

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HESAI TECHNOLOGY CO., LTD.,
Petitioner,

v.

OUSTER, INC.,
Patent Owner

IPR2023-01457
Patent 11,190,750

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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LIST OF EXHIBITS

EX1001	U.S. Patent No. 11,190,750 to Pacala et al. (“the ’750 patent”)
EX1002	Excerpts from the Prosecution History of the ’750 Patent (“the Prosecution History”)
EX1003	Declaration of Dr. James Shanley
EX1004	Curriculum Vitae of Dr. James Shanley
EX1005	U.S. Patent No. 10,203,399 to Retterath et al (“Retterath”)
EX1006	U.S. Patent App. Pub. No. US 2013/0300838 to Borowski (“Borowski”)
EX1007	U.S. Patent No. 7,787,105 to Hipp et al (“Hipp”)
EX1008	U.S. Patent No. 8,736,818 to Weimer et al (“Weimer”)
EX1009	U.S. Patent App. Pub. No. 2016/0274223 (“Imai”)
EX1010	JP Publication No. JP 2015-078953 (“Higashi”)
EX1011	Certified English Translation of JP Publication No. JP 2015-078953 (“Higashi”)
EX1012	U.S. Patent App. Pub. No. US 2017/0040368 (“Grzesik”)
EX1013	U.S. Patent App. Pub. No. 2014/0211194 (“Pacala”)
EX1014	Lee <i>et al.</i> , “Accuracy-Power Controllable LiDAR Sensor System with 3D Object Recognition for Autonomous Vehicle,” in <i>Sensors</i> , Vol. 20, Iss. 19 (Oct. 2020)
EX1015	ITC Inv. No. 337-TA-1363, Certain Lidar (Light Detection and Ranging) Systems And Components Thereof, EDIS Document Details re: Granting Motion for Termination

EX1016	U.S. Patent No. 9,651,658 (“Pennecot”)
EX1017	U.S. Patent No. 7,544,945 (“Tan”)
EX1018	U.S. Patent No. 6,747,747 (“Hipp-747”)
EX1019	Marino et al., <i>A compact 3D imaging laser radar system using Geiger-mode APD arrays: system and measurements</i> , MIT Lincoln Lab (2003)
EX1020	Complaint in ITC Inv. No. 337-TA-1363
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EX1023	Matsubara et al., <i>Development of Next Generation LiDAR</i> , R&D Review of Toyota CRDL (2012)
EX1024	U.S. Patent No. 7,969,558 (“Hall”)
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EX1034	Donati, Silvano, Photodetectors: Devices, Circuits and Applications, Chapter 6, 2d Ed., The Institute of Electrical and Electronics Engineers, Inc. (2021, John Wiley & Sons, Inc.)
EX1035	<i>Performance Analysis of Next-Generation LADAR for Manufacturing, Construction, and Mobility</i> , National Institute of Standards and Technology (2004)
EX1036	U.S. Patent No. 8,742,325 (“Droz”)
EX1037	<i>Report to Congress: DARPA Prize Authority</i> (2006)
EX1038	Hall et al., <i>Team DAD Technical Paper</i> , DARPA Grand Challenge (2005)
EX1039	McManamon, <i>Field Guide to LiDAR</i> , SPIE Field Guides, Vol. FG36 (2015)
EX1040	Second Declaration of Dr. Shanley
EX1041	Transcript of October 9, 2024 Deposition of Dr. Janet
EX1042	U.S. Patent No. 11,422,236
EX1043	U.S. Patent No. 9,841,495
EX1044	U.S. Patent No. 9,804,264
EX1045	Bronzi, D., et al, <i>Figures of Merit for CMOS SPADs and Arrays</i> , May 2013

- EX1046 Matsubara, H., et al, *Development of Next Generation LIDAR*, Feb. 2012
- EX1047 Villa, F., et al, *CMOS Imager With 1024 SPADs and TDCs for Single-Photon Timing and 3-D Time-of-Flight*, July 2014

I. INTRODUCTION

In an attempt to avoid prior art combinations that align with preferred embodiments of the '750 patent, Patent Owner ("PO") seeks to substitute new (narrowing) language for "coincident with" and "stop region." Surely, such narrow claim language could have been submitted here in a motion to amend. PO elected to forego this option. The Board need not rewrite the claims now.

PO also posits there are secondary indicia of nonobvious, but these theories suffer from temporal, legal, and factual flaws. Indeed, documentary evidence already in the record plainly established others considered SPADs to be a conventional option in LiDAR systems leading up to 2015. What others physically built back in 2008, or earlier, misses the mark.

II. CLAIM CONSTRUCTION

Again, no constructions that substitute language for the original claim terms are necessary to resolve invalidity given the remarkable overlap between the preferred embodiment of the '750 patent and the prior art combinations of Grounds 1A-3. Pet., 3-4. Nevertheless, Petitioner addresses PO's proposed constructions here, which contradict the '750 patent itself and improperly inject ambiguity into otherwise ordinary claim terminology.

A. “electromagnetic radiation output from each emitter in the illumination pattern []coincident with a field of view of a corresponding pixel” (claim 44)

The recited feature of a field of view “coincident with” an emission region is a common phrase that would have been understood by a POSITA without the need for any substituted terminology, as evidenced by the straightforward description of the ’750 patent and the plain usage by others at the time. EX1040, ¶¶7-10. PO mischaracterizes the Petition’s analysis of the “coincident with” element by alleging that the Petition’s analysis “only take[s] into account the *direction* of an emitter radiation outputs and fields of view—not the *area* of these regions.” POR, 2. Not so. As set forth below (*infra*, §§III.C, IV.A, V.B), the Petition demonstrated the remarkable similarity between the prior art and the ’750 patent’s preferred embodiments. PO’s narrowing proposal that “coincident with” be substituted by “cover substantially the same area in the field” (POR, 25-30)—narrowly mandating the field of view “*matches*” the “discrete spot” of an illumination source to a degree of near perfection—improperly excludes example embodiments in the ’750 patent, defies normal usage by others, and injects ambiguity. PO’s substitute language is an invitation to reversible legal error.

First, PO’s proposal conflates “coincident” with “size” or “area,” conspicuously failing to address the ’750 patent’s bifurcation of these terms. In describing an example embodiment, the ’750 patent indicates:

[T]he first illumination source 111 projects an illuminating beam that is substantially coincident (**and** substantially the same size as or minimally larger than) the field of view defined by the first aperture 141 (as shown in FIG. 4).

EX1001, 6:3-11. The '750 patent itself thus uses these terms differently.

“Coincident” does not itself require “substantially the same size as,” for if it did so, the parenthetical in column 6 would be superfluous. Rather, patent specification isolates “size” as an additional characteristic (“and”) or optional species of “coincident.” EX1040, ¶¶11-13. Tellingly, PO never acknowledged this critical part of column 6 when proposing its substitute terminology. *See* POR, 25-30.

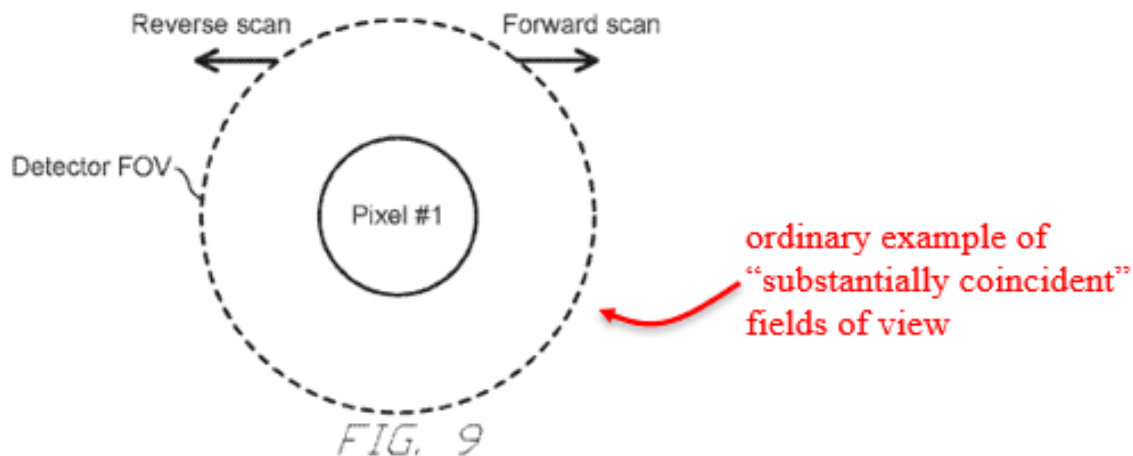
PO’s substitute amounts to a backdoor attempt to amend the term “coincident” with “substantially the same area” (EX1001, 6:3-11). To be clear, there is no dispute that this teaching in column 6 provided PO with support for a motion to amend in this proceeding—narrowing the claims to the exact scope sought in the POR. This option was waived. The Board should not rewrite claims where PO opted to forego doing so. *SuperGuide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 874-875 (Fed. Cir. 2004) (“not a substitute for, nor can it be used to rewrite, the chosen claim language. ‘Specifications teach. Claims claim.’”).

And PO’s faulty proposal is not remedied by citation to FIG. 1. Indeed, it does not illustrate a “field of view” of the pixel at all. Even if the beam (e.g., red

beam) is detected by a corresponding pixel, nothing in FIG. 1 indicates that it has substantially the same area, and certainly not “the same” area, as the emission region. EX1040, ¶¶14-15; EX1001, 3:52-63 (“each aperture in the set of apertures 144 defines a field of view in the field coincident a discrete spot output by a corresponding illumination source in the set of illumination sources 110.”). There is an overlapping relationship sufficient for the beam to be detected. *Id.* That is all from FIG. 1.

PO’s declarant relies on FIG. 1, despite its lack of indication of the extent of the fields of view. EX1041, 29. But, as illustrated below, FIG. 2 depicts so much more—and it does so in a manner plainly inconsistent with PO’s substitute terminology for a “same area” that must be neither slightly smaller nor slightly larger. *Infra*, pp. 11-12 and Sections III.C, IV.A, V.B.

Moreover, others in the LiDAR industry used “coincident” in its ordinary manner to describe overlapping areas (even if one is larger than the other):



EX1040, ¶16 (citing to EX1043, FIG. 9, 10:13-16 (“the detector FOV is *larger than* the light-source FOV, *and* the detector and light-source FOVs are *substantially coincident* or overlapped” and “may be substantially *coincident with* the left edge of the detector FOV”) and to EX1044, FIG. 36, 57:65-58:2). Indeed, PO itself has used “coincident with” in other sources in a manner inconsistent with PO’s narrow “same area” construction here. EX1040, ¶17 (citing EX1042, cl. 20).

Second, PO’s substitute language excludes express examples recited by the ’750 patent. It is a fundamental canon that “a claim interpretation that excludes a preferred embodiment from the scope of the claim is rarely, if ever, correct.” *Accent Packaging, Inc. v. Leggett & Platt, Inc.*, 707 F.3d 1318, 1326 (Fed. Cir. 2013). For example, PO applies its proposed construction to the point of excluding embodiments in which the field of view has different sizes. POR, 43 (excludes “slightly larger than”), 53 (excludes “slightly smaller than”); EX1040, ¶18-19. But in doing so, PO’s proposed construction inexplicably excludes express options described in the specification—“substantially the same size as *or minimally larger than*.” EX1001, 6:3-11; *see also* 11:11-19 (“substantially identical to *or slightly greater than*”).

In fact, Figure 2 of the ’750 patent illustrates an embodiment that in which the emission region that is significantly different from the field of view of the corresponding pixel:

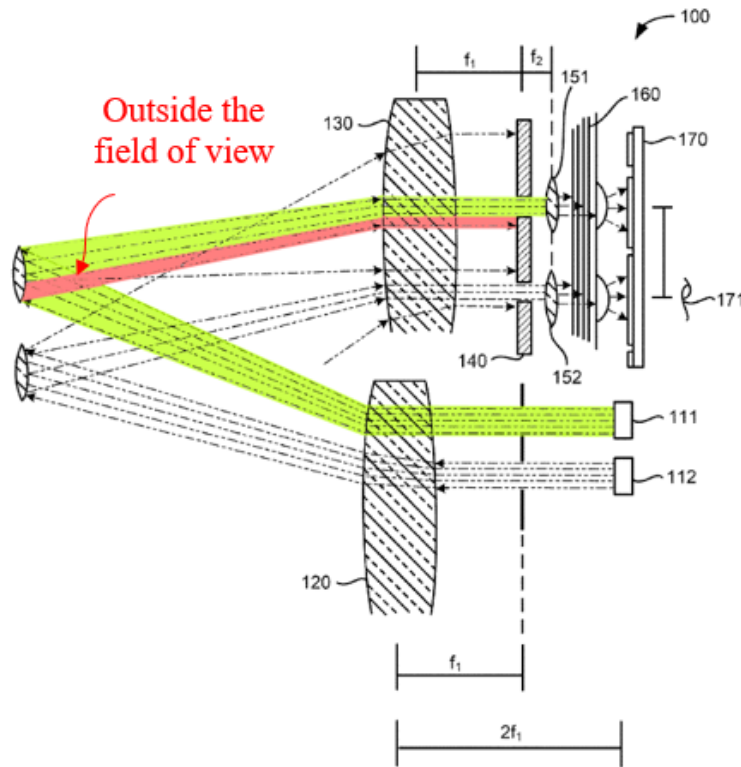


FIG. 2

EX1040, ¶¶19-21. Here, a meaningful portion of the area of the emission region from emitter 111 is *outside the field of view* of the corresponding pixel such that it is blocked by the aperture layer 140. *Id.* PO's declarant acknowledged he didn't consider FIG. 2 in forming his opinions about the field of view. EX1041, 29-31. Fatally, the POR ignored it too. POR, 24-30.

Third, PO's application of "substantially" injects unpredictable ambiguity into the claim, especially where the claim language is already clear on its face for purposes of resolving invalidity in view of the similar prior art. EX1040, ¶22. For example, as detailed below, the POR repeatedly alleges that "*substantially* the

same area” somehow excludes prior art examples in which one is “slightly smaller than” or “slightly larger than” the other. POR, 43 (excludes “slightly larger than”), 53 (excludes “slightly smaller than”). This remarkable line-drawing, of course, results in wild unpredictability for the public. And, the so-called expert testimony cited in the POR only makes the puzzle more confounding. PO’s declarant indicated that the substitute language can only be resolved upon consideration of further factors of “minimizing wasted power and maximizing signal integrity discrimination or signal to noise ratio.” EX1041, 50. Such an extreme departure from the otherwise ordinary usage of “coincident with” injects unnecessary and burdensome unpredictability. EX1040, ¶22. The prior art combinations align with the same type of “coincident with” examples used in the ’750 patent and likewise used by others in the LiDAR industry at the time (cited above). That is enough.

B. “stop region” (claim 44)

There is no need to formally construe the language of claim 44 to resolve invalidity in view of the similarity of the prior art. PO, however, advances an implicit construction of the term “stop region” that excludes structures blocking the detectable portion of the light spectrum, regardless of whether other types of optical energy may pass. PO alleges that the “stop region” demands an absolute, optically perfect form of opacity. POR, 21 (“partial or substantial absorption of some light does not indicate a ‘stop region.’”); EX1040, ¶23. PO fails to identify

support in the '750 patent for its narrowed interpretation, and there is none.

This is not remedied by citation of an “opaque polymer” or the “stop region 146 (i.e., an opaque or reflecting region),” which merely restate the terms PO now tries to narrow. POR, 21; EX1001, 4:6-12; EX1040, ¶24.

PO’s theory is not remedied by out-of-context citation to Dr. Shanley’s testimony. Dr. Shanley acknowledged the possibility of light passing through even a structure made of an “opaque” material (*see, e.g.*, EX2010, 75:9-76:18), and never indicated a material must perfectly block all wavelengths to be effectively “opaque” for a LiDAR system. EX1040, ¶25.

III. THE RETTERATH GROUNDS (1A-1D)

PO does not dispute that Grounds 1A-1D disclose most limitations of independent claim 44. PO focuses solely on the “stop region” (44(d)), “coincident with” (44(f)), “adjacent” (44(e)) and “threshold distance” (44(c)) limitations, but PO’s theories fail to rebut that the claim language simply ensnares the prior art. EX1040, ¶¶26-49.

A. The Retterath Grounds disclose the claimed aperture layer including a “stop region” (44(d))

PO makes two arguments, both of which fail to rebut the analysis set forth in the Petition.

First, PO’s theory, here again, is based on implicit construction of the term “stop region” as excluding structures blocking the detectable portion of the light

spectrum, regardless of whether other types of optical energy may pass. PO's proposal is based on legal error. *Supra*, §II.B; EX1040, ¶27.

Second, PO's theory is factually defective; Retterath plainly provides a "stop region" as described in claim 7. Retterath expressly indicates that "inbound optical energy"—energy that includes light from any number of sources and a full spectrum of wavelengths—is "*substantially blocked* by the detector waveguide." EX1005, 8:59-65; EX1041, 78-79 (acknowledging Retterath's "inbound optical energy" includes "plethora of other types of optical energy whether the type is differentiated by the source or the type is differentiated by the wavelength. . ."). Simply put, the light that encounters the waveguide material includes wavelengths across the spectrum, and Retterath indicates it is blocked without limitation or exclusion as to particular wavelengths. EX1040, ¶28. Retterath's straightforward description confirms Retterath's preference that the waveguide material absorbs/blocks as much light across as much of the spectrum as possible. *Id.*

Even applying PO's unsupported substitute language that excludes "substantially blocking" from the claimed "stop region",¹ nothing in Retterath

¹ Note that PO contends "substantially" here has the exact opposite implication from same term "substantially" in its proposed construction for claim 44.

According to PO, a teaching for "*substantially matches*" does not exclude *fully*

indicates that any meaningful amount of light can pass through the waveguide material itself. A POSITA would have recognized that substantial blocking by the Rettertrath's waveguide across a spectrum of wavelengths provided the same structure and effect as the recited "stop region." EX1040, ¶29.

PO conflates passage of light that may occur due to not encountering the waveguide material (such that the light is only "partially" or "substantially" blocked when passing through an aperture at a relative angle) with whether the waveguide material itself blocks incoming light. EX1040, ¶30. Whether some light passes through apertures in the waveguide structure has no bearing on whether the waveguide material is opaque. *Id.*

B. A POSITA was motivated to combine Hipp's "Shadow Mask" with the Retterath-Borowski Combination

Claim 44 is additionally rendered obvious based on further combination with Hipp. The Petition sets forth multiple straightforward motivations, which are expressly supported by Hipp's stated benefits. Pet., 40-44.

The fulsome obviousness analysis set forth in the Petition is not undermined by PO's assertions that the combination presents "risk of interference from light

matching (POR, 26), but somehow a teaching for "*substantially* blocked" does exclude *fully* blocking (POR, 44-45). Such inconsistency cannot be reconciled.

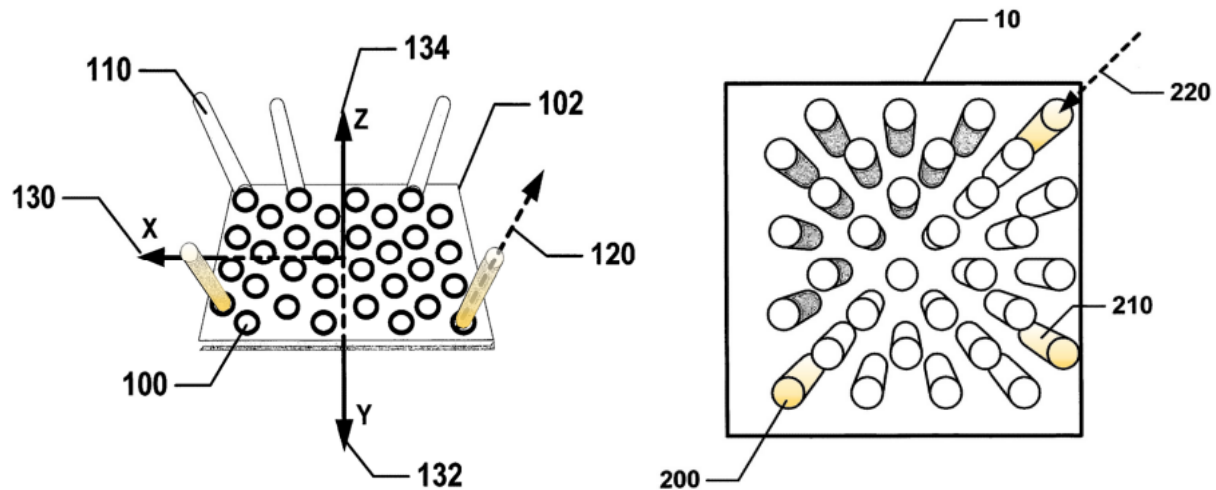
scattered by the underside of Hipp’s shadow mask.” POR, 22-23. Hipp not only acknowledges this potential scenario, but offers the traditional solution in which “the rear side of the carrier glass is provided with a layer of material absorbing signal light”—a solution applicable regardless of detector type. EX1007, 22:7-10; *see also* EX1003, ¶107, 214; EX1040, ¶31-32.

C. The Retterath Grounds Disclose the “Fields of View Coincident with” Element (44(f))

PO’s claim construction and element-by-element mapping erroneously allege that Petition relies only on Retterath’s teachings that its “emitter and detector pairs has a unique shared directional axis.” POR, 31. Instead, the Petition highlighted Retterath’s disclosure that is remarkably similar to the ’750 patent. Under the plain and ordinary meaning, or PO’s improperly narrowed substitute language, the “coincident with” element is obvious under the Retterath Grounds.

1. Retterath discloses the “fields of view coincident with” element

Beyond the layers of legal errors in PO’s substitute claim language (cited above), PO’s theories are based on factual error that overlook Reterrath’s teachings. The Petition explained Retterath’s teachings of each emission region output along a unique emission vector 120, and that each emission region is sized to be non-overlapping with other beams, such that the circular emission region is similarly oriented and sized with the circular field of view of its corresponding detector. Pet., 11-12, 22-27, 28-31 (citing EX1005, FIGS. 4, 6, 8).



Pet., 10, 31 (citing EX1005, FIGS. 4, 8); EX1040, ¶¶33-34.

The POR myopically focuses on Retterath’s alternative scenarios in which “emitted energy from one emitter will possibly be received at a detector that is not its pair.” POR, 32-33. But Retterath’s contemplation of such alternative scenarios is no different from the ’750 patent, which likewise expressly acknowledges energy emitted from one emitter being received by a detector that is not its pair. *See* EX1001, 6:3-11; EX1040, ¶35.

Even if PO’s substitute language is imported into the claim, Retterath’s detector fields of view and the emission region of a corresponding emitter are just like the ’750 patent itself. EX1040, ¶36. The ’750 patent acknowledge emission region and detector field of view that have slightly different sizes (*supra*, Section II.A), and nothing in Retterath indicates an emission region more than slightly different than the corresponding field of view. *Id*; Pet., 11-12, 22-27, 28-31 (citing EX1005, FIGS. 4, 8 (received light beams 210), 7 (collimated beam 92), 18a, 4:13-

23, 20:41-44).

2. The combination discloses the “fields of view coincident with” elements based on further combination with Weimer

Even if Retterath alone did not teach this element (which it does), the Petition explained that the “coincident with” limitations are further rendered obvious based on Weimer’s teaching, which remains largely unrebutted by PO. Pet., 34-36 (“match the field-of-view” of each pixel to the emission region of an emitter” and “controlling the emission pattern of individual lasers to match the field of view of a corresponding pixel.”), 37-39.

The combination includes field of view and emission region areas that are substantially the same in accordance with Weimer’s teachings—“Individual beams 208 can be directed to cover *an area corresponding to a single pixel* of the detector.” EX1008, 4:56-58; *see also, id.* 1:56-60 (“*only slightly* smaller”). Such teachings are indistinguishable from the ’750 Patent’s preferred embodiments. EX1001, 6:3-11 (“an illuminating beam that is substantially coincident (and substantially the same size as or minimally larger than) the field of view.”). EX1040, ¶¶37-38.

PO’s faulty theory is not remedied by citation to FIGS. 2A or 3A of Weimer. PO shades some of the squares pink in in the POR, assuming a set of square-shaped fields of view with a perfect edge-to-edge relationship. POR, 34, 53. But,

this assumes too much, especially where the pixels are behind “receive optics 322” in Weimer’s embodiments. EX1008, 10:12-16. Regardless of shape, there would have been a physical boundary or space between adjacent pixels in Weimer’s device of FIG. 2A or 3A—an ordinary fact of LiDAR detectors that is unrecognized by PO’s shading. EX1040, ¶¶39-41. Based on this erroneous shading, PO reaches the erroneous conclusion that the emission beam is “significantly” smaller than the detector field of view. POR, 34.

Worse yet, PO’s myopic focus on FIGS. 2A/3A illustration ignores Weimer’s actual text. Namely, Weimer plainly suggests that each emission beam should “cover an area corresponding to a single pixel,” as described above. EX1008, 4:56-58. Fatally, PO never addresses this text. Weimer’s suggestion for the same corresponding “area” is straightforward and was readily applicable to Retterath’s circular-shaped emission regions/fields of view. Pet., 34-39; EX1040, ¶40.

PO’s assertions highlight the unworkability of its substitute language. PO owner attempts to import into claim 44 a limitation that the areas be “substantially the same” without any explanation of how much similarity is required, and then uses this improper construction in an attempt to exclude Weimer’s teaching of “an area corresponding to a single pixel” or “only slightly smaller.” EX1040, ¶42. PO owner has not explained any distinction between Weimer’s teachings and that of

the '750 patent. There is none.

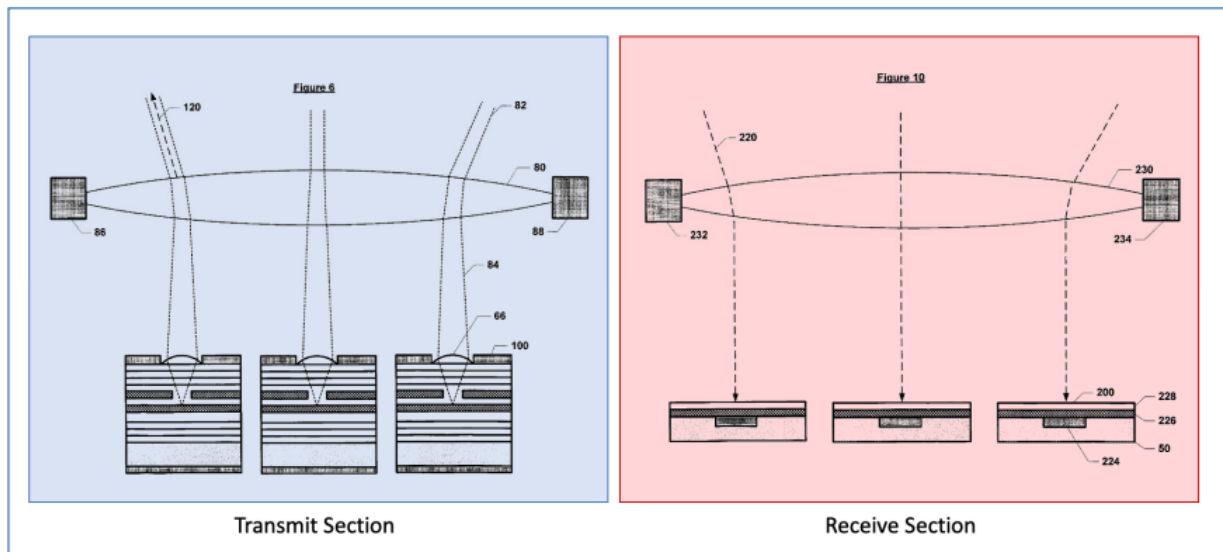
D. The Retterath Grounds disclose the claimed bulk transmitting optic “adjacent” to the bulk imaging optic (44(e))

PO does not dispute that respective lenses over the “emitter array 100” and “detector array 200” would be *adjacent* to one another. POR, 35-40. Instead, PO remarkably attempts to argue that the combination would not have respective imaging and transmitting optics at all. *Id.* But PO’s faulty theory ignores Retterath’s teachings.

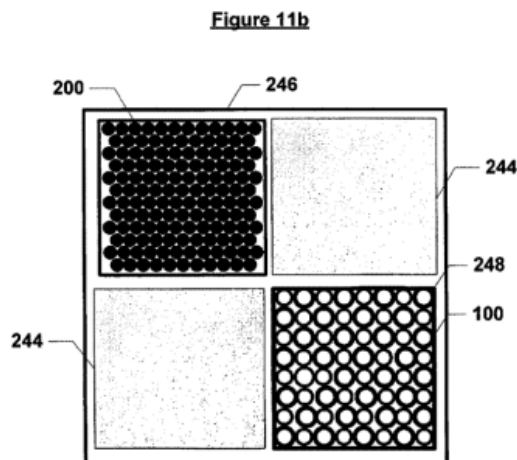
The Petition expressly describes the structure of the Retterath-Borowski combination in which bulk transmitting and imaging optics are arranged “adjacent” to one another, as well as Retterath (and numerous corroborating references) that provide straightforward teachings of this conventional arrangement. Indeed, in describing the combined system, the Petition highlighted Retterath’s teachings of “macro lens 230” positioned over the “emitter array 100” and “macro lens 80” positioned over “detector array 200,” and configurations in which the arrays and lens are positioned adjacent (e.g., diagonally) to one another. *See, e.g.,* Pet., 10-12, 19-20, 27-28 (citing EX1005, FIGS. 6, 10, 11b, 4:4-10, 6:8-15, 9:12-28 (“macro lens 80”), 10:23-30); EX1040, ¶¶43-44.

Notably, Retterath depicts that a macro lens 80 should be used when the emitter elements 100 are grouped together, and likewise, a macro detector lens 230

should be used when the detector elements 200 are grouped together:



EX1005, FIGS. 6 and 10. This is exactly what is shown in FIG. 11b, where the emitter elements 100 are grouped next to one another and detector elements 200 are grouped next to one another:



EX1005, FIG. 11b

PO's faulty theory conflates Retterath's FIG. 11a configuration (each emitter element 100 is positioned next to a detector element 200) with the FIG. 11b

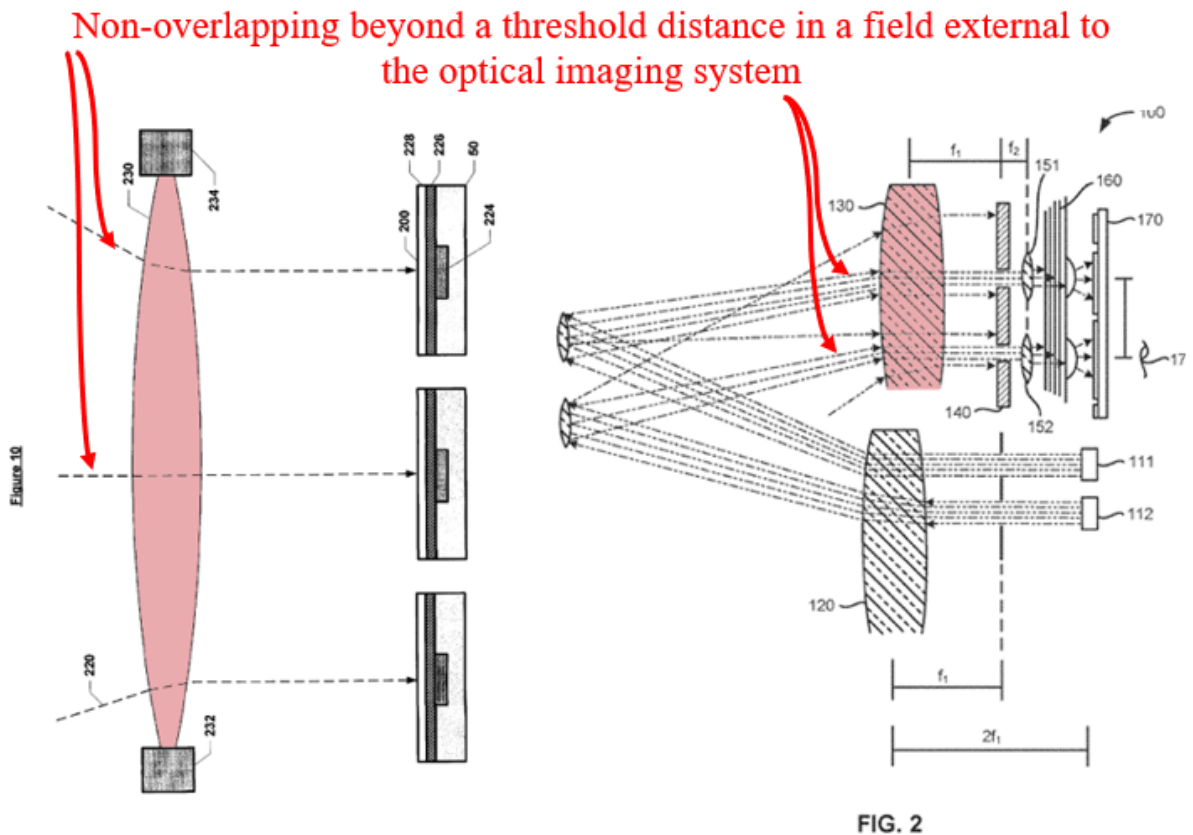
configuration. EX1040, ¶¶45-46. Figure 11a is described as having a “single global lens” for “both emitter elements 100 and detector elements 200” because each emitter element 100 is positioned directly next to a detector element 200 such that “*the distance between the emitter/detector pair must be minimal.*” EX1005, 10:40-55. But this strict condition is not the case for FIG. 11b. Rather, in FIG. 11b, all emitter elements 100 are grouped next to one another (like FIG. 6) and then all detector elements 200 are grouped next to one another (like FIG. 10), thereby resulting in the emitter elements 100 being spaced apart from the detector elements 100 (in separate quadrants of FIG. 11b). EX1005, 10:62-11:1; EX1040, ¶46. Figure 11b simply illustrates an example of a dense arrangement emitters 100 (like FIG. 6) and a dense arrangement of detectors 200 (like FIG. 10), and Retterath expressly teaches macro lenses 80 and 230 are used in such arrangements. *See, e.g.*, EX1005, 4:4-10, 6:8-15, 9:1-28, 10:23-30, 17:43-52, 20:4-12. There is no need for further “modification” of Retterath. A POSITA is not a mindless automaton; PO erroneously assumes otherwise. *Intel Corp. v. PACT XPP Schweiz AG*, 61 F. 4th 1373, 1379-80 (Fed. Cir. 2023) (“not an automaton”).

E. The Retterath Grounds disclose the claimed “threshold distance” (44(c))

The Petition described at length Retterath’s teachings that address the claimed “threshold distance.” *See, e.g.*, Pet., 21-23 (citing EX1005, 6:23-39, 7:61-

8:14, 8:36-40, 9:56-10:31, 10:32-11:25, 15:14-16:56, FIGS. 8-10. The POR never addressed it, and waived its opportunity to do so. *See* Paper 9, 9 (“may be deemed waived”).

To be clear, Retterath’s teachings on this point are just like the ’750 patent—the field-of-view for a given detector is non-overlapping with the field of view for all other detector elements at a threshold distance beyond the macro lens (e.g., macro lens 230):



Retterath

'750 Patent

EX1040, ¶¶47-48 (EX1005, FIG. 10, *see also* FIG. 8; EX1001, FIG. 2 (partial,

annotated)

The analysis set forth in the Petition is not undermined by PO's myopic focus on Dr. Shanley's explanation regarding a "number" or quantification of the "threshold distance." POR, 40-41. PO ignores that the '750 patent itself likewise never requires, or even mentions, a numeric quantification of the "threshold distance." PO cannot overcome the fact that the '750 patent provides less detail than Retterath on this same issue. The law forbids PO's double standard:

[T]hat appellant did not provide the type of detail in his specification that he now argues is necessary in prior art references supports the Board's finding that one skilled in the art would have known how to implement the features of the references.

In re Epstein, 32 F.3d 1559, 1568 (Fed. Cir. 1994).

The Retterath grounds align with the same type of "threshold distance" examples of the '750 patent. EX1040, ¶49.

IV. IMAI-HIGASHI-GRZESIK - GROUND 2

A. The Imai Ground Discloses the "Fields of View Coincident with" Element (44(f))

PO's analysis ignores the straightforward teachings set forth in the petition that align with near identity to example embodiments of the '750 Patent itself. EX1040, ¶50. PO incorrectly alleges that Imai only discloses emission regions that are "*significantly* larger or smaller" than the detection regions of the corresponding

detectors, and inaccurately states that the Petition “depends on the view that *any* overlap between emission and detection regions is sufficient.” POR, 41-43.

In fact, as set forth in the Petition, Imai’s description is just like the description of the ’750 patent, both describing examples in which the emission region is “slightly larger”/“minimally larger” than the pixel field of view:

Imai	'750 Patent
The irradiation range of each LD is set to be slightly larger than corresponding light receiving ranges of the four PDs.	... that is substantially coincident (and substantially the same size as or minimally larger than) the field of view

EX1009, [0101]; EX1001, 6:3-18. There is no meaningful distinction between the area described by Imai and the ’750 Patent. EX1040, ¶¶51-52; *see also*, Pet., 54-58, 61-64; EX1009, [0099], [0100]-[0101].

To be clear, PO never disputes the further analysis set forth in the Petition explaining why “a POSITA would have been motivated to implement the 16 LDs such that electromagnetic radiation output from each LD is coincident with a field of view of a corresponding PD.” Pet., 63-64 (balanced tradeoff of detection time and detection distance); EX1040, ¶53. This analysis provides an independent reason demonstrating the Imai grounds render obvious Element 44(f), and is waived by PO. *See* Paper 9, 9.

B. The Imai Ground Discloses the Claimed Bulk Transmitting Optic Adjacent to the Bulk Imaging Optic (44(e))

PO's analysis is premised on the assertion that "Figure 2C does not indicate that any element is adjacent to any other element, because elements have been omitted." POR, 45. This is specious at best. Imai expressly addresses the spatial relationship of the depicted aspects of the system, including a spatial (xyz) coordinate system. EX1040, ¶54.

Imai explains exactly what is "partially omitted"—portions of the "optical path" to/from the mirror 24, including the optical path extending out of the page (y-axis) from the perspective shown in FIG. 2C. EX1009, [0038]. For those objects depicted in the X-Z plane of FIG. 2C, the relative positions of the structures are accurately depicted. For example, there is no dispute that the LDA is adjacent to the coupling lens 22 in that X-Z plane, nor is there any dispute that the PDA adjacent to the imaging forming optical system in that X-Z plane. EX1040, ¶¶55-56. PO provides no explanation as to why Imai's FIG. 2C would accurately depict adjacent objects in the x-direction of that X-Z plane, but then suddenly become indecipherable in z-direction of that X-Z plane. Again, PO assumes the POSITA is a mindless automaton. *Intel*, 61 F. 4th at 1379-80.

PO's assertion is not supported by selective citation of Dr. Shanley's testimony. PO falsely states that "Dr. Shanley confirmed in his testimony that

Figure 2C is not an accurate representation of spatial relationships in the depicted system.” POR, 47. Instead, Dr. Shanley explains that even a “schematic drawing” would have been useful to a POSITA to convey the physical layout. EX1040, ¶57; EX2010, 139:3-22. This is especially the case in FIG. 2C, which illustrates the respective lenses are aligned on the x-direction, and spaced adjacently along the z-direction—an arrangement indistinguishable from the ’750 Patent’s example in which “the bulk transmitting optic is adjacent and offset laterally and/or vertically from the bulk imaging optic.” EX1001, 11:2-7.

Even if Imai does not expressly use the word “adjacent” in its text, PO ignores that the prior art must be read “for all that it teaches.” *Smith & Nephew, Inc. v. Rea*, 721 F.3d 1371, 1378 (Fed. Cir. 2013). Imai plainly illustrates the respective lenses adjacent to one another in the z-direction of an X-Z plane, without any disclosure for a non-adjacent arrangement of those lenses, and a POSITA would have recognized Imai’s suggestion based on “everything it teaches.” *Id.*; EX1040, ¶58.

**C. The Imai Grounds Disclose the Claimed “Threshold Distance”
(44(c))**

Here again, POR ignores the Petition’s analysis of Imai’s teachings that address the claimed “threshold distance.” *See, e.g.*, Pet., 51-52, 55-59, (citing EX1009, [0099]-[0101], [0125], FIGS. 7A-7B, 10-11; EX1001, 5:17-28, 11:16-

19), fn. 3; EX1040, ¶¶59-60. PO waived its opportunity to do so. *See* Paper 9, 9.

To be clear, the Petition’s analysis is not undermined by PO’s bare assertion regarding Dr. Shanley’s testimony as to whether the threshold distance is a “quantifiable number.” POR, 50; EX1040, ¶¶59-60. PO ignores that the ’750 patent itself likewise never requires, or even mentions, a numeric quantification of the “threshold distance.” *Epstein*, 32 F.3d at 1568; *Paulsen*, 30 F.3d at 1481 n.9.

V. WEIMER-BOROWSKI-HIPP - GROUND 3

A. The Weimer Ground Discloses the Claimed Bulk Transmitting Optic Adjacent to the Bulk Imaging Optic (44(e))

The Petition expressly identified Retterath’s teachings (and numerous corroborating references) of a bulk transmitting optic (e.g., transmit optics 318) and bulk imaging optic (e.g., receive optics 322), and their adjacent arrangement. Pet., 73 (“receive optic 322”), 76 (citing EX1009, 10:3-16, FIG. 3A).

The entirety of PO’s argument amounts to an assertion that FIG. 3A is not said to be drawn to scale. POR, 51. Whether or not the entirety of the drawing is “to scale,” however, does not detract from its usefulness to a POSITA to convey the physical layout. EX1040, ¶¶61-62. This is especially the case in FIG. 3A, which provides horizontal (“Cross-track”) and vertical (“Direction of Flight”) axes, and illustrates the respective lenses 318 and 322 are aligned on the vertical-axis, and spaced adjacently along the horizontal-axis. Here again, this arrangement is indistinguishable from the ’750 Patent’s description. EX1001, 11:11-13.

Even if not expressly disclosed (which it is), Weimer at least suggests an adjacent relationship between the transmitting and imaging optics. Again, the prior art must be read “for all that it teaches.” *Smith & Nephew*, 721 F.3d at 1378. Weimer amply illustrates the respective lenses adjacent to one another (consistent with conventional adjacent arrangements), without any disclosure for a contrary arrangement. EX1040, ¶63.

B. The Weimer Ground Discloses The “Coincident With” Element (44(f))

PO’s assertions regarding Weimer in Ground 3 fail for the same reasons as discussed above regarding the Retterath-Borowski-Weimer system. *Supra*, III.A.2. Weimer’s teachings are indistinguishable from the ’750 Patent’s preferred embodiments. EX1008, 4:56-58 (“Individual beams 208 can be directed to cover an area corresponding to a single pixel of the detector.”); *see also, id.* 1:56-60 (“only slightly smaller”); EX1001, 6:3-11; Pet. 74-75, 77-78; EX1040, ¶64.

C. The Weimer Ground Discloses The Claimed “Threshold Distance” (44(c))

Similar to its faulty analysis in Grounds 1 and 2, PO never addresses the Petition’s analysis of Weimer’s teachings of the claimed “threshold distance,” and waived its opportunity to do so. *See, e.g.,* Pet., 72-73, 74-76 (citing EX1008, 1:56-59, 4:56-58, 10:17-45, FIGS. 2A, 3A); EX1001, 5:17-28, 11:16-19; Paper 9, 9.

And here again, PO ignores that the ’750 patent itself never requires, or even

mentions, a numeric quantification of “threshold distance.” *Epstein*, 32 F.3d at 1568. Patent Owner’s myopic focus on testimony regarding quantification of the “threshold distance” is inapposite. POR, 53; EX1040, ¶¶65-66.

D. A POSITA Would Not Have Been Motivated to Combine Weimer, Borowski, and Hipp

PO relies on the same deficient analysis as to Hipp in the Retterath grounds, and thus its assertions fail for the same reasons described above. *Supra*, III.B; EX1040, ¶67.

VI. PO’S SECONDARY CONSIDERATIONS ARE LEGALLY AND FACTUALLY DEFICIENT

A. PO Failed to Demonstrate Nexus

PO alleges secondary considerations, but does not even attempt to demonstrate a nexus between any unique features of the challenged claims and the purported “skepticism” and “failure of others” to use SPADs in LiDAR systems. POR, 54-58. While the challenged claims are directed to a specific structural arrangement tailored to SPADs with other optical elements and features, PO proffers only vague contentions about “SPADs in LiDAR systems” generally. *Id.* This is not a “nexus,” and at most, it is only tenuously related to one claim element never alleged to be novel. *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR 2018-00129, Paper 33, 34-35 (PTAB “Precedential Jan. 24, 2020) (“must be a nexus to some aspect of the claim not already in the prior art”); *In re Kao*, 639 F.3d 1057, 1068-

69 (Fed. Cir. 2011); EX1040, ¶68. PO’s deficient analysis does not even mention “nexus.”

B. PO’s Purported Evidence Ignores The Widespread Teachings of “SPADs in LiDAR Systems” At The Relevant Time

Even if there was a nexus (there is not), PO’s evidence is factually flawed and ignores prior art already in the record. PO erroneously asserted industry “skepticism” of SPADs in LiDAR systems based on Dr. Shanley’s account of one project *in 2008*—many years before the critical date of the ’750 patent. *See* POR, 55-56. Such evidence suffers from a fatal temporal flaw, and does nothing to dispel conventional option for using SPADs in LiDAR systems by 2015. There is no dispute that Borowski, Imai, and Higashi establish others described using SPADs in LiDAR systems to achieve known benefits before the ’750 priority date. Pet., 7, 12-18, 46-50; EX1003, ¶¶51-62. By 2015, SPADs were more advanced and were embraced by the industry as some of the best LiDAR system photodetectors. EX1003, ¶¶51-62, 89-95, 112, 118-122; EX1040, ¶¶69-71.

And this ubiquitous nature of SPADs in LiDAR systems extended beyond Borowski, Imai, and Higashi. EX1040, ¶72. An academic article from 2013 provides that “SPADs...are emerging as most suitable photodetectors for...single-photon timing (Lidar...) applications.” EX1045, 2-5. Another 2012 article describes a LiDAR system that combines “a SPAD array with an optical scanning

system” to improve performance. EX1046, 1-11. Another (2014) describes “(SPADs) are the best candidates” for LiDAR systems. EX1047, 1-8.

These articles also directly contradict PO’s assertion that “many had sought—but failed—to develop arrays of SPADs for use in LIDAR systems” in 2015. *See* POR, 56-57. PO cites just one article—the Vinogradov paper. EX2014, 4. As demonstrated above, however, SPADs were often a preferred option in LiDAR systems for many others in 2015. EX1040, ¶¶73-74. At a minimum, the recited SPAD claim element in the ’750 patent was by no means “novel” in 2015. *Kao*, 639 F.3d at 1068-69.

VII. PO’S DECLARANT LACKS SUFFICIENT LIDAR EXPERIENCE

PO’s proposed POSITA definition attempts to shrink the level of skill to accommodate its declarant’s limited LIDAR experience, calling for as little as “one year” of experience with “LIDAR designs.” POR, 4-5; EX1040, ¶¶75-77. The record lacks indication that PO’s declarant has even this minimalistic level of LIDAR experience. He is not a POSITA under the appropriate definition supported by evidence—the law mandates his “opinions are neither relevant nor reliable.” *Kyocera Senco Indus. Tools, Inc. v. ITC*, 22 F.4th 1369, 1376-77 (Fed. Cir. 2022).

PO’s allegation that Petitioner advances a “changing” POSITA definition is false. POR, 5. Rather, Petitioner considered the 2-3 years of experience to be consistent with PO’s previous position for a similar type of LiDAR patent. *See*

IPR2018-00255, Pap. 30, 7-8; IPR2018-00256, Pap. 33, 7-8 (same). It is PO who is now changing positions.

PO points to a different IPR case in which the claims of the patent (11,287,515) are focused on a mechanical assembly (including an enclosure, shaft, stator assembly, rotor assembly, etc.). POR, 5. Such different nature of claims gives rise to a different type of ordinary artisan. But here, PO provides no explanation why the level of skill should be vastly different from what it previously proposed in IPR2018-00255/-00256. The lack of LiDAR experience for PO's declarant explains everything.

Respectfully submitted,

Dated: October 21, 2024

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioner's Reply to Patent Owner's Response totals 5,578 words, which is less than the 5,600 allowed under 37 CFR § 42.24(c)(1).

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e), the undersigned certifies that on October 21, 2024, a complete and entire copy of this Petitioner's Reply to Patent Owner's Response and accompanying exhibits were provided by email, to the Patent Owner, by serving the correspondence addresses of record as follows:

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