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Paper 41
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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.

IPR2021-01220
Patent 8,610,675 B2

Before BARBARA A. PARVIS, SHEILA F. McSHANE, and JOHN D. HAMANN, *Administrative Patent Judges.*

PARVIS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
Denying Patent Owner's Motion to Exclude
35 U.S.C. § 318(a)

I. INTRODUCTION

We instituted an *inter partes* review of claims 1, 2, 6, and 9–13 ("challenged claims") of U.S. Patent No. 8,610,675 B2 (Ex. 1001, "the '675 patent") owned by Power2B, Inc. ("Patent Owner"). Paper 12 ("Decision to Institute" or "Inst. Dec."). We have authority to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision issues pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. We determine that Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, "Petitioner") proved by a preponderance of the evidence that claims 1, 2, 6, 9–11, and 13 of the '675 patent are unpatentable. We determine Petitioner has not proved by a preponderance of the evidence that claim 12 of the '675 patent is unpatentable.

A. Procedural History

Petitioner filed a Petition (Paper 3 ("Pet.")) requesting *inter partes* review of the challenged claims of the '675 patent, along with the supporting Declaration of Benjamin B. Bederson, Ph.D. (Ex. 1002). Patent Owner filed a Preliminary Response. Paper 8 ("Prelim. Resp."). With our authorization, Petitioner filed a Reply to Patent Owner's Preliminary Response (Paper 10) and Patent Owner filed a Sur-Reply (Paper 11).

The Decision to Institute (Paper 12) was entered on January 20, 2022. Inst. Dec. 1. Subsequently, Patent Owner filed a Patent Owner Response (Paper 17 ("Resp.")), along with the supporting Declaration of Darran R. Cairns, Ph.D. (Ex. 2056). Petitioner filed a Reply (Paper 21 ("Reply")), along with the Reply Declaration of Dr. Bederson (Ex. 1035). Patent Owner filed a Sur-reply (Paper 26 ("Sur-reply")). Patent Owner also filed a Motion to Exclude certain of Petitioner's evidence (Paper 28, "Mot." or "Motion") and Petitioner filed an Opposition (Paper (Paper 34, "Opp'n"). The oral

hearing was held on October 14, 2022. A copy of the hearing transcript has been entered into the record as Paper 40 ("Tr.").[1]

B. Real Parties-in-Interest

Petitioner identifies as the real parties-in-interest the following: Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. Pet. 2. Patent Owner names itself as the real party-in-interest. Paper 7, 2.

C. Related Matters

Each party identifies a judicial matter that would affect, or be affected by, a decision in this proceeding. In particular, the parties inform us that the '675 patent is asserted in the following district court proceeding: *Power2B, Inc. v. Samsung Electronics Co., Ltd. et al.*, Case No. 6:20-cv-01183-ADA (W.D. Tex.) (filed December 23, 2020) ("parallel district court proceeding"). Pet. 2; Paper 7, 2. That case has been stayed. Tr. 28:12–14.

Petitioner also has filed (1) a petition for *inter partes* review of U.S. Patent No. 10,156,931 B2 (IPR2021-01190); (2) a petition for *inter partes* review of U.S. Patent No. 8,624,850 B2 (IPR2021-01239); (3) a petition for *inter partes* review of U.S. Patent No. 9,317,170 B2 (IPR2021-01257); and (4) a petition for *inter partes* review of U.S. Patent No. 9,569,093 B2 (IPR2021-01266). *Inter partes* review has been instituted in each of the proceedings. Final Written Decisions have been entered in IPR2021-01190 and IPR2021-01257. The remaining proceedings are ongoing.

[1] Each party filed objections to the other party's demonstrative exhibits. Papers 38, 39. We took into consideration the parties' objections in our review and reference of the transcript.

D. The '675 Patent

The '675 patent is titled "INTERACTIVE DEVICES" and relates to an interactive assembly including at least one interactive surface element. Ex. 1001, codes (54), (57). Figure 4 of the '675 patent illustrates a portion of an input device and is reproduced below. *Id.* at 7:30–31.

FIG. 4

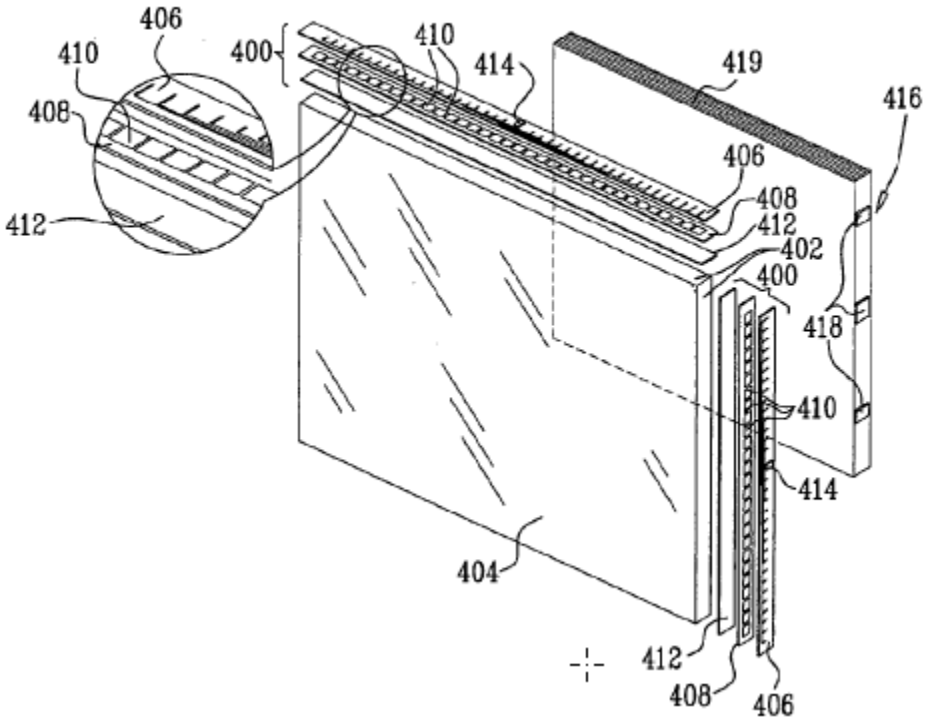


Figure 4, above, illustrates a portion of an input device employing detector elements arranged along edges of an interactive surface element. *Id.* at 18:59–63.

As shown in Figure 4, detector assembly 400 is arranged along edge 402 of interactive surface element 404 to sense light. *Id.* at 18:64–67. Interactive surface element 404 may be a single or multiple layer plate and may have one or more coating layers associated therewith. *Id.* at 18:67–19:2. Interactive surface element 404 may be associated with a display panel, such as a liquid crystal display (LCD). *Id.* at 19:2–4. The viewing plane of the display panel may coincide with a portion of the interactive surface element

404. *Id.* at 19:4–5. Detector assemblies 400 are provided along two mutually perpendicular edges 402. *Id.* at 19:6–7.

Detector assembly 400 comprises a support substrate 406 onto which is mounted a linear arrangement 408 of detector elements 410. *Id.* at 19:12–15. Interposed between linear arrangement 408 and edge 402 is a cover layer 412. *Id.* at 19:15–16. Cover layer 412 may have multiple functions including physical protection, light intensity limitation, and field-of-view limitation and it may have optical power. *Id.* at 19:16–19. Support substrate 406 may be mounted onto a display housing. *Id.* at 19:23–24. Support substrate 406 may also provide mounting for and electrical connections to the detector elements 410. *Id.* at 19:29–31. Processor 414 for processing the outputs of the detector elements 410 may also be mounted on support substrate 406. *Id.* at 19:31–33.

E. Illustrative Claim

Petitioner challenges claims 1, 2, 6, and 9–13 of the '675 patent. Pet. 1. Claims 1 and 13 are independent claims. Claims 2, 6, and 9–12 depend, directly or indirectly, from claim 1. Independent claim 1, reproduced below, is illustrative of the claimed subject matter.

> 1. [pre[2]] A position sensing assembly comprising:
>
> [a] an interactive surface element defining a surface;
>
> [b](1) at least one pixel array comprising a plurality of detector elements configured to detect electromagnetic radiation at a baseline level, (2) the at least one pixel array being configured to sense a position of at least one object with respect to a surface thereof according to locations of ones of the plurality of detector elements at which at least one of an amount of radiation detected and a change in the

[2] Herein we use Petitioner's designations for the elements of claim 1. Pet. 22–46.

amount of radiation detected exceeds a predetermined threshold, (3) the at least one pixel array being configured to sense at least a position of the at least one object with respect to the at least one pixel array when the at least one object has at least a predetermined degree of propinquity to the at least one pixel array;

[c] circuitry coupled to and receiving an output from the at least one pixel array receiving, the circuitry being configured to provide a non-imagewise input representing the position of the at least one object relative to the at least one pixel array; and

[d] wherein the change in the amount of radiation detected results from ones of the plurality of detector elements detecting reflected light from the object in addition to detecting the radiation at the baseline level.

Ex. 1001, 73:10–33.

F. Evidence

Petitioner relies on the patent document references summarized in the table below.

Name	Patent Document	Exhibit No.
Yamaguchi	US 2005/0219229 A1	1009
Reime	US 2003/0034439 Al	1010
Hinckley	US 2002/0021278 Al	1011

G. Asserted Grounds

Petitioner asserts that the challenged claims of the '675 patent are unpatentable based on the following grounds summarized in the table below:

Claims Challenged	35 U.S.C. §[3]	Reference(s)/Basis
1, 2, 6, 9–11, 13	103(a)	Yamaguchi

[3] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. § 103, and was effective on March 16, 2013. Because the challenged claims of the '675 patent have an apparent

Claims Challenged	35 U.S.C. §[3]	Reference(s)/Basis
1, 2, 6, 9–11, 13	103(a)	Yamaguchi, Hinckley
1, 2, 6, 10–13	103(a)	Reime
1, 2, 6, 10–13	103(a)	Reime, Hinckley

II. ANALYSIS

We start by addressing Patent Owner's Motion to Exclude certain of Petitioner's evidence. We then turn to our analysis of the parties' arguments and evidence regarding the patentability of the challenged claims.

A. Patent Owner's Motion to Exclude

Patent Owner filed a Motion to Exclude certain of Dr. Bederson's testimony in his Reply Declaration (Ex. 1035), arguing that the testimony is irrelevant and has little probative value. Mot 1. In particular, Patent Owner argues that we should exclude the following: (1) paragraphs 7 and 14–19 of Exhibit 1035, which Patent Owner argues are introduced for the sole purpose of supporting attorney argument against Patent Owner's proposed claim constructions (Mot. 1–2); and (2) paragraphs 23–26, 28–31, 39–40, 42, and 43 of Exhibit 1035, which Patent Owner argues are introduced for the sole purpose of supporting attorney argument for Petitioner's Grounds 1–4 (Mot. 2–3). Patent Owner relies on the Federal Rules of Evidence ("FRE" or "Fed. R. Evid.") 401 through 403 as legal support for its arguments that the identified paragraphs are inadmissible. *See generally* Mot.

In its Opposition, Petitioner provides a table including the testimony in each contested paragraph, along with citations to the record set forth in that testimony, and the corresponding argument in Patent Owner's Response

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effective filing date before March 16, 2013, we refer to the pre-AIA version of 35 U.S.C. § 103.

that the testimony responds to. Opp'n 2–6. Petitioner argues, in contrast to Patent Owner's arguments, that Dr. Bederson's testimony directly responds to arguments in Patent Owner's Response and, therefore, is highly relevant and probative of the issues raised by Patent Owner. *Id.* at 1, 7. Petitioner also argues that Bederson's testimony "is replete with citations to the record" and is "well-supported" proper expert testimony. *Id.* (citing Fed. R. Evid. 702–704; Patent Trial and Appeal Board Consolidated Trial Practice Guide (November 2019) ("TPG")[4]).

Petitioner argues that the probative value of Dr. Bederson's testimony in his Reply Declaration (Ex. 1035) is not outweighed by any unfair prejudice or confusion. Opp'n. 7. Petitioner argues that Patent Owner's arguments in that regard are conclusory and unsupported. *Id.* at 7–8. Petitioner further argues any "alleged 'prejudice'" is Patent Owner's "own making" because Patent Owner did not take a deposition to cross-examine Dr. Bederson regarding his testimony in his Reply Declaration. *Id.* at 1.

Petitioner further argues that Patent Owner's Motion to Exclude is procedurally improper because it constitutes an unauthorized motion to strike. *Id.* at 9–10.

We find persuasive Petitioner's arguments on the relevancy and the probative value of the expert testimony at issue. Patent Owner does not provide any specific explanations as to why the testimony at issue is irrelevant or has little or no probative value. Federal Rule of Evidence 401 provides that evidence is relevant if it "has any tendency to make a fact more or less probable than it would be without the evidence" and "the fact is of

[4] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated; *see also* 84 Fed. Reg. 64,280 (Nov. 21, 2019).

consequence in determining the action." Fed. R. Evid. 401; Fed. R. Evid. 402 ("Relevant evidence is admissible"). Courts have characterized the relevance threshold as being "very low." *United States v. White*, 692 F.3d 235, 246 (2nd Cir. 2012) (quoting *United States v. Al-Moayad*, 545 F.3d 139, 176 (2nd Cir. 2008)). Under this standard, we find that Dr. Bederson's testimony is relevant. Additionally, under the circumstances here, a bench trial, Rule 403 has limited applicability. *See, e.g.*, *Schultz v. Butcher III*, 24 F.3d 626, 632 (4th Cir. 1994). Patent Owner does not provide explanation as to why there would be prejudice to it and we can weigh the evidence without improper inference. Accordingly, we do not find a basis for exclusion under Federal Rule of Evidence 403.

We agree with Petitioner (Opp'n 1) that Patent Owner's arguments go to the weight we should give Dr. Bederson's testimony, not its admissibility. Patent Owner has not been left without an opportunity to address the Reply argument and evidence. Patent Owner was given the opportunity to file a sur-reply to Petitioner's reply. Paper 13, 11. Indeed, Patent Owner filed a Sur-reply responding to Petitioner's arguments and evidence in its Reply regarding claim construction and patentability. *See generally* Sur-reply. Also, Patent Owner had the opportunity, but declined to request a deposition of Dr. Bederson to cross-examine him on his Reply Declaration.

Regarding Petitioner's procedural argument that Patent Owner's Motion to Exclude is an unauthorized Motion to Strike (Opp'n 9–10), we are not persuaded on the record before us that Petitioner's Reply or Dr. Bederson's Reply Declaration include new, improper argument. Patent Owner argues that the testimony supports attorney argument, but Patent Owner does not argue that the attorney argument is new or improper and

Patent Owner does not identify any portions of Petitioner's Reply that Patent Owner argues should be excluded.

For the reasons given, we *deny* Patent Owner's Motion to Exclude.

B. Patentability: Principles of Law

To prevail in its challenges to the patentability of all claims of the '675 patent, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). "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); *see also* 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim"). That burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015); *see also In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375–78 (Fed. Cir. 2016) (discussing the burden of proof in *inter partes* review).

A patent 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 the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *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) when in evidence, objective

evidence of nonobviousness, i.e., secondary considerations.[5] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

C. Level of Ordinary Skill in the Art

Petitioner asserts the following:

> One of ordinary skill in the art would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and at least two 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.

Pet. 8 (citing Ex. 1002 ¶ 40).

At the institution stage Petitioner's proposed qualifications were undisputed. *See generally* Prelim. Resp.; Inst. Dec. 19. For purposes of the Decision to Institute, we adopted Petitioner's proposed qualifications for an ordinary level of skill, except we declined to adopt "at least" as that language is vague and open-ended. Inst. Dec. 19.

At this stage in the proceeding, Patent Owner disagrees with Petitioner's proposed qualifications and asserts the following:

> A person having ordinary skill in the art ("POSITA") would have had a bachelor's degree in electrical engineering, computer engineering, physics, or a related field, and at least three years of experience relating to research, design, and/or development of sensor systems, circuits and signal processing algorithms, or the equivalent, with education substituting for experience and vice versa.

Resp. 9 (citing Ex. 2056 ¶¶ 8–10). Patent Owner states, however, that it does not believe that the parties' differing definitions of a person of ordinary skill

[5] Patent Owner does not present objective evidence of nonobviousness. *See generally* Resp.; Tr. 59:18–60:3.

in the art affect the resolution of any dispute between the parties. *Id.* Petitioner does not respond to Patent Owner's proposed qualifications. *See generally* Reply.

We find that, for the most part, Petitioner's proposed definition is the better definition for purposes of this proceeding, except we again decline to adopt "at least" because that language is vague and open-ended. With respect to the educational qualifications, Petitioner's proposed qualifications are that one of ordinary skill in the art would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field. Pet. 8 (citing Ex. 1002 ¶ 40). The claims are directed to an interactive assembly comprising at least one input sensor to provide an output indicative of an impingement of an electromagnetic radiation spot. Individuals with bachelor's degrees in physics would be knowledgeable in researching, designing, or developing such assemblies and would be able to comprehend and evaluate the teachings of the prior art. Accordingly, Petitioner's proposed qualifications are overly narrow in not including individuals with bachelor's degrees in physics. With respect to work experience, a person having two years of experience would be able to comprehend and evaluate the teachings of the prior art, consistent with Petitioner's proposal.

Considering the subject matter of the '675 patent, the background technical field, and the asserted prior art, we agree with Patent Owner's addition of "physics" in its proposed qualifications of the educational level for a person having an ordinary level of skill and we otherwise agree with Petitioner's proposed qualifications, except without the "at least" language. Based on the complete record now before us, the level of skill that we adopt is set forth immediately below.

> One of ordinary skill in the art would have had a bachelor's degree in electrical engineering, computer engineering, computer science, physics, or a related field, and at least two 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.

We find that the definition set forth above is consistent with the level of skill reflected in the Specification of the '675 patent and the asserted prior art references. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Our analysis and conclusions herein, however, do not turn on whether we adopt Petitioner's proposed qualifications, Patent Owner's proposed qualifications, or differences in the qualifications set forth immediately above.

D. Claim Construction

We construe the challenged claims by applying the standard used in federal courts, in other words, "the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b)," which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). Under this standard, the words of a claim generally are given their "ordinary and customary meaning," which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips*, 415 F.3d at 1312–13. "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v.*

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

1. Recitations including the term "propinquity"

At the institution stage, Patent Owner provided the claim constructions entered in the parallel district court proceeding for the term "propinquity" and the phrase "when the [at least one] object [has at least/is within] a predetermined degree of propinquity" that includes the term "propinquity." Prelim. Resp. 25 (citing Ex. 1034). The District Court determined that the term "propinquity" means "proximity" as the final claim construction for the term. *Id.*; Ex. 1034, 2.[6] With respect to the claim phrase reciting the term "propinquity" with additional language, the District Court adopted the "plain and ordinary meaning for the remaining language." *Id.*; Ex. 1034, 2. At the institution stage, we stated "[f]or the claim recitations that include 'propinquity,' Petitioner has made a sufficient showing on the

[6] The District Court's Claim Construction Order includes a table that was sent to the parties prior to the Markman hearing. Ex. 1034; Ex. 2027. The table includes a column having the header "Court's Preliminary Construction." Ex. 1034. The District Court's Claim Construction Order states "[t]he Court held a Markman hearing on October 19, 2021" and "[d]uring that hearing, the Court provided *its final constructions*." Ex. 1034, 1 (emphasis added). The District Court's Claim Construction Order further states "[t]he Court now enters those claim constructions." *Id.* Notwithstanding the work "preliminary" in the column header, both parties treat the Court's Claim Construction Order as its final claim construction ruling. *See, e.g.*, Paper 10, 1; Reply 2; Sur-reply 3–4; Ex. 2028. Accordingly, we refer to the court's constructions in its November 10, 2021 Claim Construction Order as final. Nonetheless, our analysis and conclusions herein do not turn on whether the Court's claim constructions are preliminary or final.

merits under the claim construction that the Patent Owner applies, that is, the construction adopted by the District Court for these terms." Inst. Dec. 20–21.

In its Patent Owner Response, Patent Owner argues that the phrase "a predetermined degree of propinquity" means "a specified proximity distance established in advance and does not include touching." Resp. 11–12. Patent Owner relies on recitations in dependent claims 4, 7, and 10 and the '675 patent Specification. *Id.* at 10–19; *see also* Sur-reply 2–8. Patent Owner does not rely on the prosecution history. *Id.* Patent Owner argues that dependent claims 4, 7, and 10 "demonstrate that Patent Owner affirmatively uses different language to describe when an object 'touches' or is 'touching' the device." Resp. 14–15 (citing *Phillips*, 415 F.3d at 1315; *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004)).

Petitioner counters that claim language including the language of the dependent claims supports Petitioner's position, not Patent Owner's proposed construction. Reply 3–5. Petitioner argues that Patent Owner incorrectly relies on *Liebel-Flarsheim* in which the Federal Circuit held that "the presence of a dependent claim that adds a particular limitation raises a presumption that the limitation in question is not found in the independent claim." *Id.* at 5 (quoting *Liebel-Flarsheim*, 358 F.3d at 910). Petitioner argues in contrast, Patent Owner relies on claim differentiation "to achieve the opposite result—a narrower independent claim that excludes touching from the scope of possible 'predetermined degrees of propinquity.'" *Id.* Petitioner also argues "[a] claim construction that 'excludes the preferred embodiment is rarely, if ever, correct and would require highly persuasive evidentiary support.'" *Id.* at 6 (quoting *SynQor, Inc. v. Artesyn Techs., Inc.*, 709 F.3d 1365, 1378–79 (Fed. Cir. 2013) (internal citations omitted)).

In its Sur-reply, Patent Owner responds that claim 7 recites "additional 'utilization circuitry' operations" that are not precluded or excluded under Patent Owner's interpretation. Sur-reply 5. Patent Owner also argues that the "pixel array" operations in claim 1 and the "additional 'utilization circuitry' operations" in claim 7 are separately listed elements that are presumed distinct. *Id.* (citing *CAE Screenplates Inc. v. Heinrich Fiedler GmbH & Co. KG*, 224 F.3d 1308, 1317 (Fed. Cir. 2000); *Kyocera Senco Indus. Tools Inc. v. Int'l Trade Comm'n*, 22 F.4th 1369, 1382 (Fed. Cir. 2022)). Patent Owner also argues that claims need not cover every embodiment. *Id.* at 7 (citing *SIMO Holdings Inc. v. Hong Kong uCloudlink Network Tech. Ltd.*, 983 F.3d 1367, 1378 (Fed. Cir. 2021); *Kyocera*, 22 F.4th at 1383; *see also TIP Sys., LLC v. Phillips & Brooks/Gladwin, Inc.*, 529 F.3d 1364, 1373 (Fed. Cir. 2008)).

Patent Owner's construction is overly narrow and not supported by the intrinsic record. Starting with the claim language, nothing in the claim language prohibits a proximity distance of zero or excludes touching. Patent Owner incorrectly focuses on the term "propinquity" itself and ignores the surrounding claim language. That is whether propinquity and touching are mutually exclusive, as Patent Owner argues, is inapposite. The claims do not recite having a particular propinquity. Rather, they recite "ha[ving] *at least* a predetermined degree of propinquity," without reciting a lower bound. *E.g.*, Ex. 1001, 67:2–4 (emphasis added). The plain meaning thus includes a degree of propinquity and lesser distances (e.g., touching which has a zero distance).

We agree with Petitioner's arguments (Reply 3–5) that the dependent claim recitations do not support Patent Owner's position (Resp. 14–15; Sur-reply 4–5). We find unavailing Patent Owner's arguments regarding claim

differentiation and Patent Owner's responsive argument that its position does not raise a nullity concern because claims 1 and 7 recite different structures and operations that do not reference or exclude each other. *Id.* That claims 4 and 7 depending from claim 1 recite distinguishing between touching and not touching supports Petitioner's position that the "position sensing assembly" recited in claim 1 broadly encompasses sensing both touching and non-touching objects. That dependent claim 7 recites circuitry that performs the additional function of distinguishing between instances of touching or non-touching does not undermine Petitioner's argument that independent claim 1 does not exclude sensing the position of an object that is touching a pixel array. Similarly, the recitation in claim 10, which depends from claim 1, requiring that "the array detection output includes information corresponding to at least one of the location of an impingement point of the object on the surface and the location of the object relative to the surface" supports Petitioner's position that claim 1 encompasses both positions in which the object is touching and not touching the surface.

Although Patent Owner relies on embodiments in the '675 patent Specification (Resp. 10–19; Sur-reply 6–8), Patent Owner acknowledges that the '675 patent Specification describes alternate embodiments that support Petitioner's position. Sur-reply 6–8. Patent Owner further acknowledges that it relies on certain examples and does not assert that the Specification includes a definition or disavowal. Tr. 40:5–9.

Consistent with Petitioner's position, the '675 patent Specification includes description of embodiments in which an object is touching and not touching the pixel array. Ex. 1001, 62:11–13 ("In FIG. 20A, the user's fingers are located in propinquity to interactive surface element 1508, at a height H therefore, and in FIG. 20B, the user's fingers touch interactive

surface element 1508."), 62:48–50 ("In FIG. 21A, the user's fingers are located in propinquity to interactive surface element 1508, at respective heights H1 and H2 therefrom, and in FIG. 21B, the user's fingers touch interactive surface element 1508."), 67:57–58 (describing that the user's finger is spaced from the interactive surface element "by a first distance D1 which may be greater than *or equal to zero*"), 69:17–18 (describing that the user's hand is located "at a third distance D3, less than D2 and typically zero from the keyboard zone"), Figs. 20A, 20B, 21A, 21B, 26C. Contrary to Patent Owner's argument that the Specification explains that "touching" and "propinquity" are mutually exclusive (Sur-Reply 6–7), the Specification simply describes that the non-touching height is within propinquity of the surface to show the object is close, not far away.

Also, consistent with Petitioner's arguments (*see, e.g.*, Reply 6–7), the Specification describes touching as an exemplary distance from the device. *Id.* at 66:53–61 (describing "that various distances of the finger from the second region of the interactive surface element overlying slider 1708" may correspond to various operations and then describing that an exemplary distance is that "the finger touches" slider 1708). Furthermore, the '675 patent Specification's descriptions of "a predetermined degree of propinquity" include distances of zero. *See, e.g.*, Ex. 1001, 67:57–58 (describing that the user's finger is spaced from the interactive surface element "by a first distance D1 which may be greater than *or equal to zero*") (emphasis added), 69:17–18 (describing that the user's hand is located "at a third distance D3, less than D2 and typically zero from the keyboard zone"), Figs. 23B–D, 26C. These descriptions support that the phrase "a predetermined degree of propinquity," understood in light of the Specification, encompasses touching.

Both parties argue that the District Court's claim construction supports their position. Reply 2; Sur-reply 3–4. Although the District Court did not adopt "when the [at least one] object is within a predetermined proximity to and when the object is touching" as the construction for the disputed phrase (Ex. 1034, 2), the District Court also did not adopt Patent Owner's proposed construction excluding touching. *Id.* Neither party has provided analysis by the District Court. We, therefore, determine that Petitioner's position that the independent claims encompass touching is consistent with the District Court's construction. Even if it is not, however, Petitioner's position is consistent with the intrinsic record, after consideration of the District Court's claim construction, absent supporting analysis.

We turn to the remainder of Patent Owner's construction, i.e., that the phrase "a predetermined degree of propinquity" means "*a specified proximity distance established in advance* and does not include touching" (emphasis added). We note that Patent Owner's argument alternatively refers to "a specified proximity distance" as "actual z-distance" or "actual proximity distance." *See, e.g.*, Resp. 27–29, 55–56. Such a requirement is not supported by the actual claim language or the intrinsic record.

First, Patent Owner's construction changes the term "degree" to "specified distance." Patent Owner, however, acknowledges that such precision is not required by the claim. Tr. 31:17–38:4 (arguing even under Patent Owner's construction any z-distance or proximity distance is simply a determination of whether the object is within a range or limit to the surface). We discern no support for modifying the ordinary and customary meaning of "degree" in the manner proposed by Patent Owner.

Second, to the extent Patent Owner's construction imparts a requirement that a three-dimensional position be determined, that construction is inconsistent with the language of claim 13. In particular, claim 13 recites "wherein *the position of the object includes at least one of a two-dimensional position of the object*, a three-dimensional position of the object and angular orientation of the object." Ex. 1001, 74:58–61 (emphasis added).

Although we agree with Patent Owner that patentees may claim specific embodiments (*see SIMO Holdings*, 983 F.3d at 1378), Patent Owner has not directed us to embodiments that support its inclusion of "a specified proximity distance" or its narrow reading of the claim with that language. Indeed, the specification discusses that the object is at exemplary heights and distances, but does not describe determining or calculating those heights or distances in a manner more precise than determining whether the object is within a range or limit. Ex. 1001, 62:11–46 (describing "[w]hen the user's fingers touch, as in FIG. 20B, or are located in propinquity to, as in FIG. 20A, interactive surface element 1508" and calculating "the two-dimensional position of the impingement points of the user's fingers on or above interactive surface element 1508"), 62:48–50 ("In FIG. 21A, the user's fingers are located in propinquity to interactive surface element 1508, at respective heights H1 and H2 therefrom, and in FIG. 21B, the user's fingers touch interactive surface element 1508" and describing that location determining circuitry "calculates the two-dimensional position of the impingement points of the user's fingers on or above interactive surface element 1508").

The '675 patent Specification describes calculating a two-dimensional position when an object is in propinquity, but is not touching. For instance,

the '675 patent describes sensing by a "propinquity responsive input functionality" a finger "in propinquity to keyboard 1604" and then determining a two-dimensional "impingement area." *See, e.g., id.* at 64:50–54. Also, the '675 patent Specification describes limiting distance data to "three states: Off (representing no finger detected within the predetermined threshold range), Hover (representing a finger detected within the threshold range but not touching the interactive surface), and Touch (representing a state in which the finger is detected at the level of the interactive surface)." *Id.* at 72:50–55. The '675 patent describes that "[f]or the two latter states (Hover and Touch), *X and Y position coordinates* relative to the interactive surface are preferably provided by the utilization circuitry as described above." *Id.* at 72:55–58 (emphasis added). The '675 patent Specification describes distinguishing between touch and hover "by noting a clear difference in overall signal intensity produced by touch as opposed to hover." *Id.* at 50:27–29. Thus, signal intensity, not a measurement of proximity distance is used. *Id.* That the '675 patent Specification describes calculating a two-dimensional position when an object is in propinquity, but is not touching, supports that the disputed claim recitation encompasses calculating a two-dimensional position and does not require calculating "a specified proximity distance," as required by Patent Owner's proposed construction.

In addition, we have reviewed the testimony of the parties' experts, 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).

Based on the complete record now before us, consistent with the District Court's claim construction, we determine that the term "propinquity" means "proximity" and, with respect to the remaining language, we adopt the "plain and ordinary meaning." Ex. 1034, 2. Also, as further clarification, neither the term "proximity" nor the "plain and ordinary meaning" of the remaining language prohibits or excludes touching, contrary to Patent Owner's argument. Nevertheless, we also provide analysis using Patent Owner's construction in-part, specifically that the degree of propinquity is "established in advance and does not include touching," because Petitioner has shown that the prior art teaches the disputed recitations even using that construction. *See* §§ II.E, II.F.

2. "the at least one pixel array being configured to sense a position of at least one object with respect to a surface thereof"

Claims 1 and 13 (elements 1[b](2) and 13[b](2)) recite "the at least one pixel array being configured to sense a position of at least one object with respect to *a surface thereof*" (emphasis added). The District Court determined that the term is indefinite. Ex. 1034, 3. The District Court did not provide its analysis in its Claim Construction Order, nor have the parties provided any other Court analysis, regarding that determination. *See generally* Ex. 1034.

Upon consideration of the District Court's determination and the parties' contentions at the institution stage, we made a preliminary determination that "a surface thereof" has a definite meaning. Inst. Dec. 24. In particular, we stated "we preliminarily determine that 'a surface thereof' should be treated as 'said surface' because the term derives antecedent basis from the recitation 'a surface' in the phrase 'an interactive surface element defining *a surface*.'" *Id.*

At the institution stage we provided analysis as follows:

> Each of independent claims 1 and 13 recites "an interactive surface element defining a surface." These are the only recitations of "surface," besides the claim term at issue, in the independent claims. Based on that claim language, "a surface thereof" would derive antecedent basis from the recitation "a surface" in the phrase "an interactive surface element defining *a surface*" (emphasis added).
>
> We turn to the '675 patent Specification. In the '675 patent Specification, the term "surface" is used consistently in connection with "interactive surface element." *See*, *e.g.*, Ex. 1001, 3:39–41 (describing sensing "the position of the object with respect to the interactive *surface* element" (emphasis added)), 3:59–60 (same), 4:53 (describing "a position sensing assembly including an interactive surface element defining a surface" and "at least one pixel array" that is "operative to sense a position of an object with respect to *the surface*" (emphasis added)), 50:9–13 (describing calculating "the two-dimensional position of the impingement point of the user's finger on or above interactive surface element 1208"). Indeed, the '675 patent Specification also uses just the term "surface" to refer to the surface of the "interactive surface element." *See*, *e.g.*, *id.* at 5:53–57 (describing that the "reflected light propagates within the *interactive surface element*" and "[a]lternatively, the reflected light propagates above *the surface*" (emphases added)). We do not discern other meaningful discussion in the '675 patent relating to "surface" used in connection with determining a position.
>
> The Examiner's analysis pertaining to "a surface thereof" consistently supports that that "a surface thereof" derives antecedent basis from the recitation "a surface" in the phrase "an interactive surface element defining *a surface*" (emphasis added). In the Office Action rejecting claims issued January 16, 2013, the Examiner identified "the transmission medium (display screen)" as the "interactive surface element" of "a position sensing assembly." Ex. 1004, 1862. With respect to "the at least one pixel array being configured to sense a position of at least one object with respect to a surface thereof," the Examiner explained that input detection system 100 "provides a position of

> the user's input with respect to the light beams 106 that *preferabl[y] have a predetermined relative location with respect to the transmission media 108 (e.g., display screen)*." *Id.* at 1863 (emphasis added).

Inst. Dec. 23–24.

> At the institution stage, we noted
>
> that in instances involving an error in antecedent basis, the Board has authority to correct inadvertent errors. *See Fitbit, Inc. v. Valencell, Inc.*, 964 F.3d 1112, 1119–20 (Fed. Cir. 2020). Error correction is permissible when the correction is not subject to reasonable debate based on consideration of the claim language and the specification and, further, when the prosecution history does not suggest a different interpretation of the claims. *Id.* (quoting *Novo Indus., L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1354 (Fed. Cir. 2003)).

Inst. Dec. 22–23.

Based on the complete record now before us, neither party disputes our analysis regarding the construction of "a surface thereof" or the ability to correct the error. *See generally* Resp.; Reply; Tr. 26:22–28:6, 29:1–25. Also, the District Court has not provided any further determinations or analysis regarding the term. Tr. 28:9–14.

Based on the complete record now before us, we maintain our analysis at the institution stage, which is reproduced in this Decision. We also maintain our determination that we have authority to correct inadvertent errors, such as the antecedent basis error in the instant proceeding. Based on the complete record now before us, we determine that "a surface thereof" has a definite meaning. In particular, we determine that "a surface thereof" should be treated as "said surface" because the term derives antecedent basis from the recitation "a surface" in the phrase "an interactive surface element defining *a surface*" (emphasis added). Accordingly, we correct the

inadvertent error and treat "a surface thereof" as "said surface" in our analysis herein.

3. Remaining Terms

At the institution stage, Patent Owner provided the claim construction entered in the parallel district court proceeding for "circuitry coupled to and receiving an output from the at least one pixel array receiving." Prelim. Resp. 26. According to the Patent Owner, the phrase means "circuitry coupled to and receiving an output from the at least one pixel array." *Id.* At the institution stage, Patent Owner indicated that the District Court determined for the terms "pixel array" and "radiation at [a/the/said] baseline level" the plain and ordinary meaning should be applied. *Id.* at 25–26.

Based on the complete record now before us, neither party disputes those determinations. Also, Petitioner has shown the prior art teaches the claims under the claim construction that the Patent Owner applies, that is, the construction adopted by the District Court for these terms. *See* §§ II.E, II.F. We, therefore, adopt the constructions adopted by the District Court and need not make further determinations regarding construction of the remaining terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017), *cert. denied* 138 S. Ct. 1695 (April 30, 2018) (noting that "we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'") (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

E. Unpatentability of Claims 1, 2, 6, 9–11, and 13 under 35 U.S.C. § 103(a) as Obvious over Yamaguchi Alone or with Hinckley

Petitioner asserts that claims 1, 2, 6, 9–11, and 13 are unpatentable as obvious over Yamaguchi alone or with Hinckley. Pet. 4. Patent Owner

counters that Petitioner's reasoning to combine the prior art references is deficient and the asserted art does not teach elements 1[b](3) and 13[b](3). Resp. 19–36.

As is discussed further below, both disputes are premised on Patent Owner's construction for "predetermined degree of propinquity." Under the correct construction, Yamaguchi alone teaches all elements of claim 1. Indeed, as discussed below, Patent Owner acknowledges that Yamaguchi alone teaches elements 1[b](3) and 13[b](3) and Petitioner's reliance on Hinckley relates to only an alternative ground for showing elements 1[b](3) and 13[b](3).

We begin with an overview of Yamaguchi and Hinckley. We then turn to the parties' contentions.

1. Yamaguchi

Yamaguchi relates to an image display device including the capability of detecting an object position. Ex. 1009 ¶ 3. Figure 13 of Yamaguchi shows the general configuration of an image display device. *Id.* ¶ 158.

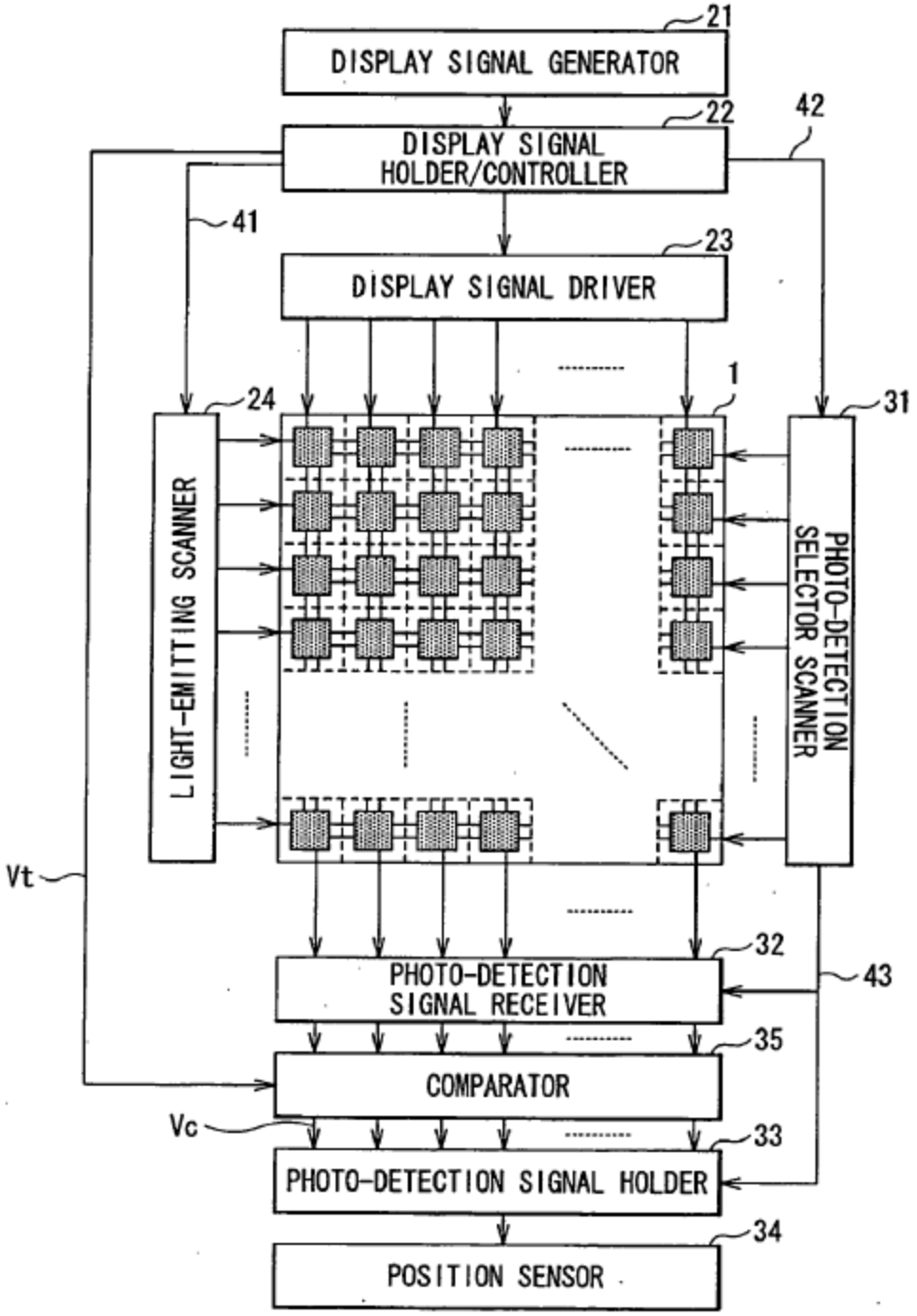


FIG. 13

Figure 13, above, illustrates an image display device that includes display 1, display signal driver 23, light-emitting scanner 24, photo-detection signal selector scanner 31, photo-detection signal receiver 32, comparator 35, photo-detection signal holder 33, and position sensor 34. *Id.*

Display 1 includes an organic or inorganic electroluminescence display or liquid crystal display (LCD) including a matrix of a plurality of picture elements 11 over the whole surface. *Id.* ¶ 96. Each picture element 11 includes a light-emitting/photo-detection cell (CWR), including one light-emitting/photo-detection device. *Id.* Scanner 24 and driver 23 act to drive each light-emitting/photo-detection cell CWR for light emission, and scanner 31 acts to drive each cell CWR for photo-detection. *Id.* ¶ 98.

Comparator 35 compares the photo-detection signal outputted by photo-detection signal receiver 32 to a threshold voltage signal V_t, which is a predetermined voltage, outputted by display signal holder/controller 22. *Id.* ¶ 159. Comparator 35 converts the photo-detection signal into digital data "1" when the photo-detection signal has a higher voltage than the threshold voltage signal V_t, or comparator 35 converts the photo-detection signal into digital data "0" when the photo-detection signal has a lower voltage than the threshold voltage signal V_t. *Id.* Comparator 35 outputs the digital data (i.e., a comparator output signal V_c) to photo-detection signal holder 33. *Id.* Comparator 35 is interposed between photo-detection signal receiver 32 and photo-detection signal holder 33, so that digital data is inputted to and handled by photo-detection signal holder 33 and position sensor 34. *Id.* ¶ 162.

2. Hinckley

Hinckley 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.

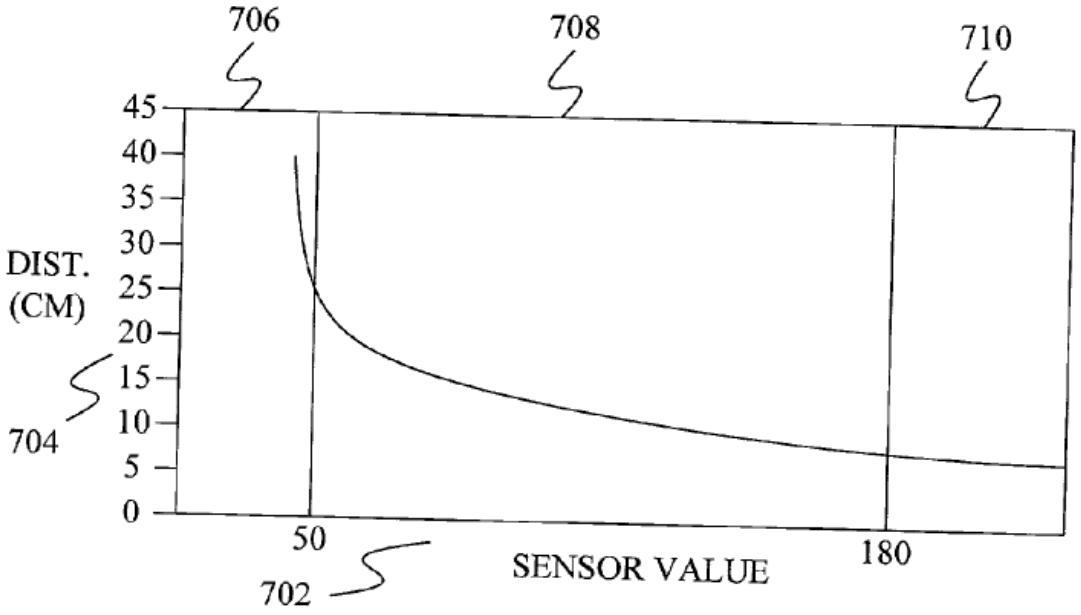


FIG. 7

Figure 7, reproduced above, shows a response curve for proximity sensor 262.

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.*

3. Independent Claim 1

a) Reasoning to Combine Yamaguchi and Hinckley

Petitioner provides an overview of its contentions as to why a person having ordinary skill in the art would have combined the teachings of

Yamaguchi and Hinckley (Pet. 21–22), as well as more detailed contentions for element 1[b](3) (*id.* at 39–41). We discuss the parties' contentions regarding reasoning to combine Yamaguchi and Hinckley here. We discuss the parties' contentions regarding obviousness over Yamaguchi alone in the element-by-element analysis below.

Although we start with the parties' contentions regarding reasoning to combine Yamaguchi and Hinckley, we note we find that Yamaguchi alone teaches all recitations in claim 1 under the correct constructions. *See* II.E.3.c. We discuss Petitioner's contentions regarding obviousness over Yamaguchi and Hinckley as an additional, independent ground supporting our unpatentability conclusions herein.

Petitioner points to Yamaguchi's disclosures (Pet. 21, 39 (citing Ex. 1009 ¶¶ 169–171)) of detection of an object in "close proximity" (Ex. 1009 ¶ 118) and changing the threshold voltage V_t according to "the purpose of detection (e.g., position detection, size detection, color detection)" and "accuracy of detection" (*id.* ¶ 171). Petitioner further argues the following:

> A POSITA would have been motivated to modify Yamaguchi in view of Hinckley. As explained above, Yamaguchi discloses detection of an object in "close proximity" and that the detection threshold for the object in proximity can be set depending on the purpose of the detection and for "accuracy of detection". Ex-1009, [0169], [0171]. Hinckley specifically defines close as 7 cm or closer (less than 3 inches) and explains how to set the detection threshold accordingly. A POSITA seeking to implement Yamaguchi's teaching of accurate, close proximity detection, would have known to use well-known equations relating sensor output as a function of distance, such as disclosed in Hinckley, to establish the degree of propinquity in advance. Ex-1002, ¶87.

> Moreover, Hinckley describes additional device features that can be enabled by having predetermined degrees (or ranges) of propinquity, such as controlling device power consumption based on the presence and motion and of an object within different levels of nearness to the device, Ex-1011, [0106]-[0108], and activating an audio receiver based on proximity, *id.*, [0062]. Even aside from the accuracy reasons taught in Yamaguchi, which alone is a sufficient rationale for incorporating Hinckley's teachings, a POSITA would have been motivated to incorporate such ranges of nearness between the object and device to obtain these additional benefits. Indeed, Yamaguchi recognizes and teaches features designed for reduced power consumption. Ex-1009, [0155], [0162] ("Thus, the modified example 1 can achieve . . . a reduction in power consumption, as well as the advantageous effects of the first embodiment."). Ex-1002, ¶88.

Pet. 39–40: *see also id.* at 21–22 (arguing a person having ordinary skill in the art would have made the proposed combination to obtain Hinckley's additional features and benefits) (citing, e.g., Ex. 1011 ¶¶ 62, 106–108; Ex. 1002 ¶¶ 59–60).

Regarding whether a person having ordinary skill in the art would have had a reasonable expectation of success, relying on the testimony of Dr. Bederson, Petitioner argues the following:

> A POSITA would have had a reasonable expectation of success in combining the teaching[s] of Yamaguchi and Hinckley. Each purports to solve these problems in similar and predictable ways, such as by using well-known position sensors, such as those based on light emitters and detectors (*see* Ex-1011 [0029], Ex-1009 [0110]), to detect the positions of an object in contact with or in close proximity to a display device, using similar hardware and software. Ex-1002 ¶61.

Pet. 22; *see also id.* at 40–41 (arguing that the '675 patent and the art "make clear that such approaches were well-understood at the time and predictable

to implement with a reasonable expectation of success") (citing, e.g., Ex. 1002 ¶ 89).

Dr. Bederson testifies that the common knowledge of position sensors, such as those taught by Yamaguchi and Hinckley, "is exemplified by the fact that the '675 patent does not teach anything at all about how to determine 'predetermined' propinquity. Rather, the patent and the art make clear that such approaches were well-understood at the time and predictable to implement." Ex. 1002 ¶ 89. Dr. Bederson further testifies "a POSITA would have had a reasonable expectation of success in implementing proximity sensors in the devices disclosed by Yamaguchi, regardless of the hardware used in these sensors." *Id.* (citing Ex. 1025 ¶ 31). Dr. Bederson also testifies "because Yamaguchi acknowledges that light-emitting and photo-detection devices for infrared or other light was known in the art, Hinckley's teachings would have been understood as easily implementable into the devices taught by Yamaguchi." *Id.* ¶ 90 (citing Ex. 1009 ¶ 8).

Patent Owner counters that Hinckley's proximity sensor and Yamaguchi's integrated display/touch panel "address fundamentally different issues" because Yamaguchi is directed to "determining horizontal x-y positions relating to an object 'touching' a surface," whereas "Hinckley's proximity sensor relates to rudimentary directional ranges." Resp. 24 (citing Ex. 1009, code (57); Ex. 1011, code (57); Ex. 2056 ¶ 50); *see also id.* at 32 (arguing that Petitioner's proposed combination would have resulted in "an inoperable device") (citing Ex. 2056 ¶ 70). Patent Owner argues that Dr. Bederson "cherry-picks" Hinckley's teachings of a proximity sensor from Hinckley's "'touch' teachings" and then "summarily concludes" a person having ordinary skill in the art would have been

motivated to combine the teachings. *Id.* at 24 (citing Ex. 2056 ¶ 51). Dr. Cairns testimony is substantially the same as Patent Owner's argument.

Throughout its arguments, Patent Owner does not address Yamaguchi's teaching that "when a target object 15 such as a finger is brought into contact *or close proximity* with the display 1, light LW1 emitted from the light-emitting/photo-detection cell CWR23, for example, is reflected by the target object 15" and Yamaguchi's device uses such reflected light to detect target object 15 throughout display 1. Ex. 1009 ¶ 118, Fig. 5 (emphasis added). Yamaguchi's teachings are not limited to determining positions when an object is touching a surface, but instead Yamaguchi expressly teaches position detecting when an object is brought into "close proximity" with display 1. *Id.* With respect to Figure 5 of Yamaguchi illustrating position detecting of a finger that is not touching the display surface, the configuration of the elements and drawings may teach relative relationships between or among the depicted elements. *Vas–Cath, Inc. v. Mahurkar,* 935 F.2d 1555, 1566 (Fed. Cir. 1991). Patent Owner's arguments regarding differences in Yamaguchi and Hinckley are unavailing as those arguments are based in part on Patent Owner's mischaracterization of Yamaguchi as narrowly relating to only touch technology.

Contrary to Patent Owner's arguments and Dr. Cairns's testimony, we find Petitioner's arguments and Dr. Bederson's testimony that Yamaguchi and Hinckley relate to similar technologies consistent with those references. For instance, we find consistent with Petitioner's arguments and Dr. Bederson's testimony (*see, e.g.*, Pet. 21; Ex. 1002 ¶¶ 59–60) that each of Yamaguchi and Hinckley relates to image display devices and is directed to techniques that use reflected light for detecting the positions of an object in

contact with or in proximity to a display device. *See, e.g.*, Ex. 1009, code (57), ¶¶ 3, 118, Fig. 5; Ex. 1011 ¶¶ 2, 42, Figs. 3, 7.

Turning to Patent Owner's cherry-picking argument (Resp. 24), Patent Owner implicitly acknowledges that Hinckley teaches both technologies operating together. Indeed, Hinckley describes a device including its proximity sensor, as well as "two touch sensors 254 and 256" showing that Hinckley's device is similar to Yamaguchi's devices and that a person having ordinary skill in the art would have reasonably expected to be successful in implementing Hinckley's proximity sensor in such devices. Ex. 1011 ¶ 29.

Patent Owner also argues that the device resulting from combining Hinckley's proximity sensor with Yamaguchi would have had "space constraints due to additional unnecessary hardware," "power constraints due to additional emitter usage," "an additional or separate proximity sensor" requiring significantly more power and unknown and unspecified changes to Yamaguchi's hardware to incorporate the sensor, and the resulting device would not have worked. Resp. 24–26 (citing, e.g., Ex. 2056 ¶¶ 52–54; Exs. 2061–2063); *see also id.* at 35 ("A POSITA would understand that having two independent hardware operations would drastically increase size, power consumption, and other design considerations, making the final product worse."). Regarding Patent Owner's argument that the device would not have worked, Patent Owner further argues that the resulting device would have had "to project drastically more light to detect the presence of an object at the proposed distances," which would have "wash[ed] the receivers and entire pixel array with light, thereby preventing the device from detecting any object." *Id.* at 32–33 (citing, e.g., Ex. 2056 ¶ 72). Dr. Cairns testimony is substantially the same as Patent Owner's argument.

Patent Owner also argues that "Yamaguchi's touch detection operations are incompatible with Hinckley's proximity detection operations." *Id.* at 33. Patent Owner argues that Yamaguchi teaches "a specific sequence of activating/deactivating emitters and receivers" because the device is not capable of detecting while emitting light and the device should emit "a minimal amount of light to prevent false detections," whereas Hinckley teaches a receiver that constantly measures signal strength. *Id.* at 33–35 (citing, e.g., Ex. 2056 ¶¶ 73–75); *see also id.* at 35 (arguing Hinckley's transmitter would have interfered with Yamaguchi's time-based scanning). Patent Owner also argues that a person having ordinary skill in the art would not have had a reasonable expectation of success because the proposed modifications would have rendered Yamaguchi "incapable of detecting the position of the object." *Id.* at 35 (citing Ex. 2056 ¶ 76). Dr. Cairns testimony is substantially the same as Patent Owner's argument.

As an initial matter, Patent Owner narrowly focuses on the physical differences between the exemplary systems disclosed in the references and requires bodily incorporating Hinckley's sensor into Yamaguchi's device. "It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements." *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012); *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc); *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (Obviousness does not require that all of the features of the secondary reference be bodily incorporated into the primary reference.).

Patent Owner's arguments imply that changes are needed to Yamaguchi's sensor hardware, which are based on a mischaracterization of Yamaguchi's hardware. Contrary to Patent Owner's argument, Yamaguchi

describes that its technology detects objects in proximity, but not touching the display. For instance, Yamaguchi expressly describes that "the position sensor 34 and the comparator 35 or 351 compare the amount of each photo-detection signal to a predetermined threshold voltage V_t, thereby detecting where an object in contact with *or in close proximity to* the display device is situated." Ex. 1009 ¶ 169 (emphasis added) (cited in e.g., Pet. 39). Although Yamaguchi describes setting the predetermined threshold voltage V_t, "to varying values" to expand or limit the two-dimensional area corresponding to the position of the object (*id.* ¶ 170, Figs. 17A–17C), a prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular example it is describing. *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). Indeed, Yamaguchi expressly describes that its disclosures are not limited to that particular example and, instead, more broadly encompasses other changes to the predetermined threshold voltage V_t as follows:

> [U]sers may optionally change the threshold voltage V_t according to the properties of the object (e.g., a size, a surface state (e.g., reflectivity, a color, roughness, and the like), etc.), the purpose of detection (e.g., position detection, size detection, color detection, and the like), the accuracy of detection, and so on, in order to realize position detection with higher accuracy and greater convenience.

Ex. 1009 ¶ 171 (cited in e.g., Pet. 37, 39).

Petitioner's argument and Dr. Bederson's testimony that a person having ordinary skill in the art seeking to implement Yamaguchi's teaching of accurate, close proximity detection, would have known to use well-known equations relating sensor output as a function of distance, such as disclosed in Hinckley, to establish the degree of propinquity in advance (Pet. 39–40; Ex. 1002 ¶ 87) are consistent with and supported by Yamaguchi's express

disclosure that its hardware detects objects in close proximity and that its predetermined threshold voltage V_t may be changed to realize position detection with higher accuracy and greater convenience. Petitioner's proposed modification pertains to using mathematical equations relating to sensor output as a function of distance to change Yamaguchi's predetermined threshold voltage V_t. Petitioner's argument and Dr. Bederson's testimony do not require the hardware modifications implied by Patent Owner's arguments.

As an independent reason for our determination, even to the extent hardware changes to Yamaguchi's sensors would have been needed, after consideration of Patent Owner's arguments and evidence, including the testimony of Dr. Cairns, we credit and afford significant weight to Dr. Bederson's testimony regarding the knowledge a person having ordinary skill would have had of position sensors, such as those taught by Yamaguchi and Hinckley and that "a POSITA would have had a reasonable expectation of success in implementing proximity sensors in the devices disclosed by Yamaguchi, regardless of the hardware used in these sensors." Ex. 1002 ¶ 89 (citing Ex. 1025 ¶ 31). Dr. Bederson's testimony (*id.*) is consistent with and supported by the evidence cited therein, such as the disclosure below.

> Various types of touch sensors are capable of determining the proximity of a touch implement hovering over the surface of a touch sensitive panel. For example, hover detection and/or *proximity measurement* may be performed using capacitive touch sensors, infrared touch sensors, and/or optically sensitive liquid crystal displays (LCDs), among others. Embodiments of the invention are directed to the use of pre-touch information to provide enhanced touch sensing functionality. Pre-touch information may include, for example, *hover detection, proximity measurement, and/or pre-touch location determination*.

Ex. 1025 ¶ 31 (emphases added). In an obviousness analysis, we must consider the combination of references, as a whole, in light of the general knowledge of an ordinarily skilled artisan. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Also, Yamaguchi's teachings are consistent with and support Dr. Bederson's testimony that "Yamaguchi acknowledges that light-emitting and photo-detection devices for infrared or other light [were] known in the art" and that "Hinckley's teachings would have been understood as easily implementable into the devices taught by Yamaguchi." Ex. 1002 ¶ 90 (citing Ex. 1009 ¶ 8); *see also id.* ¶ 60 (testifying "Yamaguchi explains that the detection threshold for the object in proximity can be set depending on the purpose of the detection") (citing Ex. 1009 ¶ 170). For instance, Yamaguchi describes as background "[t]echniques for detecting the position and other conditions of an object in contact with or in *close proximity* to a display device *have been heretofore known*" including techniques described in connection with a patent application directed to "an infrared finger entry pointer device" that includes "light-emitting and photo-detection devices for infrared or other light." Ex. 1009 ¶¶ 5, 8 (emphases added).

We do not agree that Patent Owner's argument and evidence demonstrates significant design challenges and undue experimentation relating to infrared technologies and proximity sensors. Resp. 24 (citing Exs. 2061–2063); *see also id.* at 32–33 (citing Ex. 1011 ¶ 44, Fig. 7; Ex. 2056 ¶ 72). Certain of Patent Owner's evidence describes design considerations with backlighting and ambient light-levels, including considerations in smartphone designs, and calibrations and other design considerations with a non-smartphone system, Kinect, that emits infrared beams and uses reflected light to sense a user's position. Exs. 2061–2063. Patent Owner's evidence,

however, describes successful implementations of those technologies and illustrates that the technologies would have been known. Exs. 2061–2063. Additionally, Exhibit 2062 describes measuring position of objects in a room, including users standing at least six to eight feet from the device. Ex. 2062. Such technology differs from the technology at issue here. In particular, in contrast, Hinckley describes that a range of "a distance of approximately 27 centimeters to infinity" indicates "that no objects are within range of mobile device 200." Ex. 1011 ¶ 44. In other words, objects farther than 27 centimeters from mobile device 200 are not within detection range. *Id.*

We also do not agree that Patent Owner's argument and evidence demonstrates incompatibility of Yamaguchi and Hinckley. Resp. 33–35 (citing, e.g., Ex. 1009 ¶¶ 118, 121, Figs. 6A–6C; Ex. 1011 ¶¶ 43–45, Fig. 7; Ex. 2056 ¶ 73–77). Indeed, the disclosures relied on by Patent Owner are contrary to Patent Owner's own argument and the testimony of Dr. Cairns. For instance, the paragraphs of Yamaguchi relied on by Patent Owner describe detecting an object that is brought into "close proximity with the display 1" and "detecting the presence or absence of the target object 15 close to the display 1 and detecting the position of the target object 15 if the target object 15 is present." Ex. 1009 ¶¶ 118, 121, Figs. 6A–6C. Also contrary to Patent Owner's argument and the testimony of Dr. Cairns, the paragraphs of Hinckley relied on by Patent Owner describe an "infrared receiver" and that "[t]he light produced by transmitter 264 bounces off objects that are near mobile device 200 and the reflected light is received by receiver 266." Ex. 1011 ¶ 43. Hinckley describes that it "relates to devices with displays" including "computing and mobile devices." *Id.* ¶ 2. Hinckley expressly describes that its technology is implemented in devices including

other sensors, such as "touch sensors 254 and 256." *Id.* ¶ 29 (cited in e.g., Pet. 37).

Patent Owner's argument and Dr. Cairns's testimony that Petitioner's proposed combination would not work because a person having ordinary skill in the art would have to modify Yamaguchi to incorporate Hinckley's ranges (including greater than 27 cm) (Resp. 32–33; Ex. 2056 ¶ 72) do not address that Hinckley describes that a range of "a distance of approximately 27 centimeters to infinity" indicates "that no objects are within range of mobile device 200." Ex. 1011 ¶ 44. Patent Owner's Response and Dr. Cairns's testimony acknowledge that 27 centimeters corresponds to 10.6 inches or less than one foot. Pet. 26; Ex. 2056 ¶ 55. In other words, objects farther than 27 centimeters or 10.6 inches from mobile device 200 are not within detection range in accordance with Hinckley. *Id.*

Also, we find that Dr. Cairns's testimony that "significantly more power" would be needed "to emit light sufficient for detecting z-direction distances between 2.7 inches to 10.6 inches" (Ex. 2056 ¶ 52) is conclusory and vague as to what constitutes "significantly more power," and is not supported by data. *See generally id.* Accordingly, we afford Dr. Cairns's testimony little to no weight. 37 C.F.R. § 42.65 ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight."). Additionally, Patent Owner's arguments and Dr. Cairns's testimony are based on an overly narrow reading of the prior art without addressing the knowledge of a person having ordinary skill in the art of various types of sensors (Ex. 1025 ¶ 31) such as infrared sensors and optically sensitive light crystal displays (LCDs) for providing enhanced sensing functionality using proximity measurement, for example. *Cf. In re Paulsen*, 30 F.3d 1475, 1480–81 (Fed. Cir. 1994) (rejecting an argument that

"fails to recognize that a prior art reference must be 'considered together with the knowledge of one of ordinary skill in the pertinent art.'") (citing *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

On this record, Petitioner has provided persuasive evidence to show that incorporating Hinckley's predetermined ranges into Yamaguchi's device as set forth in the Petition and in Dr. Bederson's testimony (*see, e.g.*, Pet. 21–22, 37–41; Ex. 1002 ¶¶ 59–61, 85–90) would not have been "uniquely challenging or difficult for one of ordinary skill in the art" at the time of the invention. *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 418). Petitioner's argument and evidence, including the testimony of Dr. Bederson, is not undermined by Patent Owner's argument and evidence, including the testimony of Dr. Cairns.

Patent Owner also argues "[s]ensing x-y distance using Hinckley's ranges and thresholds simply makes no sense in the context of Yamaguchi, and it would prevent any meaningful x-y position detection for the size of Yamaguchi's device." Resp. 26 (citing, e.g., Ex. 2056 ¶ 55); *see also id.* at 31 ("A POSITA at the time of the invention would not look to Hinckley's 'proximity sensor' to satisfy the claimed 'pixel array' structure because they are different structures.") (citing Ex. 2056 ¶ 68). Patent Owner also argues a person having ordinary skill in the art would have had "no reason to look beyond Yamaguchi to increase the x-y position detection accuracy absent hindsight reconstruction." *Id.* at 32 (citing Ex. 2056 ¶ 71); *see also id.* at 26 (arguing Dr. Bederson's testimony is "hindsight speculation"). Dr. Cairns testimony is substantially the same as Patent Owner's argument.

Patent Owner misapprehends Petitioner's argument. Petitioner argues that a person having ordinary skill in the art would have incorporated

Hinckley's teachings to set Yamaguchi's threshold, which is used to detect objects *in close proximity to*, but not touching the device, and also to obtain the additional benefits described in Hinckley, not to improve the accuracy of detecting an x-y position. Pet. 21–22, 39. For instance, Petitioner relies on Yamaguchi's explanations regarding an "object in proximity" and argues "Hinckley provides additional teachings on quantifying object proximity based on sensor output." *Id.* at 21 (citing Ex. 1009 ¶ 170; Ex. 1002 ¶¶ 59–60). Petitioner also argues that a person having ordinary skill in the art "would have been motivated to modify Yamaguchi according to Hinckley's teachings to obtain . . . additional features and benefits," such as using proximity information for a number of purposes "including controlling device idle state and power consumption based on the presence and motion and of an object" and "activating an audio receiver." *Id.* at 21–22 (citing, e.g., Ex. 1011 ¶¶ 62, 106–108).

In its Sur-reply, Patent Owner argues that Petitioner presents new theories in its Reply. *See, e.g.*, Sur-reply 8–9 (citing Reply 11). Petitioner's theories, however, were set forth in the Petition. *See, e.g.*, Pet 21 ("Yamaguchi explains that the detection threshold for the object in proximity can be set depending on the purpose of the detection.") (citing Ex. 1009 ¶ 170); *see also id.* at 37 (arguing a person having ordinary skill in the art would have recognized from Yamaguchi's teachings "that detection of the object in 'close proximity' teaches or suggests establishing the threshold to respond to and sense an object at some predetermined degree of propinquity, i.e., a set level of nearness to the device") (citing Ex. 1009 ¶ 171; Ex. 1002 ¶ 84). Patent Owner also argues that Petitioner shifts positions. Sur-reply 13–14. Again, however, Petitioner's positions were set forth in the Petition. *See, e.g.*, Pet. 40–41 (citing Ex. 1002 ¶¶ 88–90).

Nonetheless, we do not find that any arguments made in the Reply or the Reply Declaration are beyond the proper scope of a reply under 37 C.F.R. § 42.23(b). *See Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015); *see also Belden Inc., v. Berk-Tek LLC*, 805 F.3d 1064, 1078−80 (Fed. Cir. 2015) (holding that the Board may rely on new evidence submitted with a reply because the evidence was legitimately responsive to patent owner's arguments and not needed for petitioner's showing of obviousness).

Patent Owner also argues in its Sur-reply that Petitioner fails to address certain arguments made in the Patent Owner Response, including Patent Owner's arguments regarding incompatibility. *See, e.g.*, Sur-reply 12–13, 14–19. We disagree with Patent Owner. In addition to responding to Patent Owner's arguments, Petitioner refers to the Petition's explanations and evidence that are contrary to Patent Owner's arguments. *See, e.g.*, Reply 14 (citing, e.g., Ex. 1002 ¶¶ 87–90; Pet. 39–41).

Patent Owner presents additional arguments regarding alleged irrelevance of Hinckley's technology and incompatibilities between Yamaguchi and Hinckley. *See generally* Sur-reply. Patent Owner's arguments in this regard are not consistent with the evidence of record and do not undermine Petitioner's position for the same reasons given with respect to Patent Owner's incompatibility arguments in its Patent Owner Response. Furthermore, to the extent Patent Owner presents new theories and explanations in its Sur-reply, Patent Owner's arguments and evidence are belatedly presented and will not be considered. *See* Paper 13, 9 ("Patent Owner is cautioned that any arguments not raised in the response may be deemed waived."); *see also In re NuVasive, Inc.*, 842 F.3d 1376, 1379–82 (Fed. Cir. 2016) (holding patent owner waived an argument addressed in the

preliminary response by not raising the same argument in the patent owner response); TPG 66 (stating that the Patent Owner Response "should identify all the involved claims that are believed to be patentable and state the basis for that belief").

After consideration of Patent Owner's arguments and evidence, including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and afford significant weight to the testimony of Dr. Bederson because Petitioner's contentions and Dr. Bederson's testimony are consistent with the evidence of record. Further, we find Dr. Cairns's testimony, which is substantially the same as Patent Owner's arguments, is unsupported and contradicted by the evidence of record for the same reasons given with respect to Patent Owner's arguments above.

After consideration of the contentions and the evidence of record, we are persuaded that Petitioner has offered articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Yamaguchi and Hinckley in the manner recited in claim 1. We determine that Petitioner's arguments and evidence are not undermined by Patent Owner's arguments and evidence.

b) Elements 1[pre] and 1[a]

The preamble of claim 1 recites "[a] position sensing assembly comprising" and element 1[a] recites "an interactive surface element defining a surface." Ex. 1001, 73:10–11. Petitioner argues that Yamaguchi teaches the preamble and element 1[a] by describing an image display device, such as the device illustrated in Figure 13 of Yamaguchi. Pet. 22–24 (citing, e.g., Ex. 1009 ¶¶ 3, 134, Figs. 5, 13). Petitioner argues "display 1 is such an interactive surface element that defines a surface." *Id.* at 27–28 (citing Ex. 1009 ¶¶ 134, 196, Figs. 13, 25; Ex. 1002 ¶¶ 67–71).

Patent Owner does not dispute Petitioner's arguments or evidence regarding the preamble and element 1[a]. Petitioner's contentions are supported by the cited portions of Yamaguchi. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Yamaguchi teaches the preamble of claim 1 and element 1[a].

c) Element 1[b]

Element 1[b] is reproduced below:

> [b](1) at least one pixel array comprising a plurality of detector elements configured to detect electromagnetic radiation at a baseline level, (2) the at least one pixel array being configured to sense a position of at least one object with respect to a surface thereof according to locations of ones of the plurality of detector elements at which at least one of an amount of radiation detected and a change in the amount of radiation detected exceeds a predetermined threshold, (3) the at least one pixel array being configured to sense at least a position of the at least one object with respect to the at least one pixel array when the at least one object has at least a predetermined degree of propinquity to the at least one pixel array.

Ex. 1001, 73:12–24.

We begin with element 1[b](1). Petitioner argues that Yamaguchi teaches element 1[b](1) based on Yamaguchi's disclosure that that "the display 1 includes an organic or inorganic EL (electroluminescence) display or LCD (liquid crystal display) including a matrix of a plurality of picture elements 11 over the whole surface." Pet. 29–30 (citing Ex. 1009 ¶ 96). Petitioner also points to Yamaguchi's disclosure that "[e]ach picture element 11 includes a light-emitting/photo-detection cell CWR including one light-emitting/photo-detection device." *Id.* Petitioner points to further details regarding the light emission and detection of display 1. *Id.* at 29–31 (citing, e.g., Ex. 1009 ¶¶ 21, 110, 178, 187, 357, Figs. 22E–F). Petitioner's

contentions regarding element 1[b](1) are supported by the cited portions of Yamaguchi.

We turn to element 1[b](2). For the reasons given with respect to claim construction (*see supra* § II.2), we determine that "a surface thereof" recited in element 1[b](2) has a definite meaning. In particular, we determine that "a surface thereof" should be treated as "said surface" because the term derives antecedent basis from the recitation "a surface" in the phrase "an interactive surface element defining *a surface*" (emphasis added). We use that determination in our analysis herein.

Petitioner argues that Yamaguchi teaches element 1[b](2) based on Yamaguchi's disclosures relating to sensing where the target object 15 is situated on the display 1. Pet. 33 (citing Ex. 1009 ¶ 118). Petitioner also points to Yamaguchi's disclosure that the comparator 35 "compares the photo-detection signal outputted by the photo-detection signal receiver 32 to a *threshold voltage* signal Vt, which is a *predetermined voltage*, outputted by the display signal holder/controller 22." *Id.* at 33–34 (citing, e.g., Ex. 1009 ¶ 159). Petitioner points to further details in Yamaguchi relating to position detection. *Id.* at 33–35 (citing, e.g., Ex. 1009 ¶¶ 118, 159, 160, 170, 171, Figs. 5, 13, 14E–14F, 17A–17C). Petitioner's contentions regarding element 1[b](2) are supported by the cited portions of Yamaguchi.

We now turn to element 1[b](3). Petitioner argues that Yamaguchi teaches element 1[b](3) based on Yamaguchi's disclosure that the image display device senses a nearby object "when a target object 15 such as a finger is brought into contact or close proximity with the display 1." Pet. 36 (citing Ex. 1009 ¶ 118, Fig. 5). Petitioner provides an annotated version of Figure 5 of Yamaguchi. *Id.*

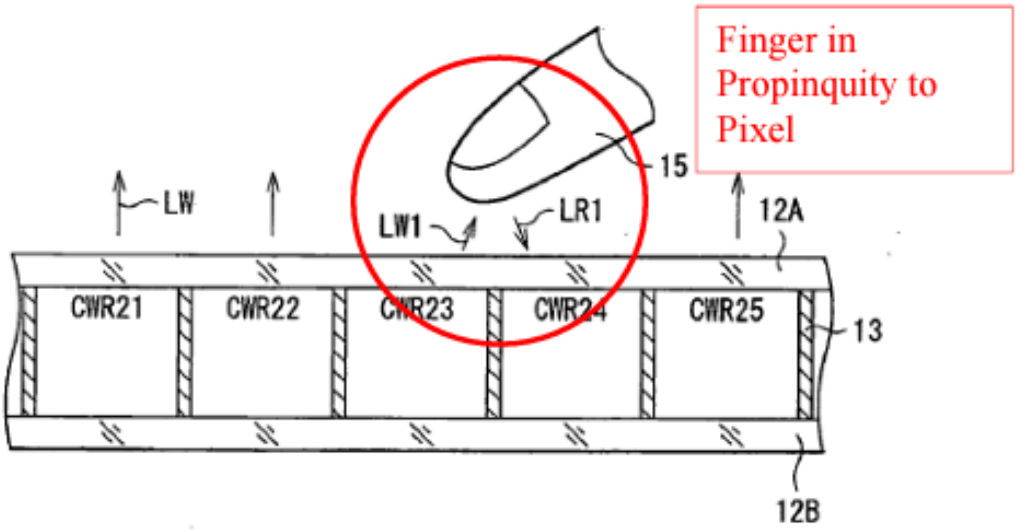


FIG. 5

Figure 5 of Yamaguchi, reproduced above, is a schematic illustration showing a process for detecting a target object, which is executed by the image display device, and with Petitioner's red annotation of a circle around the space between object 15 and the surface and Petitioner's red text annotation stating "Finger in Propinquity to Pixel." *Id.*; Ex. 1009 ¶ 32.

Regarding obviousness over Yamaguchi alone, Petitioner argues the following:

> A POSITA would recognize from this teaching that detection of the object in "close proximity" teaches or suggests establishing the threshold to respond to and sense an object at some predetermined degree of propinquity, i.e., a set level of nearness to the device, to avoid false positives and ensure "accuracy of detection." Ex-1009, [0171]; Ex-1002, ¶84. Moreover, sensing the object within a predetermined degree of propinquity or proximity would have been an obvious modification to a POSITA in view of Yamaguchi's suggestion that the threshold voltage can be adjusted based on the "purpose of [the] detection" to account for, among other things, "position detection" within a set nearness or range to the device. Ex-1009, [0171]; Ex-1002, ¶84.

Pet. 37.

Petitioner alternatively relies on Hinckley's disclosure of proximity sensor 262, with infrared transmitter 264 and infrared receiver 266, as well as Hinckley's disclosure of determining whether a distance to the object falls into one of three ranges. *Id.* at 37–38 (citing Ex. 1011 ¶¶ 29, 44, Fig. 7; Ex. 1002 ¶¶ 85–90). According to Petitioner, Hinckley's range 710, extending from 7 centimeters to 0 centimeters, teaches that the degree of propinquity to the surface is predetermined, because the object must be within 7 centimeters (a distance set in advance) to be considered "close" to mobile device 200. *Id.* at 38 (citing Ex. 1011 ¶ 44, Fig. 7; Ex. 1002 ¶¶ 85–90). Petitioner's reasoning to combine Yamaguchi and Hinckley and Patent Owner's dispute are discussed above. *See* § II.E.3.a.

Patent Owner counters that the asserted art does not teach element 1[b](3) because Yamaguchi's disclosure of detecting objects "in proximity to the display" is "only in the context of determining the x-y position on the display." Resp. 27 (citing, e.g., Ex. 1009 ¶¶ 104, 119). Patent Owner also argues that Yamaguchi is deficient because "the object's actual z-distance is irrelevant" to Yamaguchi's position calculations, Yamaguchi's system "is incapable of determining or calculating any 'z' position," and Yamaguchi's process "removes any meaningful information that would be necessary to determine or calculate an object's proximity of 'z' position." *Id.* at 27–28 (citing Ex. 1009 ¶¶ 161, 162, 169; Ex. 2056 ¶¶ 57–59). Patent Owner also argues Yamaguchi is deficient because it "is directed to determining x-y positions corresponding to a touch event and/or objects in contact with the display." *Id.* at 28–29 (citing Ex. 1009 ¶¶ 19, 101, 104, 134, 177, 195; Ex. 2056 ¶ 60). Dr. Cairns testimony is substantially the same as Patent Owner's argument.

In its Sur-reply, repeats certain of its arguments in its Response. Sur-reply 11. Also, relying on the testimony of Dr. Cairns, Patent Owner argues "there is simply no reason to modify Yamaguchi to 'change or adjust the threshold voltage to control the distance' because Yamaguchi has nothing to do with controlling distance." *Id.* at 12 (citing Ex. 1037, 179:13–18).

Patent Owner also argues Hinckley does not teach sensing the position of an object when the object has a "predetermined degree of propinquity." Resp. 29–32 (citing, e.g., Ex. 2056 ¶¶ 62–69). Patent Owner argues "[a]t best, Hinckley's arbitrary 'ranges' are rudimentary 'estimates,' which cannot teach the claimed 'predetermined degree.'" *Id.* at 30 (citing Ex. 2056 ¶ 64); *see also id.* ("Hinckley's approximated categories do not teach or suggest the claimed 'predetermined degree of propinquity' let alone determining any 'position' when Hinckley's sensor values fall within any rudimentary range.") (citing Ex. 2056 ¶ 65). Patent Owner also argues that Hinckley is distinguishable because "its proximity sensor can measure estimated proximity ranges up to 'infinity.'" *Id.* (citing Ex. 1011 ¶¶ 44–45, 55, Table 3, Fig. 7). Patent Owner further argues "Hinckley does not teach, disclose, or suggest using its proximity sensor to aid in determining positions for any touch interaction." *Id.* at 31 (citing Ex. 2056 ¶ 66); *see also id.* (arguing Petitioner does not identify a "pixel array" in Hinckley's disclosure and "[a] POSITA at the time of the invention would not look to Hinckley's 'proximity sensor' to satisfy the claimed 'pixel array'") (citing, e.g., Ex. 2056 ¶¶ 67–68). Dr. Cairns testimony is substantially the same as Patent Owner's argument.

We start with Patent Owner's arguments and Dr. Cairns's testimony that each of Yamaguchi and Hinckley are deficient because the proximity determination is too rudimentary or approximate to meet the claim

limitations and the asserted prior art fails to calculate an actual z-distance. Resp. 19–32; Ex. 2025 ¶¶ 41–69. At the institution stage, we stated the following:

> We preliminarily determine that the recitation "sense at least a position" is met by determining a two-dimensional or x-y position. Neither claim 1 nor claim 13 recite expressly a requirement that the position sensed is three-dimensional. Indeed claim 13 includes the recitations that are the same as claim 1, i.e., "sense *a position* of at least one object with respect to a surface thereof" and "sense at least *a position* of the at least one object with respect to the at least one pixel array." *Compare* Ex. 1001, 74:38–46 (emphases added), *with id.* at 73:15–22. Claim 13 further recites "wherein *the position of the object includes at least one of a two-dimensional position of the object*, a three-dimensional position of the object and angular orientation of the object." *Id.* at 74:58–61 (emphasis added). The '675 patent Specification similarly describes that the position of the object "includes at least one of a two-dimensional position of the object, a three-dimensional position of the object and angular orientation of the object." *Id.* at 6:9–16. Thus, the intrinsic record does not support a requirement that "z" be calculated, but only that the two-dimensional position be sensed "when the at least one object has a predetermined degree of propinquity" to the pixel array. *Id.* at 73:21–24.

Inst. Dec. 34–35.[7]

With respect to "sense at least a position," Patent Owner has not disputed our analysis in the Decision to Institute including our analysis of

[7] Each of independent claims 1 and 13 recites "a position" and "at least a position," each of which pertains to the configuration of the "at least one pixel array" as set forth in the full recitations, i.e., "the at least one pixel array being configured to sense [a/at least a] position." At the institution stage, we determined that the second of those recitations, i.e., sensing "at least a position" is met by determining the two-dimensional or x-y position. In other words, at the institution stage, we determined the independent claims require sensing only a single position.

the language of claims 1 and 13 and, in particular, the recitation in claim 13 of "wherein *the position of the object includes at least one of a two-dimensional position of the object*, a three-dimensional position of the object and angular orientation of the object." Ex. 1001, 74:58–61 (emphasis added). Patent Owner also has not disputed our analysis of the '675 patent Specification. Inst. Dec. 35. Any dispute by Patent Owner of our analysis and claim construction determinations regarding "sense at least a position" has been waived. Paper 13, 9 ("Patent Owner is cautioned that any arguments not raised in the response may be deemed waived."); *see also NuVasive*, 842 F.3d at 1379–82 (holding patent owner waived an argument addressed in the preliminary response by not raising the same argument in the patent owner response); TPG 66 (stating that the Patent Owner Response "should identify all the involved claims that are believed to be patentable and state the basis for that belief").

We adopt as our final analysis our analysis herein including the portions of the Decision to Institute regarding "sense at least a position" (Inst. Dec. 34–35) reproduced in this Decision.

With respect to claim construction of recitations including the term "propinquity," we determined above that Patent Owner's construction is overly narrow and not supported by the intrinsic record. We stated based on the complete record now before us, consistent with the District Court's claim construction, we determine that the term "propinquity" means "proximity" and, with respect to the remaining language, we adopt the "plain and ordinary meaning." *See* § II.D.1 (citing Ex. 1034, 2).

Under the correct constructions, element 1[b](3) is taught by Yamaguchi alone and we need not consider Petitioner's contentions regarding Hinckley. Indeed, Patent Owner acknowledges that Yamaguchi

alone "teaches determining x-y coordinates of an object in contact with a touch panel." *See, e.g.*, Resp. 27. Patent Owner's dispute relating to element 1[b](3) is premised on Patent Owner's overly narrow construction that requires that the degree of propinquity "does not include touching." *See generally* Resp. That construction is not consistent with the intrinsic record. *See* § II.D.1.

After consideration of Patent Owner's arguments and evidence, including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and give significant weight to the testimony of Dr. Bederson regarding Yamaguchi's teachings of sensing the position of an object because Petitioner's contentions and Dr. Bederson's testimony are consistent with the evidence of record under the correct constructions. We credit and afford significant weight to Dr. Bederson's testimony over the testimony of Dr. Cairns because we find that Dr. Bederson's testimony is supported by the evidence of record and we find Dr. Cairns's testimony, which is substantially the same as Patent Owner's arguments, is premised on Patent Owner's overly narrow construction "a predetermined degree of propinquity" and is unsupported and contradicted by the evidence of record in light of the scope of claim 1 under the correct construction of that term.

As an independent reason for our conclusions herein, we also provide analysis using Patent Owner's construction in-part specifically that the degree of propinquity is "established in advance and does not include touching," because Petitioner has shown that the prior art teaches the disputed recitations even using that construction. We now turn to that analysis.

Under the correct claim construction for "sense at least a position" (*see* § II.E.3.c) and under Patent Owner's construction in-part, i.e., that the

degree of propinquity is "established in advance and does not include touching" (*see* § II.D.1), after consideration of Patent Owner's arguments and evidence, including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and afford significant weight to the testimony of Dr. Bederson. We find Petitioner's contentions and Dr. Bederson's testimony regarding obviousness over Yamaguchi alone, and the alternative of obviousness over Yamaguchi and Hinckley, are consistent with the evidence of record even using Patent Owner's construction in-part. We credit and afford significant weight to Dr. Bederson's testimony over the testimony of Dr. Cairns because we find that Dr. Bederson's testimony is supported by the evidence of record and we find Dr. Cairns's testimony, which is substantially the same as Patent Owner's arguments, is unsupported and contradicted by the evidence of record.

Patent Owner's arguments and Dr. Cairns's testimony relating to deficiencies in each of Yamaguchi and Hinckley on the basis that the proximity determination is too rudimentary or approximate to meet the claim limitations and the asserted prior art fails to calculate an actual z-distance (Resp. 19–32; Ex. 2025 ¶¶ 41–69) are not consistent with the evidence of record even under Patent Owner's construction in-part, i.e., that the degree of propinquity is "established in advance and does not include touching" (*see* § II.D.1). Importantly, as discussed throughout this Decision, contrary to Patent Owner's arguments and Dr. Cairns's testimony, Yamaguchi describes sensing position "when a target object 15 such as a finger is brought into contact or *close proximity* with the display 1." Ex. 1009 ¶ 118 (emphasis added); *see also id.* ¶ 104 ("This makes it possible to determine the position of an object in contact with or *in close proximity* to the display device.") (emphasis added), ¶ 134 (describing "when a target object such as

a finger is brought into contact or *close proximity* with the display 1, the detecting process takes place to detect its position and the like") (emphasis added), ¶ 169 (describing comparing "the amount of each photo-detection signal to a predetermined threshold voltage V_t thereby detecting where an object in contact with or *in close proximity* to the display device is situated") (emphasis added). As emphasized in italics in each of Yamaguchi's disclosures, Yamaguchi describes position detection when the object is in "close proximity," but not touching.[8]

We also agree with Petitioner's contentions and credit and afford significant weight to Dr. Bederson's testimony that a person having ordinary skill in the art would have recognized from Yamaguchi's disclosures of position detection when an object is in "close proximity" that the threshold is established to respond to and sense an object at some predetermined degree of propinquity, i.e., a set level of nearness to the device. Pet. 37; Ex. 1002 ¶ 84. "A prior art reference must be 'considered together with the knowledge of one of ordinary skill in the pertinent art." *Paulsen*, 30 F.3d at 1480 (seeing no error in a finding that a person having ordinary skill in the art "certainly was capable of providing the circuitry necessary to make the device operable for use as a computer"). Yamaguchi describes photo-detecting signal being obtained from a detection cell near a target object on

[8] The aforementioned disclosures show that Yamaguchi describes sensing more than one position. Although we determine only one position needs to be sensed to meet the claim recitations, even if sensing more than one position is required, Petitioner has shown the disputed limitation is met. Yamaguchi, for instance, describes "when a target object such as a finger is brought into contact or close proximity with the display 1, the detecting process takes place to detect its position" and "[t]his enables users to conveniently operate the device." Ex. 1009 ¶ 134.

the x-y plane and the photo-detection signal level becomes lower farther away on the x-y plane. Ex. 1009 ¶¶ 118, 169–171. Yamaguchi expressly describes different threshold voltage settings and the effect those setting having on x-y position detection. Ex. 1009 ¶ 170 (describing that Figures 17A–17C illustrate regions "where the amount of photo-detection signal of the light emitting/photo-detection cell CWR is larger than the threshold voltage V_t, and this indicates that the object is detected at the position of each region"). Yamaguchi is not limited to the particular embodiments it describes and, instead, expressly states "users may optionally change the threshold voltage V_t according to the properties of the object (e.g., a size, a surface state (e.g., reflectivity, a color, roughness, and the like), etc.), the purpose of detection (e.g., position detection, size detection, color detection, and the like), the accuracy of detection, and so on." Ex. 1009 ¶ 171.

Petitioner argues that Patent Owner "offers no rebuttal to Dr. Bederson's opinion that it would have been obvious to determine such a distance corresponding to threshold voltage V_t." Reply 10 (citing Pet. 37; Ex. 1002 ¶ 84). We agree with Petitioner. In its Sur-reply, Patent Owner argues that Petitioner's position shifted (Sur-reply 11), but as we discuss herein, the argument was made in the Petition and supported by the testimony of Dr. Bederson submitted with the Petition. Pet. 37; Ex. 1002 ¶ 84. Also, relying on the testimony of Dr. Cairns, Patent Owner argues "there is simply no reason to modify Yamaguchi to 'change or adjust the threshold voltage to control the distance' because Yamaguchi has nothing to do with controlling distance." Sur-reply 12 (citing Ex. 1037, 179:13–18). Patent Owner's argument is conclusory and Patent Owner does not meaningfully dispute Petitioner's assertion and evidence that a person having ordinary skill in the art would have incorporated adjusting the

threshold "to avoid false positives and ensure 'accuracy of detection.'" Pet. 37 (citing Ex. 1009 ¶ 171; Ex. 1002 ¶ 84).

Regarding Patent Owner's arguments that Yamaguchi's system "is incapable of determining or calculating any 'z' position," and Yamaguchi's process "removes any meaningful information that would be necessary to determine or calculate an object's proximity of 'z' position" (Resp. 27–28 (citing Ex. 1009 ¶¶ 161, 162, 169; Ex. 2056 ¶¶ 57–59)), although Yamaguchi describes an embodiment in which a comparator output signal is "1" when the amount of the signal is larger than the predetermined threshold voltage V_t and is "0" when the amount of the signal is smaller than the predetermined threshold voltage signal V_t (Ex. 1009 ¶¶ 161–162, 169), Patent Owner acknowledges that Yamaguchi's embodiment relied upon by Patent Owner senses an x-y position. *See, e.g.*, Resp. 19–20, 27. Indeed, the sensing is with varying levels of accuracy, including a single cell. Ex. 1009 ¶ 170, Figs. 17A–17C. Contrary to Patent Owner's argument, Yamaguchi expressly describes sensing the x-y position when "the position sensor 34 and the comparator 35 or 351 compare the amount of each photo-detection signal to a predetermined threshold voltage V_t," and detect "an object in contact with or *in close proximity to* the display." *See, e.g.*, Ex. 1009 ¶ 169 (emphasis added). Thus, Patent Owner's arguments and Dr. Cairns's testimony do not address the full teachings of Yamaguchi that its comparator provides an output indicating whether an object is within "close proximity." *Id.*

We are persuaded that Petitioner has offered articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have modified the teachings of Yamaguchi in the manner recited in claim 1.

We also are persuaded Petitioner has shown a person having ordinary skill in the art would have had a reasonable expectation of success.

With respect to Petitioner's proposed combination of Yamaguchi and Hinckley, Patent Owner's arguments that Hinckley is deficient because its proximity distance determination is too rudimentary or approximate to meet the claim limitations (Resp. 19–32; Ex. 2025 ¶¶ 41–69) are premised on its overly narrow claim construction. As discussed above (*see* §§ II.D.1, II.E.3.c), the intrinsic record does not support any claim interpretation that supports Patent Owner's argument. *See also* Tr. 31:17–38:4 (arguing even under Patent Owner's construction any z-distance or proximity distance is simply a determination of whether the object is within a range or limit to the surface).

Indeed, Hinckley describes two ranges including range 708, which "extends from approximately 7 centimeters to 27 centimeters" and range 701 "which extends from 7 centimeters to 0 centimeters" and is "considered to be close to mobile device 200." Ex. 1011 ¶ 44. Hinckley describes using proximity distance in the operation of an audio receiver and in determining whether the device should enter an idle state. *Id.* ¶¶ 62, 66, 67, 104–108. Hinckley's disclosures meet the claim even under an incorrect, narrow construction requiring distinguishing between degrees of propinquity within a given threshold set forth in an example in the '675 patent Specification (Ex. 1001, 64:48–65:23) relied on by Patent Owner (Resp. 16), but not expressly argued as an alternative to Patent Owner's proposed construction.

Patent Owner's argument that Hinckley is distinguishable because "its proximity sensor can measure estimated proximity ranges up to 'infinity'" (Resp. 30 (citing Ex. 1011 ¶¶ 44–45, 55, Table 3, Fig. 7)) is misplaced. Patent Owner mischaracterizes Hinckley as Hinckley describes that a

distance of 27 centimeters or greater is not within range of mobile device 200. Ex. 1011 ¶ 44.

We turn to Patent Owner's remaining arguments including that "Hinckley does not teach, disclosure, or suggest using its proximity sensor to aid in determining positions for any touch interaction." Resp. 31 (citing Ex. 2056 ¶ 66). Patent Owner also argues Petitioner does not identify a "pixel array" in Hinckley's disclosure and "[a] POSITA at the time of the invention would not look to Hinckley's 'proximity sensor' to satisfy the claimed 'pixel array.'" *Id.* (citing, e.g., Ex. 2056 ¶¶ 67–68). The relevant issue is whether the teachings of Yamaguchi and Hinckley, taken as a whole, would have suggested the patentees' invention to a person having ordinary skill in the art. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Attacking each reference's teachings individually does not undermine Petitioner's showing of obviousness over the combination of Yamaguchi and Hinckley. *See Keller*, 642 F.2d at 426 (nonobviousness cannot be established by attacking prior art teachings individually where the ground of unpatentability is based upon a combination of the prior art teachings).

We turn to Patent Owner's argument regarding Petitioner's reasoning to combine Yamaguchi and Hinckley. *See*, *e.g.*, Resp. 24–26, 32–35; Sur-reply 8–9, 12–19. For the reasons given above, we determine that Patent Owner's arguments do not undermine Petitioner's showing. *See supra* § II.E.3.a.

In summary, Petitioner's contentions for element 1[b] are supported by the cited portions of Yamaguchi and Hinckley. Also, we determine that Petitioner has offered articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have modified Yamaguchi alone and combined the teachings of Yamaguchi and Hinckley in the manner

recited in claim 1. We also find that Petitioner has established a person having ordinary skill in the art would have had a reasonable expectation of success. We further determine that Patent Owner's arguments do not undermine Petitioner's showing. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Yamaguchi alone or with Hinckley teaches element 1[b] of claim 1.

d) Element 1[c]

Element 1[c] recites "circuitry coupled to and receiving an output from the at least one pixel array receiving, the circuitry being configured to provide a non-imagewise input representing the position of the at least one object relative to the at least one pixel array." Ex. 1001, 73:25–29. Petitioner argues that Yamaguchi teaches element 1[c] based on Yamaguchi's description of components of the image display device illustrated in Figure 13. Pet. 41–43 (citing Ex. 1009 ¶¶ 157–161, Figs. 13, 14E–14G, 22G).

In the portions of Yamaguchi relied on by Petitioner, Yamaguchi describes Figure 14 as showing that the "comparator output signal Vci" is "connected to the *cells CWRi*." Ex. 1009 ¶ 160. Yamaguchi explains this is used "for detecting the target object 15." *Id.* Yamaguchi also describes that a photo-detection signal that is obtained "during the photo-detection signal detection periods TH1 and TF2," "results in detection of the presence of the target object 15 near the light-emitting/photo-detection cells CWRij, CWRi(j+l) and CWRi(j+2)." *Id.* ¶ 161.

Although Patent Owner disputed Petitioner's showing for element 1[c] at the institution stage, Patent Owner has not maintained its dispute. *See generally* Resp.; Sur-reply. Any such dispute, therefore, has been waived. Paper 13, 9 ("Patent Owner is cautioned that any arguments not raised in the response may be deemed waived."); *see also NuVasive*, 842 F.3d at 1379–82

(holding patent owner waived an argument addressed in the preliminary response by not raising the same argument in the patent owner response); TPG 66 (stating that the Patent Owner Response "should identify all the involved claims that are believed to be patentable and state the basis for that belief").

Petitioner's contentions are supported by the cited portions of Yamaguchi. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Yamaguchi teaches element 1[c] of claim 1.

e) Element 1[d]

Element 1[d] recites "wherein the change in the amount of radiation detected results from ones of the plurality of detector elements detecting reflected light from the object in addition to detecting the radiation at the baseline level." Ex. 1001, 73:30–33. We note that "wherein the change in the amount of radiation detected" recited in element 1[d] derives antecedent basis from "a change in the amount of radiation detected" recited in element 1[b](2). We, therefore, consider Petitioner's contentions for both elements 1[b](2) and 1[d]. In those contentions, Petitioner relies on Yamaguchi's disclosure of detecting reflected light from the object in addition to detecting the radiation at the baseline level. Pet. 32–35, 44–45 (citing Ex. 1009 ¶¶ 159, 118, 159, 160, 170, 171, 187, Figs. 5, 14E–F, 17A–C, 22E–G; Ex. 1002 ¶¶ 76–81, 96–97).

Petitioner's contentions are supported by the cited portions of Yamaguchi. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Yamaguchi alone or with Hinckley teaches element 1[d] of claim 1.

f) Conclusion

After consideration of the contentions and the evidence in the complete record now before us, we determine that Petitioner has shown that Yamaguchi alone or with Hinckley teaches all recitations in claim 1. Also, we are persuaded that Petitioner has offered articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have modified Yamaguchi alone and combined the teachings of Yamaguchi and Hinckley in the manner recited in claim 1. We also are persuaded that Petitioner has demonstrated that such person would have had a reasonable expectation of success.

Accordingly, based on the complete record now before us, we conclude that Petitioner has established by a preponderance of the evidence that claim 1 is unpatentable under 35 U.S.C. § 103(a) as obvious over Yamaguchi alone or with Hinckley.

4. Independent Claim 13

Independent claim 13 is similar to independent claim 1, except claim 13 further recites "wherein the position of the object includes at least one of a two-dimensional position of the object, a three-dimensional position of the object and angular orientation of the object." Ex. 1001, 74:58–61. Petitioner's analysis of claim 13 is the same as the analysis of claim 1, except Petitioner points to the two-dimensional position sensed in Yamaguchi for the further recitation in claim 13. Pet. 45–46 (citing, e.g., Ex. 1009 ¶¶ 40, 42–44, 104, 166, 168, 170, Fig. 17A).

Patent Owner does not argue claim 13 separately. *See generally* Resp. Petitioner's assertions regarding claim 13 are supported by the cited portions of Yamaguchi and Hinckley. For the reasons given with respect to claim 1,

we find that Patent Owner's arguments and evidence do not undermine Petitioner's showing. *See supra* § II.D.3.

After consideration of the contentions and the evidence in the complete record now before us, we determine that Petitioner has shown that Yamaguchi alone or with Hinckley teaches all recitations in claim 13. Also, we are persuaded that Petitioner has offered articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have modified Yamaguchi alone and combined the teachings of Yamaguchi and Hinckley in the manner recited in the claim. We also are persuaded that Petitioner has demonstrated that such person would have had a reasonable expectation of success.

Accordingly, based on the complete record now before us, we conclude that Petitioner has established by a preponderance of the evidence that claim 13 is unpatentable under 35 U.S.C. § 103(a) as obvious over Yamaguchi alone or with Hinckley.

5. Dependent Claims 2, 6, and 9–11

Claim 2 depends from claim 1 and further recites "wherein the at least one pixel array is configured to sense light reflected from the at least one object." Petitioner argues "Yamaguchi explains that '[t]he surface of the display 1 of the image display device is irradiated with and exposed to ambient light, as well as light reflected from an object in contact with or in close proximity to the display device.'" Pet. 47 (quoting Ex. 1009 ¶ 178). Petitioner also argues that "Yamaguchi further explains that the reflected light can be detected by the display device." *Id.* (citing Ex. 1009 ¶ 195, Fig. 5).

Claim 6 depends from claim 1 and further recites "wherein the utilization circuitry is further configured to compute at least one

characteristic of a trajectory of motion of the at least one object generally parallel to the at least one pixel array, wherein the at least one characteristic includes at least one of location, direction, velocity and change in direction." Petitioner argues "[a]ny one of location, direction, velocity and change in direction is sufficient to satisfy the claim." Pet. 49. Petitioner relies on Yamaguchi description of enabling "more accurate detection of the position and other conditions of an object which moves at high speed," using circuitry such as position sensor 34." *Id.* (citing Ex. 1009 ¶ 247, Fig. 13). Petitioner also relies on Yamaguchi's description of detecting position in connection with Figure 17A. *Id.* at 50–51 (citing Ex. 1009 ¶ 170, Fig. 17A).

Claim 9 recites the following:

> 9. A position sensing assembly according to claim 1, further comprising a processing subassembly including:
>
> detector analyzing processing circuitry configured to receive detector outputs of individual ones of the plurality of detector elements, to determine whether at least one of the amount of radiation and the change in the amount of radiation detected by the individual ones of the plurality detector element exceeds the predetermined threshold, and to provide detector analysis outputs for the individual ones of the plurality of detector elements;
>
> array processing circuitry configured to receive the detector analysis outputs of the plurality of detector elements of a single one of the at least one pixel array and to generate an array detection output therefrom; and
>
> position ascertaining circuitry configured to receive the array detection output of the at least one pixel array and to ascertain the position of the object therefrom.

For claim 9, Petitioner argues "[t]he primary distinction between Claim 9 and Claim 1 is that Claim 9 relates to 'individual ones' of the detectors, as opposed to all of the detectors together." Pet. 53. Petitioner

argues "[t]his operation on the individual ones of the detectors is disclosed by Yamaguchi." *Id.* (citing, e.g., Ex. 1009 ¶¶ 168–170, Figs. 16, 17A). Petitioner also argues that "photo-detection signal receiver 32," "comparator 35," and "photo-detection signal holder 33" are "array processing circuitry configured to receive data from the individual pixels and generate array detection data therefrom." *Id.* at 55 (citing Ex. 1002 ¶ 112–114). Petitioner further argues "[a]nd this array detection output is then used by 'position sensor' 34, which is position ascertaining circuitry for ascertaining the position of the object." *Id.*

Claim 10 depends from claim 1 and further recites "wherein the array detection output includes information corresponding to at least one of the location of an impingement point of the object on the surface and the location of the object relative to the surface." Petitioner argues "Yamaguchi's output includes information corresponding to the location of the object relative to the surface because it includes a two-dimensional position of the object on the display surface." Pet. 57 (citing Ex. 1009 ¶ 170, Fig. 17A).

Claim 11 depends from claim 1 and further recites "wherein the radiation at the baseline level is provided by at least one source of radiation external to the position sensing assembly." Petitioner argues "Yamaguchi teaches that the radiation at the baseline level is provided by ambient light." Pet. 58 (citing Ex. 1009 ¶ 21).

We have considered Petitioner's arguments and evidence for dependent claims 2, 6, and 9–11 and we find that Petitioner's arguments and the testimony of Dr. Bederson are consistent with and supported by the evidence cited therein. We are persuaded that Petitioner has shown that Yamaguchi alone or with Hinckley teaches the further recitations in each of

those dependent claims. Patent Owner does not present arguments separately contesting Petitioner's assertions for claims 2, 6, and 9–11. Accordingly, based on the complete record now before us, we conclude that Petitioner has established by a preponderance of the evidence that claims 2, 6, and 9–11 are unpatentable under 35 U.S.C. § 103(a) as obvious over Yamaguchi alone or with Hinckley.

F. Unpatentability of Claims 1, 2, 6, and 10–13 under 35 U.S.C. § 103(a) over Reime and Hinckley

Petitioner asserts that claims 1, 2, 6, and 10–13 are unpatentable as obvious over Reime alone or with Hinckley. Pet. 4. Patent Owner counters that Petitioner's reasoning to combine the prior art references is deficient and the asserted art does not teach elements 1[b] and 13[b]. Resp. 36–58.

We begin with an overview of Reime. We then turn to the parties' contentions.

1. 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.

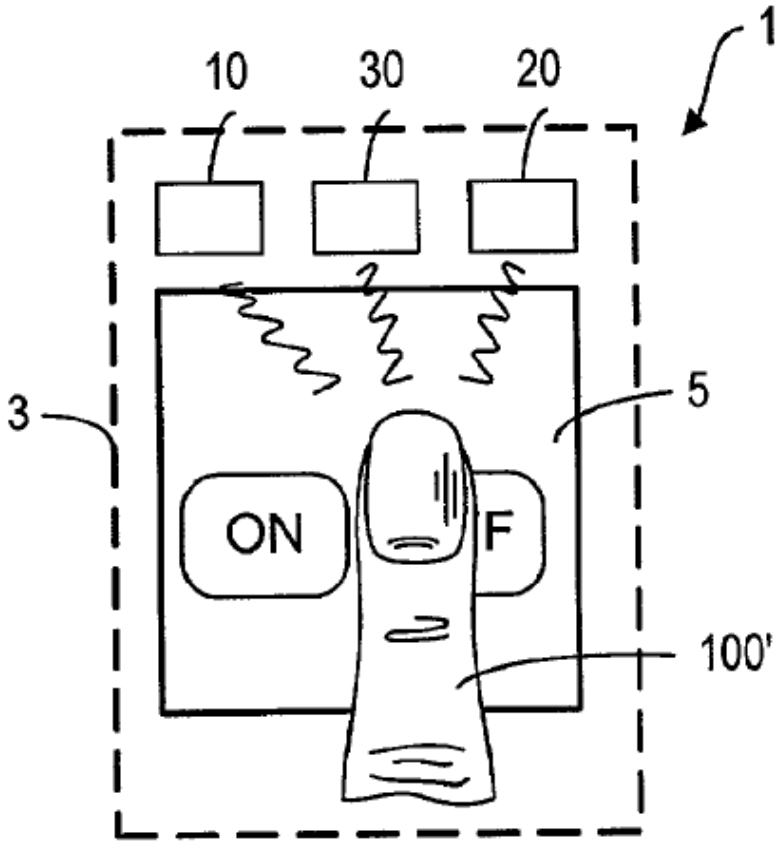


FIG. 2A

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.*

2. Independent Claim 1

a) Reasoning to Combine

Petitioner provides an overview of its contentions as to why a person having ordinary skill in the art would have combined the teachings of Reime and Hinckley (Pet. 59–60), as well as more detailed contentions for element 1[b] (*id.* at 66–75). We discuss the parties' contentions regarding reasoning to combine Reime and Hinckley here. We discuss the parties' contentions regarding obviousness over Reime alone in the element-by-element analysis below.

Although we start with the parties' contentions regarding reasoning to combine Reime and Hinckley, we note we find that Reime alone teaches all recitations in claim 1 under the correct constructions. *See* § II.F.3.c. We discuss Petitioner's contentions regarding obviousness over Reime and Hinckley as an additional, independent ground supporting our unpatentability conclusions herein.

Petitioner argues that "Reime discloses that the sensitivity and the optical response of the light receivers may vary from one application to another." Pet. 59, 69, 74 (citing Ex. 1010 ¶ 111). Petitioner further argues that "Hinckley provides additional teachings on quantifying object proximity based on sensor output" and "using this information for a number of such applications, including controlling device idle state and power consumption." *Id.* at 59–60 (citing Ex. 1011 ¶¶ 62, 104–106; Ex. 1002 ¶ 120).

For element 1[b](2) and Petitioner's alternate argument relating to adding Hinckley's predetermined threshold to Reime, Petitioner, more specifically, argues that Hinckley, for example, teaches that a mobile phone, such as disclosed in Reime, "can be put in a full power mode when a

touching objecting is in or near a touch pad area, for power efficiency reasons." *Id.* at 70 (citing Ex. 1011 ¶¶ 104–105). Relying on the testimony of Dr. Bederson, Petitioner argues that a person having ordinary skill in the art would have been motivated to include Hinckley's thresholds in Reime's mobile phone to obtain additional features and benefits, such as Hinckley's power efficiency features. *Id.* at 60, 70 (citing Ex. 1002 ¶ 140).

For element 1[b](3) and Petitioner's alternate argument relating to adding Hinckley's sensing an object when it has a predetermined degree of propinquity, Petitioner, more specifically, argues that Hinckley "teaches applications where the optical responses of the light receivers are judged based on proximity" and also "teaches activating an audio receiver based on proximity." *Id.* at 74 (citing Ex. 1011 ¶¶ 62, 66, 67, 104, 106, 107). Petitioner argues that a person having ordinary skill in the art would have been motivated to include Hinckley's predetermined ranges in Reime based on, for example, Reime's sensitivity adjustment ability. *Id.* at 74–75 (citing Ex. 1002 ¶¶ 145–146).

Regarding whether a person having ordinary skill in the art would have had a reasonable expectation of success, relying on the testimony of Dr. Bederson, Petitioner argues as follows:

> A POSITA would have had a reasonable expectation of success in combining the teaching of Reime and Hinckley. Each purports to solve these problems in similar and predictable ways, such as by using well-known position sensors, such as those based on infrared detectors (see Ex-1011 [0029], Ex-1010 [0106]), to detect the positions of an object in contact with or in close proximity to a display device, using similar hardware and software. Ex-1002 ¶121.

Id. at 60.

For element 1[b](2), Petitioner, more specifically, argues that a person having ordinary skill in the art would have had a reasonable expectation of success because Reime "already discloses comparing the high-pass filtered signal to zero." *Id.* at 70 (citing Ex. 1010 ¶ 89). Relying on the testimony of Dr. Bederson, Petitioner argues a person having 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." *Id.* (citing Ex. 1002 ¶ 141). For element 1[b](3), relying on the testimony of Dr. Bederson, Petitioner argues a person having ordinary skill in the art would have understood how to implement Hinckley's proximity sensors in Reime's device. *Id.* at 75 (citing, e.g., Ex. 1002 ¶ 147).

In support of Petitioner's contentions regarding reasoning to combine, including Petitioner's contentions for elements 1[b](2) and 1[b](3), Dr. Bederson testifies that each of Reime and Hinckley purports to solve problems "in similar and predictable ways, such as by using well-known position sensors, such as those based on infrared detectors" and that the references use "similar hardware and software." Ex. 1002 ¶ 121; *see also id.* ¶ 147 (reiterating the same testimony), ¶ 141 (testifying that Reime and Hinckley "propose solutions that are predictable to implement using the same types of hardware and software"). Also, Dr. Bederson's testimony regarding Reime and Hinckley refers to his testimony regarding Yamaguchi and Hinckley. *Id.* ¶ 147 (citing Ex. 1002 § XII.A.2.c.(3)).[9] As discussed above, Dr. Bederson testifies that the knowledge of position sensors, such as

[9] Dr. Bederson's testimony cites to "Section XII.A.2.c.(3)," but his Declaration does not include that sub-section. Based on the substance of his testimony, we treat his testimony as citing to "Section XIII.A.2.c.(3)" and deem the reference to "XII" instead of "XIII" as a typographical error.

those taught by Yamaguchi and Hinckley, "is exemplified by the fact that the '675 patent does not teach anything at all about how to determine 'predetermined' propinquity. Rather, the patent and the art make clear that such approaches were well-understood at the time and predictable to implement." Ex. 1002 ¶ 89; *see also id.* ¶ 147 (testifying "the '675 patent does not teach anything at all about how to determine 'predetermined' propinquity"). Dr. Bederson further testifies "a POSITA would have had a reasonable expectation of success in implementing proximity sensors in the devices disclosed by Yamaguchi, regardless of the hardware used in these sensors." *Id.* ¶ 89 (citing Ex. 1025 ¶ 31); *see also id.* ¶ 147 (citing Ex. 1025 ¶ 31) (testifying "a POSITA would understand how to implement proximity sensors with many different types of technology").

We start with Petitioner's overview of its contentions regarding reasoning to combine and reasonable expectation of success, as well as Petitioner's argument regarding element 1[b](3) as the parties' arguments relating to the overview and element 1[b](3) overlap. Patent Owner counters that Petitioner's argument and Dr. Bederson's testimony do not show why or how a person having ordinary skill in the art would or could have modified Reime alone or in combination with Hinckley. *See, e.g.*, Resp. 36–45, 53, 58–59. For instance, Patent Owner argues Dr. Bederson's testimony "relies on superficial analysis, unsupported statements, and hindsight reconstructions." Resp. 36 (citing Ex. 1002 ¶¶ 119–121; Ex. 2056 ¶ 79); *see also id.* at 40 ("Petitioner must not use the patent as a roadmap"), 41 ("Dr. Bederson could not reconcile the fundamental differences between the purpose of Hinckley's proximity sensor and Reime's touch pad and only provides generic self-serving statements regarding motivation to combine these references") (citing Ex. 1002 ¶¶ 119–121; Ex. 2056 ¶ 91), 42 ("Dr.

Bederson's statements are akin to stating in a conclusory fashion that the combination 'would have been obvious'"). Patent Owner also argues that "Dr. Bederson identifies problems associated with 'touch,'" but "Hinckley does not disclose, teach, or suggest using its 'proximity sensor' to solve any 'touch' related issue." *Id.* at 36–37 (citing Ex. 1002 ¶¶ 119–121, 139); *see also id.* at 41 ("Hinckley does not disclose, teach, or suggest using its 'proximity sensor' to solve any 'touch' issue because Hinckley already discloses touch screens and touch sensors"). Patent Owner also argues a person having ordinary skill in the art would not have been motivated to make the proposed combination because Hinckley would not have provided any benefit that would have improved Reime's "touch-detection." *Id.* at 41 (citing Ex. 2056 ¶ 90); *see also id.* at 37–40 (discussing Reime and arguing Reime's lightguide requires light transmission within the light guide "to determine x-y positions of a touching object"), 42 ("It would be nonsensical" to use Hinckley's teachings "because Reime does not measure or care about proximity").

Patent Owner argues that Dr. Bederson "cherry-pick[s]" Hinckley's teachings of a proximity sensor from Hinckley's "teaching relating to 'touch' detection." Resp. 36; *see also id.* at 40 ("Dr. Bederson does not explain why a POSITA would ignore Hinckley's teachings regarding a 'touch' sensor and instead cherry-pick[s] Hinckley's proximity sensor to modify Reime's 'touch pad.'") (citing *Apple Inc. v. Contentguard*, Paper 9 at 15, 17; *P&G v. Teva Pharms. USA, Inc.*, 566 F.3d 989, 995 (Fed. Cir. 2009)). Dr. Cairns testimony is substantially the same as Patent Owner's argument.

Patent Owner's arguments are premised on its mischaracterization of Reime as relating to only sensing touch. *See, e.g.*, Resp. 36–45, 53, 58–59.

Throughout its arguments, Patent Owner does not address Reime's disclosure 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 object 100' is detected by optical sensor components 10, 20, and 30." Ex. 1010 ¶ 74. Figure 1 of Reime, below, illustrates a group of two light emitters and a light receiver is used to detect the presence of a nearby object. *Id.* ¶ 28.

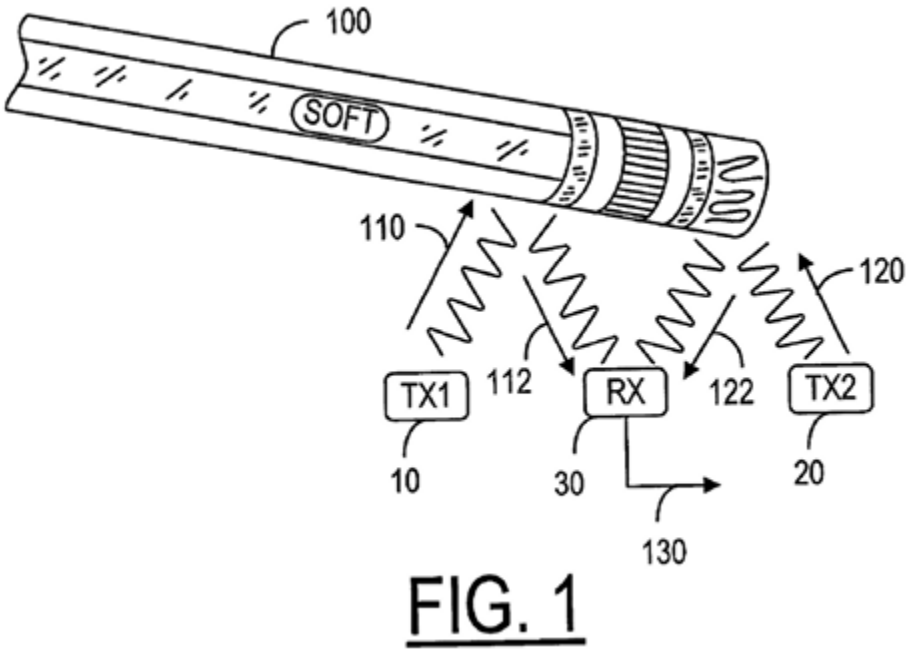


FIG. 1

Figure 1 of Reime, above, is a diagrammatic representation where two light emitters 10, 20 are positioned on opposite sides of light receiver 30 and light emitters 10, 20 and light receiver 30 are used to detect the presence of nearby object 100'. *Id.* ¶¶ 28, 73.

Patent Owner's argument that a person having ordinary skill in the art would not have been motivated to make the proposed combination because Hinckley would not have provided any benefit that would have improved Reime's touch-detection requiring "light transmission within the light guide" (Resp. 37–41 (citing Ex. 1010, code (57), ¶¶ 8–10, 74–75, 79–80, 86–89, Fig. 8D; Ex. 2056 ¶¶ 84–86, 90)) also misrepresents the teachings of Reime.

The paragraphs of Reime relied on by Patent Owner (*id.*) are consistent with and support Petitioner's position and are contrary to Patent Owner's position. For example, Reime describes optical sensor components including light emitters and one or more detectors, measuring changes in the amount of light received by the one or more detectors, and determining the location of the object based on the measurements. Ex. 1010, code (57), ¶¶ 8–10, 74–75, 79–80, 86–89. Contrary to Patent Owner's arguments, Reime describes unlike other technologies, "[i]t is not necessary for the object 100' to physically touch or press the area 5 at a touching point" for Reime's optical sensor components to detect the object. *Id.* ¶ 74. Furthermore, Reime further clarifies "the phrase 'touching the surface', as used hereinafter, regarding the touch pad device 1 of the present invention, can be interpreted as 'making contact with the surface' or being adjacent to the surface.'" *Id.* Reime describes detecting both "the approaching and touching of the user's finger." *Id.* ¶ 86; *see also id.* ¶ 75 (describing "[w]hen the user's finger 100' touches or *approaches* the pad area 5, as shown in FIG. 2A, it is usually possible to determine from the changes in the output signal of the receiver 30 that the OFF function is selected" (emphasis added)), ¶ 111 ("The present invention provides a method and device for detecting and sensing the presence of a touching object and the movement thereof in or *near* a touch pad area" (emphasis added)). Although Figure 8D illustrates "total internal reflection," Reime discloses other embodiments in the paragraphs identified by Patent Owner, as well as in the disclosures set forth in the Petition, that are consistent with and support Petitioner's position and Dr. Bederson's testimony. *See, e.g.*, *id.* ¶¶ 74–75, 79–80, 86–89, Fig. 8D.

Contrary to Patent Owner's arguments that Dr. Bederson's testimony "relies on superficial analysis, unsupported statements, and hindsight

reconstructions" and similar arguments characterizing Dr. Bederson's testimony as generic, conclusory, and relying on the '675 patent as a roadmap (Resp. 36, 40–42 (citing Ex. 1002 ¶¶ 119–121; Ex. 2056 ¶¶ 79, 91), Dr. Bederson's testimony supports Petitioner's articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Reime and Hinckley in the manner recited in the claim set forth above. Pet. 59–60, 69, 74 (citing Ex. 1010 ¶ 111; Ex. 1011 ¶¶ 62, 104–106; Ex. 1002 ¶ 120). Dr. Bederson testifies as follows:

> Moreover, as set forth in more detail below, Reime discloses that the sensitivity and the optical response of the light receivers may vary from one application to another. Ex-1010, [0111]. Although well-known to a POSITA at the time of the invention, Hinckley provides additional teachings on quantifying object proximity based on sensor output. Hinckley describes using this information for a number of such applications, including controlling device idle state and power consumption based on the presence and motion and of an object. Ex-1011, [0106]–[0108]. Hinckley also teaches activating an audio receiver in the device based on proximity. *Id.*, [0062]. A POSITA would have been motivated to modify Reime according to Hinckley's teachings to obtain such additional features and benefits.

Ex. 1002 ¶ 120. Dr. Bederson provides further detailed testimony regarding reasoning to combine for elements 1[b](2) and 1[b](3) to incorporate Hinckley's thresholds and Hinckley's sensing an object when it has a predetermined degree of propinquity. Ex. 1002 ¶¶ 140, 145–146 (citing Ex. 1011 ¶¶ 62, 66, 67, 104–107).

Patent Owner's arguments are premised on its position that a person having ordinary skill in the art would not have been motivated to make the proposed combination because Hinckley would not have provided any benefit that would have improved Reime's touch-detection. *See, e.g.*, Resp.

36–45, 53, 58–59. In addition to mischaracterizing Reime for the reasons discussed above, Patent Owner also misrepresents the teachings of Hinckley and the express disclosures in Hinckley of the benefits of incorporating its proximity sensor techniques with touch sensing technology. Indeed, Petitioner provides arguments regarding features and benefits set forth expressly in Hinckley that would have motivated a person having ordinary skill in the art to make the proposed combination. *Id.* at 60, 70, 74 (citing Ex. 1002 ¶¶ 140, 145–146; Ex. 1011 ¶¶ 62, 66, 67, 104–107).

Contrary to Patent Owner's arguments that Hinckley's teachings do not support Petitioner's position, Hinckley's teachings are consistent with and support Petitioner's position and Dr. Bederson's testimony. For instance, Hinckley describes a device including proximity sensor 262 consisting of infrared transmitter 264 and infrared receiver 266, and Hinckley describes benefits of controlling device idle state, controlling power consumption, and activating an audio receiver by including Hinckley's proximity technology. Ex. 1011 ¶ 29 (describing "proximity sensor 262 consisting of an infrared transmitter 264 and an infrared receiver 266"), ¶ 62 (describing activating an audio receiver "based on a proximity sensor that senses when the input device is close to the user"), ¶¶ 104–106 (describing a mobile phone placing itself "in full-power mode" based on a combination of sensors and describing preventing "a mobile device from entering an idle mode if the user is handling the device or gesturing toward the device"), ¶¶ 107–108 (describing that "motion near the device" is detected "by changes in the output of the proximity sensor and is indicative of a user gesturing toward the device").

We turn to Patent Owner's argument that "Dr. Bederson identifies problems associated with 'touch,'" but "Hinckley does not disclose, teach, or

suggest using its 'proximity sensor' to solve any 'touch' related issue." Resp. 36–37 (citing Ex. 1002 ¶¶ 119–121, 139). As discussed in detail above, Patent Owner mischaracterizes Dr. Bederson's testimony and Reime's teachings as relating to only touch. Dr. Bederson, for instance, testifies regarding Reime's description of sensing "movement thereof in or *near a touch pad area*." Ex. 1010 ¶ 111 (emphasis added) (cited in Ex. 1002 ¶ 120). Dr. Bederson further testifies "[a]lthough well-known to a POSITA at the time of the invention, Hinckley provides additional teachings on quantifying object proximity based on sensor output." Ex. 1002 ¶ 120. Dr. Bederson also testifies that a person having ordinary skill in the art would have be motivated to incorporate Hinckley's teachings regarding thresholds and notes Reime's teachings relating to a touching object, as well as an object "near" the touchpad area. *Id.* ¶ 140. Dr. Bederson's testimony that a person having ordinary skill in the art would have incorporated Hinckley's thresholds to improve power efficiency (*id.*) are consistent with Hinckley's teachings of using sensor technology to determine if the user wants the device to be in full-power mode and to control power consumption. Ex. 1011 ¶¶ 104–107. We are not persuaded that Dr. Bederson's testimony regarding Reime's touch technology undermines his testimony as to why a person have ordinary skill in the art would have made the proposed modification.

Turning to Patent Owner's cherry-picking argument (Resp. 36, 40), Patent Owner's reliance on *P&G* is misplaced. Resp. 40 (citing, e.g., *P&G*, 566 F.3d at 995). Petitioner does not rely on structural similarities between chemical compounds as a reason to combine Reime and Hinckley. Pet. 59–60, 69–70, 74–75. To the extent that Patent Owner's cherry-picking arguments pertain to unpredictability or a lack of a reasonable expectation of

success, for the reasons given herein, we agree with Petitioner explanation and evidence. Pet. 59–60, 69–70, 74–75. Patent Owner also relies on a decision in a proceeding between Apple and Contentguard (Resp. 40), without providing further information identifying the proceeding Patent Owner relies on from among approximately 15 proceedings between Apple and Contentguard.

Patent Owner's cherry-picking argument also is serves as an implicit acknowledgement that Hinckley teaches both technologies operating together. Indeed, Hinckley describes a device including its proximity sensor, as well as "two touch sensors 254 and 256" and Hinckley describes benefits of controlling device idle state, controlling power consumption, and activating an audio receiver by including Hinckley's proximity technology with its touch technology. Ex. 1011 ¶¶ 29, 62, 104–108. Hinckley's disclosures (*id.*) are consistent with and support the testimony of Dr. Bederson that a person having ordinary skill in the art would have been motivated to incorporate Hinckley's technology into Reime to achieve these benefits. Ex. 1002 ¶¶ 120–121, 140, 145 (citing, e.g., Ex. 1011 ¶¶ 29, 62, 104–108). Contrary to Patent Owner's argument and the testimony of Dr. Cairns, the Petition and Dr. Bederson's testimony provide reasoning why a person having ordinary skill in the art would have been motivated to incorporate Hinckley's technology into Reime and the evidence of record is consistent with and supports Petitioner's position.

Patent Owner also counters that hardware incompatibilities would have kept a person having ordinary skill in the art from making the proposed combination. Resp. 42–45, 58–59 (citing, e.g., Ex. 2056 ¶¶ 93–98). Patent Owner argues that Hinckley's proximity sensor "operates in a constant listening mode and outputs signals corresponding to detected light over its

enter operational range" and would have been incompatible with "Reime's measurement cycles." *Id.* at 43 (citing Ex. 1010 ¶¶ 75, 80, 82; Ex. 1011 ¶ 47, Fig. 7; Ex. 2056 ¶ 93); *see also id.* at 59 (arguing "Reime's time-dependent measurement cycles for measuring touch would not work with Hinckley's proximity sensor because Hinckley's requires keeping its receiver and transmitter on for all measurement cycles to measure any light being reflected by an object (up to infinity)"). Patent Owner also argues that Hinckley and Reime are incompatible because Hinckley's infrared transmitter projects light outward from the device, whereas Reime's waveguide transmits and detects light reflected internally and a person having ordinary skill in the art would have understood that the proposed modification would have required "washing [Reime's] waveguide and receivers with light" rendering them inoperable. *Id.* at 43–44 (citing Ex. 1010 ¶ 110, Fig. 8D; Ex. 1011, Fig. 3; Ex. 2060, 154:17–156:2; Ex. 2056 ¶¶ 94–96, 98). Patent Owner argues that a person having ordinary skill in the art would not have understood "how Hinckley's proximity sensor works" or how it could have been combined with Reime. *Id.* at 44 (citing, e.g., Ex. 2056 ¶ 97; Ex. 2060, 155:8–20; Exs. 2061–2063).

As an initial matter, Patent Owner narrowly focuses on the physical differences between the exemplary systems disclosed in the references and requires bodily incorporating Hinckley's sensor into Reime's device. "It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements." *Mouttet*, 686 F.3d at 1332; *Etter*, 756 F.2d at 859; *Keller*, 642 F.2d at 425 (Obviousness does not require that all of the features of the secondary reference be bodily incorporated into the primary reference.).

We do not agree that Patent Owner's argument and evidence demonstrates that a person having ordinary skill in the art would not have understood "how Hinckley's proximity sensor works" or how it could have been combined with Reime. Resp. 44 (citing Exs. 2061–2063; Ex. 2056 ¶ 97). Patent Owner relies on some of the same evidence discussed above with respect to the Yamaguchi grounds and Patent Owner's arguments are not persuasive for the same reasons given above. For instance, certain of Patent Owner's evidence describes design considerations with backlighting and ambient light-levels, including considerations in smartphone designs, and calibrations and other design considerations with a non-smartphone system, Kinect, that emits infrared beams and uses reflected light to sense a user's position. Exs. 2061–2063. Patent Owner's evidence, however, describes successful implementations of those technologies and illustrates that the technologies were known. Exs. 2061–2063. Additionally, Exhibit 2062 describes measuring position of objects in a room, including users standing at least six to eight feet from the device. Ex. 2062. In contrast, Hinckley describes that a range of "a distance of approximately 27 centimeters to infinity" indicates "that no objects are within range of mobile device 200." Ex. 1011 ¶ 44. In other words, objects farther than 27 centimeters from mobile device 200 are not within detection range. *Id.*

We credit and afford significant weight to Dr. Bederson's testimony regarding the knowledge of position sensors, such as those taught by Reime and Hinckley, the understanding of how to implement such sensors with manner different types of technology, and that a person having ordinary skill in the art would have had a reasonable expectation of success in implementing proximity sensors in the devices disclosed by Reime, "regardless of the hardware used in these sensors." Ex. 1002 ¶¶ 89, 147

(citing Ex. 1025 ¶ 31); *see also id.* ¶ 147 (citing Ex. 1025 ¶ 31) (testifying "a POSITA would understand how to implement proximity sensors with many different types of technology"). Dr. Bederson's testimony (*id.*) is consistent with and supported by the evidence cited therein, such as the disclosure below.

> Various types of touch sensors are capable of determining the proximity of a touch implement hovering over the surface of a touch sensitive panel. For example, hover detection and/or *proximity measurement* may be performed using capacitive touch sensors, infrared touch sensors, and/or optically sensitive liquid crystal displays (LCDs), among others. Embodiments of the invention are directed to the use of pre-touch information to provide enhanced touch sensing functionality. Pre-touch information may include, for example, *hover detection, proximity measurement, and/or pre-touch location determination*.

Ex. 1025 ¶ 31 (emphases added). In an obviousness analysis, we must consider the combination of references, as a whole, in light of the general knowledge of an ordinarily skilled artisan. *Merck*, 800 F.2d at 1097.

Also contrary to Patent Owner's argument and the testimony of Dr. Cairns, Hinckley describes that it "relates to devices with displays" including "computing and mobile devices." Ex. 1011 ¶ 2. Hinckley expressly describes that its technology is implemented in devices including other sensors, such as "touch sensors 254 and 256." *Id.* ¶ 29 (cited in e.g., Pet. 37). Furthermore, consistent with Petitioner's contentions and Dr. Bederson's testimony, Reime would not have had to been modified in the manner argued by Patent Owner because Reime's device sense provides describes 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 object 100' is detected by optical sensor components 10, 20, and 30." Ex. 1010 ¶ 74.

On this record, Petitioner has provided persuasive evidence to show that incorporating Hinckley's predetermined ranges into Reime's device as set forth in the Petition and in Dr. Bederson's testimony would not have been "uniquely challenging or difficult for one of ordinary skill in the art" at the time of the invention. *Leapfrog,* 485 F.3d at 1162 (citing *KSR*, 550 U.S. at 418). Petitioner's argument and evidence, including the testimony of Dr. Bederson, is not undermined by Patent Owner's argument and evidence, including the testimony of Dr. Cairns.

For the reasons given, we agree with Petitioner's arguments and evidence in its overview of its contentions as well as Petitioner's argument and evidence element 1[b](3). We determine Petitioner's arguments and evidence are not undermined by Patent Owner's arguments in its Patent Owner Response.

Regarding element 1[b](2), Patent Owner argues that Dr. Bederson's testimony summarily concludes a person having ordinary skill in the art would have used Hinckley's teachings in combination with Reime and absent hindsight a person having ordinary skill in the art would not have looked to "Hinckley's proximity range estimates" for the "first predetermined threshold." Resp. 50–52 (citing, e.g., Ex. 1002 ¶¶ 137–138, Ex.1011 ¶¶ 44–45, 55, Fig. 7; Ex. 2056 ¶¶ 106–110). Patent Owner also argues "Dr. Bederson's self-serving statements to somehow combine Hinckley with Reime to 'ensure more consistent responses in the varying applications envisioned by Reime' lack context, as well as support in the record." *Id.* at 53 (citing Ex. 1002 ¶ 139; Ex. 2056 ¶¶ 111–112).

Although we summarize Petitioner's contentions regarding element 1[b](2) above, we note that, relying on the testimony of Dr. Bederson, the Petition includes several pages of explanation of why a person having

ordinary skill in the art would have made the proposed modification and why such a person would have had a reasonable expectation of success. *See, e.g.*, Pet. 68–70 (citing Ex. 1002 ¶¶ 137–141). Contrary to Patent Owner's argument (*see, e.g.*, Resp. 50–52), we do not find that Dr. Bederson's testimony summarily concludes a person having ordinary skill in the art would have made the proposed combination or that Dr. Bederson relies on hindsight. Instead, Dr. Bederson's testimony provides detailed explanations and support, as set forth, for example, below.

> 139. A POSITA would have been motivated to modify Reime in view of Hinkley. Reime discloses that the "sensitivity and the optical response of the light receivers … may vary from one application to another." Ex-1010, [0111]. A POSITA would have been motivated to include a predetermined threshold in [response] to the "sensitivity" and "optical response" of the device and measure the detected signal against a known-in-advance benchmark. This would ensure more consistent responses in the varying applications envisioned by Reime. Hinckley expressly teaches a number of applications where the optical responses of the light receivers are judged against of the previously discussed predetermined thresholds. Ex-1011, Fig. 7, [0106], [0066], [0067], [0104], [0107]. A POSITA would have been motivated to improve Reime's sensitivity adjustment ability based on the predetermined threshold techniques of Hinckley.
>
> 140. Further, Reime discloses methods and devices for "sensing the presence of a touching object . . . in or near a touchpad area," and that the scope of the invention "includes any applications and products." Ex-1009, [0111]. Reime further teaches that the device could be a mobile phone with a touch pad device. *Id.*, FIG. 15. Hinckley expressly teaches that a mobile phone can be put in a full power mode when a touching objecting is in or near a touch pad area for power efficiency reasons. Ex-1011, [0104]–[0105]. Thus, a POSITA would also have been motivated to implement the mobile phone device disclosed by Reime to include this additional power efficiency feature based on the predetermined thresholds of Hinckley.

> 141. Moreover, a POSITA would have had a reasonable expectation of success in combining the teachings of Reime and Hinckley. Reime already discloses comparing the high-pass filtered signal to zero. Ex-1010, [0089]. A POSITA would have seen no impediment to comparing the signal to a different predetermined threshold to determine a range rather than simple presence because such a comparison is a simple arithmetic operation. Additionally, both references solve detection problems in similar and predictable ways, such as by using well-known position sensors, such as those based on infrared detectors (*see* Ex-1011 [0029]; Ex-1010 [0106]), to detect the positions of an object in contact with or with a degree of propinquity to a display device as explained below. Both recognize these issues and propose solutions that are predictable to implement using the same types of hardware and software, the at least one pixel array being configured to sense at least a position of the at least one object with respect to the at least one pixel array when the at least one object has at least a predetermined degree of propinquity to the at least one pixel array.

Ex. 1002 ¶¶ 139–141.

Patent Owner's argument that Dr. Bederson's testimony to "combine Hinckley with Reime to 'ensure more consistent responses in the varying applications envisioned by Reime' lack context, as well as support in the record" (Resp. 53 (citing Ex. 1002 ¶ 139; Ex. 2056 ¶¶ 111–112)) also is not consistent with the evidence in the complete record now before us. Consistent with Petitioner's arguments and Dr. Bederson's testimony, Reime describes that it "provides a method and device for detecting and sensing the presence of a touching object and the movement thereof in or *near* a touch pad area" using "a time-dependent signal based on a series of measurements." Ex. 1010 ¶ 111 (emphasis added). Reime describes its broad applicability stating "[t]he scope of the present invention includes *any applications and products* that use the disclosed method and/or device using that time dependent signal." *Id.* (emphasis added). Reime also describes that

"the sensitivity and optical response of the light receivers" used in connection with its method and device "may vary from one application to another." *Id.*

Dr. Bederson's testifies that "Hinckley expressly teaches a number of applications where the optical responses of the light receivers are judged against of the previously discussed predetermined thresholds," "Hinckley expressly teaches that a mobile phone can be put in a full power mode when a touching objecting is in or near a touch pad area for power efficiency reasons," and a person having ordinary skill in the art would have been motivated to include one or more of Hinckley's applications or features based on Hinckley's predetermined thresholds. Ex. 1002 ¶¶ 139–140 (citing Ex. 1011 ¶¶ 66, 67, 104–107, Fig. 7). Consistent with Petitioner's arguments and Dr. Bederson's testimony, Hinckley describes benefits of controlling device idle state, controlling power consumption, and activating an audio receiver by including Hinckley's proximity technology. Ex. 1011 ¶ 62 (describing in "embodiments that use proximity, touch, and tilt to determine when to activate the audio receiver" deactivating the audio receiver "if any one of these criteria stops being met"), ¶¶ 104–106 (describing a mobile phone placing itself "in full-power mode" based on a combination of sensors and describing preventing "a mobile device from entering an idle mode if the user is handling the device or gesturing toward the device"), ¶¶ 107–108 (describing that "motion near the device" is detected "by changes in the output of the proximity sensor and is indicative of a user gesturing toward the device").

For the reasons given, we agree with Petitioner's arguments and evidence regarding element 1[b](2). We determine Petitioner's arguments

and evidence are not undermined by Patent Owner's arguments in its Patent Owner Response.

Above, we discuss Petitioner's overview of its contentions regarding reasoning to combine and reasonable expectation of success, as well as Petitioner's argument regarding element 1[b](3) as the parties' arguments relating to the overview and element 1[b](3) overlap. We agree with Petitioner's arguments and evidence regarding both elements 1[b](2) and 1[b](3) and determine Petitioner's arguments and evidence are not undermined by Patent Owner's arguments in its Patent Owner Response.

We turn to Patent Owner's Sur-reply. In its Sur-reply, Patent Owner argues that Petitioner fails to address arguments made in the Patent Owner Response, including Patent Owner's arguments regarding incompatibility. *See, e.g.*, Sur-reply 24–27. In addition to responding to Patent Owner's arguments, Petitioner refers to the Petition's explanations and evidence that are contrary to Patent Owner's arguments. *See, e.g.*, Reply 17–18 (citing, e.g., Ex. 1002 ¶¶ 139–142; Pet. 59–60, 69–70).

Patent Owner argues for the first time in its Sur-reply that Hinckley's equation would not work with Reime's waveguide. Sur-reply 27. Patent Owner's argument is belatedly presented and we should not consider it for that reason alone. Furthermore, we agree with Petitioner's arguments and afford significant weight to Dr. Bederson's testimony that the proposed modification would involve a simple arithmetic operation and a person of ordinary skill would have been able to choose a threshold that would have worked within Reime's system. Pet. 68–70, 73–75; Ex. 1002 ¶¶ 141, 144–147.

Patent Owner presents additional arguments in its Sur-reply regarding alleged irrelevance of Hinckley's technology and incompatibilities between

Yamaguchi and Hinckley. *See generally* Sur-reply. Patent Owner's arguments in this regard are not consistent with the evidence of record and do not undermine Petitioner's position for the same reasons given with respect to Patent Owner's incompatibility arguments in its Patent Owner Response. Furthermore, to the extent Patent Owner presents new theories and explanations in its Sur-reply, Patent Owner's arguments and evidence are belatedly presented and will not be considered. *See* Paper 13, 9 ("Patent Owner is cautioned that any arguments not raised in the response may be deemed waived."); *see also NuVasive, Inc.*, 842 F.3d at 1379–82 (holding patent owner waived an argument addressed in the preliminary response by not raising the same argument in the patent owner response); TPG 66 (stating that the Patent Owner Response "should identify all the involved claims that are believed to be patentable and state the basis for that belief").

After consideration of Patent Owner's arguments and evidence in all papers including its Patent Owner's Response and Sur-reply and also including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and afford significant weight to the testimony of Dr. Bederson (Exs. 1002, 1035) because Petitioner's contentions and Dr. Bederson's testimony are consistent with the evidence of record. We credit and afford significant weight to Dr. Bederson's testimony over the testimony of Dr. Cairns because we find that Dr. Bederson's testimony is supported by the evidence of record and we find Dr. Cairns's testimony, which is substantially the same as Patent Owner's arguments, is unsupported and contradicted by the evidence of record for the same reasons given with respect to Patent Owner's arguments.

After consideration of the contentions and the evidence of record, we are persuaded that Petitioner has offered articulated reasoning with a rational

underpinning as to why one of ordinary skill in the art would have combined the teachings of Reime and Hinckley in the manner recited in claim 1. We determine that Petitioner's arguments and evidence are not undermined by Patent Owner's arguments.

b) Elements 1[pre] and 1[a]

The preamble of claim 1 recites "[a] position sensing assembly comprising" and element 1[a] recites "an interactive surface element defining a surface." Ex. 1001, 73:10–11. Petitioner argues that Reime teaches the preamble and element 1[a] by describing a "touch pad device" that "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." Pet. 60–62 (citing, e.g., Ex. 1010, code (57), Figs. 2A–2D; Ex. 1002 ¶¶ 120–127).

Patent Owner does not dispute Petitioner's arguments or evidence regarding the preamble and element 1[a]. Petitioner's contentions are supported by the cited portions of Reime. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Reime teaches the preamble of claim 1 and element 1[a].

c) Element 1[b]

Element 1[b] is reproduced below:

> [b](1) at least one pixel array comprising a plurality of detector elements configured to detect electromagnetic radiation at a baseline level, (2) the at least one pixel array being configured to sense a position of at least one object with respect to a surface thereof according to locations of ones of the plurality of detector elements at which at least one of an amount of radiation detected and a change in the amount of radiation detected exceeds a predetermined threshold, (3) the at least one pixel array being configured

> to sense at least a position of the at least one object with respect to the at least one pixel array when the at least one object has at least a predetermined degree of propinquity to the at least one pixel array.

Ex. 1001, 73:12–24.

(1) Element 1[b](1)

Petitioner argues that Reime teaches element 1[b](1) based on Reime's disclosure that that touch panel 5 includes LCD 92, which is housed in printed circuit board (PCB) 90. Pet. 64 (citing Ex. 1010 ¶ 87, Figs. 8A–8C, 9E). Petitioner argues that "[t]ouch panel 5 includes LCD 92, which is made up of a number of pixels." *Id.* Petitioner relies on Reime's receivers 30, 32, 34, and 36 for teaching detector elements. *Id.* at 64–65. Figure 9E of Reime with Petitioner's annotations is reproduced below.

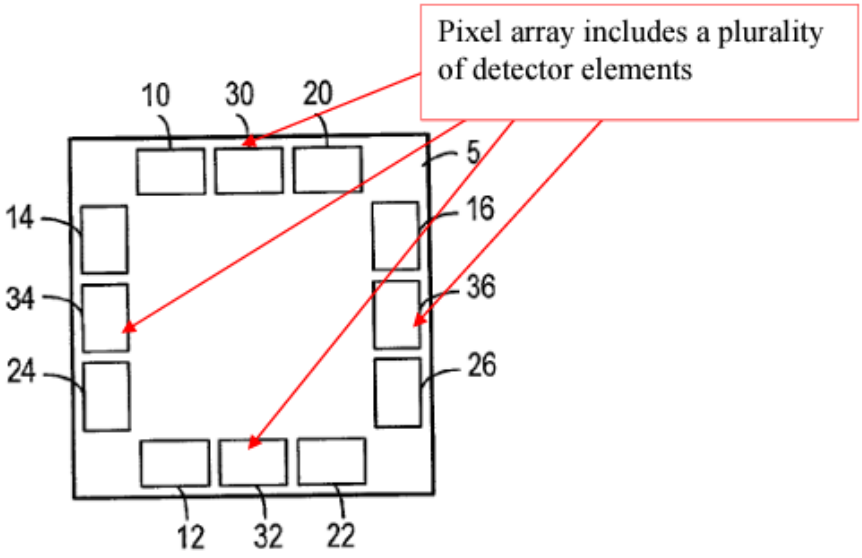


FIG. 9E

Figure 9E of Reime, above, is a diagrammatic representation showing a touch pad device having four groups of optical sensor components placed within the touch pad area (Ex. 1010 ¶ 56) that includes Petitioner's red annotations of four arrows each with an arrowhead pointing to one of

receivers 30, 32, 34, and 36 and the shaft ending at a red box with the text "[p]ixel array includes a plurality of detector elements" (Pet. 64).

Petitioner relies on Reime's disclosure that PCB 90 holds optical elements including emitters and detectors and LCD 92. *Id.* at 63–64 (citing Ex. 1010 ¶ 87, Figs. 8A–8C, 9E; Ex. 1002 ¶¶ 130–133, 152). Petitioner also relies on other teachings in Reime for teaching detecting by optical detector elements in an environment with ambient light. *Id.* (citing, e.g., Ex. 1010, Fig. 10C; Ex. 1002 ¶ 133).

Patent Owner argues that Reime's optical sensors are not part of a pixel array. Resp. 46. Patent Owner acknowledges that the "LCD in Reime may include pixels" and that the LCD and the optical sensors "reside on the same substrate." *Id.* (citing, e.g., Ex. 2056 ¶ 99). Patent Owner's dispute centers on its position that the LCD and optical sensors are separate elements and that Reime's disclosure that the optical sensors elements are mounted on the same substrate "near an LCD" does not teach "a pixel array comprising a plurality of detector elements." *Id.* at 45–48 (citing, e.g., Ex. 2056 ¶ 101). Patent Owner also argues that Petitioner's position in the instant proceeding is inconsistent with its position in IPR2021-01239. *Id.* at 46–47 (citing, e.g., Ex. 2056 ¶ 100).

Consistent with Petitioner's arguments and Dr. Bederson's testimony, Reime describes measurements taken using receivers 30, 32, 34, and 36 to determine the location of the object. Ex. 1010 ¶¶ 73, 75 (describing measuring light received by receiver 30 to detect an object touching or approaching a touch pad area), ¶ 74 (describing that "the phrase 'touching the surface'" as used in Reime means making contact with or being adjacent to the surface), ¶ 79 (describing carrying out a series of measurements with receivers 30 and 32), ¶ 82 (describing similarly carrying out a series of

measurements with receivers 30, 32, 34, and 36), ¶ 87 (referring to the prior disclosures with respect to Figure 9E). Reime describes that "[i]n a mobile device or other electronic device, the touch pad area 5 can be a display panel such as liquid crystal display (LCD) 92 mounted on a printed circuit board (PCB) or a printed wire board (PWB) 90." *Id.* ¶ 86 (referred to in Ex. 1010 ¶ 87, which is cited in Pet. 64). Dr. Bederson testifies that "[t]ouch panel 5 includes an LCD 92, which is made up of a number of pixels." Ex. 1002 ¶ 132. We agree with Petitioner (Reply 14–16) that Patent Owner does not provide meaningful argument or evidence disputing that Reime's optical sensor elements are "detector elements" and that Reime's LCD is made up of pixels. *See generally* Resp. Patent Owner also does not dispute Petitioner's contentions regarding detecting position in environments having ambient light. *See generally id.*

Patent Owner's sole dispute is that LCD 92 and optical detectors 30, 32, 34, and 36 are separate elements and that Reime's disclosure that the optical sensors elements are mounted on the same substrate, for example PCB 90, does not teach "a pixel array comprising a plurality of detector elements." *Id.* at 45–48; *see also* Sur-reply 20–21. Patent Owner's argument is premised on claim construction for "pixel array" that has not been set forth expressly in the instant proceeding.

Based on the argument in the complete record now before us, Patent Owner's implied construction is not consistent with or supported by the intrinsic record. Element 1[b](1) recites "at least one pixel array comprising a plurality of detector elements" and, therefore, "the at least one pixel array" comprises more than pixels. "Comprising" is a term of art used in claim language, which means that the named elements are essential, but other elements also may be included to constitute additional components within

the scope of the claim. *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997). Accordingly, the recitation "at least one pixel array comprising" is broad and may comprise other elements in addition to pixels and detector elements, such as a printed circuit board. Neither party has directed us to support on this issue in the '675 patent Specification or the prosecution history. Upon consideration, we do not discern a reason based on the intrinsic record to read the recitation narrowly.

Regarding the parties' arguments in IPR2021-01239, to the extent Patent Owner presents argument in the instant proceeding, Patent Owner mischaracterizes Petitioner's positions. *See, e.g.*, Resp. 46–47; *see also* Sur-reply 20–21. Patent Owner quotes Dr. Bederson's testimony IPR2021-01239 and argues it is inconsistent with his testimony here, but his testimony is the same as the testimony and Petitioner's argument presented here, i.e., that a person having ordinary skill in the art would have understood that an LCD is made up of pixels. *Id.* at 46 (citing IPR2021-01239, Ex. 1002 ¶ 70). Patent Owner cites to many paragraphs of Dr. Bederson's testimony for different challenged claims in IPR2021-01239, and then makes a conclusory argument that his testimony in IPR2021-01239 is inconsistent with his testimony in the instant proceeding. *Id.* at 46–47 (citing, e.g., IPR2021-01239, Ex. 1002 ¶¶ 66–88, 92–94, 102–114, 140–145). Patent Owner's Response must include a full statement of the reasons for the relief requested with a detailed explanation of the significance of the evidence and Patent Owner's argument must be made in its Response. 37 C.F.R. § 42.22 (a) (2); 37 C.F.R. § 42.23. "Arguments must not be incorporated by reference from one document into another document" and "[c]ombined motions, opposition, replies or other combined documents are not permitted." 37 C.F.R. § 42.6(a)(3). Patent Owner's argument in the instant proceeding is

conclusory and fails to explain the significance of the many paragraphs of testimony cited that was submitted in connection with Petitioner's arguments in a different proceeding.

In its Sur-reply, Patent Owner also argues for the first time that Petitioner's argument for "pixel array" contradicts its argument in the instant proceeding for "interactive surface element." Sur-reply 20. Patent Owner's argument is belatedly presented and should not be considered. As a separate, independent reason for our determinations herein, Patent Owner's argument mischaracterizes Petitioner's argument and evidence. Petitioner argues "PCB 90, housing the LCD pixels 92 and the optical elements is a pixel array comprising a plurality of detector elements." Pet. 64 (citing Ex. 1002 ¶ 152; Ex. 1010, Fig. 9E). Petitioner argues "touch pad 5 is such an interactive surface element." *Id.* at 62. Thus, Petitioner identifies different structures in Reime as corresponding to different elements recited in claim 1, i.e., the "pixel array" and the "interactive surface element," respectively.

Accordingly, we find that element 1[b](1) is taught by Reime's arrangement of PCB 90 housing LCD 92 and detectors 30, 32, 34, and 36. Consistent with Petitioner's contentions and Dr. Bederson's testimony, Reime describes that "the optical sensor components can also be placed inside the touch pad area 5, as shown in FIGS. 9A–9F." Ex. 1010 ¶ 87; *see also id.* at Fig. 9E (illustrating detector elements within touch pad area 5).

After consideration of Patent Owner's arguments and evidence, including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and afford significant weight to the testimony of Dr. Bederson because Petitioner's contentions and Dr. Bederson's testimony are consistent with the evidence of record. We credit and afford significant weight to Dr. Bederson's testimony over the testimony of Dr. Cairns because we find that

Dr. Bederson's testimony is supported by the evidence of record and we find Dr. Cairns's testimony is substantially the same as Patent Owner's arguments and, therefore, is unsupported and contradicted by the evidence of record for the same reasons given with respect to Patent Owner's arguments above.

(2) Element 1[b](2)

Petitioner argues that Reime teaches element 1[b](2) based on Reime's disclosures relating to position detection. Pet. 66–67 (citing Ex. 1010 ¶¶ 73, 88, 89, Figs. 1, 5, 10B; Ex. 1002 ¶¶ 134–136, 139). Petitioner argues that a person having ordinary skill in the art would have measured the detected signal against a known-in-advance benchmark to ensure more consistent responses in the varying applications envisioned by Reime. *Id.* at 69 (citing Ex. 1002 ¶ 139). Petitioner, alternatively, relies on Hinckley's techniques for determining distance to an object and asserts a person having ordinary skill in the art would have been motivated to combine Hinckley's techniques with Reime's teachings to improve Reime's mobile phone. *Id.* at 68–70 (citing Ex. 1011 ¶¶ 29, 44, 66, 67, 104–107, Fig. 7; Ex. 1002 ¶ 137–141).

Patent Owner argues that "Reime does not disclose any 'threshold' and the heart of Dr. Bederson's position relates to Reime's 'pulse mode' operations and a 'high-pass filter' that filters lower frequency signals." Resp. 48–49 (citing Ex. 1010 ¶¶ 88–89; Ex. 1002 ¶ 136; Ex. 2056 ¶¶ 102–104). Patent Owner argues "filtering out 'frequency' does not relate to and does not disclose the claimed operations." *Id.* Patent Owner also argues that Reime "only teaches determining the position of an object based on its 'emitters,' not receivers." *Id.* at 50 (citing Ex. 1010 ¶¶ 10, 13, 73; Ex. 2056 ¶ 106).

Patent Owner also argues that "Dr. Bederson does not address or discuss how [Hinckley] teaches any of the claimed operations of sensing the position of an object according to the location of detector elements." Resp. 51 (citing, e.g., Ex. 1002 ¶ 138; Ex. 2056 ¶ 107). Patent Owner argues "Hinckley does not mention an 'predetermined threshold' but instead teaches 'estimated' ranges corresponding to (1) no object is near, (2) the object is near, and (3) the object is in-range" and a person having ordinary skill in the art would not have looked to Hinckley's range estimates to teach element 1[b](2). *Id.* at 51–52 (citing Ex. 1011 ¶¶ 44-45, 55, Fig. 7; Ex. 2056 ¶¶ 108, 110). Patent Owner also argues that "the plotted response curve appears to correspond to drawing horizontal references lines in a graph of already-measured data," which does not correspond to the disputed claim recitation. *Id.* (citing Ex. 2056 ¶ 109).

For the reasons given with respect to claim construction (*see supra* § II.D.2), we determine that "a surface thereof" recited in element 1[b](2) has a definite meaning. In particular, we determine that "a surface thereof" should be treated as "said surface" because the term derives antecedent basis from the recitation "a surface" in the phrase "an interactive surface element defining *a surface*" (emphasis added). The disputes between the parties do not pertain to our construction and neither party disputes our construction. We use that construction in our analysis herein.

We start with the parties' contentions regarding Reime alone and Patent Owner's argument that Reime does not disclose a "threshold," the "heart" of Petitioner's position relates to Reime's pulse mode operations and high-pass filter, and pulse mode operations and filtering by the high pass filter does not relate to and does not disclose the claimed operations. Resp. 48–49 (citing Ex. 1010 ¶¶ 88–89; Ex. 1002 ¶ 136; Ex. 2056 ¶¶ 102–104). As

discussed above, Petitioner argues that Reime teaches element 1[b](2) based on Reime's disclosures relating to position detection. Pet. 66–67 (citing Ex. 1010 ¶¶ 73, 88, 89, Figs. 1, 5, 10B; Ex. 1002 ¶¶ 134–136, 139).

Petitioner, more specifically argues that a person having ordinary skill in the art "would have established *the predetermined threshold to be substantially zero*." *Id.* at 67 (emphasis added). Consistent with Petitioner's position and Dr. Bederson's testimony, Reime teaches "when the touching object is not present," the output signal "is substantially zero." Ex. 1010 ¶ 89. Using Reime's techniques, "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.* ¶ 88; *see also id.* ¶ 73 (describing that the "amount of light received by the receiver 30 can be measured from the output signal 130: and "the presence of the object 100 near emitters 10, 20 and the receiver 30 would cause a change in the output signal 130"), ¶ 82 (describing receivers 30, 32, 34, and 36), ¶ 87 (referring to disclosures in paragraph 82, among other paragraphs, with respect to Figure 9E), Fig. 9E (illustrating receivers 30, 32, 34, and 36).

Additionally, consistent with Petitioner's position and Dr. Bederson's testimony, Reime includes Figure 10B, which shows "the output signal of a receiver attributable to a light emitter in a pulsed mode," Figure 10C, which shows "the output signal of a receiver attributable to a light emitter operated in a pulsed mode and ambient light," and Figure 10E, which shows "the output signal of a receiver attributable to a light emitter and a compensation emitter operated in a pulsed mode with complimentary phases." Ex. 1010 ¶¶ 59, 60, 62, Figs. 10B, 10C, 10E. Reime describes that with a compensation emitter as shown in Figure 10E, "when the touching object is not presented" after filtering "the output signal of the receiver 30 is

substantially zero." *Id.* ¶ 89. Contrary to Patent Owner's argument, Reime describes the "approaching and touching of the user's finger is detected by the reflection off the finger." *Id.* ¶ 86; *see also id.* 73 ("When a user uses an object such as a pencil 100 or a finger 100' (FIG. 2A) to touch the touch pad 5, some light 110 emitted from emitter 10 encounters the surface of the object 100," "[p]art of the light 110 reflects off the object 100 and is received by the receiver 30," likewise light from emitter 20 "encounters the surface of the object 100 and then reflects off the object 100 to receiver 30," and with a series of measurements of received reflected light "it is possible to track the positions of the object 100 and thus its movement").

Reime describes compensating for ambient light and other device or atmospheric imperfections using the high-pass filter to filter light not originating from the emitters. *Id.* ¶¶ 88–89. That Reime describes a device and technique that performs more than the claimed operations does not undermine Petitioner's position or Dr. Bederson's testimony because claim 1 recites "comprising." *Genentech*, 112 F.3d at 501 ("Comprising" is a term of art used in claim language, which means that the named elements are essential, but other elements also may be included to constitute additional components within the scope of the claim).

For similar reasons, we find that Patent Owner's argument that Reime "only teaches determining the position of an object based on its 'emitters,' not receivers" (Resp. 50 (citing Ex. 1010 ¶¶ 10, 13, 73; Ex. 2056 ¶ 106)) does not undermine Petitioner's position or Dr. Bederson's testimony. In particular, Reime describes determining the position of an object based on the location of emitters, which is an additional feature not precluded by claim 1 because claim 1 recites "comprising." Petitioner relies on Reime's output signal of one or more receivers or detectors. Pet. 66–67 (stating

"Reime discloses 'output I_R of the receiver attributable to the output intensity' of the reflected light received by the detector") (citing, e.g., Ex. 1010 ¶¶ 88–89). We find Reime's disclosure of using output signals of receivers, which are detectors, teaches sensing a position "with respect to a surface thereof according to locations of one of the plurality of detector elements." We further note that Reime describes that the location of detectors is relative to the location of emitters. *See, e.g.*, Ex. 1010 ¶ 73 (describing "two light emitters 10, 20 are positioned on opposite sides or a light receiver 30"), Fig. 9E (illustrating that each of receivers 30, 32, 34, and 36 is between two emitters, i.e., emitters 10 and 20, emitters 12 and 22, emitters 14 and 24, and emitters 16 and 26, respectively).

In its Sur-reply, Patent Owner asserts that Petitioner does not dispute Patent Owner's asserted deficiency. Sur-reply 21. We disagree. First, Petitioner's position contrary to Patent Owner's argument is set forth in the Petition and need not be repeated in the Reply. *See, e.g.*, Pet. 66–67. Second, in its Reply, Petitioner maintains its argument that claim 1 is unpatentable over Reime alone and that Reime teaches the disputed recitation. *See, e.g.*, Reply 16–17 (arguing, for example, that Patent Owner's dispute regarding "according to the locations of detector elements" is contrary to Reime's teaching of using light received by the receiver "to 'track the positions of object 100'").

Also in its Sur-reply, Patent Owner repeats certain arguments relating to Reime's high-pass filtering operations (Sur-reply 22–24), which we find are inconsistent with the scope of claim 1 and the teachings of Reime for the reasons given above. Patent Owner further makes new arguments in its Sur-reply including, for example, that Patent Owner's position is supported by Reime's lightguide operations when a finger makes contact and that

Petitioner did not demonstrate a connection "between Reime's alleged 'pixel array' and the alleged 'substantially zero' predetermined threshold." *Id.* at 22–24. Patent Owner's Sur-reply arguments are conclusory and belatedly presented as they are argued for the first time in the Sur-reply. For those reasons alone, Patent Owner's arguments do not undermine Petitioner's showing or Dr. Bederson's testimony.

Furthermore, even upon consideration, Patent Owner's new Sur-reply arguments are not consistent with the evidence of record. For instance, in the next sentence to that relied on by Patent Owner, Reime describes "[a]ccordingly, both the increase and the decrease of the received light amount by the receiver 30 indicate that touch pad device 1 is 'touched.'" Ex. 1010 ¶ 86. Notwithstanding Reime's description of internal reflection, Reime uses reflected light and the techniques relied on by Petitioner to sense position of the object. *Id.* As discussed above, other of Reime's disclosures regarding using measurements of reflected light to track positions of an object also are consistent with and support Petitioner's position and Dr. Bederson's testimony and are contrary to Patent Owner's position. Additionally, Reime's disclosures connect the "substantially zero" threshold to receiver 30, which is an exemplary receiver. *See, e.g.*, Ex. 1010 ¶ 89 ("after being filtered by a high-pass filter, the output signal of *the receiver 30 is substantially zero*") (emphasis added). Receiver 30 is one of the optical components positions in proximity of touch pad 5 (*see, e.g., id.* ¶¶ 73, 87) and touch pad 5 comprises LCD 92 mounted on PCB 90. *Id.* ¶ 86. As explained herein, Reime discloses other receivers, for example, receivers 32, 34, and 36. *Id.* ¶ 87, Fig. 9E.

For the reasons given, upon consideration of the arguments and evidence of record, we agree with Petitioner's arguments that Reime alone

teaches element 1[b](2). We determine Petitioner's arguments are not undermined by Patent Owner's arguments and evidence.

We turn to the parties' contentions regarding the alternative ground of obviousness over Reime and Hinckley and Patent Owner's argument that Hinckley's "'estimated' ranges corresponding to (1) no object is near, (2) the object is near, and (3) the object is in-range" and plotted response curve of already-measured data do not teach element 1[b](2). Resp. 51–52 (citing Ex. 1011 ¶¶ 44–45, 55, Fig. 7; Ex. 2056 ¶¶ 108–110). As discussed above, as an alternative ground of obviousness, Petitioner relies on Hinckley's techniques for determining distance to an object and asserts a person having ordinary skill in the art would have been motivated to combine Hinckley's techniques with Reime's teachings to improve Reime's mobile phone. *Id.* at 68–70 (citing Ex. 1011 ¶¶ 29, 44, 66, 67, 104–107, Fig. 7; Ex. 1002 ¶ 137–141).

Relying on the testimony of Dr. Bederson, Petitioner, more specifically, states "the position of the object relative to the sensor is determined by comparing the output value to *thresholds 50 and 180, which are predetermined*." *Id.* at 68–69 (emphasis added) (citing Ex. 1002 ¶ 138). Consistent with Petitioner's argument and Dr. Bederson's testimony, Hinckley's Figure 7 illustrates values of "50" and "180" along horizontal axis 702. Ex. 1011, Fig. 7. Hinckley describes that "[i]n FIG. 7, the sensor value is shown along horizontal axis 702." *Id.* ¶ 44. Figure 7 of Hinckley further illustrates range 706 corresponding to sensor values from 0 to 50. *Id.* at Fig. 7. Hinckley describes that "the actual distance to the object is shown along vertical axis 704" and Figure 7 of Hinckley illustrates a distance of approximately 27 centimeters corresponding to the sensor value of 50. *Id.* at Fig. 7, ¶ 44. Hinckley describes that a sensor value in range 706 "indicates

no objects are within range of mobile device 200." *Id.* Figure 7 of Hinckley illustrates range 708 corresponding to sensor values 50 to 180 and range 710 corresponding to sensor values greater than 180. *Id.* at Fig. 7. Hinckley describes that range 708 "extends from approximately 7 centimeters to 27 centimeters and indicates that at least one object is within range of mobile device 200" and "[r]eadings in third range 710, which extends from 7 centimeters to 0 centimeters, are considered to be close to mobile device 200." *Id.* ¶ 44. We, therefore, find Petitioner's argument and Dr. Bederson's testimony that sensor values 50 and 180 are "thresholds," which are "predetermined" (Pet. 68–69; Ex. 1002 ¶ 138), to be consistent with and supported by Hinckley's disclosures.

We turn to Patent Owner's argument that Hinckley does not teach sensing the position of an object according to the location of detector elements. Resp. 51 (citing Ex. 1002 ¶ 138; Ex. 2056 ¶ 107). Petitioner argues and Dr. Bederson testifies that Hinckley describes determining "the position of the object relative to the sensor" by comparing the sensor value to the thresholds as discussed above. Pet. 68–69; Ex. 1002 ¶ 138. We find Petitioner's argument and Dr. Bederson's testimony consistent with Hinckley's disclosures. For instance, Hinckley describes that Figure 7 "shows a response curve" for an embodiment of "the proximity sensor" and "the actual distance to the object is shown along vertical axis 704." Ex. 1011 ¶ 44.

In summary for element 1[b](2), after consideration of Patent Owner's arguments and evidence, including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and afford significant weight to the testimony of Dr. Bederson because Petitioner's contentions and Dr. Bederson's testimony are consistent with the evidence of record. We credit

and afford significant weight to Dr. Bederson's testimony over the testimony of Dr. Cairns because we find that Dr. Bederson's testimony is supported by the evidence of record and we find Dr. Cairns's testimony is substantially the same as Patent Owner's arguments and, therefore, is unsupported and contradicted by the evidence of record for the same reasons given with respect to Patent Owner's arguments.

(3) Element 1[b](3)

Petitioner argues that Reime teaches element 1[b](3) based on Reime's disclosure of sensing the position of an object that is near receiver 30 using reflected light received by receiver 30. Pet. 71–72 (citing Ex. 1010 ¶¶ 73, 74, Fig. 2A). Petitioner argues that Reime discloses it "is not necessary for the object 100' to physically touch or press the area 5 at a touching point." *Id.* at 72–73 (quoting Ex. 1010 ¶ 74). Petitioner alternatively relies on Hinckley's disclosures as set forth below.

> To the extent the "predetermined degree of propinquity" portion of this element is not taught by Reime alone, a POSITA would have made such a modification in further view of Hinckley (Ground 4). Ex-1002, ¶144–147. *See supra*, Section XII.B.2.c(2) (discussing Hinckley's disclosures and Fig. 7). Because Reime discloses that it "is not necessary for the object 100' to physically touch or press the area 5 at a touching point," Ex-1010, [0074], for example, a POSITA could choose a first predetermined threshold, such as 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." Ex-1011, [0044]. The exact threshold would be chosen in accordance with the "the sensitivity and the optical response of the light receivers."9 Ex-1010, [0111]; Ex-1002 ¶144.

Pet. 73.

Petitioner argues that a person having ordinary skill in the art would have been motivated to modify Reime to obtain Hinckley's "features and

benefits that use set ranges of 'nearness' between the object and device." Pet. 74–75 (citing Ex. 1010 ¶ 111; Ex. 1011 ¶¶ 62, 66, 67, 104, 106, 107, Fig. 7; Ex. 1002 ¶¶ 145–146). Petitioner also argues that a person would have had a reasonable expectation of success "by using well-known position sensors, such as those based on infrared detectors" to detect the positions of an object when the object has a predetermined degree of propinquity to the pixel array. *Id.* at 75 (citing Ex. 1010 ¶ 92; Ex. 1011 ¶ 29; Ex. 1024 ¶ 31; Ex. 1002 ¶ 147). We agree with Petitioner's arguments and Dr. Bederson's testimony regarding reasoning to combine because Petitioner's arguments and Dr. Bederson's testimony are consistent with the evidence of record and we find Patent Owner's arguments and evidence do not undermine Petitioner's showing for the reason discussed above. *See* § II.F.2.a.

Patent Owner counters that the asserted art does not teach element 1[b](3) because Reime discloses determining the two-dimensional x-y coordinates, but "the object's actual z-distance or 'specified proximity distance' is irrelevant to Reime's x-y measurements." Resp. 55 (citing, e.g., Ex. 1010 ¶ 74; Ex. 2056 ¶ 15). Patent Owner also asserts that Hinckley describes arbitrary "ranges" that represent rudimentary "estimates," which cannot teach the recitation of "predetermined degree of propinquity." *Id.* at 57–58. Patent Owner also argues that a person having ordinary skill in the art would have understood Hinckley teaches using the proximity sensor values to estimate when a user wants to interact with the device, not to determine or sense the position of the object when it is within a specific distance. *Id.* at 58 (citing Ex. 2056). Patent Owner also refers to and repeats some of its previous arguments that Petitioner's reasoning to combine is deficient and the resulting combination would not work (*id.* at 55–58), which

we determine do not undermine Petitioner's position for the reasons discussed above. *See* § II.F.2.a.

In its Sur-reply, Patent Owner argues that Petitioner "does not dispute that Reime does not distinguish between 'touching the surface,' 'making contact with the surface,' and 'being adjacent to the surface.'" Sur-reply 26 (citing Ex. 1010 ¶ 74; Ex. 2056 ¶¶ 115–117; Resp. 55–56). Patent Owner again in its Sur-reply repeats some of its previous arguments that Petitioner's reasoning to combine is deficient and the resulting combination would not work (*id.* at 26–27) and makes a new argument, which we determine do not undermine Petitioner's position for the reasons discussed above. *See* § II.F.2.a.

As discussed above with respect to grounds relating to Yamaguchi, we adopt as our final analysis our analysis herein including the portions of the Decision to Institute regarding "sense at least a position" (Inst. Dec. 34–35) reproduced in this Decision. *See* § II.E.3.c. With respect to claim construction of recitations including the term "propinquity," we determined Patent Owner's construction is overly narrow and not supported by the intrinsic record. We stated based on the complete record now before us, consistent with the District Court's claim construction, we determine that the term "propinquity" means "proximity" and, with respect to the remaining language, we adopt the "plain and ordinary meaning." *See* § II.D.1 (citing Ex. 1034, 2).

Under the correct constructions, element 1[b](3) is taught by Reime alone and we need not consider Petitioner's contentions regarding Hinckley. Indeed, Patent Owner acknowledges that Reime "teaches operations to determine the object's x-y coordinate or the 'horizontal location of the touching point.'" *See, e.g.*, Resp. 55. Patent Owner's dispute relating to

element 1[b](3) is premised on Patent Owner's overly narrow construction that requires that the degree of propinquity "does not include touching." *See generally* Resp. That construction is not consistent with the intrinsic record. *See* § II.D.1.

After consideration of Patent Owner's arguments and evidence, including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and give significant weight to the testimony of Dr. Bederson regarding Reime's teachings of sensing the position of an object because Petitioner's contentions and Dr. Bederson's testimony are consistent with the evidence of record under the correct constructions. We credit and give significant weight to Dr. Bederson's testimony over the testimony of Dr. Cairns because we find that Dr. Bederson's testimony is supported by the evidence of record and we find Dr. Cairns's testimony, which is substantially the same as Patent Owner's arguments, is premised on Patent Owner's overly narrow construction and is unsupported and contradicted by the evidence of record in light of the scope of claim 1 under the correct constructions.

As an independent reason for our conclusions herein, we also provide analysis using Patent Owner's construction in-part specifically that the degree of propinquity is "established in advance and does not include touching," because Petitioner has shown that the prior art teaches the disputed recitations even using that construction. We now turn to that analysis.

Under the correct claim constructions for "sense at least a position" (*see* § II.E.3.c) and under Patent Owner's construction in-part, i.e., that the degree of propinquity is "established in advance and does not include touching" (*see* § II.D.1), after consideration of Patent Owner's arguments

and evidence, including the testimony of Dr. Cairns, we agree with Petitioner's contentions and we credit and afford significant weight to the testimony of Dr. Bederson. We find Petitioner's contentions and Dr. Bederson's testimony regarding obviousness over Reime alone and over the combination of Reime and Hinckley are consistent with the evidence of record. We credit and afford significant weight to Dr. Bederson's testimony over the testimony of Dr. Cairns because we find that Dr. Bederson's testimony is supported by the evidence of record and we find Dr. Cairns's testimony, which is substantially the same as Patent Owner's arguments, is unsupported and contradicted by the evidence of record.

Patent Owner's arguments and Dr. Cairns's testimony relating to deficiencies in each of Reime and Hinckley on the basis that the proximity determination is too rudimentary or approximate to meet the claim limitations or the asserted prior art fails to calculate an actual z-distance (*see, e.g.*, Resp. 54–58) are not consistent with the evidence of record even under Patent Owner's construction in-part, i.e., that the degree of propinquity is "established in advance and does not include touching" (*see* § II.D.1). Importantly, as discussed throughout this Decision, contrary to Patent Owner's arguments and Dr. Cairns's testimony, Reime describes detecting the presence of a nearby object. For instance, Reime discloses 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 object 100' is detected by optical sensor components 10, 20, and 30." Ex. 1010 ¶ 74 (quoted in Pet. 72–73). Figure 1 of Reime, below, illustrates a group of two light emitters and a light receiver is used to detect the presence of a nearby object. *Id.* ¶ 28.

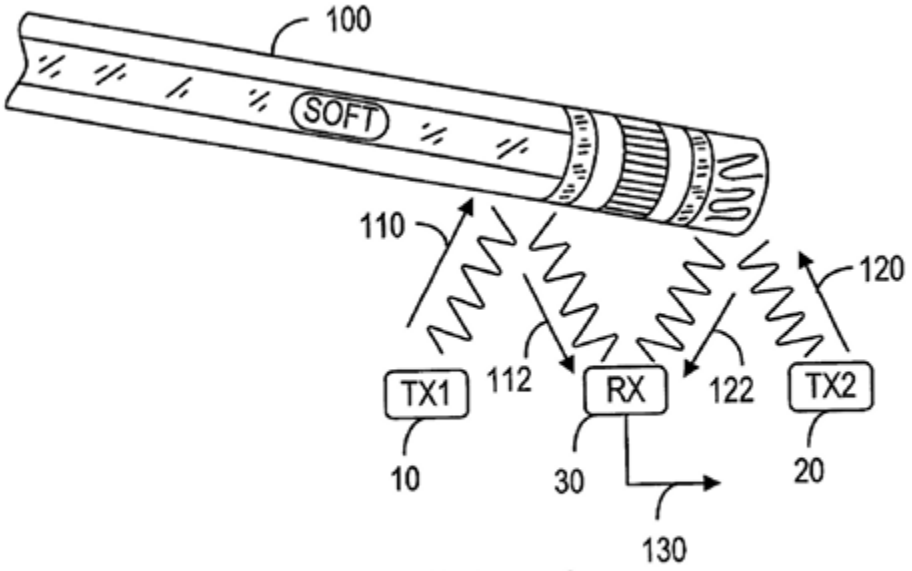


FIG. 1

Figure 1 of Reime, above, is a diagrammatic representation where two light emitters 10, 20 are positioned on opposite sides of light receiver 30 and light emitters 10, 20 and light receiver 30 are used to detect the presence of nearby object 100'. *Id.* ¶¶ 28, 73 (cited in Pet. 66, 71–72).

Reime describes "[w]hen the user's finger 100' touches or *approaches* the pad area 5, as shown in FIG. 2A, it is usually possible to determine from the changes in the output signal of the receiver 30 that the OFF function is selected." *Id.* ¶ 75 (emphasis added) (cited in Pet. 15, 61, 62, 71); *see also id.* ¶ 111 ("The present invention provides a method and device for detecting and sensing the presence of a touching object and the movement thereof in or *near* a touch pad area." (emphasis added)) (cited in Pet. 73). Furthermore, Reime further clarifies "the phrase 'touching the surface', as used hereinafter regarding the touch pad device 1 of the present invention, can be interpreted as 'making contact with the surface' or 'being adjacent to the surface.'" *Id.* ¶ 74 (cited in Pet. 72–73).

Patent Owner's argument that Petitioner "does not dispute that Reime does not distinguish between 'touching the surface,' 'making contact with the surface,' and 'being adjacent to the surface'" (Sur-reply 26 (citing Ex. 1010 ¶ 74; Ex. 2056 ¶¶ 115–117; Resp. 55–56)) misrepresents Petitioner's position. The Petition specifically refers to Reime's disclosures above of sensing the position of a nearby or approaching object, rather than a touching object and includes the quotation of Reime, set forth above, stating that the object need not "physically touch or press the area 5." Pet. 71–74 (quoting Ex. 1010 ¶ 74; citing, e.g., Ex. 1010 ¶¶ 73, 111). In its Reply, Petitioner references certain of its arguments and evidence in the Petition and makes further argument in connection with Dr. Bederson's Reply Declaration that are contrary to Patent Owner's arguments regarding touching the surface, making contact with the surface, and being adjacent to the surface in its Response. *See, e.g.*, Reply 19 (citing Pet. 72–73; Ex. 1010 ¶ 74; Ex. 1035 ¶¶ 37–40).

Also, as discussed above with respect to element 1[b](2), Figure 7 of Hinckley further illustrates range 706 corresponding to sensor values from 0 to 50. *Id.* at Fig. 7. Hinckley describes that "the actual distance to the object is shown along vertical axis 704" and Figure 7 of Hinckley illustrates a distance of approximately 27 centimeters corresponding to the sensor value of 50. *Id.* at Fig. 7, ¶ 44. Hinckley describes that a sensor value in range 706 "indicates no objects are within range of mobile device 200." *Id.* Figure 7 of Hinckley illustrates range 708 corresponding to sensor values 50 to 180 and range 710 corresponding to sensor values greater than 180. *Id.* at Fig. 7. Hinckley describes that range 708 "extends from approximately 7 centimeters to 27 centimeters and indicates that at least one object is within range of mobile device 200" and "[r]eadings in third range 710, which

extends from 7 centimeters to 0 centimeters, are considered to be close to mobile device 200." *Id.* ¶ 44.

Patent Owner's argument that a person having ordinary skill in the art would have understood Hinckley teaches using the proximity sensor values to estimate when a user wants to interact with the device, not to determine or sense the position of the object when it is within a specific distance (Resp. 58 (citing Ex. 2056)) is unavailing because Petitioner relies on the combination of Reime and Hinckley. For instance, Petitioner argues "[b]ecause Reime discloses that it 'is not necessary for the object 100' to physically touch or press the area 5 at a touching point,' Ex-1010, [0074], for example, a POSITA could choose a first predetermined threshold, such as 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. 73 (citing Ex. 1011 ¶ 44; Ex. 1010 ¶ 74). Petitioner relies on Reime for sensing not only the that an object is nearby (i.e., within a certain z-distance) but also Petitioner asserts Reime senses the x-y position. *See, e.g.*, Pet. 62, 66–67 (citing, e.g., Ex. 1010, code (57), ¶¶ 73, 88–89, Fig. 1). Petitioner also argues Hinckley discloses an interactive surface element and Petitioner's contentions are consistent with the evidence cited therein. *See, e.g.*, Pet. 62.

Turning to Patent Owner's argument that Petitioner's reasoning to combine Reime and Hinckley is deficient, for the reasons given above, we determine that Patent Owner's arguments do not undermine Petitioner's showing. *See supra* § II.F.2.a.

In summary, under the correct constructions, Petitioner has shown that element 1[b](3) is taught by Reime alone and we need not consider Petitioner's contentions regarding Hinckley. As an independent reason for

our conclusions herein, under Patent Owner's construction in-part specifically that the degree of propinquity is "established in advance and does not include touching," Petitioner has shown that element 1[b](3) is taught by Reime alone and the combined teachings of Reime and Hinckley.

(4) Conclusion Element 1[b]

In summary, Petitioner's contentions for element 1[b] are supported by the cited portions of Reime and Hinckley. Also, after consideration of the contentions and the evidence of record, we are persuaded that Petitioner has offered articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Reime and Hinckley in the manner recited in claim 1. *See supra* § II.F.2.a. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Reime teaches element 1[b] of claim 1.

d) Element 1[c]

Element 1[c] recites "circuitry coupled to and receiving an output from the at least one pixel array receiving, the circuitry being configured to provide a non-imagewise input representing the position of the at least one object relative to the at least one pixel array." Ex. 1001, 73:25–29. Petitioner argues that Reime teaches element 1[c] based on Reime's disclosure that "the signal processing module 450 sends measurement information 452 to the microprocessor 460." Pet. 76 (citing, e.g., Ex. 1010 ¶ 106, Fig. 14).

In the portions of Reime relied on by Petitioner, Reime describes Figure 14 as "a block diagram showing the basic components 400 in a system for detecting the presence of the touching object 100 and determining the location of the touching point on the touch pad area 5." Ex. 1010 ¶ 106. Reime describes that microprocessor 460 makes use of measurement results

and after the measurement cycles are completed "microprocessor 460 determines the location of the touching point." *Id.*

Petitioner's contentions are supported by the cited portions of Reime. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Reime teaches element 1[c] of claim 1.

e) Element 1[d]

Element 1[d] recites "wherein the change in the amount of radiation detected results from ones of the plurality of detector elements detecting reflected light from the object in addition to detecting the radiation at the baseline level." Ex. 1001, 73:30–33. We note that "wherein the change in the amount of radiation detected" recited in element 1[d] derives antecedent basis from "a change in the amount of radiation detected" recited in element 1[b](2). We, therefore, consider Petitioner's contentions for elements 1[b](2) and 1[d] together. In those contentions, Petitioner relies on Reime's disclosure of detecting reflected light from the object in addition to detecting the radiation at the baseline level. Pet. 66–67, 77 (citing, e.g., Ex. 1010 ¶¶ 73, 88, 89, Figs. 1, 10B, 10C; Ex. 1002 ¶¶ 131–141, 153–154).

Petitioner's contentions are supported by the cited portions of Reime. After consideration of the contentions and the evidence of record, we determine that Petitioner has shown that Reime teaches element 1[d] of claim 1.

f) Conclusion

After consideration of the contentions and the evidence of record in the complete record now before us, we determine that Petitioner has shown that Reime alone or with Hinckley teaches all recitations in claim 1. Also,

we are persuaded that Petitioner has offered articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have modified Reime and combined the teachings of Reime and Hinckley in the manner recited in claim 1. We also are persuaded that Petitioner has demonstrated that such person would have had a reasonable expectation of success.

Accordingly, based on the complete record now before us, we conclude that Petitioner has established by a preponderance of the evidence that claim 1 is unpatentable under 35 U.S.C. § 103(a) as obvious over Reime alone or with Hinckley.

3. Independent Claim 13

Independent claim 13 is similar to independent claim 1, except claim 13 further recites "wherein the position of the object includes at least one of a two-dimensional position of the object, a three-dimensional position of the object and angular orientation of the object." Ex. 1001, 74:58–61. Petitioner's analysis of claim 13 is the same as the analysis of claim 1, except Petitioner points to Reime's sensing the two-dimensional position of the object. Pet. 78 (citing, e.g., Ex. 1010 ¶ 80).

Patent Owner does not argue claim 13 separately. *See generally* Resp. Petitioner's assertions regarding claim 13 are supported by the cited portions of Reime and Hinckley. For the reasons given with respect to claim 1, we find that Patent Owner's contentions do not undermine Petitioner's showing. *See supra* § II.E.2.

After consideration of the contentions and the evidence in the complete record now before us, we determine that Petitioner has shown that Reime alone or with Hinckley teaches all recitations in claim 13. Also, we are persuaded that Petitioner has offered articulated reasoning with a rational

underpinning as to why one of ordinary skill in the art would have combined the teachings of Reime and Hinckley in the manner recited in the claim. We also are persuaded that Petitioner has demonstrated that such person would have had a reasonable expectation of success.

Accordingly, based on the complete record now before us, we conclude that Petitioner has established by a preponderance of the evidence that claim 13 is unpatentable under 35 U.S.C. § 103(a) as obvious over Reime alone or with Hinckley.

4. Dependent Claims 2, 6, 10, and 11

Claim 2 depends from claim 1 and further recites "wherein the at least one pixel array is configured to sense light reflected from the at least one object." Petitioner argues "as shown in FIG. 10C, '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.'" Pet. 79 (citing Ex. 1010 ¶ 88, Fig. 10C). Petitioner also argues as "illustrated in FIG. 8B, Reime explains that '[t]he approaching and touching of the user's finger is detected by the reflection off the finger.'" *Id.* (citing, e.g., Ex. 1010 ¶ 86, Fig. 8B).

Claim 6 depends from claim 1 and further recites "wherein the utilization circuitry is further configured to compute at least one characteristic of a trajectory of motion of the at least one object generally parallel to the at least one pixel array, wherein the at least one characteristic includes at least one of location, direction, velocity and change in direction." Petitioner argues "Reime discloses a utilization circuitry that is configured to compute at least the location of the one object, as shown in FIGS. 1 and 2A, as well as its movement." Pet. 80 (citing, e.g., Ex. 1010 ¶ 73, Figs. 1A, 2A).

Claim 10 depends from claim 1 and further recites "wherein the array detection output includes information corresponding to at least one of the location of an impingement point of the object on the surface and the location of the object relative to the surface." Petitioner argues "Reime's output includes information corresponding to the location of the object relative to the surface because it includes a two-dimensional position of the object: 'the two dimensional coordinates of the touching point with respect to the touch pad area 5.'" Pet. 81 (citing, e.g., Ex. 1010 ¶ 80).

Claim 11 depends from claim 1 and further recites "wherein the radiation at the baseline level is provided by at least one source of radiation external to the position sensing assembly." Petitioner argues "as shown in FIG. 10C [of Reime], '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.'" Pet. 82 (citing, e.g., Ex. 1010 ¶ 88). Petitioner argues "[a]mbient light source of radiation external to the position sensing assembly." *Id.*

We have considered Petitioner's arguments and evidence for dependent claims 2, 6, 10, and 11 and we find that Petitioner's arguments and the testimony of Dr. Bederson are consistent with and supported by the evidence cited therein. We are persuaded that Petitioner has shown that Reime alone or with Hinckley teaches the further recitations in each of those dependent claims. Patent Owner does not present arguments separately contesting Petitioner's assertions for claims 2, 6, 10, and 11. Accordingly, based on the complete record now before us, we conclude that Petitioner has established by a preponderance of the evidence that claims 2, 6, 10, and 11

are unpatentable under 35 U.S.C. § 103(a) as obvious over Reime alone or with Hinckley.

5. Claim 12

Claim 12 depends from claim 1 and further recites "wherein the at least one pixel array comprises a single pixel array arranged along an edge of the surface." Petitioner argues "[a]s shown in FIG. 8B, Reime discloses the at least one pixel array comprises a single pixel array arranged along an edge of the surface." Pet. 83 (citing Ex. 1010, Fig. 8B). Petitioner also argues "[t]he cross section shows the emitters/detectors next to the edge of LCD 92, and coverplate 70." *Id.*

Patent Owner relies on its contentions for claim 1 that Reime does not teach a pixel array comprising detector elements and argues as "neither Reime nor Hinkley disclose a pixel array comprising detector elements, it logically follows that neither disclose that such a pixel array is arranged at the edge of the surface, as required by claim 12." Resp. 60–61. Patent Owner also argues "Fig. 8B, reproduced by Dr. Bederson as disclosing a pixel array arranged at the edge of a surface, actually shows an LCD 92 around which is an emitter and a receiver" and the emitter and receiver of Fig. 8B of Reime would not have been considered as the pixel array that includes the LCD. *Id.* at 61–62 (citing, e.g., Ex. 2056 ¶ 139).

In its Reply, Petitioner argues "Figure 9E [of Reime] shows detectors 30 and 32 'along the edge' because elements 30 and 32 of Figure 9E are behind 10 and 12 from the particular view in Figure 8." Reply 22 (citing Ex. 1037, 169:2–17; Ex. 2060, 124:17–125:12; Ex. 1035 ¶ 43, Figs. 8B, 9E). Petitioner also argues "[t]his is consistent with the specification instruction that '"at edges" is to be interpreted broadly as including structures which are

located behind edges …, about edges …, and along edges….'" *Id.* (citing Ex. 1001, 48:43–49).

In its Sur-reply, Patent Owner argues that Petitioner "presents new evidence that includes an annotated combination of Figures 8 and 9E, and advances arguments that detectors 30 and 32 satisfy the claimed 'single pixel array'" and that Petitioner's argument is an "improper shift." Sur-reply 28. Patent Owner also argues "[t]he claimed 'at least one pixel array' cannot be one element of Reime for one limitation, and another element for another limitation in the same claim." *Id.*

We find that Petitioner fails to show that Reime teaches the further recitations in claim 12. Petitioner's theory in the Petition simply referring to Figure 8B and stating "[t]he cross section shows the emitters/detectors next to the edge of LCD 92, and coverplate 70" (Pet. 83 (citing Ex. 1010, Fig. 8B)) is conclusory. Petitioner, for example, fails to identify pixels in the "emitters/detectors," which Petitioner relies on for the "single pixel array" or otherwise identify how this limitation is taught by Reime.

Petitioner's arguments in its Reply are unavailing. Petitioner argues "Figure 9E shows detectors 30 and 32 'along the edge' because elements 30 and 32 of Figure 9E are behind 10 and 12 from the particular view in Figure 8." Reply 22 (citing Ex. 1037, 169:2–17; Ex. 2060, 124:17–125:12; Ex. 1035 ¶ 43). Reime describes "as illustrated in FIGS. 2A through 8C, all of the optical sensor components are placed outside the touch pad area 5." Ex. 1010 ¶ 87. For Figure 9E, Reime describes that "the optical sensor components can also be placed inside the touch pad area 5, as shown in FIGS. 9A–9F." *Id.* Petitioner's argument does not address its varying positions: that Reime describes Figures 8B and 9E differently in that in Figure 8B, the optical sensor components are outside touch pad area 5 and in

Figure 9E, the optical sensor components are inside touch pad area 5. Moreover, Petitioner does not explain how detectors 30 and 32 shown at the center of top and bottom edges of Figure 9E, respectively, teach "wherein the at least one pixel array comprises a single pixel array arranged along an edge of the surface" recited in claim 12.

Petitioner relies on only Reime for the teachings of the recitations in claim 12. Pet. 82–83; Reply 21–22. We determine that Petitioner has not shown that Reime teaches the recitations in dependent claim 12. Accordingly, based on the complete record now before us, we conclude that Petitioner has not established by a preponderance of the evidence that claim 12 is unpatentable under 35 U.S.C. § 103(a) as obvious over Reime alone or with Hinckley.

III. CONCLUSION

The outcome for the challenged claims is set forth below.[10] In summary:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 6, 9–11, 13	103(a)	Yamaguchi	1, 2, 6, 9–11, 13	

[10] 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).

Claims Challenged	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatent-able	Claims Not Shown Unpatent-able
1, 2, 6, 9–11, 13	103(a)	Yamaguchi, Hinckley	1, 2, 6, 9–11, 13	
1, 2, 6, 10–13	103(a)	Reime	1, 2, 6, 10, 11, 13	12
1, 2, 6, 10–13	103(a)	Reime, Hinckley	1, 2, 6, 10, 11, 13	12
Overall Outcome			1, 2, 6, 9–11, 13	12

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1, 2, 6, 9–11, and 13 of the '675 patent have been proven to be unpatentable;

FURTHER ORDERED that claim 12 of the '675 patent has not been proven unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude (Paper 28) is denied; and

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

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