

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 IPR2025-00437
Patent No. 10,788,690

**PATENT OWNER RESPONSE TO PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,788,690**

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EXHIBITS

Exhibit No.	Description
2004	Declaration of Alan E. Willner, Ph.D.

I. INTRODUCTION

Patent Owner Applied Optoelectronics, Inc. (“AOI”) submits this Patent Owner Response to the Petition of Cambridge Industries USA, Inc. (“CIG USA” or “Petitioner”) for *Inter Partes* Review of U.S. Patent No. 10,788,690 (the “’690 Patent”) (Ex. 1001) challenging the patentability of Claims 1-19 (the “Challenged Claims”).

On August 26, 2025, the Board granted institution of *Inter Partes* Review. The ’690 patent generally relates to an optical isolator array with a magnetic base that allows alignment of a number of optical isolator modules within an optical subassembly module. The ’690 patent has two independent claims: claims 1 and 11. Claim 1 is directed to an optical isolator array. Claim 11 is directed to an optical transceiver.

CIG USA presents two grounds of invalidity against the Challenged Claims.

In Ground 1, CIG USA challenges claims 1–10 as anticipated by China patent CN 208421455U to Peng Wang (“Wang”).

In Ground 2, CIG USA challenges claims 11–19 as obvious over Wang “in view of knowledge of skill in the art, as exemplified by [U.S. Patent No. 9,563,073] to Xiong” (“Xiong”). See Petition at p. 2.

Neither of the prior art references, separately or in combination, discloses every feature of the Challenged Claims in Ground 2. Specifically, neither Wang nor Xiong discloses at least the following limitations as recited in claims 11–19:

- [11c] “at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing;”
- [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”.

II. BACKGROUND

A. '690 Patent

The '690 Patent is directed to an optical isolator array with magnetic base that allows for mounting and alignment of multiple isolators. Ex. 1001, Abstract; *see also* Ex. 2004 (“Declaration of Alan E. Willner, Ph.D”) at ¶ 55. The '690 Patent provides “referring to the Figures, FIG. 1, an optical transceiver 100, consistent with embodiments of the present disclosure, is shown and described. In this embodiment, the optical transceiver 100 includes a multi-channel transmitter optical subassembly (TOSA) arrangement 104 and a multi-channel receiver optical subassembly (ROSA) arrangement 106 coupled to a substrate 102, which may also be referred to as an optical module substrate.” *Id.* at Col 4:13-20. The '690 Patent further discloses that “the multi-channel TOSA arrangement 104 includes a TOSA housing 114 with a plurality of sidewalls that define a cavity (not shown). The cavity includes a plurality of laser arrangements 110, an optical isolator array 127, and a multiplexing device 124 disposed therein.” *Id.* at Col. 4:45-49.

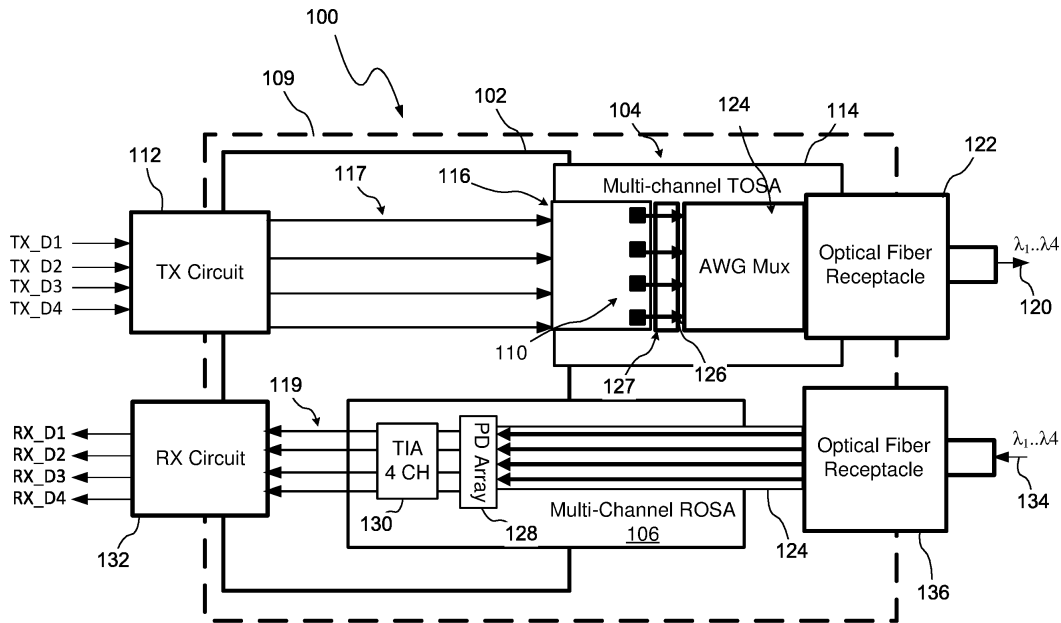


FIG. 1

B. Relevant File History

The application for the '690 Patent was filed on January 25, 2019 as application no. 16/257,635 with 19 claims, including two independent claims. *See, generally*, Ex. 1002; *see also* Ex. 2004 at ¶ 56.

During prosecution, no Office Actions were sent. The Examiner initiated an interview with AOI, held on June 30, 2020, and obtained AOI's authorization to amend two dependent claims. A Notice of Allowance was mailed on July 8, 2020, which included a statement of reasons for allowance. *See id.* at ¶ 57.

The '690 Patent issued on September 29, 2020 with 19 claims, including two independent claims, 1 and 11. *See id.* at ¶ 58.

C. Alleged Prior Art References

1. Wang and Wang English Translation (Exhibits 1005 and 1006)

Wang (Exs. 1005 and 1006) is directed to a multi-channel isolator device. Ex. 1006. Specifically, Wang discloses a multi-channel isolator device that includes a substrate with multiple channels where a plurality of isolators are disposed in the respective channels on the substrate. *Id.*; *see also* Ex. 2004 at ¶ 62.

2. Xiong (Exhibit 1008)

Xiong (Ex. 1008) is directed to a combined splitter, isolator, and spot-size converter for use with a single channel. Ex. 1008, Abstract; *see also* Ex. 2004 at ¶ 63.

Specifically, Xiong discloses three embodiments that each combine a splitter, isolator, and spot-size converter. In one embodiment, an integrated optical component 700 is disclosed that uses a single wedge approach “to provide spot-size conversion to provide a combined splitter, isolator, and spot-size converter with a reduced number of parts.” *Id.* at Col. 7:36-39; Fig. 7a (reproduced below). In this embodiment, the integrated optical component includes a wedge prism, an input polarizer, a Faraday rotator, and an output polarizer. *Id.* at Col. 7:40-47; *see also* Ex. 2004 at ¶ 64.

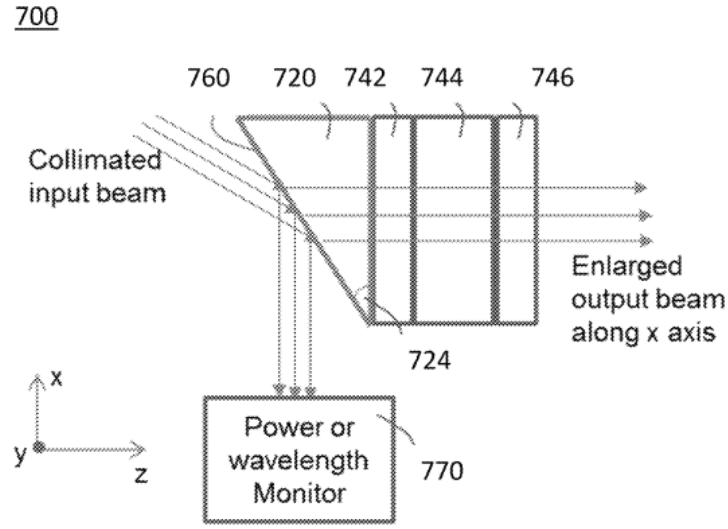


FIG. 7a

In a second embodiment, Xiong discloses another integrated optical component 800 that combines a splitter, isolator, and spot-size converter. *Id.* at Col. 10:5-6; Fig. 8a (reproduced below). In this second embodiment, the integrated optical component 800 includes a birefringent wedge, a Faraday rotator, and an output polarizer. *Id.* at Col. 10:6-9. “The birefringent wedge 820 functions as a spot-size converter and as a polarizer.” *Id.* at Col. 10:13-14; *see also* Ex. 2004 at ¶ 65.

800

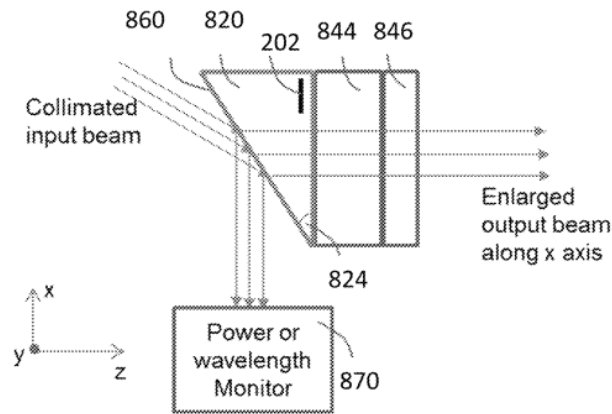


FIG. 8A

In a third embodiment, Xiong discloses another integrated optical component 900 that combines a splitter, isolator, and spot-size converter. *Id.* at Col. 12:46-47; Fig. 9a (reproduced below). In this third embodiment, the integrated optical component 900 includes a wedge prism, a Faraday rotator, and an output polarizer. *Id.* at Col. 12:47-48. “The wedge prism 920, which functions as a spot-size converter, beam-splitter, and a polarizer, may be a simple anamorphic prism.” *Id.* at Col. 12:54-56; *see also* Ex. 2004 at ¶ 66.

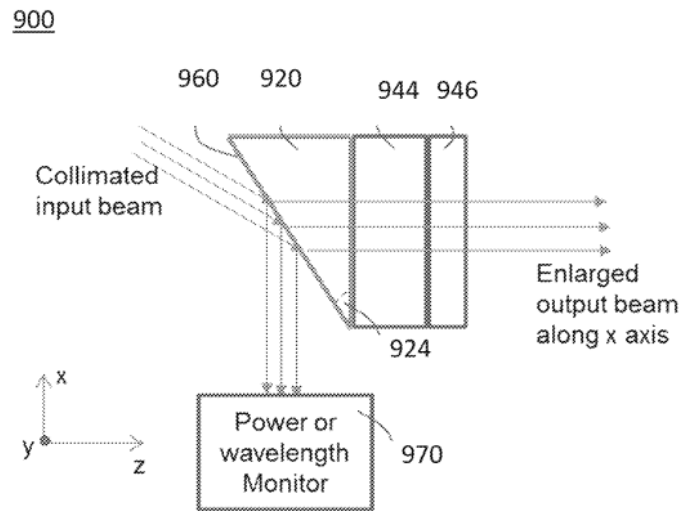


FIG. 9A

Xiong discloses that in the three embodiments, “the integrated optical components 700, 800, and 900 advantageously use the inclined surface of the wedge” “as a support for a coating that reflects a portion of the incident beam of light towards a power and/or wavelength monitor.” *Id.* at Col. 14:51-56. Xiong further states that “[s]ince the wedge is used for sizing and/or shaping the incident beam of light, using the inclined surface of the wedge to support the coating reduces the number of elements to be assembled in the combined optical beam splitter, isolator, spot-size converter.” *Id.* at Col. 14:56-61. Xiong also mentions the resulting structures “have the *potential* to be used as key building blocks in TOSA.” *Id.* at Col. 14:61-63 (emphasis added); see also Ex. 2004 at ¶ 67.

III. DEFINITION OF A PERSON OF ORDINARY SKILL IN THE ART

For the purposes of this Patent Owner Response, AOI applies CIG USA's proposed level of skill in the art: A person of ordinary skill in the art ("POSITA") knowledgeable of the technical field of the '690 Patent would have had at least (1) an undergraduate degree in electrical engineering, computer engineering, computer science, or a comparable field of study and (2) at least two years of experience with optical data communications or a comparable field of work. *See* Ex. 1003, ¶ 22. Individuals with different education and additional experience also could be of ordinary skill in the art if that experience compensates for a deficit in their educational training as mentioned above. *Id.* Additional education might substitute for some experience, and vice versa. *Id.*; *see also* Ex. 2004 at ¶¶ 37-39.

IV. CLAIM CONSTRUCTION

CIG USA states that "[the] language used in the claims of the '690 Patent is self-explanatory and would have been recognized by a POSITA as having plain and ordinary meanings. As the claim terms appear understandable in the context of the disclosure provided by the specification of the '690 Patent, Petitioner submits that no special constructions are required. *See* Petition at p. 10.

AOI agrees that the claim terms should be given their plain and ordinary meaning as understood by a POSITA. *See* Ex. 2004 at ¶¶ 60-61.

V. GROUND 2: CIG USA HAS NOT SHOWN THAT WANG IN VIEW OF XIONG RENDERS OBVIOUS CLAIMS 11-19.

A. Claim 11

(1) The Wang-Xiong Combination Does Not Disclose the “at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing” Limitation of Claim 11.

Limitation [11c] of Claim 11 recites “at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing.” The Wang-Xiong combination does not disclose this limitation. *See* Ex. 2004 at ¶ 69.

The '690 Patent states that “referring to the Figures, FIG. 1, an optical transceiver 100, consistent with embodiments of the present disclosure, is shown and described. In this embodiment, the optical transceiver 100 includes a multi-channel transmitter optical subassembly (TOSA) arrangement 104 and a multi-channel receiver optical subassembly (ROSA) arrangement 106 coupled to a substrate 102, which may also be referred to as an optical module substrate.” Ex. 1001 at Col 4:13-20. The '690 Patent further discloses that “the multi-channel TOSA arrangement 104 includes a TOSA housing 114 with a plurality of sidewalls that define a cavity (not shown). The cavity includes a plurality of laser

arrangements 110, an optical isolator array 127, and a multiplexing device 124 disposed therein.” *Id.* at Col. 4:45-49; *see also* Exhibit 2004 at ¶ 55.

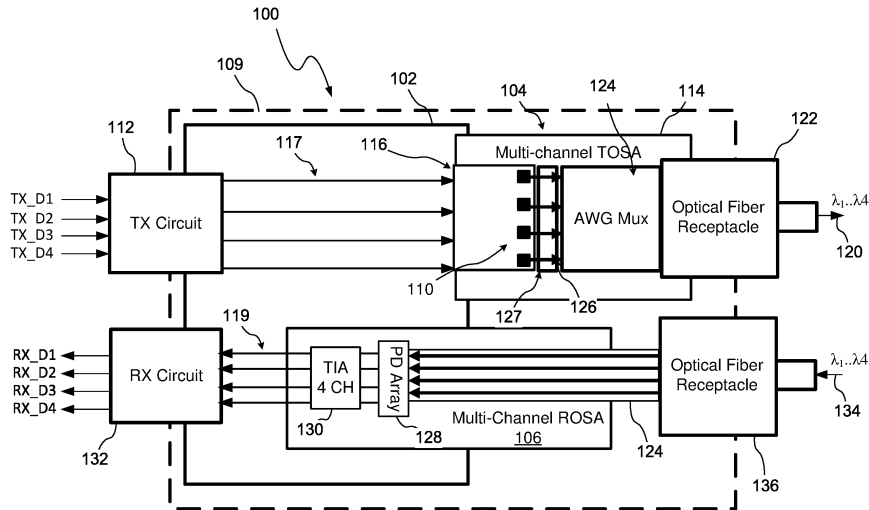


FIG. 1

Petitioner argues only that Xiong discloses at least one TOSA arrangement, and does not argue that Wang discloses the at least one TOSA arrangement. *See* Petition at p. 27; *see also* Ex. 1003, ¶ 102. However, Xiong does not disclose a TOSA arrangement that is multi-channel as required by the '690 Patent. *See* Ex. 2004 at ¶ 70; *see also* Ex. 1001 at Col 4:13-20 (“the optical transceiver 100 includes a *multi-channel transmitter optical subassembly (TOSA) arrangement 104* and a multi-channel receiver optical subassembly (ROSA) arrangement 106 coupled to a substrate 102) (emphasis added); *see also* Col. 4:45-49 (“the *multi-channel TOSA arrangement 104* includes a TOSA housing 114 with a plurality of

sidewalls that define a cavity)(emphasis added). At most, Xiong mentions using the single combined splitter, isolator, and spot-size converter in a single-channel TOSA. *Id.*; see also, e.g., Ex. 1008 at Col. 14:61-63 (“The resulting structures, which have the potential to be used as key building blocks in TOSA, have a relatively compact size, lower cost, and simplified assembly process”); Abstract (“An integrated and compact multifunctional optical isolator (i.e., a combined splitter, isolator, and spot-size converter), which is suitable for use in a TOSA, includes input optics including a first polarizer, a Faraday rotator, and a second polarizer.”). Thus, a POSITA would not understand the discloser in Xiong to recite the claimed “at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing.” *Id.*

For at least this reason, the Wang-Xiong combination does not disclose at least the “at least one optical transmitter subassembly (TOSA) arrangement disposed in the transceiver housing” limitation of Claim 11. Accordingly, CIG USA has not shown that the combination renders obvious Claim 11.

(2) The Wang-Xiong Combination Does Not Disclose the “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” Limitation of Claim 11.

Limitation [11e] of Claim 11 recites “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.” The Wang-Xiong combination does not disclose this limitation.

A POSITA would understand that a plurality of laser diodes, each emitting a different channel wavelength, correspond to the channels of the claimed multi-channel TOSA arrangement. *See* Ex. 2004 at ¶ 72.

Again, Petitioner argues only that Xiong discloses this limitation, and does not argue that Wang discloses the TOSA including 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* Petition at p. 28; *see also* Ex. 1003, ¶ 104. However, a POSITA would not understand Xiong to disclose a plurality of laser diodes, each emitting different wavelengths for a multi-channel TOSA arrangement. *See* Ex. 2004 at ¶ 74. Xiong relates to a single combined splitter,

isolator and spot-size converter for potential use in a single-channel TOSA. *Id.*; *see also, e.g.*, Ex. 1008 at Abstract (“An integrated and compact multifunctional optical isolator (i.e., a combined splitter, isolator, and spot-size converter), which is suitable for use in a TOSA, includes input optics including a first polarizer, a Faraday rotator, and a second polarizer.”). Therefore, a POSITA would not understand Xiong to disclose the claimed “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.” *Id.*

For at least this reason, the Wang-Xiong combination does not disclose the “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” limitation of Claim 11. Accordingly, CIG USA has not shown that the combination renders obvious Claim 11.

(3) The Wang-Xiong Combination Does Not Disclose the “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 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” Limitation of Claim 11.

Limitation [11f] of Claim 11 recites “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.” The Wang-Xiong combination does not disclose this limitation.

Petitioner argues that “Xiong discloses an optical isolator array mounted adjacent to laser diodes such that the light paths intersect with the optical isolator array.” Petition at p. 29; Ex 1003 at ¶ 106. However, this is not accurate. Xiong does not disclose an isolator array. See Ex. 2004 at ¶ 77; *see also* Ex. 1008 at

Abstract. Xiong discloses a single isolator. *Id.* Moreover, as discussed in conjunction with limitation [11e], Xiong does not disclose a plurality of laser diodes. *Id.* Therefore, Xiong does not disclose an optical isolator array mounted adjacent to laser diodes such that the light paths intersect with the optical isolator array as CIG USA contends. *Id.*

For at least this reason, the Wang-Xiong combination does not disclose all of the limitations of Claim 11. Accordingly, CIG USA has not shown that the combination renders obvious Claim 11.

(4) A POSITA Would Not Have Been Motivated to Combine Wang and Xiong.

Even if the proposed Wang-Xiong combination satisfied limitations [11c], [11e], and [11f], which it does not, a POSITA would not have been motivated to combine the two references to achieve the claimed invention. *See* Ex. 2004 at ¶ 79.

First, Xiong discloses a single optical isolator that would be used for a single channel. *Id.* at ¶ 80; *see also* Ex. 1008 at Abstract. Petitioner argues for employing the multi-channel optical isolator array described in Wang in an optical subassembly module for an optical transceiver as described in Xiong. *See* Petition at p. 26. However, doing so would render Xiong unsatisfactory for its intended

purpose. MPEP §2143.01 states that: “if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification,” and the obviousness argument fails.

The intended purpose of Xiong is to provide an optical isolator combined with a splitter and spot-sized converter for potential use in a single-channel TOSA. *Id.* at ¶ 81; *see also* Ex. 1008 at Abstract. Further, combining Wang and Xiong, if even possible, would require significant redesigns. *Id.*

The single optical isolator of Xiong would need to be modified to create an array of optical isolators. An array of optical isolators requires additional elements, such as substrate elements. For example, if the isolator of Xiong is modified into an isolator array as taught by Wang, multiple laser chips or a set of light-emitting elements would be required. In response to the multiple laser chips or the addition of light-emitting elements, it is highly likely that the collimating lens and spot converter would also need to be arrayed. Neither Wang nor Xiong disclose how to make this modification. This would require an entire redesign to create a more complicated profile. Further, even if such modifications could be done, the result would be a more complicated design which would result in the opposite of an intended purpose of Xiong, which was to create an optical

component with a reduced number of parts. *Id.* at ¶ 82.

In addition, the proposed modification to achieve the combination proposed by CIG USA would change the principle of operation of the reference. *Id.* at ¶ 83. As stated in MPEP §2143.01, “if the proposed modification ... would change the principle of operation of the prior art invention being modified, then the teachings of the reference are not sufficient to render the claims *prima facie* obvious.”

Xiong discloses a single optical isolator that would be used for a single channel. Modification of the isolator in Xiong with the array from Wang would require a substantial reconstruction and redesign of the elements in Xiong as well as a change in the basic principle under which the single channel was designed to operate. This is not disclosed in Xiong and would highly likely be the result of changing the single-channel principle of operation of Xiong to multi-channel operation. *Id.* at ¶ 84.

Accordingly, for at least each of these reasons, a POSITA would not be motivated to combine Wang and Xiong. *Id.* at ¶ 85. Therefore, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 11, not only because the proposed combination does not satisfy the claim limitations, but also because a POSITA would not have been motivated to combine these references.

B. Claim 12

Claim 12 depends from Claim 11. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 11, the combination also does not disclose all of the limitations of Claim 12. Accordingly, CIG USA has not shown that the combination renders obvious Claim 12.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 12, not only because the proposed combination does not satisfy the claim limitations, but also because there would have been no motivation to combine these references for at least the reasons discussed in conjunction with Claim 11.

C. Claim 13

Claim 13 depends from Claim 11. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 11, the combination also does not disclose all of the limitations of Claim 13. Accordingly, CIG USA has not shown that the combination renders obvious Claim 13.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 13, not only because the proposed combination does not satisfy the claim limitations, but also because there would have been no motivation to combine these references for at least the reasons discussed in

conjunction with Claim 11.

D. Claim 14

Claim 14 depends from Claim 11. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 11, the combination also does not disclose all of the limitations of Claim 14. Accordingly, CIG USA has not shown that the combination renders obvious Claim 14.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 14, not only because the proposed combination does not satisfy the claim limitations, but also because there would have been no motivation to combine these references for at least the reasons discussed in conjunction with Claim 11.

E. Claim 15

Claim 15 depends from Claim 11. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 11, the combination also does not disclose all of the limitations of Claim 15. Accordingly, CIG USA has not shown that the combination renders obvious Claim 15.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 15, not only because the proposed combination does not satisfy the claim limitations, but also because there would have been no

motivation to combine these references for at least the reasons discussed in conjunction with Claim 11.

F. Claim 16

Claim 16 depends from Claim 11. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 11, the combination also does not disclose all of the limitations of Claim 16. Accordingly, CIG USA has not shown that the combination renders obvious Claim 16.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 16, not only because the proposed combination does not satisfy the claim limitations, but also because there would have been no motivation to combine these references.

G. Claim 17

Claim 17 depends from Claim 11. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 11, the combination also does not disclose all of the limitations of Claim 17. Accordingly, CIG USA has not shown that the combination renders obvious Claim 17.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 17, not only because the proposed combination does not satisfy the claim limitations, but also because there would have been no

motivation to combine these references for at least the reasons discussed in conjunction with Claim 11.

H. Claim 18

Claim 18 depends from Claim 11. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 11, the combination also does not disclose all of the limitations of Claim 18. Accordingly, CIG USA has not shown that the combination renders obvious Claim 18.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 18, not only because the proposed combination does not satisfy the claim limitations, but also because there would have been no motivation to combine these references for at least the reasons discussed in conjunction with Claim 11.

I. Claim 19

Claim 19 depends from Claim 18. Because the Wang-Xiong combination does not disclose all of the limitations of Claim 18, the combination also does not disclose all of the limitations of Claim 19. Accordingly, CIG USA has not shown that the combination renders obvious Claim 19.

Accordingly, CIG USA has not shown that the Wang-Xiong combination renders obvious Claim 19, not only because the proposed combination does not

satisfy the claim limitations, but also because there would have been no motivation to combine these references for at least the reasons discussed in conjunction with Claim 11.

VI. CONCLUSION

For the reasons set forth above, Applied Optoelectronics, Inc. respectfully requests that the Board deny CIG USA's request to cancel the Challenged Claims of the '690 Patent.

Dated: November 18, 2025

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CERTIFICATE OF WORD COUNT

Under the provisions of 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the Microsoft Office word count including all footnotes for the foregoing Patent Owner's Preliminary Response, excluding the table of contents, table of authorities, certificate of word count, appendix and certificate of service, totals 4,002 words, which is less than the 14,000 words allowed under 37 C.F.R. § 42.24(b)(2).

Dated: November 18, 2025

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CERTIFICATE OF SERVICE

The undersigned hereby certifies service on the Petitioner, pursuant to 37 C.F.R. § 42.6(e) and by agreement of counsel, by electronic (e-mail) delivery of a true copy of the foregoing **PATENT OWNER'S RESPONSE**, which was served on November 18, 2025 to the following Counsel for Petitioner via e-mail:

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