

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MATSING, INC.,
Petitioner,

v.

ALL.SPACE NETWORKS LTD. f/k/a ISOTROPIC SYSTEMS, LTD.,
Patent Owner.

IPR2022-01108
Patent 10,553,947 B2

Before KARL D. EASTHOM, MICHAEL R. ZECHER, and
JON M. JURGOVAN, *Administrative Patent Judges*.

EASTHOM, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Matsing, Inc. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) with a Declaration of Anthony Teillet (Ex. 1012, “Teillet Declaration”) requesting an *inter partes* review of claims 1–19 of U.S. Patent No. 10,553,947 B2 (Ex. 1001, the “’947 patent”). All.Space Networks f/k/a Isotropic Systems, Ltd. (“Patent Owner”) filed a Preliminary Response (Paper 7, “Prelim. Resp.”). *See* Paper 8 (notifying Board of Patent Owner’s name change to All.Space Networks Limited).

After the Institution Decision (Paper 9, “Inst. Dec.”), Patent Owner filed a Response (Paper 16, “PO Resp.”) with a Declaration of Nader Behdad, Ph.D. (Ex. 2008, “Behdad Declaration”), Petitioner filed a Reply (Paper 19, “Reply”) with a Supplemental Declaration of Anthony Teillet (Ex. 1013, “Supp. Teillet Declaration”), and Patent Owner filed a Sur-reply (Paper 21, “Sur-reply”). Patent Owner deposed Mr. Teillet (Ex. 2007, “Teillet Deposition”; Ex. 2025, “Supp. Teillet Deposition”) based on the Teillet Declaration and the Supplemental Teillet Declaration. Petitioner deposed Dr. Behdad (Ex. 2026, “Behdad Deposition”) based on the Behdad Declaration. After the briefing, the Board conducted an oral hearing and entered a Transcript thereof in the record.¹ Paper 29 (“Tr.”).

For the reasons set forth in this Final Written Decision pursuant to 35 U.S.C. § 318(a), we determine that Petitioner demonstrates by a preponderance of evidence that challenged claims 1–19 of the ’947 patent are unpatentable.

¹ The “record” hereinafter refers to the fully developed trial record, which consists of all Papers and Exhibits filed to date.

A. Real Party in Interest

Petitioner identifies itself as the real party-in-interest. Pet. 2. Patent Owner identifies All.Space Networks Ltd. as the real party-in-interest. Paper 8, 1. Patent Owner “note[s] that Isotropic Systems, Ltd., recently changed its name to All.Space Networks L[t.d.], but the entity itself remains otherwise unchanged and the patent-at-issue remains assigned to All.Space Networks L[t.d.] f/k/a Isotropic Systems, Ltd.” *Id.*

B. Related Matters

The record indicates there are no related matters. Pet. 3 (stating there are no related matters); *see generally* PO Resp. (not identifying any related matter).

C. The '947 Patent

The '947 patent generally describes “a[n] antenna system that includes a plurality of lens sets.” Ex. 1001, code (57). “Each lens set includes a lens and *at least one* feed element.” *Id.* (emphasis added). “*At least one* feed element . . . align[s] with the lens” and “direct[s] a signal through the lens at a desired direction.” *Id.* (emphasis added). One embodiment includes a “specially optimized” “GRadient Index (GRIN)” lens. *Id.* at 2:56–57.

Figure 2 of the '947 patent follows:

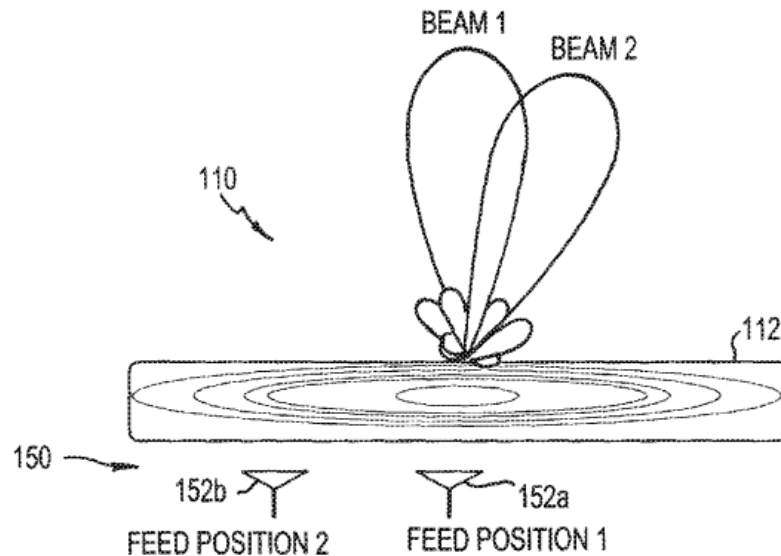


Figure 2 above shows feeds 152a and 152b that direct electromagnetic energy through lens 112 (in lens set 110) in patterns as represented by Beam 1 and Beam 2, respectively. Ex. 1001, 7:46–64. “Only two feed elements 152a, 152b are shown here for clarity but a typical feed cluster might have, for example, 19, 37, or more individual feeds.” *Id.* at 7:47–49.

“[S]electively activating one of the feed elements 152a, 152b enables the lens set 110 to generate a radiation pattern in a desired direction (i.e., to beam scan by feed selection).” *Id.* at 7:60–63. Accordingly, “the lens set 110 may operate in a wide range of angles.” *Id.* at 7:63–64.

Patent Owner’s annotated version of Figure 4 of the '947 patent follows:

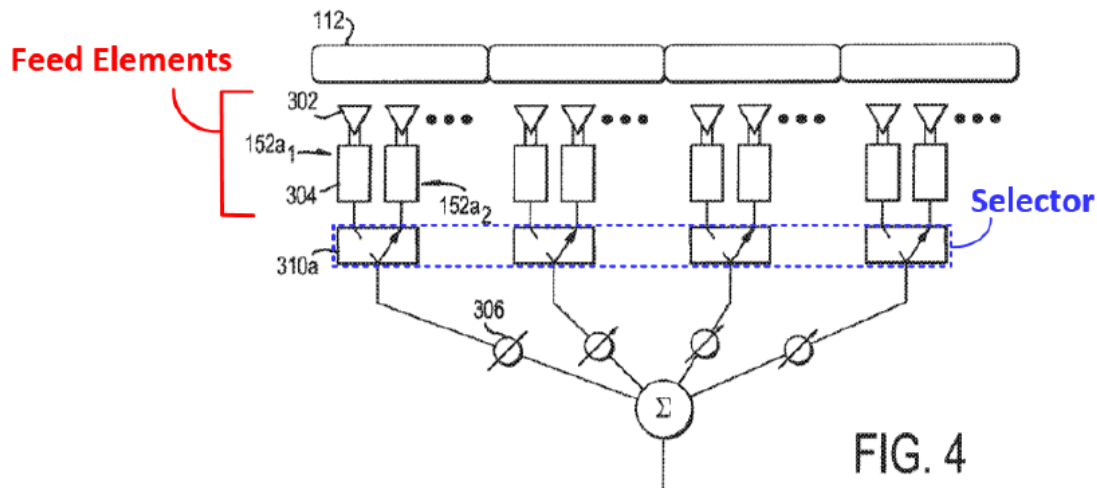


Figure 4, as annotated by Patent Owner, illustrates selector 310a (blue), which “effectuates such steering/scanning by selectively activating feed elements [204, 152, 302 (red)].” PO Resp. 4, 6 (citing Ex. 1001, 4:43–67, 7:60–64, 9:24–10:5, 18:13–21; Ex. 2008 ¶ 40). In relation to Figure 4, the ’947 patent refers to “one or more switches 310 at each lens 112,” but Figure 4 illustrates only a single switch at each lens. Ex. 1001, 9:26. The description of Figure 4 does not refer to 310 as a selector. *Id.* at 9:24–10:5. On the other hand, Figure 4 illustrates “another example in which a feed element or a plurality of feed elements included in a lens set of a phased array is *selectively activated*.” *Id.* at 9:65–67 (emphasis added).

“[E]ach lens and its multiple feed elements can form multiple beams simply by enabling and exciting separate feed elements in each lens with independent RF [radio frequency] signals.” Ex. 1001, 3:50–53. The ’947 patent describes embodiments with fixed feed elements and others with movable feed elements:

In one embodiment, the array would steer *one or more* beams over a specified angular range or field of regard with *no moving parts* by having multiple feeds in the focal region of each lens and selecting the active feed to steer the element beam. In

another highly-simplified embodiment an array with minimal parts count could also be implemented by *physically moving each feed element in the corresponding lens's focal region*.

Ex. 1001, 3:10–16 (emphasis added).

Each lens can form “multiple independent element patterns” by selecting different feeds within the lens, using multiple lenses to obtain “a high gain beam”:

Each lens and feed subsystem can form multiple independent element patterns whose beams are steered according to the displacement of the feeds from the nominal lens focal point. Further, by combining and phasing the corresponding ports of a multiplicity of such lens and feed subsystems a high gain beam is formed with finely controlled beam direction.

Ex. 1001, 4:17–23.

D. Illustrative Claim

Illustrative independent claim 1, the sole independent claim, follows (with bracketed alphanumeric information added):

1. An antenna system comprising:

[a] a phased array having a plurality of lens sets, each lens set including:

[a.1] a plurality of non-spherical lenses;

[a.2] a plurality of feed elements aligned with a respective one of said plurality of lenses and configured to transmit/receive a signal through said respective one of said plurality of lenses at a desired direction; and

[b] a selector connected to each of said plurality of feed elements of said plurality of lens sets to dynamically select a subset of said plurality of feed elements to transmit/receive the signal through said non-spherical lens.

E. Asserted Grounds of Unpatentability

Petitioner asserts that claims 1–19 are unpatentable based on the following grounds (Pet. 7).

Claim(s) Challenged	35 U.S.C §	Reference(s)/Basis
1–5, 9–11, 15, 18, 19	103 ²	Matitsine-860, ³ Demetriadou, ⁴ Ebling ⁵
6	103	Matitsine-860, Demetriadou, Ebling, Matitsine-537 ⁶
7, 8	103	Matitsine-860, Demetriadou, Ebling, Matitsine-537, Lee ⁷
12–14, 16	103	Matitsine-860, Demetriadou, Ebling, Ray-767 ⁸
17	103	Matitsine-860, Demetriadou, Ebling, Ray-767, Turcotte-804 ⁹

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103, was effective on March 16, 2013. Petitioner asserts that the “earliest possible effective filing date for the ’947 patent” is March 17, 2017. Pet. 4. Because this date is after the effective date of the applicable AIA amendment, the post-AIA version of § 103 applies.

³ Matitsine et al., U.S. Patent No. 9,728,860 B2, filed Dec. 3, 2015, issued Aug. 8, 2017. Ex. 1002.

⁴ A. Demetriadou and Y. Hao, *Slim Luneburg Lens for Antenna Applications*, Optics Express, V. 19, No. 21, 19925 (Oct. 2011). Ex. 1003.

⁵ Ebling et al., U.S. Patent No. 7,605,768 B2, issued Oct. 20, 2009. Ex. 1004.

⁶ Matitsine, U.S. Patent No. 8,518,537 B2, issued Aug. 27, 2013. Ex. 1005.

⁷ Y.T. Lo and S.W. Lee, ANTENNA HANDBOOK, THEORY, APPLICATIONS, AND DESIGNS (1988). Ex. 1006.

⁸ Ray, U.S. Patent Pub. No. 2016/0172767 A1, published June 16, 2016. Ex. 1007.

⁹ Turcotte et al., U.S. Patent No. 5,856,804, issued Jan. 5, 1999. Ex. 1008.

II. OBVIOUSNESS ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner asserts the following:

A person of ordinary skill in the art (“POSITA”) is a hypothetical person who is presumed to be aware of all relevant prior art. *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986). At the time that the patent application for the ‘947 Patent was filed, a POSITA would have had an understanding of basic antenna theory as it applies specifically to wireless communication antennas, and to further have a basic understanding of the wide variations of antenna types that have been developed over the past 50 years.

Pet. 16.

Patent Owner disagrees with this proposed level of skill in the art. PO Resp. 7. Patent Owner asserts Petitioner’s proposal “includes no educational or experience requirement, requires only a ‘basic understanding’ of antenna types, does not mention lenses, and has no expert support.” *Id.* According to Patent Owner, a person of ordinary skill in the art “would have had a Bachelor’s or graduate degree in electrical engineering or applied physics and at least two years of experience with lens antenna design. *More education could substitute for experience, and vice versa.*” *Id.* (citing Ex. 2008 ¶¶ 31–33) (emphasis added).

The two proposals largely overlap, because a person with a Bachelor’s degree in electrical engineering or applied physics, or with less education, but with “at least two years of experience with lens antenna design” (PO Resp. 7), falls into the category of a person having “an understanding of basic antenna theory as it applies specifically to wireless communication antennas, and to further have a basic understanding of the wide variations of antenna types that have been developed over the past 50 years” (Pet. 16).

Determining the level of ordinary skill in the art involves various factors, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citation omitted). The prior art of record also reflects the level of ordinary skill in the art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). For purposes of this Final Written Decision, we adopt the proposals offered by the parties and treat them as alternatives as they largely overlap, are consistent with each other, and are consistent with the ’947 patent and the asserted prior art. Moreover, even if we were to adopt Patent Owner’s proposal to the exclusion of Petitioner’s proposal or vice versa, we would reach the same result.

B. Claim Construction

In *inter partes* reviews, the Board construes claims using the same claim construction standard employed in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2020). Under the principles set forth by our reviewing court, the “words of a claim ‘are generally given their ordinary and customary meaning,’” as would have been understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in

evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner relies on the plain meaning of the terms. Pet. 17 (citing 37 C.F.R. § 42.100(b); *Phillips*). Patent Owner does not specify a claim construction standard, but relies on “the common understanding in the art,” (which is essentially the *Phillips* standard) with respect to the meaning of “non-spherical lens.” PO Resp. 73. We analyze the parties positions with respect to this term in our analysis of the grounds of unpatentability below. No need exists to construe any other claim term expressly to resolve the parties’ disputes. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

C. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103 “if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” 35 U.S.C. § 103 (2011); *accord KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (quoting similar language in pre-AIA version of 35 U.S.C. § 103). The question of obviousness involves resolving the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the

art; and (4) when in evidence (none on this record), objective indicia of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

D. Analysis of the Grounds

1. Matitsine-860, Demetriadou, and Ebling

Petitioner asserts that claims 1–5, 9–11, 15, 18, and 19 would have been obvious under 35 U.S.C. § 103 based on the combined teachings of Matitsine-860, Demetriadou, and Ebling. Pet. 17–32.

a) Matitsine-860 (Ex. 1002)

Matitsine-860 relates to “[a] radio frequency antenna,” with “an array of spherical lens[es]” and “mechanically movable radio frequency (RF) elements along the surface of the spherical lens to provide cellular coverage for a narrow geographical area.” Ex. 1002, code (57).

Matitsine-860 defines a “spherical lens” broadly, and lists an example of a spherical lens as a “Luneberg lens” or other spherical lens having “at least 50% . . . of [its] surface area conform[ing] to the shape of a sphere”:

A spherical lens is a lens with a surface having a shape of (or substantially having a shape of) a sphere. *As defined herein, a lens with a surface that substantially conform[s] to the shape of a sphere means at least 50% (preferably at least 80%, and even more preferably at least 90%) of the surface area conforms to the shape of a sphere. Examples of spherical lenses include a spherical shell lens, the Luneburg lens, etc.* The spherical lens can include only one layer of dielectric material, or multiple layers of dielectric material. A conventional Luneburg lens is a spherically symmetric lens that has multiple layers inside the sphere with varying indices of refraction.

Ex. 1002, 4:54–65 (emphasis added).

Matitsine-860's Figure 1A follows:

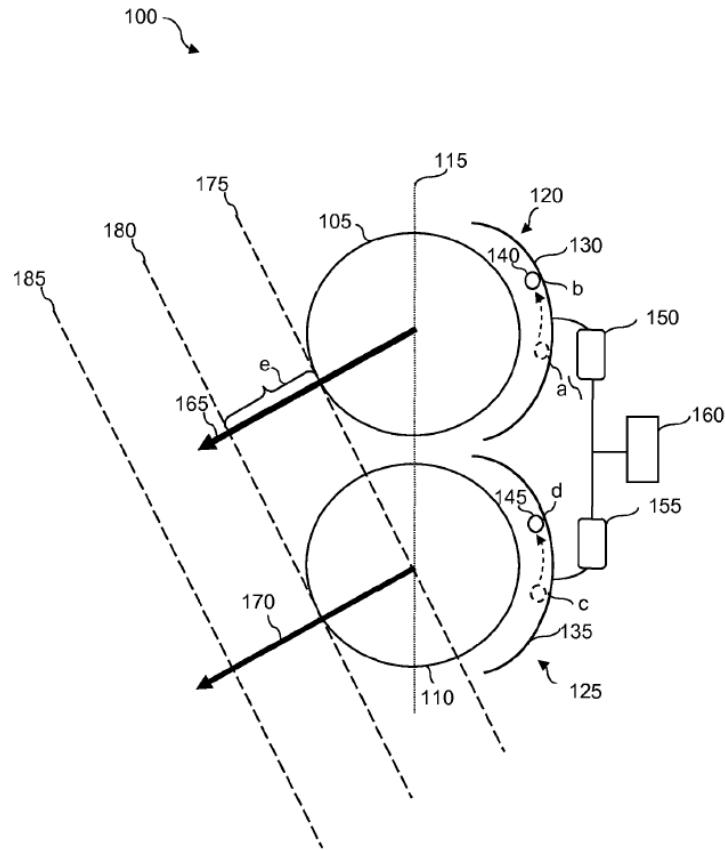


Figure 1A, reproduced above, illustrates antenna system 100 with RF radiating elements 140 and 145 movable along curved tracks 130 and 135 of adjacent surfaces of spherical lenses 105 and 110 aligned along virtual axis 115. Ex. 1002, 4:47–5:29. Matitsine-860 “contemplate[s] that each element assembly can house multiple RF elements on one or more tracks.” *Id.* at 5:27–28. Matitsine-860 similarly states that “[m]ultiple RF elements can be placed on a single track.” *Id.* at 2:17. “An RF element can include an emitter, a receiver, or a transceiver.” *Id.* at 5:22–23.

Matitsine-860's Figure 3 follows:

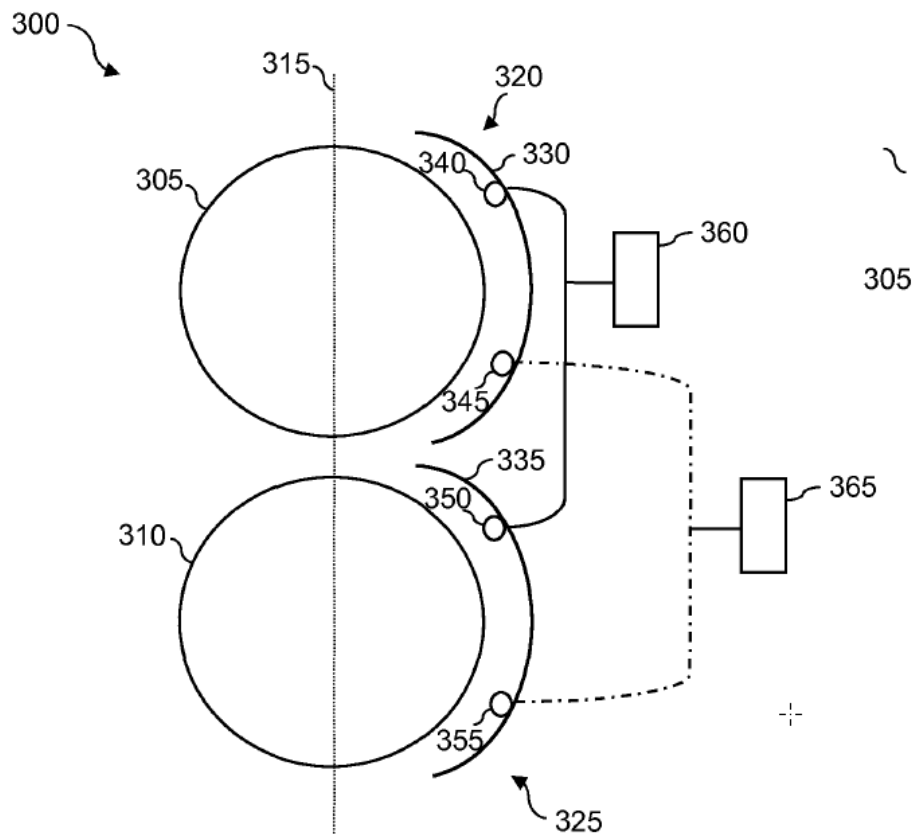


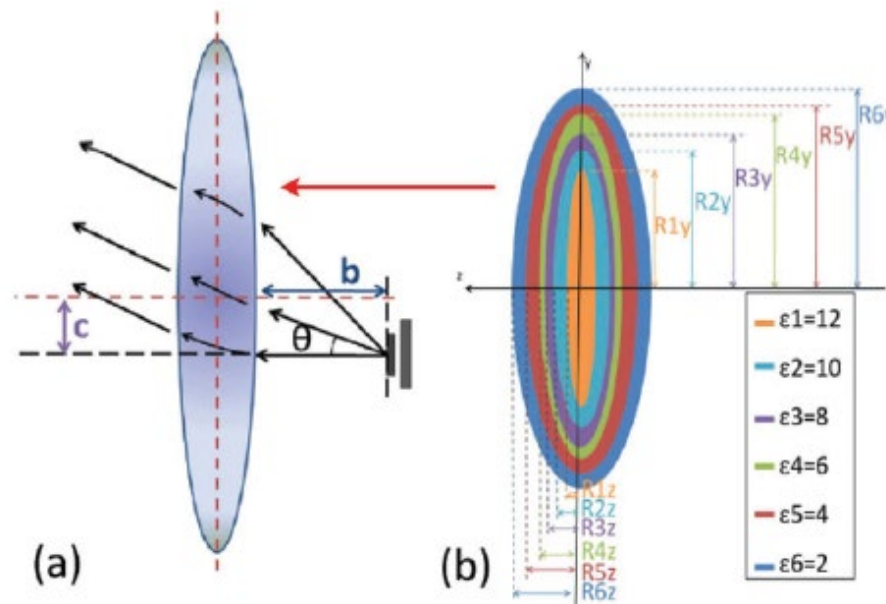
Figure 3, reproduced above, illustrates antenna system 300 with RF elements 340, 345 and 350, 355 movable along curved tracks 320 and 335 of adjacent surfaces of each lens 305 and 310, respectively. Ex. 1002, 8:1–20. Control mechanism 360, which includes a phase shifter, controls the phase and positions of RF elements 340, 350. *Id.* at 8:28–37. Similarly, control mechanism 365, which also includes a phase shifter, controls the phase and position of RF elements 345, 355. *Id.*

b) Demetriadou (Ex. 1003)

Demetriadou, titled “Slim Luneburg Lens for Antenna Applications,” describes “a transformation that reduces the profile of the original [spherical] Luneburg lens without affecting its unique properties.” Ex. 1003,

Abstract. This transformation “creates a slimmer lens,” or a “‘discus’-shaped lens, by ‘squeezing’ or ‘slimming’ the spherical lens.” *Id.* at 19927.

Demetriadou’s Figures 3a and 3b follow:



As illustrated above, Figure 3(b) is a cross-section of the lens in Figure 3(a), which is a transformed (i.e., flattened) Luneberg lens. Ex. 1003, 5.

“[T]he transformed lens can be used to replace conventional antenna systems (i.e. Fabry-Perot resonant antennas) *producing a high-directivity beam with low side-lobes. In addition, it provides excellent steering capabilities for wide angles, maintaining the directivity and side-lobes at high and low values respectively.*” Ex. 1003, Abstract (emphasis added).

c) Ebling

Ebling relates to a switch for a plurality of feed elements oriented around an electromagnetic (dielectric) lens. Ex. 1004, code (57), 4:10–21.

Figure 1 of Ebling follows:

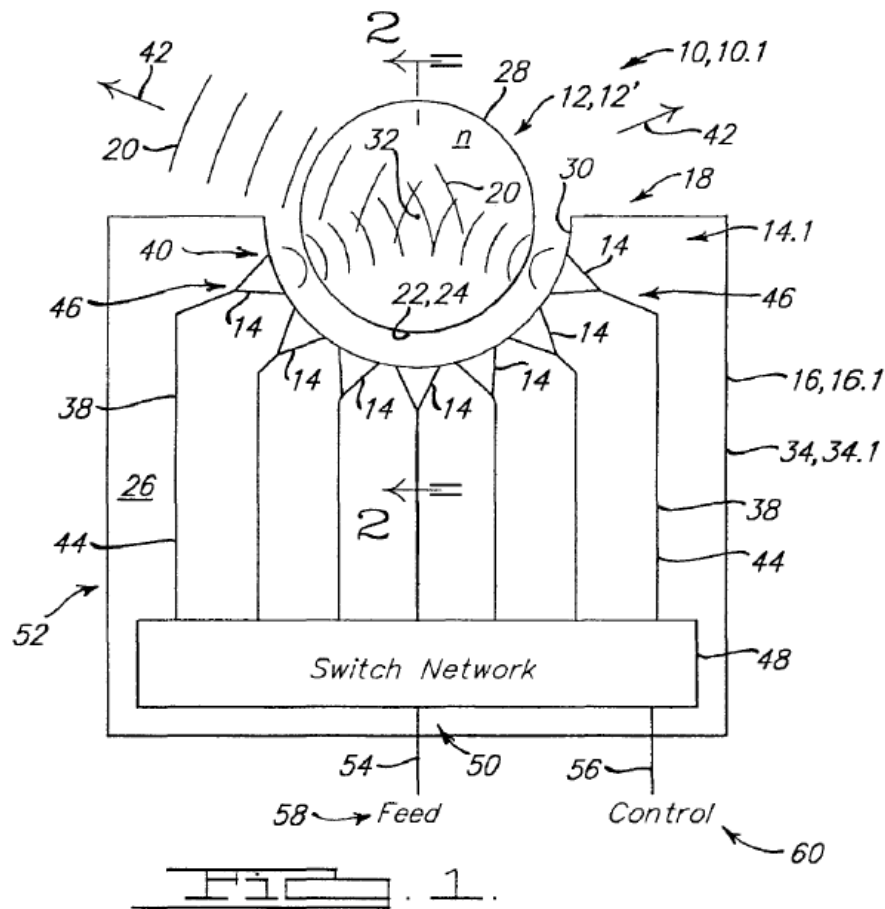


Figure 1, reproduced above, illustrates switch network 48, which switches feed signal 58 to “the associated feed port 46 of one or more antenna feed elements 14, . . . responsive to a control signal 60 applied to the control port 56.” Ex. 1004, 6:27–33. “The associated beams of electromagnetic energy 20 launched by different antenna feed elements 14 propagate in different associated directions 42.” *Id.* at 6:41–43. “[T]he plurality of antenna feed elements 14 are adapted to radiate or receive a corresponding plurality of beams of electromagnetic energy 20 through the at least one electromagnetic lens 12.” *Id.* at 4:13–15.

In accordance with known principles of diffraction, the shape and size of the at least one electromagnetic lens 12, the refractive

index *n* thereof, and the relative position of the antenna feed elements 14 to the electromagnetic lens 12 are adapted in accordance with the radiation patterns of the antenna feed elements 14 to provide a desired pattern of radiation of the respective beams of electromagnetic energy 20 exiting the second side 28 of the at least one electromagnetic lens 12.

Ex. 1004, 4:33–42.

Although “the at least one electromagnetic lens 12 is illustrated as a spherical lens 12’,” each lens “is not limited to any one particular design, and may, for example, comprise either a spherical lens, a Luneburg lens, a spherical shell lens, a hemispherical lens, an at least partially spherical lens, an at least partially spherical shell lens, an elliptical lens, a cylindrical lens, or a rotational lens.” Ex. 1004, 4:41–48. Also, “[e]lectromagnetic lens 12 may be truncated for improved packaging, without significantly impacting the performance of the associated multi-beam antenna 10.” *Id.* at 4:49–51.

d) Claim 1

i. Preamble and Limitation 1.a

The preamble and limitation 1.a recites “[a]n antenna system comprising: a phased array having a plurality of lens sets.” Petitioner generally reads the preamble and limitation 1.a.1 onto Matitsine-860’s Figures 1A and Figure 3. *See* Pet. 17–18.

Petitioner contends that Matitsine-860’s Figure 1A represents a phased array antenna with a plurality of radiating elements 140 and 145 and lenses 105 and 110. *See* Pet. 17–18 (citing Ex. 1002, 4:47–5:29, Fig. 1A; Ex. 1012 ¶ 21). As background, Petitioner also provides evidence that Matitsine-860 discloses multiple RF elements as feed elements around a single track of each lens and discloses multiple RF elements around each lens of Figure 3, as discussed further below in connection with limitation

1.a.2 and 1.b. *See id.* at 11–14 (citing Ex. 1001, Fig. 1A, Fig. 3, 2:17–24, 8:5–18, 9:1–26), Pet. 20 (citing Ex. 1003, Figs. 1A, Fig. 3). Patent Owner does not dispute that Matitsine-860 discloses the preamble and limitation 1.a. *See* PO Resp. 11 (characterizing Matitsine-860 as “having multiple spherical lenses with associated RF elements allow antenna system 100 to (1) provide multiple coverage areas and/or (2) increase the capacity within a coverage area . . . to effectively [] double the capacity for the coverage” (citing Ex. 1002, 6:27–35)).

On this record, Petitioner’s showing as to the preamble and limitation 1.a is persuasive.

ii. Limitation 1.a.1

Limitation 1.a.1 recites “each lens set including: [a.1] a plurality of non-spherical lenses.” Addressing the “non-spherical lenses” of limitation 1.a1, Petitioner states that

Matitsine-860 . . . discloses an antenna system with lenses described with “a surface having a shape of (or substantially having a shape of) a sphere. As defined herein, a lens with a surface that substantially conform[s] to the shape of a sphere means at least 50% (preferably at least 80%, and even more preferably at least 90%) of the surface area conforms to the shape of a sphere.”

Pet. 18 (quoting Ex. 1002, 4:55–60). Based on the above-quoted language in Matitsine-860, Petitioner asserts that “Matitsine-860 teaches that as much as 50% of the lenses can comprise a non-spherical surface” (*id.*) and, therefore, Matitsine-860 “discloses use of a non-spherical lens (e.g.,] 50% of the lens is non-spherical)” (*id.* at 20). Matitsine-860 discloses that an example of a spherical lens is a “Luneburg lens.” Ex. 1002, 4:60–61.

Petitioner alternatively asserts that it would have been obvious to replace Matitsine-860's lenses with Demetriadou's non-spherical lenses. Pet. 18–20. Petitioner notes that Demetriadou teaches transforming a spherical Luneberg lens to produce a “slim” lens. *See id.* at 18 (quoting Ex. 1003, Abstract). Petitioner further relies on Demetriadou's teaching that “[t]his slimmed, non-spherical lens ‘provides excellent steering capabilities for wide angles, maintaining the directivity and side-lobes at high and low values respectively.’” *Id.* at 19 (quoting Ex. 1003, Abstract). Relying on the Teillet Declaration, Petitioner also contends that a “[person of ordinary skill in the art] would find motivation to combine the non-spherical lens of Demetriadou with the lens sets of Matitsine-860, as the truncated geometry of non-spherical lens provides for a reduced implementation cost by virtue of relatively smaller lens volume.” *Id.* at 19–20 (citing Ex. 1012 ¶ 22). Petitioner also contends that replacing “the spherical lens in Matitsine-860 with the non-spherical lens in Demetriadou . . . would produce predictable results via the combination of familiar elements.” *Id.* at 19 (citing Ex. 1012 ¶ 22); *KSR*, 550 U.S. at 416 (“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”).

Patent Owner argues that Matitsine-860 does not disclose “non-spherical lenses.” PO Resp. 19. Patent Owner also argues “[t]hat [the allegation] is irrelevant to any ground, because [all the grounds] rely on a combination of Matitsine-860, Demetriadou and Ebling that replaces Matitsine-860's lenses with Demetriadou's.” *Id.* at 25 (citing Pet. 7, 17; Ex. 2007, 63:13–65:6).

The trial record does not support Patent Owner's arguments. The Petition asserts that Matitsine-860 discloses non-spherical lenses. Pet. 18, 20. Patent Owner otherwise concedes that "Petitioner also alleged that Matitsine-860 discloses non-spherical lenses." PO Resp. 25 (citing Pet. 18, 20). Contrary to Patent Owner's characterization, the cited Petition pages are part of Ground 1 of the Petition. *See* Pet. 17–22 (Ground 1, claim 1); Reply 24 ("The Petition clearly argues that a non-spherical lens is disclosed in Matitsine-860" (citing Pet. 18)). In particular, after summarizing Matitsine-860's disclosure and asserting that "Matitsine-860 teaches that as much as 50% of the lenses can comprise a non-spherical surface" (Pet. 18), Petitioner states that "Matitsine-860 not only *discloses use of a non-spherical lens* (e.g. 50% of the lens is non-spherical) but also it would have been obvious to substitute the discus lens of Demetriadou" (*id.* at 20 (emphasis added)).

Although Patent Owner points to Mr. Teillet's deposition testimony at which Mr. Teillet testifies that his Declaration (Ex. 1012) does not specifically rely on Matitsine-860 as disclosing a non-spherical lens (Ex. 2007, 63:13–65:6), he also testifies in his deposition that Matitsine-860 "is also referring to non-spherical" (*id.* at 64:3–4). In any event, the Petition asserts that Matitsine-860 discloses a non-spherical lens, as found above. *See* Pet. 18, 20.

Arguing that Matitsine-860 only discloses spherical lenses, Patent Owner contends that "every Matitsine-860 embodiment leverages the direction independence of a spherical lens to achieve its disclosed capabilities." PO Resp. 73 (citing Ex. 2008 ¶¶ 168–171, 195–198, 203–204). Patent Owner also argues that

Matitsine-860's definition of a spherical lens as encompassing lenses that are not perfect spheres is consistent with the common understanding in the art and with a [person of ordinary skill in the art's] understanding that a spherical lens may have non-spherical surfaces because a full sphere is not needed to provide the direction-independent properties of a spherical lens.

Id. (citing Ex. 1004, Figs. 1–3, 4:48–54; Ex. 2008 ¶¶ 204–208; Ex. 2016, 4:59–62) (“the term ‘spherical lens’, as used herein, refers to any lens for which a substantial portion of the outer [s]urface is spherical in shape and is not limited to lenses having a fully spherical outer surface”). Patent Owner also argues that Matitsine-860 “us[es] spherical lenses in the shape of a truncated sphere,” which thereby “provides coverage of multiple geographic areas with a direction independent transmit/receive response, and the coverage capacity can be doubled by moving both RF elements 140, 145 to cover the same geographic area.” *Id.* at 75 (citing Ex. 2008 ¶¶ 100–105; Ex. 2016, 4:59–62).

These arguments and cited evidence are unavailing. Matitsine-860 does not explicitly disclose a truncated sphere. Moreover, the arguments and evidence relate to prior art patents that employ different definitions for spherical lenses, instead of addressing the plain meaning of a non-spherical lens in light of the '947 patent. Petitioner and Mr. Teillet persuasively construe a non-spherical lens, according to its plain meaning, as a lens that is not in the shape of a sphere. Reply 24–25 (arguing that a person of ordinary skill “with an understanding of basic antenna theory as it applies specifically to wireless communication antennas” “would have an ordinary understanding of the term ‘non-spherical’, as being something that is not spherical”); Ex. 2007, 217:4 (testifying “if it’s truncated, it’s no longer a

sphere”), 231:16–17 (testifying that Ebling’s truncated sphere is “basically not like a sphere”).

As discussed further below, even if a lens is not a perfect sphere and a prior art patent *defines* a spherical lens as including a substantially spherical lens *for use of that term in that patent*, this does not conflict with the plain meaning of a non-spherical lens as a lens that is not spherical. The plain meaning of a “spherical antenna” is “[a]n antenna whose overall shape, or whose radiators, are spherical.” WILEY ELECTRICAL AND ELECTRONICS DICTIONARY, 737, Steven M. Kaplan (2004), *available at* <https://ieeexplore.ieee.org/book/5273107>. Ex. 3002. It follows that the plain meaning of a spherical lens is a lens whose overall shape is spherical, and the plain meaning of a non-spherical lens is a lens whose over all shape is not spherical.

The parties agree that Matitsine-860 discloses lenses with “up to 50% non-spherical surfaces.” *See* PO Resp. 74; Pet. 18, 20. Even if Matitsine-860 limits its disclosure to a truncated sphere (it does not), a truncated sphere is not a sphere. Nothing in the ’947 patent limits a “non-spherical” lens such that it precludes a truncated sphere or Mattison-860’s lenses, which the parties agree include “50% non-spherical surfaces.” *See* PO Resp. 72 (citing Ex. 2008 ¶¶ 201–202); Pet. 18, 20.¹⁰

¹⁰ A hemi-spherical lens has spherical surface area of $2\pi r^2$.² Its flat surface area is πr^2 .² Accordingly, the relative spherical surface area of a hemi-spherical lens is 66% (i.e., $2\pi r^2 / (\pi r^2 + 2\pi r^2) = 2/3$). Therefore, a hemi-spherical lens is a spherical lens according to *Matitsine-680’s definition*, because only 33% of its surface area is non-spherical. But the plain meaning of a hemi-sphere is a half of a sphere, so a hemi-sphere is not spherical because it does not have the overall shape of a sphere. *See* WILEY

Patent Owner acknowledges that the '947 patent specification does not mention a non-spherical lens. *See* Tr. 82:9–12 (Judge Zecher: “But you can admit that non-spherical is not mentioned in the specification whatsoever?” Mr. Giunta: Yes, because it’s a known term in the art, right.”). The '947 patent specification does not shed light on the metes and bounds of what a non-spherical lens encompasses, and it generally states that “while specific dimensions, sizes and shapes may be provided in certain embodiments of the invention, those are simply to illustrate the scope of the invention and are not limiting.” Ex. 1001, 19:34–36. Neither party relies on prosecution history to clarify the meaning of a “non-spherical lens.”¹¹

ELECTRICAL AND ELECTRONICS DICTIONARY, 737, Steven M. Kaplan (2004), *available at* <https://ieeexplore.ieee.org/book/5273107>; *see also* Ex. 1004, 4:45–46 (disclosing, *inter alia*, a “spherical lens” and a “hemi-spherical lens”).

¹¹ As noted in the Institution Decision, the Petition shows that during prosecution, “the Applicant amended claim 1 to include 1) ‘a plurality of non-spherical lenses’ and 2) ‘a selector connected to each of said plurality of feed elements of said plurality of lens sets.’” Inst. Dec. 28 (quoting Pet. 11; Ex. 1010, 2). In instituting review here despite a 35 U.S.C. § 325(d) challenge to the Petition by Patent Owner, we determined that the Petition shows that the Office erred in allowing the claims over “Matitsine” (Ex. 1009), “a continuation of Matitsine-860,” partly because we preliminarily found that the Petition shows that Matitsine-860 (and by implication, Matitsine) discloses a non-spherical lens. *See id.* at 27–30; *cf.* 35 U.S.C. § 325(d) (In deciding to institute, “the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.”); *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential) (evaluations under § 325(d) involve a two-part framework, including “whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims”).

Patent Owner argues that “Matitsine-860 says ‘[a] spherical lens’ substantially has the shape of a sphere which is ‘defined’ by ‘at least 50% . . . of the surface area conform[ing] to the shape of a sphere.’” PO Resp. 72 (quoting Ex. 1002, 4:54–60). Patent Owner refers to “Matitsine-860’s *definition* of a spherical lens as encompassing lenses that are not perfect spheres.” PO Resp. 73 (emphasis added). Matitsine-860 includes within its definition of a “spherical lens,” a lens with a surface “substantially having the shape of a sphere,” and then states, “[a]s *defined herein*, a lens with a surface that substantially conform to the shape of a sphere means at least 50% (preferably at least 80%, and even more preferably at least 90%) of the surface area conforms to the shape of a sphere.” Ex. 1002, 4:54–60 (emphasis added). By *defining* the term “spherical lens” for use “herein,” Matitsine-860 signifies it is not using the plain meaning of “spherical lens,” otherwise there would have been no reason to *define* the term. Matsine-860 essentially broadens the plain meaning of what a sphere is so that it captures lenses with up to 50% non-spherical surface areas. As Mr. Teillet testifies, “if it’s truncated, it’s no longer a sphere” (Ex. 2007, 217:4), and “in my mind, a spherical lens is a sphere” (*id.* at 218:20–21).

Patent Owner cites Ebling and other evidence to support its argument that a person of ordinary skill in the art’s “understanding that a spherical lens may have non-spherical surfaces because a full sphere is not needed to provide the direction-independent properties of a spherical lens.” PO Resp. 73 (citing Ex. 1004, Figs. 1–3, 4:48–54; Ex. 2008 ¶¶ 204–208; Ex. 2016,

4:59–62).¹² Ebling states the following at the column that Patent Owner cites:

Whereas the at least one electromagnetic lens 12 is illustrated as a spherical lens 12' in FIGS. 1 and 2, the at least one electromagnetic lens 12 is not limited to any one particular design, and may, for example, comprise either a spherical lens, a Luneburg lens, a spherical shell lens, a hemi-spherical lens, an at least partially spherical lens, an at least partially spherical shell lens, an elliptical lens, a cylindrical lens, or a rotational lens. Moreover, one or more portions of the electromagnetic lens 12 may be truncated for improved packaging, without significantly impacting the performance of the associated multi-beam antenna 10, 10.1.

Ex. 1004, 4:41–54. This passage supports Petitioner as to the plain meaning of a non-spherical lens. In the passage, Ebling describes a “truncated [lens] for improved packaging,” but Ebling lists it after it lists three types of spherical lenses (i.e., “a spherical lens, a Luneburg lens, a spherical shell lens”), and after it lists several types of non-spherical lenses (i.e., “a hemi-spherical lens, an at least partially spherical lens, an at least partially spherical shell lens, an elliptical lens, a cylindrical lens, or a rotational lens”). *Id.* Listing several different types of lenses (e.g., “a spherical lens,” “an at least partially spherical lens,” and “an elliptical lens”) as Ebling does signifies that artisans of ordinary skill considered these lenses as separate species in the genus of lenses known in the art.

¹² The cited passage of Exhibit 2016 does not shed light on the meaning of a non-spherical lens because, like Matitsine-860, it simply defines how it uses the term “spherical lens,” indicating it is broadening the plain meaning of a “spherical lens.” *See* Ex. 2016, 4:48–54 (“It should be appreciated that the term ‘spherical lens,’ *as used herein*, refers to any lens for which a substantial portion of the outer surface is spherical in shape and is not limited to lenses having a fully spherical outer surface.” (emphasis added)).

Mr. Teillet testifies with respect to Ebling’s truncated lens that “in . . . Ebling, it looks like they are—they take the sphere; they chop the top and chop the bottom, and they’re moving around like that [around the equatorial circumference]. So we have *similar to an elliptical*.” Ex. 2007, 222:4–7 (emphasis added), 222:11–18 (explaining that the truncated lens is similar to a compressed ball or flattened sphere, which is an “ellipse in the XZ plane or the YZ plane,” but circular “at the circumference in the [compressed] ball in the XY plane”).

Therefore, Ebling and Mr. Teillet’s testimony further shows that the claimed “non-spherical lens” reads on a truncated lens, which Patent Owner asserts that Matitsine-860 discloses. Ebling also shows that a person of ordinary skill would have considered lenses with over 50% spherical surface areas (which includes a hemi-spherical lens, an at least partially spherical lens, and a truncated lens, each of which fall within Matitsine-860’s disclosure), as types of non-spherical lenses, because Ebling lists a “hemi-spherical lens,” “an at least partially spherical lens,” and a “truncated” lens as distinct from “a spherical lens,” as quoted above. Ex. 1004, 4:41–54. The Petition notes that Ebling “describes . . . a ‘frusto[-]spherical’ or an ‘at least partially spherical electromagnetic lens 12’ for use in a multi-beam antenna.” Pet. 14 (citing Ex. 1004, 21:42–44, 22:13–14).

During prosecution, the ’947 patent Applicant argued that “the claimed lens (claim 33) has a substantially planar interior surface, *not spherical*,” and “[b]y providing a *non-spherical lens with a linear surface*, the present invention is compact with a small profile.” Ex. 1010, 6 (emphasis added). This prosecution history corroborates our claim construction and indicates that a non-spherical lens may include a linear

surface or a substantially planar surface (to create a “compact” “small profile” relative to a spherical lens), such as the truncated lens that Patent Owner contends Matitsine-860’s discloses (or a hemi-spherical lens). Therefore, if the plain meaning of a spherical lens includes a truncated spherical lens (as Patent Owner argues here), then the plain meaning of the claim term “non-spherical lens” does not include that lens. But this is the opposite of what the ’947 patent Applicant argued during prosecution, because it broadened the plain meaning of “non-spherical lens” to capture lenses with a “linear” or “substantially planar” surface (such as a truncated spherical lens). *See id.*

Finally, as indicated above, Patent Owner argues that Matitsine-860 discloses only spherical lenses because Matitsine-860’s system discloses placing the RF elements around the largest circumference (e.g., equator) of a sphere, which implies a similar placement around the largest circumference of a truncated sphere, in order to obtain the functional result of “the same coverage for different geographic areas” to “leverage[] the direction-independence.” *See* PO Resp. 73. This observation about how some of Matitsine-860’s embodiments operate is not particularly germane as to how an artisan of ordinary skill viewing the ’947 patent would have construed the term “non-spherical lens.” In contrast to Patent Owner’s characterization of Matitsine-860’s embodiments, the ’947 patent illustrates placing the radiating elements adjacent to one of the flatter sides of relatively flat GRIN lenses. *See, e.g.,* Ex. 1001, Fig. 3, Fig. 4. Yet the challenged claims do not specify any structural relationship between the radiating feed elements and a lens surface. Therefore, Patent Owner improperly attempts to read limitations into the challenged claims based on alleged structural and

functional relationships as described by combining teachings from *other specifications from other patents* (e.g., Matitsine-860 (defining spherical lenses)), Ebling (disclosing a truncated lens)) so that the claimed “non-spherical lens” does not include a truncated spherical lens. As a consequence, as indicated above, Patent Owner seeks to narrow the same claim term in this trial (i.e., to exclude a truncated spherical lens) from the meaning that the ’947 patent Applicant advanced during prosecution (i.e., to include a lens with a linear substantially planar surface, e.g., a truncated spherical lens).¹³

Based on the foregoing discussion, Petitioner persuasively shows that Matitsine-860 discloses limitation 1.a.1.

Under Petitioner’s alternative position for combining the teachings of Matitsine-860 and Demetriadou to account for limitation 1.a.1, Patent Owner argues that the only reason Petitioner advances is that Demetriadou’s lens “reduce[s] implementation cost by virtue of relatively smaller lens volume.” PO Resp. 22. Patent Owner also argues that “[t]he limited steering capabilities of Demetriadou’s lens make it unsuitable for use in Matitsine-860’s system.” *Id.* at 24. Patent Owner also argues that implementing “Demetriadou’s lens . . . would have increased the system’s cost, degraded the system’s performance, and provided no meaningful benefit.” *Id.* (citing Ex. 2008 ¶¶ 129–189).

As Patent Owner recognizes, Petitioner also asserts that a person of ordinary skill would have modified Matitsine-860’s lenses because “doing so would produce predictable results via the combination of familiar

¹³ The ’947 patent Applicant did not inform the Examiner of its new theory here that Matitsine-860 discloses truncated spherical lenses. *See* Ex. 1006.

elements.” PO Resp. 39 (quoting Pet. 19); Pet. 19 (citing Ex. 1012 ¶ 22). Patent Owner contends these assertions are conclusory and unsupported by evidence. PO Resp. 39. Patent Owner also asserts that Demetriadou’s lens is inferior to, and more costly than, Matitsine-860’s *spherical* lens. *Id.* at 41–71. Patent Owner also argues that Demetriadou’s simulated lens is not a “familiar element.” *Id.* at 41 (quoting Ex. 2008 ¶¶ 125–127).

In summary, alleging a lack of a showing of obviousness, Patent Owner’s arguments and evidence compare Matitsine-860’s totally spherical lens, instead of its 50% spherical lenses, to Demetriadou’s lens, in asserting that the latter would not have been an obvious substitution for the former because of alleged cost, decreased performance, decreased directivity, power loss, increased interference, and other alleged shortcomings. *See* PO Resp. 41–71; Reply 23 (“Patent Owner is arguing that Matitsine-860 requires perfect spherical lens with no steering losses to satisfy its intended purpose and principle of operation.” (citing PO Resp. 35)). Although, as explained above, Patent Owner asserts that a truncated lens provides the same beam shape in all directions just like a spherical lens (assuming one places the radiating RF elements along the largest circumference of the truncated sphere), Patent Owner acknowledges that there is a loss of gain due to radiation exiting the truncated (i.e., flat) portions of the lens (a loss which is not present in a spherical lens). *See* PO Resp. 73–74. Also, as noted above, Matitsine-860 does not disclose that all of its lenses with 50% non-spherical surface areas are truncated spheres (and does not specifically disclose a truncated sphere), so that Patent Owner’s comparison of Demetriadou’s flat Luneberg lens to a spherical lens is not apt for gauging the obviousness of

using a flat lens in the place of a lens that is only 50% spherical in terms of its surface area.

In other words, as Petitioner persuasively argues, “Matitsine-860 does not require a perfectly performing spherical lens that has no losses. The fact that Matitsine-860 contemplates that up to 50% of the lens can be non-spherical means that Matitsine-860 does not require a lack of steering losses to satisfy its intended purpose.” Reply 23. Petitioner also notes that “Demetriadou teaches a range of non-spherical lenses, from very thin to almost spherical.” *Id.* at 22 (citing Ex. 2026, 265). Therefore, although Patent Owner urges stark differences exist between Demetriadou’s flat lenses and Matitsine-860’s spherical lenses in terms of alleged cost, decreased performance, decreased directivity, power loss, increased interference, the record does not show qualitatively how much these alleged differences exist between Matitsine-860’s lenses with 50% non-spherical surface areas and the wider range of flatness/compression envisioned for Demetriadou’s elliptical lenses. *See* PO Resp. 41–71; Reply 22–23 (showing that the degree of slimness is controlled by δ (“delta”) (citing Ex. 2026 (Behdad Deposition), 265)); Ex. 2026, 264:20–25 (Q. “Let’s say you have delta of 1.2. That wouldn’t be very much flattening, would it? A. “That wouldn’t be a large compression factor, right.”). Dr. Behdad generally testifies that for Demetriadou’s lens with a “delta 1.2” (which is not as flat as Demetriadou’s lens with a delta of 6 that Dr. Behdad analyzed), the performance “would not be as good as a spherical lens.” Ex. 2026, 265:12–25.

Matitsine-860 states that “[a] conventional Luneburg lens is a spherically symmetric lens that has multiple layers inside the sphere with

varying indices of refraction.” Ex. 1002, 4:63–65.¹⁴ Demetriadou’s method approximates a Luneberg lens by slimming it down, which results in a flattened lens (similar to a truncated Luneberg lens). Demetriadou explains as follows:

[D]ue to the large spherical (or cylindrical in 2D) shape of the [Luneberg] lens, it is very unsuitable for antenna applications. Also, it is difficult to spatially control an antenna, since it has to be moved on the circumference of such a large lens. Therefore, we propose a transformation of the Luneburg lens, which creates a slimmer lens, while all the properties of the original Luneburg lens are maintained. The transformation equations create a ‘discus’-shaped lens, by ‘squeezing’ or ‘slimming’ the spherical lens and are given by [the following equation].

Ex. 1003, 3 (emphasis added). The passage above shows that Demetriadou suggests replacing, in *antenna applications* in general, a Luneberg lens with a slimmed down version of a Luneberg lens *because of the large size of a spherical lens*, while *maintaining properties of a Luneberg lens*.

Demetriadou similarly states that a “Luneburg lens is a marvelous optical lens *but is extremely difficult to be applied in any practical antenna system due to its large spherical shape*.” Ex. 1003, Abstract (emphasis added). As noted above, Ebling similarly states that “one or more portions of the electromagnetic lens 12 may be truncated for improved packaging.”

¹⁴ The ’947 patent discloses a “specially optimized” “GRadiant Index (GRIN)” lens. Ex. 1001, 2:56–57. This is similar to a Demetriadou lens in that both include different layers of dielectric constants (resulting in different refractive indices). *Compare* Ex. 1001, 2:54–56 (GRIN lens), *with* Ex. 1003, 2 (“The Luneburg lens belongs to a family of GRIN (GRadiant Index) lenses that feature spherical iso-surfaces for their refractive index.”) and Ex. 2008 ¶ 55 (noting a GRIN lens includes a Luneburg lens, which has a permittivity continuously varying from 1 at the edge to 2 at the center of the lens).

Ex. 1004, 4:48–50. During his deposition, Dr. Behdad agreed that “[t]here are some examples of applications where a spherical lens may not be an ideal choice,” and there are “situations where, you know, you don’t have enough room to accommodate . . . a large lens, . . . then that could be a good reason for trading performance for size.” Ex. 2026, 60:17–61:2. All of this evidence supports Petitioner’s reason for using Demetriadou’s slim lens based on its “relatively smaller lens volume” as compared to a spherical lens such as a Luneberg lens. *See* Pet. 19–20; *accord* Pet. 31 (addressing dependent claim 19, arguing that a person of ordinary skill in the art “would understand the substitution of the spherical lens of Matitsine-860 with the non-spherical lens of Demetriadou to be obvious as the truncated geometry of non-spherical lens *provides for a smaller lens volume*” (emphasis added) (quoting Ex. 1012 ¶ 42)).

In other words, even if the cost of Demetriadou’s lens exceeds that of a Luneberg lens, and other properties are inferior, Demetriadou and other evidence shows that the size (volume) of the lens is a valid consideration, which supports the Petition. Ex. 1003, 3. As noted, Dr. Behdad agrees that size is important as a trade-off consideration in some applications. *See* Ex. 2026, 60:17–51:2. Given the trade-off in size of Demetriadou’s slimmed down Luneberg lens, Petitioner persuasively shows a benefit in using a smaller lens for some antenna applications, where Demetriadou’s lens is a suitable option for Luneberg lens (at least relative to the breadth of claim 1 as discussed further below). *See* Reply 19 (“The Petition identified smaller lenses as being desirable and pointed to Demetriadou as a reference teaching that slimmed, non-spherical lenses provide ‘excellent steering capabilities for wide angles, maintaining the directivity and side-lobes at high and low

values respectively.” (quoting Ex. 1003, Abstract)), 21 (“[T]he Petition pointed out that a smaller volume of the system would be an advantage. This is common sense.”); Pet. 31 (addressing claim 19, which depends from claim 1, and arguing a person of ordinary skill in the art “would understand the substitution of the spherical lens of Matitsine-860 with the non-spherical lens of Demetriadou to be obvious as the truncated geometry of non-spherical lens *provides for a smaller lens volume*” (citing Ex. 1012 ¶ 42) (emphasis added)).

Although Petitioner tied a “reduced implementation cost” to the “relatively smaller lens volume” of a “truncated geometry of [a] non-spherical lens” as “motivation” for using Demetriadou’s lens with respect to claim 1, this is sufficient notice to raise the issue of a smaller lens volume as a reason to substitute Demetriadou’s lens in place of Matitsine-860’s truncated or other non-spherical lens, notwithstanding Patent Owner’s argument to the contrary. *See* Pet. 19–20; PO Sur-reply 15–16 (arguing that that “the *sole* motivation the Petition advanced for replacing Matitsine-860’s lens with Demetriadou’s was to reduce cost”). And as indicated above, addressing claim 19, which depends from claim 1, Petitioner specifically cites “smaller lens volume” as a rationale for substituting Demetriadou’s lens without tying the volume to cost. Also, in advancing its rationale for claim 1, the Petition predicates it on characterizing Demetriadou as disclosing “a ‘slim’ or ‘discus’-shaped lens, [produced] by ‘squeezing’ or ‘slimming’ [a] spherical lens.” Pet. 18 quoting (Ex. 1003, Abstract).

A smaller lens is “an implicit motivation to combine.” *DyStar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1368 (Fed. Cir. 2006) (“[W]e have repeatedly held that an implicit motivation to combine

exists not only when a suggestion may be gleaned from the prior art as a whole, but when the ‘improvement’ is technology-independent and the combination of references results in a product or process that is more desirable, for example because it is stronger, cheaper, cleaner, faster, lighter, *smaller*, more durable, or more efficient.” (emphasis added)).

Patent Owner’s arguments regarding reduced performance of Demetriadou’s lens relative to a Luneberg lens, as summarized above, are essentially teaching away arguments, and are not reasonably commensurate in scope with the challenged claims, which recite a non-spherical lens, and capture Demetriadou’s lens, a non-spherical lens. *See* PO Resp. 41–74. In other words, the claimed “non-spherical lens” includes Demetriadou’s non-spherical lenses, thereby capturing any inferior properties as alleged by Patent Owner. Claim 1 also includes a “specially optimized” “GRadient Index (GRIN)” lens, which is similar to Demetriadou’s lens. *See supra* note 14. “Evidence concerning whether the prior art teaches away from a given invention *must relate to and be commensurate in scope with the ultimate claims at issue.*” *Idemitsu Kosan Co., Ltd., v. SFC Co., Ltd.*, 870 F.3d 1376, 1381 (Fed. Cir. 2017) (emphasis added) (citing *In re Zhang*, 654 F. App’x 488, 490 (Fed. Cir. 2016) (“While a prior art reference may indicate that a particular combination is undesirable for its own purposes, the reference can nevertheless teach that combination if it remains suitable *for the claimed invention.*” (emphasis added))); *see also In re Self*, 671 F.2d 1344, 1348 (CCPA 1982) (“Many of appellant’s arguments fail from the outset because . . . they are not based on limitations appearing in the claims.”). Here, the combination remains “suitable for the claimed invention,” *see In re Zhang*, 654 F. App’x at 490, because the challenged claims do not recite limitations

requiring perfect steerability (or any set degree of steerability), or otherwise recite limitations related to cost or other allegedly inferior properties (side-lobe gain, interference, etc.). *See also Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1381 (Fed. Cir. 2023) (“*Intel Corp. I*”) (a prior art teaching need not provide the best option if it provides a “suitable option”); Reply 9 (describing a suitable option of using Ebling’s switch in lieu of moving elements on a rail and the benefit of speed); 17 (citing *Intel Corp.* 1, 61 F.4th at 1381).

Further regarding cost, Patent Owner contends that Mateo-Segura shows that the Demetriadou lens is more expensive than Matitsine-860’s lens. PO Resp. 49 (citing Ex. 2003, Ex. 2006).¹⁵ Patent Owner asserts that Mateo-Segura “characterized its lens as low-cost and easy to manufacture ***relative to other transformed lenses***—not relative to [a] ***spherical*** lens as used in Matitsine-860.” PO Resp. 50 (citing Ex. 2008 ¶ 149) (emphasis added). However, Matitsine-860 does not preclude a transformed lens. Also, as indicated above, comparing Demetriadou’s lens to a spherical lens is not germane because Matitsine-860 discloses lenses with up to 50% non-spherical surfaces, showing that Matitsine-860 is not limited to ideal characteristics of a Luneberg lens, which Patent Owner uses as a standard for comparing cost and other properties.

Similar remarks apply to Patent Owner’s characterization of Demetriadou’s measured directivity. *See* PO Resp. 57–59. Specifically, other than asserting that a truncated lens is similar in performance to a spherical lens as noted above, Patent Owner’s analysis does not compare the

¹⁵ Patent Owner filed a second copy of Mateo-Segura (Ex. 2006) that is easier to read than the first-filed copy (Ex. 2003).

directivity at 0° to the directivity of other Matitsine-860 lenses with almost 50% non-spherical surface area. *See id.* Similar remarks apply to the other angles and loss values. *See id.* Rather, Patent Owner states that “Matitsine-860’s *spherical* lenses have the same directivity in all directions—they suffer no directivity losses so the beam is the same from all directions.” *Id.* at 59.

Dr. Behdad cites Mateo-Segura as comparing the directivity of Demetriadou’s simulated slimmed Luneberg lens and a simulated spherical Luneberg lens, and the data shows a nominal gain difference between the two (i.e., 2 %). *See* Ex. 2008 ¶ 98 (reproducing Ex. 2006, Fig. 7). And for angles up to 12 degrees away from boresight, there is only a 12% reduction in gain relative to the gain at boresight for the slimmed Luneberg lens (which relates to steerability). Ex. 2008 ¶ 100 (Table A-1). Dr. Behdad characterizes this showing as “significant steering losses across a relatively small range of angles” (*id.* ¶ 101), but this characterization contradicts both Demetriadou and Mateo-Seguro (and does not account for the scope of claim 1, which does not require uniform gain in all directions). For example, Mateo-Segura states that that the “flat Luneberg lens antenna validate the design and *confirm a high-directivity performance*. A directivity of 17.96 dBi, low side-lobe levels for both main planes [at approximately] -26 dB, *excellent directivity performance within the X-band and beam steering up to 34° were achieved.*” Ex. 2006, Abstract (emphasis added). Demetriadou states that “[s]ince all the properties of the traditional Luneburg lens are preserved, then the new lens can create a *high-directivity beam with very low levels of side-lobes and steering capabilities for relatively wide-angles.*” Ex. 1003, 1–2 (emphasis added). Therefore, the record shows that artisans

of at least ordinary skill do not agree with Dr. Behdad's characterization that "significant steering losses" occur in Demetriadou's lens.

Moreover, Patent Owner agrees that Demetriadou's "beam would still only be steerable for $\pm 20^\circ$." PO Resp. 59 (citing Ex. 2008 ¶¶ 99–101). In addition, Patent Owner's evidence shows that the gain at $\pm 20^\circ$ is 15dBi (32 times the power) relative to *an isotropic* radiator.¹⁶ *See id.* A Luneberg lens is an isotropic radiator (but it has more gain than a simple isotropic radiator because it focuses the beam due to its continually varying dielectric constant). *See* PO Resp. 8–9 (illustrating the focusing of a Luneberg lens). Patent Owner does not specify what this gain is. *See id.* at 59. In other words, Patent Owner does not compare the gain at $\pm 20^\circ$ for a Luneberg lens (or at any angle because the gain does not change as Patent Owner argues) versus that of Demetriadou's lens.

Patent Owner attempts to explain the discrepancy over the characterization of Demetriadou's steerability by arguing that Demetriadou's characterization of the superior properties of its lens is "not relative to [a] spherical lens as used in Matitsine-860." PO Resp. 50 (citing Ex. 2008 ¶ 149). Dr. Behdad similarly attempts to explain it by testifying that his testimony regarding steering losses is "relative to spherical lenses, like Matitsine-860, which have none," whereas "Demetriadou proposed" its lenses for other applications, "e.g., as a replacement for conventional Fabry-Perot resonator antennas." Ex. 2008 ¶ 101. But as explained above, Patent Owner does not provide data comparing the gain of the two lenses at each

¹⁶ Each 3dB logarithmically doubles the power (or each negative dB halves the power), so a 15dB gain is 2^5 times the power. *See, e.g.*, PO Resp. 58 (calculating -2.6. dB as a 45 % reduction in power).

angle. Even if the gain at $\pm 20^\circ$ for Demetriadou's lens is less than its gain at boresight, if the gain at $\pm 20^\circ$ is greater than the gain of a Luneberg lens, then it delivers more power at that angle than a Luneberg lens. Therefore, Patent Owner's evidence is not helpful.

In addition, as explained above, Matitsine-860 discloses spherical lenses with about 50% non-spherical surface areas, suggesting other flat lens applications not limited to truncated or purely spherical lenses that have no steering losses. *See* Ex. 1002, 4:54–60. As also noted above, Demetriadou states that “the large spherical . . . shape of the [Luneberg] lens,” renders “it . . . very unsuitable for antenna applications,” and “difficult to spatially control . . . , since it has to be moved on the circumference of such a large lens,” and “[t]herefore, we propose a transformation of the Luneburg lens, which creates a slimmer lens, while all the properties of the original Luneburg lens are maintained.” Ex. 1003, 3.

Therefore, Demetriadou's description of preserving properties of a “traditional Luneburg lens” and problems with that lens based on size contradicts both Patent Owner's explanation and Dr. Behdad's testimony that Demetriadou characterizes its flat lens as having good steering capabilities and low side-lobe levels only in comparison to that of other flat lenses (or Fabry-Perot resonators). As quoted above, Demetriadou essentially describes a suitable alternative to a Luneberg lens as its flattened Luneberg lens. Ex. 1003, 3.

Similar flaws appear in Patent Owner's analysis of side-lobe data and power loss data. PO Resp. 60–63. Patent Owner does not compare side-lobe data for Demetriadou's lens with the side-lobe levels for a lens with almost 50% non-spherical surface areas as Matitsine-860 discloses. *See id.*

at 62–63. And Patent Owner does not compare power loss data for Demetriadou’s lens with power loss data for a lens with almost 50% non-spherical surface areas as Matitsine-860 discloses. *See id.* at 62–63. In any event, as noted above, Demetriadou describes its lens as “creat[ing] a high-directivity beam with very low levels of side-lobes and steering capabilities for relatively wide-angles.” Ex. 1003, 2–3.

With further respect to directivity, Demetriadou states that

the most significant advantage of the slim Luneburg lens as discussed above is its steering properties. The steerable behaviour of the slim lens was examined by moving the patch antenna along the y-axis by a distance c (defined in Fig. 3(a)). It was found that the lens steered the main lobe, while it maintained high values for the directivity and low side-lobes.

Ex. 1003, 8 (emphasis added). In other words, the steerable properties with “high values for directivity” in Demetriadou’s lenses are “significant advantage[s]” according to Demetriadou. Patent Owner concedes that Demetriadou “suggests there are applications requiring a lens with a lower profile than a spherical lens allows and that Demetriadou’s lens may perform well enough to make it a suitable alternative for such applications.” PO Resp. 64. Accordingly, even if Patent Owner’s data comparisons shows inferior characteristics of Demetriadou’s lens as compared to a Luneberg lens with respect to directivity, steering, power loss, cost, and other characteristics, the parties agree that trade-offs exist such that a slim lens is a suitable alternative for some applications. The challenged claims encompass these applications, as explained above.

Also, notwithstanding Patent Owner’s argument that “there is no need for a low-profile lens” in Matitsine-860 (PO Resp. 64), Matitsine-860 confirms that a narrow beam is advantageous (high directivity) and wide

steerability is not a paramount concern, depending on the application: “The spherical lens allows the output RF signal to narrow so that the resultant beam can travel a farther distance.” Ex. 1002, 5:34–35. Tracks “can cover *smaller or larger portions of the surface areas of the spherical lenses.*” *Id.* at 5:15–17 (emphasis added). The system “uses an array of spherical lens[es] and mechanically movable radio frequency (RF) elements along the surface of the spherical lens to provide cellular coverage *for a narrow geographical area,*” further showing that that a wide steering angle is not a paramount concern. *Id.* at code (57).

Patent Owner’s argument that “Matitsine-860’s antenna system is steerable across a wider range than Demetriadou suggests” (PO Resp. 64) fails to recognize that the challenged claims do not require the same steering range of a Luneberg lens or require any set minimum angle of steerability. Similarly, as noted above, Matitsine-860’s system is flexible in that it discloses “cover[ing] smaller or larger portions of the surface areas of the spherical lenses,” which translates to smaller or wider steering ranges as desired. Ex. 1002, 5:15–16.

Patent Owner similarly argues that “Matitsine-860 describes an antenna system for a cellular base station (e.g., on a cell tower) where there is no need for a low-profile lens,” and Demetriadou’s lenses change the principle of operation of Matitsine-860. *See* PO Resp. 64–70. However, this argument contradicts Patent Owner’s contention that Matitsine-860 discloses truncated spherical lenses, which an artisan of ordinary skill would have recognized as disclosing or suggesting a low profile lens. *See* Ex. 1004, 4:48–51 (“[O]ne or more portions of the electromagnetic lens 12 may be truncated for improved packaging, without significantly impacting the

performance of the associated multi-beam antenna.”). Similarly, Matitsine-860’s disclosure of lens with up to 50 % non-spherical surface areas embraces lenses with a smaller profile than a sphere or truncated lens and further suggests that Matitsine-860’s broad disclosure applies to applications other than cellular base stations. In addition, Patent Owner concedes that “[w]hen the RF elements are positioned dead center [of Demetriadou’s lens], there is no steering loss for the *single* geographical area corresponding to the red arrow.” PO Resp. 68. As noted above, the challenged claims do not require maintaining the same or similar gain when steered over different areas and they do not require any minimal steering angle, and Matitsine-860 contemplates applications with narrow steering coverage.

The evidence of record further shows that Demetriadou’s lens is a familiar element in the art even though Patent Owner argues that “Demetriadou did not manufacture its lens.” PO Resp. 48. Rather, Patent Owner concedes that Mateo-Segura shows an example of how to make Demetriadou’s lens by “Demetriadou’s principal investigator (Dr. Yang Hao).” *Id.* (citing Ex. 2006, 1). As noted in the Institution Decision, Patent Owner cited Mateo-Segura (Ex. 2003, Ex. 2006) as an example of how to make Demetriadou’s lens.¹⁷ See PO Resp. 48–49 (citing Inst. Dec. 18; Prelim. Resp. 21). Dr. Behdad’s testimony indicates that Demetriadou’s lens is a known subset of lenses made using “a technique known as transformation optics (TO)”:

¹⁷ Patent Owner characterizes Matego-Segura (introduced during prosecution history) as cumulative of Demetriadou’s teachings. See Prelim. Resp. 13 (citing Ex. 2003). As noted in the Institution Decision, Mateo-Segura states that “[t]he manufacturing technique [for a thin lens] is low-cost and easy to reproduce.” Inst. Dec. 18 (quoting Ex. 2003, 2).

Given the many attractive properties of a spherical Luneburg lens, the permittivity map of the Luneburg lens is often the target of transformation optics in an attempt to mimic the performance with a lens having a lower profile lens. As discussed in further detail below, Demetriadou (Ex. 1003) utilized transformation optics to transform the permittivity map of a spherical Luneburg lens into a “discus-shaped” lens. Demetriadou, [1–3]; Ex. 2006 (Mateo-Segura), [2] (describing a transformation in which the Luneburg lens is “‘squeezed’ into a cylindrical shape”).

Ex. 2008 ¶ 60.

Based on the discussion above, contrary to Patent Owner’s arguments, artisans of ordinary skill readily would have known about the properties of Demetriadou’s lens and Matitsine-860’s system and considered them “familiar elements.” *See* PO Resp. 40–42; *KSR*, 550 U.S. at 416 (“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”). Therefore, Petitioner’s contention that replacing “the spherical lens in Matitsine-860 with the non-spherical lens in Demetriadou . . . would produce predictable results via the combination of familiar elements” is persuasive. Pet. 19 (citing Ex. 1012 ¶ 22; *KSR*, 550 U.S. at 416). The predictable result would have been a thinner lens with similar properties and functionality as compared to a Luneburg lens operating in a similar fashion in Matitsine-860’s system, even if a Luneburg lens provides wider steering angles and is superior in other properties, such as cost, side lobe gain, loss, and interference. Given a choice of providing flat lenses to fit into small allotted spaces, versus a choice of not fitting spherical lenses into those spaces, an artisan of ordinary skill would have recognized that the benefit of a flatter lens outweighs any disadvantages asserted by Patent Owner.

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge of limitation 1.a.1.

iii. Limitation 1.a.2

Limitation 1.a.2 recites that “each lens set includ[es]: . . . a plurality of feed elements aligned with a respective one of said plurality of lenses and configured to transmit/receive a signal through said respective one of said plurality of lenses at a desired direction.” Ex. 1001, 19:56–57, 19:59–62. Petitioner reads this limitation on Matitsine-860’s RF elements 140 and 145 in Figure 1A, and also on “the plurality of discrete feed elements . . . taught in Fig. 3.” Pet. 20 (citing Ex. 1003, Figs. 1A, 3). Petitioner also relies on Matitsine-860’s “disclos[ure] that ‘[m]ultiple RF elements can be placed on a single track’ around each lens.” *Id.* (quoting Ex. 1002, 2:17). Matitsine-860 supports the Petition at the cited passage, stating as follows: “Multiple RF elements can be placed on a single track. In these embodiments, the multiple RF elements on the same track can be moved independently of each other.” Ex. 1002, 2:17–19. In addition, Figure 3 discloses multiple feed elements 340, 345 coaxially aligned around lens 305, and with multiple feed elements 350, 355 coaxially aligned around lens 310. *Id.* (citing Ex. 1002, Fig. 3); *see infra* § II.D.d.iii (reproducing Figures 1 and 3).

To address the “configured to transmit/receive a signal through said respective one of said plurality of lenses at a desired direction” recitation in limitation 1.a.2, Petitioner explains that Matitsine-860 teaches that “each RF element (from RF elements 140 and 145) is configured to transmit an output signal (e.g., a radio frequency signal) in the form of a beam to the atmosphere through its corresponding spherical lens.” Pet. 20 (quoting

Ex. 1002, 5:30–34). Petitioner explains that “the RF elements 140 and 145 are configured to receive/detect incoming signals that have been focused by the lenses 105 and 110.” *Id.* (quoting Ex. 1002, 5:35–38). As indicated above, Petitioner also relies on Matitsine-860’s teaching that “[m]ultiple RF elements can be placed on a single track” (which corresponds to a single lens). *See id.* at 13–14, 20 (quoting Ex. 1002, 2:17); Ex. 1002, 2:17–19. Petitioner quotes Matitsine-860 as teaching that “the control mechanism is also programmed to coordinate multiple pairs (or groups) of RF elements and to configure the phase shifter to modify a phase of the output signals transmitted from the same pair (or group) of RF elements, so that the signals would be in-phase.” Pet. 13–14 (quoting Ex. 1002, 2:17–24) (referring to Ex. 1003, Fig. 3).

Patent Owner argues that Petitioner fails “to identify some plurality of feed elements that are connected to a selector and aligned to transmit/receive through the *same* [“one”] lens.” PO Resp. 32. This argument is unavailing.

As summarized above, Petitioner relies on Matitsine-860’s Figure 3, which shows a plurality of feed elements (e.g., 350, 355 or 340, 345) around a single lens, as summarized above. *See* Pet. 20. Petitioner also relies on Matitsine-860’s Figure 1A, which includes a plurality of feed elements around the same lens based on Matitsine-860’s disclosure that “[m]ultiple RF elements can be placed on a single track” (which corresponds to a single lens, but which Figure 1 does not depict). *See id.* at 13–14 (quoting Ex. 1002, 2:17–24), 20 (quoting Ex. 1002, 2:17); Ex. 1002, 2:17–19.

These multiple elements on the same track apply to Figure 1A and 3 and other embodiments that include tracks, because this general disclosure

falls in the “SUMMARY OF THE INVENTION” section of Matitsine-860.

Id. (emphasis added) (quoting Ex. 1002, 2:17).

To provide context, the Petition quotes Matitsine-860 as follows:

Multiple RF elements can be placed on a single track. In these embodiments, the multiple RF elements on the same track can be moved independently of each other. In addition, the control mechanism is also programmed to coordinate multiple pairs (or groups) of RF elements and to configure the phase shifter to modify a phase of the output signals transmitted from the same pair (or group) of RF elements, so that the signals would be in-phase.

Pet. 13–14 (quoting Ex. 1002, 2:17–24) (emphasis added). Matitsine-860 also specifically “contemplate[s] that each element assembly can house multiple RF elements on one or more tracks” with respect to Figure 1A. Ex. 1002, 5:29–30. Patent Owner does not otherwise dispute Petitioner’s showing as to limitation 1.a.2. See PO Resp. 32–33.

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge of limitation 1.a.2.

iv. Limitation 1.b

Limitation 1.b recites “a selector connected to each of said plurality of feed elements of said plurality of lens sets to dynamically select a subset of said plurality of feed elements to transmit/receive the signal through said non-spherical lens.” To address this limitation, Petitioner relies on Ebling’s selector as combined with Matitsine-860’s system. Pet. 21–23.

Petitioner contends that “Matitsine-860 discloses that the antenna system can be programmed ‘via the control mechanism’ to configure the radiating elements to ‘provide coverage at different geographical areas and different capacity (by having *more or less RF elements* covering the same

geographical area) depending on demands at the time.” Pet. 21 (emphasis added) (quoting Ex. 1002, 6:17–20). Relatedly, and as we noted in the Institution Decision (Inst. Dec. 20), Petitioner states that “Matitsine-860 . . . discloses that radiating elements associated with different lenses can be grouped together to adjust the vertical footprint of the resultant beam (‘polarized coincident radiation pattern’) and provide overlapping geographical areas.” *Id.* at 13 (quoting Ex. 1002, 9:1–26).

As background, Petitioner quotes Matitsine-860 as teaching that “the control mechanism is also programmed to coordinate multiple pairs (or groups) of RF elements and to configure the phase shifter to modify a phase of the output signals transmitted from the same pair (or group) of RF elements, so that the signals would be in-phase.” Pet. 13–14 (citing Ex. 1002, 2:17–24; quoting *id.* at 2:20–24) (referring to Ex. 1003, Fig. 3). Petitioner also quotes Matitsine-860 as teaching that “[m]ultiple RF elements can be placed on a single track’ around each lens.” *Id.* at 20 (quoting Ex. 1002, 2:17). In the next sentence, Matitsine-860 states that these “multiple RF elements on the same track can be moved independently of each other.” Ex. 1002, 2:18–19.

Figures 1A and 3 of Matitsine-860 follow:

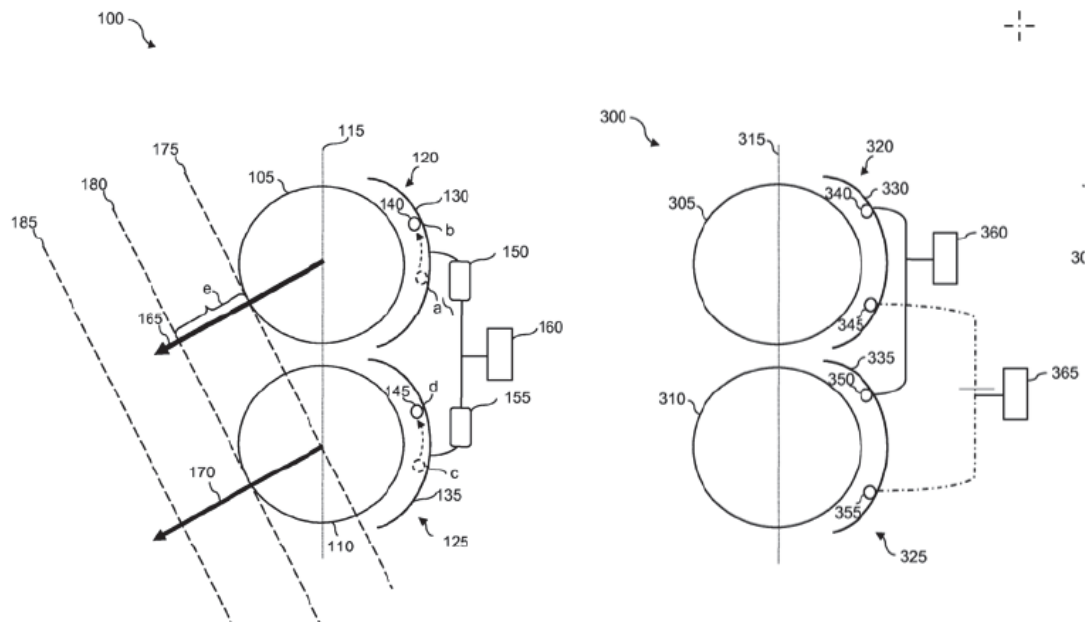


Figure 1A (left) shows moveable RF feed element 145 on track 135 for transmission/reception through lens 110, and moveable RF feed element 140 on track 130 for transmission/reception through lens 105, with “multiple RF elements on one or more tracks” contemplated but not depicted. *Id.* at 5:23–29. Figure 3 (right) shows multiple moveable RF feed elements 350, 355 on track 325 for transmission/reception through lens 310, and multiple moveable RF feed elements 340, 345 on track 335 for transmission/reception through lens 305. *Id.* at 8:13–15.

Turning to the “selector” of limitation 1.b, Petitioner contends that “while [Matitsine-860’s] control mechanism provides the ability to select which geographic area the signal is transmitted/received, Matitsine-860 *does not appear to teach a selector* to dynamically select a subset of feed elements.” Pet. 22 (emphasis added). Petitioner turns to Ebling as teaching such a selector. *Id.* at 22–23.

Figure 1 of Ebling follows:

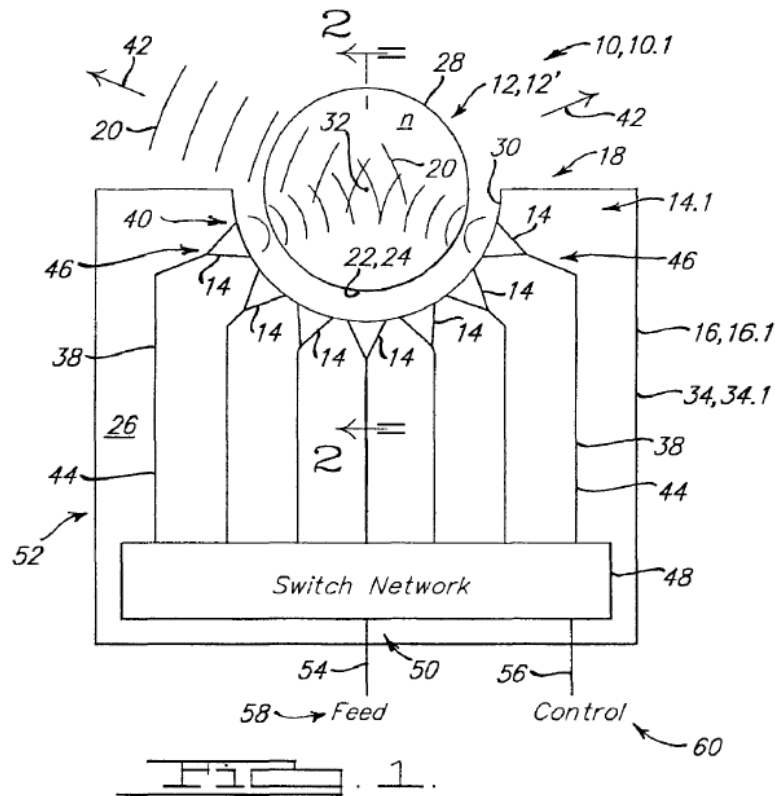


Figure 1, reproduced above, illustrates Ebling’s switch network 48, which switches/selects feed signal 58 to “the associated feed port 46 of one or more antenna feed elements 14, . . . responsive to a control signal 60 applied to the control port 56.” Ex. 1004, 6:27–33. “The associated beams of electromagnetic energy 20 launched by different antenna feed elements 14 propagate in different associated directions 42.” *Id.* at 6:41–43. Relying on the Teillet Declaration, Petitioner contends that Ebling’s selector, “switch network 48,” includes “one input (50) and multiple outputs (52),” to “switch[] among multiple outputs to produce one output at a time,” similar to the selection process of the ’947 patent. Pet. 22 (citing Ex. 1012 ¶ 24). Petitioner notes that “Ebling . . . generally teaches a multi-beam antenna having a lens and a plurality of radiating elements arranged about the lens.” *Id.* at 14 (quoting Ex. 1004, code (57)).

Based on the combined teachings of Matitsine-860 and Ebling, including Matitsine-860's teaching about selecting a geographic area based on selecting feeds, Petitioner also contends that "[i]t would have been obvious to add a switching network as taught in Ebling to the array system in Matitsine-860 in order to select subsets of radiating elements for signal transmission or reception." Pet. 22. According to Petitioner, "[t]here is no difference between a switch and a selector because a selection is done by switching." *Id.* (quoting Ex. 1012 ¶ 24). Petitioner also contends that "combining Matitsine-860, and Ebling would have been no more than combining prior art elements according to known methods to yield predictable results for a person of ordinary skill in the art." *Id.* at 23 (citing *KSR*, 550 U.S. at 416).

Patent Owner argues that the proposed combination does not satisfy claim 1 because the Petition does not identify any feed elements with respect to Figure 3 of Matitsine-860. *See* PO Resp. 32, 36. Relatedly, Patent Owner argues that "Petitioner never explains its combination—Petitioner merely alleges it 'would have been obvious to add a switching network as taught in Ebling to the array system in Matitsine-860 in order to select subsets of radiating elements'" but never identifies what those "subsets of radiating elements" are. *Id.* at 32. Patent Owner also argues that the Petition relies on a subset of feed elements 140 and 145 for signal transmission or reception, but these elements "operate simultaneously and are independently controllable so they either provide coverage for different geographic areas or provide higher capacity coverage for the same area when needed." *Id.* at 35 (citing Ex. 2008 ¶¶ 217–219; Pet. 22). Patent Owner also argues that Petitioner's expert "identifies Matitsine-860's RF elements 140, 145 in

Fig. 1A” as “the **only** feed elements Petitioner’s expert identified as meeting claim 1.” *Id.* at 33–34 (citing Ex. 1012 ¶ 23). Patent Owner also argues that selecting a subset of feed elements 140 and 145 “would defeat the benefits Matitsine-860 describes of having multiple RF elements.” *Id.* at 35 (citing Ex. 2008 ¶¶ 216–219). Patent Owner also argues that Petitioner fails to identify “some plurality of feed elements that are connected to a selector and aligned to transmit/receive through the **same** [**one**] **lens**,” and fails to specify what the “subsets of radiating elements’ are.” *Id.* at 32.¹⁸

Contrary to these arguments, as summarized above, the Petition relies on Matitsine-860’s Figure 1A and Figure 3 to show a plurality of RF feed elements in related limitation 1.a.2, which are the same plurality, and include a subset thereof, as recited in selector limitation 1.b. *See* Pet. 20 (stating that “Matitsine-860 further discloses the plurality of discrete feed elements is taught in Fig. 3”); *supra* §§ II.d.iii (addressing limitation 1.a.2). And as noted in the discussion of limitation 1.a.2, the Petition further relies on Matitsine-860’s teaching that “Matitsine 860 discloses that ‘[m]ultiple RF elements can be placed on a single track’ around each lens.” *Id.* (emphasis added) (quoting Ex. 1002, 2:17).

Patent Owner’s arguments do not address the Petition’s reliance on Matitsine-860’s disclosure of multiple RF elements around a single lens and the controlling of groups of RF elements as described in relation to Figures 1A and 3, nor does Patent Owner address the Petition’s reliance on Figure 3. *See* Reply 15–16 (arguing the Petition refers to Fig. 3 of Matitsine-860 (citing Ex. 1002, 4:54–60; Ex. 1012 ¶ 21)). Therefore, contrary to Patent

¹⁸ The first portion of this argument applies to limitation 1.a.2 as indicated in the previous section.

Owner’s arguments, the Petition identifies, with particularity, “what those ‘subsets of radiating elements’ are” in Matitsine-860 (PO Resp. 32)—they are any subset of the multiple RF elements of Figure 3, or a subset of the multiple RF elements placed on a single track of Figure 1A or Figure 3 (or otherwise as part of a pair or group). *See* Ex. 1002, 2:17–24, 4:54–60. As indicated above, the Petition refers to “select[ing] subsets of radiating elements for signal transmission or reception” (Pet. 22), which implicitly refers back to subsets of “the plurality of radiating elements” that the Petition identifies in connection with limitation 1.a.2. as the claimed feed elements (*id.* at 20).

As explained further below, in reply to the Response, Petitioner elaborates on the Petition’s rationale for combining Ebling’s switch network 48/selector teachings, and argues that “the specific subsets of radiating elements for Figure 3 would be 340 and 350, and 345 and 355.” Reply 13 (citing Ex. 1013 ¶¶ 33–34); *see also* Reply 6 (“The use of less than all radiating elements is even taught in Ebling Fig. 1, in which it appears that only two of the seven radiating elements are operating.”); 9 (arguing that one hypothetical combination uses “one independent beam produced at a time”).¹⁹ Mr. Teillet elaborates further by testifying in his Supplemental

¹⁹ Depending on the context, “one independent beam at a time” may include a beam emanating through two or more lenses to create one beam radiating in phase as occurs in Matitsine-860’s Figure 1A and its corresponding description. That is, the output beam increases the capacity (power) of the same coverage area (e.g., doubles it for two lenses, triples it for three lenses). *See* Ex. 1002, Fig. 1A, 6:18–20, 6:51–7:20; Ex. 2007, 206:11–20 (question and answers indicating “one beam at a time” operates through “one pair” of RF elements with “one feed signal” with respect to Figure 1A of Matitsine-860).

Declaration that “adding Ebling’s selector [(i.e., switch network 48)] to Matitsine-860 Figure 3 would allow for radiating elements 340, 345, 350, 355 to be turned on/off at different times.” Ex. 1013 ¶ 25. Mr. Teillet further elaborates by stating that “the original function of a moving radiating element is not affected by simply adding a selector that can turn the radiating element on and off.” *Id.* ¶ 33.

These are proper reply arguments because “[a] party is ‘not barred from elaborating on [its] arguments on issues previously raised.’” *Masimo Corp. v. Apple, Inc.*, No. 2022-1631, 2023 WL 5921622, slip op. at *5 (Fed. Cir. Sept. 12, 2023) (quoting *Chamberlain Grp., Inc. v. One World Techs., Inc.*, 944 F.3d 919, 925 (Fed. Cir. 2019)). “That type of elaboration is particularly permissible when it rebuts arguments raised by the other party.” *Id.* (citing *Provisur Techs., Inc. v. Weber, Inc.*, 50 F.4th 117, 122 (Fed. Cir. 2022) (finding the petitioner’s reply proper when it was “directly responsive” to the patent owner’s arguments)); *see also Belden v. Bertek LLC*, 805 F.3d 1064, 1077–79 (Fed. Cir. 2015) (“Evidence admitted in rebuttal to respond to the patent owner’s criticisms will commonly confirm the prima facie case. That does not make it necessary to the prima facie case.”); *SAS Inst., Inc. v. ComplementSoft, LLC.*, 825 F.3d 1341, 1351 (Fed. Cir. 2016) (“What concerns us is not that the Board adopted a construction in its final written decision, as the Board is free to do, but that the Board ‘change[d] theories in midstream.’” (quoting *Belden*, 805 F.3d at 1080)).

Claim 1 does not require any more particularity than what the Petition shows, because claim 1 broadly recites “a plurality of feed elements aligned with a respective one of said plurality of lenses,” and “a selector connected to each of said plurality of feed elements of said plurality of lens sets to

dynamically select *a subset* of said plurality of feed elements to transmit/receive the signal through said non-spherical lens.” That is, claim 1 does not specify any particular subsets; rather, it generally requires a selector coupled to the plurality of feed elements to dynamically select “a subset” thereof.

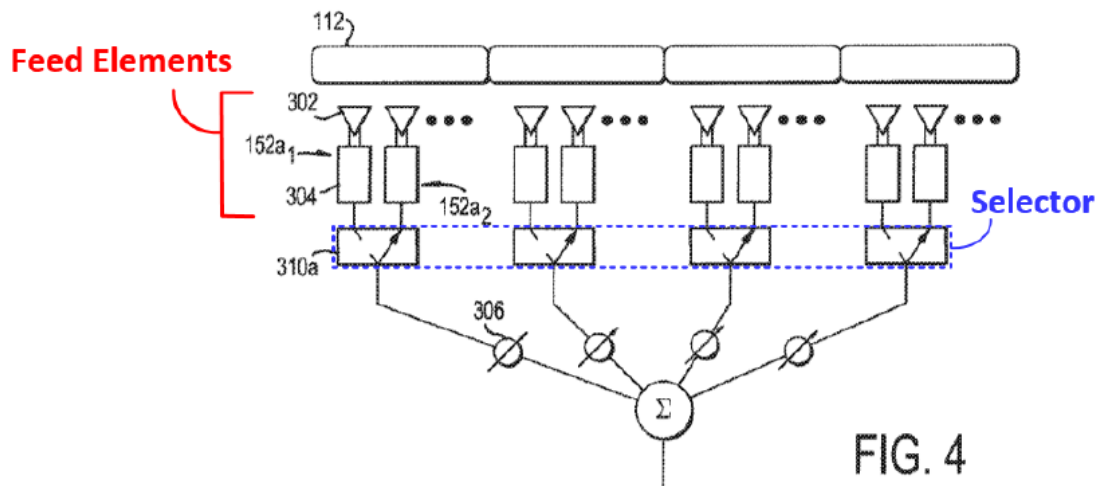
In addition, claim 1 is broad enough such that “a subset” reads on one (or more) feed element(s) of one lens, such as one of the RF feed elements of the pair in Matitsine-860’s Figure 3, or one or more of the feed elements on a track as generally disclosed at column 2 of Matitsine-860 and applicable to Figure 1A or Figure 3 (or a subset out of two or more RF elements across a larger group of the array of lenses).²⁰ Turning to claim 1, as noted, “a subset” includes one or more RF elements that may operate through a single lens. Limitation 1.a.2 recites “a plurality of feed elements aligned with *a respective one* of said plurality of lenses.” (It does not recite “a plurality of feed elements aligned with *each respective one* of said plurality of lenses.”) In any event, limitation 1.b. recites “select a subset of *said plurality of feed elements* to transmit/receive the signal *through said non-spherical lens*,” so it refers to 1) a subset of the antecedent “plurality of feed elements aligned with . . . *one* . . . of said . . . lenses” in limitation 1.a.2,

²⁰ In addition to describing multiple RF elements per lens, Matsine-860 broadly describes using multiple lenses. *See* Ex. 1002, 2:17 (“multiple RF elements on the same track can be moved independently of each other” and “the control mechanism is also programmed to coordinate multiple pairs (or groups) of RF elements”), 4:30–31 (describing “at least two spherical lens”), 4:32–33 (stating that “[e]ach element assembly has at least one track”), 4:51–54 (stating that “although only two spherical lenses are shown in this example, more spherical lens can be aligned along the virtual axis 115 in the antenna system 100”).

and 2) one (or possibly more) of the antecedent “plurality of non-spherical lenses” recited in limitation 1.a. A “phased array,” which limitation 1.a also recites, may use “only one beam at a time.” *See* Ex. 2008, 206:21–24.

In summary, claim 1 is an apparatus claim that requires selectable subsets of RF elements, where a subset may include a single RF element at a single lens, even if the '947 describes the capability to operate through two or more RF elements and lenses at one time. *See Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990) (“[A]pparatus claims cover what a device *is*, not what a device *does*.”). Patent Owner does not argue that the recited “subset” of limitation 1.b or any other limitation in claim 1 precludes the selector from selecting a single RF element at a single lens (out of a group of such lenses) as a subset. *See generally* PO Resp.

The purported disclosed “selector” that Patent Owner relies upon further supports this claim interpretation. In context to the claimed “selector,” Patent Owner points to Figure 4 in the '947 as support for it (PO Resp. 6):



Patent Owner annotates Figure 4 to illustrate selector 310a (blue), which “effectuates such steering/scanning by selectively activating feed elements

[304, 152a₁, 152a₂, 302 (red)].” *Id.* (citing Ex. 1001, 4:43–67, 7:60–64, 9:24–10:5, 18:13–21; Ex. 2008 ¶ 40). Figure 4 indicates the ability to select among subsets of feed elements 152 for “one example embodiment of the invention.” *See* Ex. 1001, 9:24–46.²¹

The ’947 patent also describes (in connection with another embodiment) “selectively activating *one of the feed elements* 152a, 152b, [which] enables the lens set 110 to generate a radiation pattern in a desired direction (i.e., to beam scan by feed selection).” Ex. 1001, 7:60–63.²² The abstract of the ’947 patent generally states that “[e]ach lens set includes a lens and *at least one feed element*.” Ex. 1001, code (57) (emphasis added) (“*At least one feed element* is aligned with the lens and configured to direct a signal through the lens at a desired direction.” (emphasis added)); *see also* Ex. 1001, 3:1–14 (“In one embodiment, the array would steer *one or more* beams over a specified angular range or field of regard with no moving parts by having multiple feeds in the focal region of each lens and *selecting the active feed* to steer the element beam.” (emphasis added)).

Therefore, the ’947 patent disclosure (also discussed above (§ I.C)) further supports reading “a subset” of claim 1 on any one or more of RF elements in Matitsine-860’s one or more lenses (as modified to include Ebling’s selector teachings). Comparing the ’947 patent’s disclosed

²¹ The description of Figure 4 does not mention a “selector” but for purposes of this trial, given Patent Owner’s reliance on Figure 4, the claimed selector is a selector at least includes a switch or set of switches. *See id.* at 9:24–46. The ’947 patent also states that Figure 4 incorporates “*one or more switches 310 at each lens 112 to select the appropriate feed element*,” but Figure 4 only shows one switch at each lens. *See id.* at 9:25–27 (emphasis added).

²² Figure 4 does not depict feed element 152b. Rather, it depicts feed elements 152a₁, 152a₂.

switch-selector disclosure to Ebling's similar teachings, Mr. Teillet's credibly testifies that "the selector (switching network) of Ebling switches among multiple outputs to produce one output at a time, which is equivalent to the selection process described by [the '947 patent]." Ex. 1012 ¶ 24. The trial record (as summarized above) supports this testimony and it is un rebutted.

Patent Owner's argument that elements 140 and 145 of Matitsine-860's feed elements of Figure 1A are "independently controllable" (PO Resp. 35) simply corroborates the Petition's showing that it would have been obvious to control each of Matitsine-860's RF feed elements with a selector/switch in order to select any subset of the multiple RF elements of multiple lenses from which to transmit/receive. *See* Pet. 21–23; Ex. 1013 ¶ 18 ("Adding the switch network 48 to the array of Matitsine-860 would allow for each radiating element in Matitsine-860 to turn on/off."). There is no dispute on this trial record that artisans of ordinary skill would have known that selecting different RF feed elements controls beam steering. *See* Pet. 21 (noting that Matitsine-860 describes covering different capacity and areas depending on the selected RF elements); PO Resp. 21 (arguing that Ebling teaches its "sole reason" for selecting feed elements is to "change the beam direction"); Inst. Dec. 21 ("Based on the preliminary record, Ebling appears to support Petitioner's rationale for combining Ebling and Matitsine-860 to dynamically determine the radiation pattern of the transmission and reception based on the selected subsets of feeds.").

Contrary to Patent Owner's arguments alleging a loss of the benefit of Matitsine-860's "**multi-beam** antenna system" (PO Resp. 36–37), Matitsine-860 as combined with Ebling's switch network 48 teachings (i.e., the

claimed selector) retains Matitsine-860's alleged benefits of using multiple lenses in some scenarios. *See, e.g.*, Ex. 2008 ¶¶ 22–23 (selecting a pair of RF elements, which transmit through two different lenses in Matitsine-860's Fig. 3). According to Patent Owner, this loss of benefit occurs because “Mr. Teillet alleged [during the Teillet Deposition] that a [person of ordinary skill] would have added Ebling's switch network to switch the single feed signal between different RF elements.” *Id.* at 38 (citing Ex. 2007, 204:25–205:12).²³ As discussed further below, the relied-upon deposition testimony does not undermine Petitioner's showing, because, at the least, the testimony shows the beneficial use of a switch with a single radio, even if the testimony does not contemplate transmitting/receiving through multiple lenses at the same time. *See* Ex. 2007, 203:11–18 (testifying “[if] you have a single radio, *you would need the selector*” (emphasis added)), 204:25–205:22, 208:22–209:10 (testifying that “a single radio would not allow you to connect to all ports of the radio” as compared to using a “multi[-]radio” for which “you would want to connect to all ports of the radio”).

Patent Owner also argues that adding Ebling's switch teachings “would have added no functionality” it and “also indisputably [would have] change[d] the principle of operation of Matitsine-860's multi-beam antenna—entitled ‘Spherical Lens Array Based Multi-Beam Antennae’—

²³ Patent Owner asserts that this testimony is a “new argument” related to Mr. Teillet's testimony that a “hypothetical base station might have only a single-port radio (signal generator) capable of generating just one feed signal” (PO Resp. 38) and “should not be considered” (*id.* at 37). However, Patent Owner raises arguments with respect to this testimony in support of its position (alleging certain admissions by Mr. Teillet), so it is necessary to address the full context, which we do further below. *See id.* at 36–37.

and render it unsuitable for the intended purpose of providing a multi-beam antenna.” PO Resp. 38 (citing Ex. 2008 ¶¶ 220–225).

These arguments are unavailing. As found above, Petitioner’s proposed combination allows for radiating through multiple lenses in some scenarios, for example, with respect to Figure 3 of Matitsine-860 (which Patent Owner does not address). In addition, even if the combination results in transmitting/receiving through one lens at a time, Matitsine-860’s system does not disparage using one RF element at a time, even if that is not an optimal situation. As Patent Owner notes, Matitsine-860’s system selects subsets of feed elements operating at multiple lenses to obtain higher capacity or different coverage. *See* PO Resp. 35 (arguing that Matitsine-860’s “[e]lements 140 and 145 operate simultaneously and are independently controllable so they either provide coverage for different geographic areas or provide higher capacity coverage for the same area when needed” (citing Ex. 2008 ¶¶ 216–219)). Matitsine-860 provides similar independent controllability to allow for turning off a signal to each *pair* of RF elements (as a group) in Figure 3, “with little or no modification,” according to Dr. Behdad. *See* Ex. 2008 ¶ 220 (discussed further below). And turning off a pair allows for the other pair to transmit via two lenses in Figure 3, *thereby satisfying limitation 1.b*, because it amounts to a selection of a subset of RF elements (which Patent Owner does not address).

Moreover, adding Ebling’s switch network teachings does not eliminate the capability of transmitting through two lenses. Rather, it provides an option of operating through one lens at a time, by selecting an individual RF element (or a pair or group thereof to the extent Matitsine-860

does not explicitly disclose this selection capability) for transmission or reception. In Matitsine-860, each “RF element can include an emitter, receiver, or a transceiver” (Ex. 1002, 5:22–23; Inst. Dec. 9 (quoting same)), further suggesting some type of switch to operate the RF element and supporting the Petition’s rationale of using Ebling’s switch network teachings “in order to select subsets of *radiating elements* for signal transmission or reception” (Pet. 22).²⁴ Therefore, contrary to Patent Owner’s argument, Ebling’s switch/selector teachings adds functionality, including the option of turning selected RF elements on/off for transmission/reception. *See* Pet. 21–23; Ex. 1013 ¶¶ 18, 22–23 (showing block diagram circuits representing the proposed combination and describing on/off RF element operation).

In addition, Patent Owner’s line of argument as to the alleged loss of the use of multiple lenses is beyond the scope of claim 1, because as noted above, claim 1 includes a selector that selects one or more RF elements (“a subset of said plurality of feed elements”) for transmission, and one RF element operates through a single lens. *See, e.g.*, Ex. 1001, Fig. 1, Fig. 4.

Dr. Behdad’s testimony at or near the paragraphs cited by Patent Owner supports Petitioner. PO Resp. 35 (citing Ex. 2008 ¶¶ 217–219). First, at paragraph 216, Dr. Behdad states that selecting one or the other of

²⁴ The Petition also reasons that it would have been obvious to use Ebling’s switch network teachings to select a subset of feed elements where “Matitsine-860 does not appear to teach a selector to dynamically select a subset of feed elements.” Pet. 22. On the other hand, selecting feed elements for transmission may imply the transceivers are not at each RF element because the feed elements receive signals from the transceivers. *See* Ex. 2008 ¶ 220 (Dr. Behdad describing “turn[ing] off” “the signal feed” in Matitsine-860 as “requiring little or no modification”).

feed elements 140 or 145 in Figure 1 would “eliminate the coverage provided by one of the RF elements.” Ex. 2008 ¶ 216. Nevertheless, eliminating the coverage of one or more RF elements may be desirable “depending on the demands of the time.” *See id.* ¶ 216 (quoting Ex. 1002, 6:3–35); Pet. 21 (quoting same). At the cited passage, Matitsine-860 describes “configur[ing] the radiating elements ‘to provide coverage at different geographical areas and different capacity (*by having more or less RF elements* covering the same geographical area) depending on demands at the time.’” Pet. 21 (emphasis added) (quoting Ex. 1002, 6:16–20). Therefore, contrary to Patent Owner’s arguments, Matisine-860 at least suggests using one RF element (“less RF elements”) to cover an area “depending on demands at the time.” *See id.* In any event, Ebling’s switch-selector teachings provide this option as Petitioner argues and as found above. *See id.* at 22–23.

Under Patent Owner’s “los[s] of benefit” theory wherein using only one lens at a time is undesirable (*see* PO Resp. 36), the signal to RF feed elements 140 and 145 in Figure 1A (or feed elements 340 and 350 in Figure 3) must transmit all the time in Matitsine-860’s unmodified system, even though Patent Owner argues they are otherwise “independently controllable” and “provide higher capacity coverage” for the same area “as needed.” *See id.*; *accord* Tr. 51:12–14 (Patent Owner arguing that RF elements 140 and 145 (which transmit through two lenses) “are independently controllable RF elements that can point in different directions, or they point in the same direction, *to double the signal strength*” (emphasis added)). Moreover, each “RF element can include an emitter, receiver, or a transceiver.” Ex. 1002,

5:22–23; Inst Dec. 9. This further implies the ability to control transmission power for each RF element individually.

Patent Owner’s overly restrictive view of Matitsine-860’s teachings and what Matisine-860 suggests in view of Ebling limits the flexibility as proposed by the combination to always transmitting through both RF elements 140 and 145 (or elements 340 and 350) even when there is no “need[]” to provide coverage to two different areas. *See* PO Resp. 36–38. That is, Patent Owner’s arguments provide one central choice in the absence of Ebling’s switch teachings—the feed signal to both RF elements 140 and 145 (or similarly, to both pairs of RF elements in Figure 3) must remain on/transmitting (to focus with double power on the same area A or to split that power between different areas A and B). *See* PO Resp. 36–38; Tr. 56:12–14; Ex. 2008 ¶¶ 216–217, 220.

In other words, Patent Owner’s “los[s] of benefit” (PO Resp. 35–36) position reduces to the assertion that an artisan of ordinary skill would have limited Matitsine-860 as suggesting turning both pairs of RF elements off in Figure 3, but not turning individual RF elements of a pair or group off.²⁵ Petitioner’s proposed modification of incorporating Ebling’s switch network teachings provides additional choices, namely the ability to selectively turn one or more RF elements off/on for transmission/reception, which Matitsine-860 suggests may be desirable depending on the demands of the time. *See*

²⁵ *Compare* Tr. 40:11–41:4 (indicating that Matitsine-860’s RF elements are “always on” and answering “I don’t know” and “there may be some mechanism” after being asked “[c]an you turn them off?”), *with* Ex. 2008 ¶ 220 (testifying that “the signal feed could simply be turned off for [the pair of] RF elements 345 and 355, requiring little or no modification to the system”).

Ex. 1002, 6:1–35. By way of example, the flexibility provided by Ebling’s switch network teachings allows for providing reduced power to one area, for example, by moving RF element 140 to focus on area A and turning element 145 off, thereby providing reduced power (1/2 relative to both RF elements) to area A and no power to area B. This is in contrast to focusing both elements 140 and 145 on the same area A, which doubles the power transmitted to area A, or splitting the power between area A and B, according to Patent Owner’s limited view of Matitsine-860. *See* PO Resp. 13, 35; Tr. 51:12–14; Ex. 2008 ¶¶ 216–217. Because Matitsine-860’s scheme provides for reduced (1/2) power to *both* areas A and B simultaneously as Patent Owner argues, the record does not support Patent Owner’s argument that using Ebling’s switch network teachings to provide reduced power to *either* area A or B, while not providing power to the other area B or A, “would defeat the benefits Matitsine-860 describes of having multiple RF elements.” *See* PO Resp. 35 (citing Ex. 1002, 6:3–35). As noted, at the passage relied upon by Dr. Behdad, Matitsine-860 describes providing flexibility by “configur[ing] the RF elements to provide coverage at different geographical areas and different capacity (*by having more or less RF elements covering the same geographical area) depending on demands at the time.*” Ex. 1002, 6:15–20 (emphasis added); Inst. Dec. 9 (similar quotation); Pet. 21 (similar quotation). Therefore, Matitsine-860’s teaching of using fewer RF elements suggests, in combination with Ebling’s switch network teachings, selecting one or more RF elements for transmission, “depending on the demands on the time,” further supporting Petitioner’s position. *See id.*

Second, Dr. Behdad argues that “each pair of RF elements” “(i.e., RF element pair 340, 350 and RF element pair 345, 355)” in Figure 3 “provides the desired cellular coverage to the corresponding geographic area.” Ex. 2008 ¶ 217 (citing Ex. 1002, 8:20–37). Dr. Behdad argues that a person of ordinary skill in the art “would not have configured Matitsine-860’s base station to provide desired coverage of geographic areas and then reduced the coverage by selecting a subset of the RF elements to transmit/receive,” because “selecting subsets of RF elements to operate and not others would defeat the purpose of Matitsine-860’s multi-beam antenna.” *Id.* ¶ 219.

For the reasons discussed above in connection with Matitsine-860’s Figure 1A, there is insufficient support for this testimony that implies that Matitsine-860 does not contemplate selecting different pairs of RF elements (or a single element of a pair) for transmission. In addition, Petitioner’s proposed modification allows for, but does not require, always operating/selecting only one pair of RF elements or a single RF element. *See* Pet. 21–23 (Ebling’s switch network teachings allow for *dynamically* controlling subsets); Ex. 1013 ¶ 18 (“Adding the switch network 48 to the array of Matitsine-860 would *allow* for each radiating element in Matitsine-860 to turn on/off.” (emphasis added)), ¶¶ 22–23 (modified circuit showing operation of “two independent beams” through two lenses), ¶ 25 (“According to Ebling’s teachings, adding Ebling’s selector to Matitsine-860 Figure 3 would allow for radiating elements 340, 345, 350, 355 to be *turned on/off at different times.*” (emphasis added)).

Also, as interpreted above, claim 1 is broad enough to include the capability to select and operate a single pair of RF elements or a single RF element at a given time. Much of Dr. Behdad’s testimony and Patent

Owner's arguments essentially assume that Matitsine-860 teaches that its primary purpose is to operate all RF elements all the time, but the trial record does not support that view, as found above. *See* Ex. 1002, 6:15–20 (describing “program[ing] to configure the RF elements to provide coverage at different geographical areas and different capacity (by having more or less RF elements covering the same geographical area) depending on demands at the time”).

Perhaps recognizing that his view of Matitsine-860 is strained, Dr. Behdad hedges by testifying as follows:

Even if there were a reason to reduce the coverage by selecting subsets of RF elements to transmit/receive, that could be achieved by turning off the feed signal to those RF elements. For example, in Fig. 3 of Matitsine-860 reproduced below, if a [person of ordinary skill in the art] wanted to select RF elements 340 and 350 for transmission and not RF elements 345 and 355, the signal feed could simply be turned off for RF elements 345 and 355, requiring little or no modification to the system.

Ex. 2008 ¶ 220. This testimony supports the Petition by correctly observing that Matitsine-860's system “*would require[e] little or no modification*” to “simply” turn off the feed to a pair of RF elements (and turn them back on), in order to eliminate coverage from, or provide coverage to, the desired areas. *See id.* Moreover, as found above, this hypothetical scenario involves transmitting through two lenses 305 and 310 in Matitsine-860, and satisfies limitation 1.b, where RF elements 340 and 350 are the “subset” recited in limitation 1.b.

And this testimony assumes that Matitsine-860's system already includes some type of switching functionality for each feed signal (i.e., “no modification”) or includes the same with “little . . . modification.”

Therefore, this testimony supports using Ebling's switch network 48 with

“little modification” to control subsets of RF elements, where the Petition states that Matitsine-860 “does not appear” to include a selector/switch. Pet. 22. The testimony also supports using Ebling’s switch network 48 to control a subset consisting of a single pair of RF elements or a single RF element, which Matsine-860 further suggests by teaching that the RF elements include active emitter, receiver, or transceiver components. *See* Ex. 1002, 5:22–23. That is, to the extent Matsine-860 does not disclose a switch to control each RF element, but does disclose some switching functionality to control the feed signal to a pair of RF elements (according to Dr. Behdad (Ex. 2008 ¶ 220)), the Petition persuasively relies on Ebling to show that it would have been obvious to employ Ebling’s switch/selector teachings to select specific RF elements or feed signal(s) thereto (i.e., a subset) to control. *See* Pet. 21–23; Reply 13; Ex. 1013 ¶¶ 25, 33.

Patent Owner also argues that Petitioner’s reason for using Ebling’s switch network 48 in Matitsine-860’s system “is legally insufficient.” PO Resp. 21. As indicated above, Patent Owner contends that that “the sole reason Ebling uses a switch network—to provide the ability to change the beam direction by selecting among fixed feed elements pointing in different directions—is unnecessary in Matitsine-860 which provides the ability to change beam direction in a different way—by moving a feed element about a spherical lens.” *Id.* (citing Ex. 2008 ¶¶ 210–213). Patent Owner similarly argues that Petitioner’s rationale is “circular.” Sur-reply 5 (arguing the rationale is a “circular non-reason” because it asserts that a person of ordinary skill in the art would have added a selector to Matitsine-860 “to select subsets of radiating elements for signal transmission or reception”).

Contrary to these arguments, as explained above, Patent Owner’s arguments and Dr. Behdad’s testimony indicating that Matitsine-860’s system controls feed signals at some level of granularity at or above a pair of RF elements, but not at the RF element level (*see* Ex. 2008 ¶ 220), supports Petitioner’s reasons for implementing Ebling’s switch/selector teachings to the extent Matitsine-860’s system does not disclose a switches/selector—namely to provide the ability to select a subset of RF elements, where a subset includes one or more RF elements. *See* Pet. 22 (arguing “[t]here is no difference between a switch and a selector because a selection is done by switching” (quoting Ex. 1012 ¶ 24)). In essence, Patent Owner appears to argue it would not have been obvious to employ a selector in Matitsine-860, because Matitsine-860 already discloses some type of switching (or the functional equivalent thereof). *See* Ex. 2008 ¶ 224 (testifying that “[a]dding Ebling’s switch network would have provided no additional functionality—it would select between two alternatives with the exact same functionality” (emphasis added)). This line of argument and testimony is unavailing because it does not account for using Ebling’s switch/selector teachings to turn on/off each RF element or to provide a single output at a time by controlling feed signals. *See* Pet. 22–23.

Patent Owner similarly argues that “Mr. Teillet conceded that selecting subsets of Matitsine-860’s RF elements would lose the benefit of Matitsine-860’s **multi-beam** antenna system and be undesirable.” PO Resp. 36–37 (citing Ex. 2007, 203:13–22, 210:180–211:1). Patent Owner also argues that Mr. Teillet “admitted a [person of ordinary skill in the art] had **no reason** to add Ebling’s switch network to Matitsine-860’s antenna system

if the system were to be operated as Matitsine-860 intended.” *Id.* (citing Ex. 2007, 204:8–205:12, 206:11–19, 209:3–10, 210:20–211:1).

It is not correct that Mr. Teillet testifies that “selecting subsets . . . would . . . be undesirable” at the cited deposition testimony. *See* Ex. 2007 (Teillet Deposition), 203:13–22, 210:180–211:1. Mr. Teillet does testify that using a selector to operate a single radio “would not be as good as having multiple radio[s],” but he also testifies that using a single radio provides “good flexibility to steer the radio” and “optimize your coverage and reduce interference to another sector.” Ex. 2007, 207:9–11, 211:10–13.

With respect to the arguments alleging “los[s] of benefit off Matitsine-860’s **multi-beam** antenna system” and “no reason to add Ebling’s switch network,” Mr. Teillet testifies about two hypothetical scenarios relative to Matitsine-860’s Figure 3 embodiment: 1) selecting among different RF element (ports) by connecting a single hypothetical radio to those ports using a selector switch, versus 2) connecting each of the multiple ports of a hypothetical “multi[-]radio” to each RF feed. *See* Ex. 2007, 200:1–211:1. For example, Mr. Teillet testifies with respect to the Matitsine-360 Figure 3 embodiment that “[i]f you have a [hypothetical] single radio, you would need the selector. Now if you [hypothetically] upgrade the system with [the multi[-]radio,] then you do not need the selector.” Ex. 2007, 203:15–18 (emphasis added), 208:25–209:1 (testifying that “a single radio would not allow you to connect to all the ports of the antenna” absent a selector).

But this testimony relates to Matitsine-860’s use of “passive” RF elements instead of Matitsine-860’s option of the RF elements each including an active device (e.g., a transceiver). *See* Ex. 2007, 201:14–202:15; Ex. 1002, 5:22–23. Mr. Teillet assumes that with Matitsine-860’s

Figure 3, there is a hypothetical (i.e., not described in Matitsine-860) “multi[-]radio,” and “you would want to connect to all the ports of the radio” (Ex. 2007, 209:9–10) to each RF element in Figure 3, which “in the last ten years,” has “been mounted on towers directly behind the antenna to minimize the loss, the cable loss, between the antenna on the radio,” but “in the past . . . would be mounted at the bottom of the tower in the cabinet” (*id.* at 201:11–13).

As indicated above, however, even if Matitsine-860’s Figure 3 can operate all RF elements all the time to provide maximum coverage using different radio signals, Matitsine-860 contemplates using “more or less RF elements covering the same geographical area[] depending on demands at the time.” Pet. 21 (quoting Ex. 1002, 6:17–20). And the hypothetical scenarios and questions by Patent Owner during the deposition do not discuss how the operator turns the multi-radio on/off, which is located at the top of the tower, according to Mr. Teillet’s testimony. Ex. 2007, 209:9–13. It is not clear if the hypothetical scenario assumes some switching functionality in the hypothetical multi-radio to power off individual ports as needed.²⁶ In any event, whether you “*need* [Ebling’s] selector” (Ex. 2007, 203:15–18 (emphasis added)) to bodily incorporate Matitsine-860’s Figure 3 circuit with a hypothetical multi-radio (which may or may not contain switching functionality) is not germane to the obviousness inquiry, where here, the claimed selector and Ebling’s switch network 48 each provide similar switching functionality.

²⁶ This deposition testimony (Teillet Deposition, Ex. 2007) occurs before Mr. Behdad’s above-discussed testimony (Behdad Declaration, Ex. 2008) that admits that Matitsine-860’s Figure 3 employs some switching functionality with “little or no modification.” Ex. 2008 ¶ 220.

Therefore, Mr. Teillet’s testimony about the normal or preferential use of Matitsine-860’s Figure 3 embodiment (albeit modified with a hypothetical multi-radio), which appears to include operating all RF elements all the time, is not particularly helpful to resolve the simple issue of whether it would have been obvious to employ switching functionality using a selector to control which RF elements to operate as desired, which Matitsine-860 teaches is a goal. *See* Ex. 2007, 200:1–211:1; Ex. 1002, 6:17–20. In addition, the challenged claims do not require a multi-radio operating all ports simultaneously (with polarized beams), so Patent Owner’s arguments based on selected portions of the testimony are beyond the scope of the claims.²⁷

Also, as noted above, Mr. Teillet testifies that there is a benefit to using a single radio with a selector employed with Matitsine-860’s Figure 3: “You could have the advantage of, you know, reducing some interference, steering your beam. Basically you’ve created a phased array because you are steering your beam, but you have the limitation of using only one beam at a time” Ex. 2007, 206:21–207:1.²⁸

Moreover, later testimony by Mr. Teillet reveals other benefits to combining a switch with Matitsine-860’s Figure 1A and 3 embodiments, as discussed above and further below. *See, e.g.*, Ex. 2025, 306:17–3

²⁷ Mr. Teillet also testifies that the RF elements in Figure 3A receive different RF signals, and each RF element of a pair receives a polarized signal from the hypothetical multiple radios. *See* Ex. 2007, 202:7–204:5.

²⁸ As noted above, Patent Owner urges the panel not to consider Mr. Teillet’s deposition testimony regarding use of a selector with a single radio in Matitsine-860’s Figure 3 embodiment. *Supra* note 23. Nevertheless, as also indicated, Patent Owner raises the issue by relying on selected portions of the deposition testimony.

(describing rapid switching in one hypothetical use of the switch and use of multiple beams in another (discussing Ex. 1013 ¶¶ 22, 27)); Ex. 1013 ¶¶ 18–27, 35); *supra* note 26 (discussing the timing of the testimony). For these reasons, and for the same reasons discussed above and further below in addressing Patent Owner’s “los[s] of benefit” arguments, Patent Owner’s argument that alleges that Mr. Teillet’s testifies that steering a single beam with a single radio would change the principle of Matitsine-860, render it unsuitable for its intended purpose, and related arguments, are unavailing. *See* PO Resp. 37–38.

Dr. Behdad’s testimony and Patent Owner’s arguments further support the Petition, because they show minimal alteration of Matitsine-860’s system as modified by Ebling’s switch teachings. *See* Ex. 2008 ¶ 220; PO Resp. 38. As Petitioner reasons, “combining Matitsine-860[] and Ebling would have been no more than combining prior art elements according to known methods to yield predictable results for a person of ordinary skill in the art.” Pet. 23 (citing *KSR*, 550 U.S. at 416). The record does not support Patent Owner’s counter-argument that the functionality of Matitsine-860’s system changes if combined with Ebling’s switch network 48 so that *KSR* does not apply (*see* PO Resp. 29), because Dr. Behdad testifies that the functionality of Matitsine-860’s system “require[s] little or no modification” to implement switching. *See* Ex. 2008 ¶ 220. Patent Owner’s argument that “[a]dding Ebling’s switch network would have added no functionality—it would select between two alternatives *with the same functionality*,” supports the Petition for the same reason—it shows similar switching functionality where Matisine-860 is not explicit as to how it provides switching. *See* PO Resp. 38 (emphasis added) (citing Ex. 2008 ¶¶ 224–225); Pet. 22–23. The

proposed combination simply provides for switching at the RF element or pair level (and/or RF signal feed level) as noted above and as Mr. Teillet testifies. *See* Reply 13 (“[T]he original function of a moving radiating element is not affected by simply adding a selector that can turn the radiating element on and off,” and “[t]he process of connecting the switching network/selector in Ebling multiple radiating elements on the same lens would be relatively simple, and within the skill of a [person of ordinary skill in the art].” (quoting Ex. 1012 ¶ 33)).²⁹

Contrary to Patent Owner’s related arguments, the Petition need not explain explicitly how implementing Ebling’s switch/selector teachings *does not* change the function of Matitsine-860’s system. PO Resp. 30. Patent Owner does not cite precedent to support this proposition. In any event, the record shows that changing a beam direction by using a switch or by moving elements does not appreciably alter the underlying functionality of individual components of either Matitsine-860’s system or Ebling’s system of providing for different beam directions. As also discussed above, Dr. Behdad’s testifies that selecting one pair of RF elements and not another pair

²⁹ In Sur-reply, Patent Owner argues that the functions of other combined elements such as “Ebling’s switch network and Matitsine-860’s control mechanism and phase shifter” “are indisputably changed” in the combinations argued in the Reply. Sur-reply 8 (citing Ex. 2025, 276:5–11; 277:14–278:7; 301:13–23; 304:18–305:11; 309:21–311:19; 327:21–328:8). Dr. Behdad’s above-discussed testimony and Patent Owner’s above-quoted argument (“same functionality”) refute this line of argument, because they show the functionality of Matitsine-860 does not change or changes minimally, and Ebling’s switching network simply performs its function of providing switching. *See* Ex. 1013 ¶ 23 (“The electrical components, connectors, and wiring that would be required to connect Ebling’s switch network with each of the radiating RF elements would be within routine skill in the art.”).

“for transmission” in Matsine-860 “*requir[es] little or no modification to the system.*” Ex. 2008 ¶ 220 (emphasis added)). This testimony supports Petitioner’s argument that “the original function of a moving radiating element is not affected by simply adding a selector that can turn the radiating element on and off.” Reply 13 (citing Ex. 1013 ¶¶ [2]3–24); Ex. 1013 ¶ 23 (“The electrical components, connectors, and wiring that would be required to connect Ebling’s switch network with each of the radiating RF elements would be within routine skill in the art.”).

Patent Owner argues that because “Matitsine-860 uses moveable RF elements to provide desired beam directions in a different way than using fixed feed elements and switch network—a [person of ordinary skill in the art] would not have added Ebling’s switch network to Matitsine-860’s system.” PO Resp. 25. Petitioner replies that a person of ordinary skill in the art “would have common sense to realize that electronically coordinated elements are faster, and likely more reliable, than physically moveable elements.” Reply 9. This issue is similar to the issue in *Leapfrog Enters., Inc. v. Fisher–Price, Inc.*, 485 F.3d 1157, 1161–62 (Fed. Cir. 2007). In that case, the court determined that that it would have been obvious to use “electronic components” to update a learning toy that “relies on an electric motor and mechanical structures rather than a processor and related electronics,” “to produce an electronics-based learning toy for children” “in order to gain the commonly understood benefits of such adaptation, such as decreased size, increased reliability, simplified operation, and reduced cost.” *Id.* at 1161–62. Based on the reasoning of *Leapfrog*, which is analogous to the facts here, Petitioner’s argument that an artisan of ordinary skill would have recognized commonly understood benefit of speed (akin to simplified

operation) and reliability of electronic switching versus mechanical operation is persuasive.

As discussed above, Petitioner generally relies on the benefit of Ebling's switch as allowing for "select[ing] subsets of radiating elements for signal transmission or reception." Pet. 22; *accord* Reply 18. Petitioner also argues that "[i]f there's a known technique to address a known problem using 'prior art elements according to their established functions,' then there is a motivation to combine . . . [and] '[i]t's not necessary to show that a combination is the best option, only that it be a suitable option.'" Reply 17 (alterations in original)(quoting *Intel Corp. I*, 61 F.4th at 1381). In *Intel Corp. I*, the court reversed the Board because "contrary to the Board's suggestion, Intel never had to show that replacing Kabemoto's secondary cache with Bauman's secondary cache was an 'improvement' in a categorical sense." *Id.* Rather, "Intel just had to show that Bauman's secondary cache was a 'suitable option' to replace Kabemoto's secondary cache." *Id.* (quoting *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021)). As discussed above, Petitioner's Reply demonstrates that Ebling's electric switch network 48 is also at least a "suitable option" for Matsine-860's mechanically-guided feed system under the rationale of *Intel Corp. I*. See *Intel Corp. I*, 61 F.4th at 1381; Reply 9.

Several well-known common sense benefits flow from this switching capability at the RF level. First, as noted in the Institution Decision, and as discussed above, selecting different subsets provides the ability for beam steering. Second, arguing that the modification provides the ability to select one or more RF elements *for transmission or reception* is another way of

stating that a switch performs its natural function of turning the RF elements on/off. *See* Reply 12–13.

Patent Owner’s Sur-reply notes that the Reply “admits the Petition never argued that a [person of ordinary skill in the art] would have added Ebling’s selector to Matitsine-860 to ‘change beam direction.’” Sur-reply 4.³⁰ This is a correct characterization of the Reply, but in context, it was well-known that one of the results, or benefits, of selecting different RF elements, is to steer the beam, as found above and as noted in the Institution Decision. Inst. Dec. 21–22 & n.9 (noting that “Patent Owner acknowledges that a prior art patent to Collier cited during prosecution ‘discloses switching or throwing different switches 34 to shape a pattern’ and contends that this teaching is cumulative to Ebling” (quoting Prelim. Resp. 14; citing Ex. 2004, 7:35–42)). As another example, Patent Owner verifies that “Ebling uses a switch network to change beam direction.” Sur-reply 4 (arguing “Matitsine-860 changes beam direction in other ways so it does not need Ebling’s selector”). Finally, Petitioner observes that, “[i]n this case, the problem being solved by each of the three main references is *using lens arrays for beam steering*.” Reply 19.

In general, relying on the Supplemental Declaration of Mr. Teillet, Petitioner elaborates by citing benefits that flow from the ability to select subsets of RF elements using Ebling’s switch/selector teachings in reply to the Response’s assertion of a failure to establish a legally sufficient reason to

³⁰ Petitioner asserts in its Reply that the “Petitioner didn’t argue that a [person of ordinary skill in the art] would combine Matitsine-860 and Ebling to change beam direction, Petitioner said they would combine teachings from the references to have the ability to select subsets of radiating elements (e.g., to turn some on and off at different times).” Reply 12–13.

use Ebling's switch/selector in Matitsine-860's system. *See* Reply 5–10. Petitioner also elaborates by providing simple block circuit diagrams showing “how” to implement Ebling's switch/selector teachings in Matsine-860's system in direct response to the Response's argument that the Petition fails to show how to combine Ebling and Matitsine-860. *See id.* at 9 (citing Ex. 1012 ¶¶ 26–27); Ex. 1012 ¶¶ 26–27; PO Resp. 29 (“Petitioner never explains how Ebling's switch could be added to Matitsine-860's system without changing the function of the ‘known elements’ a [person of ordinary skill in the art] allegedly would have combined.”).

Patent Owner argues that the Supplemental Declaration “is not proper Reply and instead repeatedly seeks to belatedly establish *prima facie* obviousness.” Sur-reply 6. Patent Owner similarly argues that “[t]he Reply's new arguments that seek to explain how the Matitsine-860 and Ebling elements allegedly would have been combined could have been in the Petition and belatedly seek to establish *prima facie* unpatentability, and therefore should not be considered.” *Id.* at 8.

Contrary to the Sur-reply arguments, as noted above, “a party is ‘not barred from elaborating on [its] arguments on issues previously raised.’” *Masimo Corp.*, 2023 WL 5921622, slip op. at *5 (quoting *Chamberlain Grp., Inc.*, 944 F.3d at 925). “That type of elaboration is particularly permissible when it rebuts arguments raised by the other party.” *Id.* (citing *Provisur Techs.*, 50 F.4th at 122 (finding the petitioner's reply proper when it was “directly responsive” to the patent owner's arguments)); *cf. In re NuVasive, Inc.*, 841 F.3d 966, 972 (Fed. Cir. 2016) (“In the related, non-IPR context, we have relied on the APA's requirements to find a ‘new ground’ where ‘the thrust of the rejection’ has changed, even when the new ground

involved the same prior art as earlier asserted grounds of invalidity.”
(quoting *In re Leithem*, 661 F.3d 1316, 1319 (Fed. Cir. 2011)).

For the reasons explained above, the Petition establishes *prima facie* obviousness with respect to the selector limitation without considering the Reply and Supplemental Declaration other than in the context of proper reply to the Response. The Reply relies and elaborates on its original theory that using Ebling’s switch teachings would have been obvious in order to select desired RF elements for transmission and reception and, therefore, is responsive to Patent Owner’s expert. This is within “the permissible scope of an IPR petitioner’s reply”:

The APA, the IPR statute, the Board’s regulations, and our precedents collectively impose two separate, but related, restrictions on what a petitioner may include in its reply. First, the arguments and evidence in the reply must not be part of a *new* theory of unpatentability. Second, the arguments and evidence in the reply must be *responsive* to the patent owner’s contentions or the Board’s institution decision.

Corephotonics, Ltd. v. Apple, Inc., No. 2022-1340, 2023 WL 6798899, slip op. at *11 (Fed. Cir. Oct. 16, 2023) (“[W]e are not persuaded . . . that the Board erred in permitting Apple to argue in reply that its prior art references are analogous to the Challenged Patent because they satisfy *both* the field of endeavor and pertinent to the problem tests, *even though Apple’s petition only invoked the field of endeavor test.*” (emphasis added)); *see also Belden*, 805 F.3d at 1077–79 (“Evidence admitted in rebuttal to respond to the patent owner’s criticisms will commonly confirm the *prima facie* case. That does not make it necessary to the *prima facie* case.”); *SAS*, 825 F.3d at 1351 (“What concerns us is . . . the Board ‘change[d] theories in midstream.’” (quoting *Belden*, 805 F.3d at 1080)). Here, as in *Corephotonics*, the Reply

does not present a new theory or alter the thrust of the Petition, and it properly responds to arguments in the Response in most instances, as outlined above and below. *Cf. NuVasive*, 841 F.3d at 972 (indicating that changing the thrust is improper reply); *Belden*, 805 F.3d at 1080 (“[T]he [Trial Practice] Guide cannot fairly be read to do more than put the public on notice that the Board may, in its discretion, refuse to consider a Reply if any part is improper.”).

Patent Owner does not allege with specificity that the Reply presents a new theory to the Petition with respect to the selector limitation. *See* Sur-reply 4–14. In particular, as explained above, the Petition relies on the rationale that it would have been obvious to employ Ebling’s switch/selector teachings in Matitsines’860’s system in order to allow selection (i.e., switching) of subsets and/or to produce one output at a time, which includes switching one RF element, or groups thereof, at a time. *See* Pet. 21–22 (citing Ex. 1012 ¶ 24). The Reply and Supplemental Declaration do not deviate from this combination and simply fill in gaps in response to arguments presented in the Response that generally assert that the Petition fails to show how to implement Ebling’s switch teachings and lacks in legally sufficient rationale.

For example, as outlined above, the Reply asserts that the Petition “combine[s] teachings from the references to have the ability to select subsets of radiating elements (e.g., to turn some on and off at different times).” Reply 12–13. In addition, the Reply asserts that a person of ordinary skill “would think to use both mechanical and electronic (switch) means to adjust beam direction, because using one is not inconsistent with using the other” and “redundancy in changing beam direction could be

important.” *Id.* at 13. The Reply also asserts that “using a switch network” is “faster” and more reliable, than “moving elements on a rail,” because it is “common sense” that “electronically coordinated elements are faster.” *Id.* at 8–9 (citing Ex. 1013 ¶¶ 32–34).

Notwithstanding Patent Owner’s arguments that Petitioner does not support with evidence that these benefits flow from using Ebling’s switch/selector teachings, and that Petitioner “offers numerous inconsistent explanations for what the Matisine-860/Ebling combination allegedly is” (Sur-reply 6), the Teillet Supp. Declaration provides persuasive evidence with rational underpinning showing multiple ways to satisfy the breadth of claim 1. For example, the testimony provides persuasive evidence that switches are faster than mechanical movement, where the benefit is a well-known common sense result of using an electrical switch/selector. *Compare* Sur-reply 10 (citing Ex. 1013 ¶¶ 26–27), *with* Reply 8–9 (citing Ex. 1013 ¶¶ 26–27); Ex. 1013 ¶¶ 26 (testifying that the combination results in “chang[ing] beams direction rapidly with switches, instead of moving elements on a rail”), 22 (same); *see also Leapfrog*, 485 F.3d at 1161–62 (providing persuasive reasoning and evidence that artisans of ordinary skill generally would have recognized the benefit of increased reliability and simplification in electronic versus mechanical systems).

As another example, Petitioner shows that a person of ordinary skill in the art “would think to include multiple radiating elements even though they are not all needed all the time—to account for the ability to save power during low requirements, and to provide sufficient power in the event of broken radiating elements.” Reply 5–6. This is a well-known benefit of using a switch to control electric energy devices—e.g., turning one or more

light bulbs off, like turning on or more transmitting RF feed elements off, saves power (and also changes the pattern of radiation). As Petitioner also shows, like Matitsine-860, Ebling also teaches operating “less than all radiating elements” with respect to Figure 1. *See* Reply 6 (reproducing Ebling Fig. 1).

Patent Owner also argues that “every combination supported in the Supplemental Declaration relies solely on fixed RF elements and eliminates mechanical beam steering and thus does not provide redundancy in changing beam direction at all.” Sur-reply 13. Contrary to this argument, Mr. Teillet also generally testifies that “[a]dding the switch network 48 to the array of Matitsine-860 would allow for each radiating element in Matitsine-860 to turn on/off,” without specifying that this applies to only non-moveable elements. Ex. 1013 ¶ 18; *see also id.* ¶ 25 (similar testimony); Reply 13 (asserting that “us[ing] both mechanical and electronic (switch) means to adjust beam direction” is redundant).³¹ Patent Owner otherwise agrees that Petitioner “argues that a [person of ordinary skill in the art] would provide both movable control and switching control of RF elements.” Sur-reply 11 (citing Reply 12–14).

Patent Owner also argues that “Matsing disparaged Ebling’s approach as unsuitable and opted instead to mechanically move the RF elements.”³²

³¹ Given the holding of our Final Written Decision, there is no need to decide if Petitioner’s alleged redundancy benefit and other asserted benefits not discussed herein are proper responses, and we do not consider them.

³² Patent Owner contends that “Matitsine-860 is Matsing’s own Reference.” Sur-reply 10 (indicating that the cover page of Matsine-860 shows that its assignee is “Matsing, Inc.” (citing Ex. 1002)). Although Matsing, Inc. is listed as the assignee of Matitsine-860 (Ex. 1002, code (73), the USPTO assignment records show that the assignors (inventors) executed the

Sur-reply 11 (citing Ex. 1002, 1:41–48).³³ The cited passage does not support the argument that Matsing, Inc. (or Matsing-860) disparages Ebling’s approach of using switch network 48. *See supra* note 33; Ex. 1002, 1:26–48 (stating that some prior art systems, including a prior art steerable antenna system as disclosed in a patent to Sreenivas, which “us[es] a phased array antenna and a spherical lens,” and Ebling’s system, “are not suitable for base station antennas,” without explanation as to why and without mentioning a switch or selector). Also, Matitsine-860 did not “opt[] instead to mechanically move the RF elements” to the exclusion of employing fixed RF elements, because Matitsine-860 discloses an antenna system with fixed RF elements. *See* Ex. 1002, Fig. 5, 10:25–29 (“While the RF elements 520–535 are shown to be placed at fixed locations in this figure, in some other embodiments, the antenna 500 can also include tracks that enable the RF elements to move to different positions along the surface of their respective spherical lenses.”).

Patent Owner’s Sur-reply argument that “selecting subsets of Matitsine-860’s RF elements would lose the benefit of Matitsine-860’s multi-beam antenna and there was no reason to add Ebling’s switch network if Matitsine-860’s system were to be operated as intended” is a repeat of its Response argument and is unavailing for the reasons noted above. Sur-reply 14. In addition, these arguments, and related arguments in the Sur-reply and

assignment to Matsing, Inc. on Dec. 9, 2015, after the filing date of Matitsine-860, Dec. 3, 2015. Accordingly, the record does not support Patent Owner’s argument that “*Matsing* disparaged Ebling’s approach.”

³³ This argument has been waived/forfeited as it does not respond to an argument in the Reply and is not in the Response. *See* Paper 10, 9 (“Patent Owner is cautioned that any arguments not raised in the response will be deemed waived.”) Nevertheless, we exercise discretion and consider it.

Response, are essentially teaching away arguments that are not reasonably commensurate in scope with claim 1. *See id.* For example, Patent Owner’s allegations that Mr. Teillet testified in his Supplemental Deposition that the combination results in “*further* drawbacks” such as “decreased resolution, undesirable signal coupling, potential power loss, and potential increased cost” are essentially teaching away arguments that are not reasonably commensurate in scope with claim 1. *Id.* (emphasis added) (citing Ex. 2025, 297:10–299:13, 324:7–344:12, 348:5–13).

In other words, as determined above, claim 1 does not require the selector to select more than one RF element of a subset at a single lens at each and every time that the operator makes a desired selection. Claim 1 also does not require any set amount of resolution, coupling, power loss or gain, or cost. “Evidence concerning whether the prior art teaches away from a given invention *must relate to and be commensurate in scope with the ultimate claims at issue.*” *Idemitsu Kosan*, 870 F.3d at 1381 (emphasis added) (citing *In re Zhang*, 654 F. App’x at 490 (“While a prior art reference may indicate that a particular combination is undesirable for its own purposes, the reference can nevertheless teach that combination if it remains suitable *for the claimed invention.*” (emphasis added))). In addition, as found above, Petitioner’s proposed modifications contemplate transmitting/receiving through a single RF element and also multiple RF elements and their respective lens(es).

As indicated above, Patent Owner’s arguments also raise trade-off issues, but Patent Owner’s citations and summary of the alleged testimony fail to account for qualifying statements by Mr. Teillet. *See* Sur-reply 14 (citing Ex. 2025, 297:10–299:13, 324:7–344:12, 348:5–13). For example,

Dr Teillet testifies in the Supplemental Deposition that the switch losses “shouldn’t be significant,” quantifying the losses in the 0.1 or 0.2 DB range. Ex. 2025, 343:16–19. As to decreased resolution in using a finite number of fixed RF elements as opposed to moving elements on a rail, Mr. Teillet testifies that “the advantage is rapid switching.” *See id.* at 299:3–9. As to cost, Mr. Teillet testifies that a “cost comparison” between “how you design the rails” and “how that would compare in having multiple elements with a switch network.” *Id.* at 341:1–343:2.³⁴ Similarly, Dr. Behdad’s testimony regarding the cost and transmission loss associated with a selector (Ex. 2008 ¶¶ 224–225) raises trade-off issues between those factors, and, for example, the ability to select desirable RF elements, switch rapidly, and reduce power, as needed, according to the Supp. Teillet Declaration (*see* Ex. 1013 ¶¶ 22, 26).

As Petitioner contends, “Matitsine-860 discloses that the antenna system can be programmed ‘via the control mechanism’ to configure the radiating elements to ‘provide coverage at different geographical areas and different capacity (by having more or less RF elements covering the same geographical area) depending on demands at the time.’” Pet. 21 (quoting Ex. 1002, 6:17–20). An artisan of ordinary skill would have known that providing Ebling’s switch/selector teachings ensures the capability of

³⁴ Patent Owner’s string citation to the Supplemental Deposition, including a citation to twenty pages (Sur-reply 14 (citing Ex. 2025, 324:7–344:12)), invites the Board to play archeologist with the record. Absent a further and more pointed analysis by Patent Owner as to where in the record all the listed drawbacks exist, we decline to search and analyze the testimony further.

controlling fewer RF elements, thereby benefiting Matsine-860's goal of meeting the "demands at the time," notwithstanding other trade-offs.

In addition, Patent Owner's arguments and evidence do not undermine Petitioner's showing that the known benefits of using a switch to selectively turn desired RF elements on and off would not have been outweighed by other trade-off considerations. *See Intel Corp. v. PACT XPP Schweiz AG*, No. 2022-1038, 2023 WL 2198649, slip op. at *4 (Fed. Cir. Feb. 24, 2023) (reversing the Board and finding patent owner's expert's testimony did not support the Board's finding of a lack of motivation where the expert "does not opine on whether the benefits of the implementation outweigh the [speed] cost").

Patent Owner also argues that the Petition conflates the requirements of a reasonable expectation of success with motivation to combine. PO Resp. 20. As discussed above, Petitioner's rationale for combining the teachings is persuasive. Patent Owner does not argue separately that Petitioner's proposed combination results in a lack of a reasonable expectation of success. *See id.* Nevertheless, we find below that Petitioner's proposed combination satisfies the requirement of a reasonable expectation of success.

On the record, an artisan of ordinary skill would have had a reasonable expectation of success in implementing Ebling's switch teachings in Matsine-860's system as modified (with and without Demetriadou's lenses). As discussed above (*supra* § I.C), the '947 patent describes "one or more switches" for each lens of Figure 4, but Figure 4 only depicts one switch per lens, indicating that artisans of ordinary skill readily were able to implement switches. Ex. 1001, 9:24–28. As also discussed above, Dr.

Behdad testifies, switching “require[s] little or no modification” to Matitsine-860’s system, indicating further that an artisan of ordinary skill would have had a reasonable expectation of success implementing Ebling’s switch teachings in light of the breadth of claim 1, which lacks specificity as to selecting any particular subset of feed elements. *See* Ex. 2008 ¶ 220; *Tokai Corp. v. Easton Enters. Inc.*, 632 F.3d 1358, 1371 (Fed. Cir. 2011) (reasoning that “the nature of the mechanical arts is such that ‘identified, predictable solutions’ to known problems may be within the technical grasp of a skilled artisan” (quoting *KSR*, 550 U.S. at 421)). In addition, Mr. Teillet testifies that the modification would have been “easy” and “within routine skill in the art.” Ex. 1013 ¶¶ 22–23 (providing an example block diagram circuit representing the combination), ¶¶ 26–27 (providing another example block diagram circuit representing the combination).

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge of limitation 1.b.

v. Summary of Claim 1

Based on the record, we determine that Petitioner shows by a preponderance of evidence that claim 1 would have been obvious over the combined teachings of Matitsine-860, Demetriadou, and Ebling.

e. Claims 2–5, 9–11, 15, 18, and 19

Claims 2–5, 9–11, 15, 18, and 19 depend directly from independent claim 1. Petitioner contends that these claims would have been obvious over the combined teachings of Matitsine-860, Demetriadou, and Ebling. Pet. 23–32. Patent Owner specifically challenges claims 2, 3, and 19, and

otherwise relies on the alleged deficiencies addressed above in connection with claim 1, as discussed below.

i. Claims 2 and 3

Claim 2 recites “[t]he antenna system of claim 1, wherein said selector coherently combines/splits signals from said subset of said plurality of feed elements to generate a first beam signal from said phased array as a whole.”

Similar to its showing for claim 1, Petitioner quotes Matitsine-860 as disclosing a “control mechanism . . . programmed to coordinate multiple pairs (or groups) of RF elements and to configure a phase shifter to modify a phase of the output signals.” Pet. 23 (quoting Ex. 1002, 2:20–23). Still tracking its showing for claim 1, Petitioner quotes Matitsine-860 as disclosing that “the antenna system 100, via the control mechanism 160, can be programmed to configure the RF elements to provide coverage at different geographical areas and different capacity (by having more or less RF elements covering the same geographical area) depending on demands at the time.” *Id.* (quoting Ex. 1002, 6:17–20).

Still tracking its showing for claim 1, Petitioner contends that “Matitsine-860 does not appear to teach a selector,” and relies on Ebling’s switch/selector teachings. Pet. 24. Petitioner contends that Ebling teaches a selector because it discloses switching network 48 that receives a transmission signal, “such that the operation of the switches of the switching network (i.e., selection of the inputs) determines the directivity characteristic in the transmission direction (i.e., the directivity of the beam formed in the far field).” *Id.* at 23–24 (quoting Ex. 1004, 4:37–43). Ebling teaches that “switching network 48 further comprises at least one control port 56 for

controlling which outputs 52 are connected to the at least one input 50 at a given time.” Ex. 1004, 6:17–20; *see also* Pet. 14 (citing Ex. 1004, 6:17–20).

Petitioner contends as follows:

[T]he coherent signal combination and splitting by the [’947 patent’s] selector refers *to the process by which each given signal/beam is combined in-phase*. This limitation is described by the control mechanism 160 of Matitsine-860, where it is ‘. . . configured to automatically determine the phase modifications necessary to bring the output beams in-phase based on the positions of the RF elements’.”

Pet. 24 (quoting Ex. 1012 ¶ 26) (emphasis added).

Patent Owner contends as follows:

First, claim 2 limits the selector – “**said selector** coherently combines/splits signals[.]” Petitioner alleged the “selector” was met by Ebling’s switch network (Petition, 22), not Matitsine-860’s control mechanism. [Ex. 2008] ¶226.

Second, Matitsine-860’s control mechanism 160 “configures the phase shifters 150 and 155 to modify (or adjust) the phase of the output signal transmitted by either RF element 140 or 145” ([Ex. 1002], 6:66–7:3), but is nowhere described as combining/splitting signals from the RF elements. [Ex. 2008] ¶227.

PO Resp. 75–76.

The record supports Petitioner’s persuasive reliance on the combination of Matitsine-860’s control mechanism 160 together with Ebling’s switch/selector teachings to account for the limitation of claim 2. Patent Owner’s arguments do not undermine this persuasive showing. Contrary to Patent Owner’s second argument, Matitsine-860’s Figure 1A clearly depicts control mechanism 160 splitting the feed signal to two different lenses 105/110 via RF elements 140 and 145, and vice versa (combining two signals into one). *See* Ex. 1002, Fig. 1A. The record does not support Patent Owner’s arguments or Dr. Behdad’s testimony on this

point. *See* Ex. 2008 ¶ 226. Dr. Behdad testifies that “Matitsine-860 does not describe the circuitry or feed network *that provides/receives signals to/from the RF elements 140 and 145 or that combines/splits signals for RF elements that are provided the same feed signal.*” Ex. 2008 ¶ 226 (emphasis added). This testimony supports the Petition, because it admits that Matitsine-860’s system “*provides/receives signals to/from the RF elements 140 and 145 or that combines/splits signals for RF elements that are provided the same feed signal.*” Patent Owner’s and Dr. Behdad’s position appears to be that there is no explicit description about how Matisin-860’s circuit works, but this is not a requirement for a disclosure or a teaching where the circuit’s operation is clear. *See id.* ¶ 226 (arguing that “Matitsine-860 does not describe control mechanism 160 as combining or splitting signals from the RF elements.”); PO Resp. 76 (similar).

Dr. Behdad otherwise testifies that “controller 160 can be configured to adjust the phase of the output beams emitted by RF elements 140 and 145 to bring the RF signals exiting the respective lenses in-phase.” *Id.* ¶ 77 (citing Ex. 1002, 5:39–47, 7:1–9).³⁵ It follows that control mechanism 160 processes a signal from one input line and then splits that signal for phase shifting as depicted in Fig. 1A (and vice versa). *See* Ex. 1012 ¶ 26 (testifying that control mechanism 160 combines and splits signals similar to the process described in the ’947 patent). Matitsine-860’s disclosure supports Mr. Teillet on this point based on Figure 1A and its accompanying disclosure, as explained above.

³⁵ As Dr. Behdad explains, the position of the RF elements relative to each lens determines if the output beams from different lenses “lead or lag one another by a distance ‘e’.” Ex. 2008 ¶ 76. This lead or lag represents a phase difference between two signals that are otherwise the same.

Regarding Patent Owner's first argument, according to the '947 patent's Figure 4, the phrase at issue, "said selector coherently combines/splits signals," necessarily involves additional circuit components that perform the "combines/split" functionality—that is, in addition to the selector that Patent Owner identifies with respect to Figure 4 of the '947 patent (which the '947 patent identifies as "switch 310" but not as a selector). *See* Ex. 1001, 9:29 ("switch 310"); *supra* § 1.C (Fig. 4 showing selector as identified by Patent Owner); PO Resp. 5–6 (annotating Ex. 1004, Fig. 4 to designate a selector (blue box) that includes switch 310a and other similar switches depicted in block diagram form).

In describing switch/selector 310, Patent Owner does not contend that it combines and/or splits signals. PO Resp. 5–6. Rather, the summer/divider 308 (Σ) of Figure 4 of the '947 patent is what performs those functions, because Figure 4 shows this summer is the only place that the circuit combines or splits signals (i.e., from many to one and vice versa).³⁶ *See* Tr. 30:15–34:11 (a panel member pointing out that the relied-upon selector (i.e. switch 310) in Figure 4 of the '957 patent does not combine signals by itself, and Patent Owner demurring, stating that Petitioner carries the burden). Petitioner explains that "the coherent signal combination and splitting by the ['947 patent's] selector refers to the process by which each given signal/beam is combined in-phase." Pet. 24. And as noted above, Petitioner contends that Matitsine-860's control mechanism 160 performs this functionality, "where it is ' . . . configured to automatically determine the

³⁶ Figure 3 designates summer/divider 308a and 308b as the summer/divider Σ , but Figure 4 does not designate summer/divider Σ as 308.

phase modifications necessary to bring the output beams in-phase based on the positions of the RF elements’.” *Id.* (quoting Ex. 1012 ¶ 26).

In other words, Petitioner asserts that the claimed selector operates as part of a process (with other components) to result in combining/splitting signals as claimed. *See* Pet. 24. Neither Patent Owner nor Petitioner assert that the disclosed switch 310, as described in the ’947 patent (which Patent Owner identifies as a selector), actually combines/splits anything in operation by itself. Against the background of the ’947 patent disclosure, Petitioner persuasively shows that the combination of Matitsine-860’s control mechanism 160 and phase shifters 150, 155, as modified by Ebling’s switch/selector teachings, constitute the selector limitation required by claim 2.

Patent Owner essentially agrees with this view of Petitioner’s position by arguing that “the Petition alleged the selector requirements are met by Matitsine-860’s control mechanism 160 and not by Ebling’s switch network.” Sur-reply 24 (Pet. 23–25). That is, Patent Owner is correct that Petitioner relies, in part, on Matitsine-860’s control mechanism 160, but Petitioner relies on the combination of Matitsine-860’s control mechanism 160 together with Ebling’s switch/selector teachings to reach the selector limitation of claim 2, as explained above.

Patent Owner also is correct that Matisine-860’s control mechanism 160 (albeit in conjunction with phase shifters 150, 155) modifies the phase from one of the two output signals transmitted by either RF element 140 or 145. *See* PO Resp. 75–76. Matitsine-860’s Figure 1A shows that modifying the phase of one signal at 150 or 155 “bring[s] the output beams in-phase based on the positions of the RF elements,” wherein control mechanism 160

either splits the signals before that or combines them thereafter, similar to the process of Figure 4 of the '947 patent, as Petitioner argues. *See* Ex. 1002, Fig. 1, 6:36–7:9; Pet. 24. Patent Owner does not particularly dispute Petitioner's persuasive argument and Mr. Teillet's persuasive testimony that the '947 patent system works in a similar fashion, and Patent Owner does not address the combined teachings of the two references as asserted in the Petition. *See* PO Resp. 75–76.

The record supports Petitioner's observation that Matitsine-860 and the '947 patent systems work in similar fashion. That is, "summer/divider" (Σ) 308a or 308b illustrated in Figures 3 and 4 of the '947 patent combines/divides signals like the control mechanism 160 of Matitsine-860's Figure 1A. *See* Ex. 1001, Fig. 4, 9:24–64 (describing "pass[ing] signals between the first feed elements 152a1, 152b1 (or the second feed element 152a2, 152b2) and the summer/divider 308" so that "summer/divider 308 . . . support[s] multiple feed elements"). As discussed above, Petitioner's showing involves combining Matitsine-860's control mechanism 160 functionality with Ebling's switch/selector teachings to arrive at the claimed features. As also indicated above, Ebling teaches that "switching network 48 . . . control[s] which outputs 52 are connected to the at least one input 50 at a given time." *See* Ex. 1004, 6:17–20; Pet. 14 (citing Ex. 1004, 6:17–20).

As discussed in connection with claim 1 above, Petitioner shows that Ebling's switch/selector teachings provide for turning selected RF elements on/off without otherwise appreciably altering Matitsine-860's process of combining/dividing, and provides persuasive reasons to combine Ebling's switch/selector teachings with Matitsine-860's system. *See* Ex. 1013 ¶ 33 ("The process of connecting the switching network/selector in Ebling

multiple radiating elements on the same lens would be relatively simple, and within the skill of a [person of ordinary skill in the art]. Indeed, the original function of a moving radiating element is not affected by simply adding a selector that can turn the radiating element on and off.”).

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge to claim 2.

Claim 3 recites

[t]he antenna system of claim 2, wherein said subset of said plurality of feed elements comprises a first subset that transmits/receives a first beam signal from/to said phased array as a whole, and further where said selector dynamically selects a second subset of said plurality of feed elements to transmit/receive a second beam signal from/to said phased array as a whole.

Similar reasoning applies to claim 3, which depends from claim 2. Petitioner explains persuasively how Matitsine-860 discloses the added limitations of dynamically selecting first and second subsets in Figure 3, and further describes splitting the RF signals for output transmission from two lenses so that they are in-phase to form a phased array. *See* Pet. 24–25 (citing Ex. 1002, 6:17–20, 8:24–26, 28–32, 35–37; Ex. 1012 ¶ 28).

Patent Owner relies on its arguments for claim 2 and similarly asserts that “claim 3 further limits the selector—‘said selector dynamically selects’—but Petitioner alleges claim 3 is met only by features of Matitsine-860’s system (Petition, 24-25) rather than by Ebling’s switch network that is allegedly the ‘selector’ in the Matitsine-860/Demetriadou/Ebling combination.” PO Resp. 76 (citing Ex. 2008 ¶ 228). Contrary to Patent Owner’s argument, as discussed above in connection with claim 2, Petitioner

relies on the combination of Matitsine-860 and Ebling to reach the selector limitation, where claim 3 depends from claim 2.

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge to claim 3.

Based on the record, we determine that Petitioner shows by a preponderance of evidence that claims 2 and 3 would have been obvious over the combined teachings of Matitsine-860, Demetriadou, and Ebling.

ii. Claims 4, 5, 9–11, 15, and 19

Claims 4, 5, 9–11, 15, and 18 depend directly or indirectly from claim 1. Petitioner persuasively maps the added limitations of 4, 5, 9–11, 15, and 18 to Matitsine-860, Demetriadou, and Ebling. Petitioner provides persuasive reasons with a reasonable expectation of success for the combination in challenging these claims. *See* Pet. 25–30. Patent Owner relies on the alleged deficiencies addressed above in connection with claim 1. PO Resp. 75.

Based on the foregoing discussion, we determine that Petitioner shows by a preponderance of evidence that claims 4, 5, 9–11, 15, and 18 would have been obvious over the combined teachings of Matitsine-860, Demetriadou, and Ebling.

iii. Claim 19

Claim 19 recites “[t]he antenna system of claim 1, said non-spherical lens having a substantially planar interior surface, said plurality of feed elements linearly aligned with the substantially planar surface of said non-spherical lens.” Citing “Fig. 3” of Demetriadou, Petitioner argues that Demetriadou discloses a “non-spherical lens” with a “substantially planar

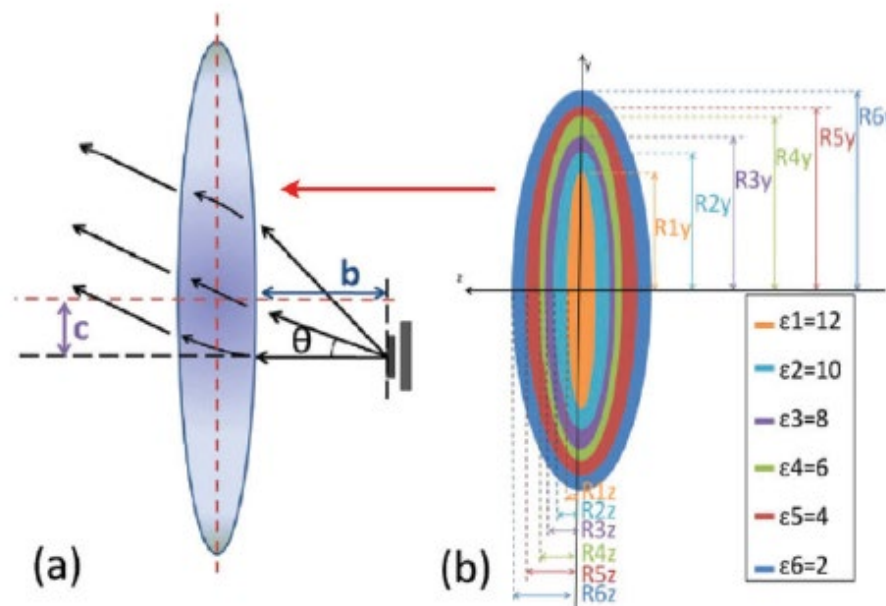
interior surface.” Pet. 31 (citing Ex. 1003, Fig. 3; Ex. 1012 ¶ 42). Petitioner further argues that a person of ordinary skill in the art “would [have understood] the substitution of the spherical lens of Matitsine-860 with the non-spherical lens of Demetriadou to be obvious as the truncated geometry of non-spherical lens provides for a smaller lens volume.” *Id.* (citing Ex. 1012 ¶ 42). Petitioner also argues that “it would have been obvious to linearly align the RF elements of Matitsine-860 with a substantially planar interior surface of the non-spherical lens in Demetriadou as it ‘would produce the predictable result of reducing implementation cost.’” *Id.* (quoting Ex. 1012 ¶ 42). Petitioner also argues that arranging RF elements in “the same plane, such that the set of [RF] elements are in-phase, is well-known.” *Id.* (citing Ex. 1012 ¶ 42).

Patent Owner responds that Demetriadou does not illustrate a “substantially planar interior surface” of a lens, as claim 19 recites, in “Demetriadou’s Fig. 3(a).” *See* PO Resp. 77. Specifically, Patent Owner asserts that “Petitioner relied only on Demetriadou Fig. 3a—the only figure [reproduced from Demetriadou] ‘below’ (Petition, 31)—but Fig. 3(a) does not illustrate Demetriadou’s lens.” *Id.* According to Patent Owner, “Fig. 3(a) illustrates an antenna setup Demetriadou simulated to simulate performance of *its Fig. 3b lens* and schematically shows where Demetriadou’s Fig. 3b lens was positioned in Demetriadou’s simulations.” *Id.* (citing Ex. 1003, 19929-19930; Ex. 2007, 67:15–69:3; Ex. 2008 ¶¶ 130, 229–230).

Patent Owner mischaracterizes the Petition’s showing. Patent Owner is correct that the Petition only reproduces Demetriadou’s Figure 3(a). *See* Pet. 31. However, the Petition generally cites to “Fig. 3” as showing the

claimed lens and as disclosing “a substantially planar interior surface.” *Id.* (quoting Ex. 1012 ¶ 42). At Figure 3, Demetriadou depicts Figures 3a, 3b, and 3c side-by-side under the generic label “Fig. 3.” Ex. 1003, 6 (“Fig. 3”). At the cited paragraph in the Teillet Declaration, Mr. Teillet testifies that “the lens from Demetriadou, Fig 3, includes a substantially planar interior surface.” Ex. 1012 ¶ 42; Pet. 31 (citing Ex. 1012 ¶ 42). As Petitioner argues, Demetriadou discloses a lens with substantially planar interior surface in what Demetriadou itself refers to as “Fig. 3.” *See* Ex. 1003, 6 (showing that “Fig. 3” includes “Fig. 3 . . . (b)”).

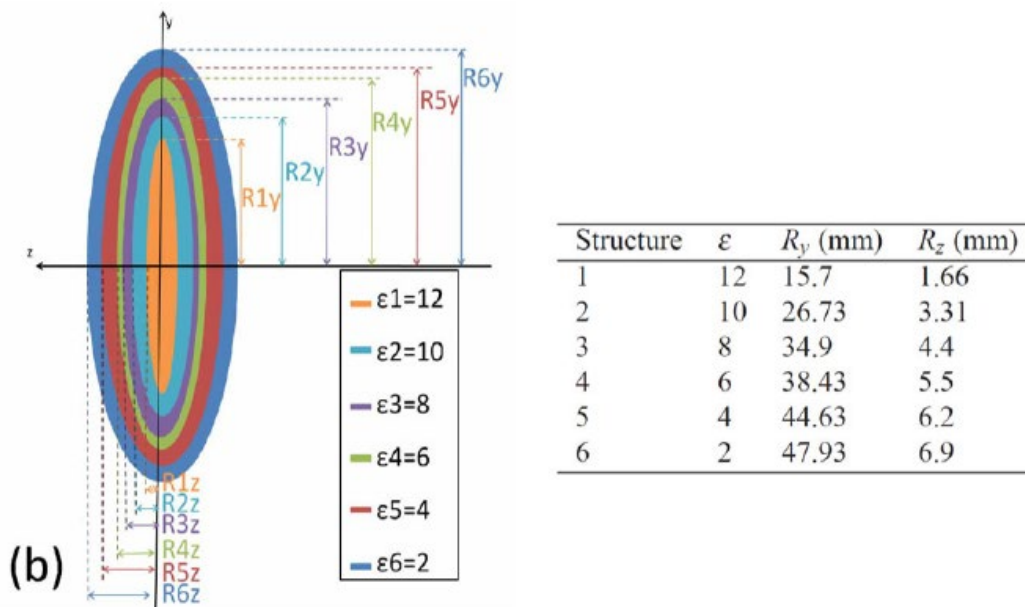
Demetriadou’s Figures 3a and 3b follow:



As illustrated above, Figure 3(b) is a cross-section of the lens in Figure 3(a) and shows a substantially planar interior surface (orange). Ex. 1003, 5. Demetriadou’s Figures 3a and 3b appear side-by-side above, just as they do in Demetriadou (Ex. 1003, 6) and in the Behdad Declaration (Ex. 2008 ¶ 93).

Dr. Behdad’s testimony corroborates Petitioner’s showing that Demetriadou’s “Fig. 3” illustrates a substantially planar interior surface:

While Demetriadou did not manufacture its lens, Demetriadou recognized that any practical realization of the lens requires discretizing the permittivity map using *a series of shells*, each having a constant, but different permittivity value, as shown by the discretized lens illustrated in Fig. 3 (below left) and Table 1 (below right):



Ex. 2008 ¶ 92. Demetriadou’s Figure 3b above appears next to Table 1 in the Response and in the Behdad Declaration. PO Resp. 16 (citing Ex. 2008 ¶¶ 89, 92); Ex. 1003, 5–6). According to Patent Owner, “[t]o allow for a more manufacturable lens, Demetriadou approximated the transformed permittivity map (Demetriadou, [4]) then *discretized it into six elliptical shells* $\epsilon 1$ – $\epsilon 6$ having permittivity values from 2–12 as illustrated in Fig. 3(b) ([above] left) and Table 1 ([above] right).” *Id.* (emphasis added). As seen above, Figure 3(b) depicts a discretized inner elliptical shell (orange) with a

substantially planar interior surface. Ex. 1003, 6. Mr. Teillet testifies that “Figure 3B is just showing *the inside[,] the layers* of the lens.” Ex. 2007, 68:24–25 (emphasis added). It follows that Figure 3B illustrates a “non-spherical lens having a substantially planar interior surface,” as claim 19 recites.

As noted above, like the Petition, Dr. Behdad refers to Demetriadou’s Figure 3(b) as “Fig. 3.” Ex. 2008 ¶ 92 (describing “the discretized lens illustrated in Fig. 3”). Similarly, Petitioner also refers to Figure 3(b) as “Fig. 3.” Pet. 31. By pointing to Demetriadou’s “Fig. 3” in the Petition, Petitioner placed Patent Owner on notice that Figure 3b shows a planar interior surface, where both parties refer to Figure 3b as “Fig. 3,” Figures 3a and 3b appear side-by-side in Demetriadou and in the Behdad Declaration, and these two figures show different views of the same lens. In addition, Patent Owner referred to Figure 3 during Mr. Teillet’s deposition: “Can you tell me what surface you are referring to *in Figure 3* of Demetriadou?” Ex. 2007, 226:2–3. Mr. Teillet answered as follows: “I guess the inside layer, the one with a Dk of 12, *it’s close to a planar surface.*” *Id.* at 226:4–5 (emphasis added).

Mr. Teillet also explained why Demetriadou’s innermost elliptical shell is substantially planar:

Q. So you are saying that an elliptical surface is substantially planar?

A. Yeah. The interior surface is more planar than the outer layers. So, yeah, theoretically it’s still – it’s still an ellipse, but it’s highly flattened for the one in the middle compared to the one outside. So that’s what it’s referring –

Ex. 2007, 226:10–16.

In Reply, Petitioner “agrees” that it “cited a figure [(i.e., Demetriadou’s Fig. 3a)] that did not *expressly* show[] the claim[’]s interface surface.” Reply 27 (emphasis added). Petitioner also argues that a person of ordinary skill “would apply common sense to appreciate that any non-spherical lens could be manufactured by combining two non-spherical halves.” *Id.* We do not consider this latter Reply argument, because it is untimely and is not a proper reply to a new argument raised in the Response, as Patent Owner argues.³⁷ Sur-reply 25. Instead, for the reasons discussed above, we rely on the Petition’s initial citation to Demetriadou’s “Fig. 3” and Mr. Teillet’s reliance on and testimony about the same, and we find that Patent Owner had notice of Petitioner’s reliance on Demetriadou’s lens illustrated in “Fig. 3,” including its substantially planar interior surface illustrated in Fig. 3b. *See* Pet. 31 (citing Ex. 1006, Fig. 3; Ex. 1012 ¶ 42 (citing same)); PO Resp. 76–78 (focusing on Demetriadou’s Fig. 3a without addressing Petitioner’s showing regarding its cross-section, Fig. 3b, and Petitioner’s initial reliance on “Fig. 3.”).³⁸

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge to claim 19.

³⁷ In its Sur-reply, Patent Owner also argues that “Matsing[-860] does not even allege that the resulting system would meet claim 19’s requirement that ‘said plurality of feed elements linearly [are] aligned with the substantially planar surface.’” Sur-reply 25–26. This argument applies to Petitioner’s improper argument in the Reply, which we do not consider. The argument does not address the Petition, which shows the claimed linear alignment, as summarized above.

³⁸ Mr. Teillet did not reproduce any figures from Demetriadou (or any prior art) in the Teillet Declaration. *See* Ex. 1012 ¶ 42.

Based on the record, we determine that Petitioner shows by a preponderance of evidence that claim 19 would have been obvious over the combined teachings of Matitsine-860, Demetriadou, and Ebling.

2. Matitsine-860, Demetriadou, Ebling, and Matitsine-537

Petitioner asserts that claim 6, which depends from claim 1, would have been obvious over the combined teachings of Matitsine-860, Demetriadou, Ebling, and Matitsine-537. Pet. 32–33. In support, Petitioner relies on the Teillet Declaration, and provides citations to teachings in Matitsine-860 and Matitsine-537. *Id.*

Petitioner persuasively maps the added limitations of claim 6 to the asserted prior art and provides persuasive reasons with a reasonable expectation of success for the combination. *See* Pet. 32–33. Patent Owner relies on the alleged deficiencies addressed above in connection with claim 1. PO Resp. 79. For the same reasons we identify above in connection with claim 1, Patent Owner’s arguments do not undermine Petitioner’s showing.

Based on the record, we determine that Petitioner shows by a preponderance of that claim 6 would have been obvious over the combined teachings of Matitsine-860, Demetriadou, Ebling, and Matitsine-537.

3. Matitsine-860, Demetriadou, Ebling, Matitsine-537, and Lee (Ground 3)

Petitioner asserts that claims 7 and 8, which depend from claim 6, would have been obvious over the combined teachings of Matitsine-860, Demetriadou, Ebling, Matitsine-537, and Lee. Pet. 33–34. In support, Petitioner relies on the Teillet Declaration, and provides citations to teachings in Matitsine-860 and Lee. *Id.*

Petitioner persuasively maps the added limitations of claims 7 and 8 to the asserted prior art and provides persuasive reasons with a reasonable

expectation of success for the combination. *See id.* Patent Owner relies on the alleged deficiencies addressed above in connection with claim 1. PO Resp. 79. For the same reasons we identify above in connection with claim 1, Patent Owner’s arguments are not persuasive.

Based on the record, we determine that Petitioner shows by a preponderance of that claims 7 and 8 would have been obvious over the combined teachings of Matitsine-860, Demetriadou, Ebling, Matitsine-537, and Lee.

4. *Matitsine-860, Demetriadou, Ebling, and Ray-767*

Claim 12 recites “[t]he antenna system of claim 1, wherein the plurality of lens sets are placed in a nonuniform tiling configuration.” Claims 13, 14, and 16 depend directly or indirectly from claim 12.

Petitioner asserts that these claims would have been obvious over the combined teachings of Matitsine-860, Demetriadou, Ebling, and Ray-767. Pet. 35–37. In support, Petitioner relies on the Teillet Declaration. *Id.*

Addressing claim 12, Petitioner contends that “Ray-767 discloses ‘congruent non-uniform linear receive and/or transmit antenna arrays’ where the radiating elements are spaced out in varying configurations,” and that a person of ordinary skill in the art “would find it ‘obvious to combine the familiar element of the phased array of Matitsine-860 with the non-uniform array spacing for RF Elements, to achieve predictable results since the non-uniform element configuration is a mathematical function optimized with algorithms to produce the lowered sidelobes’” Pet. 35 (citing Ex. 1007 ¶ 20; Ex. 1012 ¶ 50).

Patent Owner responds that Petitioner fails to “explain how Ray-767’s non-uniform spacing of a *lens-less linear* array of *fixed* antenna elements

(see Fig. 1A of Ray-767 below) could be applied to Matitsine-860's system having RF elements movable around a spherical lens, nor why a [person of ordinary skill in the art] would have made the (unidentified) modifications to Matitsine-860." PO Resp. 79 (citing Ex. 2008 ¶¶ 234–236).

Petitioner replies that "Patent Owner argues that the Ray reference (Ex. 1007) fails to render Claim 12 obvious because *Ray's lens sets do not use lenses.*" Reply 27 (emphasis added) (citing PO Resp. 79). Petitioner quotes Ray-767 as disclosing that "[t]he methods and apparatus disclosed herein provide an operative system for congruent non-uniform linear receive and/or transmit antenna arrays." *Id.* (quoting Pet. 25; Ex. 1007 ¶ 20). Patent Owner argues in its Sur-reply that the Petition fails to establish a persuasive reason for the modification. *See* Sur-reply 26.

Contrary to Patent Owner's arguments, the Teillet Declaration, which the Petition cites, provides persuasive reasons at the cited paragraph for including non-uniform spacing of Matitsine-860's lens sets. *See* Pet. 25 (citing Ex. 1012 ¶ 50); Ex. 1012 ¶ 50. For example, Mr. Teillet testifies that non-uniform spacing for RF elements provides a predictable result of producing lowered side-lobes. Ex. 1012 ¶ 50. Mr. Teillet testifies that "[t]his well-known technique works for any type of radiating elements, including a lens element array as described in Matitsine[-]860." Ex. 1012 ¶ 50. Mr. Teillet also testifies that "it would have been obvious to *space lenses in Matitsine-860 in a non-uniform tiling* per the teachings of Ray-767 in order to utilize 'an *improved antenna array that employs wider spacing between the antenna elements [and] preserv[es] the unambiguous phase information necessary for array processing.*'" *Id.* (emphasis added) (quoting Ex. 1007 ¶ 20).

Mr. Teillet's testimony is un rebutted and the record supports it based on citations to Ray-767. *See* Ex. 2008 ¶¶ 234–236 (not addressing the proposed combination that involves spreading some of Matitsine-860's lenses out to obtain non-uniform tiling). Contrary to Patent Owner's arguments, Mr. Teillet relies on spreading out Matsine-860's lenses, not just the RF elements. *See* PO Resp. 80 (arguing "[t] is non-sensical to impose Ray-767's non-uniform spacing of fixed antenna elements on Matitsine-860's RF elements"). Spreading out some of Matitsine-860's lenses relative to other lenses in the array (obtaining non-uniform tiling) naturally also spreads the RF elements associated with each lens relative to each other, thereby garnering Ray-767's improvements that Petitioner relies upon.

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge to claim 12.

Claim 13 recites "[t]he antenna system of claim 12, wherein the tiling configuration of the plurality of lens elements improves the antenna radiation pattern over a wide field of regard and/or frequency range." Petitioner notes that Matitsine-860's Figure 3 shows a lenses together in a tiling configuration. Pet. 35. Petitioner also notes that Matitsine-860's lenses cover a geographical area. *Id.* (citing Ex. 1002, 8:7, 10:31). According to Petitioner, "[c]ombining the wide field of view afforded by the lenses from Matitsine 860 fig 1A with the non-uniform tiling technique described in Ray 767 Fig 1B would be obvious, as the predicable improvement is the wider field of view produced via the combination of familiar elements." *Id.* at 36 (quoting Ex. 1012 ¶ 51).

Patent Owner argues that “Petitioner never explains how the non-uniform positioning of Ray-767’s fixed feed elements would widen the field of view of Matitsine-860’s system that uses movable feed elements.” PO Resp. 81. This argument is not reasonably commensurate in scope with claim 13. Claim 13 does not require widening the field. The argument also does not address Petitioner’s showing. As discussed in connection with claim 12, from which claim 13 depends, Petitioner relies on spreading some of Matitsine-860’s lenses out per Ray-767’s technique, such that the combination improves the radiation pattern over a wide field of view. *See* Reply 28 (asserting that “the Petition explains that the array taught by Ray provides for ‘non-uniform array spacing to improve [radiation] pattern[s] with lower sidelobes,’ with this advantage being ‘well known and well documented’” (quoting Pet. 35; Ex. 1012 ¶ 50)).

Based on the foregoing discussion, Petitioner provides persuasive reasons for combining the prior art teachings with a reasonable expectation of success, thereby supporting its challenge to claim 13.

Petitioner persuasively maps the added limitations of claims 14 and 16, which depend indirectly from claim 12, to Matitsine-860, and provides persuasive reasons with a reasonable expectation of success for the combination. *See* Pet. 36–37. Patent Owner relies on the alleged deficiencies addressed above in connection with claim 1. PO Resp. 79. For the same reasons we identify above in connection with claim 1, Patent Owner’s arguments do not undermine Petitioner’s showing.

Based on the record, we determine that Petitioner shows by a preponderance of that claims 12–14 and 16 would have been obvious over

the combined teachings of Matitsine-860, Demetriadou, Ebling, and Ray-767.

*5. Matitsine-860, Demetriadou, Ebling,
Ray-767, and Turcotte-804*

Petitioner asserts that claim 17, which depends from claim 14, would have been obvious over the combined teachings of Matitsine-860, Demetriadou, Ebling, Ray-767, and Turcotte-804. Pet. 38. In support, Petitioner relies on the Teillet Declaration, and provides citations to teachings in Turcotte-804. *Id.*

Petitioner persuasively maps the added limitations of claim 17 to Turcotte-804, and provides persuasive reasons with a reasonable expectation of success for the combination. *See* Pet. 36–37. Patent Owner relies on the alleged deficiencies addressed above in connection with claim 1. PO Resp. 79. For the same reasons we identify above in connection with claim 1, Patent Owner’s arguments do not undermine Petitioner’s showing.

We determine that Petitioner shows by a preponderance of that claim 17 would have been obvious over the combined teachings of Matitsine-860, Demetriadou, Ebling, Ray-767, and Turcotte-804.

IV. CONCLUSION

For the reasons discussed above, Petitioner has shown by a preponderance of the evidence that claims 1–19 of the ’947 patent are unpatentable, as summarized in the table below.

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1–5, 9– 11, 15, 18, 19	103	Matitsine-860, Demetriadou, Ebling	1–5, 9–11, 15, 18, 19	

6	103	Matitsine-860, Demetriadou, Ebling, Matitsine- 537	6	
7, 8	103	Matitsine-860, Demetriadou, Ebling, Matitsine- 537, Lee	7, 8	
12–14, 16	103	Matitsine-860, Demetriadou, Ebling, Ray-767	12–14, 16	
17	103	Matitsine-860, Demetriadou, Ebling, Ray-767, Turcotte-804	17	
Overall Outcome			1–19	

V. ORDER

Accordingly, it is

ORDERED that Petitioner establishes by a preponderance of evidence that challenged claims 1–19 are unpatentable;

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.³⁹

³⁹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. *See* 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent

Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. §§ 42.8(a)(3), (b)(2).

IPR2022-01108
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