



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/963,246	06/04/2019	10313024	PAT266-001US	7189

27543 7590 05/15/2019
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

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):

I-Lung HO, Sugar Land, TX;
Applied Optoelectronics, Inc., Sugar Land, TX;
Kevin LIU, Houston, TX;
YongXuan Liang, Stafford, TX;

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), by mail or fax, or via EFS-Web.

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

By fax, send to: (571)-273-2885

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

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

27543 7590 03/26/2019
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

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

Certificate of Mailing or Transmission

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

April Davis	(Typed or printed name)
	(Signature)
April 18, 2019	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/963,246	04/26/2018	I-Lung HO	PAT266-001US	7189

TITLE OF INVENTION: TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RETRACES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	06/26/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
BARUA, PRANESH K	2637	398-079000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list:

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

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

1. Grossman Tucker Perreault
2. & Pflieger, PLLC
3. Norman S. Kinsella

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

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

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

Applied Optoelectronics, Inc.

Sugar Land, Texas

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

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-1705

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 April 18, 2019

Typed or printed name

Kevin J. Carroll

Registration No. 36,384

Electronic Patent Application Fee Transmittal				
Application Number:		15963246		
Filing Date:		26-Apr-2018		
Title of Invention:		TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		
First Named Inventor/Applicant Name:		I-Lung HO		
Filer:		Kevin J. Carroll/April Davis		
Attorney Docket Number:		PAT266-001US		
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	1000	1000

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

Electronic Acknowledgement Receipt

EFS ID:	35766880
Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	I-Lung HO
Customer Number:	27543
Filer:	Kevin J. Carroll/April Davis
Filer Authorized By:	Kevin J. Carroll
Attorney Docket Number:	PAT266-001US
Receipt Date:	18-APR-2019
Filing Date:	26-APR-2018
Time Stamp:	14:55:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 1000
RAM confirmation Number	041919INTEFSW00001277501705
Deposit Account	501705
Authorized User	April Davis

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)
37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

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)	IssueFee_Transmittal_041819.pdf	137270	no	1
			aefb8e3223ecfaa99af115e660ebd49b7ab514a7		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30586	no	2
			77c3c7662253a2bba110a9511a391bebeb4a9a59		

Warnings:

Information:

Total Files Size (in bytes):	167856
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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



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NOTICE OF ALLOWANCE AND FEE(S) DUE

27543 7590 03/26/2019
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

EXAMINER	
BARUA, PRANESH K	
ART UNIT	PAPER NUMBER

2637

DATE MAILED: 03/26/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/963,246	04/26/2018	I-Lung HO	PAT266-001US	7189

TITLE OF INVENTION: TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	06/26/2019

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

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27543 7590 03/26/2019
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

Certificate of Mailing or Transmission

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/963,246	04/26/2018	I-Lung HO	PAT266-001US	7189

TITLE OF INVENTION: TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RE TRACES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	06/26/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
BARUA, PRANESH K	2637	398-079000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

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

2 _____

3 _____

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

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(A) NAME OF ASSIGNEE

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

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

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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

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☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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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
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/963,246	04/26/2018	I-Lung HO	PAT266-001US	7189
27543 7590 03/26/2019 APPLIED OPTOELECTRONICS, INC. 13115 JESS PIRTLE BLVD. SUGAR LAND, TX 77478			EXAMINER BARUA, PRANESH K	
			ART UNIT 2637	PAPER NUMBER
DATE MAILED: 03/26/2019				

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

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

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

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

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

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

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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 to the Federal Bureau of Investigation or other law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/963,246	Applicant(s) HO et al.	
	Examiner PRANESH K BARUA	Art Unit 2637	AIA (FITF) Status Yes

-- 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 2/19/2019.
☐ 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 1-8,10,12-14 and 16-20. 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 areply 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 _____.
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/PRANESH K BARUA/ Examiner, Art Unit 2637	/DAVID C PAYNE/ Supervisory Patent Examiner, Art Unit 2637
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<i>Notice of References Cited</i>	Application/Control No. 15/963,246		Applicant(s)/Patent Under Reexamination HO et al.	
	Examiner PRANESH K BARUA		Art Unit 2637	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20050105915-A1	05-2005	Light, Greta	G02B6/4292	398/164
*	B	US-9614620-B2	04-2017	Ho; I-Lung	G02B6/43	1/1
*	C	US-7798820-B2	09-2010	Hong; Liu	H05K1/117	385/92
*	D	US-20070237472-A1	10-2007	Aronson; Lewis B.	G02B6/4292	385/101
*	E	US-20050286906-A1	12-2005	Togami, Chris K.	G02B6/4277	398/164
*	F	US-20050175350-A1	08-2005	Hartzell, Robert	G02B6/4246	398/135
*	G	US-20170272169-A1	09-2017	HO; I-Lung	H04B10/40	1/1
*	H	US-20040163836-A1	08-2004	Kumar, Dev E.	H01S5/02212	174/50
*	I	US-20120301152-A1	11-2012	EDWARDS; Phillip	G02B6/4201	398/135
*	J	US-20110188863-A1	08-2011	MASON; Thomas Beck	H04B10/40	398/137
*	K	US-20050225955-A1	10-2005	Grebenkemper, John	H05K1/0218	361/780
*	L	US-20150162990-A1	06-2015	Daiber; Andrew John	H04B10/503	398/183
*	M	US-20130114629-A1	05-2013	Firth; Paul	G02B6/4201	372/20

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

<i>Notice of References Cited</i>	Application/Control No. 15/963,246		Applicant(s)/Patent Under Reexamination HO et al.	
	Examiner PRANESH K BARUA		Art Unit 2637	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20150162989-A1	06-2015	OOMORI; Hirotaka	H04B10/50	398/201
*	B	US-20160139477-A1	05-2016	Jack; Gordon	G09G3/19	359/275
*	C	US-20140152373-A1	06-2014	Romas, JR.; Gregory George	H01L25/18	327/374
	D					
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	K					
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FOREIGN PATENT DOCUMENTS

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	S					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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	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>Search Notes</i> 	Application/Control No. 15/963,246	Applicant(s)/Patent Under Reexamination HO et al.
	Examiner PRANESH K BARUA	Art Unit 2637

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

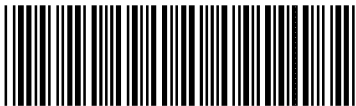
US Classification - Searched*			
Class	Subclass	Date	Examiner
398	398/135 398/164 398/79	11/12/2018	P.B.

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor search completed	11/12/2018	P.B.
USPC search completed	11/12/2018	P.B.
See attached PDF history	11/13/2018	P.B.
Interference search completed	03/16/2019	P.B.
See updated attached search history	03/16/2019	P.B.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04B10	H04B10/80	03/16/2019	P.B.

/PRANESH K BARUA/ Examiner, Art Unit 2637	
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Issue Classification 	Application/Control No. 15/963,246	Applicant(s)/Patent Under Reexamination HO et al.	
	Examiner PRANESH K BARUA	Art Unit 2637	

CPC						
Symbol					Type	Version
H04B	/	10	/	80	F	2013-01-01
H01S	/	5	/	0222	I	2013-01-01
H01S	/	5	/	02415	I	2013-01-01
H04J	/	14	/	02	I	2013-01-01
H01S	/	5	/	4087	I	2013-01-01
H01S	/	5	/	02284	I	2013-01-01
H04B	/	10	/	50	I	2013-01-01
H01S	/	5	/	042	I	2013-01-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
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/PRANESH K BARUA/ Examiner, Art Unit 2637 (Assistant Examiner)	16 March 2019 (Date)	Total Claims Allowed: 17	
/DAVID C PAYNE/ SPE, Art Unit 2637 (Primary Examiner)	18 March 2019 (Date)	O.G. Print Claim(s) 14	O.G. Print Figure 3

Issue Classification 	Application/Control No. 15/963,246	Applicant(s)/Patent Under Reexamination HO et al.	
	Examiner PRANESH K BARUA	Art Unit 2637	

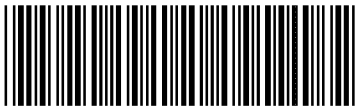
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CLAIMED			
H04J	/	14	/ 02
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NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
398	79

CROSS REFERENCES(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
398	135	164			

/PRANESH K BARUA/ Examiner, Art Unit 2637 (Assistant Examiner)	16 March 2019 (Date)	Total Claims Allowed: 17	
/DAVID C PAYNE/ SPE, Art Unit 2637 (Primary Examiner)	18 March 2019 (Date)	O.G. Print Claim(s) 14	O.G. Print Figure 3

Issue Classification 	Application/Control No. 15/963,246	Applicant(s)/Patent Under Reexamination HO et al.
	Examiner PRANESH K BARUA	Art Unit 2637

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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2	2	11	13												
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7	7	16	19												
8	8	17	20												
9	10														

/PRANESH K BARUA/ Examiner, Art Unit 2637 (Assistant Examiner)	16 March 2019 (Date)	Total Claims Allowed: 17	
/DAVID C PAYNE/ SPE, Art Unit 2637 (Primary Examiner)	18 March 2019 (Date)	O.G. Print Claim(s) 14	O.G. Print Figure 3

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	70	((("HO") near3 ("I-Lung"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/12 22:26
S2	114	((("LIU") near3 ("Kevin"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/12 22:26
S3	9	((("Liang") near3 ("YongXuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/12 22:26
S4	116	((("APPLIED") near3 ("OPTOELECTRONICS") near3 ("INC"))).AS,AANM.	USPAT	OR	ON	2018/11/12 22:26
S5	230610	hermetic\$4 and "1"	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:12
S6	70	((("HO") near3 ("I-Lung"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:12
S7	5	hermetic\$4 and S6	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:12
S8	115	((("LIU") near3 ("Kevin"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S9	2	hermetic\$4 and S8	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S10	9	((("Liang") near3 ("YongXuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S11	3	hermetic\$4 and S10	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S12	116	((("APPLIED") near3 ("OPTOELECTRONICS") near3 ("INC"))).AS,AANM.	USPAT	OR	ON	2018/11/13 03:16
S13	4	hermetic\$4 and S12	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:16
S14	41	S6 and isolat\$3	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:23
S15	22	tosa and substrate and driv\$3 and (transmit near connect\$3)	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:29
S16	44	S12 and isolat\$3	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:34
S17	22	S16 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:34
S18	752	tosa and substrate and driv\$3	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:38
S19	135	S18 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:38
S20	1322	tosa and driver and laser	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:43
S21	452	S20 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:43
S22	21	rf near10 power and S21	US-PGPUB;	OR	ON	2018/11/13

			USPAT; USOCR			03:43
S23	58	trace near10 power and tosa and driver	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:48
S24	7	("20140286636" "20160192545" "7130194" "7273381" "7798820" "8083415" "8983406").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:50
S25	14	top near10 bottom near10 (layer or side) and tosa and driv\$3 and (trace near10 signal near10 power)	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 04:15
S26	1671	transmitter near optical near subassembly	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:05
S27	226	(transmitter near optical near subassembly).ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:05
S28	5	"20130121651"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:07
S29	187	multi near layer and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:19
S30	3	"20120301152"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:31
S31	3	"20110188863"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:36
S32	9	"10409837"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:55
S33	3	"20050175350"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:59
S34	169	power near30 trace near30 (interference or isolat\$3) near20 (layer or surface)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:02
S35	1	S26 and S34	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2018/11/13 10:02

			DERWENT; IBM_TDB			
S36	1	S34 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:05
S37	755	power near30 trace near30 (interference or isolat\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:05
S38	5	S37 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:06
S39	6384	hermetic\$4 near10 laser	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:13
S40	89	S39 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:13
S41	116	((("APPLIED") near3 ("OPTOELECTRONICS") near3 ("INC"))).AS,AANM.	USPAT	OR	ON	2018/11/13 10:52
S42	3	S41 and interconnect	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:52
S43	6141	(398/135 398/164 398/79).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:53
S44	24	S39 and S43	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:53
S45	25	dc near bus near bar and wire near bond	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:54
S46	53	dc near bus near bar and wire near bond\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:00
S47	47	different near20 interconnect and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:03

S48	130	dc near5 bus near5 bar and wire near5 bond\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:06
S49	0	S48 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:06
S50	4226	bus near5 bar and wire near5 bond\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:08
S51	0	S50 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:12
S52	0	transmitter near optical near subassembly and S50	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:12
S53	877	S50 and pcb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:14
S54	215	pins near20 tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:19
S55	625	(bus near5 bar near20 (surface or layer)) and wire near5 bond\$3 near10 (surface or layer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:20
S56	583	(bus near5 bar near10 (surface or layer)) and wire near5 bond\$3 near10 (surface or layer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:20
S57	7	"20090123116"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:33
S58	6	("2009/0123116").URPN.	USPAT	OR	ON	2018/11/13 11:33
S59	0	("9900991").URPN.	USPAT	OR	ON	2018/11/13 11:33
S60	2352	coupl\$3 near10 trace near10 power	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:40
S61	2	S60 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:40

S62	36085	coupl\$3 near10 trace	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:41
S63	106	S62 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:41
S64	12	wire and bus and S63	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:41
S65	448	wire near5 bond\$3 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:46
S66	10870	wire near5 bond\$3 near10 power	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:48
S67	41	S66 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:48
S68	1802	wire near5 bond\$3 near10 power near10 signal	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:00
S69	14	S68 and S26	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:00
S70	0	dc near5 bus near5 bar and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:08
S71	6	bus near5 bar and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:08
S72	32	dc near5 bus near5 bar near10 substrate	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:09
S73	59	dc near5 bus near5 bar near10 surface	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:13
S74	108	dc near5 bus near5 interconnect	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:16
S75	0	S74 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:16
S76	175	dc near5 bus near5 advantage	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:17
S77	0	dc near bus near bar near5 advantage	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:20
S78	0	dc near5 bus near5 bar near5 advantage	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:20
S79	32	dc near5 bus near5 bar near10 substrate	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:20
S80	6	bus near5 bar and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:31
S81	18	dc near5 bus near5 bar near10 pcb	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:32
S82	137	dc near5 bus near5 bar and laser	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:34
S83	374	dc near5 bus near5 bar and substrate	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:35
S84	19	S83 and 359/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:35
S85	0	S83 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:35
S86	19	S83 and 359/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:36
S87	0	S83 and 356/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:36
S88	74	dc near5 bus near5 bar and substrate and laser	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:36

S89	0	dc near5 bus near5 bar and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:39
S90	0	dc near5 bus near5 bar and optica	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:40
S91	74	dc near5 bus near5 bar and optic	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:40
S92	36	dc near5 bus near5 bar same wire near5 bond\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 13:03

3/ 16/ 2019 6:43:20 AM
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Bibliographic Data

Application No: 15/963,246

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /PRANESH K BARUA/

Examiner's Signature

Initials

Title:

TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE
ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN
POWER AND RF TRACES

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
04/26/2018	398	2637	
RULE			

APPLICANTS

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Kevin LIU Houston, TX, UNITED STATES

YongXuan Liang Stafford, TX, UNITED STATES

CONTINUING DATA

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/17/2018

STATE OR COUNTRY

UNITED STATES

ADDRESS

FILING FEE RECEIVED

\$1,720

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: I-Lung Ho

Examiner: Barua, Pranesh K

Serial No.: 15/963,246

Group Art Unit: 2637 Conf. No.: 7189

Filed: April 26, 2018

Docket: PAT266-001US

Title: TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO
PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

RESPONSE UNDER 37 C.F.R. § 1.111

This is in response to the Official Action in this case mailed November 19, 2018. This response is being filed within the three-month shortened statutory period for reply on or before February 19, 2019. Hence, the Applicant believes no extension of time fees are required. However, the Applicant conditionally petitions for an extension of time to provide for the possibility that the need for an extension has inadvertently been overlooked. As provided below, please charge Deposit Account No. 50-1705 for any required fee, or for any deficiency in the enclosed fee.

Serial Number: 15/963,246

Filing Date: April 26, 2018

Title: TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN
POWER AND RF TRACES

IN THE SPECIFICATION

Please amend the Application Title as follows:

TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE
ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

IN THE CLAIMS

1. (Currently Amended) A transmitter optical subassembly (TOSA) module comprising:

a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity;

a substrate defined by first and second surfaces disposed opposite each other, the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit and a light engine interface region for electrically coupling with the hermetically-sealed light engine;

a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the hermetically-sealed light engine to output one or more channel wavelengths; ~~and~~

wherein the substrate includes at least a first trace disposed on the first surface to provide the power signal and at least a second trace disposed on the second surface to provide the RF signal, the first and second traces being disposed in an opposing arrangement to provide electrical isolation to reduce electrical interference between the power signal and the RF signal

a feedthrough device to electrically couple the at least one laser package to the light engine driving circuit; and

wherein the feedthrough device is defined by at least a first surface disposed opposite a second surface, and wherein the first and second surfaces extend substantially parallel with the first and second surfaces of the substrate.

2. (Original) The TOSA module of claim 1, further comprising at least a first interconnect device of a first type electrically coupled to the first trace and a corresponding trace of the hermetically-sealed light engine housing to provide the power signal, and at least a second interconnect device of a second type electrically coupled to the second trace and a corresponding

trace of the hermetically-sealed light engine housing to provide the RF signal, the first and second types of interconnect devices being different.

3. (Original) The TOSA module of claim 2, wherein the first type of interconnect device is a DC bus bar interconnect.

4. (Original) The TOSA module of claim 2, wherein the second type of interconnect device is a wire bond.

5. (Original) The TOSA module of claim 1, further comprising at least one ground trace disposed on the second surface adjacent the second trace.

6. (Original) The TOSA module of claim 5, further comprising a DC bus bar interconnect device electrically coupled to the at least one ground trace and a wire bond electrically coupled to the second trace.

7. (Original) The TOSA module of claim 1, wherein the electrical isolation is provided at least in part by a width of the substrate and/or material properties of a material that forms the substrate.

8. (Original) The TOSA module of claim 1, further comprising a plurality of electrical interconnects that brace the substrate to the housing of the hermetically-sealed light engine.

9. (Cancelled)

10. (Original) The TOSA module of claim [[9]] 1, wherein the feedthrough device is configured to directly couple to the substrate with an end-to-end connection.

11. (Cancelled)

12. (Currently Amended) The TOSA module of claim [[11]] 1, wherein the first and second surfaces of the feedthrough device are substantially coplanar with the first and second surfaces of the substrate when the feedthrough device and substrate are coupled together.

13. (Currently Amended) The TOSA module of claim [[11]] 1, further comprising at least one trace for receiving the power signal from the light engine driving circuit disposed on the first surface of the feedthrough and at least one trace for receiving the RF signal from the light engine driving circuit disposed on the second surface.

14. (Currently Amended) An optical transceiver comprising:
a housing;
a transmitter optical subassembly (TOSA) module disposed in the housing, the TOSA module comprising:

a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package disposed within the hermetic-sealed cavity;

a substrate defined by first and second surfaces disposed opposite each other, the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit and a light engine interface region for electrically coupling with the hermetically-sealed light engine;

a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the hermetically-sealed light engine to output one or more channel wavelengths; and

wherein the substrate includes at least a first trace disposed on the first surface to provide the power signal, and at least a second trace disposed on the second surface to provide the RF signal, the first and second traces being disposed in an opposing arrangement to provide electrical isolation to reduce electrical interference between the power signal and the RF signal;

at least a first interconnect device of a first type electrically coupled to the first trace and a corresponding trace of the hermetically-sealed light engine to provide the power signal, and at least a second interconnect device of a second type electrically coupled to the second trace and a corresponding trace of the hermetically-sealed light engine to provide the RF signal, the first and second types of interconnect devices being different;
a receive optical subassembly (ROSA) module disposed in the housing.

15. (Cancelled).

16. (Currently Amended) The optical transceiver of claim 14, wherein the first type of interconnect device ~~TOSA module further~~ comprises a DC bus bars disposed on the first and second surfaces of the substrate.

17. (Currently Amended) The optical transceiver of claim 14, wherein the ~~TOSA module further comprises a second plurality of interconnect devices to provide an RF signal from the light engine driving circuit to the at least one laser package of the hermetic sealed cavity, and wherein the second type plurality of interconnect devices are~~ is a wire bonds.

18. (New) A transmitter optical subassembly (TOSA) module comprising:
a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity;
a substrate defined by first and second surfaces disposed opposite each other, the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit and a light engine interface region for electrically coupling with the hermetically-sealed light engine;
a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the hermetically-sealed light engine to output one or more channel wavelengths;

wherein the substrate includes at least a first trace disposed on the first surface to provide the power signal and at least a second trace disposed on the second surface to provide the RF signal, the first and second traces being disposed in an opposing arrangement to provide electrical isolation to reduce electrical interference between the power signal and the RF signal; and

at least a first interconnect device of a first type electrically coupled to the first trace and a corresponding trace of the hermetically-sealed light engine housing to provide the power signal, and at least a second interconnect device of a second type electrically coupled to the second trace and a corresponding trace of the hermetically-sealed light engine housing to provide the RF signal, the first and second types of interconnect devices being different.

19. (New) The TOSA module of claim 18, wherein the first type of interconnect device is a DC bus bar interconnect.

20. (New) The TOSA module of claim 18, wherein the second type of interconnect device is a wire bond.

REMARKS

Please reconsider the application in view of the following remarks. Applicant submits that the claims, as presented, are in condition for allowance and respectfully requests the withdrawal of all pending rejections of the claims.

Status of Claims

Claims 1-17 stand rejected. Independent claim 1 has been amended to include the limitations of claims 9 and 11. Independent claim 14 has been amended to include the limitations of dependent claim 2. Dependent claims 12, 13, 16 and 17 have been amended to be consistent with the amendments to independent claims 1 and 14. Dependent claims 9, 11 and 15 have been cancelled herein without prejudice or disclaimer. New independent claim 18 has been presented herein, as well as claims 19 and 20 which depend directly from claim 18. Claim 18 recites the limitations of claims 1 and 2 as originally filed. No new matter has been added.

Accordingly, claims 1-8, 10, 12-14, and 16-20 remain pending for examination with claims 1, 14 and 18 being independent claims.

Allowable Subject Matter

Applicant notes with appreciation the Examiner's indication of allowable subject matter in claims 2-4 and 11-13.

Amendments to the Specification

Applicant herein amends the Application Title to correct a minor informality (See Page 2 of this paper).

Rejections Under 35 U.S.C. § 103

Claims 1, 5, 7, 8, 14 and 15 were rejected under 35 U.S.C. 103 as being unpatentable over U.S. Pat. Pub. No. 2005/0175350 (Hartzell) and U.S. Pat. Pub. No. 2005/0225955 (Greibenkemper), and further in view of U.S. Pat. Pub. No. 2015/0162990 (Daiber). Claim 6 was rejected under 35 U.S.C. 103 as being unpatentable over Hartzell, Grebenkemper, Daiber, and further in view of U.S. Pat. Pub. No. 2014/0152373 (Romas). Claims 9 and 10 were rejected under 35 U.S.C. 103 as being unpatentable over Hartzell, Grebenkemper, Daiber, and further in view of U.S. Pat. Pub. No. 2012/0301152 (Edwards). Claim 16 was rejected under 35 U.S.C. 103 as being unpatentable over Hartzell, Grebenkemper, Daiber, and further in view of U.S. Pat. Pub. No. 2016/0139477 (Jack). Claim 17 was rejected under 35 U.S.C. 103 as being

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unpatentable over Hartzell, Grebenkemper, Daiber, and further in view of U.S. Pat. Pub. No. 2013/0114629 (Firth). Applicant respectfully requests reconsideration.

Without conceding as to the merits of these rejections, Applicant herein amends independent claims 1 and 14. In particular, independent claim 1 has been amended to include the limitations of claim 11 which were indicated by the Office Action as allowable, and the limitations of intervening claim 9 from which claim 11 depends. In addition, Applicant amended independent claim 14 to include the limitations of independent claim 2, which was also indicated as allowable.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1-17 under 35 U.S.C. 103.

New Claims

New independent claim 18 and dependent claims 19 and 20 are presented herein. Independent claim 18 recites the limitations of both claims 1 and 2, as originally filed, and thus Applicant respectfully notes claims 18-20 are allowable.

Conclusion

Having dealt with all the objections raised by the Examiner, it is respectfully submitted that the present application, as amended, is in condition for allowance. Thus, early allowance is earnestly solicited.

If the Examiner desires personal contact for further disposition of this case, the Examiner is invited to call the undersigned Attorney at 603.668.6560.

In the event there are any fees due, please charge them to our Deposit Account No. 50-1705 (Ref: PAT266-001US).

Respectfully submitted,

By: /Kenneth M. Thompson/

Date: February 19, 2019

Kenneth M. Thompson
Reg. No. 72,001

Electronic Acknowledgement Receipt

EFS ID:	35192476
Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	I-Lung HO
Customer Number:	27543
Filer:	Kenneth M. Thompson/April Davis
Filer Authorized By:	Kenneth M. Thompson
Attorney Docket Number:	PAT266-001US
Receipt Date:	19-FEB-2019
Filing Date:	26-APR-2018
Time Stamp:	17:05:01
Application Type:	Utility under 35 USC 111(a)

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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		PAT266_001US_Response_asfilled.pdf	53873	yes	9
			6155a6ffd5b38016859c297060bb2a3dff95fc9e		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Specification	2	2
	Claims	3	7
	Applicant Arguments/Remarks Made in an Amendment	8	9

Warnings:

Information:

Total Files Size (in bytes):	53873
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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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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/963,246	Filing Date 04/26/2018	☐ To be Mailed
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ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 = *		x \$100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 = *		x \$460 =	
☐ 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).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED - PART II

	(Column 1)		(Column 2)	(Column 3)	RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	02/19/2019		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	
	Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0	x \$100 = 0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	x \$460 = 0
	☐ Application Size Fee (37 CFR 1.16(s))					
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					
TOTAL ADD'L FEE						0
AMENDMENT			CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =
	☐ Application Size Fee (37 CFR 1.16(s))					
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					
TOTAL ADD'L FEE						
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.						LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/CHRISTINE MOLLISH/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".						
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.						

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/963,246	04/26/2018	I-Lung HO	PAT266-001US	7189
27543	7590	11/19/2018		
APPLIED OPTOELECTRONICS, INC.			EXAMINER	
13115 JESS PIRTLE BLVD.			BARUA, PRANESH K	
SUGAR LAND, TX 77478				
			ART UNIT	PAPER NUMBER
			2637	
			NOTIFICATION DATE	DELIVERY MODE
			11/19/2018	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@gtp.com
kcarroll@gtp.com
kinsella@ao-inc.com

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Objections

2. Claim 17 is objected to because of the following informalities:

Claim 17 states wherein the TOSA module comprises a second plurality of interconnect devices. Claim 17 depends on claim 14 but claim 14 doesn't mention any "first plurality of interconnect devices". Claim 17 should depend on claim 15 which makes note of the first plurality of interconnect devices. Appropriate correction is required.

Allowable Subject Matter

3. **Claims 2-4 and 11-13** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent **form including all of the limitations of the base claim and any intervening claims.**

Claim Rejections - 35 USC § 103

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

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
7. Claims 1, 5, 7, 8, 14 and 15 is/are rejected under 35 U.S.C. 103 as being unpatentable over Hartzell (US 2005/0175350) in view of Grebenkemper (US 2005/0225955) in view of Daiber (US 2015/0162990).

Regarding claim 1, Hartzell teaches a transmitter optical subassembly (TOSA) module (**Fig. 1, TOSA 120**) comprising: a light engine with a housing and at least one laser package for emitting an associated channel wavelength disposed within the housing (**paragraph [0023]**); a substrate defined by first and second surfaces disposed opposite each other (**Fig. 2, paragraph [0025]**, *electronic interface 200 that can be formed on multi-layer board 130...*; **Fig. 3, first and second surfaces 301 and 306 respectively**), the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit (**Fig. 2, electrical coupling region 131**) and a light engine interface region for electrically coupling with the light engine (**Fig. 2, light engine interface region 220**); a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the light engine to output one or more channel wavelengths (**Fig. 2, driving circuit 240: paragraph [0025]**, *transmitter portion 240 can include a laser driver to control a laser diode in TOSA 120*; **Fig. 4B, driver 222**

provides both power and rf signal to drive the light engine); and wherein the substrate includes at least a first trace disposed on the first surface to provide a power signal (**paragraph [0030], layer 301 will include metallic traces for power supply....and metallic traces for portions of connector 131 and connector 220)** and at least a second trace disposed on the second surface to provide the RF signal (**paragraph [0030], layer 306 provides metallic traces for transmitter 240)**, the first and second traces being disposed in an opposing arrangement (**Fig. 3, layer 301 and 306 are disposed in an opposite arrangement**).

Although Hartzell teaches a driver that outputs power and rf signals to the TOSA, Hartzell doesn't clearly state that the traces for power and rf signals are placed in separate layers opposing each other.

Grebenkemper teaches a PCB layout where power transmitting plane is isolated from signal transmitting layer (**Fig. 1, power plane 102 is separate and opposite from signal layer 104 comprising trace 110, paragraph [0018], lines 10-12**).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the PCB structure with the driver as taught by Hartzell and incorporate the transmitting of power and data signal on different layers that are isolated with each other as taught by Grebenkemper so that noise on the power plane is isolated from the signal traces on the signal layer (**Grebenkemper: paragraph [0018], lines 10-12**).

Although Hartzell teaches a TOSA, Hartzell doesn't explicitly state that the TOSA comprises a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity.

Daiber teaches that the TOSA comprises a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity (**Fig. 4, housing 200 is hermetically sealed and includes laser components 300; paragraph [0084], lines 16-19).**

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the placement of a TOSA as taught by Hartzell to incorporate the hermetically sealed cavity to incorporate the laser components as taught by Daiber so that the sealed cavity can protect the laser components within itself (**Daiber: paragraph [0084]).**

Regarding claim 5, Hartzell in view of Daiber teaches the TOSA module of claim 1, further comprising at least one ground trace disposed on the second surface adjacent the second trace (**Hartzell: paragraph [0035], board traces 220 are capable of providing signal, power and ground...**).

Regarding claim 7, Hartzell in view of Grebenkemper in view of Daiber teaches the TOSA module of claim 1, wherein the electrical isolation is provided at least in part by a width of the substrate and/or material properties of a material that forms the substrate (**Grebenkemper: paragraph [0021], isolates power planes 102 from signal layers 104...material properties and thickness of core layers and pre-preg layers to improve power delivery without impacting signal propagation on signal traces).**

Regarding claim 8, Hartzell in view of Grebenkemper in view of Daiber teaches the TOSA module of claim 1, further comprising a plurality of electrical interconnects that brace the substrate to the housing of the hermetically-sealed light engine. Hartzell teaches in Fig. 5A that 220 provides signals to TOSA 120 and Hartzell in view of Grebenkemper in view of Daiber already teaches in claim 1 that the driver communicated power and rf signal to the TOSA using

different surfaces. Although it is not clear shown that interconnects connect the substrate to the light engine, it would have been obvious to one of ordinary skill in the art to know that the traces 220 has to be in contact with the contacts of TOSA 120 using interconnects to be able to transmit the signals.

Regarding claim 14, Hartzell teaches an optical transceiver (**Fig. 1**) comprising: a housing (**Fig. 1, a housing to hold Fig. 1**); a transmitter optical subassembly (TOSA) module disposed in the housing (**Fig. 1, TOSA 120**), Hartzell teaches a transmitter optical subassembly (TOSA) module (**Fig. 1, TOSA 120**) comprising: a light engine with a housing and at least one laser package for emitting an associated channel wavelength disposed within the housing (**paragraph [0023]**); a substrate defined by first and second surfaces disposed opposite each other (**Fig. 2, paragraph [0025]**, *electronic interface 200 that can be formed on multi-layer board 130...*; **Fig. 3, first and second surfaces 301 and 306 respectively**), the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit (**Fig. 2, electrical coupling region 131**) and a light engine interface region for electrically coupling with the light engine (**Fig. 2, light engine interface region 220**); a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the light engine to output one or more channel wavelengths (**Fig. 2, driving circuit 240: paragraph [0025]**, *transmitter portion 240 can include a laser driver to control a laser diode in TOSA 120*; **Fig. 4B, driver 222 provides both power and rf signal to drive the light engine**); and wherein the substrate includes at least a first trace disposed on the first surface to provide a power signal (**paragraph [0030]**, *layer 301 will include metallic traces for power supply....and metallic traces for portions of connector 131 and connector 220*) and at least a second trace disposed on the second surface to provide the RF signal (**paragraph [0030]**, *layer 306 provides*

metallic traces for transmitter 240), the first and second traces being disposed in an opposing arrangement (**Fig. 3, layer 301 and 306 are disposed in an opposite arrangement**); a receive optical subassembly (ROSA) module disposed in the housing (**Fig. 1, ROSA 110**).

Although Hartzell teaches a driver that outputs power and rf signals to the TOSA, Hartzell doesn't clearly state that the traces for power and rf signals are placed in separate layers opposing each other.

Grebenkemper teaches a PCB layout where power transmitting plane is isolated from signal transmitting layer (**Fig. 1, power plane 102 is separate and opposite from signal layer 104 comprising trace 110, paragraph [0018], lines 10-12**).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the PCB structure with the driver as taught by Hartzell and incorporate the transmitting of power and data signal on different layers that are isolated with each other as taught by Grebenkemper so that noise on the power plane is isolated from the signal traces on the signal layer (**Grebenkemper: paragraph [0018], lines 10-12**).

Although Hartzell teaches a TOSA, Hartzell doesn't explicitly state that the TOSA comprises a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity.

Daiber teaches that the TOSA comprises a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity (**Fig. 4, housing 200 is hermetically sealed and includes laser components 300; paragraph [0084], lines 16-19**).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the placement of a TOSA as taught by Hartzell to incorporate the hermetically sealed cavity to incorporate the laser components as taught by Daiber so that the sealed cavity can protect the laser components within itself (**Daiber: paragraph [0084]**).

Regarding claim 15, Hartzell in view of Grebenkemper in view of Daiber teaches the optical transceiver of claim 14, wherein the TOSA module further comprises a first plurality of interconnect devices to provide a power signal from the light engine driving circuit to the at least one laser package of the hermetic-sealed cavity, and wherein the first plurality of interconnect devices brace the hermetically-sealed light engine to the substrate (Hartzell teaches in Fig. 5A that 220 provides signals to TOSA 120 and Hartzell in view of Grebenkemper in view of Daiber already teaches in claim 14 that the driver communicated power and rf signal to the TOSA using different surfaces. Although it is not clear shown that interconnects provide the power signal from the driver to the laser, it would have been obvious to one of ordinary skill in the art to know that the traces 220 has to be in contact with the contacts of TOSA 120 using interconnects to be able to transmit the signals).

8. Claim 6 is/are rejected under 35 U.S.C. 103 as being unpatentable over Hartzell (US 2005/0175350) in view of Grebenkemper (US 2005/0225955) in view of Daiber (US 2015/0162990) in further view of Romas (US 2014/0152373).

Regarding claim 6, Hartzell in view of Daiber teaches the TOSA module of claim 5.

Hartzell in view of Daiber don't explicitly teach further comprising a DC bus bar interconnect device electrically coupled to the at least one ground trace and a wire bond electrically coupled to the second trace.

Romas teaches a DC bus bar interconnect device electrically coupled to an electrically conductive layer and a wire bond electrically coupled to a conductive pad (**Fig. 10, DC bus bar 68 coupled to layer 56 and wire bond 70 connected to conductive pad on 66**).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the TOSA taught by Hartzell in view of Daiber and to incorporate the dc bus bar and wire bond taught by Romas since they provide a stronger connection between the connection pads thus improving connectivity.

9. Claims 9 and 10 is/are rejected under 35 U.S.C. 103 as being unpatentable over Hartzell (US 2005/0175350) in view of Grebenkemper (US 2005/0225955) in view of Daiber (US 2015/0162990) in view of Edwards (US 2012/0301152).

Regarding claim 9, Hartzell in view of Grebenkemper in view of Daiber teaches the TOSA module of claim 1.

Although Hartzell in view of Daiber teaches a feedthrough device to couple the laser package to the driver, this is not clearly shown.

Edwards on the other hand clearly shows a feed through device (**Fig. 16, feed through device 23b connecting the laser to the substrate**).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the TOSA taught by Hartzell in view of Grebenkemper in view of Daiber and incorporate the feed through device taught by Edwards since the feed through device allows for a better and strong communication between the laser and the substrate.

Regarding claim 10, Hartzell in view of Grebenkemper in view of Daiber in view of Edwards teaches the TOSA module of claim 9, wherein the feedthrough device is configured to

directly couple to the substrate with an end-to-end connection (**Edwards teaches that the feed through device provided an end to end connection with the substrate**).

10. Claim 16 is/are rejected under 35 U.S.C. 103 as being unpatentable over Hartzell (US 2005/0175350) in view of Grebenkemper (US 2005/0225955) in view of Daiber (US 2015/0162990) in view of Jack (US 2016/0139477).

Regarding claim 16, Hartzell in view of Grebenkemper in view of Daiber teaches the optical transceiver of claim 14.

Although Hartzell teaches a first and second surfaces, Hartzell in view of Grebenkemper in view of Daiber doesn't teach wherein the TOSA module further comprises DC bus bars disposed on the first and second surfaces of the substrate.

Jack teaches disposing DC bus bars on a substrate (**Fig. 8, DC bus bar 242 and 244**).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify both the substrate surfaces of Hartzell and incorporate the DC bus bar as taught by Jack since DC bus bars help improve connectivity.

11. Claim 17 is/are rejected under 35 U.S.C. 103 as being unpatentable over Hartzell (US 2005/0175350) in view of Grebenkemper (US 2005/0225955) in view of Daiber (US 2015/0162990) in view of Firth (US 2013/0114629).

Regarding claim 17, Hartzell in view of Grebenkemper in view of Daiber teaches the optical transceiver of claim 14, wherein the TOSA module further comprises a second plurality of interconnect devices to provide an RF signal from the light engine driving circuit to the at least one laser package of the hermetic-sealed cavity (Hartzell teaches in Fig. 5A that 220 provides signals to TOSA 120 and Hartzell in view of Grebenkemper in view of Daiber already teaches in claim 14 that the driver communicated power and rf signal to the TOSA using

different surfaces. Although it is not clear shown that interconnects provide the power signal from the driver to the laser, it would have been obvious to one of ordinary skill in the art to know that the traces 220 has to be in contact with the contacts of TOSA 120 using interconnects to be able to transmit the signals).

Hartzell in view of Grebenkemper in view of Daiber wherein the second plurality of interconnect devices are wire bonds.

Firth teaches a second plurality of interconnect devices are wire bonds connecting a driver to the laser package (**Fig. 1C, wire bonds 76 provide electrical communication between the contact of 34 and laser package 44**).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the surface of the substrate as taught by Hartzell in view of Grebenkemper in view of Daiber and incorporate the plurality of wire bonds on the second surface as taught by Firth since wire bonds provide a stronger connection between the connection pads thus improving connectivity.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. **See the notice of reference cited (PTO-892).**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PRANESH K BARUA whose telephone number is (571)270-1017. The examiner can normally be reached on Mon-Sat: 11-8pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 5712723024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/PRANESH BARUA/

Examiner, Art Unit 2637

/DAVID C PAYNE/

Acting Supervisory Patent Examiner of Art Unit 2637

<i>Notice of References Cited</i>	Application/Control No. 15/963,246		Applicant(s)/Patent Under Reexamination	
	Examiner PRANESH K BARUA		Art Unit 2637	Page 1 of 2

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20050105915-A1	05-2005	Light, Greta	G02B6/4292	398/164
*	B	US-9614620-B2	04-2017	Ho; I-Lung	G02B6/43	1/1
*	C	US-7798820-B2	09-2010	Hong; Liu	H05K1/117	385/92
*	D	US-20070237472-A1	10-2007	Aronson; Lewis B.	G02B6/4292	385/101
*	E	US-20050286906-A1	12-2005	Togami, Chris K.	G02B6/4277	398/164
*	F	US-20050175350-A1	08-2005	Hartzell, Robert	G02B6/4246	398/135
*	G	US-20170272169-A1	09-2017	HO; I-Lung	H04B10/40	1/1
*	H	US-20040163836-A1	08-2004	Kumar, Dev E.	H01S5/02212	174/50
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*	J	US-20110188863-A1	08-2011	MASON; Thomas Beck	H04B10/40	398/137
*	K	US-20050225955-A1	10-2005	Grebenkemper, John	H05K1/0218	361/780
*	L	US-20150162990-A1	06-2015	Daiber; Andrew John	H04B10/503	398/183
*	M	US-20130114629-A1	05-2013	Firth; Paul	G02B6/4201	372/20

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 15/963,246		Applicant(s)/Patent Under Reexamination	
	Examiner PRANESH K BARUA		Art Unit 2637	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20150162989-A1	06-2015	OOMORI; Hirotaka	H04B10/50	398/201
*	B	US-20160139477-A1	05-2016	Jack; Gordon	G09G3/19	359/275
*	C	US-20140152373-A1	06-2014	Romas, JR.; Gregory George	H01L25/18	327/374
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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
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NON-PATENT DOCUMENTS

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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 15/963,246	Applicant(s)/Patent Under Reexamination HO et al.
	Examiner PRANESH K BARUA	Art Unit 2637

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
398	398/135 398/164 398/79	11/12/2018	P.B.

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor search completed	11/12/2018	P.B.
USPC search completed	11/12/2018	P.B.
See attached PDF history	11/13/2018	P.B.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/PRANESH K BARUA/ Examiner, Art Unit 2637	
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Application No: 15/963,246

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /PRANESH K BARUA/

Examiner's Signature

Initials

Title:

TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE
ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN
POWER AND RF TRACES

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
04/26/2018	398	2637	
RULE			

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CONTINUING DATA

FOREIGN APPLICATIONS

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	1671	transmitter near optical near subassembly	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:05
L5	226	(transmitter near optical near subassembly).ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:05
L6	5	"20130121651"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:07
L7	187	multi near layer and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:19
L8	3	"20120301152"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:31
L9	3	"20110188863"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:36
L10	9	"10409837"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:55
L11	3	"20050175350"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 08:59
L14	169	power near30 trace near30 (interference or isolat\$3) near20 (layer or surface)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:02
L15	1	4 and 14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:02

L16	1	14 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:05
L17	755	power near30 trace near30 (interference or isolat\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:05
L18	5	17 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:06
L19	6384	hermetic\$4 near10 laser	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:13
L20	89	19 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:13
L21	116	((("APPLIED") near3 ("OPTOELECTRONICS") near3 ("INC"))).AS,AANM.	USPAT	OR	ON	2018/11/13 10:52
L22	3	L21 and interconnect	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:52
L23	6141	(398/135 398/164 398/79).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:53
L24	24	19 and 23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:53
L25	25	dc near bus near bar and wire near bond	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 10:54
L26	53	dc near bus near bar and wire near bond\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:00
L27	47	different near20 interconnect and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:03
L28	130	dc near5 bus near5 bar and wire	US-PGPUB;	OR	ON	2018/11/13

		near5 bond\$3	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			11:06
L29	0	28 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:06
L30	4226	bus near5 bar and wire near5 bond\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:08
L31	0	30 and tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:12
L32	0	transmitter near optical near subassembly and 30	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:12
L33	877	30 and pcb	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:14
L34	215	pins near20 tosa	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:19
L35	625	(bus near5 bar near20 (surface or layer)) and wire near5 bond\$3 near10 (surface or layer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:20
L36	583	(bus near5 bar near10 (surface or layer)) and wire near5 bond\$3 near10 (surface or layer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:20
L37	7	"20090123116"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 11:33
L38	6	("2009/0123116").URPN.	USPAT	OR	ON	2018/11/13 11:33
L39	0	("9900991").URPN.	USPAT	OR	ON	2018/11/13 11:33
L40	2352	coupl\$3 near10 trace near10 power	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:40
L41	2	40 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:40
L42	36085	coupl\$3 near10 trace	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:41

L43	106	42 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:41
L44	12	wire and bus and 43	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:41
L45	448	wire near5 bond\$3 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:46
L46	10870	wire near5 bond\$3 near10 power	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:48
L47	41	46 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 11:48
L48	1802	wire near5 bond\$3 near10 power near10 signal	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:00
L49	14	48 and 4	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:00
L50	0	dc near5 bus near5 bar and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:08
L51	6	bus near5 bar and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:08
L52	32	dc near5 bus near5 bar near10 substrate	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:09
L53	59	dc near5 bus near5 bar near10 surface	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:13
L54	108	dc near5 bus near5 interconnect	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:16
L55	0	54 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:16
L56	175	dc near5 bus near5 advantage	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:17
L57	0	dc near bus near bar near5 advantage	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:20
L58	0	dc near5 bus near5 bar near5 advantage	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:20
L59	32	dc near5 bus near5 bar near10 substrate	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:20
L60	6	bus near5 bar and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:31
L61	18	dc near5 bus near5 bar near10 pcb	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:32
L62	137	dc near5 bus near5 bar and laser	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:34
L63	374	dc near5 bus near5 bar and substrate	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:35
L64	19	63 and 359/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:35
L65	0	63 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:35
L66	19	63 and 359/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:36
L67	0	63 and 356/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:36
L68	74	dc near5 bus near5 bar and substrate and laser	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:36
L69	0	dc near5 bus near5 bar and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:39

L70	0	dc near5 bus near5 bar and optica	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:40
L71	74	dc near5 bus near5 bar and optic	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 12:40
L72	36	dc near5 bus near5 bar same wire near5 bond\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2018/11/13 13:03
S1	70	((("HO") near3 ("I-Lung"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/12 22:26
S2	114	((("LIU") near3 ("Kevin"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/12 22:26
S3	9	((("Liang") near3 ("YongXuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/12 22:26
S4	116	((("APPLIED") near3 ("OPTOELECTRONICS") near3 ("INC"))).AS,AANM.	USPAT	OR	ON	2018/11/12 22:26
S5	230610	hermetic\$4 and "1"	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:12
S6	70	((("HO") near3 ("I-Lung"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:12
S7	5	hermetic\$4 and S6	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:12
S8	115	((("LIU") near3 ("Kevin"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S9	2	hermetic\$4 and S8	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S10	9	((("Liang") near3 ("YongXuan"))).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S11	3	hermetic\$4 and S10	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:15
S12	116	((("APPLIED") near3 ("OPTOELECTRONICS") near3 ("INC"))).AS,AANM.	USPAT	OR	ON	2018/11/13 03:16
S13	4	hermetic\$4 and S12	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:16
S14	41	S6 and isolat\$3	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:23
S15	22	tosa and substrate and driv\$3 and (transmit near connect\$3)	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:29
S16	44	S12 and isolat\$3	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:34
S17	22	S16 and tosa	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:34
S18	752	tosa and substrate and driv\$3	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:38
S19	135	S18 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:38
S20	1322	tosa and driver and laser	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:43
S21	452	S20 and 398/\$.ccls.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:43
S22	21	rf near10 power and S21	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:43

S23	58	trace near10 power and tosa and driver	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:48
S24	7	("20140286636" "20160192545" "7130194" "7273381" "7798820" "8083415" "8983406").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 03:50
S25	14	top near10 bottom near10 (layer or side) and tosa and driv\$3 and (trace near10 signal near10 power)	US-PGPUB; USPAT; USOCR	OR	ON	2018/11/13 04:15

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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
15/963,246	04/26/2018	2636	1720	PAT266-001US	17	2

27543
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

CONFIRMATION NO. 7189
CORRECTED FILING RECEIPT



Date Mailed: 06/21/2018

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

Inventor(s)

I-Lung HO, Sugar Land, TX;
Kevin LIU, Houston, TX;
YongXuan Liang, Stafford, TX;

Applicant(s)

Applied Optoelectronics, Inc., Sugar Land, TX;

Power of Attorney: The patent practitioners associated with Customer Number 27543

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

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.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 05/17/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/963,246**

Projected Publication Date: 10/31/2019

Non-Publication Request: No

Early Publication Request: No

Title

TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

Preliminary Class

398

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.

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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

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

CORRECTED ADS FORM

Application Number	15963246
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

Inventor Information

****If no data is shown, no data has been corrected****

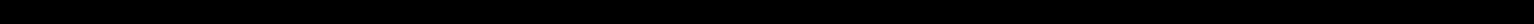
	Data of Record	Updated Data
Order Number		
Name		

Residence Information

Residency		
City		
State		
Country of Residence		

Mailing Address of Inventor

Address 1		
Address 2		
City,State/Province, Postal Code		
Country		



Application Information

	Data of Record	Updated Data
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES	<u>TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES</u>
Attorney Docket Number	PAT266-001US	
Entity Type	Regular Undiscounted	

Domestic Benefit/National Stage Information

****If no data is shown, no data has been corrected****

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121,365(c), or 386(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(a).

		Data of Record	Updated Data
	Prior Application Status		
	Application Number		
	Continuity Type		
	Prior Application Number		
	Filing Date (YYYY-MM-DD)		
	Patent Number		
	Issue Date (YYYY-MM-DD)		

Foreign Priority Information

****If no data is shown, no data has been corrected****

This section allows for the applicant to claim priority to a foreign application. 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. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

		Data of Record	Updated Data
	Application Number		
	Country		
	Filing Date		
	Access Code		

Applicant Information

****If no data is shown, no data has been corrected****

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.

	Data of Record	Updated Data
Applicant Type	ASG	
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		
Applicant is an Organization	Yes	
Name		
Organization Name	Applied Optoelectronics, Inc.	
Address 1		
Address 2		

City,State/Province,Postal Code	Sugar Land TX 77478	
Country	US	
Phone Number		<u>6036686560</u>
Fax Number		
Email Address		<u>kthompson@gtpp.com</u>

Assignee Information including Non-Applicant Assignee Information

****If no data is shown, no data has been corrected****

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office

	Data of Record	Updated Data
Order		
Applicant is an Organization		
Name		
Organization Name		

Mailing Address

Address 1		
Address 2		
City,State/Province,Postal Code		
Country		
Phone Number		
Fax Number		
Email Address		

Signature

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Kenneth M. Thompson/	Registration Number	72001
First Name	Kenneth	Last Name	Thompson

Declaration for United States Patent Application

TITLE OF APPLICATION: TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

As a below named inventor, I hereby declare that:

This declaration is directed to:

☐ the attached application, or

☒ United States Application No. or PCT Application No. 15/963,246 filed on April 26, 2018.

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

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

I have reviewed and understand the contents of the application, including the claims, and I am aware of the duty to disclose to the Office all information known to the person to be material to patentability as defined in 37 C.F.R. § 1.56 (attached hereto).

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

I-Lung HO

Full name of sole or first inventor

Sole or first inventor's signature

Date

5/30/18

Kevin LIU

Full name of additional inventor, if any

Additional inventor's signature

Date

5/30/2018

Yongxuan LIANG

Full name of additional inventor, if any

Additional inventor's signature

Date

5/30/2018

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
- (2) It refutes, or is inconsistent with, a position the applicant takes in:
 - (i) Opposing an argument of unpatentability relied on by the Office, or
 - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
- (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

Electronic Acknowledgement Receipt

EFS ID:	32935630
Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	
Customer Number:	27543
Filer:	Kevin J. Carroll/April Davis
Filer Authorized By:	Kevin J. Carroll
Attorney Docket Number:	PAT266-001US
Receipt Date:	19-JUN-2018
Filing Date:	26-APR-2018
Time Stamp:	12:57:03
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	Application Data Sheet to update/ correct info	CorrectedADS.pdf	66329	no	5
			179f43e663ea268a92caf561dc360d301daa bb54		

Warnings:

Information:					
2	Oath or Declaration filed	PAT260_001US_Corr_Declarati on_executed.pdf	671848 9afb9feb3c88f535082ffba5193f8ece4c8d0c92	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			738177		
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.					

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 15/963,246				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR 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	300			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	660			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760			
TOTAL CLAIMS (37 CFR 1.16(j))	17	minus 20 = *			OR	x 100 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	minus 3 = *				x 460 =	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			
							0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
			TOTAL			TOTAL	1720			
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR 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.										



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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
15/963,246	04/26/2018	3766	1720	PAT266-001US	17	2

CONFIRMATION NO. 7189

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13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478



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Inventor(s)

I-Lung HO, Sugar Land, TX;
Kevin LIU, Houston, TX;
YongXuan Liang, Stafford, TX;

Applicant(s)

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Power of Attorney: The patent practitioners associated with Customer Number 27543

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Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

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If Required, Foreign Filing License Granted: 05/17/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/963,246**

Projected Publication Date: 10/31/2019

Non-Publication Request: No

Early Publication Request: No

Title

TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

Preliminary Class

607

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

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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Electronic Patent Application Fee Transmittal

Application Number:	15963246			
Filing Date:				
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES			
First Named Inventor/Applicant Name:	I-Lung HO			
Filer:	Kenneth M. Thompson/April Davis			
Attorney Docket Number:	PAT266-001US			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
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 (\$)				1720

Electronic Acknowledgement Receipt

EFS ID:	32460929
Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	I-Lung HO
Customer Number:	27543
Filer:	Kenneth M. Thompson/April Davis
Filer Authorized By:	Kenneth M. Thompson
Attorney Docket Number:	PAT266-001US
Receipt Date:	26-APR-2018
Filing Date:	
Time Stamp:	22:10:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 1720
RAM confirmation Number	042718INTEFSW00000560501705
Deposit Account	501705
Authorized User	April Davis

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37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)
 37 CFR 1.20 (Post Issuance fees)
 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	fee-info.pdf	35451	no	2
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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.

Electronic Patent Application Fee Transmittal				
Application Number:		15963246		
Filing Date:				
Title of Invention:		TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		
First Named Inventor/Applicant Name:		I-Lung HO		
Filer:		Kenneth M. Thompson/April Davis		
Attorney Docket Number:		PAT266-001US		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
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 (\$)				1720

Electronic Acknowledgement Receipt

EFS ID:	32459911
Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	I-Lung HO
Customer Number:	27543
Filer:	Kenneth M. Thompson/April Davis
Filer Authorized By:	Kenneth M. Thompson
Attorney Docket Number:	PAT266-001US
Receipt Date:	26-APR-2018
Filing Date:	
Time Stamp:	19:07:30
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	Fee Worksheet (SB06)	fee-info.pdf	35451	no	2
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Total Files Size (in bytes):	35451
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Electronic Patent Application Fee Transmittal

Application Number:	15963246			
Filing Date:				
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES			
First Named Inventor/Applicant Name:	I-Lung HO			
Filer:	Kenneth M. Thompson/April Davis			
Attorney Docket Number:	PAT266-001US			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
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 (\$)				1720

Electronic Acknowledgement Receipt

EFS ID:	32452407
Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	I-Lung HO
Customer Number:	27543
Filer:	Kenneth M. Thompson/April Davis
Filer Authorized By:	Kenneth M. Thompson
Attorney Docket Number:	PAT266-001US
Receipt Date:	26-APR-2018
Filing Date:	
Time Stamp:	12:50:21
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	Fee Worksheet (SB06)	fee-info.pdf	35449	no	2
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Information:	
Total Files Size (in bytes):	35449
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.	

Electronic Patent Application Fee Transmittal

Application Number:	15963246			
Filing Date:				
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES			
First Named Inventor/Applicant Name:	I-Lung HO			
Filer:	Kenneth M. Thompson/April Davis			
Attorney Docket Number:	PAT266-001US			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
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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 (\$)				1720

Electronic Acknowledgement Receipt

EFS ID:	32451808
Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	I-Lung HO
Correspondence Address:	APPLIED OPTOELECTRONICS, INC. - 13115 JESS PIRTLE BLVD. - SUGAR LAND TX 77478 US 281-295-1800 docketing@gtp.com
Filer:	Kenneth M. Thompson/April Davis
Filer Authorized By:	Kenneth M. Thompson
Attorney Docket Number:	PAT266-001US
Receipt Date:	26-APR-2018
Filing Date:	
Time Stamp:	12:15:59
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	Fee Worksheet (SB06)	fee-info.pdf	35449	no	2
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Warnings:					
Information:					
Total Files Size (in bytes):			35449		
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.					

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 transmittal letter or application data sheet.

I hereby appoint Practitioner(s) associated with the following Customer Number:

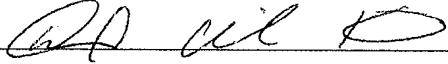
Customer Number: 27543

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 filed for the undersigned as applicant under 37 CFR 1.46 and including the application identified in the attached transmittal letter or application data sheet.

Please direct all correspondence in this case to the address associated with:

Customer Number: 27543

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

Applied Optoelectronics, Inc.	
Applicant Name	
13115 Jess Pirtle Blvd., Sugar Land, TX 77478	
Applicant Address	
Signature 	Date 9/24/2012
Name and Title (of individual signing on behalf of assignee or obligated assignee)	
David Kuo, Assistant General Counsel	

Declaration for United States Patent Application

TITLE OF APPLICATION: TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

As a below named inventor, I hereby declare that:

This declaration is directed to:

☒ the attached application, or

☐ United States Application No. or PCT Application No. _____ filed on _____.

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

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

I have reviewed and understand the contents of the application, including the claims, and I am aware of the duty to disclose to the Office all information known to the person to be material to patentability as defined in 37 C.F.R. § 1.56 (attached hereto).

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

I-Lung HO

Full name of sole or first inventor

Sole or first inventor's signature

Date

4/25/18

Kevin LIU

Full name of additional inventor, if any

Additional inventor's signature

Date

4/25/2018

Yongxuan LIANG

Full name of additional inventor, if any

Additional inventor's signature

Date

4/25/2018

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
- (2) It refutes, or is inconsistent with, a position the applicant takes in:
 - (i) Opposing an argument of unpatentability relied on by the Office, or
 - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
- (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

TECHNICAL FIELD

[0001] The present disclosure relates to optical communications and more particularly, to a transmitter optical subassembly (TOSA) with a hermetically-sealed light engine housing that electrically isolates DC and RF traces to ensure nominal performance.

BACKGROUND INFORMATION

[0002] Optical transceivers are used to transmit and receive optical signals for various applications including, without limitation, internet data center, cable TV broadband, and fiber to the home (FTTH) applications. Optical transceivers provide higher speeds and bandwidth over longer distances, for example, as compared to transmission over copper cables. The desire to provide higher speeds in smaller optical transceiver modules for a lower cost has presented challenges, for example, with respect to thermal management, insertion loss, and manufacturing yield.

[0003] Optical transceiver modules generally include one or more transmitter optical subassemblies (TOSAs) for transmitting optical signals. In general, TOSAs include one or more lasers to emit one or more channel wavelengths and associated circuitry for driving the lasers. Some optical applications, such as long-distance communication, may require TOSAs to include hermetically-sealed housings with arrayed waveguide gratings, laser packages and associated circuitry disposed therein to reduce loss and ensure optical performance. However, the inclusion of hermetically-sealed components increases manufacturing complexity, cost, and raises non-trivial challenges.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] These and other features and advantages will be better understood by reading the following detailed description, taken together with the drawings wherein:

[0005] FIGs. 1A and 1B are block diagrams of multi-channel optical transceivers, consistent with embodiments of the present disclosure.

[0006] FIG. 2A is a perspective view of a first side of an transmitter optical subassembly (TOSA) module consistent with embodiments of the present disclosure.

[0007] FIG. 2B is a perspective view of a second side of the TOSA module of FIG. 2A consistent with embodiments of the present disclosure.

[0008] FIG. 2C shows an enlarged region of the second side of the TOSA module shown in FIG. 2B in accordance with an embodiment of the present disclosure.

[0009] FIG. 3 shows a cross-sectional view of a hermetically-sealed housing consistent with an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0010] As discussed above, some TOSAs can reach optical transmission distances of up to 10km or more. Such TOSAs may be suitable for use in C form-factor pluggable (CFP), CFP2, CFP4 and quad small form-factor pluggable (QSFP) applications. In general, such TOSAs include a hermetic-sealed package (or housing) with an LC receptacle (or other suitable port) for optical coupling. The hermetic-sealed package can house laser packages, e.g., electro-absorption modulator integrated lasers (EMLs), power monitors photodiodes (PDs), an optical multiplexer such as an arrayed waveguide grating for multiplexing multiple channel wavelengths, and electrical interconnects such as flexible printed circuit boards. To supply power such as direct current (DC) and RF signaling to drive the lasers, feedthrough devices may be utilized. The feedthrough device may include patterns/traces disposed thereon to propagate signals from external circuitry to components within the hermetic-sealed package. Multiple feedthrough devices may be utilized in some instances to provide both RF and DC signals. However, the available space to route traces shrinks as TOSA packages continue to scale, which can lead to electrical interference between DC and RF signals that may degrade performance.

[0011] Thus, the present disclosure is generally directed to a TOSA having a hermetically-sealed housing with a feedthrough device that electrically isolates RF traces from power-related traces (e.g., DC traces, ground traces) by disposing power and RF traces on opposite sides. This configuration of power and RF traces may also be referred to as an opposing arrangement. In more detail, a TOSA consistent with the present disclosure includes a substrate with driving

circuitry disposed thereon. A first end of the substrate may electrically couple to transmit connecting circuitry and a second end may couple to a hermetically-sealed housing. Thus, the first end may be referred to as an electrical coupling end and the second end may be referred to as a light engine interface end. The hermetically-sealed housing can include one or more laser packages for emitting channel wavelengths in addition to monitor photodiodes (PDs), and temperature control devices such as TECs. The hermetically-sealed housing includes a first end with a feedthrough device that provides traces to electrically couple to the circuitry of the substrate. The hermetically-sealed housing further includes an optical coupling port, e.g., a LC connector, for coupling to an external fiber, for example. A first side of the feedthrough device may include traces configured to propagate power signals, e.g., DC signals, from circuitry of the substrate to components within the hermetically-sealed housing. On the other hand, a second side of the feedthrough device, opposite the first side, may include traces configured to propagate RF signals from circuitry of the substrate to components within the hermetically-sealed housing.

[0012] Therefore, the RF and power signal traces of the feedthrough device may be electrically isolated from each other based on the distance therebetween, e.g., provided by the width of the feedthrough device, and/or the material properties of the feedthrough device. For example, the feedthrough device may comprise ceramic or other suitable material that may provide electrical shielding. Likewise, the power and RF traces may be similarly disposed and routed on either side of the substrate to minimize or otherwise reduce electrical interference. In addition, a first type of interconnect device such as DC bus bars or other similarly rigid device may be utilized to electrically couple traces of the substrate to the corresponding power traces (including ground traces) of the feedthrough substrate. A plurality of the first type of interconnect devices may be both used to provide power and to brace the hermetically-sealed housing to the substrate. A second type of interconnect device, different from the first type, such as wire bonding may be utilized to electrically couple the substrate to the RF traces of the feedthrough device. Wire bonding, although particularly well suited for high-speed RF transmission, can be relatively fragile and the increased rigidity of the interface between the substrate and the hermetic-sealed housing provided by the first type of interconnect device may advantageously provide bracing to limit stress that could break or otherwise compromise the wire bonds.

[0013] As used herein, the terms hermetic-sealed and hermetically-sealed may be used interchangeably and refer to a housing that releases a maximum of about 5×10^{-8} cc/sec of filler gas. The filler gas may comprise an inert gas such as nitrogen, helium, argon, krypton, xenon, or various mixtures thereof, including a nitrogen-helium mix, a neon-helium mix, a krypton-helium mix, or a xenon-helium mix.

[0014] As used herein, “channel wavelengths” refer to the wavelengths associated with optical channels and may include a specified wavelength band around a center wavelength. In one example, the channel wavelengths may be defined by an International Telecommunication (ITU) standard such as the ITU-T dense wavelength division multiplexing (DWDM) grid. This disclosure is equally applicable to coarse wavelength division multiplexing (CWDM). In one specific example embodiment, the channel wavelengths are implemented in accordance with local area network (LAN) wavelength division multiplexing (WDM), which may also be referred to as LWDM. The term “coupled” as used herein refers to any connection, coupling, link or the like and “optically coupled” refers to coupling such that light from one element is imparted to another element. Such “coupled” devices are not necessarily directly connected to one another and may be separated by intermediate components or devices that may manipulate or modify such signals.

[0015] The term substantially, as generally referred to herein, refers to a degree of precision within acceptable tolerance that accounts for and reflects minor real-world variation due to material composition, material defects, and/or limitations/peculiarities in manufacturing processes. Such variation may therefore be said to achieve largely, but not necessarily wholly, the stated characteristic. To provide one non-limiting numerical example to quantify “substantially,” minor variation may cause a deviation of up to and including $\pm 5\%$ from a particular stated quality/characteristic unless otherwise provided by the present disclosure.

[0016] Referring to the Figures, FIG. 1A, an optical transceiver 100, consistent with embodiments of the present disclosure, is shown and described. In this embodiment, the optical transceiver 100 transmits and receives four (4) channels using four different channel wavelengths ($\lambda_1, \lambda_2, \lambda_3, \lambda_4$) and may be capable of transmission rates of at least about 25 Gbps per channel. In one example, the channel wavelengths $\lambda_1, \lambda_2, \lambda_3, \lambda_4$ may be 1270 nm, 1290 nm, 1310 nm, and 1330 nm, respectively. Other channel wavelengths are within the scope of this disclosure including those associated with local area network (LAN) wavelength division multiplexing

(WDM). The optical transceiver 100 may also be capable of transmission distances of 2 km to at least about 10 km. The optical transceiver 100 may be used, for example, in internet data center applications or fiber to the home (FTTH) applications.

[0017] This embodiment of the optical transceiver 100 includes multiple transmitter optical subassemblies (TOSAs) 120a-d for transmitting optical signals on different channel wavelengths and a multi-channel receiver optical subassembly (ROSA) 130 for receiving optical signals on different channel wavelengths. The TOSAs 120a-d and the multi-channel ROSA 130 are located in a transceiver housing 102.

[0018] A transmit connecting circuit 104 and a receive connecting circuit 108 provide electrical connections to the TOSAs 120a-d and the multi-channel ROSA 130, respectively, within the housing 102. The transmit connecting circuit 104 is electrically connected to the electronic components (e.g., the laser, monitor photodiode, etc.) in each of the TOSAs 120a-d and the receive connecting circuit 108 is electrically connected to the electronic components (e.g., the photodiodes, the TIA, etc.) in the multi-channel ROSA 130. The transmit connecting circuit 104 and the receive connecting circuit 108 may be flexible printed circuits (FPCs) including at least conductive paths to provide electrical connections and may also include additional circuitry.

[0019] Each of the TOSAs 120a-d may be implemented as the TOSA 200 as discussed in greater detail below. Each TOSA may be electrically coupled to conductive paths on the transmit connecting circuit 104 and be configured to receive driving signals (e.g., TX_D1 to TX_D4) and launch channel wavelengths on to fibers of the transmit optical fibers 122.

[0020] A multi-fiber push on (MPO) connector 110 provides optical connections to the TOSAs 120a-d and the multi-channel ROSA 130 within the housing 102. The MPO connector 110 is optically coupled to the TOSAs 120a-d and the multi-channel ROSA 130 via transmit optical fibers 122 and receive optical fibers 132, respectively. The MPO connector 110 is configured to be coupled to a mating MPO connector 112 such that the optical fibers 122, 132 in the optical transceiver 100 are optically coupled to external optical fibers 114.

[0021] Continuing on, this embodiment of the multi-channel ROSA 130 shown in FIG. 1A includes a photodetector array 134 including, for example, photodiodes optically coupled to a fiber array 133 formed by the ends of the receive optical fibers 132. The multi-channel ROSA 130 also includes a multi-channel transimpedance amplifier 136 electrically connected to the

photodetector array 134. The photodetector array 134 and the transimpedance amplifier 136 detect and convert optical signals received from the fiber array 133 into electrical data signals (RX_D1 to RX_D4) that are output via the receive connecting circuit 108. Other embodiments of a ROSA may also be used in the transceiver 100 for receiving and detecting one or more optical signals.

[0022] This embodiment of the optical transceiver 100 does not include an optical multiplexer or demultiplexer. The optical signals may be multiplexed and demultiplexed external to the optical transceiver 100.

[0023] Referring to FIG. 1B, another embodiment of an optical transceiver 100' includes the same light engine (e.g., TOSAs 120a-d and ROSA 130) described above together with an optical multiplexer 111 and an optical demultiplexer 113. The optical multiplexer 111 and the optical demultiplexer 113 both may include arrayed waveguide gratings (AWGs). The optical multiplexer 111 is optically coupled to the transmit optical fibers 122 and the optical demultiplexer 113 is optically coupled to the receive optical fibers 132. The optical multiplexer 111 multiplexes the optical signals being transmitted over transmit optical fibers 122 to provide a multiplexed optical signal on an output optical fiber 115. The optical demultiplexer 113 demultiplexes a multiplexed optical signal received on an input optical fiber 117 to provide received optical signals on receive optical fibers 132. The output optical fiber 115 and the input optical fiber 117 are coupled to an output optical connector 116 and an input optical connector 118, respectively.

[0024] This embodiment of the optical transceiver 100' includes 4 channels and may be configured for coarse wavelength division multiplexing (CWDM), although other numbers of channels are possible. This embodiment of the optical transceiver 100' may also be capable of transmission rates of at least about 25 Gbps per channel and transmission distances of 2 km to at least about 10 km and may be used in internet data center applications or fiber to the home (FTTH) applications.

[0025] Referring now to FIGs. 2A-2B, an example transmitter optical subassembly (TOSA) module 200 is shown consistent with an embodiment of the present disclosure. As shown, the TOSA 200 includes a substrate 202 and a hermetically-sealed light engine 204 coupled to an end of the substrate 202. In more detail, the substrate 202 includes a first end 206-1 that extends to a second end 206-2 along a longitudinal axis 216. The substrate may comprise a printed circuit

board (PCB) formed of silicon or any other material capable of coupling/mounting to electrical components. The substrate 202 includes at least two mounting surfaces for mounting of components, such as mounting surfaces 214-1 and 214-2, which are disposed opposite each other in an opposing arrangement/configuration.

[0026] The substrate 202 includes a transmit circuit (TX) interface region 208 proximate the first end 206-1, a light engine interface region 212 proximate the second end 206-2 of the substrate, and a light engine driving circuit 210 disposed therebetween. The TX interface region 208 may include a plurality of terminals/pads 220 for electrically coupling to a transmit connecting circuit, e.g., transmit connecting circuit 104. The TX interface region 208 may therefore receive signals, e.g., power and other signals such as RF, from an associated transmit connecting circuit when coupled thereto. The light engine interface region 212 also includes terminals/pads 222 for electrically coupling to the hermetically-sealed light engine 204.

[0027] The light engine driving circuit 210 may include power conversion circuitry and other chips/devices suitable for driving a light engine such as the hermetically-sealed light engine 204. The light engine driving circuit 210 may be disposed on one or more of the mounting surfaces of the substrate 202. For instance, as shown in FIGs. 2A and 2B, the light driving circuit is disposed on both the first and second mounting surfaces 214-1, 214-2. This dual-sided arrangement allows for separation of RF and DC traces which may advantageously minimize or otherwise reduce electrical interference with each other. However, this disclosure is not necessarily limited in this regard and the light driving circuit may be disposed on only one side of the substrate 202 depending on a desired configuration. The light engine driving circuit 210 may electrically couple to the TX interface region 208, and more specifically to the plurality of terminals/pads, via traces. Likewise, the light engine driving circuit 210 may electrically couple to the pads/terminals of the light engine interface region 212 via traces, which are described in greater detail below.

[0028] The hermetically-sealed light engine 204 includes a hermetically-sealed housing 224 or housing 224 defined by a plurality of sidewalls. The housing 224 may include a longitudinal axis 218 that extends substantially transverse relative to the longitudinal axis 216 of the substrate 202. The housing 224 may comprise, for example, metal, plastic, ceramic, or any other suitable material. The housing 224 may be formed from multiple pieces, or a single piece, of material.

[0029] The housing 224 may further define a laser cavity 226 (FIG. 3) which may be filled with an inert gas to form an inert atmosphere. In one embodiment, the inert atmosphere sealed within the hermetically-sealed container comprises nitrogen, and preferably, 1 atmosphere (ATM) of nitrogen. The inert atmosphere may also be formed from nitrogen, helium, argon, krypton, xenon, or various mixtures thereof, including a nitrogen-helium mix, a neon-helium mix, a krypton-helium mix, or a xenon-helium mix. The inert gas or gas mix included within the hermetically-sealed container may be selected for a particular refractive index or other optical property. Gases may also be selected based on their ability to promote thermal insulation. For instance, Helium is known to promote heat transfer may be utilized alone or in addition to others of the aforementioned gases. In any event, the terms hermetic-sealed and hermetically-sealed may be used interchangeably and refers to a housing that releases a maximum of about 5×10^{-8} cc/sec of filler gas.

[0030] As shown, the housing 224 may abut (e.g., directly couple to) the second end 206-2 of the substrate 202 and extend therefrom. This may also be referred to as an end-to-end connection between the housing 224 and the substrate 202. The housing 224 may be securely attached to the substrate via an adhesive or other suitable device such as screws, rivets, friction-fit, tongue-and-groove or any combination thereof. However, the housing 224 may not necessarily directly couple to the second end 206-2 of the substrate 202 and the housing 224 may indirectly couple to the second end 206-2 of the substrate 202 via an intermediate device/structure.

[0031] Alternatively, or in addition to adhesive or other attachment devices, the housing 224 may be securely attached to the substrate 202 based on electrical interconnect devices (or simply interconnects) soldered or otherwise coupled between the substrate 202 and the housing 224 such as shown in FIGs. 2A and 2B. For example, a first type of interconnects referred to collectively as 242 and individually as 242-1 and 242-2 may be coupled to the substrate 202 by way of respective pads 222. The first type of interconnect devices 242 may be substantially similar in dimension and type, although other embodiments are within the scope of this disclosure. For instance, each of the interconnect devices 242 may have substantially similar dimensions and may each comprise copper, aluminum, steel or any other suitably conductive metal or metal alloy. In other cases, the interconnect devices 242-1 may comprise a different metal material

than that of the interconnect devices 242-2 and have different dimensions. In one specific example embodiment, the interconnect devices 242 comprise DC bus bar interconnects.

[0032] As shown, the interconnects 242-1 may be coupled to the first surface 214-1 of the substrate 202 and the interconnects 242-2 may be disposed opposite the interconnects 242-1 on the second surface 214-2 of the substrate 202. This opposing configuration/arrangement of interconnects may increase structural stability of the interface between the housing 224 and the substrate 202 versus only coupling interconnects on only one side of the substrate 202. In this embodiment, each of the first interconnect devices 242-1 may be disposed in a coextensive manner with corresponding ones of the second interconnect devices 242-2, although in other cases the interconnect devices may be disposed in a staggered manner and may not necessarily be coextensive. In some cases the interconnects 242 may only be coupled on one side to provide electrical communication between the substrate 202 and the housing 224 and this disclosure should not be construed as limiting in this regard.

[0033] In any event, the interconnect devices 242 may be suitably rigid, and thus prevent or otherwise mitigate rotational movement of the housing 224 relative to the substrate 202. A substantial portion, e.g., greater than 50%, of the bottom surface of each of the interconnect devices 242 may couple to the pads 222 of the substrate 202. This may allow the interconnect devices 242 to have a relatively large amount of surface area in contact with the substrate 202 to allow for additional soldering. The additional soldering may further increase structural support and securely hold the housing 224 in position relative to the substrate 202. Thus, in some cases, the ratio of surface area of each of the interconnects 242 coupled to the substrate 202 relative to the housing 224 may be 2:1, 3:1, 4:1, 6:1, or any ratio therebetween.

[0034] In an embodiment, each of the interconnect devices 242 may form a substantially continuous electrical conductor when electrically coupled, e.g., when soldered or otherwise electrically coupled, to associated pads 222 of the substrate 202 and the pads 244 of the housing 224. The continuous electrical conductor may be straight, e.g., without bends. Although the interconnects 242-2 may be configured to carry a DC signal, the associated pads of the substrate 202 and the housing 224 may not necessarily be electrically coupled to the light engine driving circuit 210 and the laser packages 240, which may also be referred to as laser transmitter arrangements or simply laser arrangements (See FIG. 3). Instead, the interconnects 242-2 may be electrically isolated and may simply be present to provide structural support (e.g., to prevent

rotational movement) between the substrate 202 and the housing 224 and/or a ground connection. Alternatively, one or more of the interconnects 242-2 may be electrically isolated while others may be utilized to provide a DC signal between the substrate 202 and the hermetically-sealed light engine 204.

[0035] Continuing on, a second type of interconnect 246 may electrically couple the substrate 202 to the hermetically-sealed light engine 204 to provide RF signaling. The second type of interconnect 246 may comprise wire bonding, as shown, although other types of interconnect devices may be utilized. As shown, the embodiment of FIGs. 2B and 2C include a plurality of the second type of interconnect 246. Wire bonding may be particularly well suited for transmission of high-frequency RF signals. However, wire bonding can be easily damaged based on, for instance, movement between the substrate 202 and the housing 224. In an embodiment, the first interconnect devices 242 may introduce rigidity and a secure connection between the substrate 202 and the housing 224 to prevent or otherwise mitigate the potential for such damage.

[0036] FIG. 3 shows a cross-sectional view of the housing 224 consistent with an embodiment of the present disclosure. The housing 224 depicted in FIG. 3 includes transparent sections for clarity and for ease of explanation. As shown, the housing 224 includes a plurality of sidewalls that define cavity 226. The cavity 226 includes laser packages 240 disposed therein. The laser packages 240 may be configured to launch associated channel wavelengths into a fiber, e.g., one of fibers 254 (See FIG. 2B), or other waveguide disposed in connector/receptacle 250. Note, the fibers 254 may be implemented as the transmit optical fiber 122 of FIGs. 1A and 1B. Focusing lenses, e.g., focus lens 280, may be disposed within the cavity 226 and aligned with associated laser packages to launch light emitted from the same into a fiber or waveguide of receptacle 250. The cavity 226 may also include temperature control devices 252 in thermal communication with the laser packages 240. The temperature control devices 252 may comprise TECs or other suitable devices. The temperature control devices 252 may also be in thermal communication with the bottom sidewall 256 to allow for transfer of heat. Therefore, the temperature control devices 252 may advantageously disperse heat through a metal housing (or other housing) that the housing 224 may be disposed in.

[0037] The cavity 226 may be at least partially formed by a feedthrough device 228, which may also be referred to as a passthrough device 228. The feedthrough device 228 may comprise,

for example, a suitably rigid non-metal material such as inorganic material such as a crystalline oxide, nitride or carbide material, which may be commonly referred to as ceramic. Some elements, such as carbon or silicon, may also be considered ceramics, and are also within the scope of this disclosure. A first portion 232-1 of the feedthrough device 228 may at least partially extend into the cavity and a second portion 232-2 may extend from the cavity 226.

[0038] The feedthrough device 228 may be defined by at least a first mounting surface 230-1 and a second mounting surface 230-2 disposed opposite the first surface 230-1 in an opposing arrangement/configuration. Each of the first and second mounting surfaces 230-1 and 230-2 may include traces disposed/patterned thereon, and may also be referred to herein as simply first and second surfaces 230-1, 230-2. For example, the first surface 230-1 may include power traces 234 (or DC traces 234) disposed thereon that are configured for transmission of DC signals. On the other hand, the second surface 230-2 may include traces 236 (or RF traces 236) disposed thereon that are configured for transmission of RF signals. The feedthrough device 228 may include a width (or thickness) of W1, with W1 being between 0.1mm to 2mm, although other dimensions are within the scope of this disclosure. The width W1 may be configured to allow the feedthrough device 228 to prevent or otherwise reduce electrical interference between the DC and RF signals carried by the traces 234 and 236, respectively. The width W1 of the feedthrough device 228 may be equal to the width W2 of the substrate 202. However, the widths W1 and W2 may not necessarily be equal and width W2 may be greater or less than the width W1. As further shown, the first and second mounting surfaces 214-1, 214-2 of the substrate 202 may extend in parallel, and may be substantially coplanar, with the first and second surfaces 230-1, 230-2 of the feedthrough device 228 when the substrate 202 and the feedthrough device 228, are coupled together.

[0039] Continuing on, a first end of the DC traces 234 may be electrically coupled to the substrate 202, and more particularly, the light engine driving circuit 210 via respective interconnect devices, such as the first type of interconnect devices 242-1. The second end of the DC traces 234 on the first surface 230-1 of the feedthrough device 228 may then be wire bonded, such as shown, or otherwise electrically coupled to the laser transmitter arrangements 240 via a suitable approach. Each laser transmitter arrangement 240 may comprise, for instance, a laser diode and a monitor photodiode and may be configured to emit an associated channel wavelength. Likewise, a first end of the RF traces 234 electrically couple to the light engine

driving circuit 210 via respective interconnect devices, e.g., the second type of interconnect devices 242-2, and a second end electrically couples to the laser transmitter arrangements 240 via wire bonding or other suitable approach.

[0040] In an accordance with an aspect of the present disclosure a transmitter optical subassembly (TOSA) module is disclosed. The TOSA module comprising a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity, a substrate defined by first and second surfaces disposed opposite each other, the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit and a light engine interface region for electrically coupling with the hermetically-sealed light engine, a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the hermetically-sealed light engine to output one or more channel wavelengths, and wherein the substrate includes at least a first trace disposed on the first surface to provide the power signal and at least a second trace disposed on the second surface to provide the RF signal, the first and second traces being disposed in an opposing arrangement to provide electrical isolation to reduce electrical interference between the power signal and the RF signal.

[0041] In accordance with another aspect of the present disclosure an optical transceiver. The optical transceiver comprising a housing, a transmitter optical subassembly (TOSA) module disposed in the housing, the TOSA module comprising a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package disposed within the hermetic-sealed cavity, a substrate defined by first and second surfaces disposed opposite each other, the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit and a light engine interface region for electrically coupling with the hermetically-sealed light engine, a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the hermetically-sealed light engine to output one or more channel wavelengths, and wherein the substrate includes at least a first trace disposed on the first surface to provide the power signal, and at least a second trace disposed on the second surface to provide the RF signal, the first and second traces being disposed in an opposing arrangement to provide electrical isolation to reduce electrical

interference between the power signal and the RF signal, a receive optical subassembly (ROSA) module disposed in the housing.

[0042] While the principles of the invention have been described herein, it is to be understood by those skilled in the art that this description is made only by way of example and not as a limitation as to the scope of the disclosure. Other embodiments are contemplated within the scope of the present disclosure in addition to the exemplary embodiments shown and described herein. Modifications and substitutions by one of ordinary skill in the art are considered to be within the scope of the present disclosure, which is not to be limited except by the following claims.

CLAIMS

What is claimed is:

1. A transmitter optical subassembly (TOSA) module comprising:
 - a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package for emitting an associated channel wavelength disposed within the hermetic-sealed cavity;
 - a substrate defined by first and second surfaces disposed opposite each other, the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit and a light engine interface region for electrically coupling with the hermetically-sealed light engine;
 - a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the hermetically-sealed light engine to output one or more channel wavelengths; andwherein the substrate includes at least a first trace disposed on the first surface to provide the power signal and at least a second trace disposed on the second surface to provide the RF signal, the first and second traces being disposed in an opposing arrangement to provide electrical isolation to reduce electrical interference between the power signal and the RF signal.
2. The TOSA module of claim 1, further comprising at least a first interconnect device of a first type electrically coupled to the first trace and a corresponding trace of the hermetically-sealed light engine housing to provide the power signal, and at least a second interconnect device of a second type electrically coupled to the second trace and a corresponding trace of the hermetically-sealed light engine housing to provide the RF signal, the first and second types of interconnect devices being different.
3. The TOSA module of claim 2, wherein the first type of interconnect device is a DC bus bar interconnect.
4. The TOSA module of claim 2, wherein the second type of interconnect device is a wire bond.

5. The TOSA module of claim 1, further comprising at least one ground trace disposed on the second surface adjacent the second trace.

6. The TOSA module of claim 5, further comprising a DC bus bar interconnect device electrically coupled to the at least one ground trace and a wire bond electrically coupled to the second trace.

7. The TOSA module of claim 1, wherein the electrical isolation is provided at least in part by a width of the substrate and/or material properties of a material that forms the substrate.

8. The TOSA module of claim 1, further comprising a plurality of electrical interconnects that brace the substrate to the housing of the hermetically-sealed light engine.

9. The TOSA module of claim 1, wherein the hermetically-sealed light engine housing further includes a feedthrough device to electrically couple the at least one laser package to the light engine driving circuit.

10. The TOSA module of claim 9, wherein the feedthrough device is configured to directly couple to the substrate with an end-to-end connection.

11. The TOSA module of claim 9, wherein the feedthrough device is defined by at least a first surface disposed opposite a second surface, and wherein the first and second surfaces extend substantially parallel with the first and second surfaces of the substrate.

12. The TOSA module of claim 11, wherein the first and second surfaces of the feedthrough device are substantially coplanar with the first and second surfaces of the substrate when the feedthrough device and substrate are coupled together.

13. The TOSA module of claim 11, further comprising at least one trace for receiving the power signal from the light engine driving circuit disposed on the first surface of the

feedthrough and at least one trace for receiving the RF signal from the light engine driving circuit disposed on the second surface.

14. An optical transceiver comprising:
- a housing;
 - a transmitter optical subassembly (TOSA) module disposed in the housing, the TOSA module comprising:
 - a hermetically-sealed light engine with a housing that defines a hermetic-sealed cavity and at least one laser package disposed within the hermetic-sealed cavity;
 - a substrate defined by first and second surfaces disposed opposite each other, the substrate including an electrical coupling region for electrically coupling with a transmit connecting circuit and a light engine interface region for electrically coupling with the hermetically-sealed light engine;
 - a light engine driving circuit disposed on the substrate to provide a radio frequency (RF) signal and a power signal to drive the hermetically-sealed light engine to output one or more channel wavelengths; and
 - wherein the substrate includes at least a first trace disposed on the first surface to provide the power signal, and at least a second trace disposed on the second surface to provide the RF signal, the first and second traces being disposed in an opposing arrangement to provide electrical isolation to reduce electrical interference between the power signal and the RF signal;
 - a receive optical subassembly (ROSA) module disposed in the housing.

15. The optical transceiver of claim 14, wherein the TOSA module further comprises a first plurality of interconnect devices to provide a power signal from the light engine driving circuit to the at least one laser package of the hermetic-sealed cavity, and wherein the first plurality of interconnect devices brace the hermetically-sealed light engine to the substrate.

16. The optical transceiver of claim 14, wherein the TOSA module further comprises DC bus bars disposed on the first and second surfaces of the substrate.

17. The optical transceiver of claim 14, wherein the TOSA module further comprises a second plurality of interconnect devices to provide an RF signal from the light engine driving circuit to the at least one laser package of the hermetic-sealed cavity, and wherein the second plurality of interconnect devices are wire bonds.

TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES

ABSTRACT

The present disclosure is generally directed to a transmitter optical subassembly (TOSA) having a hermetically-sealed housing with a feedthrough device that electrically isolates RF and power traces. In more detail, a TOSA consistent with the present disclosure includes a substrate with driving circuitry disposed thereon. A first end of the substrate may electrically couple to transmit connecting circuitry and a second end may couple to a hermetically-sealed housing. The hermetically-sealed housing can include one or more laser packages for emitting associated channel wavelengths in addition to monitor photodiodes (PDs), and temperature control devices such as TECs. The hermetic-sealed housing includes a first end with a feedthrough device that provides traces to electrically couple to the circuitry of the substrate. The hermetic-sealed housing further includes an optical coupling port, e.g., a LC connector, for coupling to an external fiber, for example.

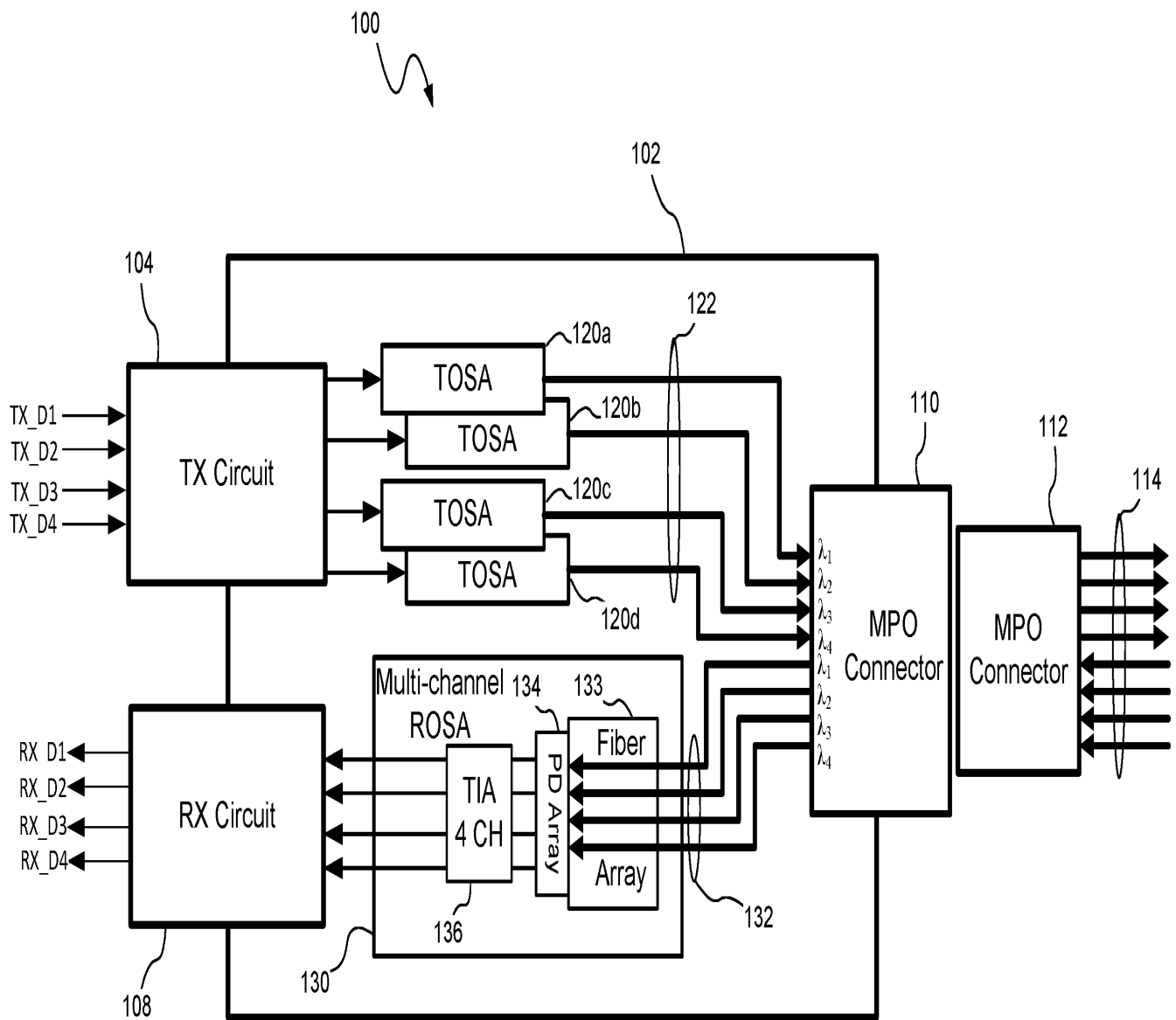


FIG. 1A

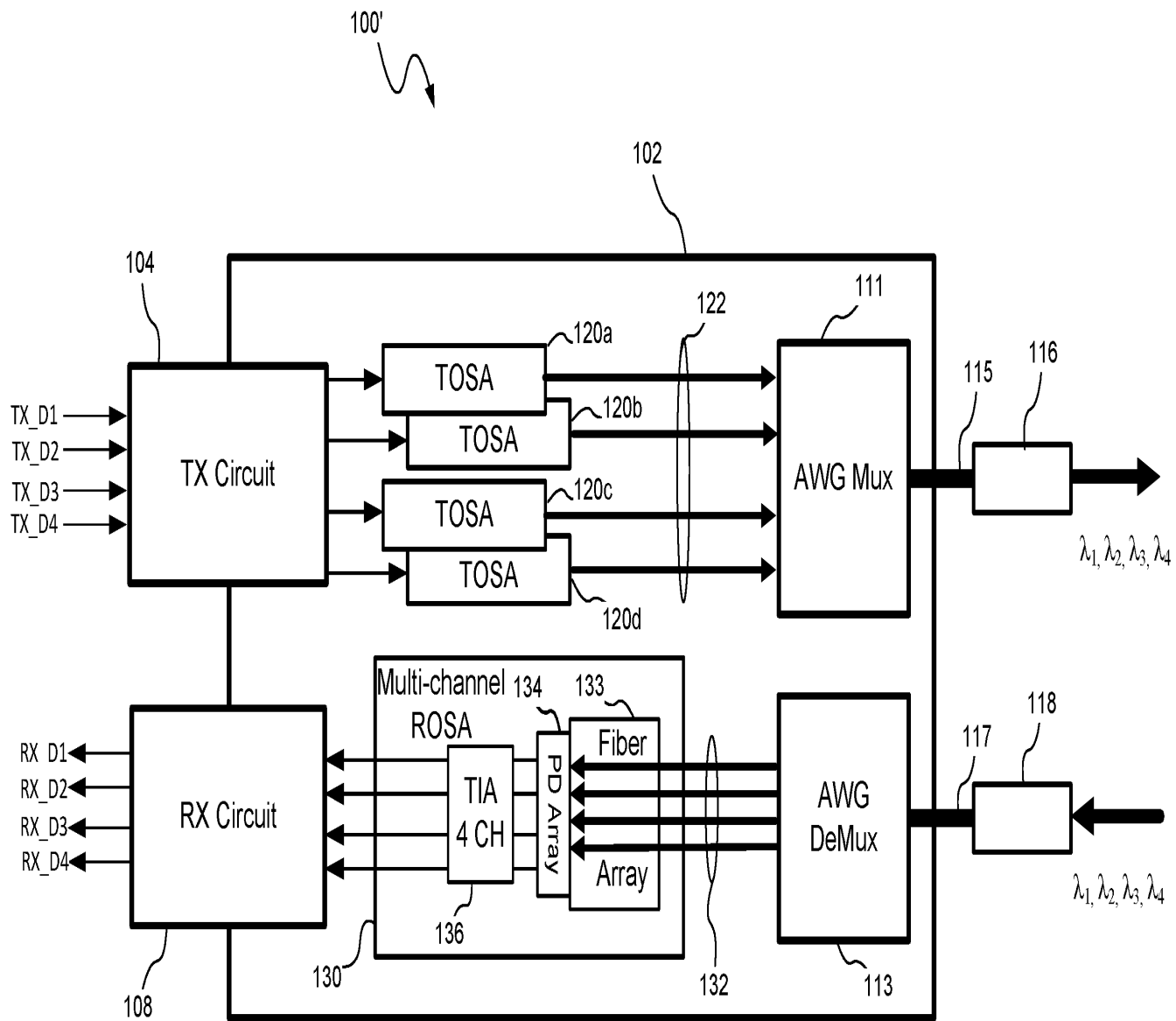


FIG. 1B

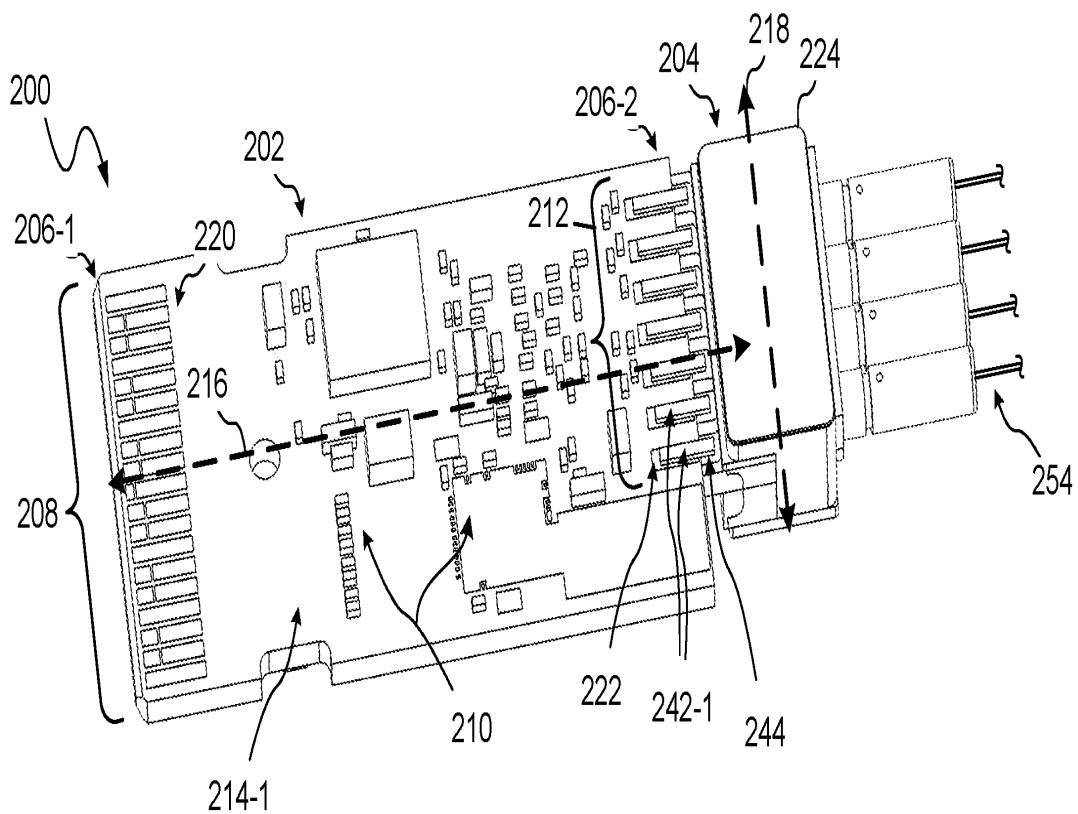


FIG. 2A

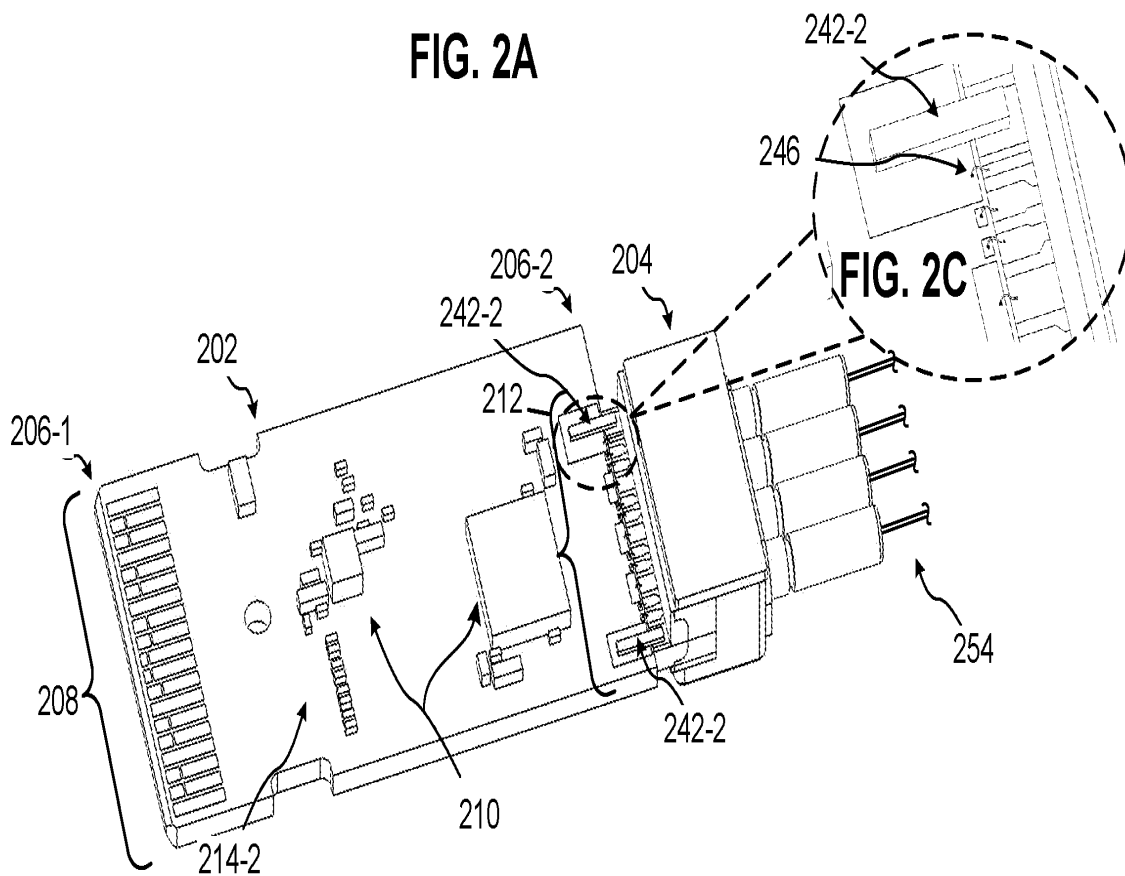


FIG. 2B

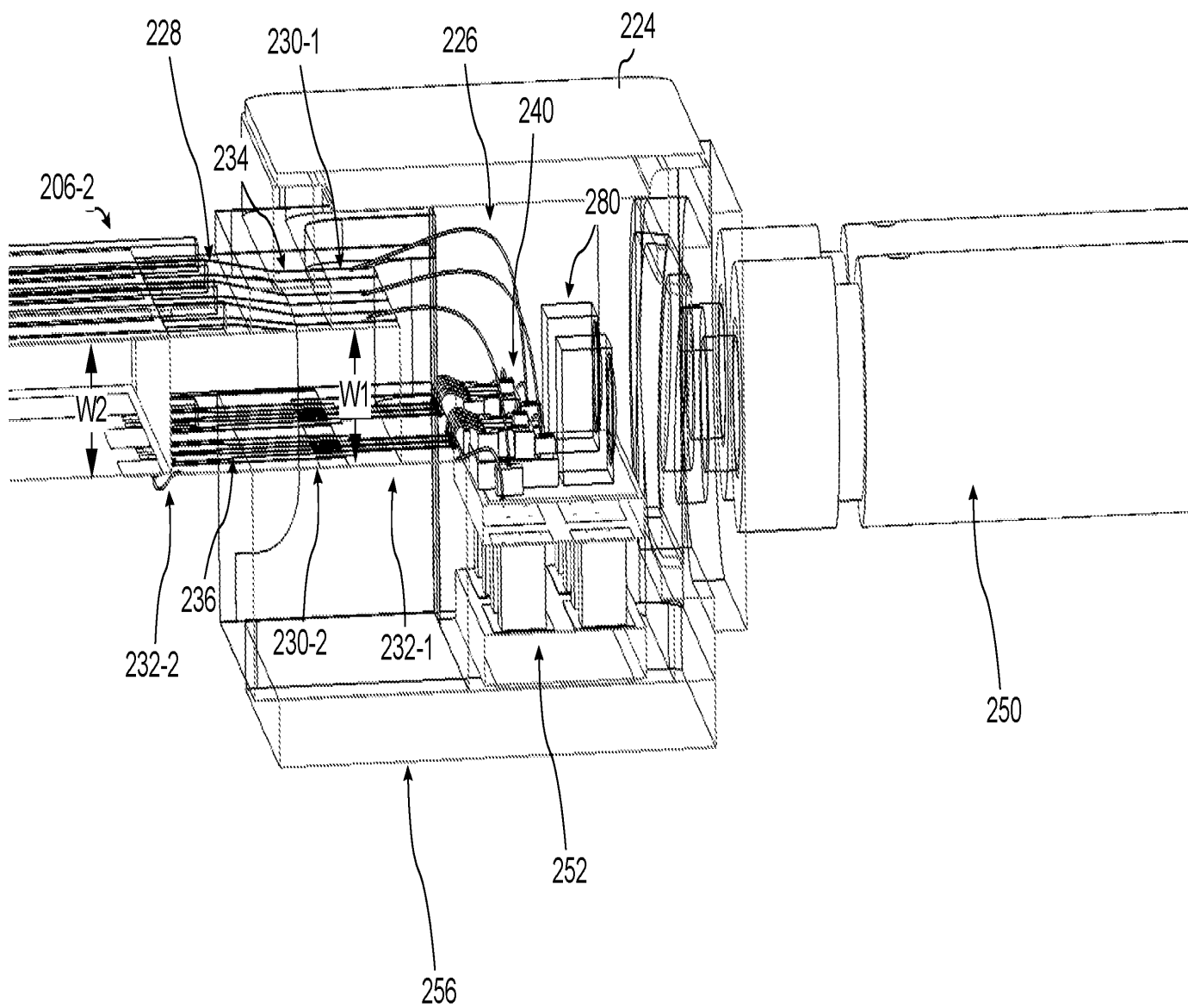


FIG. 3

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES			
First Named Inventor/Applicant Name:	I-Lung HO			
Filer:	Kenneth M. Thompson/April Davis			
Attorney Docket Number:	PAT266-001US			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
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 (\$)				1720

Electronic Acknowledgement Receipt

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Application Number:	15963246
International Application Number:	
Confirmation Number:	7189
Title of Invention:	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES
First Named Inventor/Applicant Name:	I-Lung HO
Customer Number:	27543
Filer:	Kenneth M. Thompson/April Davis
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Filing Date:	
Time Stamp:	11:54:54
Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	PAT266_001US_ADS.pdf	1822713	no	9
			1e762d3bff092650fb641a195171af49a81cc68b		

Warnings:

Information:					
2	Power of Attorney	AOI_GENERAL_POA.pdf	37470	no	1
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Warnings:					
Information:					
3	Oath or Declaration filed	PAT266_001US_DECLARATION _executed.pdf	723428	no	2
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	Document Description		Start	End	
	Specification		1	13	
	Claims		14	17	
	Abstract		18	18	
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5	Drawings-only black and white line drawings	PAT266_001US_Drawings_asfil ed.pdf	795991	no	4
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Information:					
Total Files Size (in bytes):			3521693		

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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.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	PAT266-001US
		Application Number	
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		
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	
	-Lung		HO		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Sugar Land	State/Province	TX	Country of Residence	US

Mailing Address of Inventor:

Address 1	225 Fluor Daniel Drive, #7201				
Address 2					
City	Sugar Land	State/Province	TX		
Postal Code	77679	Country	US		

Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Kevin		LIU		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Houston	State/Province	TX	Country of Residence	US

Mailing Address of Inventor:

Address 1	3230 S. Gressner Rd., Apt. 606				
Address 2					
City	Houston	State/Province	TX		
Postal Code	77063	Country	US		

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		PAT266-001US	
		Application Number			
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES				
City	Stafford	State/Province	TX	Country of Residence	US
Mailing Address of Inventor:					
Address 1	12250 South Kirkwood Rd., Apt. 1535				
Address 2					
City	Stafford	State/Province	TX		
Postal Code	77477	Country	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	27543		
Email Address	kcarroll@gtp.com	Add Email	Remove Email

Application Information:

Title of the Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		
Attorney Docket Number	PAT266-001US	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	4	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	PAT266-001US
		Application Number	
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		

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.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	27543		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim 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.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
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 priority to a foreign application. 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. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
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	PAT266-001US
		Application Number	
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.	
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	PAT266-001US
	Application Number	
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is 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 State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	PAT266-001US
		Application Number	
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		

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	Remove
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. Clear		
☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
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 Applicant is an Organization check here. ☒		
Organization Name	Applied Optoelectronics, Inc.	
Mailing Address Information For Applicant:		
Address 1	13139 Jess Pirtle Blvd.	
Address 2		
City	Sugar Land	State/Province TX
Country	US	Postal Code 77478
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee 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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	PAT266-001US
		Application Number	
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Kenneth M. Thompson/		Date (YYYY-MM-DD)	2018-04-26
First Name	Kenneth M.	Last Name	Thompson	Registration Number
				72001
Additional Signature may be generated within this form by selecting the Add button.				Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	PAT266-001US
		Application Number	
Title of Invention	TRANSMITTER OPTICAL SUBASSEMBLY WITH TRACE ROUTING TO PROVIDE ELECTRICAL ISOLATION BETWEEN POWER AND RF TRACES		

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

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).
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 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.

SCORE Placeholder Sheet for IFW Content

Application Number: 15963246

Document Date: 04/26/2018

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

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