodiment is an iteration just like that discussed above with respect to steps 301-310, with the exception that the calibration pattern for the first cycle is a long pattern, and the calibration pattern for the second calibration sequence is a short pattern. For example, a pseudorandom bit sequence having a length $2^N - 1$, with N equal to 7 or N equal to 15, can be used as the long calibration pattern for the first calibration sequence. In another example, the long calibration pattern is a set of short patterns intended to be an exhaustive set for conditions, such as inter-symbol interference patterns, of the communication channel. The short calibration pattern on the other hand, may be a simple two-byte code or set of two byte (16 bit) codes, such as AAAA, 5555 or 0F0F (hexadecimal).

[0054] In some embodiments, the exhaustive calibration sequence may use the same codes as the simpler calibration sequence, but apply shorter algorithms for computing adjustments. For, example, the values may be adjusted without requiring repeatability, or requiring less repeatability, when measuring drift than when measuring the exhaustive operation value.

Timing for Iteration Step for Transmit

[0055] Fig. 9 includes the timing waveforms used by the exhaustive calibration steps to determine an operation value, similar to the calibration sequence shown in Fig. 8 for determining drift in a system like that of Fig. 5. These timing waveforms are similar to those from Fig. 1, except that the drive point is adjusted to straddle the sampling window of the receiver in order to track the edges of the valid window of the transmitter, and

illustrate one example calibration procedure. During a drift calibration sequence, the edge values of Fig. 9, ($t_{PHASET(TXA)}$ and $t_{PHASER(TXB)}$) are replaced by correlated values determined using the short calibration sequences.

5 **[0056]** The “adjust” block in the transmit component maintains three values in storage: TXA, TX, and TXB. The TX value is the operation value used for normal operation. The TXA and TXB are the “edge” values, which track the left and right extremes of the bit window of the transmitter. Typically, the TX value is initially derived from the average of the TXA and TXB values as determined using an exhaustive calibration sequence, but other relationships are possible.

10 **[0057]** As described above, drift in the TX value is determined by a function of the TXAS and TXBS values determined during the calibration sequences that use short patterns. The function of TXAS and TXBS used depends on how the parameter drifts as measured by the exhaustive calibration patterns, as compared with how it drifts as measured by the short patterns. So long as this relationship correlates, then the short
15 pattern technique for measuring drift is straight forward. In some systems, the drift in the short pattern measurements is very close to the drift in the long pattern measurements, so that any determined drift can be applied directly to adjust the operation value of the parameter.

20 **[0058]** The “adjust” block in the transmit component maintains three values in storage: TXA, TX, and TXB for the purposes of the exhaustive calibration sequence illustrated here. For drift calculation, TXAS and TXBS are also stored. The TX value is the operation value used for normal operation. The TXA and TXB are the “edge” values, which track the left and right extremes of the bit window of the transmitter. Typically, the TX value is initially derived from the average of the TXA and TXB values, but other
25 relationships are possible. The TXA and TXB values can be maintained by the calibration operations, which from time to time, and periodically in some embodiments, interrupt normal operations for exhaustive calibration sequences. However, in embodiments of the present invention, storage of TXA and TXB may not be needed to track drift.

[0059] In Fig. 9, the position of the rising edge of CLKT has an offset of t_{PHASET} relative to a fixed reference (typically a reference clock that is distributed to all components).

[0060] When the TX value is selected ($t_{PHASET(TX)}$ in the middle trace 401 showing CLKT timing waveform) for operation, the rising edge 402 of CLKT causes the DATAT window 403 containing the value “a” to be aligned so that the DATAR signal (not shown but conceptually overlapping with the DATAT signal) at the receiving component is aligned with the receiver clock, successfully received, and ideally centered on the receiver eye.

[0061] When the TXA value is selected ($t_{PHASET(TXA)}$ in the top trace 405 showing CLKT timing waveform), the rising edge of CLKT is set to a time that causes the right edges of the DATAT window 406 (containing “a”) and the receiver set/hold window 410 (shaded) to coincide. The t_S setup time and t_H hold time surround the CLKR rising edge, together define the set/hold window 410 (not to be confused with the receiver eye of Fig. 2) in which the value of DATAR must be stable for reliable sampling around a given CLKR rising edge 404. Since the DATAT window, and the resulting DATAR window, are larger than this set/hold window 410, the transmitter has timing margin. However, in the case shown on trace 405 with the transmit clock rising edge at offset $t_{PHASET(TXA)}$, all the timing margin is on the left side of the transmitter eye for the set/hold window 410, adding delay after the t_Q timing parameter. There is essentially no margin for the t_V timing parameter in the trace 405, so that the offset defines the left edge of the calibration window.

[0062] The calibration process for TXA will compare the received pattern set to the expected pattern set, and determine if they match. If they match (pass) then the TXA value will be decremented (the $t_{PHASET(TXA)}$ offset becomes smaller shifting the transmit window 406 to the left in Fig. 9) or otherwise adjusted, so there is less margin for the t_V timing parameter relative to the receiver window 410. If they do not match (fail) then the TXA value will be incremented (the $t_{PHASET(TXA)}$ offset becomes larger shifting the transmit window 406 to the right in Fig. 9) or otherwise adjusted, so there is more margin for the t_V timing parameter.

[0063] As mentioned earlier, the results of a sequence including transmission of two or more calibration patterns may be accumulated before the TXA value is adjusted. This would improve the repeatability of the calibration process. For example, the calibration pattern could be repeated “N” times with the number of passes accumulated in a storage element. If all N passes match, then the TXA value is decremented. If any of the N passes do not match, then the TXA value is determined to have reached the edge of the window and is incremented. In another alternative, after the Nth pattern, the TXA value could be incremented if there are fewer than N/2 (or some other threshold number) passes, and decremented if there are N/2 or more passes.

[0064] When TXA is updated, the TX value will also be updated. In this example, the TX value will be updated by half the amount used to update TXA, since TX is the average of the TXA and TXB values. If TX has a different relationship to TXA and TXB, the TX update value will be different. Note that in some embodiments, the TX value will need slightly greater precision than the TXA and TXB values to prevent round-off error. In alternate embodiments, the TX value can be updated after pass/fail results of TXA and TXB values have been determined. In some cases, these results may cancel and produce no change to the optimal TX value. In other cases these results may be accumulated and the accumulated results used to determine an appropriate adjustment of the TX setting. According to this embodiment, greater precision of the TX setting relative to the TXA and TXB settings may not be required.

[0065] When the TXB value is selected ($t_{\text{PHASER(TXB)}}$ in the bottom trace 407 showing a CLK_T timing waveform) for calibration, the rising edge of CLK_T is set to a time that causes the left edge of the transmitter valid window 408 (containing “a”) and the receiver set/hold window 410 (shaded) to coincide. In this case with the transmit clock rising edge at $t_{\text{PHASER(TXB)}}$, all the timing margin is on the right side of the transmit window 408, providing more room than required by the t_v timing parameter. This means that there will be essentially no margin for the t_q timing parameter on the left side of the window 408, defining the right edge of the calibration window.

[0066] The calibration process will compare the received pattern set to the expected pattern set, and determine if they match. If they match (pass) then the TXB value will be incremented (the offset becomes larger) or otherwise adjusted, so there is less margin for

the t_Q timing parameter. If they do not match (fail) then the TXB value will be decremented (the offset becomes smaller) or otherwise adjusted, so there is more margin for the t_Q timing parameter.

[0067] As mentioned earlier, the results of transmission of two or more calibration patterns may be accumulated before the TXB value is adjusted. For example, transmission of the patterns could be repeated “N” times with the number of passes accumulated in a storage element. After the Nth sequence the TXB value could be decremented if there are fewer than N/2 passes and incremented if there are N/2 or more passes. This would improve the repeatability of the calibration process.

[0068] When TXB is updated, the TX value will also be updated. In this example, the TX value will be updated by half the amount used to update TXB, since TX is the average of the TXA and TXB values. If TX has a different relationship to TXA and TXB, the TX update value will be different. Note that the TX value will need slightly greater precision than the TXA and TXB values if it is desired to prevent round-off error.

[0069] Determination of drift may be made using a similar process, although with different calibration patterns, as explained above.

Calibration Steps for Receiver for Unidirectional Link

[0070] Fig. 10 shows, for a system like the example from Fig. 4, the steps needed to perform a timing calibration update for a receiver. Note that only steps (Block 502), (Block 507), and (Block 508) are different relative to the steps in Fig. 8.

(Step 500) Execute a first calibration sequence on initialization or other event to establish an operation value “RX” for the receive sample point, based on long calibration patterns that are intended to be exhaustive.

(Step 501) Periodically, or upon an event indicating that a drift measurement is due, suspend normal transmit and receive operations that are in progress.

(Step 502) Change the sample point of the receive component from the “RX” operation value (used for normal operations) to either the “RXAS” or “RXBS” edge value (used for calibration operations) in the “adjust” block. It may be necessary to impose a settling delay at this step to allow the new sample point to become stable.

(Step 503) Change “mux” block of the transmit component so that the “pattern” block input is enabled.

(Step 504) A pattern set is created in the “pattern” block of the transmit component and is transmitted onto the “link” using the TX drive point. The pattern set includes one or more short codes, for example one or more 2-byte codes.

(Step 505) The pattern set is received in the receive component.

- 5 (Step 506) The received pattern set is compared in the “compare” block to the expected pattern set produced by the “pattern” block in the receive component. The two pattern sets will either match or not match. As a result of this comparison (and possibly other previous comparisons) a pass or fail determination will be made.

- 10 (Step 507) Adjust either the “RXAS” or “RXBS” edge value in the receive component as a result of the pass or fail determination. The drift in the “RX” operation value in the transmit component is indicated by a function of the adjusted RXAS and RXBS values. The “RX” value is also adjusted based on that function. This adjustment may only be made after two or more of these calibration sequences have been executed, in order to ensure some level of repeatability.

- 15 (Step 508) Change the sample point of the receiver from the “RXAS” or “RXBS” edge value (used for calibration operations) to “RX” operation value (used for normal operations) in the “adjust” block of the receive component. It may be necessary to impose a settling delay at this step to allow the new drive point to become stable.

- 20 (Step 509) Change “mux” block of the transmit component so that the “normal path” input is enabled.

(Step 510) Resume normal transmit and receive operations.

- [0071] The first calibration sequence in one embodiment is an iteration just like that discussed above with respect to steps 501-510, with the exception that the calibration pattern for the first cycle is a long pattern, and the calibration pattern for the second calibration sequence is a short pattern. For example, a pseudorandom bit sequence having a length $2^N - 1$, with N equal to 7 or N equal to 15, can be used as the long calibration pattern for the first calibration sequence. In another example, the long calibration pattern is a set of short patterns intended to be an exhaustive set for conditions, such as inter-symbol interference patterns, of the communication channel.
- 25
- 30 The short calibration pattern on the other hand, may be a simple two-byte code or set of two-byte codes, such as AAAA, 5555 or 0F0F.

Timing for Iteration Step for Receive

[0072] Fig. 11 shows the exhaustive calibration steps to determine an operation value, similar to the calibration sequence shown in Fig. 8 for determining drift of the operation value, in a system like that of Fig. 4. These timing waveforms are similar to those from Fig. 1, except that the sampling point is adjusted within the bit window in order to track the edges of the window. During a drift calibration sequence, the edge values of Fig. 11, ($t_{PHASET(RXA)}$ and $t_{PHASER(RXB)}$) are replaced by correlated values determined using the short calibration sequences.

[0073] The “adjust” block in the receive component maintains three values in storage: RXA, RX, and RXB for the purpose of the exhaustive calibration sequence. The RX value is the operation value used for normal operation. The RXA and RXB are the “edge” values, which track the left and right extremes of the bit window. The RX value is derived from the first exhaustive calibration sequence, and based on the average of the RXA and RXB values determined in the first calibration sequence, but other relationships are possible. The RXAS and RXBS values are determined in the second calibration sequence using the short calibration patterns, and maintained by the calibration operations which periodically interrupt normal operations. Changes in the RXAS and RXBS values, or in only one of them, are used to determine a drift in the RX values. The RX value is updated based on that drift.

[0074] In the timing diagrams, the position of the rising edge of CLKR has an offset of t_{PHASER} relative to a fixed reference (not shown, typically a reference clock that is distributed to all components). This offset is determined by the RXA, RX, and RXB values that are stored.

[0075] When the RX value is selected ($t_{PHASER(RX)}$ in the middle trace 601 showing a CLKR timing waveform) for use in receiving data, the rising edge 602 of CLKR is approximately centered in the receiver eye of the DATAR signal containing the value “a”. The DATAR signal is the DATAT signal transmitted at the transmitter after propagation across the link, and can be conceptually considered to be the same width as DATAT as shown in Fig. 11. The receiver eye is shown in Fig. 2. The t_s setup time is the minimum time before the clock CLKR rising edge which must be within the DATAR window 603, and the t_H hold time is the minimum time after the clock CLKR rising edge

that must be within the DATAR window 603, together defining the set/hold window 604 (not to be confused with the receiver eye of Fig. 2) in which the value of DATAR must be stable for reliable sampling around a given CLKR rising edge. Since the valid window 604 of the DATAR signal is larger than this set/hold window 604, the receiver has timing margin in both directions.

[0076] When the RXA value is selected ($t_{\text{PHASER(RXA)}}$ in the top trace 605 showing a CLKR timing waveform), the rising edge of CLKR is approximately a time t_s later than the left edge (the earliest time) of the DATAR window 603 containing the value “a”. In this case, the CLKR rising edge is on the left edge of the receiver eye, and all the timing margin is on the right side of the set/hold window 604, providing more room than is required by the t_H timing parameter. This means that there will be essentially no margin for the t_s timing parameter, defining the left edge of the calibration window.

[0077] The calibration process will compare the received pattern set to the expected pattern set, and determine if they match. If they match (pass) then the RXA value will be decremented (the offset becomes smaller) or otherwise adjusted, so there is less margin for the t_s timing parameter. If they do not match (fail) then the RXA value will be incremented (the offset becomes larger) or otherwise adjusted, so there is more margin for the t_s timing parameter.

[0078] As mentioned earlier, the results of transmission and reception of two or more calibration patterns may be accumulated before the RXA value is adjusted. For example, the patterns could be repeated “N” times with the number of passes accumulated in a storage element. After the Nth sequence the RXA value could be incremented if there are fewer than $N/2$ passes and decremented if there are $N/2$ or more passes. This would improve the repeatability of the calibration process.

[0079] When RXA is updated, the RX value will also be updated. In this example, the RX value will be updated by half the amount used to update RXA, since RX is the average of the RXA and RXB values. If RX has a different relationship to RXA and RXB, the RX update value will be different. Note that in some embodiments, the RX value will need slightly greater precision than the RXA and RXB values to prevent round-off error. In alternate embodiments, the RX value can be updated after pass/fail results of RXA and RXB values have been determined. In some cases, these results may

cancel and produce no change to the optimal RX value. In other cases these results may be accumulated and the accumulated results used to determine an appropriate adjustment of the RX setting. According to this embodiment, greater precision of the RX setting relative to the RXA and RXB settings may not be required.

5 **[0080]** When the RXB value is selected ($t_{\text{PHASER}(\text{RXB})}$ in the bottom trace 606 showing a CLKR timing waveform), the rising edge of CLKR is approximately a time t_H earlier than the right edge (the latest time) of the DATAR window 603 containing the value “a”. In this case, the CLKR rising edge is on the right edge of the receiver eye, and all the timing margin is on the left side of the window 604, providing more room that required
10 by the t_S timing parameter. This means that there will be essentially no margin for the t_H timing parameter, defining the right edge of the calibration window.

[0081] The calibration process will compare the received pattern set to the expected pattern set, and determine if they match. If they match (pass) then the RXB value will be incremented (the offset becomes larger) or otherwise adjusted, so there is less margin for
15 the t_H timing parameter. If they do not match (fail) then the RXB value will be decremented (the offset becomes smaller) or otherwise adjusted, so there is more margin for the t_H timing parameter.

[0082] As mentioned earlier, the results of transmission and reception of two or more calibration patterns may be accumulated before the RXB value is adjusted. For example,
20 the sequence could be repeated “N” times with the number of passes accumulated in a storage element. After the Nth sequence the RXB value could be decremented if there are fewer than $N/2$ passes and incremented if there are $N/2$ or more passes. This would improve the repeatability of the calibration process.

[0083] When RXB is updated, the RX value will also be updated. In this example,
25 the RX value will updated by half the amount used to update RXB, since RX is the average of the RXA and RXB values. If RX has a different relationship to RXA and RXB, the RX update value will be different. Note that the RX value will need slightly greater precision than the RXA and RXB values if it is desired to prevent round-off error.

[0084] Determination of drift may be made using a similar process, although with
30 different calibration patterns, as explained above.

Bidirectional Link Alternatives

[0085] Fig. 12 shows an example of a bidirectional link. In this case, component A (700) and component B (701) each contain a transmitter and receiver connected to the link, so that information may be sent either from A to B or from B to A. The elements of the unidirectional example in Fig. 3 are replicated (two copies) to give the bidirectional example in Fig. 11. Fig. 11 shows two bidirectional components 700, 701 connected with an interconnection medium referred to as Link 702. Normal path 710 acts as a source of data signals for normal operation of component 700 during transmit operations. Normal path 731 acts as a destination of data signals for component 700 during normal receive operations. Likewise, normal path 730 acts as a source of data signals for normal operation of component 701 during transmit operations. Normal path 711 acts as a destination of data signals for component 701 during normal receive operations.

[0086] The first bidirectional component includes a block 705 labeled “pattern”, which can consist of pattern storage, pattern generation circuitry, or both, and which is used as a source of transmit calibration patterns for both the exhaustive calibration sequences and the calibration sequences used to measure drift. A multiplexer block 706 labeled “mux,” implemented for example using a logical layer or physical layer switch, enables the transmit calibration pattern set to be driven onto the link by the transmitter circuit 703. The transmitter drive point can be adjusted by the block 707 labeled “adjust”. A sideband communication channel 713 is shown coupled between the component 701 and the component 700, by which the results of analysis of received calibration patterns at the component 701 are supplied to the adjust block 707 of the component 700. Component 700 also has support for calibrating receiver 724, including a block 728 labeled “pattern”, which can consist of pattern storage, pattern generation circuitry, or both, and which is used as a source of expected patterns for comparison with received patterns. A block 729 labeled “compare” enables the received pattern set to be compared to the expected pattern set, and causes an adjustment to be made to either the transmitter or receiver. The receiver sample point can be adjusted by the block 732 labeled “adjust”.

[0087] The second bidirectional component 701 includes complementary elements supporting transmitter 723 and receiver 704. For the receiver operations, a block 708

labeled “pattern”, which can consist of pattern storage, pattern generation circuitry, or both, is used as a source of expected patterns. A block 709 labeled “compare” enables the received pattern set to be compared to the expected pattern set, and causes an adjustment to be made to either the transmitter or receiver. The receiver sample point can be adjusted by the block 712 labeled “adjust”. The second bidirectional component 701 supports transmission operations, with elements including a block 725 labeled “pattern”, which can consist of pattern storage or pattern generation circuitry, and which is used as a source of transmit calibration patterns. A multiplexer block 726 labeled “mux,” implemented for example using a logical layer or physical layer switch, enables the transmit calibration pattern set to be driven onto the link by the transmitter circuit 723. The transmitter drive point can be adjusted by the block 727 labeled “adjust”. A sideband communication channel 733 is shown coupled between the component 700 and the component 701, by which the results of analysis of received calibration patterns at the component 700 are supplied to the adjust block 727 of the component 701.

[0088] Fig. 12 allows both receive sample points and both transmit drive points to be adjusted. However, the benefit of adjustable timing will be realized if there is only one adjustable element in each direction.

[0089] The example of Fig. 13 (using the same reference numerals as Fig. 12) shows an example in which only the receiver sample points are adjustable. Thus, elements 707 and 727 of Fig. 12 are not included in this embodiment. This is equivalent to two copies of the elements of example in Fig. 4.

[0090] The example of Fig. 14 (using the same reference numerals as Fig. 12) shows an example in which only the transmitter drive points are adjustable. Thus, elements 712 and 732 of Fig. 12 are not included in this embodiment. This is equivalent to two copies of the elements of example in Fig. 5.

[0091] Example of Fig. 15 (using the same reference numerals as Fig. 12) shows an example in which the receiver sample point and transmitter drive point of the first bidirectional component 700 are adjustable. Thus, elements 712, 708, 709, 727, 726, 725 are not included in this embodiment. A storage block 750 is added between the receiver and a “mux” block 751. The “mux” block 751 is used to select between a normal source of signals 730 and the storage block 750. Also, the compare block 752 is used for

analysis of both transmit and receive calibration operations, and is coupled to both the adjust block 707 for the transmitter, and adjust block 732 for the receiver. This alternative is important because all the adjustment information can be kept within one component, eliminating the need for sideband signals for the calibration process. If
5 component 701 were particularly cost sensitive, this could also be a benefit, since only one of the components must bear the cost of the adjustment circuitry.

Calibration Steps for Transmitter for Bidirectional Link

[0092] The calibration steps for bidirectional examples in Figs. 12, 13 and 14 will be essentially identical to the calibration steps already discussed for unidirectional examples
10 in Figs. 4 and 5. However, the asymmetry in bidirectional example of Fig. 15 will introduce some additional calibration steps, and will receive further discussion.

[0093] Fig. 16 includes the steps needed to perform a timing calibration update for a system like that of Fig. 15.

(Step 800) Execute a first calibration sequence on initialization or other event to establish
15 an operation value “TX” for the transmit drive point, based on long calibration patterns that are intended to be exhaustive, or to provide results usable in the intended conditions for the system.

(Step 801) Periodically, or upon an event indicating that a drift measurement is due, suspend normal transmit and receive operations that are in progress.

20 (Step 802) Change the drive point of the transmit component (A) from the “TX” operation value (used for normal operations) to either the “TXAS” or “TXBS” edge value (used for calibration operations) in the “adjust” block. It may be necessary to impose a settling delay at this step to allow the new drive point to become stable.

(Step 803) Change “mux” block of the transmit component (A) so that the “pattern”
25 block input is enabled.

(Step 804) A pattern set is created in the “pattern” block of the transmit component (A) and is transmitted onto the “link” using the TXAS or TXBS drive point.

(Step 805) The pattern set is received in the receive component (B). Note that the sample point of the receiver is fixed relative to the reference clock of the system and is not
30 adjustable. The received pattern set is held in the “storage” block in component B.

(Step 806) The “mux” block input connected to the “storage” block in component B is

enabled. The pattern set is re-transmitted onto the link by component B.

(Step 807) The pattern set is received by component B from the link.

(Step 808) The received pattern set is compared in the “compare” block to the expected pattern set produced by the “pattern” block in the receive component (A). The two

5 pattern sets will either match or not match. As a result of this comparison (and possibly other previous comparisons) a pass or fail determination will be made.

(Step 809) Adjust either the “TXAS” or “TXBS” edge value in the transmit component (A) as a result of the pass or fail determination to determine a drift value. The “TX” operation value in the transmit component (A) is also adjusted as a result of the

10 determined drift value. This adjustment may only be made after two or more of these calibration sequences have been executed, in order to ensure some level of repeatability.

(Step 810) Change the drive point of the transmitter from the “TXAS” or “TXBS” edge value (used for calibration operations) to “TX” operation value (used for normal operations) in the “adjust” block of the transmit component (A). It may be necessary to

15 impose a settling delay at this step to allow the new drive point to become stable.

(Step 811) Change “mux” block of the transmit component (A) so that the “normal path” input is enabled.

(Step 812) Resume normal transmit and receive operations.

Calibration Steps for Receiver for Bidirectional Link

20 **[0094]** The calibration steps for the bidirectional examples of Figs. 12, 13, and 14 will be essentially identical to the calibration steps already discussed for the unidirectional examples of Figs. 4 and 5. However, the asymmetry in bidirectional example of Fig. 15 will introduce some additional calibration steps, and will receive further discussion.

25 **[0095]** Fig. 17 includes the steps needed to perform a receiver timing calibration update for a system like that of Fig. 15.

(Step 900) Execute a first calibration sequence on initialization or other event to establish an operation value “RX” for the receive sample point, based on long calibration patterns.

(Step 901) Periodically, or upon an event indicating that a drift measurement is due,
30 suspend normal transmit and receive operations that are in progress.

(Step 902) Change the sample point of the receive component (A) from the “RX”

operation value (used for normal operations) to either the “RXAS” or “RXBS” edge value (used for calibration operations) in the “adjust” block. It may be necessary to impose a settling delay at this step to allow the new drive point to become stable.

(Step 903) Change “mux” block of the transmit component (A) so that the “pattern” block input is enabled.

(Step 904) A pattern set is created in the “pattern” block of the transmit component (A) and is transmitted onto the “link”. The normal transmit drive point is used.

(Step 905) The pattern set is received in the receive component (B). Note that the sample point of the receiver in component (B) is fixed relative to the reference clock of the system and is not adjustable. The received pattern set is held in the “storage” block in component B.

(Step 906) The “mux” block input connected to the “storage” block in component B is enabled. The pattern set is re-transmitted onto the link by component B.

(Step 907) The pattern set is received by component A from the link using either the RXAS or RXBS value to determine the receiver sample point.

(Step 908) The received pattern set is compared in the “compare” block to the expected pattern set produced by the “pattern” block in the receive component (A). The two pattern sets will either match or not match. As a result of this comparison (and possibly other previous comparisons) a pass or fail determination will be made.

(Step 909) Adjust either the “RXAS” or “RXBS” edge value in the receive component (A) as a result of the pass or fail determination to determine a drift value. The “RX” operation value in the receive component (A) is also adjusted based on this drift value. This adjustment may only be made after two or more of these calibration sequences have been executed, in order to ensure some level of repeatability.

(Step 910) Change the sample point of the receiver from the “RXAS” or “RXBS” edge value (used for calibration operations) to “RX” operation value (used for normal operations) in the “adjust” block of the receive component (A). It may be necessary to impose a settling delay at this step to allow the new drive point to become stable.

(Step 911) Change “mux” block of the transmit component (A) so that the “normal path” input is enabled.

(Step 912) Resume normal transmit and receive operations.

[0096] Fig. 18 illustrates an example like that of Fig. 15, with the exception that the point to point bidirectional link of Fig. 15 is replaced with a multidrop link, coupling component 1000 to a plurality of components 1051, 1052. The multidrop link configuration can be applied in other configurations. In the representative example shown in Fig. 18, a first bidirectional component 1000 and a plurality of other bidirectional components 1051, 1052 are connected in a point to multi-point configuration, or multipoint to multipoint configuration, with an interconnection medium referred to as Link 1002. Normal path 1010 acts as a source of data signals for normal operation of component 1000 during transmit operations. Normal path 1031 acts as a destination of data signals for component 1000, during normal receive operations. The calibration operations are interleaved, and re-ordered, in this embodiment with normal communications, as described above to improve throughput and utilization of the communication medium.

[0097] The first bidirectional component 1000 includes a block 1005 labeled “pattern”, which can consist of pattern storage or pattern generation circuitry, and which is used as a source of transmit calibration patterns. A multiplexer block 1006 labeled “mux,” implemented for example using a logical layer or physical layer switch, enables the transmit calibration pattern set to be driven onto the link by the transmitter circuit 1003. The transmitter drive point can be adjusted by the block 1007 labeled “adjust”. In this embodiment, the adjust block 1007 includes storage for multiple parameter sets which are applied depending on the one of the other components 1051, 1052, ... on the link to which the transmission is being sent. Component 1000 also has support for calibrating receiver 1024, including a block 1028 labeled “pattern”, which can consist of pattern storage or pattern generation circuitry, and which is used as a source of expected patterns for comparison with received patterns. A block 1029 labeled “compare” enables the received pattern set to be compared to the expected pattern set, and causes an adjustment to be made to either the transmitter or receiver. The receiver sample point can be adjusted by the block 1032 labeled “adjust”. In this embodiment, the adjust block 1007 includes storage for multiple parameter sets which are applied depending on the one of the other components 1051, 1052, ... on the link from which the communication is being received. In the first component 1000, the compare block 1029 is used for analysis

of both transmit and receive calibration operations, and is coupled to both the adjust block 1007 for the transmitter, and adjust block 1032 for the receiver. In the example of Fig. 18, the receiver sample point and transmitter drive point of the first bidirectional component 1000 are adjustable. The other components 1051, 1052, ... are implemented as described with reference to Fig. 15 without adjustment resources, in this example, and not described here. In alternative embodiments, the components 1051, 1052, ... on the link may be provided with adjustment and calibration resources, as described for other embodiments above.

[0098] The embodiments described above involve calibration of timing parameters. Other embodiments of the invention are applied to calibration of other parameters of the communication channel, including voltage levels for drivers and comparators, resistance values such as link termination resistances, driver strength, adaptive equalization coefficients, noise cancellation coefficients, parameters that cause overshoot and undershoot of signals such as driver switching power or speed, and so on. These parameters are reflected in drifting flight times, output delays for transmitters, receiver mismatches and input delays. Also, drift occurs due to spread spectrum clocking.

[0099] The calibration sequences used for tracking drift are executed from time to time. In some embodiments of the invention, the calibration sequences for tracking drift are initiated in response to a timer, or upon sensing a change in a condition that could cause drift such as ambient temperature, temperature of a component or printed circuit board, power supply voltage variations, system state changes like switches between low and higher speed or power modes of operation, host system or system management commands, and so on. The timing for the calibration sequences is selected in preferred systems depending on time constants expected for the drifting conditions likely to have an effect on the parameters being calibrated.

[00100] According to the present invention, communication systems are provided that support periodic calibration to track drift, while conserving resources of the communication channels being calibrated. The invention reduces the hardware and storage requirements needed for calibration, reduces the impact on bandwidth and throughput across the communication channel, and maintains accuracy of the operation values of the parameters being calibrated while using less of the resources of the

communication channel. The calibration sequences tracking drift can be run more often, because overhead is smaller, than prior art schemes. Also, the techniques of the present invention improve overall latency characteristics of the communication channel in changing operating conditions.

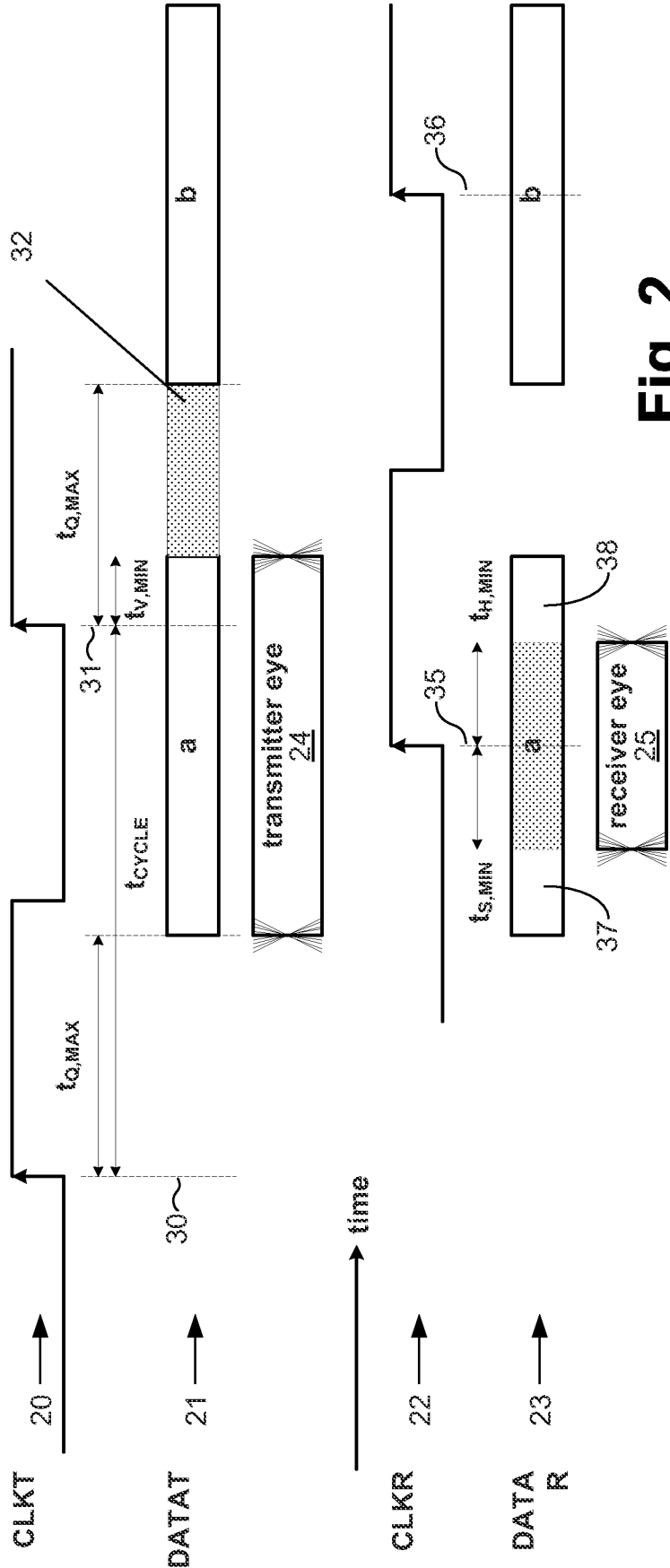
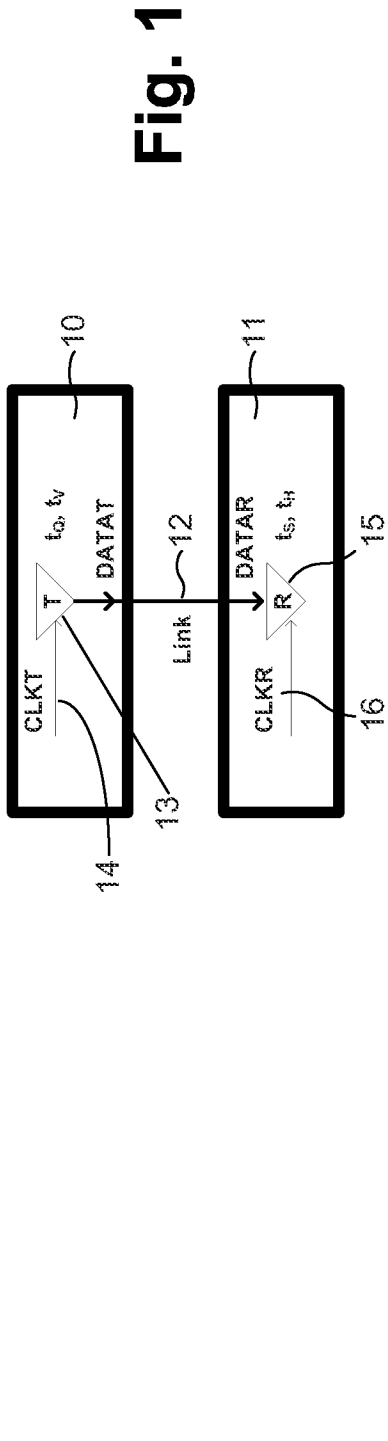
- 5 **[00101]** While the present invention is disclosed by reference to the preferred embodiments and examples detailed above, it is to be understood that these examples are intended in an illustrative rather than in a limiting sense. It is contemplated that modifications and combinations will readily occur to those skilled in the art, which modifications and combinations will be within the spirit of the invention and the scope of
- 10 the following claims. What is claimed is:

CLAIMS

- 1 1. An integrated circuit device adapted for use in a mesochronous memory system in
2 which two components communicate data and in which channel timing is periodically
3 calibrated, the integrated circuit device comprising:
4 means for performing a first calibration operation associated with communication
5 across the channel to identify a data eye timing point;
6 means for periodically performing drift tracking using a second calibration
7 operation in which drift tracking uses an expected timing point location and identifies
8 drift associated expected timing point location; and
9 means for, in response to drift tracking, updating the data eye timing point.
- 1 2. An integrated circuit device, comprising:
2 transmitter circuitry adapted to perform
3 a first calibration operation associated with communication across a
4 channel to identify a data eye timing point, and
5 a second calibration operation to perform drift tracking using an expected
6 timing point location, the second calibration operation identifying drift
7 associated expected timing point location; and
8 adjustment circuitry to update, in response to drift tracking, the data eye timing
9 point.

ABSTRACT

A method and system that provides for execution of a first calibration sequence, such as upon initialization of a system, to establish an operation value, which utilizes an algorithm intended to be exhaustive, and executing a second calibration sequence from
5 time to time, to measure drift in the parameter, and to update the operation value in response to the measured drift. The second calibration sequence utilizes less resources of the communication channel than does the first calibration sequence. In one embodiment, the first calibration sequence for measurement and convergence on the operation value utilizes long calibration patterns, such as codes that are greater than 30 bytes, or
10 pseudorandom bit sequences having lengths of $2^N - 1$ bits, where N is equal to or greater than 7, while the second calibration sequence utilizes short calibration patterns, such as fixed codes less than 16 bytes, and for example as short as 2 bytes long.



2 / 13

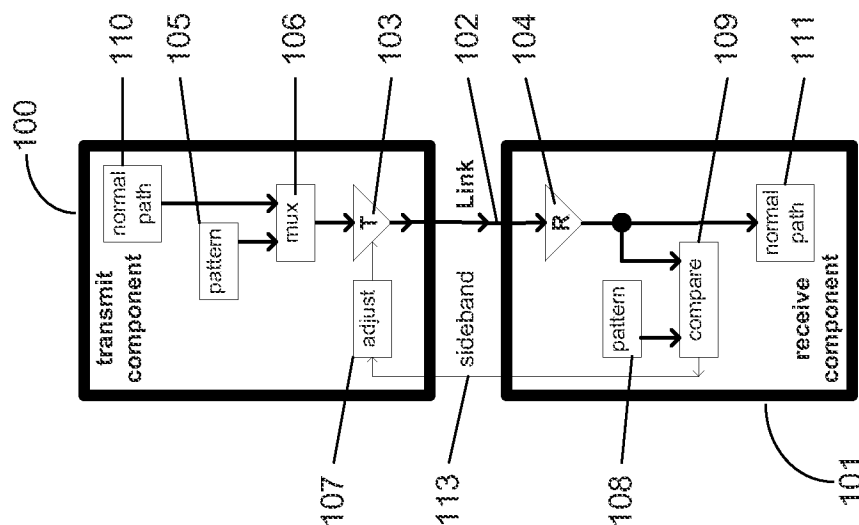


Fig. 5

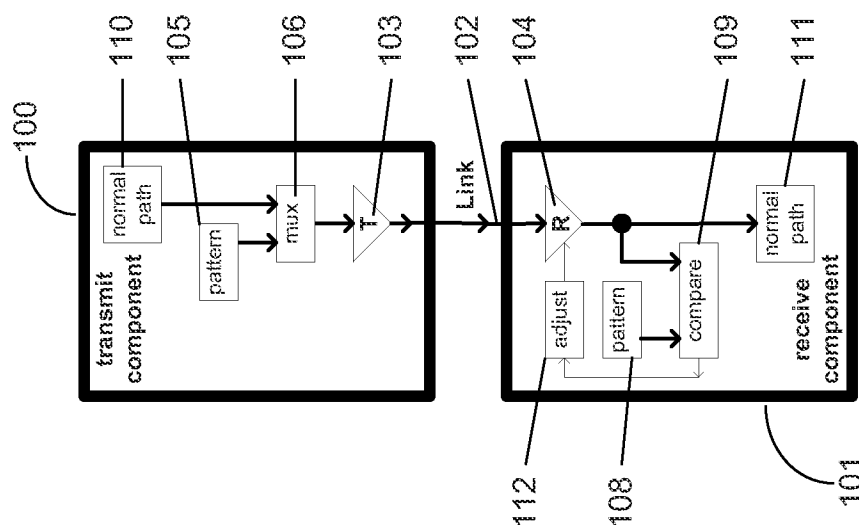


Fig. 4

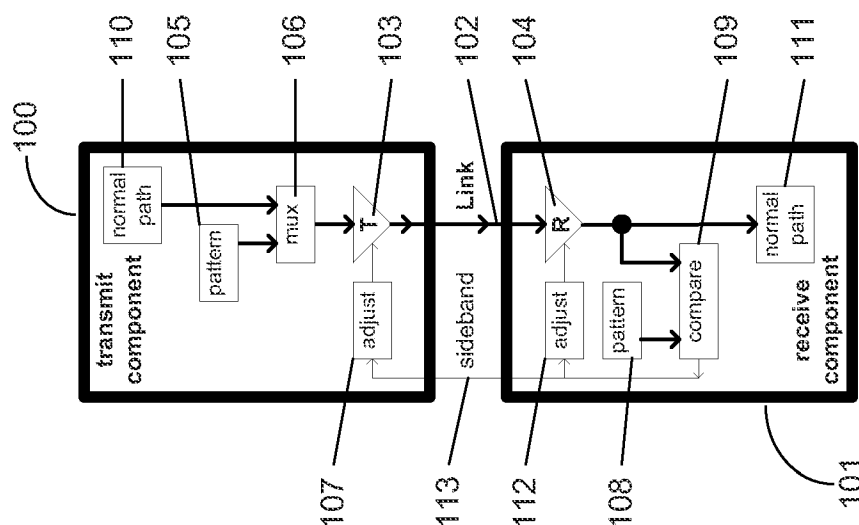


Fig. 3

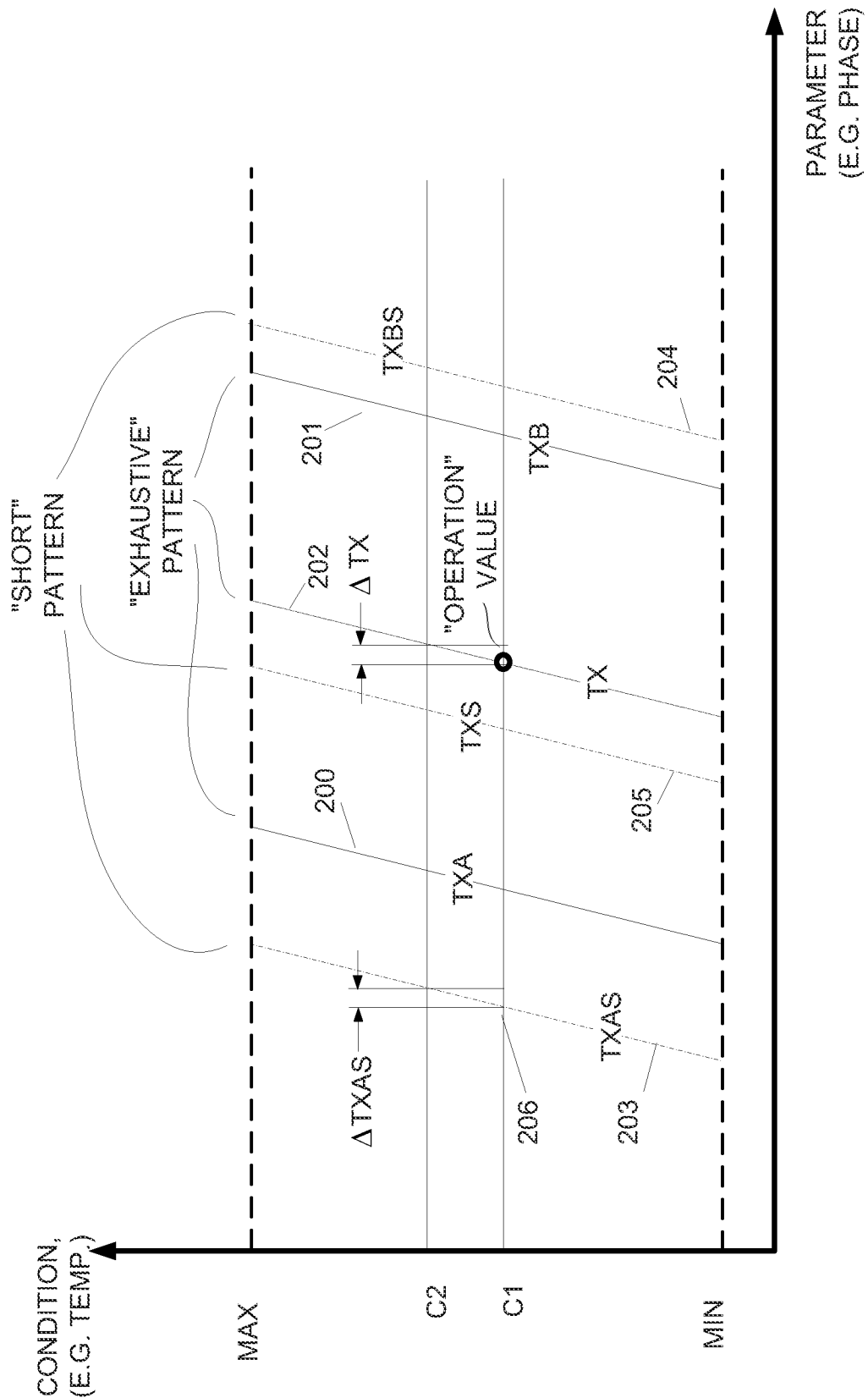
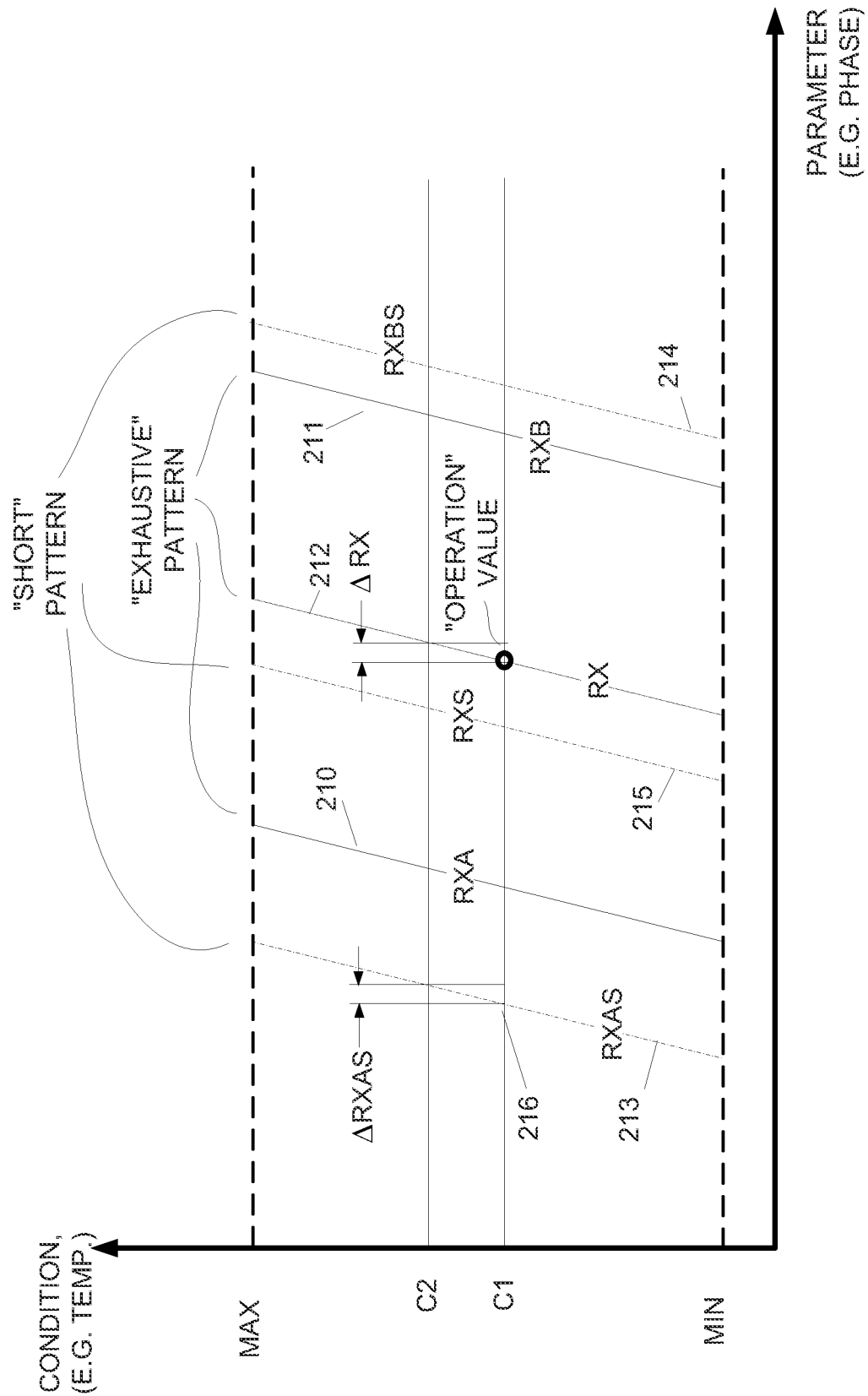


Fig. 6



5 / 13

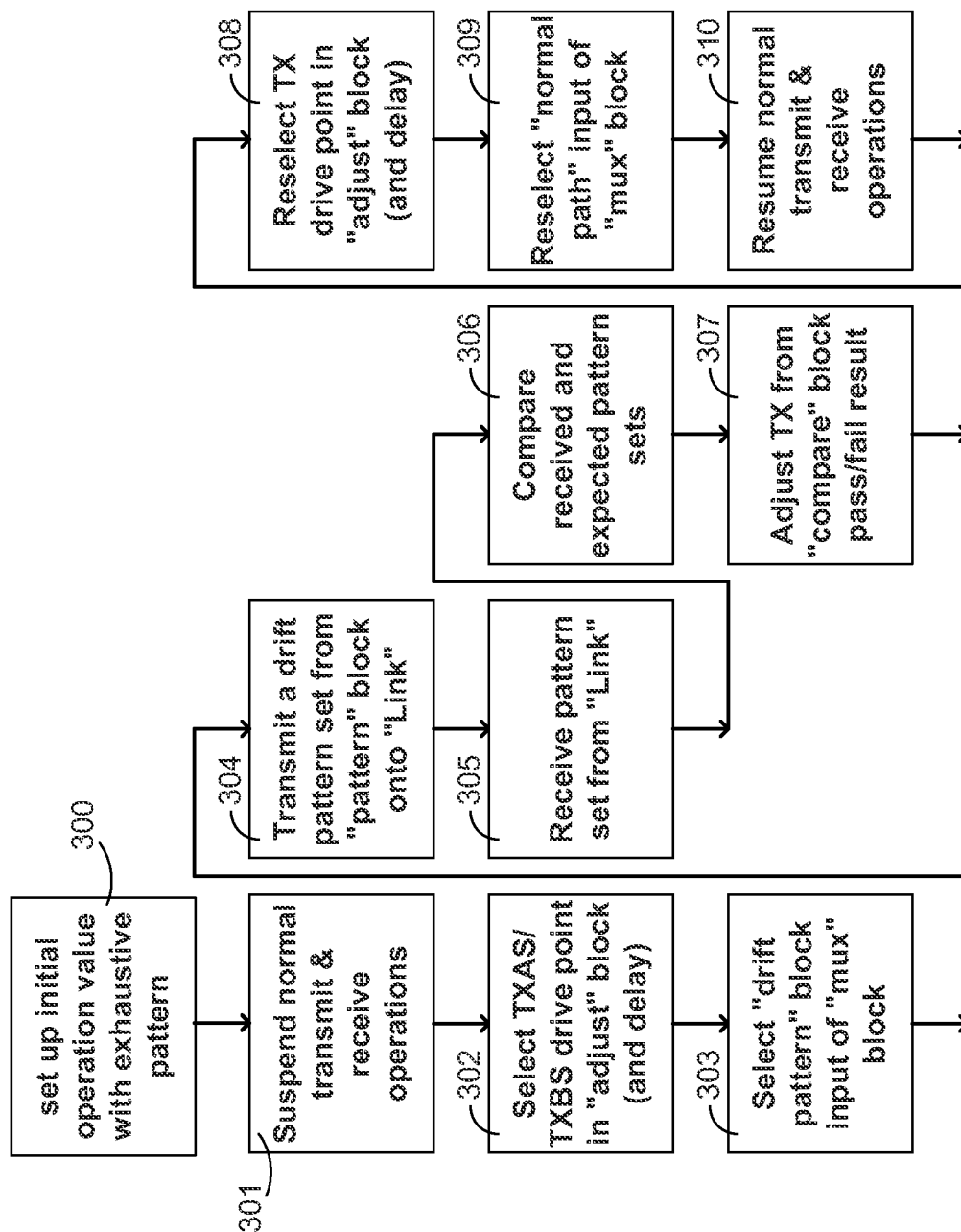


Fig. 8

6 / 13

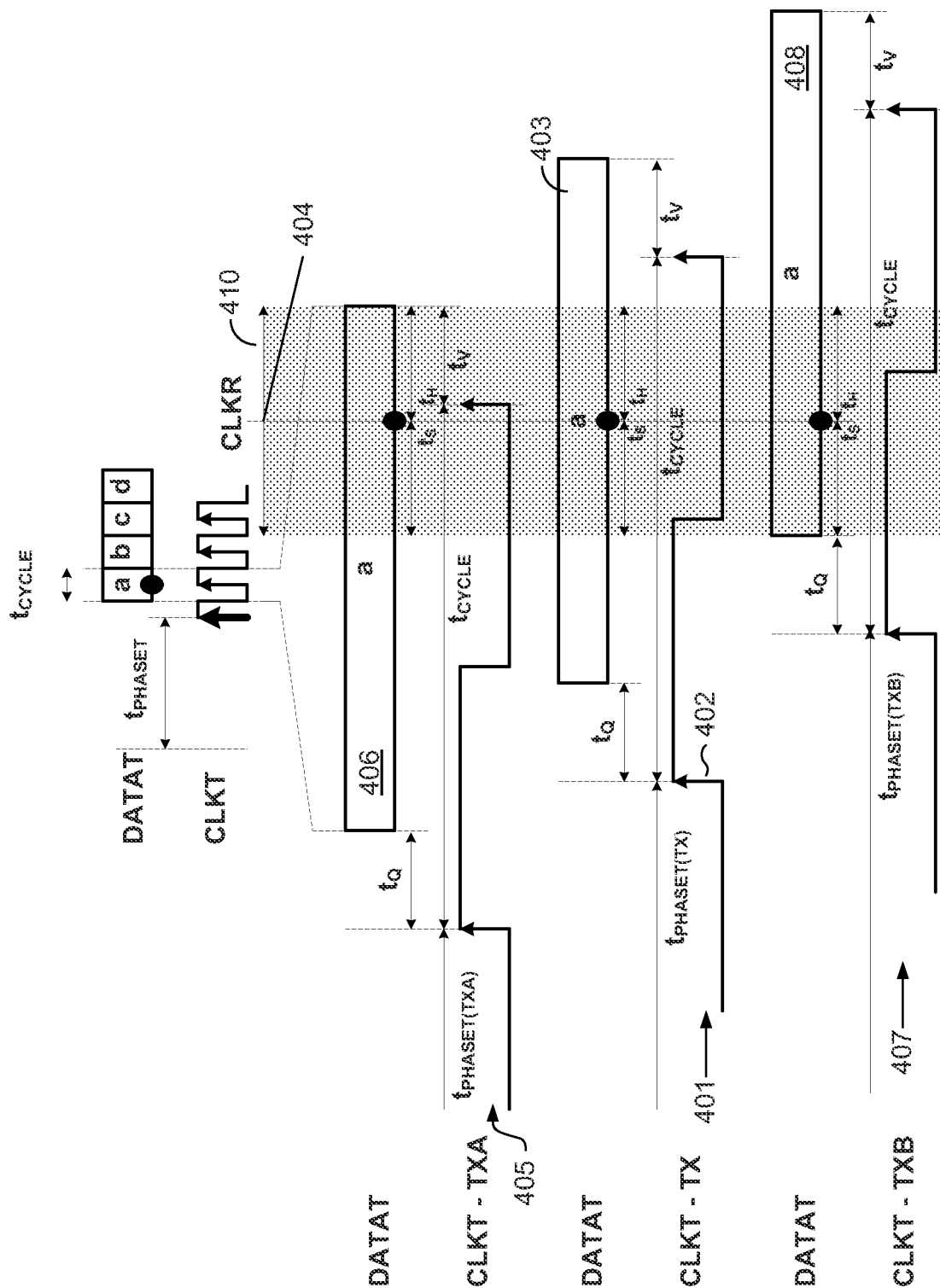


Fig. 9

7 / 13

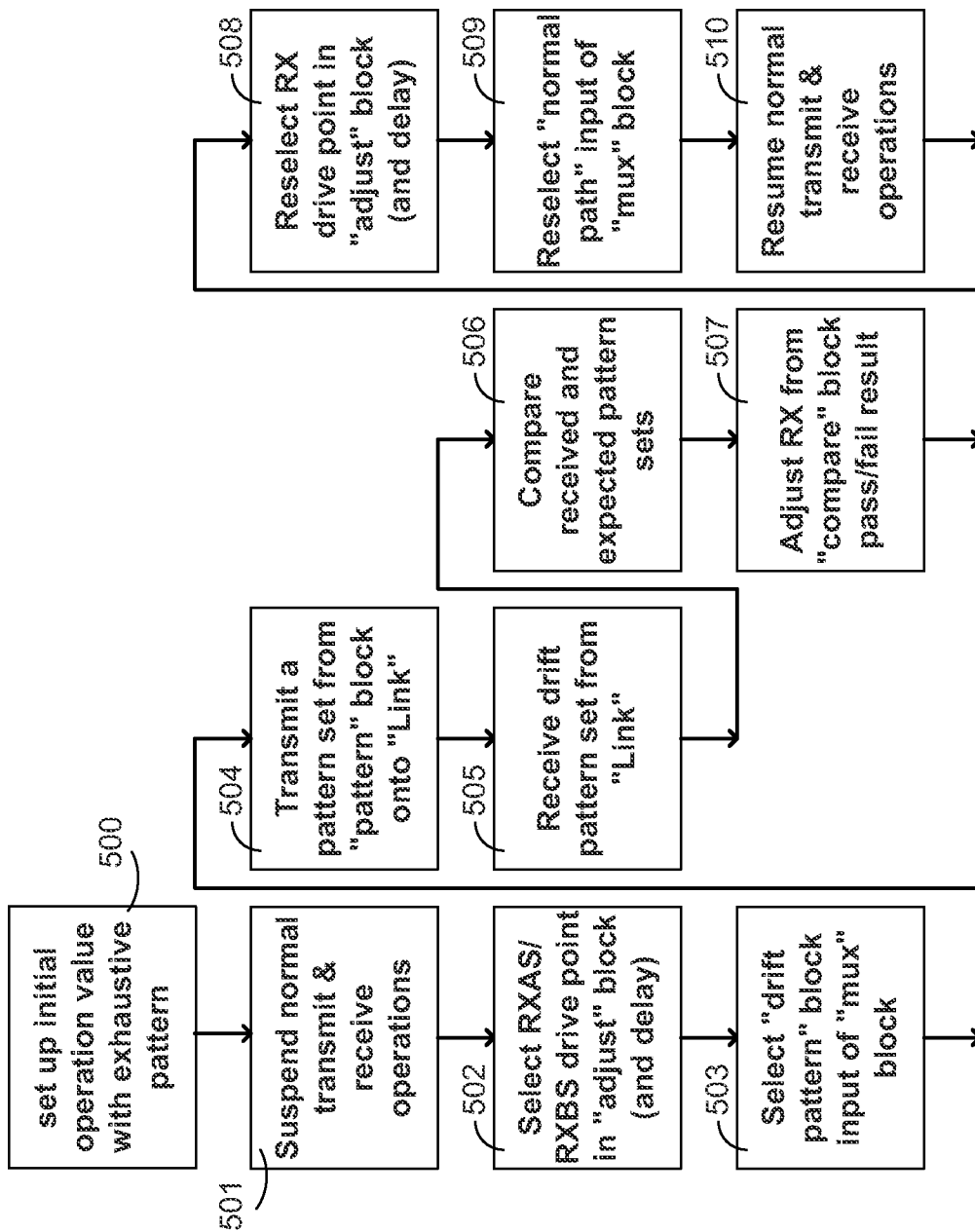


Fig. 10

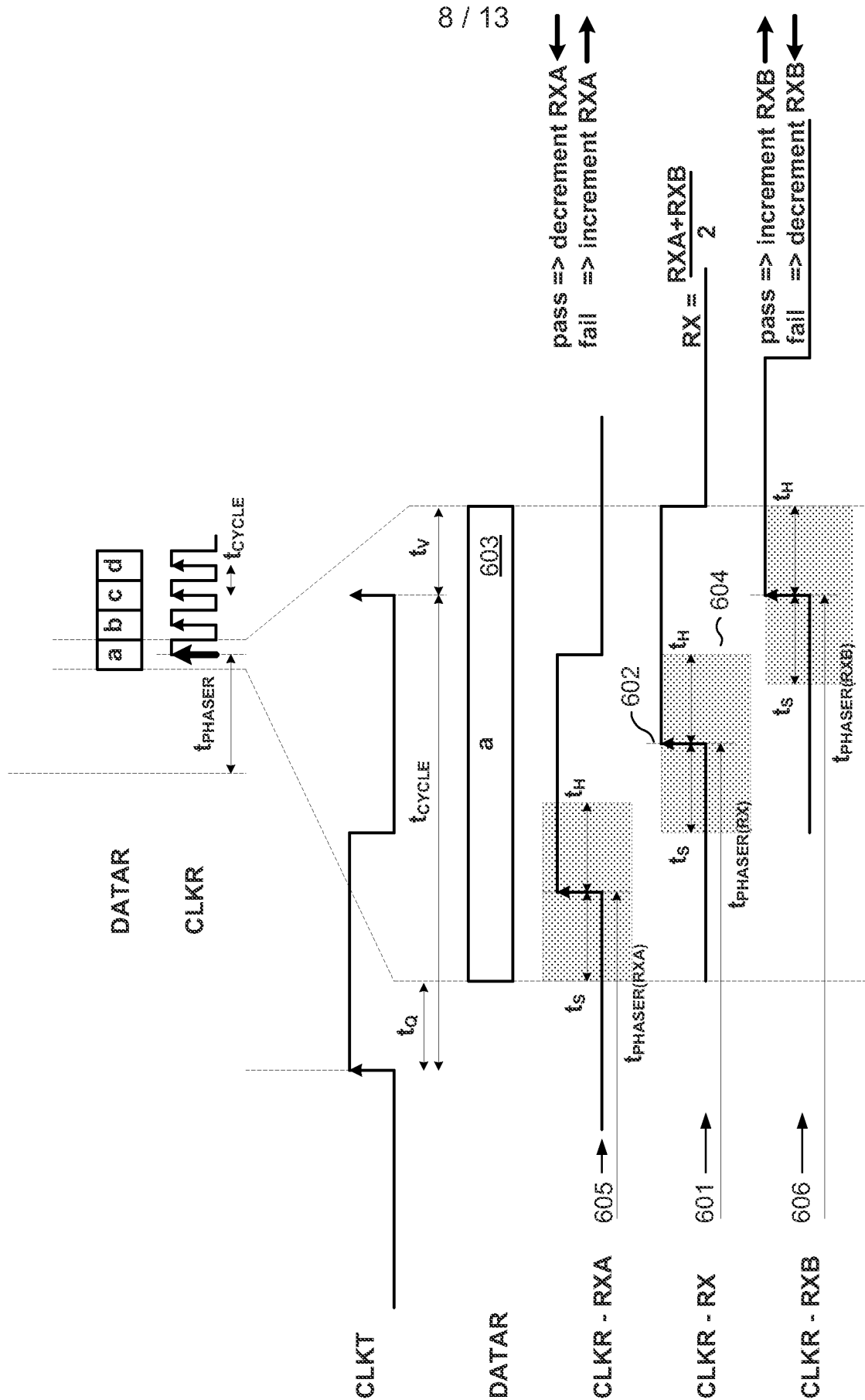


Fig. 11

9 / 13

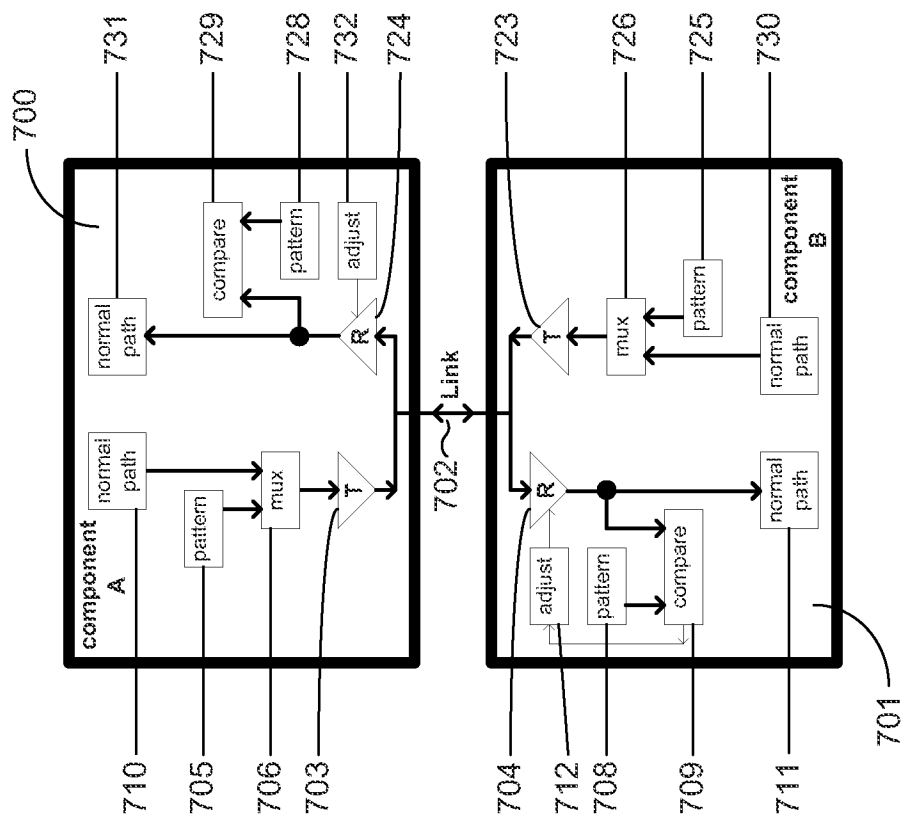


Fig. 13

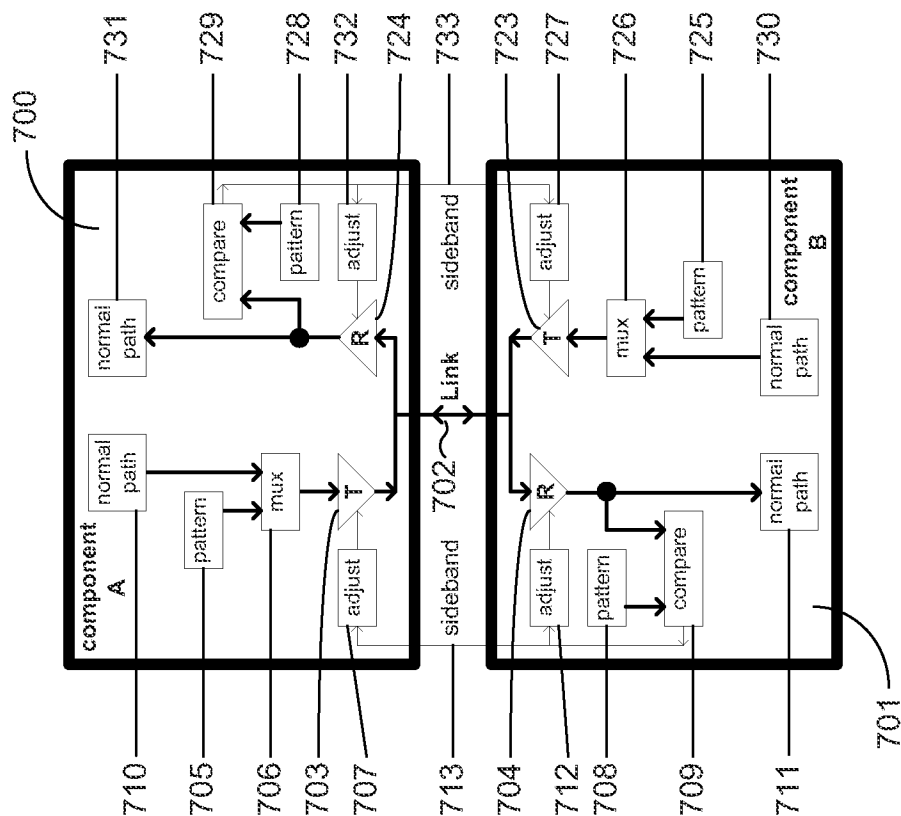


Fig. 12

10 / 13

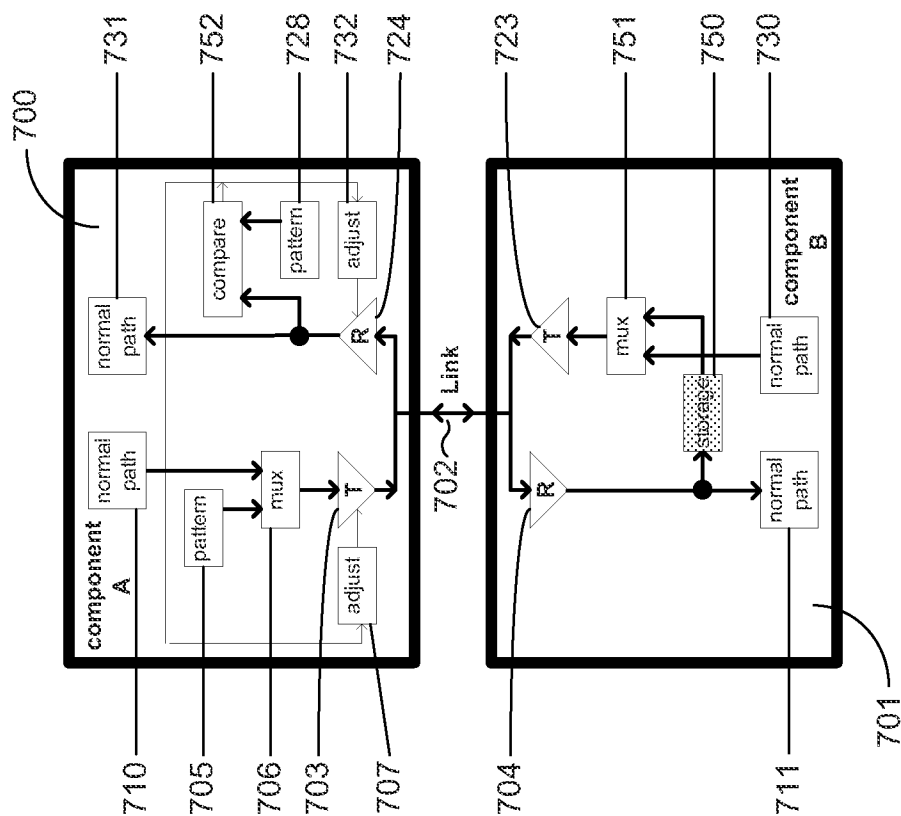


Fig. 15

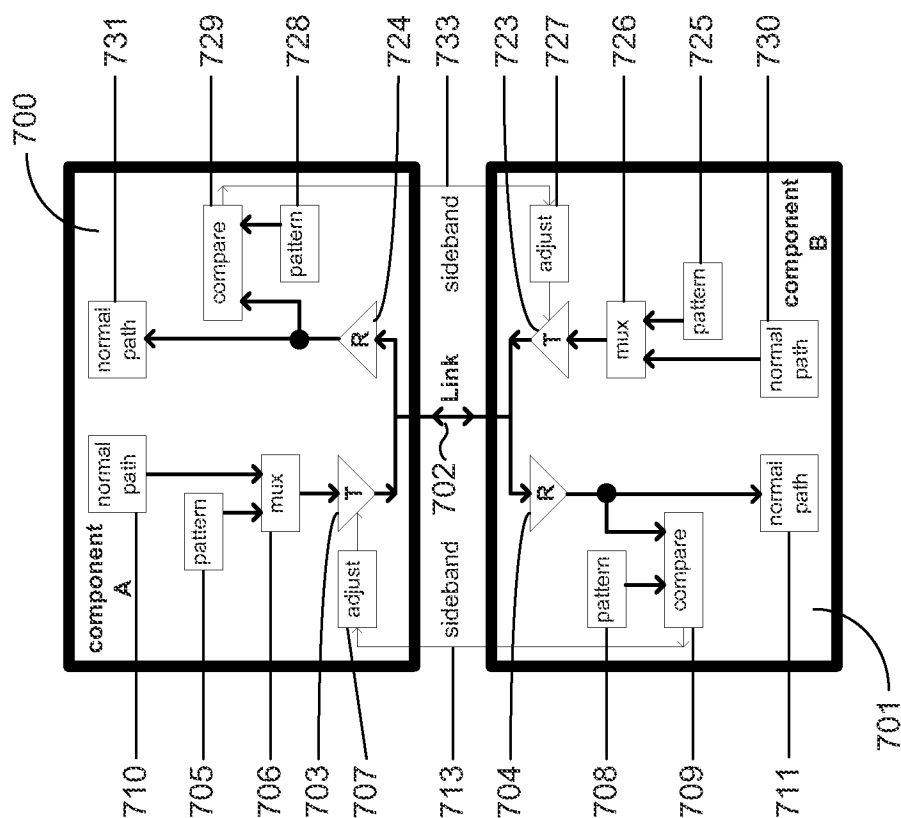


Fig. 14

11 / 13

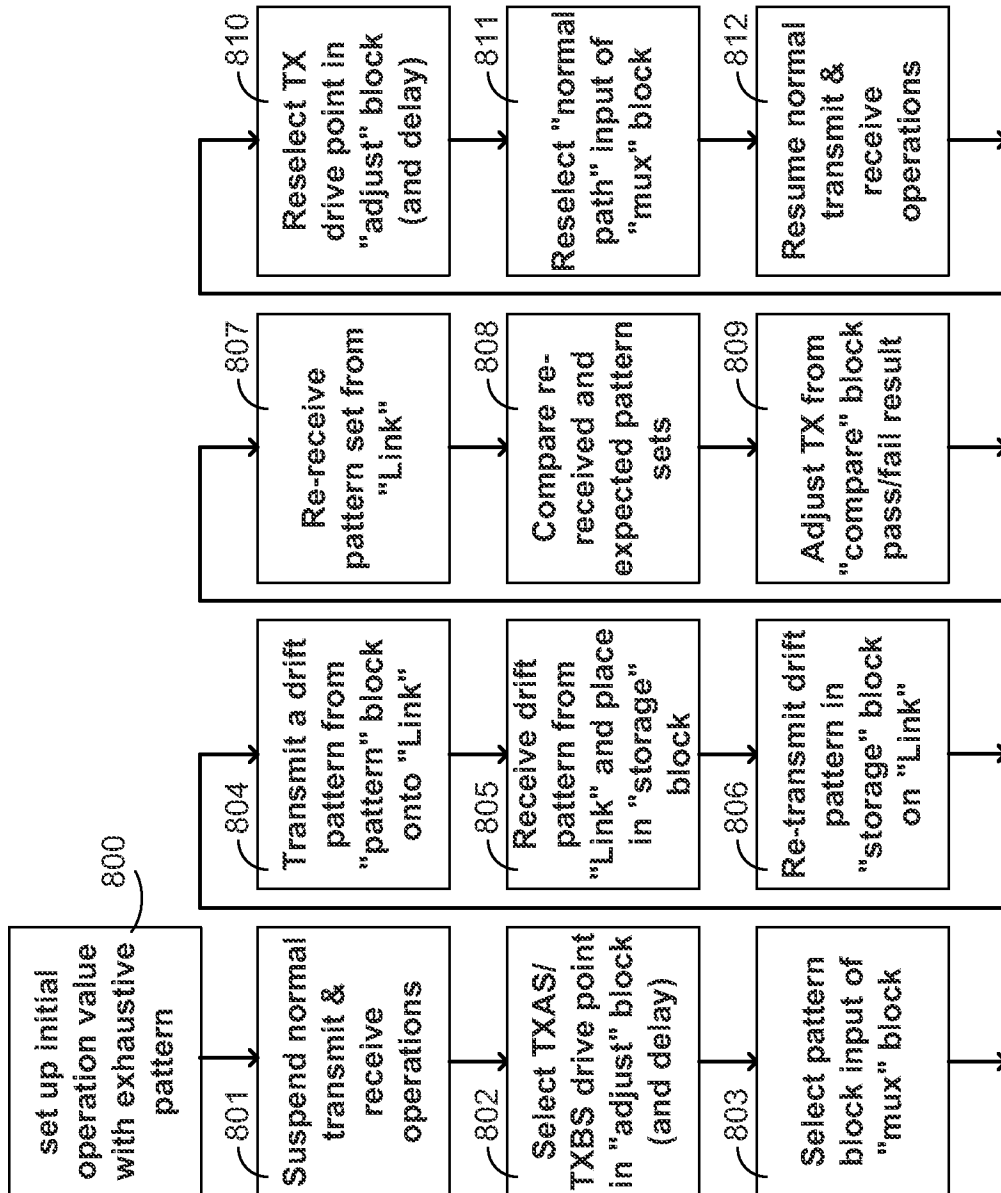


Fig. 16

12 / 13

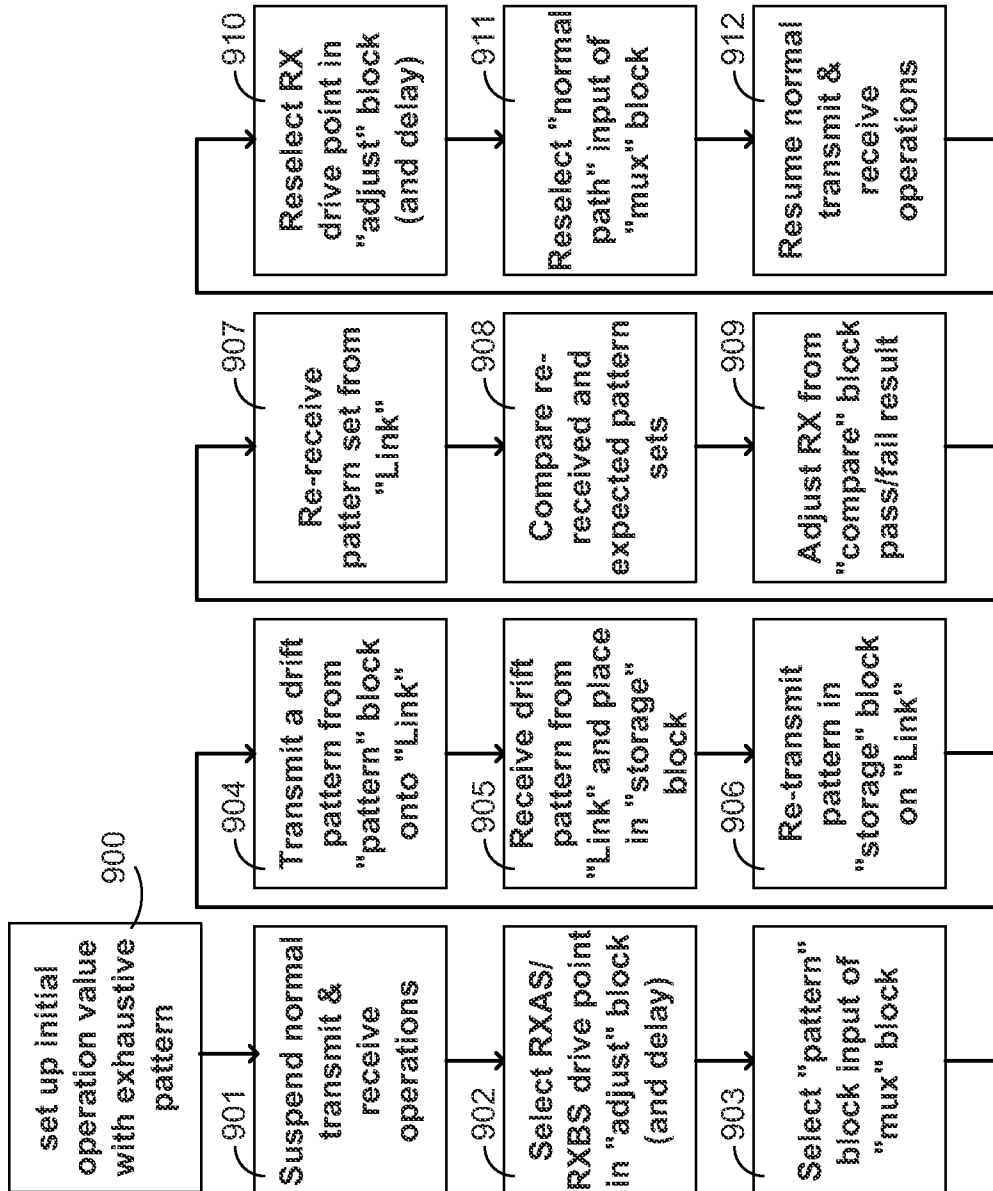
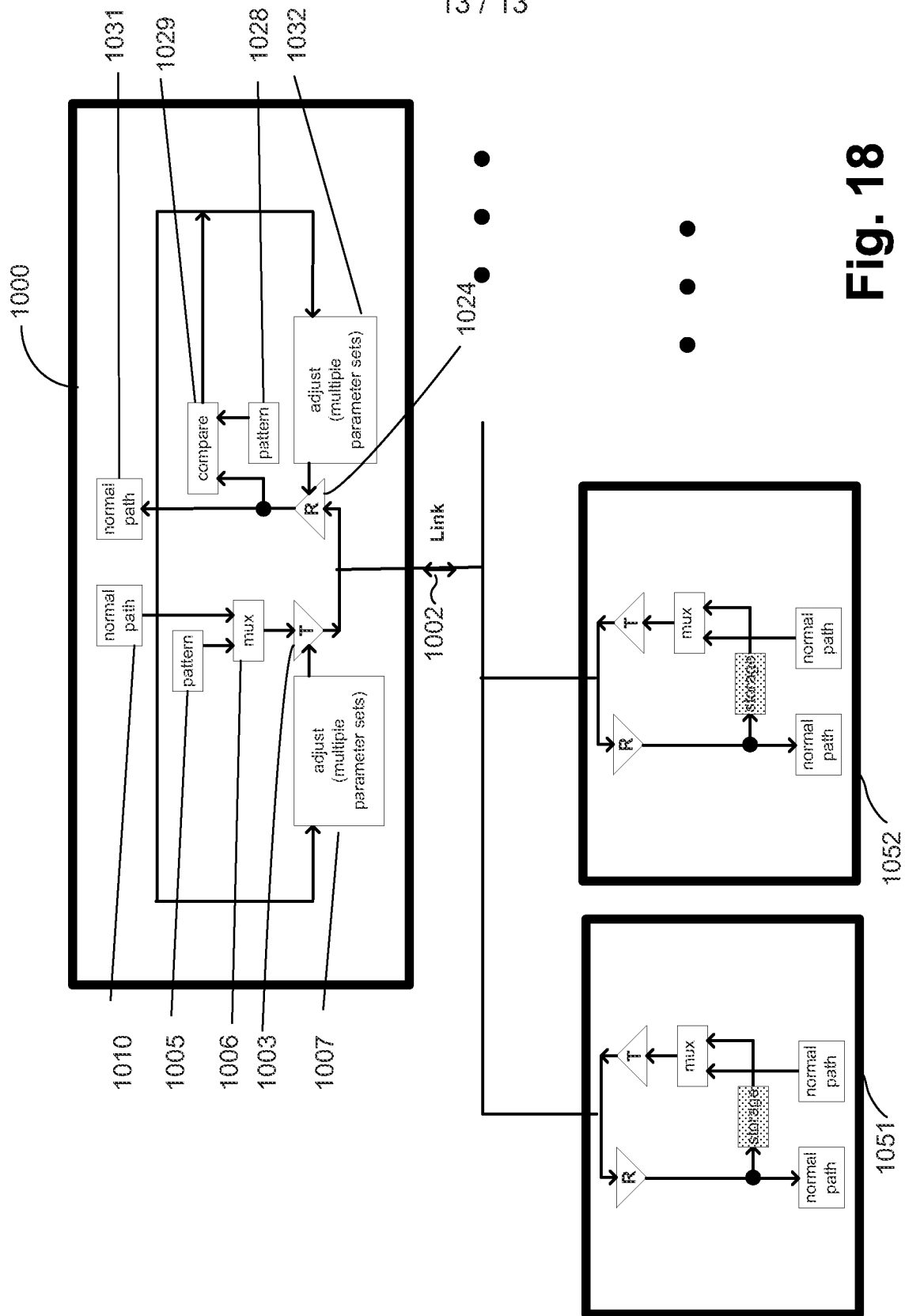


Fig. 17



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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

☒ Practitioners associated with the Customer Number:

78408

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

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



The address associated with Customer Number:

78408

OR

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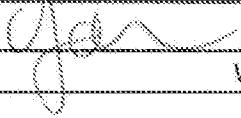
Assignee Name and Address:

Rambus Inc.
1050 Enterprise Way, Suite 700
Sunnyvale, CA 94089

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

SIGNATURE of Assignee of Record

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

Signature		Date	7/22/11
Name	Wayne Sobon, Esq.	Telephone	408 462-8000
Title	Vice-President, Corporate Counsel, Rambus Inc.		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 36 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2014074 / RA309C1C1C1C1C1
		Application Number	
Title of Invention	Periodic Calibration For Communication Channels By Drift Tracking		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Craig	E.	Hampel		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Los Altos	State/Province	CA	Country of Residence ⁱ	US

Mailing Address of Inventor:

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Address 2					
City	Sunnyvale	State/Province	CA		
Postal Code	94089	Country ⁱ	US		

Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Frederick	A.	Ware		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Los Altos Hills	State/Province	CA	Country of Residence ⁱ	US

Mailing Address of Inventor:

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Address 2					
City	Sunnyvale	State/Province	CA		
Postal Code	94089	Country ⁱ	US		

Inventor 3					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Richard	E.	Perego		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		2014074 / RA309C1C1C1C1C1	
		Application Number			
Title of Invention		Periodic Calibration For Communication Channels By Drift Tracking			
City	Thornton	State/Province	CO	Country of Residence i	US
Mailing Address of Inventor:					
Address 1		2902 E. 148th Place			
Address 2					
City	Thornton	State/Province	CO		
Postal Code	80602	Country i	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence Information of this application.			
Customer Number	78408		
Email Address	marc@schuylerlawgroup.com	Add Email	Remove Email

Application Information:

Title of the Invention	Periodic Calibration For Communication Channels By Drift Tracking		
Attorney Docket Number	2014074 / RA309C1C1C1C1C1	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	13	Suggested Figure for Publication (if any)	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2014074 / RA309C1C1C1C1C1
		Application Number	
Title of Invention	Periodic Calibration For Communication Channels By Drift Tracking		
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	78408		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status	Pending	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)		
	Continuation of	14/145966	2014-01-01		
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14/145966	Continuation of	13/452543	2012-04-20	8644419	2014-02-04
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13/452543	Continuation of	12/173530	2008-07-15	8165187	2012-04-24
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Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12/173530	Continuation of	11/754107	2007-05-25	7400671	2008-07-15
Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
11/754107	Continuation of	10/766761	2004-01-28	7400670	2008-07-15
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button. Add					

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove			
Application Number	Country i	Filing Date (YYYY-MM-DD)	Priority Claimed
			☒ Yes ☐ No
Additional Foreign Priority Data may be generated within this form by selecting the Add button. Add			

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2014074 / RA309C1C1C1C1C1
	Application Number	
Title of Invention	Periodic Calibration For Communication Channels By Drift Tracking	

Authorization to Permit Access:

☐ Authorization to Permit Access to the Instant Application by the Participating Offices
If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application. In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.	
Applicant 1	
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Remove	
☒ Assignee	☐ Legal Representative under 35 U.S.C. 117
☐ Person to whom the inventor is obligated to assign.	☐ Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:	
Name of the Deceased or Legally Incapacitated Inventor :	
If the Assignee is an Organization check here. ☒	
Organization Name	Rambus Inc.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2014074 / RA309C1C1C1C1C1
		Application Number	
Title of Invention	Periodic Calibration For Communication Channels By Drift Tracking		

Mailing Address Information:			
Address 1		1050 Enterprise Way, Suite 700	
Address 2			
City		Sunnyvale	State/Province CA
Country i	US	Postal Code	94089
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Signature: Remove					
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications					
Signature	/Marc Schuyler/		Date (YYYY-MM-DD)	2014-10-27	
First Name	Marc	Last Name	Schuyler	Registration Number	35675
Additional Signature may be generated within this form by selecting the Add button. Add					

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

**JOINT TO CORPORATE
ASSIGNMENT**

WHEREAS, the undersigned,

(1) Craig E. Hampel
5927 Dunn Avenue
San Jose, CA 95123

(2) Frederick A. Ware
13961 Fremont Pines Lane
Los Altos Hills, CA 94022

(3) Richard E. Perego
5938 Pala Mesa Drive
San Jose, CA 95123

hereinafter termed "Inventors", have invented certain new and useful improvements in

**PERIODIC CALIBRATION FOR COMMUNICATION CHANNELS BY
DRIFT TRACKING**

and have filed an application for a United States patent disclosing and identifying the above invention on _____ as Application No. _____, OR are filing such an application herewith, and have executed an oath or declaration of inventorship for such application on:

(1) the 27th day of January, 2004;

(2) the _____ day of _____, 2004;

(3) the _____ day of _____, 2004;

(hereinafter termed "application"); and

WHEREAS, Rambus, Inc., a corporation of the State of Delaware, having a place of business at 4440 El Camino Real, Los Altos, CA 94022 (hereinafter termed "Assignee"), is desirous of acquiring the entire right, title and interest in and to said application and the invention disclosed therein, and in and to all embodiments of the invention, heretofore conceived, made or discovered jointly or severally by said Inventors (all collectively hereinafter termed "said invention"), and in and to any and all patents, inventor's certificates and other forms of protection (hereinafter termed "patents") thereon granted in the United States and foreign countries.

NOW, THEREFORE, in consideration of good and valuable consideration acknowledged by said Inventors to have been received in full from said Assignee:

1. Said Inventors do hereby sell, assign, transfer and convey unto said Assignee the entire right, title and interest (a) in and to said application and said invention; (b) in and to all rights to apply for foreign patents on said invention pursuant to the International Convention for the Protection of Industrial Property or otherwise; (c) in and to any and all applications filed and any and all patents granted on said invention in the United States or any foreign country, including each and every application filed and each and every patent granted on any application which is a divisional, substitution, continuation, or continuation-in-part of any of said applications; and (d) in and to each and every reissue or extensions of any of said patents.

2. Said Inventors hereby jointly and severally covenant and agree to cooperate with said Assignee to enable said Assignee to enjoy to the fullest extent the right, title and interest herein conveyed in the United States and foreign countries. Such cooperation by said Inventors shall include prompt production of pertinent facts and documents, giving of testimony, execution of petitions, oaths, specifications, declarations or other papers, and other assistance all to the extent deemed necessary or desirable by said Assignee (a) for perfecting in said Assignee the right, title and interest herein conveyed; (b) for prosecuting any of said applications; (c) for filing and prosecuting substitute, divisional, continuing or additional applications covering said invention; (d) for filing and prosecuting applications for reissuance of any said patents; (e) for interference or other priority proceedings involving said invention; and (f) for legal proceedings involving said invention and any applications therefor and any patents granted thereon, including without limitation reissues and reexaminations, opposition proceedings, cancellation proceedings, priority contests, public use proceedings, infringement actions and court actions; provided, however, that the expense incurred by said Inventors in providing such cooperation shall be paid for by said Assignee.

3. The terms and covenants of this assignment shall inure to the benefit of said Assignee, its successors, assigns and other legal representatives, and shall be binding upon said Inventors, their respective heirs, legal representatives and assigns.

4. Said Inventors hereby jointly and severally warrant and represent that they have not entered and will not enter into any assignment, contract, or understanding in conflict herewith.

IN WITNESS WHEREOF, said Inventors have executed and delivered this instrument to said Assignee as of the dates written below.


Craig E. Hampel

1/27/04
Date

Date _____

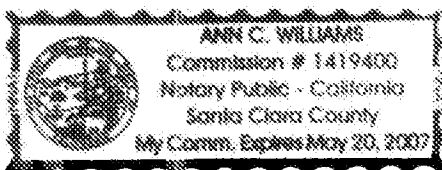
State of California
County of Santa Clara

On Jan. 27, 2004, before me, Ann C. Williams, Notary Public,
personally appeared Craig E. Hampel,

☐ personally known to me or ☒ proved to me on the basis of satisfactory evidence, to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.

Ann C. Williams
(Notary Public)

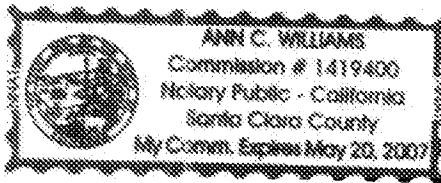




Frederick A. Ware

1/27/04

Date

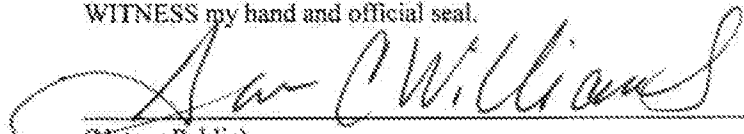


State of California)
)
County of Santa Clara)

On Jan. 27, 2004, before me, Ann C. Williams, Notary Public,
personally appeared Frederick A. Ware.

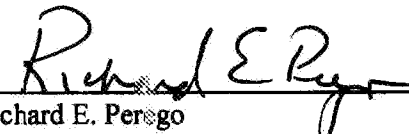
☐ personally known to me or ☒ proved to me on the basis of satisfactory evidence, to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.



(Notary Public)

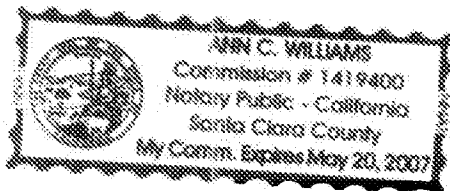
State of California)
)
County of Santa Clara)



Richard E. Perego

1/27/2004

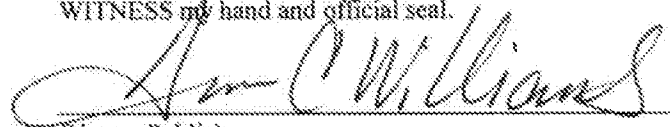
Date



On Jan. 27, 2004, before me, Ann C. Williams, Notary Public,
personally appeared Richard E. Perego.

☐ personally known to me or ☒ proved to me on the basis of satisfactory evidence, to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.



(Notary Public)

**DECLARATION (37 CFR 1.63) FOR PROVISIONAL, UTILITY, DESIGN, OR NATIONAL
STAGE OF PCT APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention: **PERIODIC CALIBRATION FOR COMMUNICATION CHANNELS BY
DRIFT TRACKING**

As a below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☐ United States Provisional Application Number [Enter App #] filed on [Enter Date], or
- ☒ United States Application Number 14/145,966, filed on January 1, 2014, and amended on February 3, 2014.

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

I have authorized and/or hereby do authorize my assignee to file patent applications claiming priority from the application referenced above, including provisional, non-provisional, design, divisional, continuation, continued prosecution, continuation-in-part, substitute, supplemental examination application, and other applications related to the subject matter of the application referenced above. I have authorized and/or hereby do authorize my assignee to make changes to the application for matters of formality.

I believe 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 Section 1001 of Title 18 of the United States Code by fine or imprisonment of not more than five (5) years, or both.

Warning: Declarant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent.

Legal Name of Inventor:

Inventor: Craig E. Hampel	Date: <i>March 11, 2014</i>
Signature: <i>Craig Hampel</i>	

**DECLARATION (37 CFR 1.63) FOR PROVISIONAL, UTILITY, DESIGN, OR NATIONAL
STAGE OF PCT APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention: **PERIODIC CALIBRATION FOR COMMUNICATION CHANNELS BY
DRIFT TRACKING**

As a below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☐ United States Provisional Application Number [Enter App #] filed on [Enter Date], or
- ☒ United States Application Number **14/145,966**, filed on **January 1, 2014**, and amended on **February 3, 2014**.

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

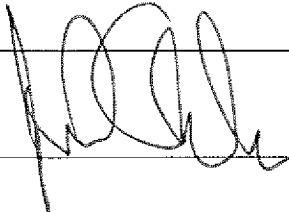
I have authorized and/or hereby do authorize my assignee to file patent applications claiming priority from the application referenced above, including provisional, non-provisional, design, divisional, continuation, continued prosecution, continuation-in-part, substitute, supplemental examination application, and other applications related to the subject matter of the application referenced above. I have authorized and/or hereby do authorize my assignee to make changes to the application for matters of formality.

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Legal Name of Inventor:

Inventor: Frederick A. Ware	Date: 2/21/2014
Signature: 	

**DECLARATION (37 CFR 1.63) FOR PROVISIONAL, UTILITY, DESIGN, OR NATIONAL
STAGE OF PCT APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention: **PERIODIC CALIBRATION FOR COMMUNICATION CHANNELS BY
DRIFT TRACKING**

As a below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☐ United States Provisional Application Number [Enter App #] filed on [Enter Date], or
- ☒ United States Application Number **14/145,966**, filed on **January 1, 2014**, and amended on **February 3, 2014**.

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Legal Name of Inventor:

Inventor: Richard E. Perego	Date: 2/27/2014
Signature: 