

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

POWER2B, INC.,
Patent Owner.

IPR2021-01266
Patent 9,569,093 B2

Before KEVIN F. TURNER, SHEILA F. McSHANE, and
JOHN D. HAMANN, *Administrative Patent Judges*.

HAMANN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision on Remand
Determining All Challenged Claims Unpatentable
35 U.S.C. §§ 144, 318

I. INTRODUCTION

This is a Final Written Decision on Remand from the United States Court of Appeals for the Federal Circuit, which affirmed-in-part, reversed-in-part, and vacated-in-part, and remanded our original Final Written Decision (Paper 39 (“Final Dec.”)) in this *inter partes* review. Paper 56 (“Appeal Dec.”).¹

We have jurisdiction under 35 U.S.C. § 6, and we issue this remand decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, we find by a preponderance of the evidence that claims 29, 36–38, 44–46, 48, 49, and 56–58 (the “remanded claims”) are unpatentable.

A. Procedural History

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Petitioner”) filed a Petition requesting *inter partes* review of claims 1, 5, 8, 11–13, 26, 29, 36–38, 44–46, 48, 49, and 56–58 (“the challenged claims”) of U.S. Patent No. 9,569,093 B2 (Ex. 1001, “the ’093 patent”). Paper 3 (“Pet.”). Power2B, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 8. With our authorization, Petitioner filed a Preliminary Reply (Paper 10) relating to claim construction and discretionary denial under § 325(d), and Patent Owner filed a Preliminary Sur-reply in response to the Preliminary Reply (Paper 11).

We instituted *inter partes* review of all of the challenged claims of the ’093 patent on all of the grounds raised in the Petition. Paper 12 (“Dec. on Inst.”), 45. Patent Owner filed a Response to the Petition. Paper 17 (“PO

¹ The Federal Circuit issued a revised Opinion (Paper 56) on September 4, 2025, correcting the listing of claims on remand, and replacing its Opinion issued on March 31, 2025 (Paper 44). The mandate for the revised Opinion issued on October 14, 2025. Paper 55.

Resp.”). Petitioner filed a Reply to Patent Owner’s Response. Paper 20 (“Pet. Reply”). Patent Owner filed a Sur-reply to Petitioner’s Reply. Paper 25 (“PO Sur-reply”). An oral hearing was held on October 26, 2022. A transcript of the oral hearing is included in the record. Paper 38.

In addition, Patent Owner filed a Motion to Exclude certain of Petitioner’s evidence (Paper 32) and Petitioner filed an Opposition (Paper 33). We denied this motion. *See* Final Dec. 58–61.

The Board issued a Final Written Decision finding that Petitioner (i) showed that claims 1, 5, 8, and 11–13 were unpatentable, and (ii) did not show that claims 26, 29, 36–38, 44–46, 48, 49, 56–58 were unpatentable. Final Dec. 25–58.

The Federal Circuit issued an Opinion concluding that the Board’s construction of “detector assembly” was erroneous, and reversed the Board’s decision that claim 26 was not unpatentable. Appeal Dec. 7–10, 21. The Federal Circuit concluded that this claim was unpatentable based on its construction and the Board’s findings. *Id.* at 7–10. In addition, the Federal Circuit vacated the Board’s decisions as to claims 29, 36–38, 44–46, 48, 49, and 56–58, and remanded for the Board to evaluate Petitioner’s obviousness contentions for these claims under the correct construction of “detector assembly.”² *Id.* at 10.

In addition, the Federal Circuit concluded that the Board properly construed “at least” or “within” “a predetermined degree of propinquity.” *Id.* at 15–20. And the Federal Circuit affirmed the Board’s decision that claims 1, 5, 8, and 11–13 were unpatentable, finding that substantial

² The Federal Circuit also construed “at an edge” and “at least one edge” to guide the Board’s analysis on remand. Appeal Dec. 10–11.

evidence supported the Board’s factual findings for these claims. *Id.* at 18–20.

With our authorization, the parties filed additional briefing limited to addressing the effect of the Federal Circuit’s claim construction on the application of the prior art of record to the claims. Petitioner filed an opening brief on remand (Paper 48, “Pet. Remand”) and a response brief on remand (Paper 51, “Pet. Resp. Remand”). Patent Owner filed an opening brief on remand (Paper 47, “PO Remand”) and a response brief on remand (Paper 49, “PO Resp. Remand”).

In addition, with our authorization pursuant to its request, Patent Owner filed an opening brief to address the *Interactive Comm’s Int’l v. Blackhawk Network, Inc.*, IPR2024-00465, Paper 40 (October 9, 2025) decision’s applicability, if any, to this proceeding. Paper 52 (“Open Br.”). Petitioner filed a response brief to the opening brief. Paper 53 (Resp. Br.)

B. Real Parties-in-Interest

The parties identify themselves as the real parties-in-interest. Paper 27, 1; Paper 42, 2.

C. Related Matters

The parties identify *Power2B, Inc. v. Samsung Electronics Co.*, Case No. 6:20- cv-01183-ADA (W.D. Tex.) as a matter that may affect, or be affected by, a decision in this proceeding. Paper 27, 1; Paper 42, 2. In addition, Petitioner filed petitions for *inter partes* review of additional patents that also are owned by Patent Owner: (i) U.S. Patent No. 10,156,931 B2 (IPR2021-01190); (ii) U.S. Patent No. 8,610,675 B2 (IPR2021-01220);

(iii) U.S. Patent No. 8,624,850 B2³ (IPR2021-01239); (iv) U.S. Patent No. 9,317,170 B2 (IPR2021-01257); (v) U.S. Patent No. 7,952,570 B2 (IPR2022-00300); (vi) U.S. Patent No. 10,664,070 B2 (IPR2022-00315); (vii) U.S. Patent No. 9,946,369 B2 (IPR2022-00325); (viii) U.S. Patent No. 8,816,994 B2 (IPR2022-00334 and IPR2022-01378); and (ix) U.S. Patent No. 8,547,364 B2 (IPR2022-00404).

D. The Challenged Patent

The '093 patent “relates to displays, information input devices[,] and user interface functionalities.” Ex. 1001, 1:36–37. More specifically, the '093 patent “seeks to provide an integrated display and input device, [with] improved user interfaces and user interface functionalities.” *Id.* at 1:55–57. Figure 23B, shown below, illustrates an embodiment of the '093 patent. *Id.* at 9:17–20.

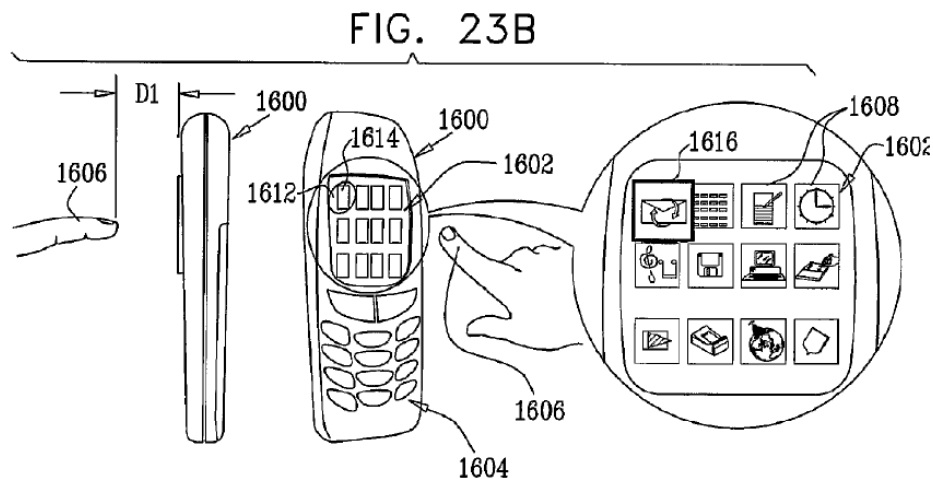


Figure 23B, above, is an “illustration[] of desktop user interface functionality of a mobile device constructed and operative in accordance with a preferred embodiment of the” '093 patent. *Id.* As illustrated, “the

³ U.S. Patent No. 8,624,850 B2 (“the '850 patent”) is the parent of the '093 patent. Ex. 1001, code (63).

integrated display and input device is a mobile computer and/or communicator 1600,” and “includes a display screen 1602 having touch responsive input functionality and/or propinquity responsive input functionality.” *Id.* at 51:37–38, 51:54–56. The “display screen 1602 typically displays an array of application launch icons 1608.” *Id.* at 52:2–4. In addition, “keyboard 1604 may be provided as part of the integrated display and input device.” *Id.* at 51:61–64.

Figure 23B “shows finger 1606 located at a first distance D1 from display screen 1602, such that the propinquity responsive input functionality senses finger 1606 in propinquity to display screen 1602 which defines an impingement area 1612 of light reflected from finger 1606 that is generally centered on a first application launch icon 1614.” *Id.* at 52:5–10. For some embodiments of the ’093 patent, the integrated display and input device also includes at least one illuminator for illuminating the object when it has the predetermined degree of propinquity to the display, and may also provide backlighting. *Id.* at 2:3–9. The ’093 patent discloses that “[t]he functionality of the mobile device 1600 causes icon 1614 to appear in an enlarged or otherwise visually sensibly emphasized form, as indicated by reference numeral 1616.” *Id.* at 52:11–14.

To enable propinquity functionality, the ’093 patent discloses various embodiments, such as illustrated in Figure 4, shown below. *Id.* at 15:24–28.

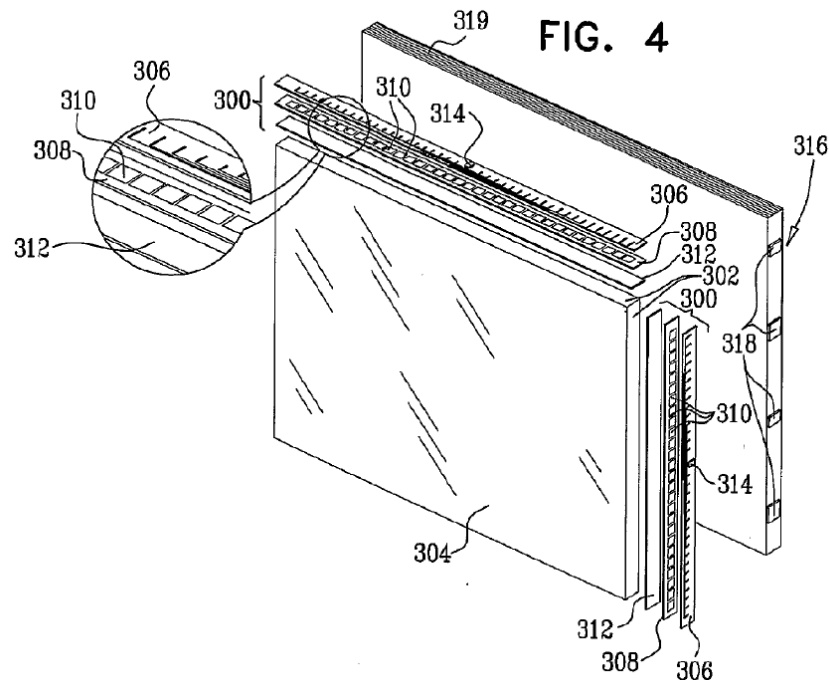


Figure 4, above, “is a simplified illustration of a portion of an input device” “employing detector elements arranged along edges of a display element,” in accordance with an embodiment of the ’093 patent. *Id.* As illustrated, Figure 4 shows “at least one detector assembly 300 is arranged along at least one edge 302 of a viewing plane defining plate 304 to sense light impinging on plate 304 and propagating within the plate 304 to the edges 302 thereof.” *Id.* at 15:28–32. “Preferably, detector assemblies 300 are provided along at least two mutually perpendicular edges 302, as shown, though detector assemblies 300 may be provided along all or most of edges 302” or “may be provided along only one edge 302 of plate 304.” *Id.* at 15:36–40. As illustrated, “the detector assembly 300 comprises a support substrate 306 onto which is mounted a linear arrangement 308 of detector elements 310.” *Id.* at 15:41–44. “Interposed between linear arrangement 308 and edge 302 is a cover layer 312,” which may provide “physical protection, light intensity limitation, and field-of-view limitation.” *Id.* at 15:44–45. The support

substrate 306 may be mounted onto a display housing or onto an edge 302 of plate 304. *Id.* at 15:52–55. “A processor 314 for processing the outputs of the detector elements 310 may also be mounted on the support substrate 306.” *Id.* at 15:60–62.

E. The Remanded Claims

The challenged claims on remand are claims 29, 36–38, 44–46, 48, 49, and 56–58. Of these, claims 29 and 36–38 depend indirectly from independent claim 1, and claims 45, 46, 48, 49 and 56–58 depend directly or indirectly from independent claim 44. Claims 1 and 44 read as follows:

1. An integrated display and input device, comprising:
 - a pixel array operative to provide a visually sensible output;
 - at least one sensor operative to sense a position of an object with respect to the pixel array when the object is within a predetermined degree of propinquity to the pixel array;
 - at least one illuminator that provides backlighting and illuminates the object within the predetermined degree of propinquity; and
 - circuitry that receives an output from the at least one sensor and provides a non-imagewise input representing the position of the object relative to the pixel array to utilization circuitry.

Ex. 1001, 67:45–58.

44. An integrated display and input device, comprising:
 - a pixel array operative to provide a visually sensible output;
 - a detector assembly arranged at an edge of a viewing plane defining plate, the detector assembly includes a support substrate and an arrangement of sensor elements, wherein at least one sensor element in the arrangement of sensor elements detects electromagnetic radiation at a baseline level and senses the position of the object with respect to the pixel array when the object is within a predetermined degree of propinquity to the pixel array; and

circuitry that receives an output from the detector assembly and provides a non-imagewise input to utilization circuitry, the non-imagewise input represents the position of the object relative to the pixel array and corresponds to a location of the at least one sensor element in the arrangement when an amount of electromagnetic radiation or a change in the amount of electromagnetic radiation detected by the at least one sensor element exceeds a first predetermined threshold.

Id. at 69:67–70:20.

F. Grounds of Unpatentability on Remand

The following grounds of unpatentability from the Petition challenge the remanded claims:

Claim(s) Challenged	35 U.S.C. §⁴	Reference(s)/Basis
29, 36–38, 44–46, 48, 49, 56–58	103(a)	Reime ⁵
29, 36–38, 44–46, 48, 49, 56–58	103(a)	Reime, Hinckley ⁶
48	103(a)	Reime, Hinckley, Eliasson ⁷

Pet. 4, 19–64. Petitioner submits the Declaration of Benjamin B. Bederson (Ex. 1002) and the Reply Declaration of Benjamin B. Bederson (Ex. 1035) in support of its arguments. Patent Owner submits the Declaration of Darran R. Cairns, Ph.D. (Ex. 2056) in support of its arguments.

⁴ The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the ’093 patent issued from an application having an effective filing date before March 16, 2013, we apply the pre-AIA version of the statutory basis for unpatentability.

⁵ US 2003/0034439 A1, published Feb. 20, 2003 (Ex. 1010, “Reime”).

⁶ US 2002/0021278 A1, published Feb. 21, 2002 (Ex. 1011, “Hinckley”).

⁷ WO 2005/026938 A2, published Mar. 24, 2005 (Ex. 1015, “Eliasson”).

II. LEVEL OF ORDINARY SKILL IN THE ART

In our Final Written Decision, we adopted the following definition for one having ordinary skill in the art at the time of the invention of the '093 patent: one who “would have had a bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and . . . years of experience in the research, design, development, and/or testing of touch and/or proximity sensors, human-machine interaction and interfaces, and related firmware and software, or the equivalent, with additional education substituting for experience and vice versa.” Final Dec. 8–9.

This definition for one having ordinary skill in the art was not the subject of appeal, and we maintain it for purposes of this Final Written Decision on Remand. Moreover, it is consistent with the '093 patent and the asserted prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

III. CLAIM CONSTRUCTION

Because the Petition was filed after November 13, 2018, we apply the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b), following the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b); 83 Fed. Reg. 51,340, 51,340–41, 51,343 (Oct. 11, 2018). In applying such standard, claim terms are generally given their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art, at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13.

The parties disputed how to construe (i) “a predetermined degree of propinquity,” (ii) “a detector assembly,” and (iii) “directly to.” PO Resp. 10–34; Pet. Reply 1–17; PO Sur-reply 2–16. We address these in turn.

A. Predetermined Degree of Propinquity

The parties disputed how to construe “a predetermined degree of propinquity.” PO Resp. 11–18; Pet. Reply 1–7; PO Sur-reply 2–7. We construed this term in the Final Written Decision. Final Dec. 10–17. In particular, we concluded for “a predetermined degree of propinquity” that (i) “propinquity” means “proximity,” (ii) its remaining language should be afforded its plain and ordinary meaning (i.e., we did not adopt Patent Owner’s proposed “a specified proximity distance established in advance” for “a predetermined degree”), and (iii) touching is not excluded. *Id.* The Federal Circuit affirmed our construction. Appeal Dec. 14–17.

B. Detector Assembly

The parties disputed how to construe “a detector assembly.” PO Resp. 19–31; Pet. Reply 7–13; PO Sur-reply 8–13. We construed this term in the Final Written Decision. Final Dec. 17–25. In particular, we concluded that (i) “detector assembly” means “two or more detector elements that detect electromagnetic radiation,” (ii) a detector assembly is not required to be physically separate from (i.e., not interspersed with) a pixel array, and (iii) “that the ’093 patent Specification does not impart a structure inherent in the word ‘assembly,’ beyond having a plurality of detector elements.” *Id.* at 21, 23–24.

The Federal Circuit found the part of our construction requiring multiple detector elements erroneous. Appeal Dec. 7–10. In particular, the Federal Circuit concluded that “[t]he claims only require an ‘assembly’ that includes at least one ‘detector’ element.” *Id.* at 8.

In addition, to guide the Board’s analysis on remand, the Federal Circuit construed “the terms ‘at an edge’ and ‘at least one edge’ [to] require a detector assembly to be arranged along one or more edges of a viewing plane defining plate.” *Id.* at 10–11. In other words, the Federal Circuit “clarif[ied] that arranging a detector assembly ‘at,’ ‘along,’ or ‘about’ ‘at least one edge’ or ‘an edge’ does not limit the detector assembly to being arranged entirely on ‘one edge.’” *Id.* at 12.

C. Directly to

The parties disputed how to construe “directly to” as used in claim 48. PO Resp. 31–34; Pet. Reply 13–17; PO Sur-reply 14–15. We did not reach this construction dispute in our Final Written Decision. Final Dec. 10 n.6. We now address the parties’ arguments for this term.

For context, claim 48 depends from claim 45, and recites “wherein the light reflected by the object is transmitted through the viewing plane defining plate *directly to* the at least one sensor element.” Ex. 1001, 70:32–35 (emphasis added). Claim 45 depends from claim 44 and recites “wherein the at least one sensor element detects electromagnetic radiation reflected by the object.” *Id.* at 70:21–23. And in part, claim 44 recites “at least one sensor element in the arrangement of sensor elements detects electromagnetic radiation.” *Id.* at 70:6–8. We note that the parties treat “light” as meaning “electromagnetic radiation” in the context of these claims, with which we agree.

Patent Owner argues that “directly to” means “without intervening reflections.” PO Resp. 31–34. Patent Owner argues that claim 48’s “plain claim language states light reflected by the object is *transmitted* through a plate ‘*directly to*’ the sensor element.” *Id.* at 31. And Patent Owner argues that dependent claims 46 and 47 use different language to describe different

light transmission paths (i.e., claim 46’s “*propagates within* the viewing plane defining plate to the at least one sensor element” and claim 47’s “*propagates above* the viewing plane defining plate to the at least one sensor element”). *Id.* at 32 (quoting Ex. 1001, 70:24–27) (alterations in original).

There is no dispute that claims 46–48 describe three different light transmission paths. *See* Pet. Reply 14–15; PO Sur-reply 15. And we agree with both parties that the light that is transmitted directly through the plate to the sensor element does not have intervening reflections—such is consistent with the plain and ordinary meaning of “directly to.” *See* PO Resp. 31–32; Pet. Reply 14–15; PO Sur-reply 15. Nothing in claim 48’s language, however, requires that all of the reflected light be transmitted directly to the sensor element, which Patent Owner argues. Ex. 1001, 70:32–35; PO Resp. 31–32; PO Sur-reply 14–16. Rather, we agree with Petitioner that the claim language “merely requires that *some* light reflected by the object goes ‘directly to’ at least one sensor element once it is transmitted through the viewing plane defining plate.” Pet. Reply 14. We also agree that “none of these dependent claims purport to be exclusive of one another.” *Id.* at 15. Rather, claims 46–48 simply require some light be transmitted (or propagated) for their particular transmission path, without reciting all light. *See* Ex. 1001, 70:24–35.

Moreover, our conclusion flows directly from the Specification’s disclosure. In particular, when describing the different transmission paths, the Specification discloses that the light “additionally or alternatively” may traverse the path. *E.g.*, Ex. 1001, 38:65–39:11, 47:33–36; *see also* PO Resp. 33. For example, the Specification discloses the following:

Light, preferably including light in the IR band emitted by illumination subassembly 1212, is reflected from a user’s finger,

a stylus (not shown) or any other suitable reflective object, touching or located in propinquity to plate 1208. The reflected light is propagated within plate 1208 and is detected by one or more of detector elements 1204. *Alternatively or additionally*, the reflected light is propagated above the surface of plate 1208 and is detected by one or more of detector elements 1204, which may extend slightly above edge surfaces 1206. Furthermore, *additionally or alternatively*, the reflected light may propagate or be transmitted through plate 1208 directly to one or more of detector elements 1204 and detected thereby.

Ex. 1001, 38:65–39:11 (emphases added). This passage makes clear that the transmission paths are not mutually exclusive—allowing for “additionally”—and claim 48’s language does not recite that all of the light reflected by the object and detected by the sensor element must be transmitted directly through the plate. *Compare id.*, *with id.* at 70:32–35.

In addition, we have reviewed the testimony of the parties’ experts that the parties cite for this term, but we give it little, if any, weight in light of the clear disclosure of the intrinsic evidence. *See Wi-LAN, Inc. v. Apple Inc.*, 811 F.3d 455, 462 (Fed. Cir. 2016) (finding extrinsic evidence “is generally of less significance than the intrinsic record” in matters of claim construction); *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583 (Fed. Cir. 1996) (finding that when “an analysis of the intrinsic evidence alone will resolve any ambiguity in a disputed claim term[,] . . . it is improper to rely on extrinsic evidence”).

In addition, we find unavailing Patent Owner’s arguments to the extent that they contend that Petitioner improperly sets forth its claim construction arguments for this term. PO Sur-reply 14. Simply put, these arguments from Petitioner involve issues related to claim construction regarding the meaning of this limitation, which was raised by Patent Owner in its Response. Petitioner is allowed to respond. *See Consolidated Trial*

Practice Guide (November 2019)⁸ (“CTPG”), 45 (“The petitioner may respond to any . . . new claim construction issues raised by the patent owner.”).

In sum, we conclude that “directly to” as used in claim 48 does not require that all of “the light reflected by the object [be] transmitted through the viewing plane defining plate directly to the at least one sensor element.” We do not need to further construe this term to resolve the parties’ dispute. *See, e.g., Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’”).

IV. PRINCIPLES OF LAW

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner except in limited circumstances not present here. *See Dynamic Drinkware*, 800 F.3d at 1378 (discussing the burden of proof in *inter partes* review).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time of the invention to a

⁸ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

person having ordinary skill in the art. *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on 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) objective evidence of non-obviousness, if present.⁹ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a claim for obviousness, we also must “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

V. ALLEGED OBVIOUSNESS OVER REIME

Petitioner argues that Reime renders obvious claims 29, 36–38, 44–46, 48, 49, and 56–58. Pet. 4, 41–61. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that Reime renders these claims obvious, except for claim 49.

A. *Summary of Reime*

Reime relates to a touch sensitive device in an electronic device or a wireless telecommunication terminal. Ex. 1010 ¶ 2. Figure 2A, reproduced below, shows touch pad device 1.

⁹ Patent Owner does not present arguments or evidence of such objective evidence of non-obviousness. *See generally* PO Resp.

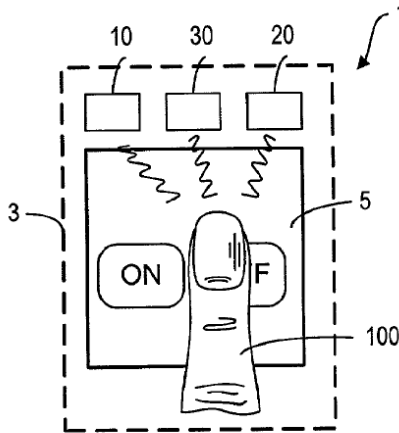


FIG. 2A

Figure 2A is a diagrammatic representation showing touch pad device 1 having optical sensor components 10, 20, and 30 placed near the top side of touch pad area 5. *Id.* ¶¶ 29, 76. As shown in Figure 2A, touch pad device 1 can be used to select the “ON” function or “OFF” function depending on the location of the “touching” point on touch pad area 5. *Id.* ¶ 75. When user’s finger 100’ touches or approaches the pad area 5, the changes in the output signal of the receiver 30 show which function is selected. *Id.*

B. Challenged Claim 29

Claim 29 depends from claim 26, which depends from independent claim 1. As we discuss above, the Federal Circuit in view of Reime already affirmed that claim 1 is obvious and concluded that claim 26 is obvious. Appeal Dec. 9–10, 21. Claim 29 further recites “wherein the detector assembly further comprises a support substrate, and an arrangement of detector elements.” Ex. 1001, 69:11–13. We agree with Petitioner that Reime teaches this limitation. Pet. 40–42; Pet. Reply 23–24, 28; Pet. Remand 2–4; Pet. Resp. Remand 1–4.

First, as we found in the Final Written Decision, Reime’s receivers 30 and 32 are two detector elements that detect electromagnetic radiation (i.e., light), and Reime’s receivers 30 and 32, collectively, comprise a detector assembly. Final Dec. 45–46 (citations omitted). Moreover, Reime’s two receivers 30 and 32 comprise a detector assembly having multiple detector elements (e.g., two receivers) to teach “an arrangement of detector elements.” Ex. 1010 ¶¶ 73, 86, Figs. 9A–9C; Ex. 2060,¹⁰ 127:17–18; Pet. 40–41; Pet. Remand 2–4.

In addition, as we found in the Final Written Decision, Reime teaches that each of receivers 30 and 32 are centered on opposite edges of the plate. Final Dec. 48–49; Ex. 1010, Figs. 9C–9F; *see also* Appeal Dec. 9–10 (citing Ex. 1010, Fig. 6A, ¶ 82) (affirming that Reime teaches having one light receiver (e.g., 30 or 32) on each side of a four-sided touch pad). In further support, we agree with Petitioner and find that Reime teaches that receivers 30 and 32 “are mounted in the peripheral area surrounding the LCD 92.” Pet. 41–42; Ex. 1010 ¶ 86; *see also id.* at Figs. 9A–9C (showing that the receivers are positioned at the edge of the LCD screen); *infra* annotated Fig. 9E (showing receivers 30 and 32 along edges of the LCD). Accordingly, we find Reime’s detector assembly that comprises receivers 30 and 32 is arranged along two edges (one edge for each receiver) of the LCD, which meets the Federal Circuit’s construction for being arranged at an edge. *See supra* Section III.B (concluding “at an edge” means “arranged along one *or more* edges”) (emphasis added).

In addition, we agree with Petitioner and find that Reime teaches that LCD 92 is “mounted on a printed circuit board (PCB) or a printed wire

¹⁰ Deposition Transcript of Dr. Benjamin Bederson (Apr. 7, 2022).

board (PWB) 90,” i.e., a support substrate. Pet. 41–42; Ex. 1010 ¶ 86; Pet. Remand 3. Petitioner provides an annotated combination of Reime’s Figs. 8B and 9E, shown below, in support of its arguments. Pet. Remand 3.

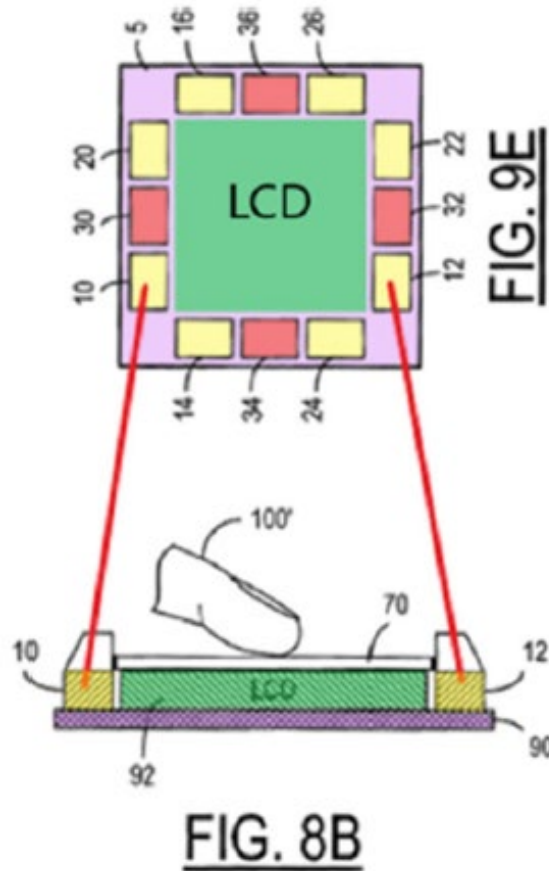


Figure 8B “is a cross-sectional side view showing a touch pad device having an LCD and a thin cover on top of the LCD for touching.” Ex. 1010 ¶ 49. Figure 9E “is a diagrammatic representation showing a touch pad device having four groups of optical sensor components placed within the touch pad area.” *Id.* ¶ 56. In making this combination of figures, Petitioner rotates Figure 9E ninety degrees counterclockwise and places it higher up on the page above Figure 8B. Pet. Remand 3. Petitioner then annotates the combined figures by drawing a red line connecting elements 10 on Figure 8B and Figure 9E, and drawing a second red line connecting elements 12 on each of these figures. *Id.* In addition, Petitioner colors in (i) green LCD 92

in both figures, (ii) purple PCB 90 in Figure 8B and the PCB portion of touchpad 5 in Figure 9E, (iii) yellow the emitters, and (iv) red the receivers (e.g., 30 and 32). *Id.*

We agree with Petitioner and find that Reime teaches that portions of the PCB 90 (i.e., the support substrate) extend beyond the LCD to be ***along one or more edges*** of the LCD—it is along all 4 edges, as shown in Figure 9E. Pet. 34–35; Pet. Remand 3–4; Ex. 1010, Figs. 8B, 9E. Moreover, Reime teaches that receivers 30 and 32 “are mounted in the peripheral area surrounding the LCD 92” on PCB 90. Ex. 1010 ¶ 86, Figs. 8B, 9E. Thus, Reime teaches that detector elements (e.g., receivers 30 and 32) are arranged on the PCB 90 substrate, arranged along two edges. *Id.*

We find unavailing Patent Owner’s argument¹¹ that one of ordinary skill in the art “would not consider Reime’s individual ‘optical sensors’ in isolation to form an ‘assembly’ structure,” and “[i]nstead, if anything, [one of ordinary skill in the art] would have understood that Reime’s alleged ‘assembly’ would have included the light guide component.” PO Resp. 56 (citing Ex. 2056 ¶ 125). As we concluded in the Final Written Decision, a detector assembly need not be a distinct and physically separate hardware structure. Final Dec. 21–25. Hence, we disagree with Patent Owner that Reime’s light guides need be included in the claimed detector assembly because they are part of Reime’s touchpad’s structure. PO Resp. 56–57. Moreover, the Federal Circuit determined that Reime’s receiver discloses the

¹¹ Patent Owner argues aspects of the claimed “detector assembly” together for claims 26 and 29. *See* PO Resp. 55–61. We address these arguments in the context of claim 29, but again note that the Federal Circuit already concluded that Reime teaches claim 26, which claims “a detector assembly.” Appeal Dec. 9–10.

claimed detector assembly in claim 26, which is contrary to requiring Reime's lightguide to be part of an assembly, as Patent Owner argues. Appeal Dec. 9–10.

We also find unavailing Patent Owner's argument that for the remanded claims, "[t]he straightforward claim language is consistent with the undisputed plain meaning of an 'assembly,' which assembles multiple components together in a single complete structure." PO Remand 1 & n.2¹²; *see also id.* at 3 (making same argument). First, we already found unavailing Patent Owner's argument that the term "'assembly', by itself, requires a hardware relationship that connects its components to form a distinct structure." Final Dec. 24 (quoting PO Resp. 23). In particular, we concluded the following:

At its simplest, a detector assembly comprises a plurality of detector elements. *See, e.g.,* Ex. 1001, 29:45–54 (disclosing a detector assembly not having a support substrate or cover layer), 37:46–51 (disclosing a detector assembly "includes a plurality of discrete single-element detector elements"). We conclude that the '093 patent Specification does not impart a structure inherent in the word "assembly," beyond having a plurality of detector elements. *Id.*

Id. The Federal Circuit reversed our conclusion that "a plurality" of detectors was needed, but not the rest of our conclusion. Appeal Dec. 7–9. And the Federal Circuit's construction for "detector assembly" does not require a specific structure—a "single complete structure" or otherwise. *Id.*

¹² Patent Owner provides links to what purports to be a recording of Oral Arguments at the Federal Circuit and to a Webster's dictionary definition. PO Remand 1 n.2. Such links constitute new evidence, which is not allowed pursuant to our authorization for additional briefing. *See* Ex. 3001, 2 ("The briefs shall not contain new declarations or other exhibits/evidence"). Thus, we do not consider this new evidence.

Second, we already decided in the Final Written Decision that a detector assembly does not require a distinct structure,¹³ as this issue was in dispute. Final Dec. 21–25. For example, Patent Owner argued that detector assembly “requires a distinct structure ‘having an array of two or more detector elements that detect electromagnetic radiation.’” PO Resp. 55; Final Dec. 21. And Patent Owner acknowledged that this issue was in dispute, stating that Petitioner “incorrectly conclude[d] the claimed ‘assembly’ structure ‘does not require a distinct component.’” PO Sur-reply 8; *see also* Final Dec. 22 (citing Pet. Reply 7–9) (“Petitioner argues that the plain and ordinary meaning of detector assembly does not require a physically separate hardware structure,” and that “[s]uch a requirement is found nowhere in the claims, according to Petitioner.”).

We addressed these arguments also in the context of the ’093 patent’s differing embodiments (i.e., whether a detector assembly was or was not interspersed with the pixel array). Final Dec. 23–24. We agreed with Petitioner and “conclude[d] that the claims do not require a detector assembly to be physically separate from (i.e., not interspersed with) a pixel array.” *Id.* at 23. In particular, we concluded that “the ’093 patent illustrates that detector elements can be located, *inter alia*, along and behind an edge while being interspersed in a pixel array.” *Id.* (citing Ex. 1001, Fig. 18F (showing detector elements 1324 along and behind an edge of plate 1328)). We now show below Figure 18F, as annotated by Petitioner to further illustrate this conclusion.

¹³ Patent Owner does not explain if or how “a single complete structure” substantively differs from “a distinct structure.” *Compare* PO Remand 3–7, 12–13, *with* PO Resp. 19–31.

FIG. 18F

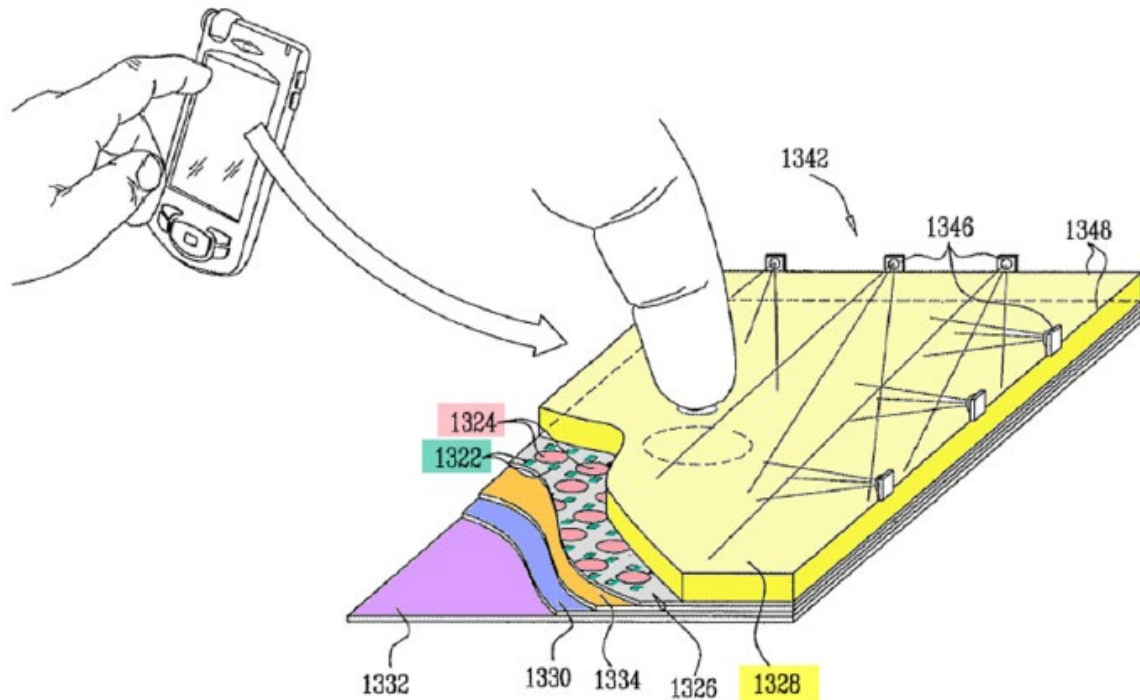


Figure 18F is a simplified illustration of an embodiment “of an illumination subassembly forming part of an integrated display and input device constructed and operative in accordance with a preferred embodiment of the” ’093 patent. Ex. 1001, 9:3–7. Petitioner annotates the figure by coloring in (i) purple reflector 1332, (ii) blue light diffusing layer 1330, (iii) orange collimating layer 1334, (iv) green light detector elements 1322 (detector assembly), (v) pink light emitters 1324 (pixel array), and (vi) yellow viewing plane defining plate 1328. Pet. Reply 12 (annotating Ex. 1001, Fig. 18F). As illustrated, detector elements 1322 are interspersed with the pixel array, rather than being together in a single complete structure.

We also find unavailing Patent Owner’s argument that the prosecution history of the ’850 patent—the parent of the ’093 patent—confirms that the claimed detector assembly hardware distinguishes over the

prior art. PO Remand 5–7; PO Resp. Remand 3–4. We already addressed such an argument in the Final Written Decision, finding it unavailing. *See* Final Dec. 24–25. Again, Patent Owner overreads the Examiner’s statement that the prior art does not teach “the at least one sensor comprises a detector assembly arranged at least one edge of a viewing plane defining plate. Ex. 2037, 835. The Examiner did not expressly state the reasons why the art failed to teach the allowed claim. *Id.*

We also find unavailing Patent Owner’s arguments that Petitioner “never attempted to (1) identify a specific set of sensor components” or “(2) distinguish between Reime’s emitters and receivers.” PO Remand 7; PO Resp. Remand 1 (making same argument). And we disagree that “the Board misunderstood [Petitioner]’s sole argument required all of Reime’s optical sensor components to satisfy the claimed ‘detector assembly.’” PO Remand 9.¹⁴ Rather, we focused on what Petitioner argued. Final Dec. 46. In particular, Petitioner argued that “Reime’s optical components *include* the recited detector assembly”—not that they all are part of the detector assembly. Pet. Reply 23 (citing Ex. 1035 ¶¶ 49–50; Ex. 1002 ¶¶ 87–88) (emphasis added). It is tautological that emitters and receivers includes receivers. And Petitioner cited¹⁵ Dr. Bederson’s deposition testimony that makes clear that Petitioner argued that Reime’s receivers (e.g., 30 and 32) comprise the detector assembly. *Id.* (citing Ex. 2060, 125:11–15, 127:17–

¹⁴ Rather than being Petitioner’s sole argument, we also addressed Petitioner’s arguments as they related to emitters in the Final Written Decision. Final Dec. 46.

¹⁵ Patent Owner faults Petitioner for only citing to the deposition testimony, rather than also quoting the testimony in a parenthetical. PO Remand 9 & n.23. We find no substantive difference as Petitioner provides a pinpoint cite to the specific testimony relied on. Pet. 23.

21). For example, to the question “[A]re [emitter] elements 10 and 12 in Figure 8B part of the detector assembly?,” Dr. Bederson responded “I’m pointing to elements 30 and 32, each as being parts of a detector assembly. I am not pointing to elements 10 and 12. I was merely pointing to those as context to show that elements 30 and 32 are at the edge of the LCD.”

Ex. 2060, 127:9–21. Moreover, the Federal Circuit affirmed our finding that Petitioner showed that Reime’s receiver is a detector element in concluding that Reime taught a detector assembly rendering claim 26 obvious. Appeal Dec. 9–10.

Nor do we agree with Patent Owner that “[t]he Board incorrectly stated the Reply ‘focuses on detectors 30 and 32’ and inserted a new improper argument that Reime’s ‘detectors 30 and 32’ collectively form ‘a detector assembly.’” *Id.* As we discuss above, Petitioner’s reliance on Dr. Bederson’s deposition testimony makes clear that Petitioner argued that Reime’s receivers (e.g., 30 and 32) comprise the detector assembly. *See* Pet. Reply 23. We also disagree with Patent Owner that Petitioner’s argument that “Figure 9E shows detectors 30 and 32 ‘along the edge’” does not evidence that Petitioner argued that “Reime’s detectors 30 and 32 collectively form a detector assembly.” PO Remand 9 (quoting Pet. Reply 23). Petitioner made this argument to show that Reime teaches “a detector assembly arranged at an edge,” and that it “includes . . . an arrangement of sensor elements.” Pet. Reply 23. The context makes clear that Petitioner argued that Reime’s receivers 30 and 32, collectively, comprise a detector assembly.

Nor do we agree that Petitioner was making a new argument. In the Petition, Petitioner quotes Reime that “all of the optical sensor components are placed outside the touch pad area” and that “the optical sensor

components 10, 12, 20, 22, 30 and 32 are mounted in the peripheral area surrounding the LCD” in arguing that “arranged at an edge” is taught for claim 26, which first recites the claimed “detector assembly.” *See* Pet. 40–41 (quoting Ex. 1010 ¶¶ 86–87). Petitioner, however, also quotes there Reime’s teaching of “a touch pad device having four transceivers placing inside the four edges of the touch pad area.” *Id.* at 41 (citing Ex. 1010 ¶ 69). This evidences that Petitioner’s arguments focused on Reime’s receivers for the detector assembly.¹⁶ Moreover, claim 26 recites that claim 1’s “at least one sensor” comprises a detector assembly. Ex. 1001, 67:45–58, 69:1–4. Petitioner argued for claim 1 that Reime’s receiver 30 was the sensor. *See* Pet. 24–25. This too shows that Petitioner’s argument that a detector assembly is taught by Reime’s receivers is not new.

We also find unavailing Patent Owner’s argument that Dr. Bederson provided deposition testimony that “clarified Reime’s detectors 30 and 32 are not ‘collectively’ part of the same detector assembly because they are instead each part of different respective assemblies on different edges.” PO Remand 10 (citing Ex. 2060, 130:7–13). Patent Owner adds that “[i]n view of the unequivocal clarifying testimony, [Petitioner] could not and did not argue Reime’s ‘detectors 30 and 32’ collectively form ‘a detector assembly.’” *Id.* But Dr. Bederson clarified this testimony and also testified that “if you had a single assembly with detectors 30 and 32 as part of a single assembly, then that would be one assembly, and that assembly as a whole would have an arrangement of multiple detector elements, and that

¹⁶ In the Final Written Decision, we disagreed with Petitioner’s arguments as they related to the emitters and their placement at at least one edge as emitters could not serve to teach the detector assembly. Final Dec. 45–46. We focused on Petitioner’s arguments as they related to Reime’s receivers.

entire detector assembly would be arranged at at least one edge.” Ex. 2060, 137:16–21, 138:10–139:3, 139:11–14; *see also infra* Section VII (providing a more fulsome discussion of his testimony).

We also find unavailing Patent Owner’s argument that Petitioner “does not point to any disclosure that teaches Reime’s individual detector component could comprise multiple detector elements.” PO Remand 11 (citing Ex. 2060, 139:7–10) (“I am not aware of a specific disclosure in Reime that shows that the detector 30 consists of multiple individual detectors.”). This argument is inapposite. As we discuss above, Petitioner relies on multiple receivers (i.e., 30 and 32) here.

We also find unavailing Patent Owner’s argument that “Reime teaches its optical sensor components are separate individual components and do not form the claimed ‘a detector assembly.’” PO Remand 12. In particular, Patent Owner argues that “Reime intentionally positions only one receiver on each side of the display,” and that “[t]o activate/disable each individual receiver, Reime physically wires each receiver to separately receive an enabling signal from an ‘enabling module 420’ and separately output a respective ‘output signal 130’ (*e.g.*, Fig. 14).” *Id.* (citing Ex. 1010 ¶¶ 79–80, 106, Figs. 2A–2D, 3A–3B, 4A–4B, 5A–5H, 6A–6B, 7, 8D, 9C–9E, 14). “At best, Reime’s individual receivers are each part of different respective assemblies on different edges,” according to Patent Owner. *Id.* at 13. These arguments are premised on Patent Owner’s argument that a detector assembly requires a single complete structure, which as we discuss above, is incorrect. Moreover, the claim language relates to sensing a position of an object, rather than how a detector assembly is wired and its signaling. Ex. 1001, 66:65–67:11, 67:15–18.

Thus, these arguments are misplaced. *See In re Hiniker Co.*, 150 F.3d 1362, 1369 (Fed. Cir. 1998) (stating “the name of the game is the claim”).

We also find unavailing Patent Owner’s argument that “Reime positions a separately wired and individually operated single receiver on different edges of the display, which teaches away from assembling multiple receivers together into ‘a detector assembly’ hardware structure.” PO Remand 13. “A reference does not teach away . . . if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed.” *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013) (citation omitted). Patent Owner identifies no such criticism of Reime’s configurations. And again, the claims do not require a single complete structure, as Patent Owner alleges.

We also find unavailing Patent Owner’s argument that “when asked if Reime’s alleged ‘detector assembly’ could be limited to a subset of receivers, [Dr. Bederson] stated he didn’t consider that ‘hypothetical,’ and ‘that’s not an analysis that I have done and I don’t feel comfortable . . . forming a definitive opinion about that modification.” PO Resp. Remand 4 (citing Ex. 2060, 127:22–128:3, 128:7–12, 128:22–129¹⁷). This argument mischaracterizes the deposition testimony. The question that Dr. Bederson was responding to was “[i]f Figure 8B was modified to include reference numbers 30 and 32 in place of reference numbers 10 and 12 respectively, would those be considered part of the detector assembly?” Ex. 2060, 127:22–128:1. Thus, Dr. Bederson testified that he did not

¹⁷ Patent Owner cites “128:22–129,” which we understand should be “128:17–129:2” from the context of the argument.

analyze replacing Figure 8B's emitters 10 and 12 with receivers 30 and 32, rather than what Patent Owner incorrectly argues. *See* Ex. 2060, 127:22–129:2.

We also find unavailing Patent Owner's argument that "Reime's PWB 90 underlies Reime's entire device and thus, cannot satisfy the claimed 'substrate' structure because it is not arranged 'at an edge of a viewing plane defining plate.'" PO Resp. 60 (citing Ex. 1010, Fig. 7; Ex. 1002 ¶ 110; Ex. 2056 ¶ 134). First, Petitioner relies on the portions of PCB 90 that extend beyond LCD 92, and those portions are along multiple edges of the LCD. Second, the '093 patent broadly views what it means to be "at an edge," by including being behind, about, or along an edge within its scope. Ex. 1001, 42:61–67; Final Dec. 23. As Reime teaches, the portions of PCB 90 on which the receivers (e.g., 30 and 32) are arranged extend beyond the LCD and are along the edges. *E.g.*, Ex. 1010 ¶ 86, Fig. 9E. Moreover, the Federal Circuit affirmed that Reime's receiver—which is on a portion of PCB 90—is along an edge (Appeal Dec. 9–10), and thus we find that the PCB 90 portion upon which it sits also is along an edge.

In sum, we find that Petitioner shows by a preponderance of the evidence that Reime teaches "wherein the detector assembly further comprises a support substrate, and an arrangement of detector elements," rendering claim 29 obvious.

C. Challenged Claim 36

Claim 36 depends from claim 29, and further recites "wherein the arrangement of detector elements comprises a plurality of discrete single-element detectors." Ex. 1001, 69:32–34. We agree with Petitioner and find that Reime teaches claim 36's limitations to one of ordinary skill in the art. Pet. 42–43; Pet. Remand 4–6.

In particular, we agree with Petitioner and find that Reime teaches that the arrangement has a plurality of discrete detectors. Pet. 42. More specifically, Reime teaches “a touch pad device” with “four receivers separately placed near the four edges of the touch pad area.” Ex. 1010 ¶ 46, Fig. 6B. And we find persuasive Dr. Bederson’s testimony that these four receivers teach a plurality of discrete detectors, as it is consistent with Reime’s teachings. *Compare id.*, with Ex. 1002 ¶ 112.

In addition, we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art “would have understood that each one of the plurality of discrete detectors in Reime must be either a single-element detector or a multi-element detector.” Ex. 1002 ¶ 113. This is supported by Dr. Bederson’s testimony that single-element and multi-element detectors were commercially available prior to the ’093 patent, as we discuss below. *Id.* ¶¶ 114 (citing Ex. 1001, 37:46–51), 117 (citing Ex. 1001, 37:46–51; Ex. 1024,¹⁸ 5–6).

We find persuasive Dr. Bederson’s testimony regarding applicant admitted prior art (“AAPA”). In particular, Dr. Bederson testifies that “the applicants of the ’093 [p]atent concede that discrete diodes used as single-element detectors were commercially available prior to the filing of the” ’093 patent. *Id.* ¶ 114 (citing Ex. 1001, 37:46–51). The ’093 patent states that “discrete single-element detector elements . . . such as Solderable Silicon Photodiodes [were] commercially available from Advanced Photonix Incorporated of Camarillo, Calif., USA under catalog designator PDB-C601-1.” Ex. 1001, 37:46–51. And we agree thus with Petitioner that

¹⁸ WayBack Machine printouts of Advanced Photonix Website, <https://web.archive.org/web/20060114010259/http://www.advancedphotonix.com:80/>.

such single-element detectors were known in the art. PO Remand 5; Pet. 43. And in view of the above, we find persuasive Dr. Bederson’s testimony that “[c]hoosing a multi-element detector or a single-element detector would have been a simple design choice using commercially available detectors.” Ex. 1002 ¶ 117. Accordingly, we find that one of ordinary skill in the art would have found it obvious for Reime’s receivers to be implemented using discrete single-element detectors. *See KSR*, 550 U.S. at 417 (“When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.”).

We find unavailing Patent Owner’s argument that “Petitioner relies on expert testimony to gap-fill missing elements regarding Reime’s failure to disclose or suggest the different claim arrangements of detector elements in a ‘detector assembly.’” PO Resp. 78 (citing Ex. 1002 ¶¶ 111–119; Ex. 2056 ¶ 171). Rather, in light of Reime’s teachings, coupled with the general knowledge of one of ordinary skill in the art, it would have been obvious to employ discrete single-element detectors for Reime’s receivers. *See Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1338 (Fed. Cir. 2020) (finding obviousness can rely on supported expert testimony to supply an element of a claim). We appropriately consider such evidence of the knowledge that one of ordinary skill in the art would have had as part of our obviousness analysis. *See Randall Mfg. v. Rea*, 733 F.3d 1355, 1362–63 (Fed. Cir. 2013).

Moreover, “AAPA can be important evidence of general background knowledge, and general knowledge can be used to supply a missing claim

limitation.” *Shockwave Med., Inc. v. Cardiovascular Sys., Inc.*, 142 F.4th 1371, 1378–79 (Fed. Cir. 2025). Here, Petitioner relies on the cited AAPA as evidence of one of ordinary skill in the art’s general knowledge at the time of the ’093 patent, and the AAPA is not the basis for this ground. *See* Pet. 4, 42–43; Pet. Remand 4–5. As *Shockwave Med.* explains, Federal Circuit “case law has long recognized numerous permissible uses for general background knowledge in an IPR such as, ‘for example, furnishing a motivation to combine, or supplying a missing claim limitation.” 142 F.4th at 1378–79 (quoting *Qualcomm Inc. v. Apple Inc.*, 24 F.4th 1367, 1376 (Fed. Cir. 2022) (citing *Randall Mfg.*, 733 F.3d at 1362; *Koninklijke*, 948 F.3d at 1337–38)).

We also find unavailing Patent Owner’s argument that “Dr. Bederson . . . appears to improperly rely on the ’093 patent itself as a motivation to modify Reime.” PO Resp. 79 (citing Ex. 1002 ¶¶ 114, 117; Ex. 2056 ¶ 172). Rather, Dr. Bederson appropriately relies on the cited AAPA to support his testimony for what the general knowledge of one of ordinary skill in the art included at the time of the ’093 patent. Ex. 1002 ¶¶ 114 (citing Ex. 1001, 37:46–51), 117 (same). And his testimony and this general knowledge can furnish a motivation to combine. *Shockwave Med.*, 142 F.4th at 1378–79.

We also find unavailing Patent Owner’s arguments relating to the claimed “arrangement” or the “detector assembly.” PO Resp. 78–79 (citing Ex. 2056 ¶ 173). We agree with Petitioner and find that “Reime discloses several different arrangements for the detector elements, such as shown in F[igures] 2A–D, 3A–B, 4A–B, 5A–H, 6A–B, 7, 8A–D, 9A–F[,], 12A–C, and 13A–D.” Pet. 42. And as we concluded in the Final Written Decision, a

detector assembly need not be a distinct and physically separate hardware structure. Final Dec. 21–25.

In sum, we find that Petitioner shows by a preponderance of the evidence that Reime teaches “wherein the arrangement of detector elements comprises a plurality of discrete single-element detectors,” rendering claim 36 obvious.

D. Challenged Claim 37

Claim 37 depends from claim 29, and further recites “wherein the arrangement of detector elements comprises an integrally formed multi-element detector array.” Ex. 1001, 69:35–37. We agree with Petitioner and find that Reime teaches claim 37’s limitations to one of ordinary skill in the art. Pet. 43–45; Pet. Remand 4–6.

In particular, we agree with Petitioner and find that Reime teaches “that the LCD 92 can be mounted on a printed circuit board or printed wire board 90, with the optical sensor components, including sensors 30 and 32, ‘mounted in the peripheral area surrounding the LCD 92.’” Pet. 44 (citing Ex. 1010 ¶ 86). We also find persuasive Petitioner’s argument that “Reime’s detector element arrangement is an ‘integrally formed detector array’ in the same way that the ’093 patent’s detector array is ‘placed on a plane integrally formed therewith’ by all being mounted on the same substrate surrounding the LCD.” Pet. Remand 5–6 (citing Ex. 1001, 13:53–56); *see also* Ex. 1001, 13:53–56 (“In accordance with a preferred embodiment of the present invention the array 200 is formed of a plurality of discrete detector elements 202 placed on a plane integrally formed therewith.”). Accordingly, we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art would have understood that Reime’s optical

components, including the sensors, can be integrally formed in an array, as this testimony is consistent with Reime’s teachings. Ex. 1002 ¶ 116.

In addition, as we discuss above for claim 36, we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art “would have understood that each one of the plurality of discrete detectors in Reime must be either a single-element detector or a multi-element detector.” Ex. 1002 ¶ 113. And as above, we find persuasive Dr. Bederson’s testimony that multi-element detectors were commercially available prior to the ’093 patent. *Id.* ¶ 117 (Ex. 1024, 5–6). In view of the above, we find persuasive Dr. Bederson’s testimony that “[c]hoosing a multi-element detector or a single-element detector would have been a simple design choice using commercially available detectors.” Ex. 1002 ¶ 117. Accordingly, we find that one of ordinary skill in the art would have found it obvious for Reime’s receivers to be implemented using multi-element detectors. *See KSR*, 550 U.S. at 417.

Patent Owner does not provide separate arguments for this claim. PO Resp. 78–79. We address above Patent Owner’s arguments for claim 36 and find them unavailing. *See supra* Section V.C. Our reasoning there applies equally to this claim.

In sum, we find that Petitioner shows by a preponderance of the evidence that Reime teaches “wherein the arrangement of detector elements comprises an integrally formed multi-element detector array,” rendering claim 37 obvious.

E. Challenged Claim 38

Claim 38 depends from claim 29, and further recites “wherein the arrangement of detector elements comprises a plurality of discrete multi-element detectors.” Ex. 1001, 69:38–40. We agree with Petitioner

and find that Reime teaches claim 38's limitations to one of ordinary skill in the art. Pet. 45; Pet. Remand 4–6; *see also* Sections V.C–D.

As we discuss above, we find persuasive Dr. Bederson's testimony that multi-element detectors were commercially available prior to the '093 patent. *Id.* ¶ 117 (Ex. 1024, 5–6). We also find persuasive Dr. Bederson's testimony that “[c]hoosing a multi-element detector or a single-element detector would have been a simple design choice using commercially available detectors.” *Id.* Accordingly, we find that one of ordinary skill in the art would have found it obvious for Reime's receivers to be implemented using discrete multi-element detectors. *See KSR*, 550 U.S. at 417.

Patent Owner does not provide separate arguments for this claim. PO Resp. 78–79. We address above Patent Owner's arguments for claim 36 and find them unavailing. *See supra* Section V.C. Our reasoning there applies equally to this claim.

In sum, we find that Petitioner shows by a preponderance of the evidence that Reime teaches “wherein the arrangement of detector elements comprises a plurality of discrete multi-element detectors,” rendering claim 38 obvious.

F. Challenged Claim 44

1. An Integrated Display and Input Device (Preamble)

Petitioner argues that Reime teaches “[a]n integrated display and input device,” as recited in the preamble of claim 44. Pet. 20–22, 46; Ex. 1001, 69:67. More specifically, Petitioner argues that Reime “relates generally to a touch sensitive device in an electronic device or a wireless telecommunication terminal.” *Id.* at 20 (quoting Ex. 1010 ¶ 2). Petitioner argues Reime's “‘touch pad device’ . . . ‘has a designated interaction area for allowing a user to use the object to interact with the touch pad device for

inputting one or more functions in an electronic device.” *Id.* at 20–21 (quoting Ex. 1010, code (57)). According to Petitioner, Reime teaches “that the display and input device are integrated,” and more particularly teaches that “[i]n a mobile device or other electronic device, the touch pad area 5 can be a display panel such as a liquid crystal display (LCD) 92 mounted on a printed circuit board (PCB) or a printed wire board (PWB) 90.” *Id.* at 21 (quoting Ex. 1010 ¶ 86); *see also id.* (citing Ex. 1010, Figs. 2A–D) (arguing that Reime’s electronic device includes an integrated display and input).

After reviewing Petitioner’s arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that Reime teaches claim 44’s preamble. In light of our finding, we need not, and thus do not, reach whether claim 44’s preamble is limiting.

2. *Pixel Array*

Petitioner argues that Reime teaches “a pixel array operative to provide a visually sensible output,” as recited in claim 44. Pet. 22–23, 46; Ex. 1001, 70:1–2. More specifically, Petitioner argues that Reime teaches that “the touch pad area 5 can be a display panel such as a liquid crystal display (LCD).” *Id.* at 22 (quoting Ex. 1010 ¶ 86). According to Petitioner, one of ordinary skill in the art, “would have understood that an LCD is made up of an array of pixels.” *Id.* (citing Ex. 1002 ¶ 71). Petitioner adds that “Reime’s pixel array is operative to provide a visually sensible output.” *Id.* In particular, Reime teaches that the “touch pad area 5 can be used as a display to provide messages to the user or to indicate the functionality of the touch pad device 1,” according to Petitioner. *Id.* at 22–23 (quoting Ex. 1010 ¶ 87); *see also id.* at 23 (citing Ex. 1010, Figs. 2A–2D) (arguing that Reime depicts visually sensible outputs on the display).

After reviewing Petitioner’s arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner shows by a preponderance of the evidence that Reime teaches this limitation.

3. *Detector Assembly*

Claim 44 further recites “a detector assembly arranged at an edge of a viewing plane defining plate, the detector assembly includes a support substrate and an arrangement of sensor elements.” Ex. 1001, 70:3–6. We agree with Petitioner and find that Reime teaches this limitation. Pet. 40–42; Pet. Reply 23–24, 28; Pet. Remand 2–4; Pet. Resp. Remand 1–4.

Notably, we already address above for claim 29 the parties’ arguments for much of this limitation. *See supra* Section V.B (finding that Reime teaches “wherein the detector assembly further comprises a support substrate, and an arrangement of detector elements”). In particular, we find above that Reime’s receivers 30 and 32 are two detector elements that collectively comprise a detector assembly, and teach an arrangement of detector elements. *See id.* We also find above that the detector assembly’s receivers 30 and 32 are arranged on a substrate along two edges (one edge for each receiver) of a LCD, which meets the construction for being arranged at an edge. *See id.*

In addition, as we found in the Final Written Decision, we agree with Petitioner that Reime teaches that its LCD has “a viewing plane defining plate.” Final Dec. 45; Pet. 40–41. More specifically, Reime teaches that its “touch pad area 5 can be a display panel such as a liquid crystal display (LCD) 92.” Ex. 1010 ¶ 86. And we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art “would have understood that a

top surface of the LCD panel is a viewing plane-defining plate.” Ex. 1002 ¶ 107; Pet. 40.

We also agreed with Petitioner’s additional arguments that “Reime [also] includes a separate viewing plane defining plate on top of the LCD panel.” Final Dec. 45; Pet. 40. In particular, Reime discloses that “[p]referably, the touchpad device 1 also includes a cover plate to provide a touch surface.” Ex. 1010 ¶ 86. We agree with Petitioner that “[t]he cover plate is a ‘viewing plane defining plate,’” as shown in Reime’s Figure 8B, where “a ‘thin’ cover plate 70 is on top of the LCD and defines the LCD viewing plane.” Pet. 41 (citing Ex. 1010, Fig. 8B).

Thus, as we found in the Final Written Decision, we agree with Petitioner that each of a top surface of the LCD panel and cover plate 70 is a viewing plane defining plate. Final Dec. 45. And thus, our findings above that Reime’s receivers 30 and 32 are arranged along two edges of a LCD also covers being arranged along the LCD’s top surface, as well as cover plate 70.

In sum, we determine that Petitioner shows by a preponderance of the evidence that Reime teaches this limitation.

4. At Least One Sensor Element

Claim 44 further recites “wherein at least one sensor element in the arrangement of sensor elements detects electromagnetic radiation at a baseline level and senses the position of the object with respect to the pixel array when the object is within a predetermined degree of propinquity to the pixel array.” Ex. 1001, 70:6–11. We agree with Petitioner and find that Reime teaches this limitation. Pet. 47–49; Pet. Reply 18–19; Pet. Remand 6–7.

First, we agree with Petitioner and find that Reime teaches “wherein at least one sensor element in the arrangement of sensor elements detects electromagnetic radiation at a baseline level.” In particular, we agree with Petitioner and find that Reime teaches using the same receivers that sense the location of an object also to detect an ambient light level. Ex. 1010 ¶ 88; Pet. 47. More specifically, Reime teaches that “as ambient light varies much slower than the frequency of the pulsed frequency, the variation in the output signal of the receiver due to the variation in ambient light is most likely a shift in the *base line* of the output signal.” Ex. 1010 ¶ 88 (emphasis added); Pet. 37. Figure 10C, shown below as annotated by Petitioner, illustrates this ambient light baseline.

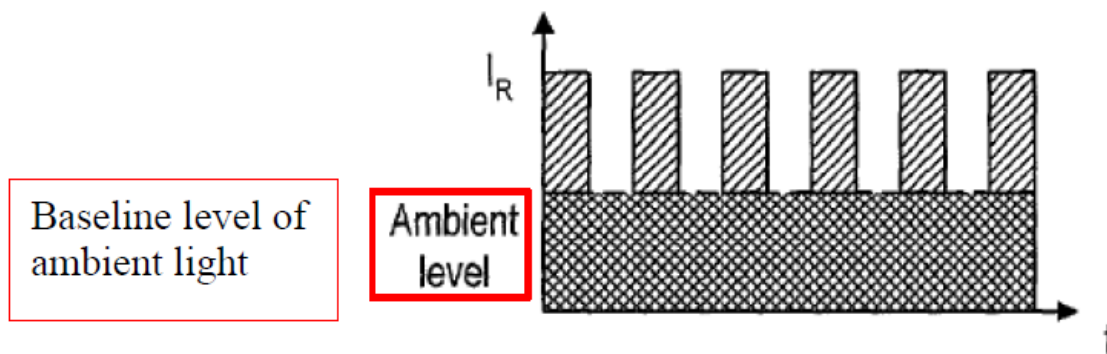


FIG. 10C

Figure 10C “is a diagrammatic representation showing the output signal of a receiver attributable to a light emitter operated in a pulsed mode and ambient light.” Ex. 1010 ¶ 60. Petitioner annotates the figure by drawing a red box around the Ambient level label on the figure and adding the label “Baseline level of ambient light.” Pet. 48. We agree with Petitioner and find that Reime’s Figure 10C shows the receiver’s output signal of the baseline level

of ambient light. Pet. 47–48. And we find persuasive Dr. Bederson’s testimony that supports this finding as it is consistent with Reime’s teachings. Ex. 1002 ¶ 124 (citing Ex. 1010 ¶ 88, Fig. 10C); Pet. 47.

Second, we agree with Petitioner and find that Reime teaches that the sensor element (e.g., receiver 30) senses a position of an object with respect to the pixel array. Pet. 48; Pet. Remand 7. In particular, we agree and find that Reime teaches “filtering out ambient light and using pulsed mode for the emitters to address problems that ambient light causes to ‘the detection and sensing of the presence of the touching object.’” Pet. 48 (quoting Ex. 1010 ¶ 88). And we agree that Reime teaches that by removing the output variation of the receivers due to ambient light, “the variation in the pulsed output signal of the receiver is mainly the result of the reflection or absorption of the approaching object over the touch pad device.” *Id.* Reime also teaches that enabling and disabling its emitters and receivers in cycles “can be used to determine the two-dimensional coordinates of the touching point with respect to the touch pad area 5.” Ex. 1010 ¶ 80; Pet. 48. We also agree with Petitioner that Reime teaches that touch pad area 5 contains the LCD display pixels. Ex. 1010 ¶ 86; Pet. 48. Moreover, Reime’s teaching of receiver 30 causing a change in the output signal 130 based on the presence of an object teaches that receiver 30 is operative to sense a position. Ex. 1010 ¶ 73; *see also* Appeal Dec. 18–19 (determining that “[t]he Board’s finding that Reime teaches detecting the position of an object . . . is also supported by substantial evidence”).

Moreover, we agree with Petitioner and find that Reime teaches that when a user uses an object such as a finger 100’ to touch the touch pad 5, light from emitters 10, 20 encounters the surface of the object 100, and a portion of that light reflects off the finger 100’ and is received by the

receiver 30. Ex. 1010 ¶ 73, Fig. 2A; Pet. 24. In particular, Reime teaches that “the presence of the object 100 near the emitters 10, 20 and the receiver 30 would cause a change in the output signal 130,” and that the change attributable to the light from each emitter that is reflected off the object’s surface can be separately measured. Ex. 1010 ¶ 73. Reime teaches “[w]hen such a change is detected,” determining which emitter 10, 20 the object 100’ is closer to, and by “a series of such measurements, it is possible to track the positions of the object 100.” *Id.*

In addition, Reime explicitly states that “[i]t is not necessary for the object 100’ to physically touch or press the area 5 at a touching point” because “the presence of the object 100’ is detected by optical sensor components 10, 20 and 30.” *Id.* ¶ 74. Put differently, Reime teaches that “touching the surface,” regarding the touch pad device 1, “can be interpreted as ‘making contact with the surface’ or *‘being adjacent to the surface.’*” *Id.* (emphasis added). Moreover, we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art also “would have understood that determining the presence of the object when it is near, but not touching, the pixel array detects its location within a predetermined degree of propinquity.” Ex. 1002 ¶ 77; Pet. 26. We also are persuaded by Dr. Bederson’s testimony that “[t]he level of nearness that triggers a response would be predetermined so that the device can distinguish nearby objects from those that are far away.” Ex. 1002 ¶ 77. This testimony is consistent with Reime’s teachings we discuss above.

We find unavailing Patent Owner’s arguments that are tethered to “a predetermined degree of propinquity” excluding touching and requiring calculating the object’s actual z-distance. *See* PO Resp. 48–50; PO Sur-reply 17. These arguments rely on portions of Patent Owner’s proposed

construction for this term, which we did not adopt. *See supra* Section III.A (discussing affirmed construction for “a predetermined degree of propinquity”).

For example, we find unavailing Patent Owner’s argument concerning Reime not calculating an “actual z-distance.” PO Resp. 49. Simply put, the plain language of this limitation does not require such a calculation. *See* Ex. 1001, 70:6–11; *see also* Final Dec. 15–17 (concluding that the ’093 patent Specification teaches measuring light to detect when it exceeds a predetermined threshold, rather than making a specific distance calculation). Likewise, we find unavailing Patent Owner’s argument that Reime’s hardware cannot be modified to calculate the object’s specified proximity. PO Resp. 49. No such modification is required. Again, the claim language does not require making such a calculation.

Moreover, the plain and ordinary meaning of “position” is broad enough to cover both two-dimensional and three-dimensional positions, as evidenced by the ’093 patent’s Specification. *See, e.g.*, Ex. 1001, 6:24–27 (describing the position of an object as including a two-dimensional position or a three-dimensional position). Thus, calculating a specific z position (i.e., the third dimension) is not required by the limitation. And, we find that “when the object is within a predetermined degree of propinquity to the pixel array” covers Reime’s teachings of determining the object’s two-dimensional position when the object is detected via a change in the output signal 130. *See* Ex. 1010 ¶¶ 73–74.

Similarly, we find unavailing Patent Owner’s arguments that Reime “does not distinguish between ‘touching the surface,’ ‘making contact with the surface,’ and ‘being adjacent to the surface.’” PO Sur-reply 17. The claim language recites “within a predetermined degree of propinquity,”

which includes being closer (e.g., touching). *See supra* Section III.A (discussing affirmed construction that touching is not excluded); Ex. 1001, 70:9–11.

We also find unavailing Patent Owner’s argument that Petitioner does not show that Reime teaches the sensing function, and does not reference any hardware structure. PO Sur-reply 18. Petitioner clearly identifies that Reime’s receivers teach the claimed at least one sensor element (e.g., receiver 30), and that Reime teaches that multiple detectors can be used to better detect the object’s position. *See, e.g.*, Pet. 24–25; Pet. Reply 19. In particular, Reime teaches that “the presence of the object 100 near the emitters 10, 20 and the receiver 30 would cause a change in the output signal 130,” and that the change attributable to the light from each emitter that is reflected off the object’s surface can be separately measured. Ex. 1010 ¶ 73. Reime teaches “[w]hen such a change is detected,” determining which emitter 10, 20 the object 100’ is closer to, and by “a series of such measurements, it is possible to track the positions of the object 100.” *Id.*

Patent Owner incorrectly conflates a sensor being “operative to sense a position” with circuitry that receives input from a sensor and outputs position information. *See* PO Sur-reply 18. Notably, claim 44 recites these elements separately. Ex. 1001, 69:67–70:20 (reciting claim 44). Reime’s teaching of receiver 30 causing a change in the output signal 130 based on the presence of the object near the emitters teaches that receiver 30 is operative to sense a position. *E.g.*, Ex. 1010 ¶ 73. This is consistent with the ’093 patent’s disclosure that a sensor senses light reflected from an object and comprises a plurality of detector elements (e.g., photodiodes). *E.g.*, Ex. 1001, 2:15–16, 2:66–67; *see also id.* at 10:54–58.

In sum, we determine that Petitioner demonstrates by a preponderance of the evidence that Reime teaches “wherein at least one sensor element in the arrangement of sensor elements detects electromagnetic radiation at a baseline level and senses the position of the object with respect to the pixel array when the object is within a predetermined degree of propinquity to the pixel array.”

5. Circuitry that Receives Output From Detector Assembly

Claim 44 further recites “circuitry that receives an output from the detector assembly and provides a non-imagewise input to utilization circuitry, the non-imagewise input represents the position of the object relative to the pixel array and corresponds to a location of the at least one sensor element in the arrangement when an amount of electromagnetic radiation or a change in the amount of electromagnetic radiation detected by the at least one sensor element exceeds a first predetermined threshold.” Ex. 1001, 70:12–20. We agree with Petitioner and find that Reime teaches this limitation. Pet. 31–32, 39–40, 49–51; Pet. Reply 25–26; Pet. Remand 7–10; Pet. Resp. Remand 3–5.

In particular, we agree with Petitioner that Reime teaches “circuitry that receives an output from the sensor.” Pet. 31. For example, Figure 14 includes signal processor 450. Ex. 1010 ¶ 106, Fig. 14. And Reime teaches that “[t]he output signal 130 from the receiver 30 and the output signal 132 from the receiver 32 are conveyed to a signal-processing module 450.” *Id.* ¶ 106.

In addition, we agree with Petitioner and find that Reime teaches that “[s]ignal processor 450 provides a non-imagewise input representing the position of the object relative to the pixel array to utilization circuitry.” Pet. 32. For example, Reime teaches that “the signal processing module 450

sends measurement information 452 to the microprocessor 460.” Ex. 1010 ¶ 106. And we agree with Petitioner that the measurement information signals are not images, but instead “are representations of the detected signal value, such as I_R shown in F[igure] 10B, or output signal 130 shown in F[igure] 1.” Pet. 32. And we agree with Petitioner, as we discuss above, that Reime teaches that “this measurement information represents the position of the object relative to the pixel array contained in touch pad area 5.” *Id.*; *supra* Section V.F.4.

In addition, we agree with Petitioner that Reime teaches “that the measurement information 452 is provided to utilization circuitry, such as to a microprocessor or ASIC 460,” as shown in Figure 14. Pet. 32 (citing Ex. 1010, Fig. 14). For example, Reime teaches that microprocessor 460 “is connected to the components 400 to control the measurement on the touch pad device and make use of the measurement results therefrom.” Ex. 1010 ¶ 106.

We also note that the Federal Circuit affirmed our finding that Reime teaches the limitations of claim 1, including a similar limitation to the first portion of this limitation in claim 44. Appeal Dec. 18; *compare* Ex. 1001, 67:55–58 (for claim 1 reciting “circuitry that receives an output from the at least one sensor and provides a non-imagewise input representing the position of the object relative to the pixel array to utilization circuitry”), with *id.* at 70:12–15 (for claim 44 reciting “circuitry that receives an output from the detector assembly and provides a non-imagewise input to utilization circuitry, the non-imagewise input represents the position of the object relative to the pixel array”).

In addition, we agree with Petitioner and find that Reime teaches “the non-imagewise input . . . corresponds to a location of the at least one sensor

element in the arrangement when an amount of electromagnetic radiation or a change in the amount of electromagnetic radiation detected by the at least one sensor element exceeds a first predetermined threshold.” In particular, we agree with Petitioner and find that Reime teaches that in pulsed mode the “output I_R of the receiver attributable to the output intensity I_E of the pulsed emitter is a series of pulses.” Ex. 1010 ¶ 88, Fig. 10B; Pet. 50. We also agree that Reime teaches using a high pass filter in addressing detection difficulties. Ex. 1010 ¶¶ 88–89; Pet. 50. In particular, we agree with Petitioner and find that Reime teaches for an embodiment that “after being filtered by a high-pass filter, the output signal of the receiver 30 is substantially zero” when the touching object is not present. Ex. 1010 ¶ 89, Figs. 10D–10E; Pet. 50. When the object is present, Reime teaches that after the high-pass filtering, “the variation in the pulsed output signal of the receiver is mainly the result of the reflection or absorption of the approaching object over the touch pad device.” Ex. 1010 ¶ 88; Pet. 50. In other words, as Dr. Bederson testifies, “when the object is not present, the ‘output signal of the receiver is substantially zero’ after filtering and that any greater output is used to determine a position.” Ex. 1035 ¶ 54 (citing Ex. 1002 ¶ 130 (citing Ex. 1010 ¶ 88)); Pet. Reply 25. In addition, we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art would have considered the substantially zero level after high-pass filtering to be the claimed predetermined threshold. Ex. 1002 ¶ 130; Ex. 1035 ¶ 52; Pet. 50; Pet. Reply 25; Pet. Remand 9. This testimony is consistent with Reime’s teachings and Dr. Bederson’s testimony that we discuss above.

In addition, we agree with Petitioner and find that “Reime’s detectors provide sensed radiation measurements from their location to ‘track the position of the object’ with the series of measurements.” Pet. Remand 8

(citing Pet. 49–50); Pet. 39–40 (citing Ex. 1010 ¶ 73, 79) (arguing that Reime teaches that “the two-dimensional coordinates of the touching point’ can be calculated using this series of measurements”). We also agree that “[t]he input provided by the circuitry thus corresponds to the sensor’s location because it is based on the output from each of the detectors in the detector assembly.” Pet. Remand 8. For these reasons, we find unavailing Patent Owner’s arguments that “Petitioner and Dr. Bederson fail to demonstrate the asserted references disclose the “location of the at least one sensor in the arrangement,” and that “Reime only teaches determining the position of an object based on its ‘emitters,’ not receivers.” PO Resp. 66–67 (citing Ex. 1010 ¶ 73).

We also find unavailing Patent Owner’s arguments that Petitioner conflates claim 13’s location regarding an object’s trajectory of motion with claim 44’s location of the sensor element. PO Resp. 66; PO Remand 14. Again, Petitioner’s arguments focus on the teachings that sensor elements provide measurements from their location, and thus, the input corresponds to the sensor element’s location. Pet. 39–40, 49–50. Petitioner does not rely on claim 13’s purpose to which the measurements are applied. *Id.*

We also find unavailing Patent Owner’s argument that one of ordinary skill in the art would have understood that “Reime teaches away from the claimed ‘circuitry’ that provides a ‘non-imagewise input’ corresponding “to a location of at least one sensor in the arrangement.” PO Resp. 67 (citing Ex. 2056 ¶ 146). Patent Owner does not provide a basis for this teaching away argument. Nor does Patent Owner identify any specific teaching in Reime that supports its argument that Reime teach away from the claimed invention—a reference teaches away if it criticizes, discredits, or otherwise discourages modifying the reference to arrive at the claimed invention. *In re*

Fulton, 391 F.3d 1195, 1201 (Fed. Cir. 2004). And we afford the cited Dr. Cairns’s testimony little to no weight as it is conclusory. *See* Ex. 2056 ¶ 146.

We also find unavailing Patent Owner’s argument that Petitioner “relies on Reime’s ‘high-pass’ time-based frequency filter, which detects ‘how often’ a signal occurs, while the claims require detecting ‘how much’ or the ‘amount.’” PO Remand 14 (citing Pet. 49–50; Pet. Reply 25–26); PO Resp. 66 (citing Ex. 2056 ¶ 144) (making same argument that frequency relates to time, and not quantity or amount); PO Resp. Remand 5 (same argument). Applying a high pass filter, is only the first part of Reime’s teachings that Petitioner cites. As we discuss above, Petitioner first argues that Reime teaches using a high pass filter to address detection difficulties (e.g., filtering out ambient light), and that after high-pass filtering the output signal of the receiver is substantially zero (i.e., the claimed threshold). But, as we discuss above, Petitioner argues that Reime secondly teaches that after the filtering, the output signal of the receiver remains substantially zero when the touching object is not present, and varies when the object is present, due to the approaching object. Thus, Reime also teaches the receiver detects an amount, and change thereof, of radiation that exceeds the threshold, as we discuss above. For the same reasons, we find inapposite Patent Owner’s argument that “[t]ime-based frequency filters are agnostic to the signal ‘amount’ and output any signal that occurs at the specified time interval regardless of magnitude.” PO Remand 14 (citing Ex. 2056 ¶ 144; PO Resp. 65–67; PO Sur-reply 23–24). Again, this argument only addresses the first part (i.e., the filtering) of Reime’s cited teachings.

6. *Summary*

In sum, we find that Petitioner shows by a preponderance of the evidence that Reime renders claim 44 obvious.

G. *Challenged Claims 45 and 46*

Petitioner argues that Reime teaches claims 45 and 46. Pet. 54–55. Claim 46 depends from claim 45, which depends from claim 44. Patent Owner does not provide separate arguments directed to claims 45 or 46, but rather relies on its arguments made for claim 44. PO Resp. 78; *generally* PO Sur-reply; PO Remand; PO Resp. Remand. As we discuss above, we find these arguments unavailing. *See supra* Section V.F.

We have reviewed Petitioner’s showings for claims 45 and 46. Based on the evidence and arguments of record, we find that Petitioner demonstrates by a preponderance of the evidence that the limitations of these claims are taught by Reime.

H. *Challenged Claim 48*

Petitioner argues that Reime teaches claim 48. Claim 48 depends from claim 45, which depends from claim 44. Claim 48 further recites “wherein the light reflected by the object is transmitted through the viewing plane defining plate directly to the at least one sensor element.” Ex. 1001, 70:32–35. We agree with Petitioner and find that Reime teaches this limitation. Pet. 55–57; Pet. Reply 29; Pet. Remand 14–15.

In particular, we agree with Petitioner and find that Reime teaches a “cover plate to provide a touch surface,” and that its sensors may be located under the cover plate. Ex. 1010 ¶ 86, Figs. 8A, 8C; Pet. 56. We also agree that Reime teaches that “[w]hen a user’s finger 100’ (F[igure] 2) approaches the cover plate 60, the light rays 203, 205 could encounter the approaching finger and partially reflect off the finger toward the receiver 30.” Ex. 1010

¶ 86, Fig. 11 (showing that light reaches the receiver 30 by reflecting off of the approaching finger towards receiver 30); Pet. 56; Pet. Reply 29. And we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art “would have understood that the angle of light reflected off the approaching finger would arrive at cover plate 60 at various angles, including some light transmitted directly to the sensor through cover plate 60 and other light propagating at various angles through cover plate 60 to reach the sensor.” Ex. 1002 ¶ 142; *see also* Ex. 1035 ¶¶ 64–65 (citing Ex. 1041,¹⁹ 1098) (testifying that “[l]ight bouncing off a finger is an example of this kind of situation where the finger surface is rough, and the light would be reflected in various directions”). Dr. Bederson’s cited testimony is consistent with Reime’s teachings. *Compare* Ex. 1010 ¶ 86, Fig. 11, *with* Ex. 1002 ¶ 142 *and* Ex. 1035 ¶¶ 64–65.

We find unavailing Patent Owner’s argument that Dr. Bederson “summarily concludes that reflected light would arrive at various angles, including ‘light transmitted directly to the sensor through cover plate 60,’” but he “provides no further reference to Reime or any other evidence in the record to support his conclusion.” PO Resp. 75–76 (citing Ex. 1002 ¶ 142). Rather, Dr. Bederson cites Reime’s paragraph 86, which supports this testimony. Ex. 1002 ¶ 142. In addition, Dr. Bederson’s reply declaration testimony, which is additionally supported by citation to a physics textbook and Reime’s Figure 11, reiterates this testimony. Ex. 1035 ¶¶ 64–65 (citing Ex. 1010, ¶ 86, Fig. 11; Ex. 1041, 1098).

¹⁹ Serway Jewett, PHYSICS FOR SCIENTISTS AND ENGINEERS (6th ed. 2004).

We do not credit Dr. Cairns’s testimony that “the general purpose of Reime’s light guide” includes “prevent[ing] direct light transmission through the plate,” and that “[i]f Reime’s light guide were modified to permit direct light transmissions through its light guide, then the receivers would not detect any light transmitted by the emitters.” Ex. 2056 ¶ 165 (citing Ex. 1010 ¶ 86, Fig. 8D). This testimony contradicts Reime’s explicit teachings that “[w]hen a user’s finger 100’ (F[igure] 2) approaches the cover plate 60, the light rays 203, 205 could encounter the approaching finger and partially reflect off the finger toward the receiver 30,” and “[r]eflection causes the increase in the received light amount by the receiver 30.” Ex. 1010 ¶ 86; *see also id.* (“[T]he approaching and touching of the user’s finger 100’ is mainly detected by the reflection off the finger.”), Fig. 11.

We also find unavailing Patent Owner’s argument based on its proposed construction—which we do not adopt—that Reime teaches away from claim 48’s light being transmitted directly to the sensor. PO Resp. 76. Rather, as we discuss above, Reime teaches that some light is reflected off an object (e.g. finger) directly to a sensor element (e.g., receiver 30). Ex. 1010 ¶ 86, Fig. 11. And this is sufficient to meet claim 48’s requirements.

We find inapposite Patent Owner’s argument that “Reime expressly teaches its lightguide requires ‘internal reflections.’” PO Sur-reply 31. As we discuss above, Petitioner focuses on the light reflected directly from a finger to a sensor, rather than the light that propagates by internal reflections within the lightguide. And some light transmitted through the plate directly to the sensor is sufficient for claim 48. *See supra* Section III.C (construing “directly to”).

We also find unavailing Patent Owner’s argument that Petitioner’s “new theory that Reime’s . . . lightguide permits ‘some’ light to travel ‘directly to’ a detector was not previously disclosed and should be disregarded.” PO Sur-reply 30 (citing Pet. 62–64; Pet. Reply 29–30). In the Petition, Petitioner argues that one of ordinary skill in the art “would have understood that the angle of light reflected off of the approaching finger would arrive at cover plate 60 at various angles, including *some* light transmitted directly to the sensor through cover plate 60 and other light propagating at various angles through cover plate 60 to reach the sensor.” Pet. 56–57 (citing Ex. 1002 ¶ 142) (emphasis added). Clearly, this is not a new theory as Patent Owner argues. Regardless, Petitioner’s reply arguments on this issue are in direct response to Patent Owner’s proposed construction, and arguments Patent Owner makes pursuant therewith, making Petitioner’s reply arguments proper for that reason also. CTPG 74 (citing 37 C.F.R. § 42.23) (“Generally, a reply or sur-reply may only respond to arguments raised in the preceding brief.”).

I. Challenged Claim 49

Petitioner argues that Reime teaches claim 49. Pet. 4, 57–58. Claim 49 recites, among other things, “a second predetermined threshold.” Ex. 1001, 70:36–40. Many of Petitioner’s arguments, however, for the second predetermined threshold rely on Hinckley, while other arguments assert that it would have been obvious to one of ordinary skill in the art to include the second predetermined threshold over Reime. Pet. 57–58.

We find Petitioner’s arguments based on Reime alone insufficient. Thus, we find that Petitioner does not show by a preponderance of the evidence that claim 49 is rendered obvious by Reime alone.

J. Challenged Claims 56–58

Petitioner argues that Reime teaches claims 56–58. Pet. 59–61. Claim 58 depends from claim 57, which depends from claim 56, which depends from independent claim 44. Patent Owner does not provide separate arguments directed to any of claims 56–58, but rather relies on its arguments made for claim 44. PO Resp. 78; *generally* PO Sur-reply; PO Remand; PO Resp. Remand. As we discuss above, we find these arguments unavailing. *See supra* Section V.F.

We have reviewed Petitioner’s showings for claims 56–58. Based on the evidence and arguments of record, we find that Petitioner demonstrates by a preponderance of the evidence that the limitations of these claims are taught by Reime.

VI. ALLEGED OBVIOUSNESS OVER REIME AND HINCKLEY

Petitioner argues that the combination of Reime and Hinckley renders obvious claims 29, 36–38, 44–46, 48, 49, and 56–58. Pet. 4, 41–61. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that the combination of Reime and Hinckley renders these claims obvious.

A. Summary of Hinckley

Hinckley relates to relates to computing and mobile devices with displays. Ex. 1011 ¶ 2. Hinckley describes mobile device 200 including, among other things, two touch sensors 254 and 256, forward/back tilt sensor 258, left/right tilt sensor 260, and proximity sensor 262 consisting of infrared transmitter 264 and infrared receiver 266. *Id.* ¶ 29. Figure 7, reproduced below, shows a response curve for proximity sensor 262.

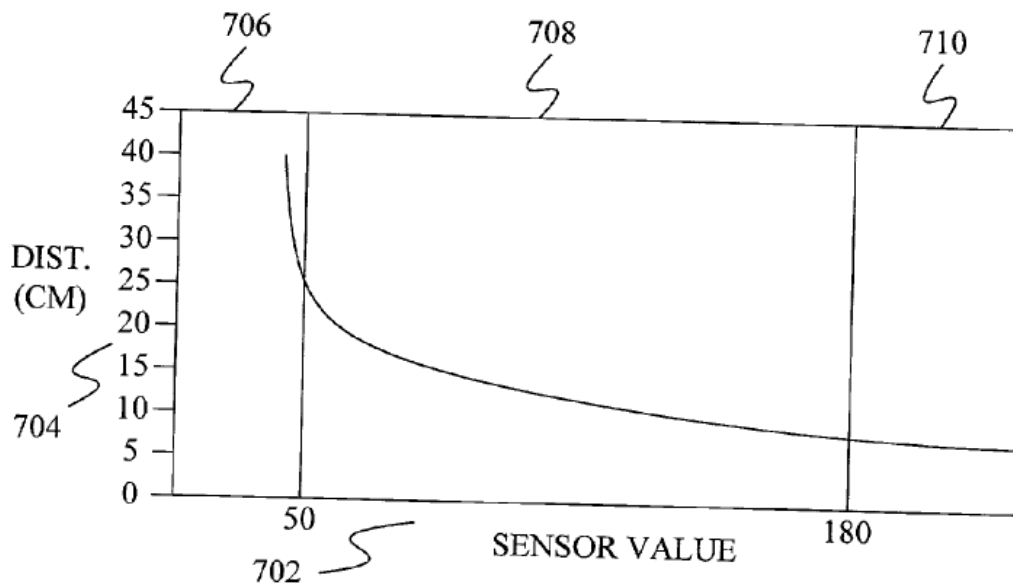


FIG. 7

Figure 7 “is a graph of distance between a user and a mobile device as a function of proximity sensor levels.” *Id.* ¶ 17. As shown in Figure 7, the sensor value is shown along horizontal axis 702 and the actual distance to the object is shown along vertical axis 704. *Id.* ¶ 44. The graph shown in Figure 7 is divided into three ranges. *Id.* Range 706 extends from a distance of approximately 27 centimeters to infinity and indicates that no objects are within range of mobile device 200. *Id.* Range 708 extends from approximately 7 centimeters to 27 centimeters and indicates that at least one object is within range of mobile device 200. *Id.* Readings in third range 710, which extends from 7 centimeters to 0 centimeters, are considered to be close to mobile device 200. *Id.*

B. Challenged Claims 29 and 36–38

Petitioner argues that the combination of Reime and Hinckley renders obvious claims 29 and 36–38. Pet. 4, 41–45. Claims 36–38 depend from claim 29, which depends from claim 26, which depends from independent claim 1. The Federal Circuit affirmed that claim 1 is rendered obvious by

Reime, and concluded that claim 26 was too. Appeal Dec. 9–10, 18–19. For claims 29 and 36–38, Petitioner does not separately rely on Hinckley.

As we discuss above, we find that Reime teaches the limitations of claims 29 and 36–38, and Patent Owner does not provide separate arguments for these claims for this ground. *See supra* Sections V.B–E. And as we discuss below, one of ordinary skill in the art would have been motivated to combine Reime and Hinckley’s teachings. *See infra* Section VI.C.1 (finding motivation to combine Reime and Hinckley’s teachings).

Accordingly, we find that Petitioner shows by a preponderance of the evidence that the combination of Reime and Hinckley²⁰ renders claims 29 and 36–38 obvious.

C. Challenged Claim 44

As we discuss above, we find that Reime teaches claim 44’s limitations. For the reasons that follow, we agree with Petitioner that Reime combined with Hinckley also teaches the latter portion of claim 44,²¹ i.e., “the non-imagewise input . . . corresponds to a location of the at least one sensor element in the arrangement when an amount of electromagnetic radiation or a change in the amount of electromagnetic radiation detected by the at least one sensor element exceeds a first predetermined threshold.” Pet. 49–54; Pet. Reply 25–27; Pet. Remand 9–10; Pet. Resp. Remand 3–5.

Petitioner annotates Hinckley’s Figure 7, reproduced below, to support its arguments.

²⁰ We do not address whether Hinckley also teaches limitations of claim 1 because the Federal Circuit affirmed that Reime teaches claim 1, and the combination of Reime and Hinckley thus also would teach claim 1. Appeal Dec. 18–19.

²¹ Petitioner also argues that Hinckley teaches at least one sensor “senses the position of the object with respect to the pixel array when the object is

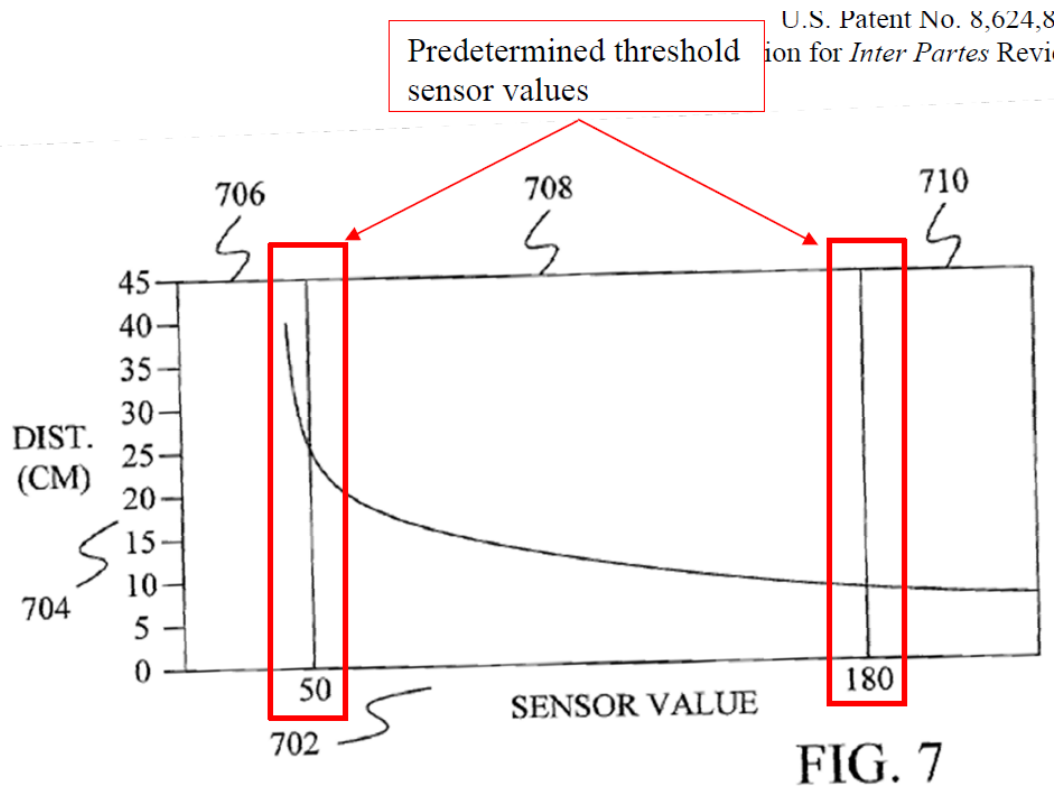


Figure 7 “is a graph of distance between a user and a mobile device as a function of proximity sensor levels.” Ex. 1011 ¶ 17. Petitioner annotates this figure by drawing red boxes around each of vertical lines 50 and 180, and labels these as “[p]redetermined threshold sensor values.” Pet. 52. We agree with Petitioner and find that Hinckley teaches that Figure 7 “shows a response curve for one embodiment of the proximity sensor.” Ex. 1011 ¶ 44; Pet. 51. “[T]he sensor value is shown along horizontal axis 702 and the actual distance to the object is shown along vertical axis 704.” Ex. 1011 ¶ 44. “The graph of [Figure] 7 is divided into three ranges”: (i) “[r]ange 706 extends from a distance of approximately 27 centimeters to infinity and

within a predetermined degree of propinquity to the pixel array” by relying on its arguments for claim 1. *See* Pet. 47–49. The Federal Circuit affirmed that Reime teaches the same element in claim 1, and the combination of Reime and Hinckley thus also would teach it. Appeal Dec. 18–19.

indicates that no objects are within range of mobile device 200”;
(ii) “[r]ange 708 extends from approximately 7 centimeters to 27 centimeters and indicates that at least one object is within range of mobile device 200”; and (iii) “[r]eadings in third range 710, which extends from 7 centimeters to 0 centimeters, are considered to be close to mobile device 200.” *Id.*; *see also id.* (providing equation for the response curve of Figure 7 relating distance and sensor value). Based on these teachings, we agree with Petitioner that Hinckley teaches that “the position of the object relative to the sensor is determined by comparing the output value to thresholds 50 and 180, which are predetermined.” Pet. 51–52 (citing Ex. 1002 ¶ 132). We find persuasive Dr. Bederson’s cited testimony in this regard as it is consistent with these teachings from Hinckley. *Compare* Ex. 1011, Fig. 7, ¶ 44, *with* Ex. 1002 ¶ 132.

In addition, we find persuasive Petitioner’s argument that Reime teaches that it “is not necessary for the object 100’ to physically touch or press the area 5 at a touching point,” and thus, one of ordinary skill in the art would have chosen “a first predetermined threshold, such as [sensor value] 180 or higher, to determine whether the object was close enough for a touch in Reime, because Hinckley teaches outputs values above that threshold are ‘close.’” Pet. 52 (quoting Ex. 1010 ¶ 74; citing Ex. 1011 ¶ 44); Ex. 1010 ¶ 74 (Reime teaching its use of the phrase “touching the surface” includes both “‘making contact with the surface’ or ‘being adjacent to the surface’”). We also find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art would have chosen the exact threshold in accordance with the “the sensitivity and the optical response of the light receivers.” Ex. 1002 ¶ 132 (quoting Ex. 1010 ¶ 111). This testimony is consistent with Reime’s

teachings that “the sensitivity and the optical response of the light receivers . . . may vary from one application to another.” Ex. 1010 ¶ 111.

In addition, we find persuasive Petitioner’s argument that one of ordinary skill in the art would have found it obvious to compare the output signal in Reime, such as output signal 130 or I_R , to a predetermined threshold as taught by Hinckley. Pet. 51 (citing Ex. 1002 ¶¶ 131–135). In particular, we find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art “would have been motivated to include a predetermined threshold to measure the detected signal against a predetermined benchmark” to “ensure more consistent responses in environmental conditions that do not vary much.” Ex. 1002 ¶ 133 (citing Ex. 1010 ¶ 111); Pet. 53. As Petitioner argues, Hinckley describes using proximity measurements based on sensor output for a number of such applications. Pet. 19–20; Ex. 1011 ¶¶ 106–108.

We also are persuaded by Dr. Bederson’s testimony that one of ordinary skill in the art would have been motivated to modify Reime to include Hinckley’s features and benefits. Ex. 1002 ¶ 65; Pet. 20. As testified to by Dr. Bederson, these benefits include “controlling device idle state and power consumption based on the presence and motion and of an object.” Ex. 1002 ¶ 65 (citing Ex. 1011 ¶¶ 106–108). Hinckley teaches the benefit of preventing a mobile device from entering an idle mode, which would be unwanted, if the user is gesturing toward the device. Ex. 1011 ¶¶ 106–107; Pet. 53. Hinckley also teaches that a device can be put in a full power mode when a touching objecting is on or near a touch pad area, for power efficiency reasons. Ex. 1011 ¶¶ 104–105; Pet. 53. We find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art would have been motivated to implement in Reime’s devices this additional

power efficiency feature based on the predetermined thresholds of Hinckley. Ex. 1002 ¶ 134; *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380 (Fed. Cir. 2023) (“‘[U]niversal’ motivations known in a particular field to improve technology provide ‘a motivation to combine prior art references *even absent any hint of suggestion* in the references themselves.’”). This rationale of power efficiency also is expressly taught by Hinckley. See Ex. 1011 ¶¶ 106–107, Fig. 7.

In addition, we agree with Petitioner and find that one of ordinary skill in the art would have had a reasonable expectation of success in combining the teachings of Reime and Hinckley. Pet. 20, 53–54. As Petitioner argues, Reime teaches comparing the filtered signal to a predetermined threshold (substantially zero) for determining whether the object is present. Ex. 1010 ¶¶ 88–89. We find persuasive Dr. Bederson’s testimony that one of ordinary skill in the art “would have seen no impediment to comparing the signal to a different predetermined threshold because such a comparison is a simple arithmetic operation.” Ex. 1002 ¶ 135. Comparing a signal to a different threshold value still is a comparison of values. We also agree with Petitioner and find that both Reime and Hinckley address detection problems in similar ways, such as by using sensors, to detect the positions of an object in contact with or with a degree of propinquity to a display device. Pet. 20; Ex. 1010 ¶ 106 (teaching using measurements results from receivers); Ex. 1011 ¶ 29 (teaching proximity sensor); Ex. 1002 ¶ 66.

Accordingly, we find that Petitioner provides “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Kahn*, 441 F.3d at 988.

We find unavailing Patent Owner’s argument that “Hinckley discloses a ‘touch’ sensor to detect when an object touches the device, and separately, Hinckley provides a ‘proximity sensor,’” which “Hinckley does not disclose or suggest using . . . in any ‘touch.’” PO Resp. 67 (citing Ex. 1011 ¶¶ 33–35, Fig. 3; Ex. 2056 ¶ 148). For this portion of claim 44, Petitioner relies on Hinckley’s teachings regarding having thresholds, as we discuss above, and not Hinckley’s proximity sensor. Thus, Patent Owner’s argument is misplaced. *See Bradium Techs. LLC v. Iancu*, 923 F.3d 1032, 1050 (Fed. Cir. 2019) (quoting *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986)) (Obviousness cannot be overcome “by attacking references individually where the [ground] is based upon the teachings of a combination of references.”). For the same reason, we find unavailing Patent Owner’s arguments regarding Petitioner and Dr. Bederson’s discussion of Hinckley’s peripheral interface controller (“PIC”) microprocessor 252 and amplifier 270. PO Resp. 67–68 (citing Ex. 1002 ¶¶ 90, 131–132, 143–147; Ex. 1011 ¶ 29; Ex. 2056 ¶¶ 149–151).²²

We also find unavailing Patent Owner’s arguments that “Dr. Bederson attempts to generalize Hinckley’s range ‘estimates’ to find the claimed ‘predetermined threshold,’” and that “Hinckley does not mention any ‘predetermined threshold’” but “instead teaches ‘estimated’ ranges [that] correspond to (1) no object is near, (2) the object is near, and (3) the object is in-range.” PO Resp. 68–69 (citing Ex. 1002 ¶¶ 131–132; Ex. 1011 ¶¶ 44–45, 55). But we focus on what Hinckley teaches and its functionality, rather

²² That Petitioner alternatively argues that Hinckley also teaches parts of claim 44 (e.g., circuitry) is of no moment. Pet. 51–52. As we discuss, Petitioner combines Reime’s circuitry with Hinckley’s teaching of having thresholds.

than what words Hinckley calls the teachings. *See In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (a reference does not have to satisfy an *ipsissimis verbis* test to disclose a claimed element). And we agree with Petitioner and find that Hinckley teaches predetermined thresholds. *See* Ex. 1011, Fig. 7, ¶ 44. In particular, Hinckley teaches selecting sensor values 50 and 180 (i.e., predetermined thresholds) that relate to distance to the object to describe its location (e.g., close). *Id.* Hinckley selects these particular sensor values to divide the distance into ranges. *Id.* That the sensor values are used as endpoints in Hinckley’s ranges does not negate that the sensor values are predetermined thresholds.

We also find unavailing Patent Owner’s argument that “Hinckley’s hardware is incompatible with Reime’s measurement cycles because Hinckley’s proximity sensor operates in a constant listening mode and outputs detected light signals over an entire operational range.” PO Resp. 70 (citing Ex. 2056 ¶ 153). This argument incorrectly describes how Petitioner combines the cited teachings for this combination. Petitioner does not bodily incorporate Hinckley’s proximity sensor into Reime. Instead, Petitioner applies Hinckley’s teachings of having predetermined thresholds to Reime’s hardware, as we discuss above, and Petitioner is not “compelled to adopt every single aspect of [Hinckley’s] teaching without the exercise of independent judgment.” *Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 889 (Fed. Cir. 1984); *In re Mouttet*, 686 F.3d 1322, 1331 (Fed. Cir. 2012) (“A reference may be read for all that it teaches, including uses beyond its primary purpose.”); Pet. 49–54.

Likewise, we also find unavailing Patent Owner’s arguments that one of ordinary skill in the art “could not achieve Hinckley’s power efficiency by isolating and somehow combining only Hinckley’s proximity sensor

with Reime's light guide," "Hin[c]kley's proximity sensor . . . does not 'detect the location of touches,'" "Reime's x,y detection signals and Hinkley's z-direction signal do not even use the same coordinate axes," and that "touching Reime's waveguides decreases or interrupts the signal, while Hinkley teaches a decreasing or 0-signal corresponds to an object at an infinite distance away (no touch)." PO Resp. 70 (citing Ex. 2056 ¶ 154); PO Remand 15 (citing Ex. 1010 ¶¶ 79, 86; Ex. 1011, Fig. 7); *see also* PO Sur-reply 25–26 (making arguments related to Hinckley's hardware). Again, Petitioner does not bodily incorporate Hinckley's hardware into Reime.

In addition, we find unavailing Patent Owner's argument that "modifying Reime to detect objects at Hinckley's proximity ranges would flood Reime's receivers with light, rendering Reime's waveguide inoperable." PO Sur-reply 25 (citing Ex. 1011 ¶¶ 44–45, 51–52, 55, Fig. 7; Ex. 1037,²³ 162:19–163:18); PO Remand 15 (citing Ex. 2056 ¶ 101; Ex. 1037, 162:25–163:9, 164:24–165:2) (making same argument); PO Resp. Remand 5. As we discuss above, Petitioner cites Hinckley's teachings for having predetermined thresholds, rather than bodily incorporating Hinckley's specific proximity ranges. And this argument relies on Dr. Cairns's testimony which is unsupported, and entitled to little to no weight. Moreover, to the extent that this testimony suggests that Reime does not teach detecting an object's presence at a distance, the testimony is contrary to Reime's teachings that it is not necessary for the object to physically touch a surface for the sensors to detect its presence. *See* Ex. 1010 ¶ 74.

²³ Deposition Transcript of Darran R. Cairns, Ph.D. (July 14, 2022).

In addition, we find unavailing Patent Owner’s arguments that “Petitioner’s statements regarding ‘simple arithmetic’ to compare between Reime’s high-pass filter outputs to Hinckley’s signal response curve make no sense,” that “Hinckley’s signal response curve is a non-linear and exponential signal and Reime’s high-pass filter does not relate to any signal amplitude,” and that one of ordinary skill in the art “would have understood that the two scales have no relationship.” PO Resp. 70 (citing Ex. 2056 ¶ 154). These arguments also incorrectly incorporate Hinckley’s specific structure—its signal response curve—rather than recognize that Petitioner relies on Hinckley’s teachings of having thresholds for comparison. And as we discuss above, Reime’s high-pass filtering is but the first part, with Petitioner also relying on Reime’s teaching of measuring the amplitude after the filtering.

We also find unavailing Patent Owner’s argument that “significant and undue experimentation would be required to implement proximity/ambient light sensing techniques with Reime’s waveguide.” PO Sur-reply 26 (citing Ex. 2056 ¶¶ 102, 154; Exs. 2061,²⁴ 2062,²⁵ 2063²⁶; Ex. 1037, 164:24–165:2). This argument relies on declaration testimony

²⁴ *LED Backlighting for LCDs Requires Unique Drivers*, Electronic Design Publication, Tomi Koskela, Applications Engineer, National Semiconductor, May 12, 2008, <https://www.electronicdesign.com/markets/lighting/article/21190412/led-backlighting-for-lcds-requires-unique-drivers>.

²⁵ *Gesturing at Your TV Isn’t Ready for Prime Time*, MIT Technology Review, Erica Naone, November 8, 2010, <https://www.technologyreview.com/2010/11/08/199103/gesturing-at-your-tv-isnt-ready-for-prime-time/>.

²⁶ *Hardware Design Guide to Smartphone Ambient-Light Sensing*, Electronic Design Publication, Steven Li, Application Manager (ams), May 3, 2016, <https://www.electronicdesign.com/technologies/android/article/21801487/hardware-design-guide-to-smartphone-ambientlightsensing>.

regarding Hinckley's hardware, despite Petitioner's combination instead adding Hinckley's teachings of having thresholds. Ex. 2056 ¶¶ 102, 154. And Patent Owner does not explain sufficiently how the cited portion of Dr. Cairns's deposition testimony supports its argument as to the combination's teachings. Moreover, Patent Owner cites Exhibits 2061–2063 without identifying any relevant portions or explaining how they support Patent Owner's argument as to Reime. PO Sur-reply 26 (citing Exs. 2061–2063).

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Reime and Hinckley renders claim 44 obvious.

D. Challenged Claims 45, 46, and 48

Petitioner argues that the combination of Reime and Hinckley renders obvious claims 45, 46, and 48. Pet. 54–57. Claims 46 and 48 depend from claim 45, which depends from claim 44. As we discuss above, we find that Reime, as well as the combination of Reime and Hinckley, teaches claim 44. *See supra* Sections V.F, VI.C. And we find that Reime teaches claims 45, 46, and 48. *See supra* Sections V.G–H. For claims 45, 46 and 48, Petitioner does not separately rely on Hinckley. Nor does Patent Owner provide separate arguments for these claims for this ground.

Accordingly, we find that Petitioner shows by a preponderance of the evidence that the combination of Reime and Hinckley renders claims 45, 46, and 48 obvious.

E. Challenged Claim 49

Claim 49 depends from claim 44 and further recites “wherein the non-imagewise input further corresponds to a location of the at least one sensor element when the amount of radiation detected by the at least one

sensor element is below a second predetermined threshold.” Ex. 1001, 70:36–40. We agree with Petitioner and find that the combination of Reime and Hinckley teaches claim 49. Pet. 49–54, 57–58.

In particular, we agree with Petitioner that claim 49 adds a “second predetermined threshold” to claim 44, and adds that the “radiation detected is below” that second threshold. *Id.* at 57. We also agree that one of ordinary skill in the art “would have found it obvious to compare the output signal in Reime, such as output signal 130 or I_R , to first and second predetermined thresholds to detect the location of touches” in light of the combined teachings. *Id.* (citing Ex. 1002 ¶ 145).

More specifically, Hinckley teaches having two predetermined thresholds (e.g., sensor values 50 and 180), as we discuss above. *See* Fig. 7, ¶ 44; *supra* Section VI.C. As Petitioner argues, Hinckley teaches that if the sensor value exceeds value 180 (a first predetermined threshold), then the object is considered close. Ex. 1011 ¶ 44. If the sensor value is below value 50 (second predetermined threshold), the object is considered out of range. *Id.*; *see also id.* ¶ 55 (teaching that the first and second thresholds result in different “context variables”, i.e., “Close,” “InRange,” and “OutOfRange”). We also agree with Petitioner and find that “Hinckley teaches to control device operations and power depending on these variables and ranges.” Pet. 58 (citing Ex. 1011 ¶¶ 46, 62). Thus, Hinckley teaches using two predetermined thresholds to provide for more functionality than a single threshold value.

In addition, we agree with Petitioner and find that one of ordinary skill in the art would have been motivated to combine Reime and Hinckley’s teachings so as to render claim 49 obvious and would have had a reasonable

expectation of success for the reasons we discuss above for claim 44. *See id.* at 58; *supra* Section VI.C.

Patent Owner does not provide separate arguments for claim 49, but rather relies on its arguments made for claim 44. PO Resp. 65–71; PO Remand 14–15. As we discuss above, we find these arguments unavailing. *See supra* Section VI.C.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Reime and Hinckley renders claim 49 obvious.

F. Challenged Claims 56–58

Petitioner argues that Reime teaches claims 56–58. Pet. 59–61. Claim 58 depends from claim 57, which depends from claim 56, which depends from independent claim 44. As we discuss above, we find that Reime, as well as the combination of Reime and Hinckley, teaches claim 44. *See supra* Sections V.F, VI.C. And we find that Reime teaches claims 56–58. *See supra* Section V.J. For claims 56–58, Petitioner does not separately rely on Hinckley. Nor does Patent Owner provide separate arguments for these claims for this ground.

Accordingly, we find that Petitioner shows by a preponderance of the evidence that the combination of Reime and Hinckley renders claims 56–58 obvious.

VII. ALLEGED OBVIOUSNESS OVER REIME, HINCKLEY, AND ELIASSON

Petitioner argues that the combination of Reime, Hinckley, and Eliasson renders obvious claim 48. Pet. 4, 61–64. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that this combination renders claim 48 obvious.

A. Summary of Eliasson

Eliasson relates to “determining the position of a radiation scattering/reflecting element, where the radiation emitter is provided at a surface of a radiation transmissive element on which radiation is incident.” Ex. 1015, code (57). “This incident radiation is scattered/diffused/reflected by the scattering/reflecting element and guided by the transmissive element toward a detector able to determine the position of the element.” *Id.*

B. Challenged Claim 48

Petitioner argues that the combination of Reime, Hinckley, and Eliasson teaches claim 48. Claim 48 depends from claim 45, which depends from claim 44. Claim 48 further recites “wherein the light reflected by the object is transmitted through the viewing plane defining plate directly to the at least one sensor element.” Ex. 1001, 70:32–35. We agree with Petitioner and find that this combination teaches this limitation. Pet. 61–64; Pet. Reply 30; Pet. Remand 14–15.

In particular, we agree with Petitioner that Eliasson teaches light reflected by an object (i.e., a finger) is transmitted through the viewing plane defining plate (i.e., transmissive plate) directly to the at least one sensor element (i.e., light sensor). Pet. 63 (citing Ex. 1015, 10:16–18); Pet. Reply 30 (citing Ex. 1015, 10:16–18, Fig. 6). For example, Eliasson teaches that its detector “is positioned at an edge portion of the plate 12 so as to directly receive the light travelling in the plate 12.” Ex. 1015, 10:16–18. And we find persuasive Dr. Bederson’s testimony that “Eliasson’s Figure 6 shows that light reflected from the user’s finger is directly received by ‘at least one’ light sensor (the circle at the right edge of plate 12)” Ex. 1035 ¶ 66.

This testimony is consistent with Figure 6, shown below, as annotated by Petitioner.

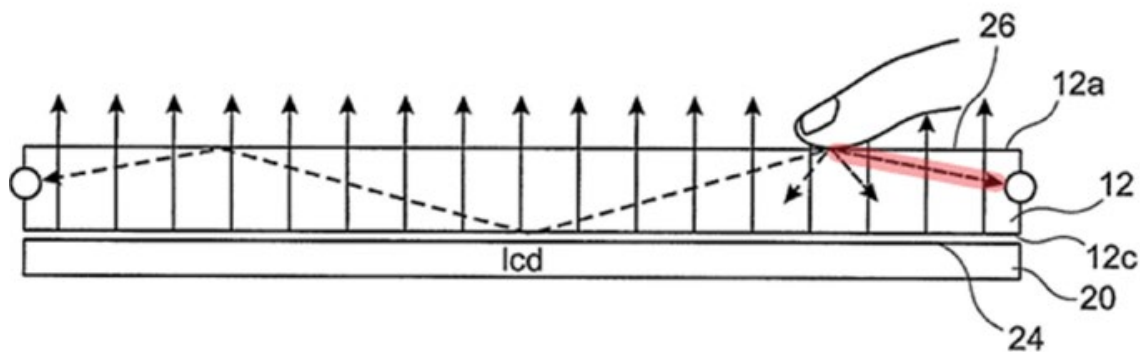


Figure 6 illustrates an embodiment using a color coding of the light in accordance with Eliasson’s teachings. Ex. 1015, 9:45–46. Petitioner annotates the figure by coloring in red the light that is reflected off the finger directly through plate 12 to the light sensor. Pet. 30.

We find unavailing Patent Owner’s argument that “Eliasson’s ‘transmissive plate’ . . . requires internal reflections, which teaches away from ‘light reflected by the object is transmitted through the viewing plane defining plate *directly* to the at least one sensor element.’” PO Resp. 77 (citing Ex. 2056 ¶ 167). As illustrated above, Eliasson teaches that some of the light is reflected directly through plate 12 to a light sensor.

We also find unavailing Patent Owner’s arguments that Petitioner provides a new theory that should be disregarded. PO Sur-reply 30. As we discuss above, Petitioner’s theory that “some” reflected light is what is required is not new. And Petitioner’s reply arguments on this issue are in direct response to Patent Owner’s proposed construction, and arguments Patent Owner makes pursuant therewith, making Petitioner’s reply arguments proper. CTPG 74.

VIII. INTERACTIVE COMMC'NS INT'L V.
BLACKHAWK NETWORK

Patent Owner argues that the Director's decision in *Interactive Commc'ns Int'l v. Blackhawk Network, Inc.*, IPR2024-00465, Paper 40 (PTAB Oct. 9, 2025) (Director Review) applies here. More specifically, Patent Owner argues that like the expert in *Interactive Commc'ns*, Petitioner's expert here provides contradictory expert testimony regarding "material hardware modifications." Open Br. 1–2. And we thus should find Petitioner's expert not credible and that "the Petition was deficient at the onset," according to Patent Owner. *Id.* (citing *Interactive Commc'ns*, Paper 40 at 3–4).

We now step through Patent Owner's arguments that Petitioner's expert provides contradictory testimony, and we find these arguments unavailing. First, Patent Owner argues that Petitioner's "expert initially referenced all of Reime's 'optical sensor components' without specifying which component(s) he was relying on." *Id.* at 1 (citing Ex. 1002 ¶¶ 86–88, 92–94). Then, during his deposition, the "expert directly contradicted his initial testimony by stating: (1) he was 'not' relying on Reime's emitters 10 and 12 . . . , [and] (2) he was apparently only relying on Reime's receivers 30 and 32," according to Patent Owner. *Id.* at 2 (citing Ex. 2060, 126:22–127:5, 127:17–18). At most, these arguments on their face allege that Dr. Bederson clarified during his deposition what he was relying on, rather than created a contradiction. Moreover, looking at the cited declaration testimony, Dr. Bederson did not state that the detector assembly includes emitters. Ex. 1002 ¶¶ 86–88, 92–94. Rather, he stated that the emitters and the detectors are located at the edges of the screen. *Id.* ¶¶ 87–88, 94. But notably, he stated that "Reime discloses that the detector assembly

comprises a support substrate and an arrangement of detector elements”—he did not include emitters in this statement. Ex. 1002 ¶ 94. Thus, the declaration testimony does not contradict the deposition testimony.

Compare Ex. 1002 ¶¶ 86–88, 92–94, *with* Ex. 2060, 126:22–127:5, 127:17–18); *see also supra* Section V.B (addressing similar argument).

Second, Patent Owner argues that Dr. Bederson contradicted his declaration testimony by testifying in his deposition that “he considered *each* of Reime’s individual receivers to be part of a ‘*different*’ respective detector assembly.” Open Br. 2 (citing Ex. 2060, 130:7–13). Patent Owner, however, ignores that during his deposition that Dr. Bederson clarified this testimony and also testified that “if you had a single assembly with detectors 30 and 32 as part of a single assembly, then that would be one assembly, and that assembly as a whole would have an arrangement of multiple detector elements, and that entire detector assembly would be arranged at at least one edge.” Ex. 2060, 137:16–21. In fact, Patent Owner’s question that followed was: “It is getting a little confused here. Your testimony was that the components 30 and 32 were detector assemblies. Now your testimony, as I understand it, is that 30 and 32 could be part of the same detector assembly; is that correct?” *Id.* at 138:10–14. Dr. Bederson’s response began as: “I’ve been -- I think I’ve been explaining all along that Reime is full of disclosures of different configurations, and I’ve been walking through several of them. I started off with simpler ones, but I think these are all examples of disclosures of Reime that were disclosed.” *Id.* at 138:16–22. And Dr. Bederson completed his response²⁷ as: “And another example would be

²⁷ We omit a question interjected during Dr. Bederson’s response, as well as the portion of his response that was to that interjected question. *See* Ex. 2060, 139:4–10.

to use detectors 30 and 32 on a single substrate that together would be a single detector assembly arranged along, in this case, I guess, two edges of the interactive surface element.” *Id.* at 139:11–14. Thus, Dr. Bederson’s deposition testimony does not contradict his declaration testimony that “Reime discloses that the detector assembly comprises a support substrate and an arrangement of detector elements”—we surmise that this is the relevant portion of the cited declaration testimony, as Patent Owner does not specifically identify a portion thereof. Ex. 1002 ¶ 94.

Third, Patent Owner argues that Dr. Bederson contradicted his declaration testimony by testifying in his deposition that “Reime does *not* disclose its individual receiver could comprise multiple detector elements.” Open Br. 2 (citing Ex. 2060, 139:7–10). During his deposition, Dr. Bederson testified that “I am not aware of a specific disclosure in Reime that shows that the detector 30 consists of multiple individual detectors, but that would clearly be obvious to a person of skill in the art.” Ex. 2060, 139:7–10. Patent Owner does not identify what in the cited declaration testimony that this deposition testimony allegedly contradicts, and we cannot discern it. *See* Open Br. 2 (citing Ex. 1002 ¶¶ 86–88, 92–94). Moreover, this deposition testimony is consistent with his declaration testimony that one of ordinary skill in the art “would have understood that each one of the plurality of discrete detectors in Reime must be either a single-element detector or a multi-element detector.” *Compare* Ex. 2060, 139:7–10, with Ex. 1002 ¶¶ 98–101.

Lastly, we find unavailing Patent Owner’s argument that Dr. Bederson testified during his deposition that “he didn’t perform any analysis regarding a ‘hypothetical’ modification to combine Reime’s receivers together to form the claimed detector assembly.” Open Br. 2

(citing Ex. 2060, 127:22–128:3, 128:7–12, 128:17–129:2). As we discuss above, this argument mischaracterizes the deposition testimony. *See supra* Section V.B. Again, Dr. Bederson testified that he did not analyze replacing Figure 8B’s emitters 10 and 12 with receivers 30 and 32, rather than not analyzing whether Reime’s receivers together formed the claimed detector assembly, as Patent Owner incorrectly alleges. *See* Ex. 2060, 127:22–129:2.

In sum, we find that *Interactive Commc’ns* does not apply to the circumstances of this proceeding.

IX. CONCLUSION²⁸

Based on the full record, we determine that Petitioner shows by a preponderance of the evidence that (i) claims 29, 36–38, 44–46, 48, and 56–58 are unpatentable over Reime; (ii) claims 29, 36–38, 44–46, 48, 49, and 56–58 are unpatentable over the combination of Reime and Hinckley; and (iii) claim 48 is unpatentable over the combination of Reime, Hinckley, and Eliasson.

Claim(s)	35 U.S.C. §	Reference(s) /Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
29, 36–38, 44–46, 48, 49, 56–58	103(a)	Reime	29, 36–38, 44–46, 48, 56–58	49

²⁸ 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. 16,654 (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).

29, 36–38, 44–46, 48, 49, 56–58	103(a)	Reime, Hinckley	29, 36–38, 44–46, 48, 49, 56–58	
48	103(a)	Reime, Hinckley, Eliasson	48	
Overall Outcome			29, 36–38, 44–46, 48, 49, 56–58	

X. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, pursuant to 35 U.S.C. § 314(a), Petitioner has shown by a preponderance of the evidence that 29, 36–38, 44–46, 48, 49, and 56–58 of the '093 patent are unpatentable; and

FURTHER ORDERED that parties to the proceeding seeking judicial review of this Final Written Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2021-01266
Patent 9,569,093 B2

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