

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CAMBRIDGE INDUSTRIES USA INC.,
Petitioner

v.

APPLIED OPTOELECTRONICS, INC.,
Patent Owner

Case No. IPR2025-00437
U.S. Patent No. 10,788,690

**DECLARATION OF DR. ANDREW G. KIRK IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 10,788,690**

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TABLE OF EXHIBITS

Exhibit	Short Name	Description
Ex. 1001	'690 Patent	U.S. Patent No. 10,788,690
Ex. 1002	'690 Patent File History	File History of U.S. Patent No. 10,788,690
Ex. 1003	Kirk Declaration	Expert Declaration of Dr. Andrew G. Kirk
Ex. 1004	Kirk CV	<i>Curriculum Vitae</i> of Dr. Andrew G. Kirk
Ex. 1005	Wang	Chinese Patent No. 208421455U
Ex.1006	—	Wang English translation
Ex. 1007	Hata	U.S. Patent App. Pub. No. US 2003/0053208 A1
Ex. 1008	Xiong	U.S. Patent No. 9,563,073
Ex. 1009	Yoshie	U.S. Patent App. Pub. No. US 2010/0002988A1
Ex. 1010	Ye	U.S. Patent App. Pub. No. US 2014/0146389A1
Ex. 1011	Scheduling Order	Doc. No. 30, Scheduling Order, <i>Applied Optoelectronics, Inc. v. Cambridge Industries USA, Inc.</i> , No. 3:24-cv-01010-JD (N.D. Cal.)

I, Andrew G. Kirk, do hereby declare and say as follows:

I. Introduction

1. My name is Dr. Andrew G. Kirk, and I have been retained as a technical expert by counsel for Petitioner Cambridge Industries USA Inc. (“CIG USA”) to address certain issues regarding U.S. Patent No. 10,788,690 (“the ’690 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owner’s expert(s) in this matter.

7. I am being compensated at my usual consulting rate of \$400 per hour for my time spent working on issues in this matter. My compensation does not

depend on the outcome of this matter or the opinions I express.

II. Qualifications

8. A true and correct copy of my curriculum vitae is submitted herewith as Ex. 1004.

9. I have over 30 years of experience in communications and signal processing. I am currently a Professor in the Department of Electrical & Computer Engineering, Photonics Systems Group, at McGill University in Montreal, Canada. I graduated with Honors from University of Bristol, United Kingdom in 1989 with an B.Sc. in Physics and went on to receive a Ph.D. from King's College, London, in 1992 in Physics. The title of my thesis was "Diffractive optical elements within parallel optical systems." I conducted Post-Doctoral research in reconfigurable optical interconnects for parallel processing applications at the University of Tokyo as a JGF Research Fellow and in design, analysis, and packaging of parallel optical interconnects in an HCM Fellowship at Vrije Universiteit Belgium, Brussels.

10. In 1996, I joined McGill University as an Assistant Professor in the Department of Electrical and Computer Engineering, and in 2002, I was promoted to Associate Professor.

11. In 2006, I became Associate Dean for Research and Graduate Education, Faculty of Engineering, and in 2011, was promoted to Professor in the Department of Electrical and Computer Engineering. My teaching responsibilities

include courses in fiber-optic communications, free-space optical systems, optoelectronics, quantum optics, thermodynamics and professional engineering.

12. I was awarded a William Dawson Scholar research chair by McGill in 2000, which was renewed in 2005. In 2011, I was appointed as a James McGill Professor (term ended in 2018). I was appointed as Department Chair in 2011 and again from 2013 to 2018 and served as Dean of the Faculty of Engineering (in an Interim position from 2011-2013). I have obtained academic appointments as a Visiting Researcher at the University of Glasgow (UK), University of Sydney (Australia), Universidad Politécnica de Valencia (Spain) and Lady Davis Institute of the Jewish General Hospital, Montreal.

13. My responsibilities as a member of the Photonics Systems Group included leading a \$800,000 research program involving approximately 5 faculty members and supervising 6 doctoral and post-doctoral students.

14. In addition to the activities, education, and professional experience listed above, I have been involved in several research projects that contribute to my expertise relating to fiber-optic communications.

15. I have received numerous awards such as James McGill Professor, the William and Reah Seath Award for Engineering Innovation and the NSERC Synergy Award (as part of a team). I am a Member of the SYTACom Research Center. I have contributed to advances in the design of integrated optical

wavelength demultiplexers and switches, to microelectromechanical optical systems, optical sensor devices and signal processing for optical sensors.

16. My research interests include passive and active components for fiber-optic communications systems, optical packaging techniques and optical sensor devices. I have extensive experience researching and teaching about optics and photonics, optical signal processing and packaging. I also have experience with optical transceiver modules, including pluggable-type modules.

17. To date, I have published book chapters on optical Interconnects and reviews in the area of fiber optic communications systems. In addition, I have published more than 150 papers in conference proceedings and more than 100 peer-reviewed journal papers. I am also a named inventor on three patents relating to fiber-optic components.

18. I have previously consulted for several major companies in the field of optical fiber communications technology, including Nortel, JDSU, Corning and Accelight Networks.

19. Through my work, I have earned the respect of the optical communication and electrical engineering community more broadly. I served as an Elected Member of the Board of Governors of the IEEE Photonics Society and as Chair of the IEEE Photonics Society Nanotechnology Committee. I have served as Board Member for several technical organizations including PROMPT-Quebec,

CQRDA and CRIAQ.

III. Scope of the Engagement

20. I have been retained by Eversheds Sutherland (US) LLP on behalf of CIG USA to provide various analyses and opinions. Among other tasks, I have been asked to address the technology claimed in the '690 Patent and to evaluate whether certain claims of the '690 Patent would have been regarded as lacking novelty or would have been obvious to a person of ordinary skill in the art.

21. All of the opinions I express in this Declaration have been made from the standpoint of a person of ordinary skill in the relevant art at the time of the invention of the '690 Patent, which I am informed is, for purposes of the '690 Patent, January 25, 2019.

22. I have been asked to identify the level of skill in the art pertinent to the '690 Patent. It is my opinion that a person of ordinary skill in the art pertinent to the '690 Patent would have had at least a bachelor's degree in electrical engineering, computer engineering, networking, or similar discipline and had approximately two years of experience with optical data communications and networks or a similar field of work. Additional graduate education might substitute for experience. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background. Such a POSITA would have had knowledge of

design considerations known in the optical industry and would have been familiar with then-existing products and solutions and would have understood how to search available literature for relevant publications.

23. A POSITA in January 2019 would have been familiar with MSA optical modules, including SFP and XFP formats. The '690 Patent concerns itself with communications and networking in optical systems, and the technologies that enable them, as well as the miniaturization of those technologies into what are commonly known as Small Form-Factor Pluggable (SFP) module. Thus, a POSITA in January 2019 would have been familiar with both communications networking technology as well as optoelectronic devices.

24. I consider myself a person of ordinary skill in the art as of at least the earliest claimed priority date (January 2019), and for many years before that.

25. My opinions regarding the level of ordinary skill in the art are based on, among other things, my more than 30 years of experience in optical networks and components therefor, my understanding of the basic qualifications that would be relevant to an engineer or scientist tasked with investigating optical networks and components therefor, my knowledge and experience with the capabilities of such systems by 2019, and my familiarity with the backgrounds of colleagues, both past and present. Although my qualifications and experience exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and

opinions regarding the '690 Patent have been based on the perspective of a person of ordinary skill in the art as of around January 2019. I am able to take on that perspective based on my experience as I have worked with individuals who had this level of experience in the 2019-time frame and am familiar with their level of knowledge.

26. My opinions are also based on the information I have reviewed as of the date of this Declaration. In connection with my analysis, I have reviewed the exhibits listed in the above list of exhibits, as well as each of the items referenced herein. I attest that the foregoing exhibits are true and accurate copies that I downloaded. My opinions directed to the invalidity of the challenged claims are based, at least in part, on the following patents and publications:

- **“Wang”** Ex. 1005, which is Chinese Patent No. CN 208421455U (“Wang”), was filed on July 20, 2018, and issued on January 22, 2019. Ex. 1006 is an English language translation of Wang.

- **“Hata”** Ex. 1007, which is U.S. Patent Application Publication No. 2014/0140665 A1, was filed on September 12, 2002, and published on March 20, 2003. I rely on this reference as additional evidence that it was well known in the field of optical communications, many years before the application for the '690 Patent was filed, to provide angled junctions at optical interfaces to reduce back reflection.

- “Xiong” Ex. 1008, which is U.S. Patent No. 9,563,073, was filed on June 27, 2014, and issued on February 7, 2017.

IV. Legal Standards

27. For purposes of this Declaration, counsel for CIG USA have instructed me to make the following assumptions:

28. Claims are construed from the perspective of a person of ordinary skill in the art (“POSITA”) as of the effective filing date of the patent application. Persons of ordinary skill in the art are deemed to read the claims in the context of the entire patent, including the specification and prosecution history. In other words, the terms are not considered in a vacuum.

29. It is my understanding that information that satisfies one of the categories of prior art set forth in 35 U.S.C. § 102 may be used in an invalidity analysis under §§ 102 or 103. If information is not properly classified as prior art under one of the subsections of § 102 of the Patent Act, then it may not form the basis of an anticipation or obviousness determination. It is also my understanding that, for *inter partes* review, applicable prior art is limited to patents and printed publications.

30. I am informed and understand that a patent claim is invalid under 35 U.S.C. § 102 if a single item of prior art discloses all of the limitations set forth in a patent claim, arranged as set forth in the claim. I understand that a POSITA may

take into account technical knowledge that would have been well known to those of skill in the relevant art when considering the disclosures of a patent and that applying such knowledge to the disclosure of a reference still qualifies as anticipation. I understand from counsel that this is sometimes referred to as “single reference obviousness,” but in this case the motivation to combine comes from the single reference itself when properly interpreted by those of skill in the art.

31. I am also informed that a patent claim is invalid under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a POSITA to which the subject matter pertains. Obviousness, I am informed, is determined based on the scope and content of the prior art, the differences between the prior art and the claim, the level of ordinary skill in the art, and secondary indications of non-obviousness to the extent they exist.

32. I understand that whether there are any relevant differences between the prior art and the claimed invention is to be analyzed from the view of a POSITA at the time of the invention. A POSITA is a hypothetical person who is presumed to be aware of all of the relevant art at the time of the invention. The POSITA is not an automaton and may be able to fit together the teachings of multiple patents (or other printed publications) by employing ordinary creativity and the common sense that familiar items may have obvious uses in another context or beyond their

primary purposes.

33. In analyzing the relevance of the differences between the claimed invention and the prior art, I understand that I must consider the impact, if any, of such differences on the obviousness or non-obviousness of the invention as a whole, not merely some portion of it. The POSITA faced with a problem is able to apply his or her experience and ability to solve the problem and also look to any available prior art to help solve the problem.

34. I understand that an invention would have been obvious if a POSITA, facing the wide range of needs created by developments in the field, would have seen an obvious benefit to the solutions tried by the patent applicant. When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, it would have been obvious to a POSITA to try the known options. If a technique has been used to improve one device, and a POSITA would recognize that it would improve similar devices in the same way, using the technique would have been obvious.

35. I understand that I do not need to look for precise teachings in the prior art directed to the subject matter of the claimed invention. I understand that I may consider the inferences and creative steps that a POSITA would have employed in reviewing the prior art at the time of the invention. For example, if the claimed invention combines elements that were known in the prior art and if the combination

yields results that were predictable to a POSITA at the time of the invention, then this would make it more likely that the claim was obvious. On the other hand, if the combination of known elements yields unexpected or unpredictable results, or if the prior art teaches away from combining the known elements, then this would make it more likely that the claim that successfully combined those elements was not obvious. I understand that hindsight must not be used when comparing the prior art to the invention during an obviousness analysis.

36. I understand that obviousness may be shown by demonstrating that it would have been obvious to modify what is taught in a single piece of prior art to create the patented invention. Obviousness may also be shown by demonstrating that it would have been obvious to combine the teachings of more than one item of prior art. I understand that a claimed invention may be obvious if some teaching, suggestion, or motivation exists that would have led a POSITA to combine the invalidating references. I also understand that this suggestion or motivation may come from sources such as explicit statements in the prior art, or from the knowledge of a POSITA. Alternatively, any need or problem known in the field at the time and addressed by the patent may provide a reason for combining elements of the prior art. I also understand that when there is a design need or market pressure, and there are a finite number of predictable solutions, persons of ordinary skill may be motivated to apply both their skill and common sense in trying to combine the known

options in order to solve the problem.

37. I understand that absent evidence of an invention date prior to the filing date of a patent, the invention date of the patent is presumed to be its filing date. A prior invention requires a complete conception of the invention and a reduction to practice of that invention. The patent owner has the burden of establishing by clear and convincing evidence a date of conception earlier than the filing date of the patent.

V. Technical Background

38. In this technical background, I describe the pertinent technology as it existed as of January 2019, the earliest alleged priority date of the '690 Patent.

39. Optical transceivers are optical data communication modules used to facilitate high-speed transmission and receipt of optical signals in a range of applications (e.g., high-speed internet and broadband television). *See* Ex. 1001, 1:15–21. Optical transceivers generally include optical subassembly modules such as TOSAs and/or ROSAs. *See id.*, 1:29–35. Components of such optical subassembly modules typically include arrays of optical isolators configured to optically communicate with other components of the optical transceivers, such as laser diodes of TOSAs or photodiodes of ROSAs, within the optical circuits.

40. Optical communications circuits often have limited usable space available. Consequently, optical circuit component designs seek to optimize the

dimensions of such circuit components. Moreover, given the precise nature of underlying optical data communications, optical subassembly modules and their respective components (e.g., optical isolator arrays) are typically designed and arranged to minimize the extent to which individual component adjustments are required and to facilitate propagation of light in preferred directions with high accuracy. *Id.*

41. Optical isolators and associated components use magnetic fields, for example, generated by magnetic materials, to propagate light incident to the optical isolators in a preferred direction with predictable results. *See generally*, Ex. 1009, ¶ [0018]; Ex. 1010, ¶ [0010]. As was understood by POSITAs in the field of optical communications, transmission and receipt of optical data requires reliable and uninterrupted optical signal transmission. It was well-known to POSITAs in the field of optical communications in January 2019 that magnetic fields could be used to orient light propagation in preferred directions (e.g., by utilizing the Faraday effect) and to prevent back reflections that could damages the lasers. *See* Ex. 1009, ¶ [0002]. POSITAs also understood that the magnetic fields needed for such purposes could readily be generated by permanent magnetic materials. *Id.*

42. Prior to the filing of the '690 Patent, optical transceivers including transmitter optical subassembly (“TOSA”) and/or receiver optical subassembly (“ROSA”) modules also were well-known to persons of ordinary skill in the art

(“POSITAs”) of optical data communications. Ex. 1008, 1:17-36. Such optical subassembly modules typically included optical isolators arranged to optically communicate with various other components (e.g., lasers or photodiodes) of the optical subassembly modules or their respective associated optical transceivers. *Id.*

43. The design of each such optical subassembly module (including the mounting and arrangement of optical isolators and other associated components) generally was selected to optimize the form factor of the module while minimizing the number of adjustments required to install the module in an optical component. For example, an array of optical isolators could be secured in a compact arrangement on a modular base, thus reducing the number of adjustments needed to align the optical isolators with respect to other optical components when available space is limited (e.g., by the physical volume of a transceiver housing).

VI. The '690 Patent

44. The '690 Patent describes and claims an optical isolator array for use in an optical subassembly module (e.g., a TOSA of an optical transceiver). *See* Ex. 1001, Abstract. The optical isolator array includes a magnetic base to support a plurality of optical isolators, which are secured by an adhesive in a predefined arrangement relative to one another, to thereby facilitate alignment with respect to other components of the associated optical transceiver. *See* Ex. 1001, 3:4–35.

45. In particular, the '690 Patent describes “an optical isolator array with

a magnetic base that allows for mounting and alignment of N number of optical isolator[] modules within an optical subassembly module.” *Id.*, Abstract. Further, “the magnetic base provides at least one mounting surface for coupling to N number of optical isolators, with N being equal to an optical channel count for the optical subassembly (e.g., 4-channels, 8-channels, and so on).” *Id.*

46. The magnetic base has a preferred number of optical isolators mounted thereon and “uniformly disposed along the same axis on the magnetic base and at a distance D from adjacent optical isolators.” *Id.* The optical isolators are secured to the magnetic base in a predefined arrangement by “[a]n adhesive such as ultraviolet-curing (UV-curing) optical adhesives.” *Id.* Arranging the optical isolators on the magnetic base in this manner provides for “a relatively compact and modular profile that supports N number of optical isolators for use in an optical subassembly module.” *Id.*, 1:9–11.

47. No specific material compositions or characteristics for the opto-isolator components are specified in the claims of the ’690 Patent, other than that the mounting surface comprise a magnetic material and that the optical components be glued in place.

48. As I will demonstrate below, the ’690 Patent is directed to structures that were well-known to POSITAs in the optical communications field at the time of the alleged invention of the ’690 Patent. Moreover, the use of such devices in

optical communication components also was well known, prior to January 2019.

VII. Prosecution History

49. Patent Owner Patent Owner filed U.S. Patent Application No. 16/257,635 (the “’635 Application”) on January 25, 2019. *See* Ex. 1002, p. 35.

50. Prior to issuance of a substantive Office action, an Examiner-Initiated Interview was conducted on June 30, 2020, during which the Patent Examiner proposed an Examiner’s Amendment to correct dependent application claims 8 and 17, such that each claim would recite “substrate mating surface” rather than “substrate mounting surface.” Ex. 1002, pp. 21-22. Patent Owner’s representative agreed to those proposed Examiner’s Amendments. *Id.*

51. A Notice of Allowance was mailed on July 8, 2020, and included a Notice of Allowability. The Notice of Allowability referenced the June 30, 2020, Examiner’s Interview and incorporated the Examiner’s Amendment discussed during the June 30, 2019 telephone interview. With respect to independent Claim 1, the Notice of Allowability further stated (*Id.*, p. 15):

[T]he prior art of record does not disclose or suggest an optical isolator array for use in an optical subassembly module, an optical isolator array for use in an optical subassembly module comprising a plurality of optical isolators mounted to the at least one mounting surface, each of the plurality of optical isolators disposed substantially in parallel relative to each other; and at least one layer of adhesive disposed on the at least one mounting surface to couple the plurality of optical isolators to the first magnetic base and to hold each optical isolator of the plurality of optical isolators at a predefined position relative to each other, along with other claim limitations.

52. Regarding independent Claim 11, the Notice of Allowability stated (*Id.*, p. 16):

[T]he prior art of record does not disclose or suggest an optical transceiver, the optical transceiver comprising, a transceiver housing; at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing, the at least one TOSA arrangement comprising, a substrate defined by at least one mounting surface; a plurality of laser diodes mounted to the at least one mounting surface of the substrate, each laser diode of the plurality of laser diodes to emit a different associated channel wavelength along a corresponding light path of a plurality of light paths; and an optical isolator array mounted to the at least one mounting surface adjacent the plurality of laser diodes such that the plurality of light paths intersect with the optical isolator array, the optical isolator array comprising a plurality of optical isolators coupled thereto, and wherein each optical isolator is optically aligned with a corresponding laser diode of the plurality of laser diodes via a corresponding light path; an optical receiver subassembly (ROSA) disposed in the transceiver housing, along with other claim limitations.

53. The remaining dependent claims were allowed due to their respective dependencies from independent Claims 1 or 11. *Id.*, pp. 15-17.

54. The Notice of Allowability cited two prior art references: Yoshie et al., US Patent Application Publication US 2010/0002988A1 and Ye, US Patent Application Publication US 2014/0146389A1. Ex. 1002, pp. 15-16, 22. The Examiner noted that neither Yoshie nor Ye teaches an optical isolator array as recited in Claim 1 or an optical transceiver as recited in Claim 11. *Id.* Instead, Yoshie and Ye each discloses structure for a *single* opto-isolator, not an array of such structures having a common mounting surface. *See generally*, Exs. 1009, 1010.

55. The Issue Fee was submitted on August 25, 2020, *id.*, pp. 2-6, and the '690 Patent issued on September 29, 2020, *id.*, 1.

56. I have been asked to evaluate Claims 1-19 of the '690 Patent. I have reproduced these challenged claims below:

Claim	Recitation
[1a]	An optical isolator array for use in an optical subassembly module, the optical isolator array comprising:
[1b]	a first magnetic base defining at least one mounting surface;
[1c]	a plurality of optical isolators mounted to the at least one mounting surface, each of the plurality of optical isolators disposed substantially in parallel relative to each other; and
[1d]	at least one layer of adhesive disposed on the at least one mounting surface to couple the plurality of optical isolators to the first magnetic base and to hold each optical isolator of the plurality of optical isolators at a predefined position relative to each other.
2	The optical isolator array of claim 1, wherein the magnetic base is formed from a permanent magnet.
3	The optical isolator array of claim 1, wherein the magnetic base introduces a first magnetic field that intersects with the plurality of optical isolators to establish a direction of propagation.
4	The optical isolator array of claim 1, wherein each optical isolator of the plurality of optical isolators comprises a Faraday Isolator.
5	The optical isolator array of claim 1, wherein each optical isolator of the plurality of optical isolators includes an angled light-receiving surface to receive channel wavelengths from an associated laser diode.
6	The optical isolator array of claim 1, wherein the plurality of optical isolators is disposed uniformly across the at least one mounting surface.
7	The optical isolator array of claim 1, wherein the at least one layer of adhesive is disposed between adjacent optical isolators of the plurality of optical isolators.

Claim	Recitation
8	The optical isolator array of claim 1, wherein the magnetic base includes a substrate mating surface, and whereby the substrate mating surface is substantially flat to correspond with a mounting surface of a substrate and to mount thereto.
9	The optical isolator array of claim 1, further comprising a second magnetic base, the second magnetic base being coupled to the plurality of optical isolators via the at least one layer of adhesive.
10	The optical isolator array of claim 9, wherein the second magnetic base introduces a second magnetic field, the second magnetic field intersecting with the plurality of optical isolators.
[11a]	An optical transceiver, the optical transceiver comprising:
[11b]	a transceiver housing;
[11c]	at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing, the at least one TOSA arrangement comprising:
[11d]	a substrate defined by at least one mounting surface;
[11e]	a plurality of laser diodes mounted to the at least one mounting surface of the substrate, each laser diode of the plurality of laser diodes to emit a different associated channel wavelength along a corresponding light path of a plurality of light paths; and
[11f]	an optical isolator array mounted to the at least one mounting surface adjacent the plurality of laser diodes such that the plurality of light paths intersect with the optical isolator array, the optical isolator array comprising a at least a first magnetic base and a plurality of optical isolators coupled thereto, and wherein each optical isolator is optically aligned with a corresponding laser diode of the plurality of laser diodes via a corresponding light path;
[11g]	an optical receiver subassembly (ROSA) disposed in the transceiver housing.

Claim	Recitation
12	The optical transceiver of claim 11, wherein the first magnetic base of the optical isolator array is formed from a permanent magnet.
13	The optical transceiver of claim 11, wherein the first magnetic base introduces a first magnetic field that intersects with the plurality of optical isolators to establish a direction of propagation.
14	The optical transceiver of claim 11, wherein each optical isolator of the plurality of optical isolators includes an angled light-receiving surface to receive channel wavelengths from a corresponding laser diode of the plurality of laser diodes.
15	The optical transceiver of claim 11, wherein the plurality of optical isolators is disposed uniformly across the at least one mounting surface.
16	The optical transceiver of claim 11, wherein at least one layer of adhesive is disposed between adjacent optical isolators of the plurality of optical isolators.
17	The optical transceiver of claim 11, wherein the first magnetic base includes a substrate mating surface, and whereby the substrate mating surface is substantially flat to correspond with the mounting surface of a substrate to mount thereto.
18	The optical transceiver of claim 11, further comprising a second magnetic base, the second magnetic base being coupled to the plurality of optical isolators and the first magnetic base via at least one layer of adhesive.
19	The optical transceiver of claim 18, wherein the second magnetic base introduces a second magnetic field, the second magnetic field intersecting with the plurality of optical isolators.

VIII. Claim Construction

57. I am informed by counsel for CIG USA that in an *Inter Partes Review*, claims should be construed “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. §282(b).” 37 C.F.R.

§42.100(b) (Nov. 13, 2018). And unless otherwise specified in the patent under review, the terms should receive their respective plain and ordinary meaning as understood by a person of ordinary skill in the art under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005).

58. It is my opinion that the terms used in the claims of the '690 Patent are self-explanatory and would have been recognized by a POSITA as having plain and ordinary meanings. It is also my view that the claim terms are understandable in the context of the disclosure provided in the specification of the '690 Patent, and thus no special constructions are required.

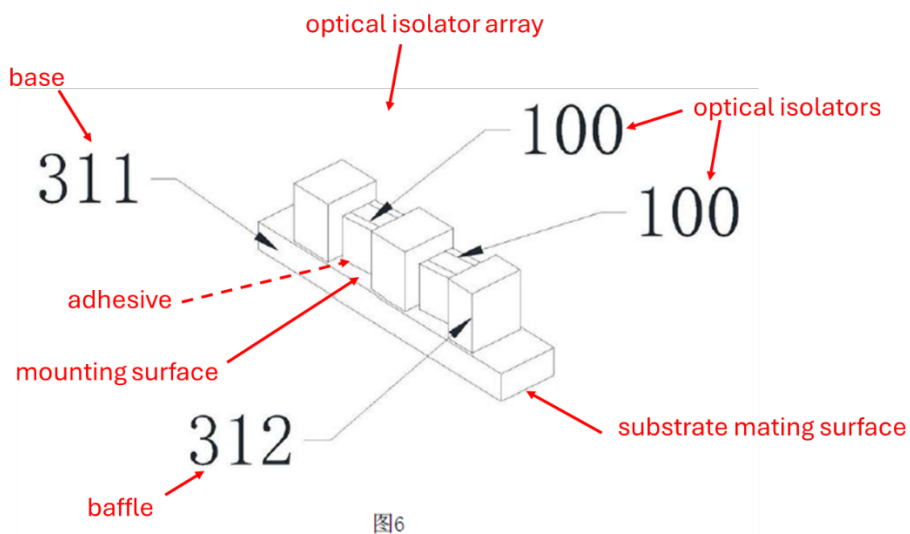
IX. Prior Art References

a. Wang Overview

59. Wang was filed on July 20, 2018, and issued on January 22, 2019. Wang qualifies as prior art under at least AIA 35 U.S.C. § 102(a)(1). Wang was neither cited nor considered during prosecution of the '635 Application that matured as the '690 Patent.

60. Wang teaches a multichannel optical isolator array that solves space limitation and assembly difficulty problems when free space isolators need to be used for multi-channel optical components. *See* Ex. 1005, FIGS. 5-10; Ex. 1006, ¶¶ [0008]-[0011] Specifically, the multi-channel isolator comprises a substrate with multiple channels and a plurality of isolators disposed in the respective

channels, wherein each opto-isolator includes a polarizer, a Faraday plate, and an analyzer disposed in sequence. Ex. 1005, FIG. 1; Ex. 1006, ¶¶ [0037]-[0039]. All or part of the substrate is made of a magnetic material that can generate a magnetic field. Ex. 1005; Ex. 1006, ¶¶ [0012], [0040]. Further, Wang teaches that the optical isolators are bonded to the substrate by adhesive. *Id.*, ¶¶ [0013]-[0014]. The multi-channel opto-isolator therefore reduces the overall space requirement of the component, improves spacing accuracy between the isolators, and simplifies assembly. *Id.*, ¶ [0021]. A first exemplary embodiment, as depicted in FIG. 6 of Wang is reproduced below.

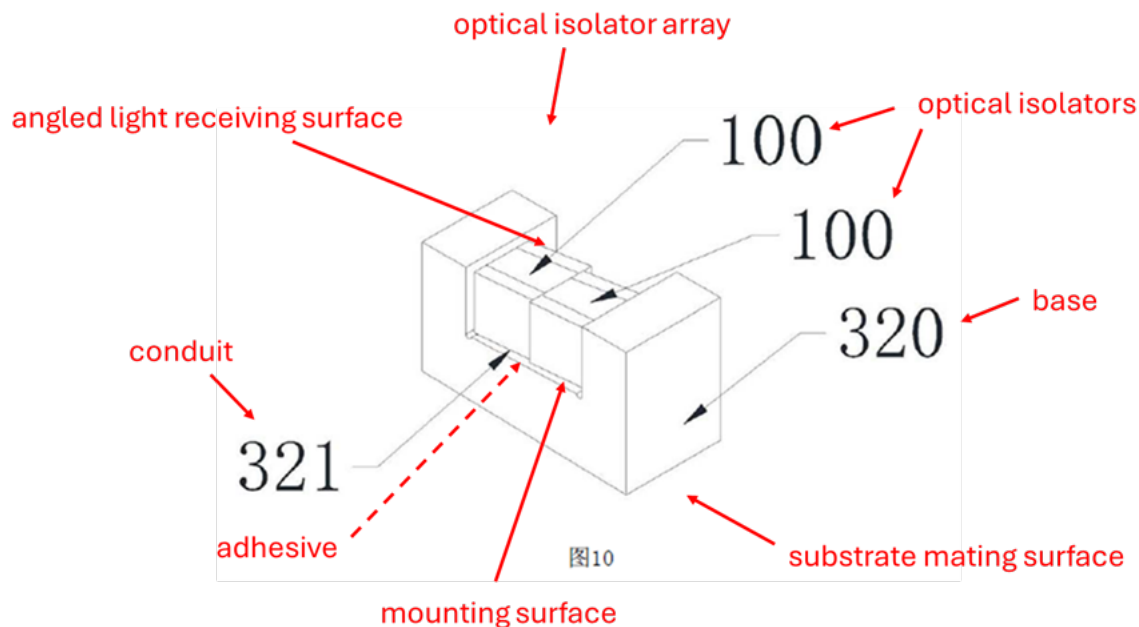


Ex. 1005, FIG. 6 (annotated)

61. The substrate disclosed in Wang includes a base that defines at least one mounting surface for the optical isolator array. Ex. 1005, FIGS. 6, 8, 10; Ex. 1006, ¶¶ [0014], [0040]. The multiple optical isolators are bonded to the base, in

between baffles, by adhesive in a substantially parallel arrangement relative to each other, such that the adhesive fills any gaps between the optical components and the substrate to control accuracy of the positioning of the isolators. Ex. 1005, FIGS. 6, 8, 10; Ex. 1006, ¶¶ [0041], [0043].

62. As would be understood by a POSITA in January 2019, Wang discloses that the magnetic base is formed from a magnetic material capable of producing a magnetic field that intersects with the optical isolators to establish a direction of propagation, defined in part by polarizing film of each optical isolator. Ex. 1005, FIGS. 1, 6; Ex. 1006, ¶¶ [0019], [0038]. Each optical isolator may further include a Faraday rotator. Ex. 1005, FIGS. 1, 6; Ex. 1006, ¶¶ [0042].



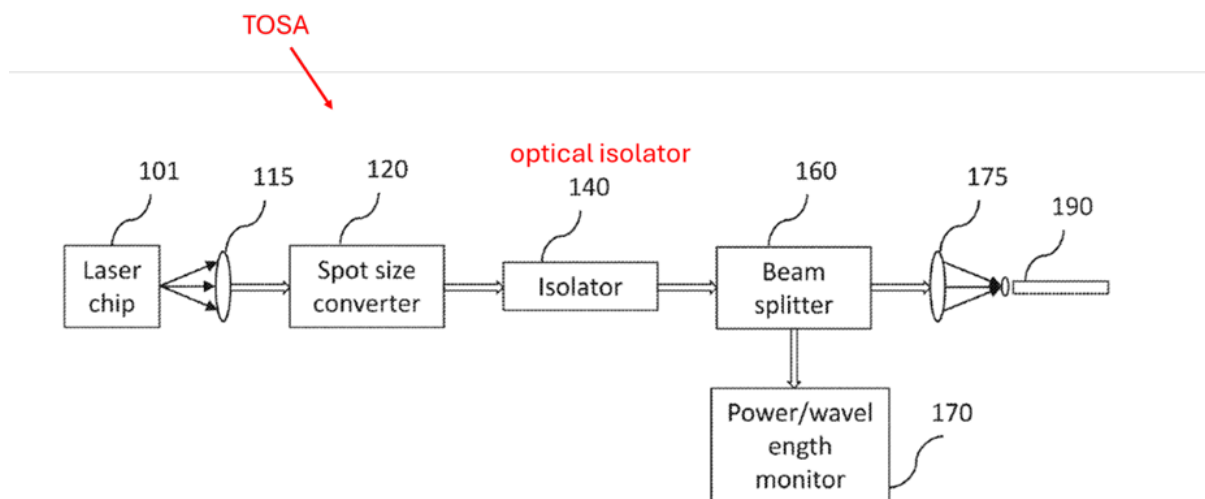
Ex. 1005, FIG. 10 (annotated)

63. As illustrated in FIG. 10 of Wang, reproduced above, the angled light receiving faces of the opto-isolators may be disposed at an angle to the incident light received from the lasers employed in the optical component into which the multi-channel opto-isolator of Wang is assembled.

b. Xiong Overview

64. Xiong, U.S. Patent No. 9,563,073, Ex. 1008 was filed on June 27, 2014, and issued on February 7, 2017. Xiong qualifies as prior art under at least AIA 35 U.S.C. § 102(a)(1). Xiong was neither cited nor considered during prosecution of the '635 Application that matured into the '690 Patent.

65. Xiong teaches “[a]n integrated and compact multifunctional optical isolator” that is “suitable for use in a TOSA” of an optical transceiver, which may further include a ROSA. *See* Ex. 1008, Abstract, 1:17–23. FIG. 1 of Xiong is reproduced below.



Ex. 1008, FIG. 1 (annotated)

66. In Xiong, the optical isolator of the TOSA “includes input optics including a first polarizer, a Faraday rotator, and a second polarizer” and utilizes magnetism (via the Faraday effect) to direct incident light passing through the TOSA arrangement. *Id.*, Abstract, 8:28-42, 10:50-64.

67. Xiong describes an optical transceiver including a TOSA and a ROSA. *Id.*, FIG. 1, 1:17-23. As further described in Xiong, a TOSA includes a number of laser diodes that are each designed to emit a different associated channel wavelength along a corresponding light path. *Id.*, 1:24-65, 6:66-7:3. The TOSA is described as including at least one optical isolator, optically aligned with a corresponding laser diode via the corresponding light path, which utilizes the Faraday effect to propagate incident light in a preferred direction. *Id.*, FIG. 7a, 1:24-65, 6:66-7:3, 8:22-42.

c. The Prior Art Herein Relates to Multi-Channel Devices

68. The prior art references analyzed herein are different than those cited and considered by the Patent Examiner during the prosecution of the '690 Patent. The primary references cited by the Examiner during prosecution — U.S. Patent App. Pub. No. US 2010/0002988 (“Yoshie”) and U.S. Patent App. Pub. No. US 2014/0146389 (“Ye”) — are directed to a single optical isolators.

69. By contrast, the references I address herein relate to optical isolators for use in multi-wavelength devices. The principal reference relied upon, Wang,

discloses an optical isolator **array** for use in a multi-wavelength optical subassembly module (e.g., a TOSA module of an optical transceiver). As such, the prior art references cited herein provide the same benefits of space-saving, ease of assembly, and alignment, as attributed to the device of the '690 Patent, whereas, during prosecution of the '635 Application, none of the references made of record disclosed an optical isolator array.

70. I understand that despite owning many earlier patents relating to optical transceivers that include TOSA and ROSA modules, the Patent Owner did not submit for the Examiner's consideration an Information Disclosure Statement identifying any of those patents during pendency of the application for the '690 Patent. *See* Ex. 1002. Instead, the only two references made of record during prosecution of the '690 Patent were those cited by the Patent Examiner.

X. Grounds

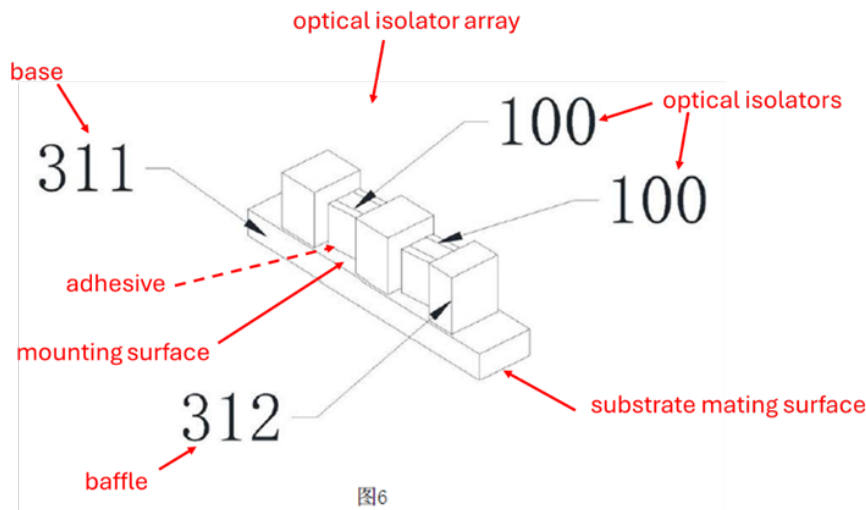
Ground	Reference	Claims
Ground 1	Wang	1-10
Ground 2	Wang in view of Xiong	11-19

a. Ground 1: Wang Anticipates Claims 1-10.

i. Claim 1: [1a] An optical isolator array for use in an optical subassembly module, the optical isolator array comprising:

71. Wang discloses a multichannel optical isolator array that solves space

limitation and assembly difficulty problems when free space isolators need to be used for multi-channel optical components. See Ex. 1005, FIG. 6; Ex. 1006, ¶¶ [0008]-[0011] FIG. 6 of Wang is reproduced below.



Ex. 1005, FIG. 6 (annotated)

ii. Claim 1: [1b] a first magnetic base defining at least one mounting surface;

72. Wang discloses that the multi-channel isolator comprises a substrate that includes a base having multiple channels forming a mounting surface, with a plurality of isolators mounted in the respective channels. Ex. 1005; FIGS. 5-10; Ex. 1006, ¶¶ [0037]-[0039]. Wang further discloses that all or part of the base is made of a magnetic material that can generate a magnetic field. Ex. 1005; Ex. 1006, ¶¶ [0012], [0040].

iii. Claim 1: [1c] a plurality of optical isolators mounted to the at least one mounting surface, each of the plurality of optical isolators disposed substantially in parallel relative to each other; and;

73. Wang discloses that its plurality of optical isolators are mounted on

the base in a substantially parallel arrangement relative to each other with an adhesive, such that the adhesive fills any gaps between the optical components and the base to control accuracy of the positioning of the isolators. Ex. 1005, 1006, ¶¶ [0041], [0043]. Wang teaches that its array achieves a compact product with improved accuracy of spacing between the isolators for multi-channel applications. Ex. 1005; Ex. 1006, ¶¶ [0008]-[0011], [0041], [0043].

iv. Claim 1: [1d] at least one layer of adhesive disposed on the at least one mounting surface to couple the plurality of optical isolators to the first magnetic base and to hold each optical isolator of the plurality of optical isolators at a predefined position relative to each other.

74. Wang teaches that the optical isolators are mounted to the substrate in predefined positions relative to one another by adhesive that holds the isolators in position. Ex. 1005, FIGS. 6, 8, 10; 1006, ¶¶ [0013]-[0014]. In particular, Wang describes that the multiple optical isolators are bonded to the base, in between baffles, by adhesive in a substantially parallel arrangement relative to each other, such that the adhesive fills any gaps between the optical components and the substrate to thereby control accuracy of the positioning of the isolators. Ex. 1005, 1006, ¶¶ [0041], [0043].

75. Accordingly, in my opinion, a POSITA would have understood that Wang anticipates Claim 1.

v. Claim 2: The optical isolator array of claim 1, wherein the magnetic base is formed from a permanent magnet..

76. Wang discloses that the magnetic base is formed from a magnetic material capable of producing a magnetic field. Ex. 1005, FIGS. 1, 6; Ex. 1006, ¶¶ [0019], [0038] Wang further describes that each optical isolator may further include a Faraday rotator. Ex. 1005, FIGS. 1, 6; Ex. 1006, ¶ [0042]. A POSITA would have understood that opto-isolators necessarily require a magnetic field, that Faraday rotators magnets, and the conventional way of obtaining a magnetic field without requiring electric current is by using a permanent magnet. *See, e.g.*, Ex. 1008, 2:5-23 (referring to Faraday rotators); Ex. 1009, ¶¶ [0018], [0023]; Ex. 1010, ¶¶ [0003], [0014]. For the device of Claim 1, *see supra*, Sections X.a.i-iv.

77. In my opinion, a POSITA would have understood that Wang anticipates Claim 2.

vi. Claim 3: The optical isolator array of claim 1, wherein the magnetic base introduces a first magnetic field that intersects with the plurality of optical isolators to establish a direction of propagation

78. Wang further discloses the magnetic base is formed from magnetic material capable of producing a magnetic field that intersects with the optical isolators to establish a direction of propagation defined in part by polarizing film of each optical isolator. Ex. 1005, FIGS. 1, 6; Ex. 1006, ¶¶ [0019], [0038]. In my opinion, a POSITA would have understood that Wang discloses that the magnetic field generated by the base necessarily intersects with the Faraday plate of the optical isolators to establish a direction of propagation. *See, e.g.*, Ex. 1005, FIG. 3

(annotated below); Ex. 1006, ¶¶ [0037]-[0039].

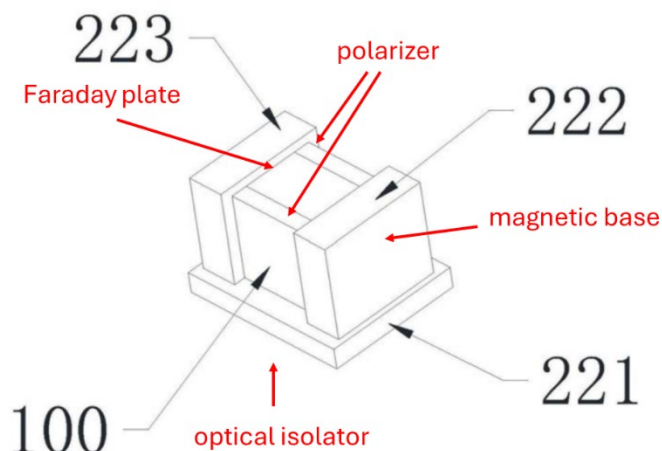


图3

Ex. 1005, FIG. 3 (annotated)

79. Absent such a magnetic field, the isolators simply would not perform their intended function. For the device of Claim 1, *see supra*, Sections X.a.i-iv.

80. In my opinion, a POSITA would have understood that Wang anticipates Claim 3.

vii. Claim 4: The optical isolator array of claim 1, wherein each optical isolator of the plurality of optical isolators comprises a Faraday Isolator.

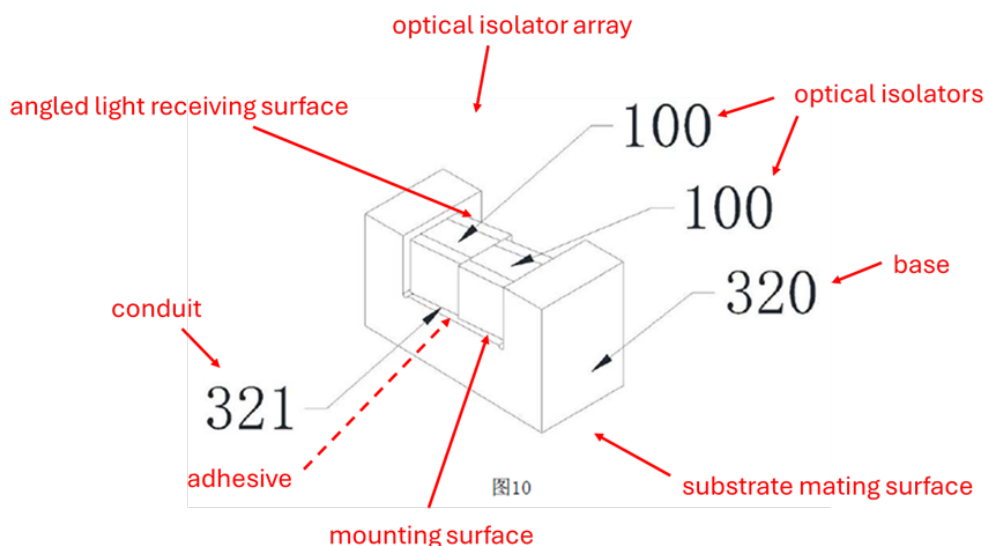
81. As discussed for Claim 3, above, and depicted in FIG. 3, Wang discloses each optical isolator includes a Faraday plate and thus constitutes a Faraday rotator. Ex. 1006, ¶¶ [0019], [0037]-[0039]. For the device of Claim 1, *see supra*, Sections X.a.i-iv.

82. In my opinion, a POSITA would have understood that Wang

anticipates Claim 4.

viii. Claim 5: The optical isolator array of claim 1, wherein each optical isolator of the plurality of optical isolators includes an angled light-receiving surface to receive channel wavelengths from an associated laser diode.

83. Wang discloses each optical isolator includes an angled light-receiving surface to receive channel wavelengths from an associated laser diode. See Ex. 1005, FIG. 10 (reproduced below, showing that the light-receiving surfaces of the isolators 100 are angled relative to the incident light).



Ex. 1005, FIG. 10 (annotated)

84. In my opinion, it was well-known in the field of opto-isolators, and a POSITA would have understood in January 2019, that the light-receiving surfaces of opto-isolators would be angled relative to the incident light to reduce back reflection, although reducing such back reflection was an intended purpose of use of the opto-isolator. Ex. 1007, FIG. 1, ¶ [0084] (describing groove in an optical

isolator that is “inclined at a predetermined angle with respect to [a] light beam axis of [an] optical fiber . . . so as to remove return lights”); *see also* Ex. 1008, 1:62-2:4; Ex. 1009, ¶ [0002]. For the device of Claim 1, *see supra*, Sections X.a.i-iv.

85. In my opinion, a POSITA would have understood that Wang anticipates Claim 5.

ix. Claim 6: The optical isolator array of claim 1, wherein the plurality of optical isolators is disposed uniformly across the at least one mounting surface.

86. Wang discloses the optical isolators are uniformly arranged across the mounting surface(s) of the base (e.g., in one or more channels provided on the base). *See* Ex. 1005, FIGS. 6, 8 (reproduced below), FIG. 10; Ex. 1006, Abstract, ¶¶ [0021], [0044], [0046]. For the device of Claim 1, *see supra*, Sections X.a.i-iv.

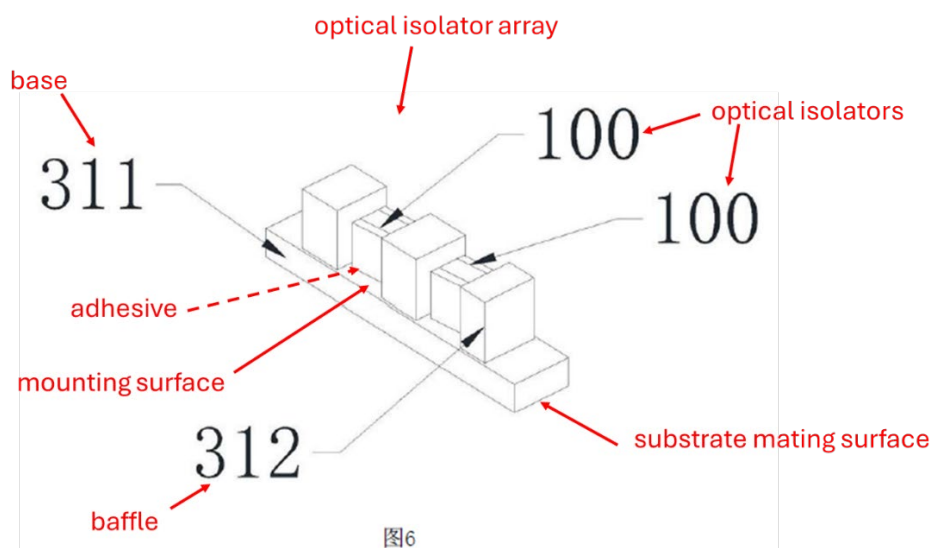


FIG. 1005, FIG. 6 (annotated)

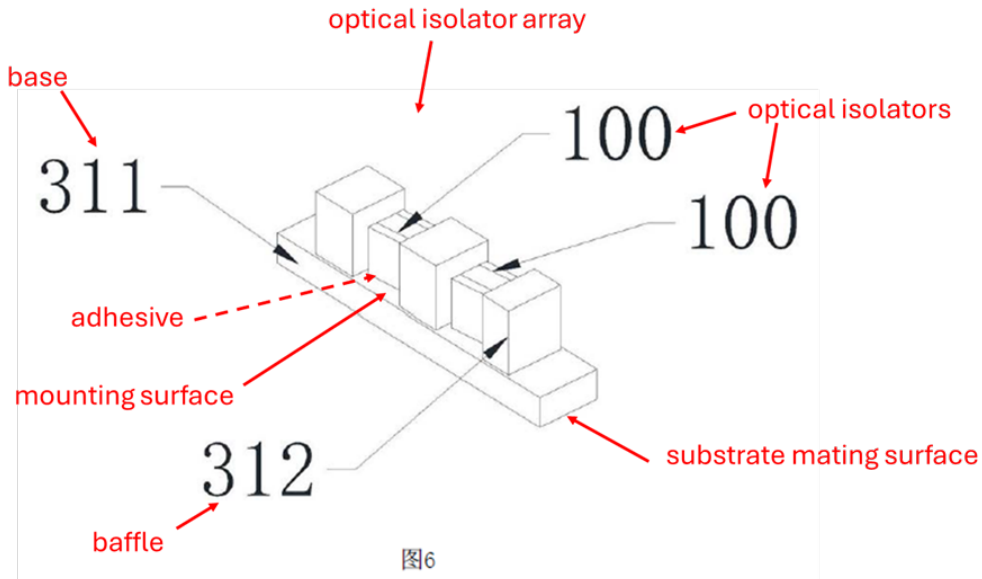


FIG. 1005, Ex. 8 (annotated)

87. Accordingly, in my opinion, a POSITA would have understood that Wang anticipates Claim 6.

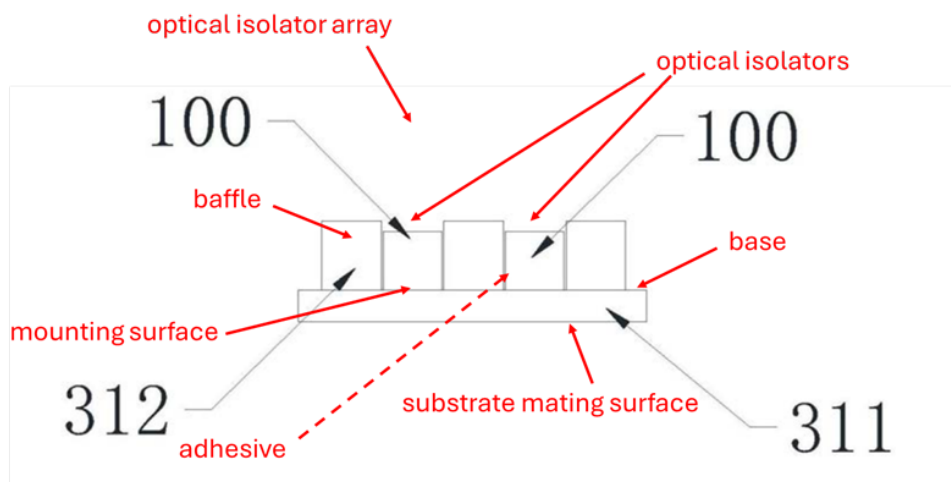
x. Claim 7: The optical isolator array of claim 1, wherein the at least one layer of adhesive is disposed between adjacent optical isolators of the plurality of optical isolators.

88. Wang further discloses the layer(s) of adhesive may be applied between adjacent optical isolators, which may be located within a channel on the base. *See* Ex. 1005, FIGS. 5, 6; Ex. 1006, ¶ [0044] (referring to FIGS. 5 and 6, “The substrate includes a base 311, and baffles 312 and isolators 100 [are] sequentially disposed on the base 311. Any adjacent ones of the baffles 312 and the base 311 form a channel for accommodating the isolator 100. The isolator 100 is separately bonded to the baffles 312 and the base 311 by means of an adhesive.”). For the device of Claim 1, *see supra*, Sections X.a.i-iv.

89. In my opinion, a POSITA would have understood that Wang anticipates Claim 7.

xi. Claim 8: The optical isolator array of claim 1, wherein the magnetic base includes a substrate mating surface, and whereby the substrate mating surface is substantially flat to correspond with a mounting surface of a substrate and to mount thereto.

90. Wang further discloses the magnetic base includes a substantially flat substrate mating surface (e.g., a horizontal lower surface of the substrate), to enable mounting thereof. *See* Ex. 1005, FIGS. 5-10 (FIG. 5 reproduced below); Ex. 1006, ¶¶ [0043]-[0046]. For the device of Claim 1, *see supra*, Sections X.a.i-iv.

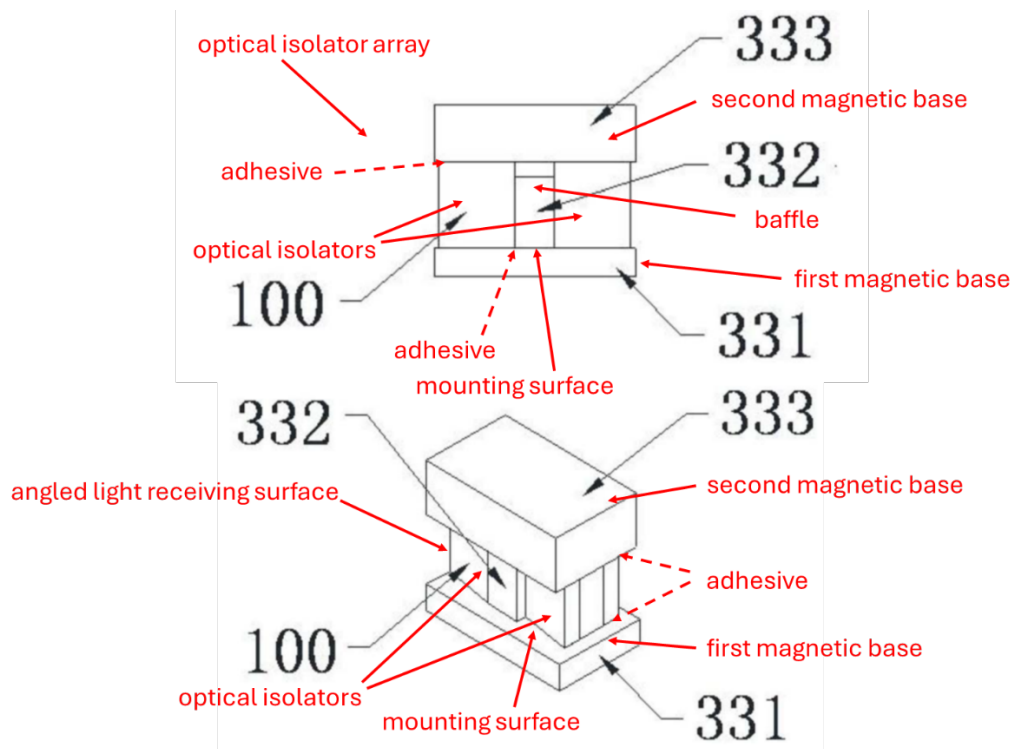


Ex. 1005, FIG. 5 (annotated)

91. In my opinion, a POSITA would have understood that Wang anticipates Claim 8.

xii. Claim 9: The optical isolator array of claim 1, further comprising a second magnetic base, the second magnetic base being coupled to the plurality of optical isolators via the at least one layer of adhesive.

92. Wang, in FIGS. 11 and 12, discloses an embodiment that includes an optical isolator array having a magnetic base (base 311 or substrate 320) at the bottom that defines at least one mounting surface for the optical isolator array, and a second magnetic base coupled by adhesive to the top of the optical isolator array, to thereby generate an annular magnetic field around the isolators. Ex. 1005, FIGS. 11, 12 (reproduced below); Ex. 1006, ¶ [0048] (“with reference to Figs. 11 and 12, the substrate further includes a top plate 313 disposed on the top of the isolators 100, and the top plate 313 is bonded to the isolators 100 by means of an adhesive to achieve an annular seal of the isolators 100, so as to obtain an annular magnetic field or an annular space.”) For the device of Claim 1, *see supra*, Sections X.a.i-iv.



Ex. 1005, FIGS. 11 and 12 (annotated)

93. In my opinion, a POSITA would have understood that Wang anticipates Claim 9.

xiii. Claim 10: The optical isolator array of claim 9, wherein the second magnetic base introduces a second magnetic field, the second magnetic field intersecting with the plurality of optical isolators.

94. As discussed *supra* with respect to Claim 9, Wang discloses a second (top) magnetic base coupled by adhesive to the isolators that generates a second magnetic field. Ex. 1005, FIGS. 11, 12; Ex. 1006, ¶ [0048]. A POSITA in January 2019 would have understood that generating an annular magnetic field around the isolators, as taught by Wang, necessarily would cause the second magnetic field generated by the second (top) magnetic base to intersect with the optical isolators as required by Claim 10. For the device of Claim 1, *see supra*, Section X.a.xiii.

95. Accordingly, in my opinion, a POSITA would have understood that Wang anticipates Claim 10.

b. Ground 2: Wang In View Of Xiong Renders Claims 11-19 Obvious.

i. Motivation to Combine

96. Wang and Xiong each is directed towards data communications in optical networks. Wang discloses an optical isolator array for use in a multichannel optical subassembly module. *See supra*, Section X.a.i. Xiong discloses integration of optical isolators into an optical subassembly module (e.g., a TOSA module of an optical transceiver). *See supra*, Section IX.b. For at least the reasons set forth

below, in my opinion, a POSITA would have been motivated to combine the optical isolator array of Wang into an optical subassembly module, as taught by Xiong, to create an optical transceiver that addresses the space, complexity and assembly problems known to exist with multi-channel optical components.

97. First, a POSITA would have understood the need to optimize available space within an optical module and also simplify the assembly and adjustment process prior to January 2019. For example, Wang specifically describes these goals for its disclosed optical isolator array. Ex. 1006, ¶¶ [0008]-[0011], [0021]. Xiong also is directed to “an *integrated* and *compact* multifunctional optical isolator . . . , which is *suitable for use in a TOSA*.” Ex. 1008, 3:29-32 (emphasis added). Xiong further explains that the structures disclosed therein beneficially “have the potential to be used as key building blocks in TOSA” due to their having “a *relatively compact size*, lower cost, and *simplified assembly process*.” *Id.* at 14:61-63 (emphasis added). Accordingly, in my opinion, a POSITA would have understood that optical transceivers having TOSAs routinely employ optical isolators, and that Wang provides an alternative solution to the optimize use of space and simplify assembly and adjustment of components employed in optical subassembly modules and optical transceivers as indicated by Xiong.

98. Second, a POSITA would have been motivated to combine Wang into an optical transceiver having a TOSA, such as Xiong, because both references

employ optical isolators to facilitate propagation of light incident to an optical isolator in preferred directions. For example, Xiong discloses using a “magneto-optic device” to utilize the Faraday Effect and to thereby propagate light incident to an optical isolator of an optical subassembly module (e.g., a TOSA) in a predetermined direction. Ex. 1008, 13:20-53. Similarly, Wang discloses that the “working principal [behind the optical isolator] is that being based on Faraday rotation” and each isolator may employ a Faraday rotator. Ex. 1005, FIGS. 1, 6; Ex. 1006, ¶¶ [0019], [0038], [0042]. Thus, a POSITA would have understood that the multi-channel optical isolator array described in Wang could be beneficially employed in an optical subassembly module for an optical transceiver as described in Xiong to control the propagation of light in a preferred direction, while additionally optimizing the form factor and manufacturability of the associated optical subassembly module and transceiver.

99. Further, a POSITA would have understood that the optical isolator array of Wang could successfully be employed in a TOSA and optical transceiver, as exemplified by Xiong, because a POSITA would have understood that achieving the stated goals and benefits in described in Wang TOSAs and optical transceivers was the intended use the device disclosed in Wang.

ii. Claim 11: [11a] A transmitter optical subassembly (TOSA) module comprising:

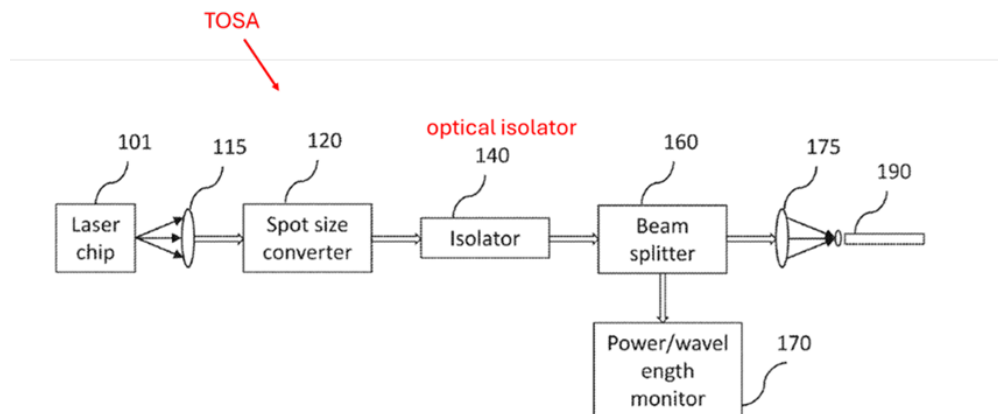
100. Xiong provides an exemplary description of an optical transceiver, which a POSITA prior to January 2019 would have understood to employ at TOSA. *See* Ex. 1008, 1:17-19.

iii. Claim 11: [11b] a transceiver housing;;

101. A POSITA would have understood, and it was well-known in January 2019, that an optical transceiver necessarily would include a transceiver housing to house various subassemblies and components of the optical transceiver.

iv. Claim 11: [11c] at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing, the at least one TOSA arrangement comprising;

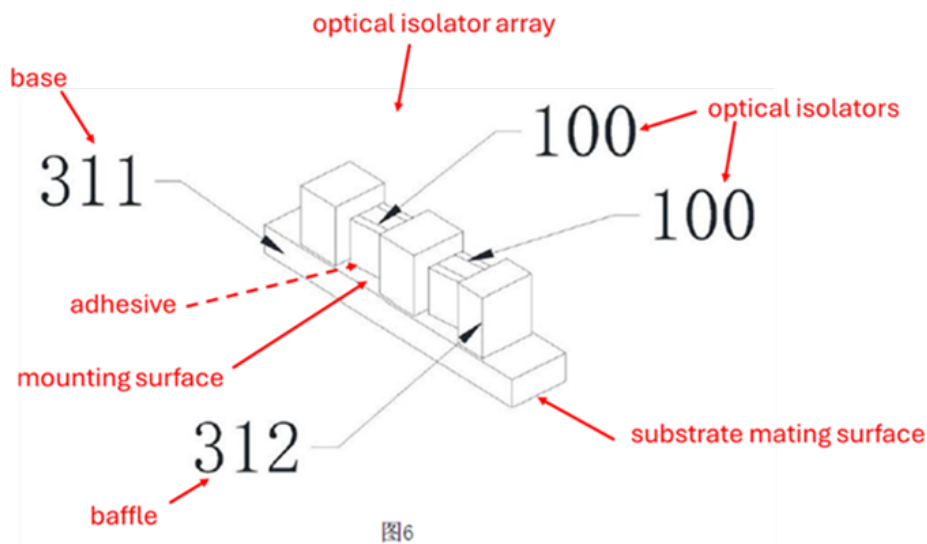
102. Xiong discloses an optical transceiver that includes at least one TOSA arrangement. *See* Ex. 1008, FIG. 1, 1:19-21. A POSITA would have understood, and it was well-known in January 2019, that the TOSA arrangement would be located in the transceiver housing of the optical transceiver.



Ex. 1008, FIG. 1 (annotated)

v. **Claim 11: [11d] a substrate defined by at least one mounting surface;**

103. Wang discloses a substrate for an optical isolator array that is defined by at least one mounting surface. Ex. 1005; FIGS. 5-10 (FIG. 6 reproduced below); Ex. 1006, ¶¶ [0037]-[0039]. A POSITA would have understood, further in view of Xiong, that the optical isolator array and associated components, are included in the TOSA arrangement.



Ex. 1005, FIG. 6 (annotated)

vi. **Claim 11: [11e] a plurality of laser diodes mounted to the at least one mounting surface of the substrate, each laser diode of the plurality of laser diodes to emit a different associated channel wavelength along a corresponding light path of a plurality of light paths; and**

104. Xiong discloses the TOSA includes a number of laser diodes each designed to emit a different associated channel wavelength along a corresponding light path of a number of light paths. See Ex. 1008, FIG. 1, 1:24-65, 6:66-7:3. A

POSITA would have understood, further in view of Wang, that the laser diodes would be mounted to the mounting surface(s) of the substrate in alignment with respective optical isolators of the optical isolator array.

vii. Claim 11: [11f] an optical isolator array mounted to the at least one mounting surface adjacent the plurality of laser diodes such that the plurality of light paths intersect with the optical isolator array, the optical isolator array comprising a at least a first magnetic base and a plurality of optical isolators coupled thereto, and wherein each optical isolator is optically aligned with a corresponding laser diode of the plurality of laser diodes via a corresponding light path;

105. Wang discloses an optical isolator array for use in an optical subassembly module comprising a substrate with multiple channels and a plurality of isolators disposed in the respective channels, wherein each opto-isolator includes a polarizer, a Faraday plate, and an analyzer disposed in sequence. Ex. 1005, FIG. 1; Ex. 1006, ¶¶ [0037]-[0039]. Wang discloses the optical isolator array includes a base (substrate 311 or substrate 320) that defines at least one mounting surface for the optical isolator array, wherein all or part of the material of the base is a magnetic material. Ex. 1005, FIG. 6 (above); Ex. 1006, ¶¶ [0012], [0040]. Wang discloses that its plurality of optical isolators are mounted on the base in a substantially parallel arrangement relative to each other. Ex. 1005, 1006, ¶¶ [0041], [0043].

106. Xiong discloses an optical isolator array mounted adjacent to laser diodes such that the light paths intersect with the optical isolator array and, moreover, such that each optical isolator is optically aligned with a corresponding

laser diode via a corresponding light path. *See* Ex. 1008, 1:24-65, 6:66-7:3. In my opinion, a POSITA would have understood that having the output of each laser diode of the plurality of laser diodes aligned with a respective isolator of the multi-channel optical isolator array of Wang, and that is exactly how the device of Wang was intended to be used.

viii. Claim 11: [11g] an optical receiver subassembly (ROSA) disposed in the transceiver housing..

107. Xiong discloses the optical transceiver includes a ROSA. *See* Ex. 1008, 1:19–23. A POSITA would have understood, and it was well-known in January 2019, that the ROSA would be located in the transceiver housing of the optical transceiver.

108. Accordingly, in my opinion, a POSITA would have understood that Wang in view of the knowledge of skill in the art as to how multi-channel optical isolators were used, as exemplified by Xiong, renders Claim 11 obvious.

ix. Claim 12: The optical transceiver of claim 11, wherein the first magnetic base of the optical isolator array is formed from a permanent magnet..

109. Claim 12 includes all of the limitations of Claims 11 in addition to the limitations of Claim 2. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the limitations of Claim 12 for the reasons set forth *supra* for Claims 11 and 2. For the

device of Claim 11, *see supra*, Sections X.b.i-vii.

110. In my opinion, a POSITA would have understood that Claim 12 is obvious.

x. Claim 13: The optical transceiver of claim 11, wherein the first magnetic base introduces a first magnetic field that intersects with the plurality of optical isolators to establish a direction of propagation.

111. Claim 13 includes all of the limitations of Claims 11 in addition to the limitations of Claim 3. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the limitations of Claim 13 for the reasons set forth *supra* for Claims 11 and 3. For the device of Claim 11, *see supra*, Sections X.b.i-vii.

112. It is therefore my opinion that a POSITA would have understood that Claim 13 is obvious.

xi. Claim 14: The optical transceiver of claim 11, wherein each optical isolator of the plurality of optical isolators includes an angled light-receiving surface to receive channel wavelengths from a corresponding laser diode of the plurality of laser diodes.

113. Claim 14 includes all of the limitations of Claims 11 in addition to the limitations of Claim 5. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the limitations of Claim 14 for the reasons set forth *supra* for Claims 11 and 5. For the

device of Claim 11, *see supra*, Sections X.b.i-vii.

114. It is therefore my opinion that a POSITA would have understood that Claim 15 is obvious.

xii. Claim 15: The optical transceiver of claim 11, wherein the plurality of optical isolators is disposed uniformly across the at least one mounting surface

115. Claim 15 includes all of the limitations of Claims 11 in addition to the limitations of Claim 6. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the limitations of Claim 15 for the reasons set forth *supra* for Claims 11 and 6. For the device of Claim 11, *see supra*, Sections X.b.i-vii.

116. It is therefore my opinion that a POSITA would have understood that Claim 16 is obvious.

xiii. Claim 16: The optical transceiver of claim 11, wherein at least one layer of adhesive is disposed between adjacent optical isolators of the plurality of optical isolators.

117. Claim 16 includes all of the limitations of Claims 11 in addition to the limitations of Claim 7. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the limitations of Claim 16 for the reasons set forth *supra* for Claims 11 and 7. For the

device of Claim 11, *see supra*, Sections X.b.i-vii.

118. It is therefore my opinion that a POSITA would have understood that Claim 16 is obvious.

xiv. Claim 17: The optical transceiver of claim 11, wherein the first magnetic base includes a substrate mating surface, and whereby the substrate mating surface is substantially flat to correspond with the mounting surface of a substrate to mount thereto.

119. Claim 17 includes all of the limitations of Claims 11 in addition to the limitations of Claim 8. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the limitations of Claim 17 for the reasons set forth *supra* for Claims 11 and 8. For the device of Claim 11, *see supra*, Sections X.b.i-vii.

120. It is therefore my opinion that a POSITA would have understood that Claim 17 is obvious.

xv. Claim 18: The optical transceiver of claim 11, further comprising a second magnetic base, the second magnetic base being coupled to the plurality of optical isolators and the first magnetic base via at least one layer of adhesive.

121. Claim 18 includes all of the limitations of Claims 11 in addition to the limitations of Claim 9. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the

limitations of Claim 18 for the reasons set forth *supra* for Claims 11 and 9. For the device of Claim 11, *see supra*, Sections X.b.i-vii.

122. It is therefore my opinion that a POSITA would have understood that Claim 18 is obvious.

xvi. Claim 19: The optical transceiver of claim 18, wherein the second magnetic base introduces a second magnetic field, the second magnetic field intersecting with the plurality of optical isolators.

123. Claim 19 includes all of the limitations of Claims 11 in addition to the limitations of Claim 10. Accordingly, in my opinion, a POSITA would have understood that Wang, in view of the knowledge of skill in the art as to how multi-channel optical isolators were used as exemplified by Xiong, discloses all of the limitations of Claim 19 for the reasons set forth *supra* for Claims 11 and 10. For the device of Claim 11, *see supra*, Sections X.b.i-vii.

124. It is therefore my opinion that a POSITA would have understood that Claim 19 is obvious

XI. Revision or Supplementation

125. In this report, I have presented my opinions regarding the invalidity of the challenged claims of the '690 Patent based on the information available to me. My opinions are subject to change in view of opinions provided by the Patent Owner or its expert, or any additional information that I may receive. I reserve the right to supplement my opinions accordingly.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed January 14, 2025 at Montreal, Canada.



Dr. Andrew G. Kirk