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Paper 44
Entered: January 6, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MIANYANG BOE OPTOELECTRONICS TECHNOLOGY CO., LTD., WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD., TIANMA MICROELECTRONICS CO. LTD., and VISIONOX TECHNOLOGY, INC.,
Petitioner,

v.

SAMSUNG DISPLAY CO., LTD.,
Patent Owner.

IPR2023-00988
Patent 10,854,683 B2

Before JAMESON LEE, TERRENCE W. McMILLIN, and JOHN A. HUDALLA, *Administrative Patent Judges*.

HUDALLA, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
Granting-in-Part Petitioner's First Motion to Strike
Dismissing Petitioner's Second Motion to Strike
Dismissing Petitioner's Motion to Exclude
35 U.S.C. § 318(a); 37 C.F.R. §§ 42.5(a), 42.64(c)

Mianyang BOE Optoelectronics Technology Co., Ltd.; Wuhan China Star Optoelectronics Semiconductor Display Technology Co., Ltd.; Tianma Microelectronics Co. Ltd.; and Visionox Technology, Inc. (collectively, "Petitioner") filed a Petition (Paper 1, "Pet.") requesting an *inter partes* review of claims 1, 2, 4–10, 13, and 15 ("the challenged claims") of U.S. Patent No. 10,854,683 B2 (Ex. 1001, "the '683 patent"). Samsung Display Co., Ltd. ("Patent Owner") filed a Preliminary Response (Paper 9). Taking into account the arguments presented by Patent Owner in the preliminary record, we determined that the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims. Pursuant to 35 U.S.C. § 314, we instituted this proceeding on January 8, 2024, as to all challenged claims and all grounds of unpatentability presented in the Petition. Paper 10 ("Dec. on Inst.").

During the course of trial, Patent Owner filed a Patent Owner Response (Paper 18, "PO Resp."), and Petitioner filed a Reply to the Patent Owner Response (Paper 28, "Pet. Reply"). Patent Owner also filed a Sur-reply (Paper 30, "PO Sur-reply"). A consolidated oral hearing with IPR2023-00987 and IPR2023-01075 was held on October 9, 2024, and a transcript of the hearing is included in the record. Paper 43 ("Tr.").

Petitioner filed declarations of P. Morgan Pattison, Ph.D., with its Petition (Ex. 1003) and Reply (Ex. 1018). Patent Owner filed declarations of Ioannis Kymissis, Ph.D. (Ex. 2009), Aris K. Silzars, Ph.D. (Ex. 2061), and Adam Fontecchio, Ph.D. (Ex. 2063) with its Response. The parties also filed the transcripts of the depositions of Dr. Pattison (Exs. 2062, 2086) and Dr. Kymissis (Ex. 1019).

Petitioner filed a first motion to strike the portions of Patent Owner's Response that allegedly incorporate arguments from Exhibits 2028 and 2041–2043. Paper 23 ("1st Strike Mot."). Patent Owner filed an opposition (Paper 24, "1st Strike Opp.") and Petitioner filed a reply (Paper 25, "1st Strike Reply").

Petitioner filed a second motion to strike (1) Exhibit 2083 and the portions of Patent Owner's Sur-reply that rely on it; (2) the portions of Patent Owner's Sur-reply that rely on certain exhibits that were not filed in this case; and (3) the portions of Patent Owner's Sur-reply that reference Exhibits 2028 and 2041–2043. Paper 32 ("2d Strike Mot."). Patent Owner filed an opposition (Paper 36, "2d Strike Opp.") and Petitioner filed a reply (Paper 37, "2d Strike Reply").

Petitioner filed a motion to exclude Exhibits 2028 and 2041–2061. Paper 38 ("Exclude Mot."). Patent Owner filed an opposition (Paper 39, "Exclude Opp.") and Petitioner filed a reply (Paper 40, "Exclude Reply").

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 1, 2, 4–10, 13, and 15 of the '683 patent. For the reasons discussed below, Petitioner has demonstrated by a preponderance of the evidence that claims 1, 4–10, 13, and 15 of the '683 patent are unpatentable. Petitioner has not demonstrated by a preponderance of the evidence that claim 2 of the '683 patent is unpatentable. We also *grant-in-part* and *deny-in-part* Petitioner's First Motion to Strike. We additionally *dismiss as moot* Petitioner's Second Motion to Strike and Petitioner's Motion to Exclude.

I. BACKGROUND

A. Real Parties-in-Interest

Petitioner identifies Mianyang BOE Optoelectronics Technology Co., Ltd.; Wuhan China Star Optoelectronics Semiconductor Display Technology Co., Ltd.; Tianma Microelectronics Co. Ltd.; and Visionox Technology, Inc. and their subsidiaries as the real parties-in-interest. Pet. 3. Patent Owner identifies Samsung Display Co., Ltd., as the real party-in-interest. Paper 6, 2.

B. Related Matters

The parties identify the following proceedings related to the ’683 patent (Pet. 3; Paper 6, 2):

Certain Active Matrix Organic Light-Emitting Diode Display Panels And Modules For Mobile Devices, And Components Thereof, Inv. No. 337-TA-1351 (USITC) (“the ITC Investigation”); and

Samsung Display Co., Ltd. v. BOE Technology Co., Ltd., Case No. 2-23-cv-00309 (E.D. Tex.) (“the Texas litigation”).

C. The ’683 Patent

The ’683 patent is directed to “a pixel arrangement structure of an organic light emitting diode (OLED) display.” Ex. 1001, 1:20–21. The ’683 patent indicates that “[a]n organic emission layer included in the pixel of an OLED display may be deposited and formed by using a mask such as a fine metal mask (FMM).” *Id.* at 1:43–45. The ’683 patent notes that “[w]hen reducing a gap between the neighboring pixels to obtain a high aperture ratio of the pixel, deposition reliability may be deteriorated,” but “[o]n the other hand, when increasing the gap between the pixels to improve

the deposition reliability, the aperture ratio of the pixel may be deteriorated." *Id.* at 1:45–50. The '683 patent also indicates that pixels of certain colors may have different lifespans from other pixels, and that the pixel arrangement structure of the OLED display may provide improved life span. *Id.* at 7:29–36.

The '683 patent indicates that an exemplary embodiment "provides a pixel arrangement structure for an OLED display having an improved aperture ratio of a pixel while efficiently setting up a gap between the pixels." Ex. 1001, 1:62–67.

Figure 1 of the '683 patent is reproduced below.

FIG.1

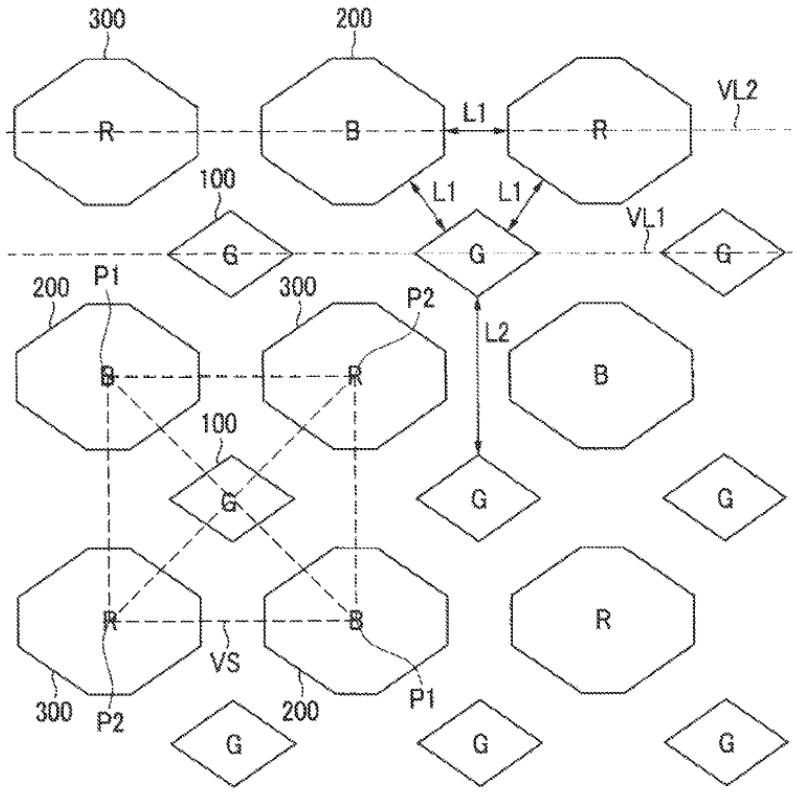


Figure 1 is "a view of a pixel arrangement structure of an OLED display." Ex. 1001, 3:3–4. "[T]he pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300," which emit green, blue, and red light, respectively. *Id.* at 3:56–59, 4:16–17, 4:34–35, 4:47–48.

According to the '683 patent, "each of the first pixels 100 has a smaller area than neighboring second pixels 200 and third pixels 300, and has a quadrilateral (i.e., four-sided) shape." Ex. 1001, 4:8–11. "The second pixels 200 are arranged diagonally with respect to the first pixels 100, such as at first vertices P1 along one diagonal of a virtual square VS having one of the first pixels 100 as a center point (or center) of the virtual square VS." *Id.* at 4:18–22. "In a similar fashion, the third pixels 300 are arranged diagonally with respect to the first pixels 100, such as at second vertices P2 along the other diagonal of the virtual square VS." *Id.* at 4:22–25.

According to the '683 patent, "[e]ach of the third pixels 300 has a larger area than the neighboring first pixel 100 and the same area as each of the second pixels 200." Ex. 1001, 4:40–42. The '683 patent indicates that "by enclosing each of the first pixels 100 by a pair of the second pixels 200 and a pair of the third pixels 300, the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300 may be improved." *Id.* at 5:24–27.

The '683 patent further states that

> the gap of the first length L1 is formed between adjacent pairs of the first pixels 100 and the second pixels 200, between adjacent pairs of the first pixels 100 and the third pixels 300, and between adjacent pairs of the second pixels 200 and the third pixels 300. In addition, the gap of the second length L2 that is longer than the first length L1 is formed between the

> neighboring ones of the first pixels 100. This results in improved deposition reliability when using a fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.

Ex. 1001, 5:13–23.

Figure 2 of the ’683 patent is reproduced below.

FIG.2

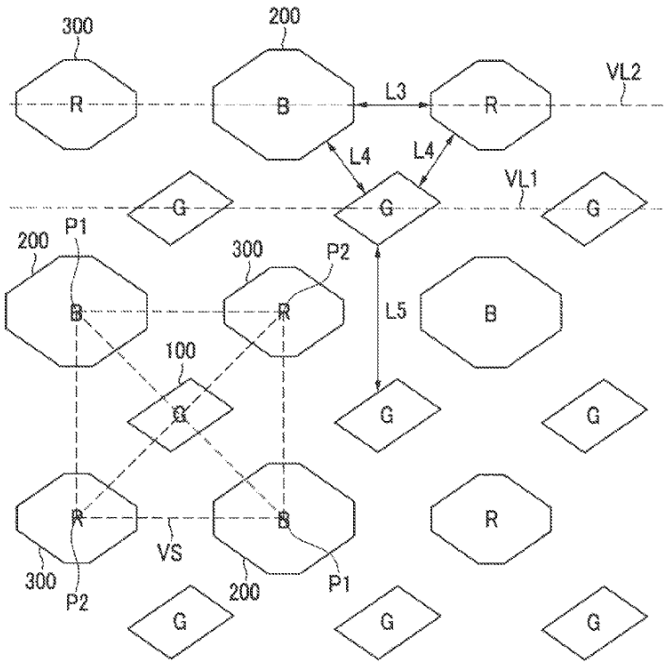


Figure 2 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 3:5–6. In Figure 2, “[t]he plurality of first pixels 100 have the same quadrilateral shape (e.g., a parallelogram)” and “the second pixels 200 have a larger area than the third pixels 300.” *Id.* at 6:4–6. According to the ’683 patent, because “the second pixels 200 that emit blue have the shortest life span,” “the second pixels 200 have a larger area than the third pixels 300, thereby suppressing the deterioration of the life span of the OLED display.” *Id.* at 6:47–52.

Figure 5 of the ’683 patent is reproduced below.

FIG.5

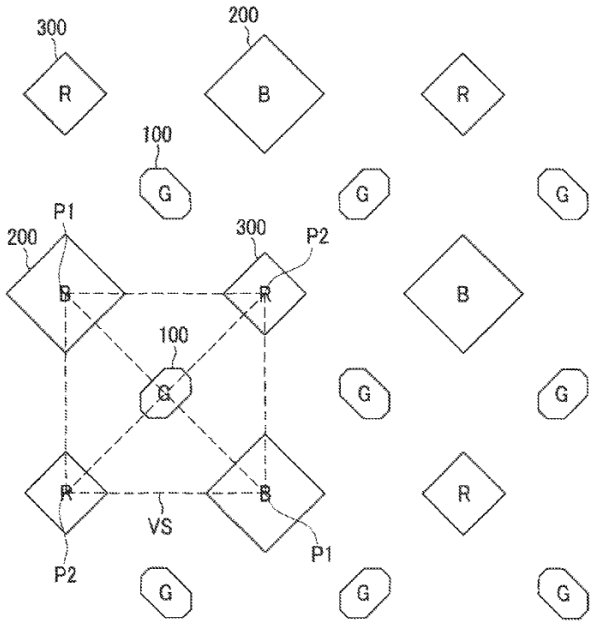


Figure 5 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 3:13–14. According to the ’683 patent, “the neighboring first pixels 100 have a[n] octagonal shape and are symmetrical to each other, while the second pixels 200 have a larger area than the third pixels 300.” *Id.* at 8:35–38. The ’683 patent states that “[t]his results in improved deposition reliability in the deposition process using the fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.” *Id.* at 8:38–42.

The application that led to the ’683 patent was filed on November 13, 2017, and claims priority to, *inter alia*, a Korean application that was filed on March 6, 2012 (i.e., the earliest possible effective filing date). Ex. 1001, codes (22), (30). For purposes of this Decision, we apply the March 6, 2012, date for qualifying the asserted references as prior art.

D. Illustrative Claim

Of the challenged claims, claims 1, 13, and 15 are independent. Claims 2 and 4–10 depend directly or indirectly from claim 1. Claim 1 is illustrative of the challenged claims and recites:

> 1. [1-pre] A pixel arrangement structure of an organic light emitting diode (OLED) display comprising:
>
> [1-a] a plurality of pixels for displaying an image on the OLED display and comprising:
>
> [1-a(1)] a first pixel;
>
> [1-a(2)] a pair of second pixels separated from the first pixel, the second pixels being located at opposite sides of the first pixel along a first line on which the first pixel, the second pixels, and another first pixel are consecutively arranged such that the first line passes through respective centers of the first pixel, the second pixels, and the other first pixel; and
>
> [1-a(3)] a pair of third pixels separated from the first pixel and the second pixels, the third pixels being located at opposite sides of the first pixel along a second line on which the first pixel, the third pixels, and an additional first pixel are consecutively arranged such that the second line passes through respective centers of the first pixel, the third pixels, and the additional first pixel, the second line crossing the first line at a location of the first pixel,
>
> [1-b] wherein a first distance between the second pixels is greater than a second distance between one of the second pixels and a neighboring one of the third pixels,
>
> [1-c] wherein the first pixels are configured to emit green light, which is a color that is different from light emitted by the second pixels and the third pixels,
>
> [1-d] wherein the first pixels are smaller than at least one of the second pixels or the third pixels, and

> [1-e] wherein each of the second pixels has a larger area than each of the third pixels.

Ex. 1001, 8:63–9:26 (Petitioner's identifiers added in brackets).

E. Prior Art

Petitioner relies on the following prior art:

> U.S. Patent No. 6,897,855 B1, filed Feb. 16, 1999, issued May 24, 2005 (Ex. 1004, "Matthies");
>
> U.S. Patent No. 7,091,986 B2, filed Dec. 5, 2003, issued Aug. 15, 2006 (Ex. 1005, "Phan");
>
> Japanese Patent No. 4496852 B2, filed June 10, 2004, issued July 7, 2010 (Exs. 1006, 1007, "Murai");[1] and
>
> U.S. Patent No. 6,366,025 B1, filed Feb. 24, 2000, issued Apr. 2, 2002 (Ex. 1008, "Yamada").

F. The Instituted Grounds

We instituted *inter partes* review of claims 1, 2, 4–10, 13, and 15 of the '683 patent on the following grounds (Dec. on Inst. 48), which are all the grounds presented in the Petition (Pet. 5):

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1, 2, 4–10, 13, 15	103(a)[2]	Matthies, Yamada
1, 4–10, 13, 15	103(a)	Phan
2	103(a)	Phan, Yamada
1, 2, 4–10, 13, 15	103(a)	Murai, Yamada

[1] Murai is a Japanese-language publication (Ex. 1006) that was filed with an English-language translation (Ex. 1007, 1–15) and a declaration attesting to the accuracy of the translation (*id.* at 16). Our citations to Murai herein refer to the translation at Exhibit 1007.

[2] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103. Because the

II. ANALYSIS

A. Legal Standards

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See 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 skill in the art; and (4) where in evidence, so-called secondary considerations. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We also recognize that prior art references must be "considered together with the knowledge of one of ordinary skill in the pertinent art." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (citing *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

B. Level of Ordinary Skill in the Art

Citing testimony from Dr. Pattison, Petitioner contends a person of ordinary skill in the art "would have had a degree in electrical engineering, materials science, physics, or a similar discipline, along with 2 years of professional experience working with display design, including OLED displays, or an equivalent level of skill, knowledge, and experience." Pet. 10

'683 patent claims priority to an application filed before March 16, 2013 (the effective date of the relevant amendments), the pre-AIA versions of §§ 102 and 103 apply.

(citing Ex. 1003 ¶¶ 37–39). Petitioner further notes that such a person of ordinary skill in the art "would have been aware of and generally knowledgeable about OLED materials, and display pixel design, layout, and operation." *Id.* (citing Ex. 1003 ¶ 39). We adopted Petitioner's definition in the Decision on Institution. Dec. on Inst. 12

Patent Owner cites the level of ordinary skill adopted in the related ITC investigation, as well as testimony from Dr. Kymissis, and contends that an ordinarily skilled artisan "would have had a relevant technical degree in Electrical Engineering, Computer Engineering, Materials Science, Physics, or the like, and experience in electroluminescence and the design of active-matrix displays or pixel arrangements for such displays." PO Resp. 4–5 (citing Ex. 2001, 15; Ex. 2009 ¶ 64). Patent Owner describes its proposal as containing "slightly different language" than Petitioner's definition and does not explain why we should adopt its proposal over Petitioner's definition. *Id.* Notwithstanding, Patent Owner contends that "Petitioner fails to establish unpatentability under either [party's] definition." *Id.* at 5.

For purposes of this Decision, we again adopt Petitioner's definition of the level of ordinary skill in the art. It is supported by the testimony of Dr. Pattison, and appears consistent with what is reflected by the content of the applied prior art references. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1354–55 (Fed. Cir. 2001) (the applied prior art may reflect an appropriate level of skill).

We find Patent Owner's articulation of the level of ordinary skill to be imprecise, because Patent Owner does not specify the amount of experience possessed by an ordinarily skilled artisan. The unbounded reference to "experience" is vague and overly broad, as it could mean 1 year of

experience or over 30 years of experience, for example. In addition, the '683 patent is directed to "a pixel arrangement structure of an organic light emitting diode (OLED) display" (Ex. 1001, 1:19–21), whereas Patent Owner's proposed experience is tied to "active-matrix displays." PO Resp. 5. Given that the field of OLED displays includes both passive and active matrix designs (*see generally* Ex. 2009 ¶¶ 40–56), we see no reason to restrict the relevant experience to active matrix displays. For these reasons, we do not adopt Patent Owner's definition of the level of ordinary skill in the art.

C. Claim Interpretation

In an *inter partes* review, we construe each claim

> using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

37 C.F.R. § 42.100(b) (2023). Accordingly, our claim construction standard is the same as that of a district court. *See id.* Under the standard applied by district courts, claim terms are generally given their plain and ordinary meaning, as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). "There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the

specification or during prosecution." *Thorner v. Sony Comput. Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

Petitioner states that "[f]or purposes of this petition . . . the terms of the '683 patent's claims do not require further construction and can be afforded their plain and ordinary meaning." Pet. 10. Patent Owner points out that the Administrative Law Judge in the related ITC Investigation issued a claim construction order that did not construe any claim terms of the '683 patent. PO Resp. 4 (citing Ex. 2001). Patent Owner further states that the parties in the ITC Investigation "submitted a list of agreed-upon constructions including certain terms of the '683 Patent." *Id.* (citing Ex. 2002). Notwithstanding, Patent Owner indicates that "[n]o specialized constructions are necessary in this proceeding" and that "Petitioner fails to prove unpatentability of any claims under any interpretation." *Id.*

We determine that no aspects of the challenged claims require explicit construction. *See, e.g.*, *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Obviousness Ground Based on Phan

Petitioner contends that the subject matter of claims 1, 4–10, 13, and 15 would have been obvious over Phan. Pet. 41–55; Pet. Reply 12–16, 19–25. Patent Owner disputes Petitioner's contentions. PO Resp. 30–38, 54–71; PO Sur-reply 15–20, 24–27.

1. Phan

Phan is a U.S. patent directed to a "display comprising pixels and dots." Ex. 1005, 1:18–19. Phan indicates that such a display may be one of a number of display technologies including an OLED display. *Id.* at 1:19–29. According to Phan, "[t]he pixels generally consist of so-called dots representing the three basic colours red, green and blue." *Id.* at 1:59–61. Phan discloses displays in which "each dot has a receiver of its own . . . to convert digital information transmitted through [a] network . . . into luminous intensity levels for [the] dots." *Id.* at 5:16–19. Phan discloses "dynamic generation of pixels wherein a one-pixel logical unit is formed by grouping adjacent dots, with adjacent pixels being physically superimposed and the dynamic pixels being generated by sequential addressing at a rate such that said generation is not perceivable by the human eye." *Id.* at 2:66–3:4.

Figures 11a and 11b of Phan are reproduced below.

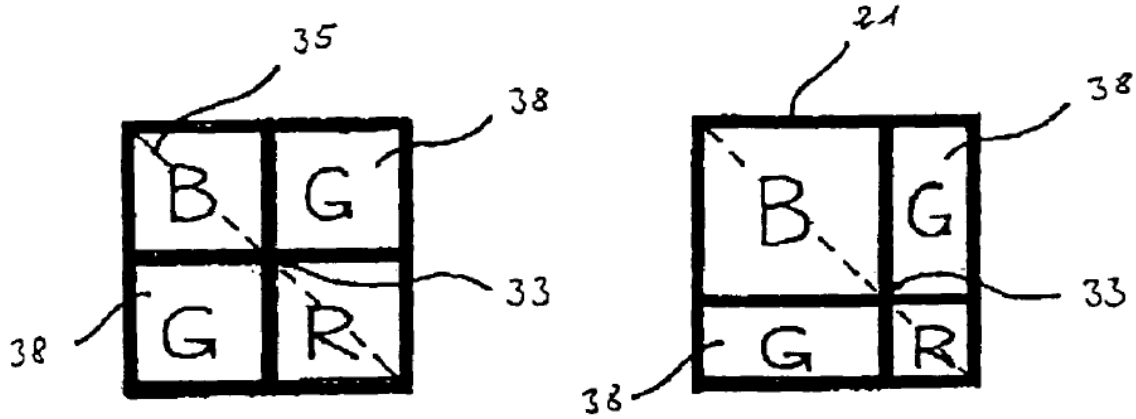


FIG. 11a FIG 11b

Figure 11a "shows a square quad pixel where the crosspoint 33 is in the centre of the four dots (individual elements) of equal light emitting area and

space, contoured by black mask or black barrier ribs 21 with the same structure." Ex. 1005, 5:47–50. Figure 11b "shows a typical square quad pixel where the crosspoint 33 moving along the diagonal line 35 forms two dots (individual elements) of equal light emitting area and space 38 of green color (G)." *Id.* at 5:51–54.

Figure 12 of Phan is reproduced below.

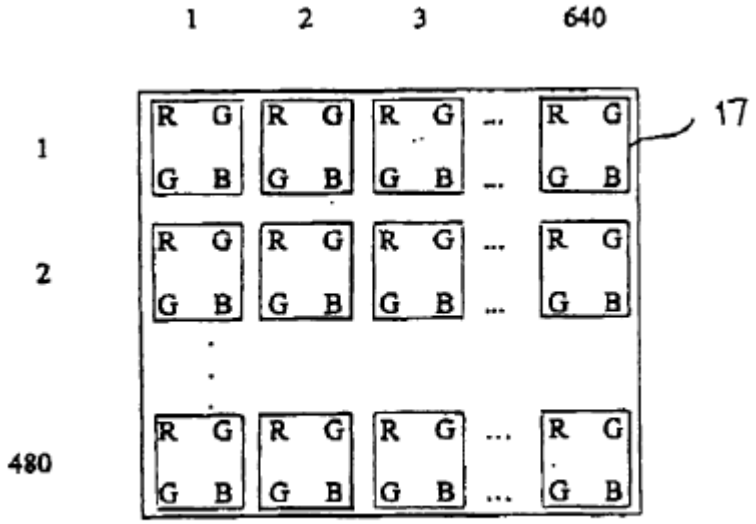


FIG. 12

Figure 12 "shows a quad pixels display with a resolution of 480x640 static pixels 17." Ex. 1005, 4:5–6, 5:55–56.

Petitioner notes that Phan issued August 15, 2006, and contends that Phan qualifies as prior art under 35 U.S.C. § 102(b). Pet. 14. Patent Owner does not contest the prior art status of Phan. We determine that Phan qualifies as prior art under 35 U.S.C. § 102(b) because Phan's issue date of August 15, 2006, is more than one year before the earliest effective filing date of the challenged claims, which is March 6, 2012. Ex. 1001, code (30); Ex. 1005, code (45).

2. Claim 1

a. Preamble [1-pre]

The preamble of claim 1 recites "[a] pixel arrangement structure of an organic light emitting diode (OLED) display." Ex. 1001, 8:63–64. Petitioner cites Phan's teaching of a "display comprising pixels and dots." Pet. 42 (quoting Ex. 1005, 1:18–19) (citing Ex. 1005, 2:51–53). Petitioner contends that "Phan's teachings can be employed with various 'display technologies,' including 'Organic Light Emitting Diode (OLED)' displays." *Id.* (quoting Ex. 1005, 1:18–29) (citing Ex. 1003 ¶¶ 325–328). Petitioner also notes that "Phan includes two sets of example pixel designs," including the "quad pixel" designs of Figure 11a and 11b. *Id.* at 54 (citing Ex. 1005, 5:47–54). Petitioner contends that an ordinarily skilled artisan would have been motivated to use these pixel designs with the displays referenced elsewhere in Phan with "every reason to believe that those pixel designs can be successfully employed." *Id.* at 54–55 (citing Ex. 1003 ¶¶ 412–414); *see also* Ex. 1003 ¶ 321 (similar testimony from Dr. Pattison). In its Reply, Petitioner argues that, like Phan, "[n]umerous prior art references" teach that "the same pixel arrangement can be used by different displays." Pet. Reply 12–13 (citing Ex. 1004, 5:28–35; Ex. 2018 ¶ 6). Petitioner specifically cites a reference known as Cok[3] for teaching that "the very same 'pixel pattern' shown in Figure 11b of Phan is useful with both 'passive-matrix or active matrix' OLEDs." *Id.* at 13 (citing Ex. 1017, 2:61–67, 4:8–15, Fig. 1).

Patent Owner disputes that Phan's pixel arrangements apply to OLEDs. PO Resp. 30–34; PO Sur-reply 15–16. Patent Owner argues that

[3] U.S. Patent No. 6,867,549 B2, filed Dec. 10, 2002, issued Mar. 15, 2005 (Ex. 1017, "Cok").

Phan makes a single passing reference to OLEDs among a "laundry list of every conceivable display technology," which does not "mean that [Phan's] embodiments of pixel arrangements were for OLEDs or for each of the listed alleged 'display technologies.'" PO Resp. 31 (citing Ex. 2009 ¶ 202); *see also* PO Sur-reply 16 (similar argument). Patent Owner also argues that "Phan does not state, nor suggest, that the pixel arrangements it draws, or Figures 11a and 11b specifically, would be suitable for an OLED display." PO Resp. 32.

As further evidence that Phan's embodiments do not relate to OLEDs, Patent Owner notes that "Phan mentions only CRT, LCD, LED, PDP, and FED in the sole portion of its specification containing any substantive discussion of the display technologies."[4] PO Resp. 32–33 (footnote omitted) (citing Ex. 1005, 1:56–2:46; Ex. 2009 ¶ 204). In a similar fashion, Patent Owner argues that an ordinarily skilled artisan would have known that Phan's mentions of "displays using 'optical fiber network[s]' and 'receivers' do not relate to OLEDs." *Id.* at 32 (alteration in original) (citing Ex. 1005, 5:9–24; Ex. 2009 ¶ 203). Patent Owner also argues that "Phan's virtual driving method—the heart of Phan's disclosure—would not be feasible in an OLED display." *Id.* at 33 (citing Ex. 1005, 2:35–38, 5:23–24, 5:55–60; Ex. 2009 ¶¶ 207–215). Patent Owner additionally notes that "Phan's figures depict essentially no spacing between adjacent dots," which is "not feasible for an OLED display due to issues of color mixing of the organic light-

[4] Patent Owner notes that the mention of "LED" in this context refers to "solid-state light-emitting diodes, which are distinct from OLEDs." PO Resp. 33 n.5 (citing Ex. 2009 ¶ 204). Petitioner does not dispute this.

emitting materials and shorting between adjacent pixels." *Id.* (citing Ex. 2009 ¶¶ 205–206).

Finally, Patent Owner argues that Petitioner's allusions to other prior art references that use the same pixel arrangement for different types of displays should be rejected because they "do not support Petitioner's attorney argument" and because they effectively amount to new combinations. PO Sur-reply 16.

At the outset, we note that claim 1 includes no specific limitations directed to OLEDs other than reciting that the claimed "plurality of pixels" display an image on an OLED display. *See* Ex. 1001, 8:63–9:26. More specifically, claim 1 includes no limitations directed to the '683 patent's disclosures about "power lines for driving each of the pixels, such as a gate line, a data line, a driving power line" or "an anode, an organic emission layer, and a cathode" corresponding to the pixels. *Id.* at 3:62–4:3. Indeed, the '683 patent states that "[t]hese configurations are technologies known in the art and further description thereof is omitted for ease of description." *Id.* at 4:3–5. Nor does claim 1 include limitations directed to the '683 patent's disclosures about manufacturing OLED displays (*see id.* at 1:42–50) or the different lifespans for various organic materials (*see id.* at 7:29–36). Thus, Petitioner's obviousness analysis need not account for these aspects of an OLED display.

Given this background, we note that the parties' disputes regarding Phan turn on whether Phan teaches that its disclosed pixel arrangements can be applied to OLED displays. We find that it does.[5] In the "Field of the

[5] Patent Owner contends that the preamble is limiting (PO Resp. 30), whereas Petitioner takes no position on this issue (*see* Tr. 6:12–22).

Invention" section, Phan states that "[t]he *invention* [of Phan] relates to a display comprising pixels and dots, including but not limited to" various "display technologies" including "Organic Light Emitting Diode (OLED)." Ex. 1005, 1:17–29 (emphasis added). Accordingly, we find that Phan fairly suggests that the pixel arrangements disclosed in Phan—which are part of Phan's "invention"—may be applied to OLEDs. *See Twitter, Inc. v. VidStream LLC*, 825 F. App'x 844, 850 (Fed. Cir. 2020) (quoting *Bradium Techs. LLC v. Iancu*, 923 F.3d 1032, 1049 (Fed. Cir. 2019)) ("[W]hen conducting an obviousness analysis, the Board must consider a prior art reference 'not only for what it expressly teaches, but also for what it fairly suggests.'"). In making this finding, we note that obviousness is determined from the perspective of a person of ordinary skill in the art (*see* 35 U.S.C. § 103(a)), who in this case would have had "2 years of professional experience working with display design, including OLED displays." *See supra* § II.B. In light of this specific experience, we find that an ordinarily skilled artisan would have been inclined to link Phan's disclosed pixel arrangements with OLEDs based on the plain statement about related "display technologies" in Phan's "Field of the Invention" section. *See, e.g.*, Ex. 1003 ¶¶ 321, 410–414. For these reasons, we disagree with Patent Owner's assertion that "Phan does not teach about OLED displays." PO Resp. 32.

The fact that Phan teaches OLED displays among "a laundry list of every conceivable display technology, including non-existent technologies"

Because Petitioner shows persuasively that Phan teaches the preamble, we need not determine whether the preamble is limiting. *See Realtime Data*, 912 F.3d at 1375.

does not undermine Phan's express statement that its disclosed invention relates to OLED displays, which themselves were known at the time of the '683 patent. *See* Ex. 1018 ¶ 96; Ex. 1019, 18:6–9. We also find Patent Owner's citation (PO Resp. 32) to *Otsuka Pharm. Co. v. Sandoz, Inc.*, 678 F.3d 1280, 1294 (Fed. Cir. 2012), regarding the alleged "laundry list" to be inapposite. *Otsuka* merely observes how a skilled artisan would not have understood a "'laundry list' of potential central nervous system controlling effects" in the involved patent to mean that every one of the trillions of compounds encompassed by that patent is a potential antipsychotic. *Id.* at 1293–94. *Otsuka* does not discredit the use of a list in a prior art patent to associate related technologies with a disclosed invention, as Patent Owner seems to imply. And, as discussed above, Phan expressly associates OLED displays with its allegedly inventive arrangements of pixels. *See* Ex. 1005, 1:17–29.

We also are persuaded by Petitioner's contentions (Pet. 42, 54–55) that an ordinarily skilled artisan would have considered Phan's pixel designs as "an obvious starting place when implementing the rest of what Phan teaches," including the "displays referenced elsewhere in Phan." *See, e.g.*, Ex. 1003 ¶¶ 325–328, 410–414; Ex. 1005, 1:18–29, 2:51–53. We consider the application of Phan's pixel arrangements to OLED displays—which themselves are disclosed in Phan—to be among the "inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418.

Patent Owner's arguments focus on the particular embodiments of Phan, which allegedly are limited to technologies other than OLED. *See* PO Resp. 32–33 (stating that Phan mentions only CRT, LCD, LED, PDP, and

FED display types and certain circuitry that is not associated with OLEDs); *see also* PO Sur-reply 15–16 (arguing that Phan's pixel arrangements do not apply to OLEDs). For example, Patent Owner argues that "Phan's virtual driving method—the heart of Phan's disclosure—would not be feasible in an OLED display." PO Resp. 33 (citing Ex. 2009 ¶¶ 207–215). But "[a] reference must be considered for everything it *teaches* by way of technology and is not limited to the particular *invention* it is describing and attempting to protect." *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1076 (Fed. Cir. 2015) (alteration in original) (quoting *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985)). Thus, regardless of whether Phan focuses on other display technologies and/or particular algorithms in its embodiments, we must still consider Phan's teaching of OLEDs being a display technology related to its pixel arrangement disclosures.

We further note that many of Patent Owner's arguments are rooted in its conception of how "Phan's figures depict essentially no spacing between adjacent dots." PO Resp. 33. As such, Patent Owner argues that an ordinarily skilled artisan would have recognized that the spacing "was not feasible for an OLED display due to issues of color mixing of the organic light-emitting materials and shorting between adjacent pixels." *Id.* (citing Ex. 2009 ¶¶ 205–206). Yet, contrariwise, Patent Owner acknowledges that "Phan does not describe its figures as drawn to scale." PO Sur-reply 18–19 (citing *Hockerson-Halberstadt, Inc. v. Avia Grp. Int'l, Inc.*, 222 F.3d 951, 956 (Fed. Cir. 2000)). Given that we generally do not rely on patent drawings for showing particular sizes (*see Hockerson-Halberstadt*, 222 F.3d at 956), we do not agree that the alleged spacing in Phan's drawings would

have impeded an ordinarily skilled artisan from using Phan's pixel designs in OLED displays.

Regarding Patent Owner's argument that an ordinarily skilled artisan "would not have had a reasonable expectation of success in making Phan an OLED display" (PO Resp. 34), we have considered Dr. Kymissis's supporting testimony. *See* Ex. 2009 ¶ 215. He relies on the same arguments discussed above in which Patent Owner attempts to cabin Phan's teachings within the specific (non-OLED) embodiments disclosed. *See id.* Against this showing, Petitioner cites Dr. Pattison's testimony and contends that an ordinarily skilled artisan would have expected success employing Phan's pixel designs with the displays referenced elsewhere in Phan. Pet. 54–55 (citing Ex. 1003 ¶¶ 411–414). We find Dr. Pattison's testimony regarding expected success more persuasive because it is consistent with Phan's express statement that its disclosed invention relates to OLEDs. *See* Ex. 1005, 1:17–29. We also note that the '683 patent itself acknowledges that OLED componentry, such as power lines for driving OLED pixels, was known in the art. *See* Ex. 1001, 3:62–4:5. This is consistent with Petitioner's assertions regarding expected success in implementing Phan's pixel arrangement in an OLED display. Finally, at least one other contemporaneous reference cited by Petitioner, Cok, discloses the same pixel arrangement as Phan (*compare* Ex. 1005, Fig. 11b, *with* Ex. 1017, Fig. 1) and states that it is for "an OLED display device" (Ex. 1017, 4:8–13), which also is consistent with Petitioner's assertions of expected success.

For these reasons, we are persuaded that Phan teaches, or at least fairly suggests, that its disclosed pixel arrangements may be implemented as an OLED display.

b. Limitation [1-a]

Claim 1 further recites "a plurality of pixels for displaying an image on the OLED display." Ex. 1001, 8:65–66. Petitioner cites Phan's teaching of a display including "so-called pixels" that "consist of so-called dots representing the three basic colours of red, green and blue." Pet. 42 (quoting Ex. 1005, 1:57–61). Petitioner maps the recited "plurality of pixels" to Phan's dots, which Petitioner calls Phan's display's "minimum display unit." *Id.* at 43 (citing Ex. 1003 ¶¶ 329–336). Petitioner also cites the same teachings discussed above from the preamble for teaching the "OLED display" and contends that the display is "intended to allow for generation of a high resolution image." *Id.* (internal quotation and alteration omitted) (citing Ex. 1003 ¶¶ 337–339; Ex. 1005, 2:51–3:25, 4:19–24).

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded that Phan's dots teach the recited "pixels." *See, e.g.*, Ex. 1005, 1:57–61. We also are persuaded that Phan teaches OLED displays and the use of such displays for generating images. *See, e.g.*, Ex. 1003 ¶¶ 337–339; Ex. 1005, 1:18–29, 2:51–3:25, 4:19–24.

c. Limitation [1-a(1)]

Claim 1 further recites "a first pixel." Ex. 1001, 8:67. A later limitation recites that the first pixels "are configured to emit green light." *Id.* at 9:20. Petitioner cites Phan's teaching of pixels that "comprise regularly disposed dots 11 radiating the basic colours red (red dot 13), green (green dot 14) and blue (blue dot 15)." Pet. 44 (quoting Ex. 1005, 4:29–32). As such, Petitioner maps the recited "first pixel" to Phan's green dots. *Id.*

(citing Ex. 1003 ¶¶ 340–343); *see also id.* at 50 (similar mapping). Patent Owner does not dispute these limitations apart from its arguments discussed above with respect to the preamble. We are persuaded that Phan's green dots teach "a first pixel" that is "configured to emit green light." *See, e.g.*, Ex. 1005, 4:29–32.

d. Limitation [1-a(2)]

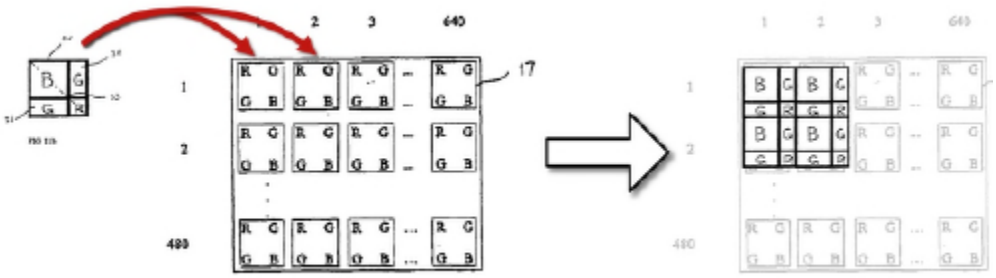
Claim 1 further recites

> a pair of second pixels separated from the first pixel, the second pixels being located at opposite sides of the first pixel along a first line on which the first pixel, the second pixels, and another first pixel are consecutively arranged such that the first line passes through respective centers of the first pixel, the second pixels, and the other first pixel.

Ex. 1001, 9:1–7. Petitioner cites the same teaching of dots from Phan and maps the "pair of second pixels" to the blue dots in particular. Pet. 44 (citing Ex. 1005, 4:29–32, Fig. 11b). Petitioner contends that adjacent dots are "separated" based on Phan's teaching that dots are "surrounded by a black mask or black barrier ribs 21 to obtain a higher contrast." *Id.* (citing Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b).

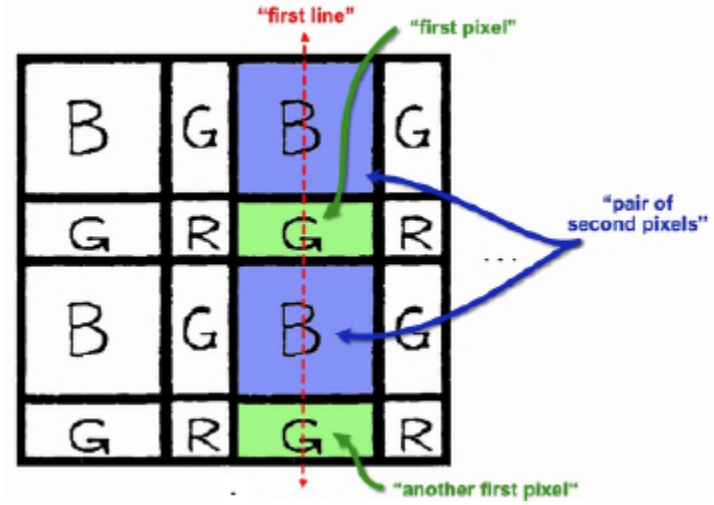
For the recited arrangement of pixels, Petitioner cites Phan's teachings of disposing square pixels in a grid pattern with dots "arranged along horizontally and/or vertically extending lines." Pet. 44–45 (quoting Ex. 1005, 1:57–61) (citing Ex. 1005, 3:33–36, 4:41–47, Figs. 1a, 2a). Petitioner also cites the "quad pixel" arrangement disclosed in Figure 11b of Phan and contends it can be implemented in the "quad pixel display" of Figure 12 from Phan. *Id.* at 45–46 (citing Ex. 1005, 5:47–60, Figs. 11–12). Petitioner depicts this concept in the following illustration from the Petition,

which includes annotated versions of Phan's Figure 11b and 12, as reproduced below.



Id. at 46. In this illustration, Petitioner indicates how "[u]se of the dot/pixel structure shown in Fig. 11b in a repeating grid or matrix [as shown in Figure 12] to produce Phan's display results in what this limitation requires." *Id.* (citing Ex. 1005, 4:29–32, 4:41–43, 5:47–54, Figs. 11b, 12). Petitioner contends that, "[d]ue to the use of a square pixel shape that is regularly arranged on lines in an identically repeating matrix, Phan's blue and green dots have ***'respective centers'*** that are located ***'along a first line.'***" *Id.* at 46–47. Petitioner further contends that, "because there are twice as many green dots as there are red and blue dots in Phan's 'quad pixel,' the blue and green dots alternate with each other and are ***'consecutively arranged'*** with blue pixels on ***'opposite sides'*** of the green pixels." *Id.* at 47 (citing Ex. 1003 ¶¶ 347–363).

To summarize these contentions, Petitioner provides the following illustration in the Petition.



Pet. 47 (citing Ex. 1003 ¶¶ 347–363). In this illustration from the Petition, Petitioner indicates the recited "first pixel" and "another first pixel" in green, the recited "pair of second pixels" in blue, and the recited "first line" in red. *Id.*

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded that Phan's blue dots teach the recited "pair of second pixels." *See, e.g.*, Ex. 1005, 4:29–32, Fig. 11b. We also are persuaded that Phan's black mask or black barrier ribs "separate" the dots. *See, e.g.*, Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b. Petitioner also has established that Phan teaches pixels arranged in a grid pattern with dots arranged along horizontal and/or vertical lines. *See, e.g., id.* at 1:57–61, 4:41–43, Fig. 2a. We also are persuaded by Petitioner's contentions that the dot/pixel structure of Phan's Figure 11b—as implemented in the repeating grid pattern of Phan's Figure 12—results in the arrangement recited in this limitation, including the recited "first line." *See, e.g.*, Ex. 1003 ¶¶ 347–363; Ex. 1005, 4:29–32, 4:41–43, 5:47–60, Figs. 11–12.

e. Limitation [1-a(3)]

Claim 1 further recites

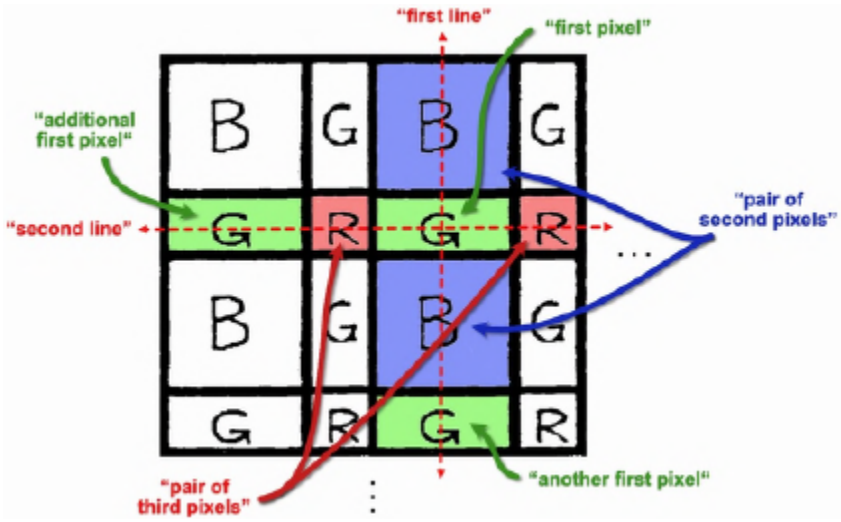
> a pair of third pixels separated from the first pixel and the second pixels, the third pixels being located at opposite sides of the first pixel along a second line on which the first pixel, the third pixels, and an additional first pixel are consecutively arranged such that the second line passes through respective centers of the first pixel, the third pixels, and the additional first pixel, the second line crossing the first line at a location of the first pixel.

Ex. 1001, 9:8–16. Petitioner cites the same teaching of dots from Phan and maps the "pair of third pixels" to the red dots in particular. Pet. 47 (citing Ex. 1005, 4:29–32, Fig. 11b). Petitioner again contends that adjacent dots are "separated" based on Phan's teaching that dots are surrounded by a black mask or black barrier ribs. *Id.* (citing Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b).

Regarding the recited arrangement of pixels, Petitioner cites Phan's teachings that its pixels and dots are identical, regularly disposed, and arranged in a "square quad shape." Pet. 48 (citing Ex. 1005, 4:29–32, 5:47–54, Fig. 11b). As such, Petitioner contends that

> the red dots have their ***"centers"*** on a ***"second line***" that runs through the red dots, the green ***"first pixel"*** and ***"an additional"*** green ***"first pixel."*** The "second line" ***"cross[es] the first line"*** at a green pixel as required. And, the pixels are ***"consecutively arranged,"*** with "third pixels" (red dots) on ***"opposite sides"*** of the "first pixel[s]" (green dots).

Id. (alterations in original) (citing Ex. 1003 ¶¶ 367–369). To summarize these contentions, Petitioner provides the following illustration in the Petition.

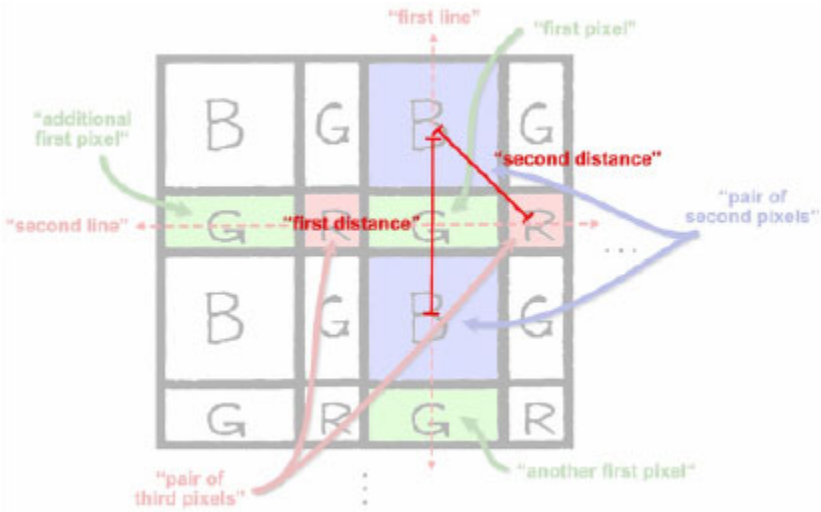


Pet. 48 (citing Ex. 1003 ¶¶ 367–369). In this illustration from the Petition, Petitioner indicates the recited "first pixel," "another first pixel," and "additional first pixel" in green, the recited "pair of second pixels" in blue, and the recited "pair of third pixels," "first line," and "second line" in red. *Id.*

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded that Phan's red dots teach the recited "pair of third pixels." *See, e.g.*, Ex. 1005, 4:29–32, Fig. 11b. We also are persuaded that Phan's black mask or black barrier ribs "separate" the dots. *See, e.g.*, Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b. Petitioner has also shown sufficiently that the dot/pixel structure of Phan's Figure 11b implemented in the repeating grid pattern of Phan's Figure 12 results in the arrangement recited in this limitation, including the recited "second line crossing the first line at a location of the first pixel." *See, e.g.*, Ex. 1003 ¶¶ 367–369; Ex. 1005, 4:29–32, 5:47–54, Figs. 11–12.

f. Limitation [1-b]

Claim 1 further recites that "a first distance between the second pixels is greater than a second distance between one of the second pixels and a neighboring one of the third pixels." Ex. 1001, 9:17–19. Petitioner notes that "Phan's 'square quad pixels' include twice as many green dots as blue or red dots," so "there are green dots located between all of Phan's 'second pixels' (the blue dots)." Pet. 48–49 (citing Ex. 1005, 5:47–54, Figs. 11a–b, 12). Petitioner further notes that "the 'second pixels' (the blue dots) and the 'third pixels' (the red dots) are arranged diagonally with no intervening pixels." *Id.* at 49 (citing Ex. 1005, Figs. 11a–b). Based on these teachings, Petitioner contends the "***'first distance'*** between Phan's blue dots will always be ***'greater'*** than a ***'second distance'*** between adjacent blue and red dots." *Id.* (citing Ex. 1003 ¶¶ 370–374). To summarize these contentions, Petitioner provides the following illustration in the Petition.



Pet. 49 (citing Ex. 1003 ¶¶ 370–374). In this illustration from the Petition, Petitioner indicates the recited "first distance" between blue dots with a longer red line and the recited "second distance" between a blue dot and a red dot with a shorter red line. *Id.* In particular, Petitioner contends that "if

the dot center to dot center distance is *x*, the 'first distance' between blue pixels will again be 2*x*" and "[t]he 'second distance' between blue and red pixels will once again be only 1.4*x*." *Id.* (citing Ex. 1003 ¶ 375).

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded that the dot/pixel structure of Phan's Figure 11b implemented in the repeating grid pattern of Phan's Figure 12 results in the arrangement recited in this limitation with a "first distance" between blue dots (i.e., "second pixels") being greater than a "second distance" between a blue dot (i.e., "one of the second pixels") and a red dot (i.e., "a neighboring one of the third pixels"). *See, e.g.*, Ex. 1003 ¶¶ 370–374; Ex. 1005, 5:47–54, Figs. 11a–b, 12.

g. Limitation [1-c]

Claim 1 further recites that "the first pixels are configured to emit green light, which is a color that is different from light emitted by the second pixels and the third pixels." Ex. 1001, 9:20–22. Petitioner relies on the same analysis discussed above mapping the "first pixels" to Phan's green dots. Pet. 50 (citing Ex. 1005, 4:29–32, Fig. 11b). Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. For the same reasons discussed above, this analysis is persuasive.

h. Limitations [1-d] and [1-e]

Claim 1 further recites that "the first pixels are smaller than at least one of the second pixels or the third pixels" and "each of the second pixels has a larger area than each of the third pixels." Ex. 1001, 9:23–26.

Petitioner cites the embodiment in Figure 11b of Phan (reproduced above) where "the central 'crosspoint' of the pixel has been shifted 'along diagonal line 35' resulting in dots with non-equal areas." Pet. 50–51 (citing Ex. 1003 ¶¶ 378–382; Ex. 1005, 5:47–54, Fig. 11b). Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. Based on Phan's Figure 11b embodiment, we are persuaded that Phan's green dots (i.e., "first pixels") are smaller than the blue dots (i.e., "second pixels") and that Phan's blue dots (i.e., "second pixels" have a larger area than the red dots (i.e., "third pixels"). *See, e.g.*, Ex. 1003 ¶¶ 378–382; Ex. 1005, 5:47–54, Fig. 11b.

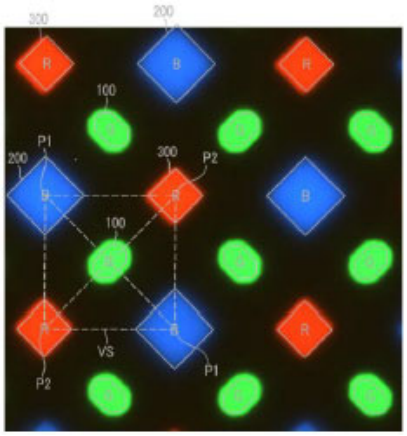
i. Secondary Considerations of Nonobviousness

"[E]vidence rising out of the so-called 'secondary considerations' must always when present be considered en route to a determination of obviousness." *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012) (quoting *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983)). "For objective evidence of secondary considerations to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the *claimed invention.*" *In re Huai-Hung Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011). Patent Owner argues that "Petitioner's obviousness theories are . . . undercut by extensive objective evidence of non-obviousness, including long-felt need, failure of others, skepticism, praise, and copying." PO Resp. 54–71; PO Sur-reply 24–27. Petitioner disputes that there is a nexus between the challenged claims and the asserted secondary considerations. Pet. Reply 25.

We now consider Patent Owner's evidence of secondary considerations of nonobviousness starting with its assertion of a nexus between the '683 patent and the Samsung Galaxy S22 Ultra smartphone. We then turn to Patent Owner's arguments regarding long-felt need, failure of others, industry praise, and copying.

(1) Nexus

Patent Owner contends that it "successfully mass-produced full-HD [full high definition] AMOLED [active-matrix OLED] displays for the first time in the world beginning with the AMOLED display for the Samsung Galaxy S4, overcoming skepticism and satisfying the industry's long-felt need." PO Resp. 68–69 (citing Ex. 2009 ¶¶ 325–327). According to Patent Owner, "the '683 Patent's 'Diamond Pixel' arrangement has been widely adopted in AMOLED displays for flagship mobile devices, including every Samsung Galaxy and Apple iPhone model that has used AMOLED displays." *Id.* at 69 (citing Ex. 2009 ¶ 327); *see also id.* at 62 (stating that Patent Owner's "'Diamond Pixel' arrangement . . . embodies the invention claimed in the '683 Patent"). As an example, Patent Owner cites, but does not analyze in its briefs, a "Galaxy S22 ULTRA Claim Chart" in support of its contention that "the Samsung Galaxy S22 Ultra product practices all challenged claims of the '683 Patent." *Id.* at 69 (citing Ex. 2009 ¶¶ 328–330; Ex. 2028 (claim chart); Ex. 2063); *see also* PO Sur-reply 24 (citing same). Patent Owner also provides one teardown image in support of its showing of nexus, which is reproduced below.



PO Resp. 69–70 (citing Ex. 2029, 5). This image from the Patent Owner Response is what Patent Owner calls "[a] teardown image . . . of the pixel arrangement obtained from a Galaxy S22 Ultra sample . . . with Figure 5 of the '683 Patent superimposed."[6] *Id.* Patent Owner additionally argues that "Petitioner does not assert any limitation is not met." PO Sur-reply 24; *see also id.* at 26 ("Regarding nexus, there is no dispute that [Patent Owner's] Diamond Pixel arrangement structures practice the claims.").

Further addressing nexus, Patent Owner argues that

> [p]racticing the claims of the '683 Patent is what enabled the manufacture of full HD AMOLED displays suitable for mobile devices by striking the Patent's novel balance of improving the

[6] In its Opposition to Petitioner's first motion to strike, which was filed after the Patent Owner Response, Patent Owner implies that the teardown images in the Response speak for themselves and, as such, are entitled to a presumption of nexus. *See* 1st Strike Opp. 3–4; *see also* Tr. 102:19–103:15 (similar argument by Patent Owner's counsel at the oral hearing). Petitioner argues that Patent Owner did not assert an entitlement to a presumption of nexus in the Response, and that Patent Owner's Opposition is an improper vehicle to introduce such an argument. 1st Strike Reply 1. We agree with Petitioner that Patent Owner did not address in the Response whether the Samsung Galaxy S22 Ultra smartphone is coextensive with the claims of the '683 patent. *See id.*; Pet. Reply 20. Accordingly, we decline to consider any argument that Patent Owner is entitled to a presumption of nexus.

> aperture ratio of the AMOLED display (by enlarging the emissive areas) and allowing an increased density of pixels while allowing for a more reliable deposition of the organic material (by ensuring sufficient gaps between pixels), and improving the display lifetime.

PO Resp. 70 (citing Ex. 2009 ¶¶ 331–334). Patent Owner also argues that "[t]he challenged claims achieve the abovementioned benefits by reciting pixel arrangements with specific groupings, shapes, sizes, and layouts of the red, green, and blue OLED sub-pixels." *Id.* at 70–71 (citing, *inter alia*, Ex. 2009 ¶¶ 331–334). According to Patent Owner, the pixel arrangement of the '683 patent allowed Patent Owner "to overcome manufacturing and design obstacles to attaining higher-resolution and higher brightness AMOLED displays that relate to the sensitive light-emitting organic layers of OLEDs." *Id.* at 71 (citing, *inter alia*, Ex. 2009 ¶¶ 331–334).

Petitioner argues that Patent Owner "has not even alleged—[l]et alone established—that any of the products it identifies are 'coextensive' with the claims." Pet. Reply 20. By Petitioner's reckoning, "[t]his makes sense, as the Samsung Galaxy S22 Ultra—and the other referenced products—are smartphones" whereas "[t]he '683 patent is not directed to a smartphone." *Id.* Petitioner also argues that Patent Owner does not establish that the asserted secondary considerations are the direct result of the unique characteristics of the claims and not the prior art. *Id.* Petitioner also argues that the claimed pixel arrangement "is at best ***indirectly*** responsible for any purported success, praise, and need satisfaction" given Patent Owner's statement that the arrangement "allowed [Patent Owner] to overcome manufacturing and design obstacles." *Id.* at 20–21 (alteration in original) (quoting PO Resp. 71). Petitioner additionally argues that "[i]t is actually Patent Owner's 'highly sophisticated evaporation technology' that permits

higher OLED resolutions." *Id.* at 21 (quoting Ex. 2065, 5) (citing Ex. 1019, 45:6–22).

A patent owner is entitled to a presumption of nexus when it shows that the asserted objective evidence is tied to a specific product that "embodies the claimed features, and is coextensive with them." *Brown & Williamson Tobacco Corp. v. Philip Morris, Inc.*, 229 F.3d 1120, 1130 (Fed. Cir. 2000). A patent owner is further "afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the direct result of the unique characteristics of the claimed invention." *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373–74 (Fed. Cir. 2019) (internal quotation omitted).

We agree with Petitioner (Pet. Reply 20; 1st Strike Reply 1) that Patent Owner is not entitled to a presumption of nexus because Patent Owner does not make any showing of coextensiveness between the Samsung Galaxy S22 Ultra smartphone and the claims of the '683 patent. Thus, Patent Owner necessarily must prove nexus "by showing that the evidence of secondary considerations is the direct result of the unique characteristics of the claimed invention." *Fox Factory*, 944 F.3d at 1373–74 (internal quotation omitted). We now discuss Patent Owner's proffered evidence of a direct nexus, and we find that it is entitled to little or no weight.

First, Patent Owner relies on the claim chart at Exhibit 2028 to support its statement that "the Samsung Galaxy S22 Ultra product practices all challenged claims of the '683 Patent." PO Resp. 69. We find below that Patent Owner's mere mention of the claim chart at Exhibit 2028 without any explanation in the Patent Owner Response amounts to improper incorporation by reference in contravention of 37 C.F.R. § 42.6(a)(3). *See*

infra § II.H. We grant Petitioner's motion to strike this statement below, and we accord it no weight in our nexus analysis. *See id.*

Second, Patent Owner's provision of "[a] teardown image . . . of the pixel arrangement obtained from a Galaxy S22 Ultra sample . . . with Figure 5 of the '683 Patent superimposed" (PO Resp. 69–70) is conclusory and entitled little or no weight. Indeed, the Patent Owner Response does not even provide a citation supporting the provenance of the annotated figure. One would have to look at paragraph 328 of Dr. Kymissis's declaration to find that annotated figure, which in turn cites Dr. Fontecchio's images of the Galaxy S22 Ultra teardown and Dr. Fontecchio's declaration. Ex. 2009 ¶ 328 (citing Ex. 2029, 5; Ex. 2063). We can only assume that Dr. Kymissis applied the annotations to an image provided by Dr. Fontecchio. Further, even if we were to overlook these gaps, we would accord little weight to the annotated figure because the overlaid aspects from Figure 5 of the '683 patent do not necessarily embody or account for all of the limitations of the challenged claims. In the absence of any explanation from Patent Owner, we find Patent Owner's annotated figure unavailing. In addition, the fact that Petitioner does not dispute the correspondence between particular limitations of the '683 patent claims and the Galaxy S22 Ultra smartphone (*see* PO Sur-reply 24, 26) is of no consequence given that Patent Owner has the burden of production on the issue of nexus. *See WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999).

Third, to the extent that Patent Owner might separately assert a nexus between Patent Owner's so-called "Diamond Pixel" arrangement[7] and the

[7] "Diamond Pixel" appears to be an advertising mark. *See* PO Resp. 57 (indicating that the term is a trademark).

claims of the ’683 patent, Patent Owner does not substantiate such a nexus with evidence or analysis. *See* PO Resp. 69–70. Although Patent Owner uses “Diamond Pixel” as a shortcut way of referring to a pixel arrangement (*see id.* at 57, 58, 62, 66, 69; PO Sur-reply 25, 26), Patent Owner has neither established what the term “Diamond Pixel” encompasses, nor attempted to compare a “Diamond Pixel” arrangement to the claims of the ’683 patent separate from its arguments related to the Galaxy S22 Ultra smartphone. The closest Patent Owner comes to providing a separate nexus analysis for a “Diamond Pixel” arrangement is in the Sur-reply, where it provides quotes from an exhibit titled “Samsung Diamond Pixels.” PO Sur-reply 25 (quoting Ex. 2027, 1). Yet Patent Owner’s mere mention of a “sub-pixel arrangement . . . [where] Red, Green, and Blue sub-pixels have very different sizes . . . [with] vertical, horizontal, and particularly diagonal line segments and vectors . . . maximiz[ing] the sub-pixel packing” is not keyed to any challenged claim. *Id.* (alterations in original) (quoting Ex. 2027, 1); *see also* PO Resp. 62–63 (similar quotation). Thus, we accord such mentions of “Diamond Pixel” arrangements no weight with respect to nexus. By extension, Patent Owner’s attempts to tie the Samsung Galaxy S4 and iPhone X smartphones to “Diamond Pixel” arrangements (*see* PO Resp. 60, 62–65, 68–69) suffer from the same deficiencies related to nexus.

Fourth, we agree with Petitioner (Pet. Reply 20–21) that Patent Owner’s statement about the claimed pixel arrangement helping Patent Owner “overcome manufacturing and design obstacles” (PO Resp. 71) tends to show an indirect link between the alleged secondary considerations and the challenged claims. Petitioner also argues persuasively (Pet. Reply 20) that a pixel arrangement is but a component of the Samsung Galaxy S22

Ultra *smartphone*, which also tends to undermine a showing of nexus for considerations tied to the smartphone. *See Fox Factory*, 944 F.3d at 1374 (discussing how there is "no or very little correspondence" between a product and a patent claim where "the patented invention is only a component of a commercially successful machine or process"). Finally, Petitioner also cites some of Patent Owner's own proffered evidence that suggests that it is Patent Owner's "highly sophisticated evaporation technology" that permits higher resolution OLEDs for its smartphones. *See* Ex. 2065, 5. This too tends to undermine Patent Owner's showing of nexus.

For these reasons, we accord Patent Owner's evidence of a nexus between the claims of the '683 patent and the Samsung Galaxy S22 Ultra smartphone little to no weight. We also find that Patent Owner does not establish any nexus between devices allegedly embodying a so-called "Diamond Pixel" arrangement and the claims of the '683 patent. Despite the weak evidence of nexus in this case, we still consider Patent Owner's evidence of long-felt need, failure of others, industry praise, and copying below.

(2) Long-Felt Need

Patent Owner argues that in the early 2010s, "AMOLED displays for mobile devices suffered from a significant shortcoming—namely the difficulty of manufacturing higher resolution displays." PO Resp. 54 (citing Ex. 2009 ¶¶ 291–300; Ex. 2013, 3). Thus, Patent Owner argues that

> [t]here was a long-felt need to develop pixel arrangements that would enable the manufacture of high-resolution AMOLED displays that would provide superior image quality, particularly displays with sufficiently high pixel densities (measured as

> pixels per inch or 'PPI'), aperture ratio, and lifetime to support 'full high definition' ('full HD') graphics in mobile devices.

Id. at 54–55 (citing Ex. 2009 ¶¶ 293–297); *see also id.* at 55–57 (further discussion about alleged manufacturing challenges). Patent Owner asserts that "the '683 Patent's novel pixel arrangement, which became widely recognized as the 'Diamond Pixel™' arrangement, enabled the manufacture of full-HD AMOLED displays suitable for mobile devices, satisfying the industry's longstanding need." *Id.* at 57; *see also* PO Sur-reply 26 (citing Ex. 2009 ¶¶ 331–333) (similar argument). Patent Owner also argues that alleged needs for higher resolutions and manufacturability of displays need not be expressly recited in the challenged claims as long as these "advantages [are] inherent in what is specifically disclosed in a patent." PO Sur-reply 26 (quoting *In re Vamco Mach. & Tool, Inc.*, 752 F.2d 1564, 1577 n.5 (Fed. Cir. 1985)).

Petitioner argues that the things Patent Owner cites as being long-felt needs, including "'AMOLED displays' with 'sufficiently high pixel densities' and 'full HD' 'graphics in mobile devices,'" are not claimed in the '683 patent. Pet. Reply 22 (quoting PO Resp. 54–55). A such, Petitioner argues that no such needs could be met by the '683 patent. *Id.* Petitioner also cites information in Patent Owner's exhibits showing "not only optimism, but that there were numerous available OLED displays on the market long before the patent was filed." *Id.* at 22–23 (citing Ex. 2016, 1; Ex. 2019, 14; Ex. 2020, 3, 7; Ex. 2023, 1; Ex. 2025, 2; Ex. 2039, 2; Ex. 2074, 15).

Patent Owner's assertion of long-felt need is tied to the so-called "Diamond Pixel" arrangement (*see* PO Resp. 57; PO Sur-reply 26); as discussed above (*see supra* § II.D.2.i.(1)), Patent Owner fails to substantiate

a nexus to the "Diamond Pixel" arrangement. Further, even if we were to assume that some resolution and manufacturability benefits might flow from certain devices within the scope of the challenged claims, the record does not substantiate that these benefits satisfied a particular unmet need related to manufacturing higher resolution OLEDs. As noted by Petitioner (Pet. Reply 21), record evidence credits Patent Owner's "highly sophisticated evaporation technology" as allowing mass production of OLEDs with higher resolutions. Ex. 2065, 5. Other record evidence substantiates commercialization of OLED displays as of the time of the patent. *See, e.g.*, Ex. 2020, 3, 7; Ex. 2023, 1; Ex. 2025, 2; Ex. 2039, 2. Further, the claimed pixel arrangements could conceivably be used in displays having various densities and resolutions and with displays produced by both difficult and easy manufacturing processes. This lack of correspondence between the alleged need and the challenged claims undermines Patent Owner's assertion of long-felt need. *See Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1336 (Fed. Cir. 2010) (holding that where claims are broad enough to cover devices that either do or do not solve the identified problem, objective evidence of non-obviousness fails because it is not commensurate in scope with the claims which the evidence is offered to support).

For these reasons, we accord Patent Owner's evidence of long-felt need little or no weight.

(3) Failure of Others

Patent Owner also argues that "display manufacturers and researchers proposed many AMOLED pixel arrangements in an attempt to answer the industry's calling for full-HD AMOLED displays suitable for mobile

devices." PO Resp. 57 (citing Ex. 2009 ¶¶ 308–314). Patent Owner argues that these "wide-ranging efforts" did not result in success. *Id.* at 57–58; *see also id.* at 58–59 (further detailing alleged failures of others). Accordingly, Patent Owner argues that "the industry was highly skeptical that a pixel arrangement could be devised that would enable the manufacture of full-HD AMOLED displays for mobile devices," and that LCDs were viewed as a preferred alternative. *Id.* at 60 (citing Ex. 2009 ¶¶ 304–306). Patent Owner even argues that "[c]ontinued research efforts *after* the inventions of the '683 Patent also failed to result in a successful pixel arrangement that has been adopted for use in flagship mobile devices." *Id.* at 60–62 (alleging failure of a pixel arrangement by Petitioner Mianyang BOE). According to Patent Owner, "it was only [Patent Owner's] innovative 'Diamond Pixel' arrangement, which embodies the invention claimed in the '683 Patent, that was ultimately successful at enabling the manufacture of full-HD mobile AMOLED displays." *Id.* at 62 (citing Ex. 2009 ¶¶ 325–326).

Petitioner argues that the alleged lack of available "full-HD AMOLED displays suitable for mobile devices" is irrelevant because "[t]he claims do not require AMOLED displays, HD, or mobile devices." Pet. Reply 23 (quoting PO Resp. 57). Further, Petitioner argues that "numerous working AMOLED displays existed before the '[683] patent." *Id.*

Patent Owner's assertions are again tied to the so-called "Diamond Pixel" arrangement (*see* PO Resp. 58, 61–62), but Patent Owner has failed to substantiate a nexus to the "Diamond Pixel" arrangement. *See supra* § II.D.2.i.(1). We also agree with Petitioner that record evidence supports the commercialization of OLED displays as of the time of the patent, which tends to disprove that others had failed. *See, e.g.*, Ex. 2020, 3, 7; Ex. 2023,

1; Ex. 2025, 2; Ex. 2039, 2. Moreover, to the extent Patent Owner's assertions of failure by others are tied to manufacturing of high-resolution displays (*see, e.g.*, PO Resp. 60, 62), such assertions fail for the same reasons as Patent Owner's long-felt need assertions discussed above. *See supra* § II.D.2.i.(2). Specifically, Patent Owner's proffered evidence related to display resolution and manufacturing is not commensurate in scope with the claims. *See Therasense*, 593 F.3d at 1336. Thus, we accord Patent Owner's evidence of failure of others little or no weight.

(4) Industry Praise

Patent Owner cites "significant praise" for the so-called "Diamond Pixel" arrangement that Patent Owner associates with the '683 patent, including "praise for the full-HD resolution and superior image quality of the AMOLED displays implementing these arrangements." PO Resp. 62–63 (citing Ex. 2009 ¶¶ 314–317; Ex. 2027, 1; Ex. 2067). Patent Owner further argues that "Samsung Galaxy S4's AMOLED display was the first commercial embodiment of the '683 Patent" and "[p]raise for the Galaxy S4's AMOLED display, and specifically the novel pixel arrangement of the '683 Patent that enabled full HD, was overwhelming." *Id.* at 63 (citing Ex. 2013, 3; Ex. 2026, 2; Ex. 2037, 3). Patent Owner also cites praise for the iPhone X and other "[f]lagship mobile devices," which also "adopted [Patent Owner's] AMOLED displays implementing the pixel arrangement of the '683 Patent." *Id.* at 64–65 (citing Ex. 2038, 1–2; Ex. 2039, 3, 5; Ex. 2040, 1–2; Exs. 2068–2072). Patent Owner additionally cites an award presented by the Commissioner of South Korea's Intellectual Property Office to inventor Sang-Shin Lee. *Id.* at 65 (citing Ex. 2066, 9).

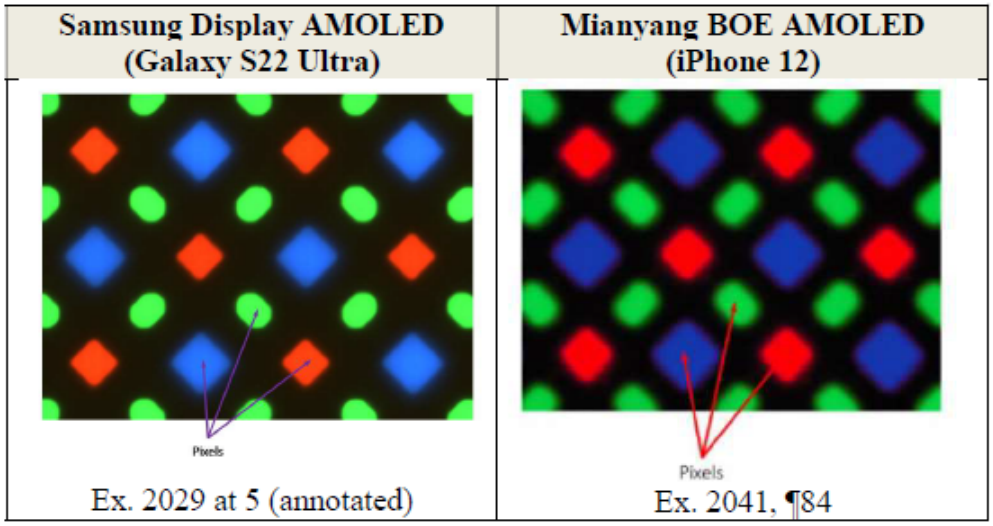
Petitioner criticizes Patent Owner's evidence of industry praise for the Samsung Galaxy S4 and the iPhone X because Patent Owner only attempts to show a nexus to the Samsung Galaxy S22 Ultra. Pet. Reply 23 (citing PO Resp. 62–65, 68–71). Petitioner also criticizes Patent Owner's reference to an award by the Korean Patent Office as being devoid of explanation tying it to the '683 patent. *Id.* Petitioner additionally argues that "pixel arrangement is simply one among many product features discussed in Patent Owner's exhibits" and that various other features, such as precision display calibration, lower screen reflectance, high dynamic range, night shift mode, true tone viewing, super dim setting, and viewing angle performance, "are also important." *Id.* at 24 (citing Ex. 2039, 2–5). Petitioner further argues that "enhancements to the circuit structure" of the Galaxy S4 allowed for an improved contrast ratio, reduced power consumption, increased outside visibility, and a thinner display with a reduced bezel. *Id.* (quoting Ex. 2037, 4).

As discussed above, Patent Owner's attempt to establish a nexus between the claims of the '683 patent and the so-called "Diamond Pixel" arrangement is entitled to little or no weight. *See supra* § II.D.2.i.(1). Thus, Patent Owner's alleged evidence of praise for the "Diamond Pixel" structure (PO Resp. 62–63) is entitled to little or no weight. Given that Petitioner's only evidence of nexus for the Samsung Galaxy S4 and the iPhone X smartphones is tied to the "Diamond Pixel" arrangement (*see supra* § II.D.2.i.(1)), we likewise accord little or no weight to Patent Owner's alleged evidence of praise for these smartphones. *See* PO Resp. 63–65. Finally, Patent Owner cites no creditable analysis or evidence tying the cited Korean Patent Office award to the challenged claims. *See id.* at 65.

For these reasons, we accord Patent Owner's evidence of industry praise little or no weight.

(5) Copying

Patent Owner argues that "widespread copying of [Patent Owner's] patented pixel arrangements is evident from teardown photographs of commercially-available AMOLED display products that employ near carbon copies of [Patent Owner's] pixel arrangements. PO Resp. 65 (citing Ex. 2009 ¶¶ 318–324). In particular, Patent Owner argues that "Petitioner Mianyang BOE copied [Patent Owner's] pixel arrangements to commercialize AMOLED displays for products including the iPhone 12." *Id.* at 66 (citing Ex. 2009 ¶ 319). In support of this argument, Patent Owner provides the following illustration.



PO Resp. 66 (citing Ex. 2029, 5; Ex. 2041 ¶ 84). In this illustration from the Patent Owner Response, the left image shows a pixel arrangement labeled "Samsung Display AMOLED (Galaxy S22 Ultra)" and the right image shows a pixel arrangement labeled "Mianyang BOE AMOLED (iPhone 12)." *Id.* According to Patent Owner, this illustration demonstrates

that "the pixel arrangement used in Mianyang BOE's AMOLED display for the iPhone 12 is nearly identical to [Patent Owner's] patented pixel arrangement," as exemplified by an image of an AMOLED display from a Galaxy S22 Ultra smartphone. *Id.*

Patent Owner additionally alleges "[w]idespread copying" by "numerous vendors of replacement AMOLED displays for mobile phones." PO Resp. 66 (citing Exs. 2042–2061). According to Patent Owner, the pixel arrangements in these replacement displays "not only infringe the challenged claims . . . , they bear such similarity to those of Samsung Display that they demonstrate copying." *Id.* at 66–67 (citing Ex. 2009 ¶¶ 320–324; Exs. 2042, 2043; *Medtronic, Inc. v. Teleflex Innovations S.a.r.l.*, 70 F.4th 1331, 1339–42 (Fed. Cir. 2023)). Patent Owner also provides a number of "[e]xemplary teardown images of such replica products . . . with Figure 5 of the '683 Patent overlayed on top" to support its analysis. *Id.* at 67–68 (citing Ex. 2029, 5; Ex. 2044, 4; Ex. 2045, 5; Ex. 2046, 6; Ex. 2047, 6; Ex. 2048, 5). Patent Owner compares these images with an image of an AMOLED display from a Galaxy S22 Ultra smartphone. *Id.*

Petitioner disputes Patent Owner's allegations of "widespread copying" because Patent Owner "does nothing more than (1) allege infringement and (2) compare product images." Pet. Reply 24 (citing PO Resp. 65–67). Petitioner argues that copying requires a showing of more than just similarity between the challenged patent and a competitor's product. *Id.* (citing, *inter alia*, *Liqwd, Inc. v. L'Oreal USA, Inc.*, 941 F.3d 1133, 1137 (Fed. Cir. 2019); *Iron Grip Barbell Co. v. USA Sports Inc.*, 392 F.3d 1317, 1325 (Fed. Cir. 2004); *Instiute Pasteur v. Focarino*, 738 F.3d 1337, 1347–48 (Fed. Cir. 2013)).

We first turn to Patent Owner's allegation that Petitioner Mianyang BOE's pixel arrangement for the iPhone 12 copied Patent Owner's patented pixel arrangements. Patent Owner bases its analysis on a comparison to an image from a Samsung Galaxy S22 Ultra smartphone. *See* PO Resp. 66. As discussed above, however, we accord Patent Owner's evidence of nexus between the claims of the '683 patent and the Samsung Galaxy S22 Ultra smartphone little to no weight. *See supra* § II.D.2.i.(1). Thus, the basis of Patent Owner's copying analysis is dubious. The remainder of Patent Owner's analysis consists of an image comparison and an allegation that the images are "nearly identical." PO Resp. 66; *see also* Ex. 2009 ¶ 319 (Dr. Kymissis's testimony regarding same). We find this analysis to be rudimentary at best. And, even if this were probative evidence of similarity, "[n]ot every competing product that arguably falls within the scope of a patent is evidence of copying" because "[o]therwise every infringement suit would automatically confirm the nonobviousness of the patent." *Iron Grip Barbell*, 392 F.3d at 1325. Indeed, our reviewing court's "case law holds that copying requires evidence of efforts to replicate a specific product." *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010). Patent Owner has presented no such evidence here. Thus, we accord Patent Owner's evidence of copying related to Mianyang BOE little or no weight.

We next turn to Patent Owner's allegations of "widespread copying" related to vendors of replacement AMOLED displays. Patent Owner relies on, *inter alia*, claim charts at Exhibits 2042 and 2043 to support its statement that certain vendors' pixel arrangements infringe the challenged claims. PO Resp. 66–67. As discussed below, we find that Patent Owner's incorporation of arguments by reference to these claim charts (and

Dr. Kymissis's accompanying testimony) constitutes a violation of 37 C.F.R. § 42.6(a)(3). *See infra* § II.H. We grant Petitioner's motion to strike this statement alleging infringement below, and we accord it no weight in our copying analysis. *See id.* Moreover, as above, the basis of Patent Owner's comparison is dubious because Patent Owner's evidence of nexus between the claims of the '683 patent and the Samsung Galaxy S22 Ultra smartphone is entitled to little or no weight. *See supra* § II.D.2.i.(1). For these reasons, we accord Patent Owner's evidence of copying related to replacement vendors little or no weight.

Considering all evidence of alleged copying presented by Patent Owner, we accord it little or no weight.

(6) Other Considerations

Although Patent Owner makes certain references to the "success[]" of its products (*see, e.g.*, PO Resp. 69), Patent Owner acknowledges that it is not asserting evidence of commercial success as a secondary consideration of nonobviousness. PO Sur-reply 27 n.5.

(7) Conclusion Regarding Secondary Considerations of Nonobviousness

Having considered the entire trial record, we accord Patent Owner's asserted evidence of secondary considerations of nonobviousness little or no weight.

j. Conclusion Regarding Claim 1

Petitioner has shown persuasively that Phan teaches or suggests all limitations of claim 1 in light of the knowledge of a person of ordinary skill

in the art. We also have considered Patent Owner's evidence of secondary considerations of nonobviousness, and we accord it little or no weight. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 1 would have been obvious over Phan.

3. Claim 4

Claim 4 depends from claim 1 and further recites that "the first pixels, the second pixels, and the third pixels are configured to emit different color lights." Ex. 1001, 9:34–36. As discussed above with respect to claim 1, Petitioner contends that "Phan's green dot is the claimed ***'first pixel,'*** its blue dot is the claimed ***'second pixel,'*** and its red dot is the claimed ***'third pixel.'***" Pet. 51; *see also supra* § II.D.2.c–e.

Patent Owner relies on the same arguments discussed above for claim 1. PO Resp. 30–34; PO Sur-reply 15–17. Based on the same analysis discussed above for claim 1, we are persuaded by Petitioner's analysis that Phan teaches green, blue, and red dots (i.e., "different color lights") corresponding to the recited first, second, and third pixels, respectively. *See supra* §§ II.D.2.c–e. Our analysis regarding secondary considerations of nonobviousness discussed above for claim 1 applies equally to this claim. *See supra* § II.D.2.i. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 4 would have been obvious over Phan.

4. Claim 5

Claim 5 depends from claim 4 and further recites that "the second pixels are configured to emit blue light, and the third pixels are configured to emit red light." Ex. 1001, 9:37–39. Petitioner relies on the same analysis from claims 1 and 4. Pet. 51; *see also supra* §§ II.D.2.c–e, II.D.3.

Patent Owner relies on the same arguments discussed above for claim 1. PO Resp. 30–34; PO Sur-reply 15–17. Based on the same analysis discussed above for claims 1 and 4, we are persuaded by Petitioner's analysis that Phan teaches blue and red dots corresponding to the recited second and third pixels, respectively. *See supra* §§ II.D.2.c–e, II.D.3. Our analysis regarding secondary considerations of nonobviousness discussed above for claim 1 applies equally to this claim. *See supra* § II.D.2.i. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 5 would have been obvious over Phan.

5. Claim 6

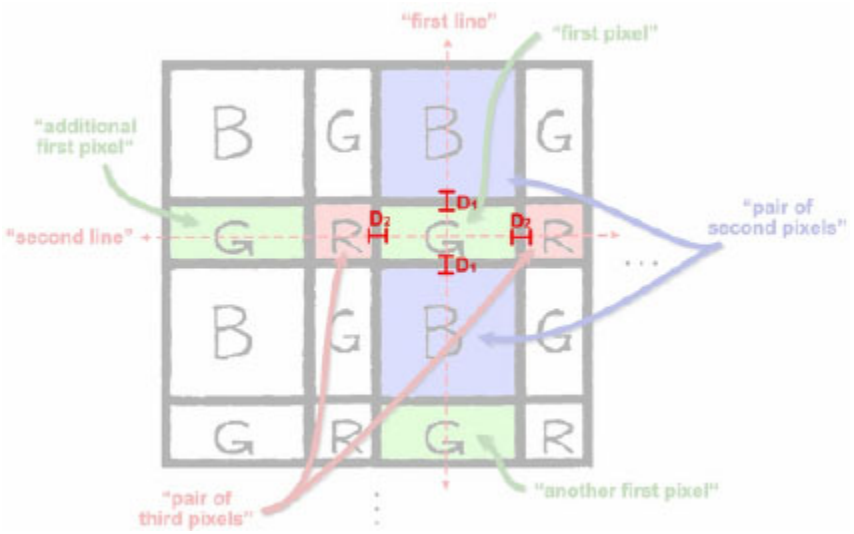
Claim 6 depends from claim 1 and further recites that "each of the second pixels has a larger area than that of the first pixel." Ex. 1001, 9:40–42. Petitioner cites Phan's Figure 11b for teaching that Phan's "***'second pixel'*** (the blue dot) has a ***'larger area'*** than its ***'first pixel'*** (the green dot)." Pet. 52 (citing Ex. 1005, Fig. 11b).

Patent Owner relies on the same arguments discussed above for claim 1. PO Resp. 30–34; PO Sur-reply 15–17. We are persuaded by Petitioner's analysis that Phan teaches a blue dot (i.e., "second pixel") that is larger than a green dot (i.e., "first pixel"). *See, e.g.*, Ex. 1005, Fig. 11b. Our analysis regarding secondary considerations of nonobviousness discussed

above for claim 1 applies equally to this claim. *See supra* § II.D.2.i. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 6 would have been obvious over Phan.

6. Claim 7

Claim 7 depends from claim 1 and further recites that "the second pixels are substantially equidistant from the first pixel interposed between the second pixels, and the third pixels are substantially equidistant from the first pixel interposed between the third pixels." Ex. 1001, 9:43–47. Petitioner cites Phan's teachings that pixels and dots "are 'identical' and 'regularly disposed' in a repeating grid or matrix." Pet. 52 (citing Ex. 1005, 4:29–32, Fig. 11b). Petitioner further cites Phan's teachings that "each pixel has a 'square quad' shape, with the pixel's dots surrounding a 'crosspoint.'" *Id.* (citing Ex. 1005, 5:47–54, Figs. 11a, 11b). Accordingly, Petitioner contends that "distances between dots will be the same across the display." *Id.* To help explain its contentions, Petitioner provides the following illustration in the Petition.

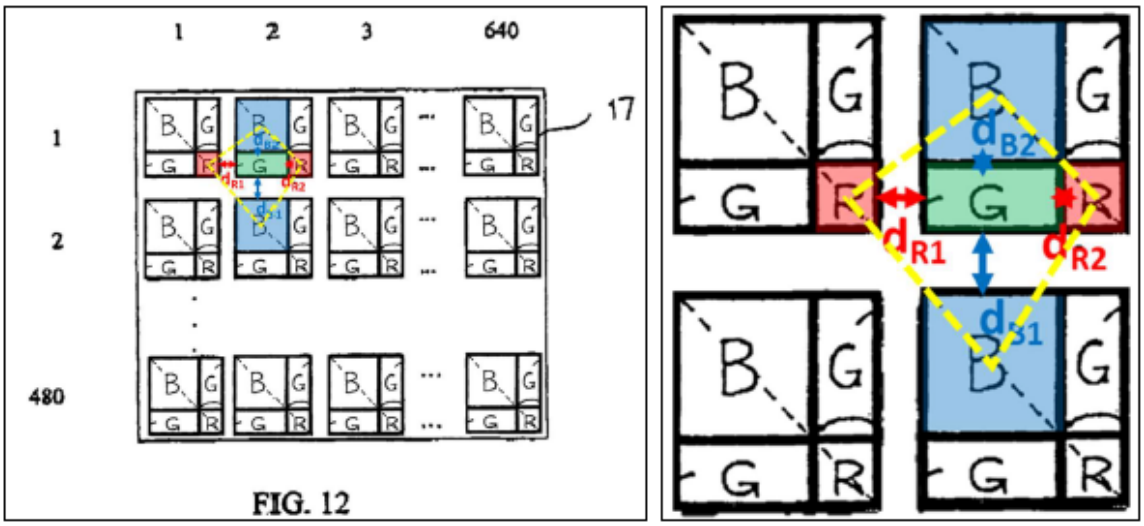


Pet. 52–53 (citing Ex. 1003 ¶¶ 393–398). In this illustration from the Petition, Petitioner indicates distances D_1 in red, which allegedly show that "a 'first pixel' will be ***'substantially equidistant'*** to two surrounding 'second pixels.'" *Id.* Petitioner also indicates distances D_2 in red, which allegedly show that "the 'first pixel' will also be ***'substantially equidistant'*** to two surrounding 'second [sic, third] pixels.'" *Id.* Petitioner contends that "[t]he distance between dots is determined by the 'black mask or black barrier ribs 21' that surrounds the dots." *Id.* at 53 (citing Ex. 1005, 4:33–37). According to Petitioner, an ordinarily skilled artisan "would have understood that this mask has (or at least obviously could have) the same width/thickness across Phan's display," and Petitioner explains that "[m]aking the black mask the same across the display would facilitate the use of 'regularly disposed' dots Phan teaches." *Id.* (citing Ex. 1003 ¶¶ 399–401).

Patent Owner disputes Petitioner's conception of how Phan's quad pixel arrangement from Figure 11b would be implemented in the display of Figure 12. PO Resp. 35–38. In particular, Patent Owner argues that "Petitioner inexplicably changes the arrangement and geometry of Phan's Figure 12 to remove the spacings between the adjacent quad-pixels." *Id.* at 36. Patent Owner further argues that "Petitioner and Dr. Pattison offer no justification for changing Phan's display to remove its clearly-disclosed spacings between adjacent quad-pixels, which would allow, for example, placement of wiring for Phan's '[c]ontrol circuitry,' or 'optical fiber network.'" *Id.* at 37 (alteration in original) (citing Ex. 1005, 5:20–24, Fig. 5; Ex. 2009 ¶¶ 221–223). Patent Owner additionally argues that "Petitioner's changes are also incompatible with Phan's dynamic pixel approach" insofar

as "the visual locus of the *dynamic* quad-pixel disclosed by Phan . . . will be perceived by the viewer to be shifted from the physical center of the *static* quad-pixel." *Id.* at 37–38 (citing Ex. 1005, Figs. 9.1–9.8; Ex. 2009 ¶¶ 226–227). Patent Owner explains that this would result in "distortion and poor image quality," which "would contradict Phan's goal of improving resolution and image quality through 'variable generation of pixels from existing dots,' *i.e.*, its 'dynamic generation of pixels.'" *Id.* at 38 (citing Ex. 1005, 2:54–3:19; Ex. 2009 ¶¶ 226–230).

Patent Owner also offers its own counterexample of how pixel spacing would have been implemented when combining Phan's Figures 11b and 12, which is shown in the following illustration from the Patent Owner Response.



PO Resp. 36. This illustration presents Patent Owner's conception of how the pixel arrangement of Phan's Figure 11b would have been implemented in the display of Phan's Figure 12. *Id.* Referring to the illustration, Patent Owner argues that "the distance from the green pixel to an adjacent blue pixel (d_{B1}) is different from the distance from the green pixel to another adjacent blue pixel (d_{B2})." *Id.* Patent Owner further argues that "the

distance from the green pixel to an adjacent red pixel (d_{R1}) is different from the distance from the green pixel to another adjacent red pixel (d_{R2})."[8] *Id.* Patent Owner explains that these types of "spacings between individual pixel unit groups were common in manufactured display devices." *Id.* at 37 (citing Ex. 2009 ¶¶ 224–225).

Petitioner replies that "all of Phan's figures show displays with the dots/sub-pixels regularly spaced in a consistent, repeating pattern." Pet. Reply 13 (citing Ex. 1005, Figs. 2a–b, 7, 9–9.8, 12–12d). Petitioner again emphasizes Phan's teachings that "pixels are 'regularly disposed' in a repeating 'grid' or 'matrix.'" *Id.* (citing Ex. 1005, 2:51–53, 4:29–50). Petitioner also counters Patent Owner's arguments about Phan's static and dynamic pixels by noting that (1) Phan teaches them as having the same matrix geometry and (2) Phan depicts them has having the same shape and geometry across the display. *Id*. at 14–15 (citing Ex. 1005, 6:4–23, 7:59–67, Figs. 2a–b, 4a–b, 5, 7, 8–8.12, 9–9.8, 12a–12d). According to Petitioner, "[t]his is purposeful" because "employing dynamic pixels that 'overlap[]' the 'static pixels' allows a 'given grid' to have an 'enhanced' or 'higher' 'resolution.'" *Id.* at 15 (quoting Ex. 1005, code (57), 2:51–53); *see also* Ex. 1018 ¶ 68 (Dr. Pattison testifying that "Phan['s] display includes not only static pixels, but many dynamic pixels that are the same size as the static pixels for purposes of increasing the display's effective resolution."). Petitioner additionally argues that it is Patent Owner's counterexample based on Phan, not Petitioner's proposal, that renders Phan's dynamic pixels

[8] Patent Owner acknowledges that the relevant "distances can be measured either edge-to-edge or center-to-center." PO Resp. 34 (citing Ex. 2009 ¶¶ 216–217).

unworkable, leading to variances in brightness from pixel-to-pixel and adding spaces so as to introduce distortion. Pet. Reply 15 (citing Ex. 1018 ¶¶ 73–79). Petitioner contends that this result "would all be contrary to Phan's teaching that its dynamic pixels are meant 'not to be perceivable by the human eye.'" *Id.* (citing Ex. 1005, 2:57–59).

Although Patent Owner states that "Phan does not describe its figures as drawn to scale," Patent Owner argues in its Sur-reply that Figure 12 of Phan depicts spacing between sub-pixels. PO Sur-reply 18–19. Patent Owner also argues

> that displays having spacing between pixel units were not uncommon . . . , that [persons of ordinary skill in the art] would have understood spacing (such as shown in Fig. 12) is necessary for Phan's control circuitry or optical fiber network . . . , and that spacing would prevent image distortion.

Id. at 19 (citing Ex. 2009 ¶¶ 223–229). Patent Owner additionally argues that "removing quad-pixel spacing . . . is contrary to Phan's goal of applying dynamic driving to a given grid." *Id.* (citing Ex. 1005, 2:50–3:19; Ex. 2009 ¶¶ 229–230).

Patent Owner's arguments are premised on its interpretation of spacing between pixels in Phan's Figure 12. *See* PO Resp. 36 ("Phan's Figure 12 shows spacings between each quad-pixel"); PO Sur-reply 18 (stating that Phan "depicts spacing between quad-pixels in Figure 12"). As stated above, however, we do not interpret Phan's teachings as being limited by the spacing depicted in Figure 12. Indeed, Patent Owner acknowledges that "Phan does not describe its figures as drawn to scale." PO Sur-reply 18–19. Further, as discussed above, we generally do not rely on patent drawings for showing particular sizes. *See Hockerson-Halberstadt*, 222 F.3d at 956.

As noted by Petitioner, the figures in Phan—including Figure 12—depict pixels having the same shape and geometry across the display. Pet. Reply 14–15 (citing Ex. 1005, Figs. 2a–b, 4a–b, 5, 7, 8–8.12, 9–9.8, 12a–12d). Phan also teaches that pixels and dots are "regularly disposed" in a "grid." *See, e.g.*, Ex. 1005, 2:51–53, 4:29–50, 5:47–54. Based on these teachings, we are persuaded that an ordinarily skilled artisan would have had reason to dispose Phan's pixels and dots in a regular pattern in the manner suggested by Petitioner. In fact, Dr. Kymissis agreed that it was common in the art of OLED displays to repeat unit pixel designs across a display. *See* Ex. 1019, 105:9–12, 106:2–6. Further, we do not agree with Patent Owner's argument (*see* PO Resp. 33; PO Sur-reply 18–19) that regular spacing is necessarily incompatible with dynamic driving of pixels. Patent Owner appears to base this argument on the need to dispose "Phan's control circuitry or optical fiber network" among the quad pixels. *See* PO Sur-reply 19 (citing Ex. 2009 ¶ 223). Yet Patent Owner has not explained how equal spacing precludes the disposition of such elements. Nor does Dr. Kymissis's supporting testimony establish as much. *See* Ex. 2009 ¶ 223.

We also have considered Patent Owner's arguments (PO Resp. 37–38; PO Sur-reply 19) about shifting of the visual locus and the potential for distortion in Petitioner's proposed pixel arrangement. Based on the full trial record, we are more persuaded by Petitioner's position because Petitioner shows persuasively how Phan's dots are intended to be evenly spaced. *See, e.g.*, Pet. 44–50, 52–53; Ex. 1003 ¶¶ 347–374, 393–398. This is supported by every drawing figure in Phan, which shows even spacing for both static and dynamic pixels. *See, e.g.*, Ex. 1005, Figs. 2a–b, 4a–b, 5, 7, 8–8.12, 9–9.8, 12a–12d. Notably, Phan does not disclose any need for "spacing

between each quad-pixel to prevent distortion and poor image quality," as is suggested by Patent Owner (PO Resp. 38), even though Phan discloses embodiments with sub-pixels of unequal sizes. Phan also teaches that dynamic pixels are not meant to be perceptible by the human eye (Ex. 1005, 2:57–59), which renders the uneven spacing in Patent Owner's counterexample—and the attendant distortion and brightness variances (*see, e.g.*, Ex. 1018 ¶¶ 73–79)—implausible, or at least outside of the natural reading of Phan.

Phan also teaches that "black mask or black barrier ribs 21" surround Phan's dots. Ex. 1005, 4:33–37. Based on this teaching, we are persuaded by Petitioner's contention that an ordinarily skilled artisan "would have understood that this mask has (or at least obviously could have) the same width/thickness across Phan's display." Pet. 53; Ex. 1003 ¶¶ 399–401. This contention is supported by Phan's teaching of "regularly disposed" pixels and dots. Given these premises, and based on the full trial record, we are persuaded that Phan teaches or suggests the "substantially equidistant" limitations of claim 7. *See, e.g.*, Pet. 52–53; Ex. 1003 ¶¶ 393–398.

Our analysis regarding secondary considerations of nonobviousness discussed above for claim 1 applies equally to this claim. *See supra* § II.D.2.i. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 7 would have been obvious over Phan.

7. Claim 8

Claim 8 depends from claim 1 and further recites that "the first distance is measured between respective centers of the second pixels, and

the second distance is measured between respective centers of the one of the second pixels and the neighboring one of the third pixels." Ex. 1001, 9:48–52. Petitioner relies on the same analysis from limitation [1-b]. Pet. 53; *see also supra* § II.D.2.f.

Patent Owner relies on the same arguments discussed above for claim 1. PO Resp. 30–34; PO Sur-reply 15–17. For the same reasons discussed above for limitation [1-b], we are persuaded by Petitioner's analysis, because Petitioner measures the recited "first distance" and "second distance" based on the centers of Phan's dots. *See supra* § II.D.2.f. Our analysis regarding secondary considerations of nonobviousness discussed above for claim 1 applies equally to this claim. *See supra* § II.D.2.i. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 8 would have been obvious over Phan.

8. Claim 9

Claim 9 depends from claim 1 and further recites that "the first line passes through respective centers of the first pixel and the second pixels, and the second line passes through respective centers of the first pixel and the third pixels." Ex. 1001, 9:53–56. Petitioner relies on the same analysis from limitations [1-a(2)] and [1-a(3)]. Pet. 54; *see also supra* §§ II.D.2.d–e.

Patent Owner relies on the same arguments discussed above for claim 1. PO Resp. 30–34; PO Sur-reply 15–17. For the same reasons discussed above for limitations [1-a(2)] and [1-a(3)], we are persuaded by Petitioner's analysis, because Petitioner's analysis disposes the "first line" and "second line" in the centers of Phan's dots. *See supra* §§ II.D.2.d–e.

Our analysis regarding secondary considerations of nonobviousness discussed above for claim 1 applies equally to this claim. *See supra* § II.D.2.i. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 9 would have been obvious over Phan.

9. Claim 10

Claim 10 depends from claim 1 and further recites that "each of the first pixels, the second pixels, and the third pixels has a convex shape." Ex. 1001, 9:57–59. Petitioner contends that "Phan's dots are square or rectangular," so "they are ***'convex.'***" Pet. 54 (citing Ex. 1003 ¶¶ 406–409; Ex. 1005, 5:47–54, Figs. 11a–b).

Patent Owner relies on the same arguments discussed above for claim 1. PO Resp. 30–34; PO Sur-reply 15–17. We are persuaded by Petitioner's showing that all of Phan's pixels are convex shapes. *See, e.g.*, Ex. 1003 ¶¶ 406–409; Ex. 1005, 5:47–54, Figs. 11a–b. Our analysis regarding secondary considerations of nonobviousness discussed above for claim 1 applies equally to this claim. *See supra* § II.D.2.i. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 10 would have been obvious over Phan.

10. Claims 13 and 15

Claims 13 and 15 are independent claims that are almost identical to claim 1. *Compare* Ex. 1001, 8:63–9:26, *with id.* at 9:66–10:27, *and id.* at 10:66–11:32. Petitioner relies on the same analysis that we have discussed above for claim 1. Pet. 42–51; *see supra* § II.D.2. Patent Owner does not

dispute Petitioner's showing for these claims apart from its arguments discussed above with respect to claim 1. *See supra* § II.D.2.a. Our analysis regarding secondary considerations of nonobviousness discussed above for claim 1 applies equally to these claims. *See supra* § II.D.2.i. Thus, for the same reasons discussed above, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 13 and 15 would have been obvious over Phan.

E. Obviousness Ground Based on Phan and Yamada

Petitioner contends that the subject matter of claim 2 would have been obvious over the combination of Phan and Yamada. Pet. 55–60; Pet. Reply 16–17, 19–25. Patent Owner disputes Petitioner's contentions. PO Resp. 38–47, 54–71; PO Sur-reply 20–22, 24–27.

1. Yamada

Yamada is a U.S. patent related to an "electroluminescence (EL) display apparatus." Ex. 1008, 1:6–7. Yamada discusses an "EL display apparatus" including "emissive regions 1B [blue], 1R [red], and 1G [green] for the display pixel of the respective color . . . arranged in a matrix configuration." *Id.* at 2:55–60; *see also id.* at 7:6–12 (discussing colors for the various emissive regions). Yamada indicates that "the emission efficiency of the emissive layer for emitting light of various colors differs with each color." *Id.* at 2:53–54. According to Yamada, when the pixels all have identically sized emissive areas, "a current larger than that supplied to the other display pixels having a high emission efficiency must be supplied" to obtain the same luminance at display pixels having a low emission

efficiency. *Id.* at 2:55–64. Yamada teaches that "[t]his causes the life of those display pixels having a low emission efficiency, in particular, to shorten, and also possibly causes the life of the EL display apparatus to shorten." *Id.* at 2:64–67.

Yamada purports to improve upon these aspects of EL displays by way of "a color display device, in which a display pixel having an emissive element is provided for every color, wherein the emissive area of the display pixel of any one color, among the display pixels of various colors, is different in size from the emissive area of the display pixel of another color." Ex. 1008, 3:17–22. According to Yamada,

> [b]y setting the emissive area of the display pixel, namely, the emissive area of the emissive element, in accordance with the emission efficiency of the emissive element as in the foregoing, and by supplying, for example, the same power to the emissive elements of colors having different emission efficiencies, it becomes possible to have the same emission luminance at the various display pixels.

Id. at 3:65–4:5. Therefore, Yamada states "it is possible to prevent the deterioration from accelerating when a load is selectively placed on the emissive element having low emission efficiency and extend the life of the display device." *Id.* at 4:11–14.

Figure 4 of Yamada is reproduced below.

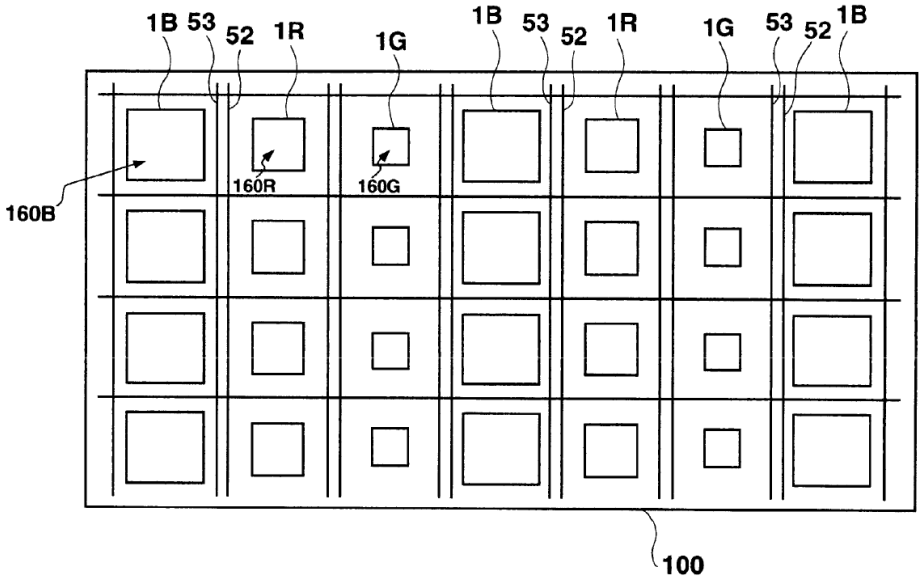


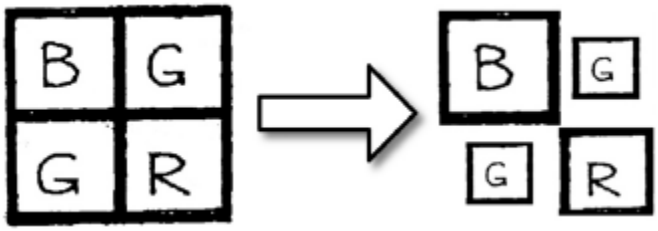
Fig. 4

Figure 4 is a "conceptual diagram showing emissive region areas of the EL display apparatus." Ex. 1008, 6:24–25. According to Yamada, Figure 4 "is a top plan view of an EL display apparatus 100" representing "a case where the respective display pixels emit red (R), green (G), and blue (B) light." *Id.* at 6:49–52. "[I]n the case of FIG. 4, the emissive area of the green display pixel 1G is provided as the smallest," while "[e]missive regions 1R and 1B of the other colors are formed with a larger area than that of emissive region 1G." *Id.* at 7:6–10. Yamada indicates that while in Figure 4 the "[a]rea of green emissive region 1G<area of red emissive region 1R<area of blue emissive region 1B," "the order in size of the emission region areas is not fixed at the above-mentioned green<red<blue, but is determined by the emission efficiency of the emissive materials that are used." *Id.* at 7:10–19.

2. Claim 2

Claim 2 depends from claim 1 and recites, *inter alia*, that "each of the second pixels and the third pixels has a larger area than the first pixel." Ex. 1001, 9:30–31. Petitioner concedes that "Phan does not . . . provide an example where its 'third pixel' (red dots) is also larger than its 'first pixel' (green dots)." Pet. 56. Thus, building upon its obviousness contentions based on Phan alone, Petitioner cites Yamada's teaching of "an OLED display with red, green, and blue pixels re-sized in accordance with the emission efficiency of each color's emissive element." *Id.* (internal quotations omitted) (citing Ex. 1008, 2:55–60, 3:16–27). Applying this teaching to Phan's Figure 11a embodiment, Petitioner contends that the result would be such that "the blue dot maintains its original size (making it relatively larger), the green dots have been made smallest and the red dot an intermediate size." *Id.* at 57 (citing Ex. 1003 ¶¶ 433–441).

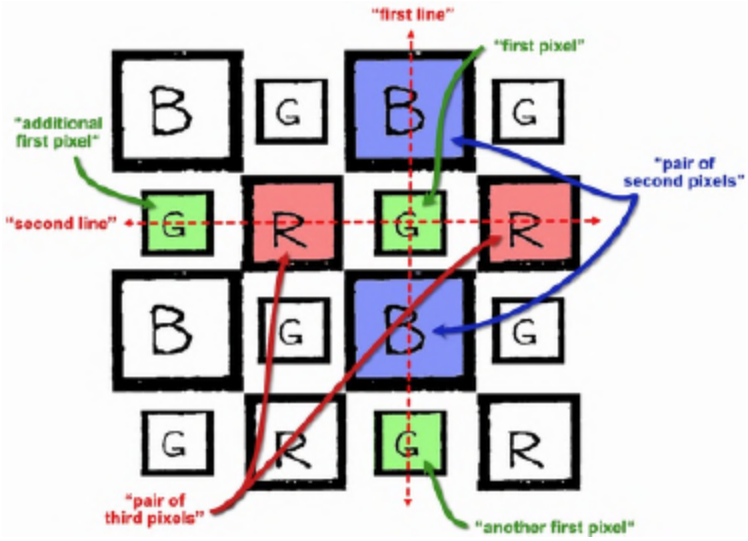
In support of this argument, Petitioner provides the following illustration at page 57 of the Petition.



Pet. 57 (citing Ex. 1003 ¶¶ 433–441). The left portion of this illustration depicts Phan's Figure 11a, which "shows a square quad pixel where the crosspoint 33 is in the centre of the four dots (individual elements) of equal light emitting area and space, contoured by black mask or black barrier ribs 21 with the same structure." Ex. 1005, 5:47–50. The right portion of this illustration shows Petitioner's resizing of dots in Phan's Figure 11a to

make the red dot a smaller size and the green dots the smallest size while maintaining the size of the blue dot. Pet. 57. According to Petitioner, "the dots remain centered on the same points maintaining the same overall geometry." *Id.* (citing Ex. 1003 ¶¶ 437–441).

Similar to the Phan obviousness ground, Petitioner applies its modified version of the dot/pixel structure from Phan's Figure 11a to the display matrix or grid of Phan's Figure 12. Pet. 57–58. To summarize these contentions, Petitioner provides the following illustration in the Petition.



Id. (citing Ex. 1003 ¶ 442). In this illustration from the Petition, Petitioner indicates the recited "first pixel," "another first pixel," and "additional first pixel" in green, the recited "pair of second pixels" in blue, and the recited "pair of third pixels," "first line," and "second line" in red. *Id.* Petitioner has resized Phan's dots in its illustration consistent with the modified version of Figure 11a discussed above. *Id.* Petitioner contends that "the dot-to-dot distances remain the same" because "the overall square shape and repeating matrix/grid Phan teaches would continue to be employed." *Id.* at 58 (citing Ex. 1003 ¶ 443).

Petitioner contends an ordinarily skilled artisan would have made this combination because "it was well-known that adjusting pixel size—and making pixels with lower emission efficiencies (blue) larger and pixels with higher emission efficiencies (green) smaller—reduces deterioration and improves display life." Pet. 58 (citing Ex. 1003 ¶¶ 444–454). According to Petitioner, an ordinarily skilled artisan "would have recognized that applying Yamada to Phan would have similarly improved the life of Phan's display." *Id.* at 59 (citing Ex. 1003 ¶¶ 444–448).

Patent Owner argues that "Phan explicitly concerns passive-matrix displays." PO Resp. 39 (citing Ex. 1005, 5:23–24). As such, Patent Owner argues that an ordinarily skilled artisan "would not have looked to Yamada, which concerns AMOLEDs, to design a pixel arrangement for Phan, which involves a passive-matrix display intended to implement Phan's dynamic pixel driving." *Id.* (citing Ex. 2009 ¶¶ 235–236). Specifically, Patent Owner argues that Petitioner's proposal to modify Phan's dots "violates Phan's requirement of adjusting the pixel sizes along a crosspoint," which "relates to Phan's passive-matrix structure." *Id.* at 41 (citing Ex. 2009 ¶¶ 241–242). Patent Owner explains that in a passive matrix structure, "each row of pixels shares the same row electrode, and each column of pixels shares the same column electrode" such that "when Phan adjusts the sizes of pixels, pixels in the same column retain an equal width and pixels in the same row retain an equal height." *Id.* In contrast, Patent Owner argues that Petitioner "splits apart the subpixels and introduces uneven spacing between them," which "ignores, and conflicts with, Phan's requirements" and is "incompatible with Phan's passive-matrix structure." *Id.* (citing Ex. 2009 ¶¶ 242–243); *see also id.* at 43 (similar argument).

Patent Owner also notes that Phan's teaching of moving the crosspoint results in a larger blue dot, green dots of intermediate size, and a red pixel that is the smallest size, which conflicts with Petitioner's proposed modification (i.e., maintaining the size of the blue dot while reducing the size of the red dot to an intermediate size and the sizes of the green dots to a smaller size). PO Resp. 42–43 (citing Ex. 1005, Figs. 11a–b; Ex. 2009 ¶ 248); *see also id.* at 44 (citing Ex. 2009 ¶ 253) (similar augment). In addition, Patent Owner argues that "keeping the blue pixel the same size and shrinking the red and green pixels would require higher current density to be applied to the red and green pixels, accelerating their aging and reducing display lifetime." *Id.* at 42 (citing Ex. 2009 ¶¶ 245–246).

In its Reply, Petitioner argues that Phan "is not limited to passive-matrix displays." Pet. Reply 16. Petitioner also argues that, based on the teachings of Cok, "it was known that the very same pixel arrangement Phan teaches can be used in an active-matrix OLED." *Id.* (citing Ex. 1017, Fig. 1).

In its Sur-reply, Patent Owner notes Dr. Kymissis's "unrebutted testimony that Phan teaches passive-matrix displays, which are fundamentally different from active-matrix displays." PO Sur-reply 20 (citing Ex. 2009 ¶¶ 47–56, 80–81, 116–128, 211, 234–238). Patent Owner also notes Dr. Kymissis's "unrebutted testimony" that the pixel arrangement of Cok's Figure 1 embodiment "is *not* described as being used in an active-matrix OLED." *Id.* at 21 (citing Ex. 1019, 70:5–18).

We agree with Patent Owner that Petitioner has not persuasively shown how or why an ordinarily skilled artisan would have modified Phan's passive-matrix structure based on Yamada in the manner suggested by

Petitioner. Importantly, Petitioner's combination is based on Phan's embodiments, which pertain to passively driven displays. *See* Ex. 1005, 5:23–24; Ex. 2009 ¶¶ 80, 211, 235. In contrast, Yamada is directed to active-matrix OLEDS. *See* Ex. 1008, 1:6–9; Ex. 2009 ¶¶ 93, 235. Although Phan may not be "limited to passive-matrix displays" (Pet. Reply 16), Petitioner still must show that an ordinarily skilled artisan would have had a reason to modify Phan's passively driven embodiments in the manner it suggests. And, as noted by Dr. Kymissis, "the design considerations for a pixel arrangement of a passive-matrix OLED are significantly different from the design considerations for a pixel arrangement of an active-matrix OLED," as we will now discuss in more detail. Ex. 2009 ¶ 237.

In particular, pixels are formed in passive-matrix OLEDs where column electrodes and row electrodes overlap. Ex. 2009 ¶ 49. "[T]he intersection of column electrodes and row electrodes defines the OLED pixel size." *Id.* In addition, "a row of pixels shares one row electrode and a column of pixels shares one column electrode," such that "one row of pixels is illuminated at a time by applying a scan signal to that row, and applying data signals to each of the columns in that row." *Id.* A complete image is outputted "[b]y scanning through all the rows successively within one time frame." *Id.* These characteristics would apply when Phan's passively driven embodiments are implemented as OLEDs, as is taught by Phan. *See id.* ¶¶ 81–82; *supra* § II.D.2.a. This is why Phan constrains the "resizing of pixels by moving the crosspoint along a diagonal," which "ensures that the pixels that share a row electrode have the same height and the pixels that share a column electrode have the same width." Ex. 2009 ¶ 242.

Despite these known design considerations for passive displays, Petitioner never explains how or why an ordinarily skilled artisan would have modified Phan's pixel arrangement to "split[] apart the subpixels and introduce[] uneven spacing between them." PO Resp. 41 (citing Ex. 2009 ¶¶ 242–243). In this way, we agree with Patent Owner that Petitioner's proposed modification is "incompatible with Phan's passive-matrix structure." *Id.* We also disagree with Petitioner that its proposed modification "maintain[s] the square pixel shape and matrix geometry Phan already employs" (Pet. 57) given that Petitioner's modification departs significantly from Phan's disclosure of moving the crosspoint to change the size of dots in a quad-pixel. *See* Ex. 1005, 5:47–54, Fig. 11b. Petitioner neither explains how a passively driven display with differently sized pixels along each column and row electrode might work, nor explains how Phan's passive embodiments might be modified to become an actively driven configuration compatible with differently sized pixels.

We also have considered Petitioner's argument that Cok's Figure 1 pixel arrangement—which is similar to Phan's Figure 11b pixel arrangement—is used in an active-matrix OLED. Pet. Reply 16 (citing Ex. 1017, Fig. 1). Although Cok makes general statements about the application of its disclosed invention to "passive-matrix or active-matrix [OLED] devices" (Ex. 1017, 2:61–67), Cok does not specify whether its Figure 1 embodiment pertains to active- or passive-matrix OLEDs. *See id.* at 4:8–13; *see also* Ex. 1019, 70:5–18 (Dr. Kymissis's testimony regarding same). And, even if we were to assume that Cok's Figure 1 pixel arrangement might be applicable to active-matrix OLEDs, this fact still would not cure the deficiencies in Petitioner's obviousness rationale.

Specifically, Petitioner offers no explanation why or how Phan's passively driven pixel arrangement would be resized in a manner at odds with Phan's own teachings to allegedly achieve the pixel arrangement of claim 2. We also note that Cok's Figure 1 pixel arrangement does not resemble Petitioner's proposed pixel arrangement for this ground, which undermines Petitioner's argument. *Compare* Ex. 1017, Fig. 1, *with* Pet. 57–58 (illustrations).

Furthermore, contrary to Petitioner's contentions (Pet. 58–59), Petitioner's proposal to maintain the size of Phan's blue dot while shrinking the red and green dots would not increase the lifetime of the display. As explained by Dr. Kymissis, "reducing the red and green light-emitting areas . . . would require a ***higher*** current density to be applied to the red and green pixels to drive them at the same amount of brightness as before, thus accelerating aging of the red and green pixels and reducing display lifetime." Ex. 2009 ¶ 245. Moreover, the size of the blue pixels is unchanged in Petitioner's proposed modification, so Petitioner's proposed combination "would not lower the current density" for blue pixels. *Id.* Petitioner essentially concedes these points in its Reply by focusing on the concept of a display's "usability over time" based on the pixels' aging relative to one another (*see* Pet. Reply 6 (citing Ex. 1018[9] ¶¶ 34–48)), but that was not Petitioner's rationale in the Petition. We decline to consider these new arguments.

For these reasons, we are not persuaded that an ordinarily skilled artisan would have modified Phan's teachings based on Yamada in the

[9] Petitioner mistakenly cites to Exhibit 1019, but the context makes clear that Petitioner intended to cite to Exhibit 1018.

manner suggested by Petitioner. Based on the entire trial record, we determine that Petitioner has not shown by a preponderance of the evidence that the subject matter of claim 2 would have been obvious over the combination of Phan and Yamada.

F. Obviousness Ground Based on Matthies and Yamada

Petitioner contends that the subject matter of claims 1, 2, 4–10, 13, and 15 would have been obvious over the combination of Matthies and Yamada. Pet. 18–41; Pet. Reply 2–12, 19–25. Patent Owner disputes Petitioner's contentions. PO Resp. 7–30, 54–71; PO Sur-reply 4–15, 24–27.

1. Matthies

Matthies is a U.S. patent directed to "large-area display devices which are formed as an array of tiled display devices." Ex. 1004, 1:8–10. Matthies states that "[b]uilding a large-area display out of smaller tiles has been recognized as a desirable solution," because "the basic unit of manufacture is relatively small," which "reduces manufacturing costs." *Id.* at 1:56–65. Matthies explains that "[n]o practical tiled display system has yet been developed" because "[w]hat has been missing is a fabrication technology that allows a display to be constructed so that pixels can be brought up to the very edge . . . while at the same time allowing for electronics to address each tile, even those tiles completely surrounded by other tiles." *Id.* at 1:66–2:7.

Figure 1 of Matthies is reproduced below.

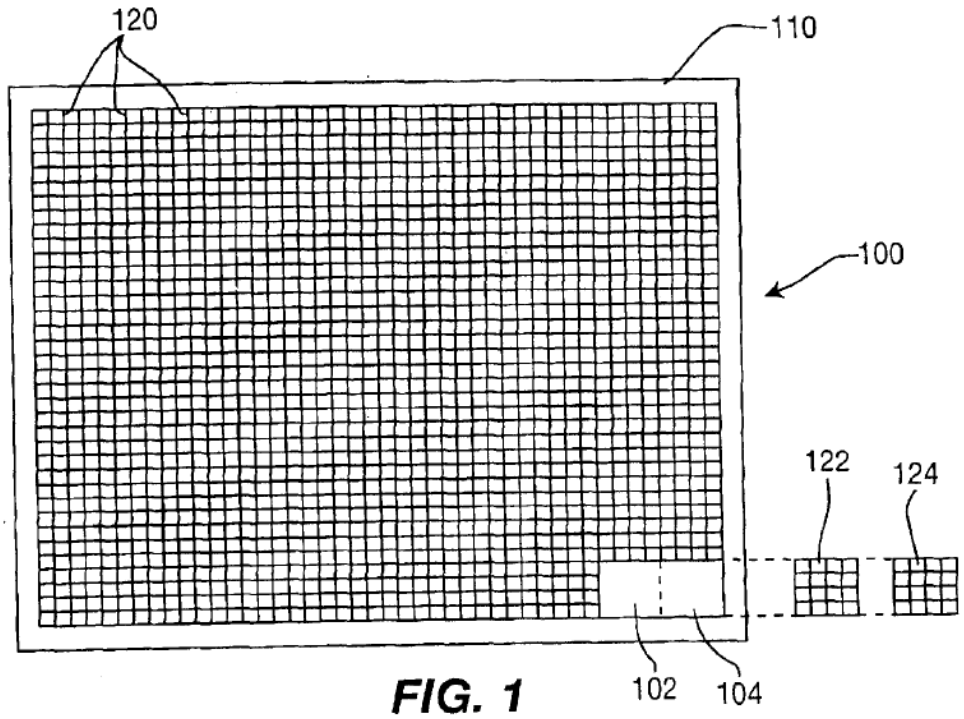


Figure 1 "is a front plan drawing of a large area display device from which two tiles have been removed." Ex. 1004, 3:49–50. According to Matthies, "display 100 is a tiled display in which emissive or reflective elements, on which the image pixels are formed, are built as relatively small arrays on tiles 120 and assembled into a frame to produce the large-area display having a large number of pixel forming elements." *Id.* at 5:38–42. Matthies indicates that "[a]lthough the display 100 is shown as being formed from tiles having 16 pixel forming elements in a four by four array, it is contemplated that each tile may include many more pixels." *Id.* at 5:56–59.

Matthies states that in an exemplary embodiment, "the pixel forming elements are made from an organic light emitting diode (OLED) material." Ex. 1004, 6:17–19. According to Matthies, "[t]he active portion . . . of the pixels occupies only about 1/4 of the total pixel area." *Id.* at 15:67–16:1.

Matthies indicates that "this spacing of the pixels leaves room along the edges of the display for the vias . . . to connect to the row and column electrodes of the pixel without interfering with the regular spacing of the pixels across tile boundaries." *Id.* at 16:5–9.

Figure 7 of Matthies is reproduced below.

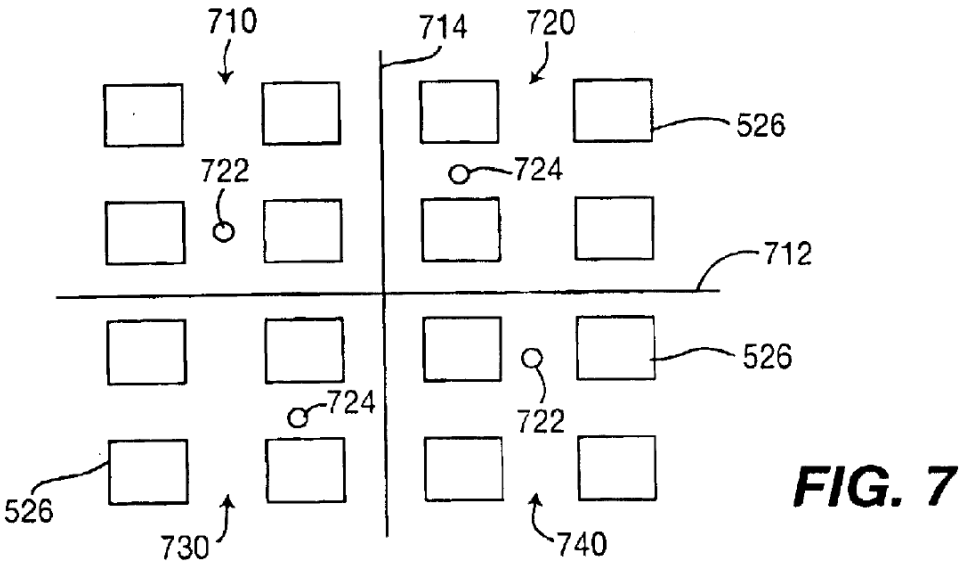


Figure 7 "is a pixel diagram which shows an exemplary pixel layout for portions of four tiles." Ex. 1004, 4:6–7. "In the layout shown in FIG. 7, the active portions 526 of the pixels are centered in their respective pixel regions and the vias which connect the row and column electrodes of the display to the electronics are formed between respective pixel elements." *Id.* at 16:22–26. "The distance between the edge of an active region 526 and the edge 712 of the display is equal on all sides of the tile." *Id.* at 16:26–28.

Figure 8B of Matthies is reproduced below.

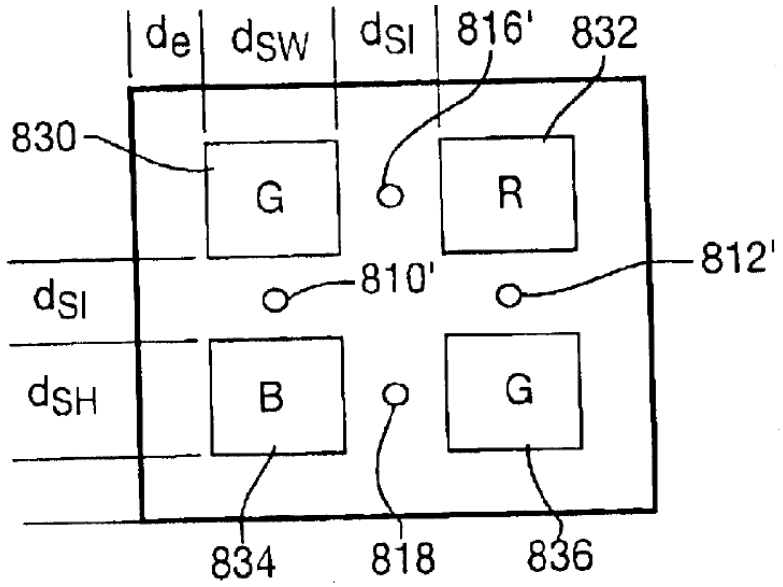


FIG. 8B

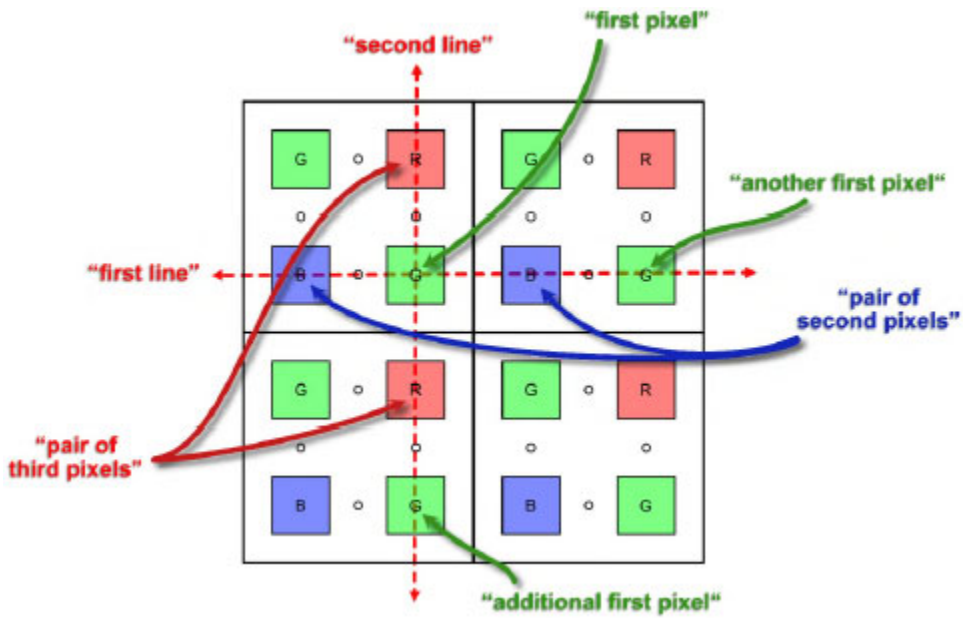
Figure 8B is "a front-plan view of an alternative single color pixel structure which includes separate sub-pixels." Ex. 1004, 4:12–13. According to Matthies, Figure 8B illustrates a "color pixel structure" that "includes four sub-pixel elements, 830, 832, 834 and 836." *Id.* at 16:62–64. "Two of these sub-pixel elements, 830 and 836 emit green light when stimulated while the other two pixel elements, 832 and 834 emit red and blue light, respectively." *Id.* at 16:64–66. Matthies indicates that "[t]his structure is known as a quad sub-pixel structure." *Id.* at 16:67. According to Matthies, "[t]he geometry of the quad sub-pixel structure is defined by the dimensions d_{SH}, the height of the sub-pixel, d_{SW}, the width of the sub-pixel, d_e, the distance from the active sub-pixel areas to the edge of the pixel area, and d_{SI}, the distance between adjacent sub-pixels." *Id.* at 17:16–20.

Matthies teaches that a "tile may also include circuitry which automatically adjusts the pixel brightness to compensate for aging of the display material," such as a "small light sensor over one or more pixel positions which continually monitors the brightness of that pixel and adjusts

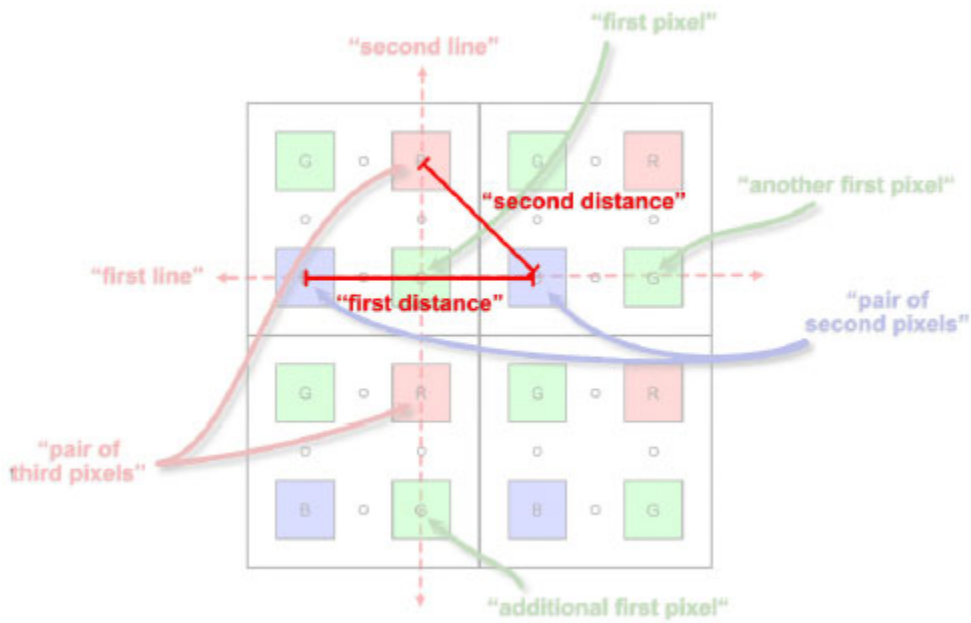
the current level applied to that pixel—and the current levels applied to all of the other pixels on the display—to compensate for variations in pixel brightness due to aging of the display." Ex. 1004, 11:47–58. Matthies also teaches "that the decay in the brightness of an OLED pixel that occurs with aging can be predicted" by, for example, "measuring the current and time for a particular pixel, and integrating the product of current and time" or by "monitor[ing] the voltage that is applied to the pixel." *Id.* at 11:61–12:16. Matthies indicates that the "methods for adjusting the current applied to a pixel in order to maintain a predetermined brightness level may be combined with any other method either as a check or to augment the performance of the other method." *Id.* at 12:41–46.

2. Discussion

Petitioner's obviousness contentions for this ground are based on the "quad sub-pixel structure" in Matthies's Figure 8B implemented with the dimensions in Matthies's Table 2. *See* Pet. 21–25. Petitioner provides the following demonstrative of several such quad sub-pixel structures in a tiled arrangement to support its analysis of various limitations in independent claims 1, 13, and 15.



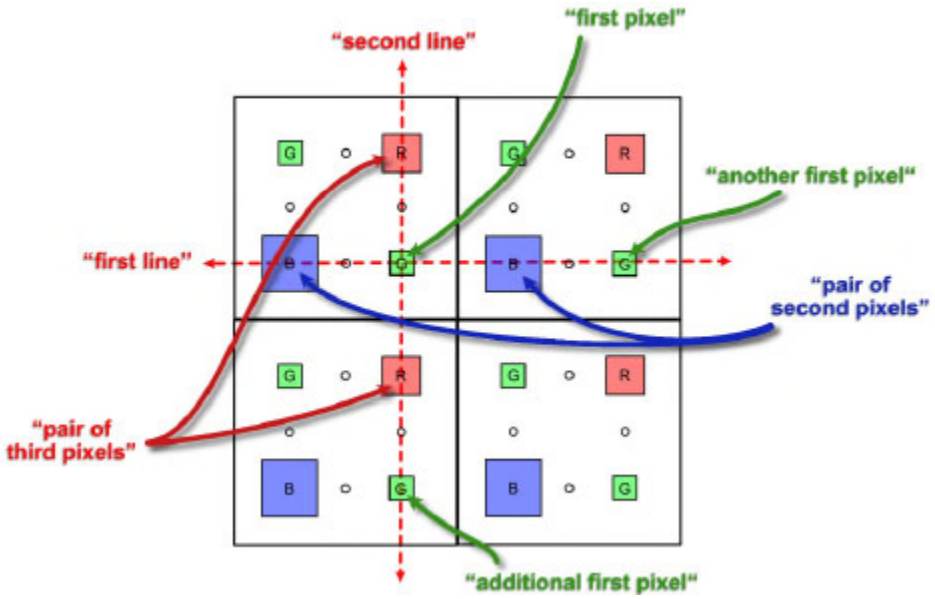
Pet. 26. In this demonstrative from the Petition, Petitioner has indicated the "first pixel[s]" in green, the "second pixels" in blue, and the "third pixels" in red. *Id.* Petitioner has also indicated the "first line" and "second line" with red dashed lines. *Id.* Petitioner provides another version of the same demonstrative, reproduced below, to show the recited "first distance" and "second distance."



Pet. 27. In this demonstrative from the Petition, Petitioner has indicated the recited "first distance" and "second distance" with red lines. *Id.*

Petitioner additionally cites Yamada's teaching that, in order to overcome the problem of OLED pixel colors having different emission efficiencies, "pixels with lower emission efficiencies (blue) should be made larger than pixels with higher emission efficiencies (green)." Pet. 35–36 (citing Ex. 1008, 2:55–3:6, 3:38–44, 3:51–57, 7:3–12, 8:19–28, 8:47–52, Figs. 4, 9). Petitioner contends it would have been obvious to apply these teachings from Yamada to Matthies's OLED display with a "quad sub-pixel structure." *Id.* at 36–37 (citing Ex. 1003 ¶¶ 274–282; Ex. 1004, code (57), 3:6–7, 10:14–18, 10:24–27, 16:21–34, 16:62–17:31, Figs. 1, 7, 8B). Accordingly, Petitioner contends that an ordinarily skilled artisan would have resized Matthies's sub-pixels "in accordance with their emission efficiencies such that the green 'first pixels' are smallest, the blue 'second pixels' are largest, and the red 'third pixels' have an intermediate size." *Id.* at 29–30. Specifically, Petitioner proposes "appl[ying] Yamada's example green:red:blue pixel area ratio of 1:2.6:5.6 to Matthies' 'quad sub-pixel structure.'" *Id.* (citing, *inter alia*, Ex. 1008, 11:8–10). Notwithstanding, Petitioner keeps the blue pixel at its original size while reducing the sizes of the other pixels in accordance with that ratio. *Id.* at 30. Petitioner also keeps the same sub-pixel spacing taught by Matthies. *Id.* Petitioner contends that its proposed modifications would extend the life of the display device. *Id.* at 36 (citing Ex. 1008, 4:5–14, 10:61–11:3).

To summarize these contentions based on the combination of Matthies and Yamada, Petitioner provides the following illustration in the Petition.



Pet. 31. In this demonstrative from the Petition, Petitioner has indicated the "first pixel[s]" in green, the "second pixels" in blue, and the "third pixels" in red. *Id.* Petitioner has also indicated the "first line" and "second line" with red dashed lines. *Id.*

Patent Owner argues that an ordinarily skilled artisan "would not have been motivated to modify Matthies' PMOLED [passive-matrix OLED] display made of multiple tiles based on Yamada's disclosure for AMOLED monolithic displays, let alone with a reasonable expectation of success." PO Resp. 12. Citing Matthies's Figure 8B, Patent Owner explains that "[t]he light-emitting area in Matthies' PMOLED is defined by the overlap of the row and column electrodes" such that "all pixels in the same row . . . have the same height, and all pixels in the same column . . . have the same width." *Id.* at 12–13 (citing Ex. 1004, 17:10–20, Fig. 8B). According to Patent Owner, an ordinarily skilled artisan

> would have recognized that, unlike in Yamada, changing the size of a pixel in Matthies' Figure 8B would entail changing the size of its row and/or column electrode, which would both (1) change the size of all the other pixels defined by that row

> and/or column electrode and (2) have electrical effects that could diminish display performance.

Id. at 13 (citing Ex. 2009 ¶¶ 121–128); *see also id.* at 29 (citing Ex. 2009 ¶ 193) (similar argument). Patent Owner further explains that "Matthies' geometric requirements flow from its PMOLED design, as each pixel is defined by the overlap of column and row electrodes, and two different color pixels are found on each row (and column) electrode." *Id.* at 25 (citing Ex. 1004, 17:10–20). In light of this, Patent Owner criticizes Petitioner's proposed re-sizing of pixels as being incompatible with Matthies. *Id.* at 28.

Patent Owner also argues that, contrary to Petitioner's contentions, Petitioner's proposed modifications would actually shorten the life of Matthies's display. PO Resp. 14–15. Patent Owner notes that Petitioner proposes maintaining the size of the blue pixels, which "would not reduce the blue pixels' current density or extend their lifetime." *Id.* at 15. Patent Owner further notes that "Petitioner's proposal would shrink the red and green pixels, substantially reducing their light-emitting areas, increasing their current densities and *reducing* their lifetimes." *Id.* (citing Ex. 2009 ¶¶ 136–137).

In its Reply, Petitioner argues that "Matthies repeatedly explains that the pixels making up its display can have different sizes and shapes." Pet. Reply 11 (citing Ex. 1004, 17:36–37, 18:63–64, 19:8–12). Petitioner also argues that Matthies is not limited to passive-matrix OLEDs and, rather, "Matthies ***repeatedly*** states that it is equally applicable to both actively and passively driven OLEDs." *Id.* at 3 (citing 7:15–19, 7:42–45, 8:20–26, 8:30–33). Thus, according to Petitioner, an ordinarily skilled artisan "plainly would have understood—just as Matthies itself states—that Matthies' OLED pixel arrangements can be used in both passive- and active-matrix displays."

Id. at 3–4 (citing Ex. 1018 ¶¶ 6–16; Ex. 1019, 17:18–18:9, 19:13–20:22, 22:7–23:1; Ex. 2009 ¶¶ 47, 119). Petitioner also addresses its rationale based on improving the lifetime of Matthies's display. According to Petitioner, "resizing OLED pixels in accordance with emission efficiency both prevents less efficient blue pixels from failing earlier ***and*** prevents different pixel aging rates from impacting display usability over time." *Id.* at 6 (citing Ex. 1018 ¶¶ 45–48).

In its Sur-reply, Patent Owner argues that "Petitioner relies on misleading quotations of the word 'active' appearing in Matthies." PO Sur-reply 5. Patent Owner explains that Petitioner's quotations actually pertain to active electronics or devices rather than active-matrix addressing. *Id.* Further, Patent Owner argues that Petitioner's obviousness theory "is exclusively based on modifying Matthies' *passive-matrix* Figure 8B display." *Id.* at 6–7.

We agree with Patent Owner that Petitioner has not persuasively shown how or why an ordinarily skilled artisan would have modified Matthies's passive-matrix structure based on Yamada in the manner suggested by Petitioner. In particular, Petitioner bases its combination on the display tile shown in Matthies's Figure 8B, which is a passive-matrix embodiment. *See* Ex. 1004, 10:31–33, 17:10–16; Ex. 2009 ¶ 106. In contrast, Yamada is directed to active-matrix OLEDS. *See* Ex. 1008, 1:6–9; Ex. 2009 ¶¶ 93, 111. For the same reasons discussed above with respect to the Phan–Yamada ground (*see supra* § II.E.2), pixels in a passive-matrix OLEDs are constrained to the intersections of row and column electrodes. *See* Ex. 2009 ¶ 49. Thus, even if Yamada might suggest resizing pixels for various reasons, Petitioner has not persuasively shown how this would be

accomplished based on Matthies's passive-matrix structure in Figure 8B. *See id.* ¶¶ 123–124 (Dr. Kymissis testifying about how pixel sizes cannot be arbitrarily changed in the PMOLED embodiment of Figure 8B). We also do not agree with Petitioner (Pet. Reply 11) that Matthies's references to "larger and smaller pixel apertures" and "different pixel pitches" salvages its proposed combination. Even if Matthies might suggest changing pixel size or the distances between pixels, Petitioner does not persuasively show how it could achieve different pixel sizes along the same column or row electrodes of the passive-matrix structure undergirding its proposed combination. *See* Ex. 2009 ¶¶ 123–124. Thus, we agree with Patent Owner that "Matthies' constraints are incompatible with Petitioner's theory of making differently-sized red, green, and blue pixels based on Yamada." PO Resp. 13 (citing Ex. 2009 ¶¶ 129–132).

Further, to the extent Petitioner cites instances of the word "active" in Matthies for allegedly teaching active-matrix displays (Pet. Reply 2–5), we do not read Matthies in this way. Indeed, nearly all of the instances of "active" cited by Petitioner pertain to active electronics or devices. *See, e.g.*, Ex. 1004, 7:15–19 (referring to "electronics 134" as "active and passive"). Matthies does not refer to active-matrix addressing, as is used with AMOLED displays. *See* Ex. 2086, 81:9–12. Moreover, the only instance of "active matrix" in Matthies appears in the following passage:

> The electronics which form the image processing and pixel driving circuitry are mounted on the layers. Electronics are used in the broadest sense to include both active and passive, and both discrete devices mounted on the layers and devices formed in place by processes such as those now used to make active matrix circuits for displays on various high temperature substrates.

Ex. 1004, 8:20–26. As recognized by Dr. Pattison (Ex. 2086, 46:8–47:19), this passage refers to the two ways Matthies discloses for creating its disclosed "image processing and pixel driving circuitry": (1) mounting discrete devices on a substrate; or (2) forming devices in place on the substrate using processes like those used to make active matrix circuits. *See* Ex. 1004, 8:20–26. Dr. Pattison also recognized that the second option refers to "a whole field of making transistors and passive components that are integrated into electronics." Ex. 2086, 47:10–19. In this sense, the reference to "active matrix" simply identifies known semiconductor manufacturing processes. It does not teach or suggest implementing Matthies's embodiments with active-matrix OLED circuits. And, regardless of how an ordinarily skilled artisan would have understood the mentions of the word "active" in Matthies, Petitioner never explains how Matthies's passively driven embodiment in Figure 8B would have been modified to accommodate differently sized pixels.

Finally, just as with the Phan–Yamada ground, we are not persuaded that reducing the size of the red and green pixels in Matthies's display while maintaining the size of the blue pixels would result in improved display life. We credit Dr. Kymissis's testimony that, based on current density considerations, the life of the blue pixels would not be extended, and the life of the red and green pixels would be reduced, which would shorten the lifetime of the display. *See* Ex. 2009 ¶¶ 135–136. Petitioner's reply arguments—which focus on the pixels' relative aging and "usability over time" (Pet. Reply 5–7)—are not the same arguments it made in the Petition, and we decline to consider them.

For these reasons, we are not persuaded that an ordinarily skilled artisan would have modified Matthies's teachings based on Yamada in the manner suggested by Petitioner. Based on the entire trial record, we determine that Petitioner has not shown by a preponderance of the evidence that the subject matter of claims 1, 2, 4–10, 13, and 15 would have been obvious over the combination of Matthies and Yamada.

G. Obviousness Ground Based on Murai and Yamada

Petitioner contends that the subject matter of claims 1, 2, 4–10, 13, and 15 would have been obvious over the combination of Murai and Yamada. Pet. 60–78; Pet. Reply 17–25. Patent Owner disputes Petitioner's contentions. PO Resp. 47–71; PO Sur-reply 22–27.

1. Murai

Murai is a Japanese patent directed to "a color image display device." Ex. 1007 ¶ 1. Murai indicates that the display device may be an "organic EL display device[]." *Id.* ¶ 58. Murai discloses a color image display device that "has unit pixels . . . made up of four dots disposed as a grid in the

vertical and horizontal direction." *Id.* ¶ 28. Figure 3 of Murai is reproduced below.

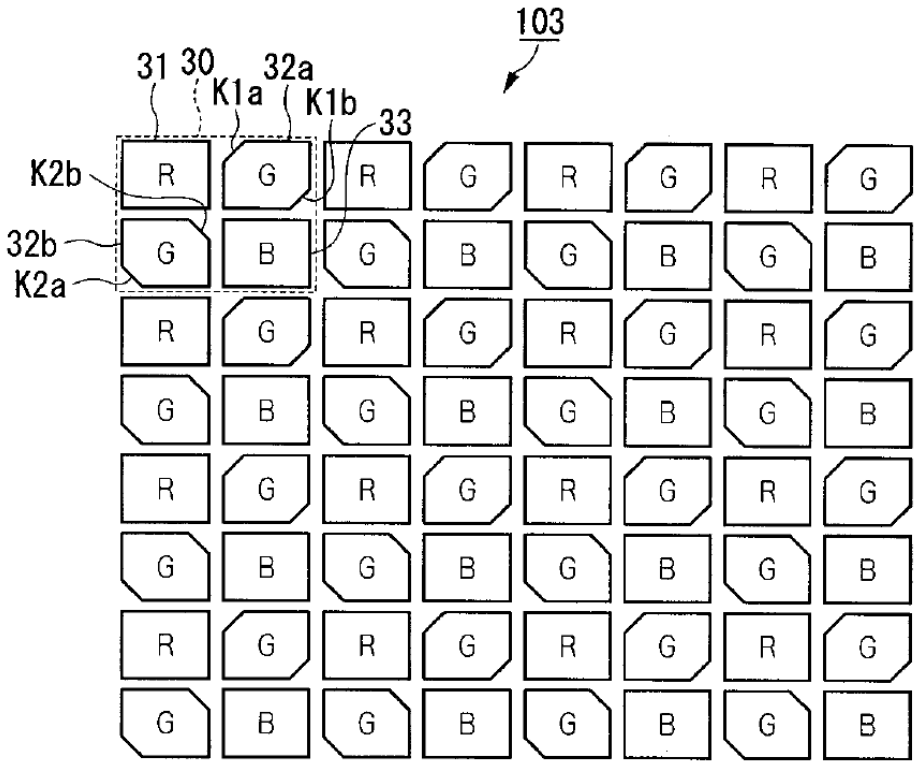


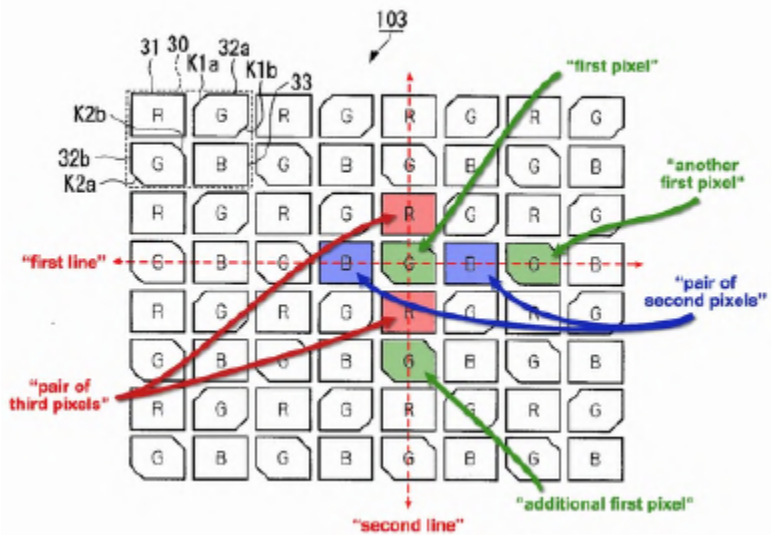
Figure 3 is "a plane view illustrating dot shape and dot arrangement in a color image display device." Ex. 1007 ¶ 27. "The unit pixels 30 are configured by four dots: one first dot 31, two second dots (32a and 32b), and one third dot 33, as a combined display unit." *Id.* ¶ 28. "[T]he second dots (32a and 32b) are configured by a first auxiliary dot 32a disposed on a top right corner of a rectangle made by the unit pixel 30 and a second auxiliary dot 32b disposed on a bottom left corner of the rectangle." *Id.* That is, "the first auxiliary dot 32a and the second auxiliary dot 32b are disposed diagonally in the rectangle made by the unit pixel 30." *Id.*

According to Murai, "the first auxiliary dot and the second auxiliary dot [may] be shaped having cut-off portions wherein at least one corner of the rectangular shape is cut off, and [may] be disposed so that there is a cut-

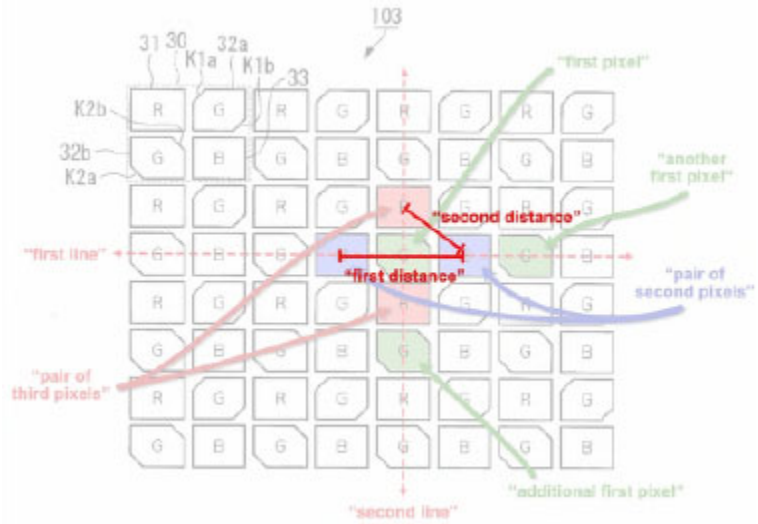
off portion near a space between the first auxiliary dot and the second auxiliary dot." Ex. 1007 ¶ 11.

2. Discussion

Petitioner's obviousness contentions for this ground are based primarily on the embodiment in Murai's Figure 3. *See* Pet. 61–62. Petitioner provides the following annotated version of Figure 3 to support its analysis of various limitations in independent claims 1, 13, and 15.



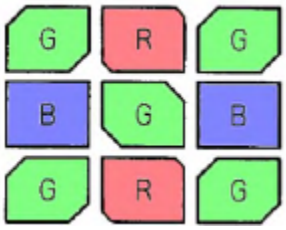
Pet. 66. In this annotated version of Murai's Figure 3, Petitioner has indicated the "first pixel[s]" in green, the "second pixels" in blue, and the "third pixels" in red. *Id.* (alteration in original). Petitioner has also indicated the "first line" and "second line" with red dashed lines. *Id.* Petitioner provides another annotated version of Murai's Figure 3, reproduced below, to show the recited "first distance" and "second distance."



Id. at 67. In this annotated version of Murai's Figure 3, Petitioner has indicated the recited "first distance" and "second distance" with red lines. *Id.*

Petitioner notes Murai's teachings of (1) different dot sizes; (2) differently shaped dots; and (3) dots with different numbers of cutouts. Pet. 68–70 (citing Ex. 1007 ¶¶ 6, 11, 13, 39, Figs. 3, 5(b), 6(a), 6(b)). Petitioner further cites Yamada's teaching of "an OLED display with red, green, and blue pixels re-sized in accordance with the emission efficiency of each color's emissive element." *Id.* at 70 (internal quotations omitted) (citing Ex. 1008, 2:55–60, 3:16–27). Applying Yamada's teachings to Murai, Petitioner contends "[t]he ***'first pixel'*** (the green dot) would continue to be ***'smaller'*** than the other pixels" but "the ***'area'*** of the ***'second pixels'*** (the blue dots) would also be made relatively ***'larger'*** than that of the ***'third pixel'*** (the red dots)." *Id.* at 71 (citing Ex. 1003 ¶¶ 529–531). The re-sizing is accomplished "using the method Murai already teaches (different numbers and sizes of cut-offs)." *Id.*; *see also id.* at 68 (citing Ex. 1007 ¶¶ 6, 11, 13, 39, Fig. 5b) (noting, *inter alia*, Murai's teachings about using "differently sized cutouts").

To summarize these contentions, Petitioner provides the following illustration in the Petition.



Pet. 71 (citing Ex. 1003 ¶ 532). The illustration depicts Petitioner's conception of 9 dots from the dot arrangement in Murai's Figure 3 that have been modified based on Yamada's teachings. *Id.* "The green dots are made smallest via the inclusion of two larger cutouts," "[t]he red dots have an intermediate size with two smaller cutouts," and "[t]he blue dots are largest because they include no cutouts." *Id.*

Petitioner contends that an ordinarily skilled artisan would have been motivated to apply Yamada's teachings to Murai because "it was well-known that adjusting pixel size—and making pixels with lower emission efficiencies (like blue) larger and pixels with higher emission efficiencies (like green) smaller—reduces deterioration and improves display life." Pet. 75–76 (citing Ex. 1003 ¶¶ 561–576). Although Petitioner acknowledges that Murai teaches differently sized dots/pixels for purposes of improving image quality by preventing continuous bands of color, Petitioner contends that an ordinarily skilled artisan "would have understood that this existing design feature could also be used to improve display life." *Id.* at 76–77 (citing Ex. 1003 ¶¶ 570–572).

Patent Owner argues that Murai's cutouts are a solution to a streaking problem that is peculiar to LCD displays with densely packed dots. PO Resp. 50 (citing Ex. 1007 ¶ 11, Fig. 6(a); Ex. 2009 ¶¶ 277–278). According

to Patent Owner, an ordinarily skilled artisan "would not have viewed Murai's cutouts as necessary" in an OLED display, particularly when implementing the emissive area ratios Petitioner cites from Yamada. *Id.* (citing Pet. 32; Ex. 1008, 11:8–10, 11:34–39; Ex. 2009 ¶¶ 277–279). Patent Owner also argues that, even if it were possible to implement the densely packed pixel arrangement of Murai's Figure 3 as an OLED, Petitioner's combination introduces an asymmetry that may exhibit visual artifacts such as color mixing and streaking effects. *Id.* at 52; *see also* Ex. 2009 ¶ 284 (Dr. Kymissis's testimony regarding same).

In addition, Patent Owner argues that downsizing Murai's pixels based on Yamada's teachings is "incompatible" with Murai's goal of improving the display's overall aperture ratio. PO Resp. 49 (citing Ex. 1007 ¶ 42; Ex. 2009 ¶ 276). Patent Owner explains that "Petitioner's modifications would reduce the aperture ratio and thereby undercut Murai's very purpose." *Id.* at 52. Patent Owner additionally argues that "reducing the sizes of the green and red pixels while keeping the blue pixels their same size would not extend the overall lifetime of Murai's display." *Id.* (citing Ex. 2009 ¶ 283).

In its Reply, Petitioner argues that "it would have been well within the ability of a[n ordinarily skilled artisan] to balance the benefits provided by Murai's pixel arrangement with Yamada's teachings to implement a working display." Pet. Reply 18. Regarding the potential for visual artifacts in Petitioner's combination, Petitioner argues that "Murai is open to the use of variably sized pixels with differently arranged cutouts" and Petitioner's example from the Petition "was merely meant to conceptually illustrate one way to apply Yamada." *Id.* (citing Ex. 1007 ¶¶ 13, 48–52).

We agree with Patent Owner that Petitioner has not persuasively shown why an ordinarily skilled artisan would have re-sized Murai's dot arrangement based on Yamada using additional corner cutouts as suggested by Murai. First, even though Murai mentions OLED devices (*see* Ex. 1007 ¶ 58), Petitioner has not persuasively shown that Murai's corner cutouts would be useful in the context of OLED displays, particularly when considering that OLED displays are spaced farther apart than the LCD displays that Murai primarily addresses. *See* Ex. 2009 ¶ 278. This problem is exacerbated when considering the OLED emissive area ratios from Yamada that Petitioner and Dr. Pattison cite in support of making the combination (*see* Pet. 70; Ex. 1003 ¶ 527), because the combination "would result in such large cut-off corners and separations between green dots that it would nullify the reason for implementing Murai's cut-off corners." Ex. 2009 ¶ 279; *see also* Ex. 1008, 11:4–15, 11:34–39 (emissive area ratios from Yamada). We also note that Petitioner does not meaningfully refute Patent Owner's arguments (PO Resp. 52–53) about asymmetries in Petitioner's proposed dot arrangement causing visual artifacts in diagonal directions, which also tends to undermine the rationale for Petitioner's combination. *See* Ex. 2009 ¶ 284.

Second, we agree with Patent Owner that Petitioner's proposed re-sizing of pixels necessarily reduces the aperture ratio of Murai's display. *See* Ex. 2009 ¶ 276. This is at odds with Murai's goal of improving the aperture ratio of the display, which tends to undermine Petitioner's rationale for the combination. *See* Ex. 1007 ¶¶ 10, 42. And, even if Petitioner is correct that an ordinarily skilled artisan could "balance the benefits provided by Murai's pixel arrangement with Yamada's teachings to implement a

working display" (Pet. Reply 18), the trial record includes no such balancing by Petitioner or Dr. Pattison to support its analysis.

Third, for similar reasons to those discussed above for the Phan–Yamada and Matthies–Yamada grounds, we do not agree that Petitioner's proposed combination would improve the lifetime of Murai's display. Keeping the size of the blue dots the same would not reduce the current density applied to the blue dots and thus would not extend the lifetime of the display. Ex. 2009 ¶ 283. Similarly, reducing the size of the green and red dots would require increased current density for these dots in order to maintain the same luminance and brightness, which would shorten the lifetime of these dots and reduce the lifetime of the display. *Id.* Petitioner again refers to its reply arguments about a display's usability over time based on the pixels' aging relative to one another (*see* Pet. Reply 19), but we decline to consider these new reply arguments.

For these reasons, we are not persuaded that an ordinarily skilled artisan would have modified Murai's teachings based on Yamada in the manner suggested by Petitioner. Based on the entire trial record, we determine that Petitioner has not shown by a preponderance of the evidence that the subject matter of claims 1, 2, 4–10, 13, 15 would have been obvious over the combination of Murai and Yamada.

H. Petitioner's First Motion to Strike

Petitioner moves to strike a sentence of Patent Owner's Response that allegedly incorporates arguments from Exhibit 2028. 1st Strike Mot. 1. The sentence states: "For example, the AMOLED display used in the Samsung Galaxy S22 Ultra product practices all challenged claims of the '683 Patent.

Ex. 2009, ¶¶328-330; Ex. 2028 (Galaxy S22 ULTRA Claim Chart); Ex. 2063." *Id.* (quoting PO Resp. 69). Petitioner faults Patent Owner for failing to explain the basis for this statement in the Response and instead "simply say[ing] so and point[ing] to Exhibit 2028 (a 20-page claim chart) for the supporting argument." *Id.* at 1, 5. Petitioner argues that this amounts to improper incorporation by reference of an argument for which Patent Owner bears the burden of production. *Id.* at 2. Petitioner also argues that Patent Owner cannot merely explain in exhibits its contention that the Samsung Galaxy S22 Ultra practices the claims of the '683 patent. *Id.* at 2–3; *see also* Exclude Reply 2 (citing Ex. 2009 ¶ 330) (arguing that "Dr. Kymissis's declaration is no better" because "he includes a bare citation to Ex. 2028 without engaging in any explanation or claim-by-claim elaboration.").

Patent Owner characterizes the claim chart at Exhibit 2028 "as supporting <u>*evidence*</u> for . . . nexus arguments that are thoroughly presented in the [Patent Owner Response]." 1st Strike Opp. 1. Patent Owner notes that the Response presents a "teardown image . . . of the pixel arrangement obtained from a Galaxy S22 Ultra . . . with Figure 5 of the '683 Patent superimposed." *Id.* at 3 (alteration in original) (citing PO Resp. 69–70); *see also supra* § II.D.2.i.(1) (reproducing referenced teardown image). Accordingly, Patent Owner argues that the Response "cites Exhibit 2028, a claim chart mapping the challenged claims to the same teardown image presented in the [Patent Owner Response], as additional evidence." 1st Strike Opp. 3; *see also* Exclude Opp. 1 (citing Ex. 2009 ¶ 330) (describing Exhibit 2028 as "a claim chart prepared by Patent Owner's expert,

Dr. Kymissis, explaining his opinion that the Galaxy S22 Ultra practices the challenged claims of the '683 Patent").

37 C.F.R. § 42.6(a)(3) states that "[a]rguments must not be incorporated by reference from one document into another document." In this case, Patent Owner's Response states the following in support of its nexus arguments: "[T]he AMOLED display used in the Samsung Galaxy S22 Ultra product practices all challenged claims of the '683 Patent. Ex. 2009, ¶¶328-330; Ex. 2028 (Galaxy S22 ULTRA Claim Chart); Ex. 2063." PO Resp. 69. But Patent Owner's argument amounts to a conclusion without any explanation.

To understand Patent Owner's argument, one must synthesize four separate exhibits: Dr. Kymissis's declaration (Ex. 2009 ¶¶ 328–330), the proffered claim chart (Ex. 2028), teardown images of the Galaxy S22 Ultra (Ex. 2029), and another declaration by Dr. Fontecchio (Ex. 2063). Specifically, one must first turn to paragraphs 329 of Kymissis's declaration to learn that "[a] software package called ImageJ was used to obtain certain information about the images of the Galaxy S22 Ultra's pixel arrangement structures." Ex. 2009 ¶ 329. Notably, Dr. Kymissis never states how he obtained the Galaxy S22 Ultra images, but he seemingly relies on a single unexplained reference to "Ex. 2063." *See id.* ¶ 328. Turning to Exhibit 2063, one would learn that Dr. Fontecchio "t[ore] down and obtain[ed] photographs from an AMOLED display in a Samsung Galaxy S22 Ultra smartphone product." Ex. 2063 ¶ 2. In turn, Dr. Fontecchio's images are contained in Exhibit 2029.[10] *Id.* ¶ 3. Then, one would have to

[10] We also note that Dr. Fontecchio does not explain his methodology for obtaining the teardown images at Exhibit 2029.

turn to the claim chart itself at Exhibit 2028 for a limitation-by-limitation analysis comparing the claims of the ’683 patent and the Galaxy S22 Ultra smartphone, which relies on Dr. Fontecchio’s images. *See* Ex. 2028. None of this is mentioned in the main document, Patent Owner’s Response. As such, the Board is forced to “play archeologist with the record” in order to understand Patent Owner’s arguments, which “is precisely what the rule against incorporation by reference was intended to prevent.” *Gen. Access Sols., Ltd. v. Sprint Spectrum L.P.*, 811 F. App’x 654, 657–58 (Fed. Cir. 2020).

We also have considered Patent Owner’s inclusion of “[a] teardown image (Ex. 2029 at 5) of the pixel arrangement obtained from a Galaxy S22 Ultra . . . with Figure 5 of the ’683 Patent superimposed.” PO Resp. 69–70; *see also supra* § II.D.2.i.(1) (reproducing referenced teardown image). Although Patent Owner characterizes the claim chart of Exhibit 2028 as “additional evidence” supporting the annotated teardown image (1st Strike Opp. 3), we do not agree with Patent Owner that this solves its incorporation problem relative to Exhibit 2028. Although Petitioner does not ask us to strike the annotated image or the sentence that supports it,[11] we agree with Petitioner that the “the explanation of [its] connection to the ’683 patent is found only in exhibits.” 1st Strike Reply 3. Indeed, the context for this annotated image is only discernable with reference to some of the same exhibits discussed in the previous paragraph. *See, e.g.*, Ex. 2009 ¶ 328 (citing Ex. 2029, 5; Ex. 2063).

[11] In our analysis of secondary considerations of nonobviousness above, we accord the annotated teardown image little to no weight based on its lack of evidentiary support.

For these reasons, we *grant* Petitioner's motion to strike the following statement from Patent Owner's Response at page 69: "For example, the AMOLED display used in the Samsung Galaxy S22 Ultra product practices all challenged claims of the '683 Patent. Ex. 2009, ¶¶328-330; Ex. 2028 (Galaxy S22 ULTRA Claim Chart); Ex. 2063." *See* 37 C.F.R. § 42.6(a)(3).

Petitioner also moves to strike another sentence in the Patent Owner Response: "Petitioner Mianyang BOE copied Samsung Display's pixel arrangements to commercialize AMOLED displays for products including the iPhone 12. Ex. 2009, ¶319." 1st Strike Mot. 1–2 (alteration omitted) (quoting PO Resp. 66). Petitioner argues that Patent Owner's statement "relies on its expert declaration and an 80-page district court complaint cited therein (Ex. 2041) to explain the allegation." *Id.* at 5; *see also id.* at 2 (noting that paragraph 319 of Dr. Kymissis's declaration in turn cites Exhibit 2041, the complaint from the Texas litigation). Petitioner again argues that Patent Owner has relegated the basis of its arguments to exhibits, which amounts to improper incorporation by reference. *Id.* at 1–2.

Patent Owner disputes that its argument relies on an 80-page complaint at Exhibit 2041. 1st Strike Opp. 2. Rather, Patent Owner argues that it only utilizes "a specific teardown image from paragraph 84 of a district court complaint." *Id.*

We agree with Patent Owner that it only relies on the complaint from the Texas litigation at Exhibit 2041 for providing a particular teardown image that it uses as part of a side-by-side comparison in its Response. *See* Ex. 2009 ¶ 319 (citing Ex. 2041 ¶ 84) (reproducing the same image from PO Resp. 66 and explaining that it is a "teardown image . . . of the pixel arrangement used in Mianyang BOE's AMOLED display used in the

iPhone 12 and comes from a complaint filed against Mianyang BOE"). Patent Owner does not incorporate any comparison or analysis from that complaint. Thus, we *deny* Petitioner's motion to strike the following sentence at page 66 of Patent Owner's Response: "Petitioner Mianyang BOE copied Samsung Display's pixel arrangements to commercialize AMOLED displays for products including the iPhone 12. Ex. 2009, ¶319."

Petitioner additionally moves to strike a third passage of Patent Owner's Response in which Patent Owner alleges copying by vendors of replacement AMOLED displays. *See* 1st Strike Mot. 1–2. Although Petitioner's motion to strike omits certain parts of the relevant passage, we reproduce the passage in its entirety below:

> Widespread copying of the '683 Patent's inventions is further evident from samples of AMOLED displays distributed by numerous vendors of replacement AMOLED displays for mobile phones. Exs. 2042-2061. These pixel arrangements not only infringe the challenged claims (*see, e.g.*, Ex. 2042 (chart mapping claims 1-2, 4-10, 13, and 15 to Group Vertical AMOLED Display); Ex. 2043 (chart mapping claims 1-2, 4-10, 13, and 15 to Sourcely Plus AMOLED Display)), they bear such similarity to those of Samsung Display that they demonstrate copying. Ex. 2009, ¶¶320–324. *See, e.g.*, *Medtronic, Inc. v. Teleflex Innovations S.a.r.l.*, 70 F.4th 1331, 1339–42 (Fed. Cir. 2023) (circumstantial evidence of "evidence of access to and substantial similarity with a patented product" can show copying (emphasis omitted)).

PO Resp. 66–67 (partially quoted at 1st Strike Mot. 2). Petitioner faults Patent Owner for not "articulating in its Response why certain third-party displays purportedly 'infringe the challenged claims'" and instead "mak[ing] a bald allegation in its Response and then point[ing] to Exhibits 2042 and 2043 (both 20-page claim charts) for the actual explanation." 1st Strike Mot. 5 (citing PO Resp. 66–67). Petitioner once again argues that Patent

Owner has relegated the basis of its arguments to exhibits, which amounts to improper incorporation by reference. *Id.* at 1–2.

Patent Owner argues that its Response provides an explanation of the alleged copying and "presents exemplary side-by-side comparisons of teardown images of the pixel arrangements in SDC's AMOLED products and teardown images of replica products." 1st Strike Opp. 2 (internal quotations omitted) (citing PO Resp. 65–68). As such, Patent Owner argues that the claim charts at Exhibits 2042 and 2043 are "*further evidence*." *Id.*

We agree with Petitioner that Patent Owner has improperly incorporated by reference the basis for Patent Owner's allegation that "[t]hese pixel arrangements . . . infringe the challenged claims (*see, e.g.*, Ex. 2042 (chart mapping claims 1-2, 4-10, 13, and 15 to Group Vertical AMOLED Display); Ex. 2043 (chart mapping claims 1-2, 4-10, 13, and 15 to Sourcely Plus AMOLED Display))." PO Resp. 66. To understand this argument, one must resort to paragraph 320 of Dr. Kymissis's declaration to learn that Dr. Kymissis had reviewed teardown images provided by Dr. Silzars. Ex. 2009 ¶ 320 (citing Exs. 2044–2061). In turn, Dr. Silzars testifies in his declaration that Exhibit 2044 includes teardown images from a Group Vertical AMOLED display sample, whereas Exhibit 2046 includes teardown images from a Sourcely Plus AMOLED display sample. Ex. 2061 ¶¶ 3, 5. Returning to Dr. Kymissis's declaration, one would learn that Dr. Kymissis used ImageJ software on Dr. Silzars's images at Exhibits 2044 and 2046 to obtain data about the Group Vertical and Sourcely Plus AMOLED displays. Ex. 2009 ¶ 322. Dr. Kymissis used this data to create the claim charts located at Exhibits 2042 and 2043. *Id.* These claim charts contain limitation-by-limitation analyses comparing the Group Vertical and

Sourcely Plus AMOLED display to the claims of the ’683 patent, which is the basis of Patent Owner’s allegation of infringement. *See* Exs. 2042, 2043. Patent Owner’s tactic of rolling up all of this background information into a single conclusory sentence about alleged infringement amounts to improper incorporation by reference.

We also have considered Patent Owner’s arguments about the claim charts at Exhibits 2042 and 2043 being further evidence to certain other of Patent Owner’s assertions, such as its presentation of side-by-side comparison of teardown images with an image of Patent Owner’s Galaxy S22 Ultra with Figure 5 of the ’683 patent overlaid on top. 1st Strike Opp. 2 (citing PO Resp. 66–68). Again, this does not solve the incorporation issue regarding alleged infringement, because the explanation about infringement, i.e., the “mapping” of the challenged claims, is found only in exhibits. *See* 1st Strike Reply 3.

For these reasons, we *grant* Petitioner’s motion to strike the following statement from Patent Owner’s Response at pages 66–67: “These pixel arrangements . . . infringe the challenged claims (*see, e.g.*, Ex. 2042 (chart mapping claims 1-2, 4-10, 13, and 15 to Group Vertical AMOLED Display); Ex. 2043 (chart mapping claims 1-2, 4-10, 13, and 15 to Sourcely Plus AMOLED Display)).” *See* 37 C.F.R. § 42.6(a)(3).

I. Petitioner’s Second Motion to Strike

Petitioner moves to strike Exhibit 2083, which comprises excerpts of testimony from Dr. Pattison in the ITC Investigation, and the portions of Patent Owner’s Sur-reply that rely on it. 2d Strike Mot. 1. We do not rely on this information in rendering this Decision, so we *dismiss as moot*

Petitioner's motion to strike these materials and the portions of the Sur-reply that refer to them.

Petitioner also moves to strike the portions of Patent Owner's Sur-reply that rely on two dictionary excerpts that were introduced during the second deposition of Dr. Pattison. 2d Strike Mot. 1, 4. The excerpts, which were identified as "Exhibit 2084" and "Exhibit 2085" at the deposition, are not of record in this proceeding. *Id.* at 4–5. We do not rely on this information in rendering this Decision, so we *dismiss as moot* Petitioner's motion to strike the portions of the Sur-reply that refer to the dictionary excerpts.

Petitioner additionally reiterates its arguments from its First Motion to Strike related to Exhibits 2028 and 2041–2043. 2d Strike Mot. 1, 5. We have already discussed these arguments above with respect to Petitioner's First Motion to Strike. *See supra* § II.H.

For these reasons, we *dismiss as moot* Petitioner's Second Motion to Strike.

J. Petitioner's Motion to Exclude

Petitioner moves to exclude Exhibit 2028, which is a claim chart supporting Patent Owner's allegations of a nexus between the challenged claims and the Samsung Galaxy S22 Ultra smartphone, as inadmissible hearsay. Exclude Mot. 1 (citing Fed. R. Evid. 802). We already have stricken Patent Owner's reference to this claim chart in Patent Owner's Response. *See supra* § II.H. As such, we do not rely on this exhibit in rendering this Decision. Thus, we *dismiss as moot* Petitioner's motion to exclude Exhibit 2028.

Petitioner moves to exclude Exhibit 2041, which is the complaint from the Texas litigation, as inadmissible hearsay. Exclude Mot. 2 (citing Fed. R. Evid. 802). Petitioner argues that the complaint constitutes hearsay because "it is an out-of-court statement that Patent Owner improperly relies on to establish the structure possessed by a BOE product." *Id.* This exhibit relates to Patent Owner's evidence of copying as a secondary consideration of nonobviousness, which we have accorded little to no weight above. *See supra* § II.D.i.5. We also have determined that certain challenged claims are unpatentable despite this evidence. *See supra* § II.D.2–10. Under these circumstances, we find the better course of action is to maintain a complete record of the evidence to facilitate review rather than to exclude this exhibit. Thus, we *dismiss as moot* Petitioner's motion to exclude Exhibit 2041.

Petitioner moves to exclude Exhibits 2042 and 2043, which are claim charts supporting Patent Owner's allegations of copying related to Group Vertical and Sourcely Plus AMOLED displays, as inadmissible hearsay. Exclude Mot. 2–3 (citing Fed. R. Evid. 802). We already have stricken Patent Owner's references to these claim charts in Patent Owner's Response. *See supra* § II.H. As such, we do not rely on these exhibits in rendering this Decision. Thus, we *dismiss as moot* Petitioner's motion to exclude Exhibits 2042 and 2043.

Petitioner moves to exclude Exhibits 2044–2060, which allegedly are teardown images of various replacement AMOLED displays, as lacking authentication. Exclude Mot. 3–4 (citing Fed. R. Evid. 901). Petitioner notes that Dr. Silzars testifies in his supporting declaration (Exhibit 2061) "only that he 'understand[s]' that the products 'were purchased' from 16 different entities." *Id.* (alteration in original) (quoting Ex. 2061 ¶ 2).

Petitioner likewise moves to exclude Exhibit 2061, Dr. Silzars's declaration, because Dr. Silzars lacks "personal knowledge of the origin of any of the products discussed in his declaration." *Id.* at 4–5 (citing Fed. R. Evid. 602). All of these exhibits relate to Patent Owner's evidence of copying as a secondary consideration of nonobviousness, which we have accorded little to no weight above. *See supra* § II.D.i.5. We also have determined that certain challenged claims are unpatentable despite this evidence. *See supra* § II.D.2–10. Under these circumstances, we find the better course of action is to maintain a complete record of the evidence to facilitate review rather than to exclude these exhibits. Thus, we *dismiss as moot* Petitioner's motion to exclude Exhibits 2044–2061.

III. CONCLUSION[12]

Petitioner has shown, by a preponderance of the evidence, that the subject matter of claims 1, 4–10, 13, and 15 of the '683 patent would have been obvious over Phan. Petitioner has not shown, by a preponderance of the evidence, that (1) the subject matter of claim 2 of the '683 patent would have been obvious over the combination of Phan and Yamada; (2) the subject matter of claims 1, 2, 4–10, 13, and 15 of the '683 patent would have

[12] 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).

been obvious over the combination of Matthies and Yamada; or (3) the subject matter of claims 1, 2, 4–10, 13, and 15 of the ’683 patent would have been obvious over the combination of Murai and Yamada.

We *grant* Petitioner’s First Motion to Strike as to the following statement from page 69 of Patent Owner’s Response: “For example, the AMOLED display used in the Samsung Galaxy S22 Ultra product practices all challenged claims of the ’683 Patent. Ex. 2009, ¶¶328-330; Ex. 2028 (Galaxy S22 ULTRA Claim Chart); Ex. 2063.” We also *grant* Petitioner’s First Motion to Strike as to the following statement from pages 66–67 of Patent Owner’s Response: “These pixel arrangements . . . infringe the challenged claims (*see, e.g.*, Ex. 2042 (chart mapping claims 1-2, 4-10, 13, and 15 to Group Vertical AMOLED Display); Ex. 2043 (chart mapping claims 1-2, 4-10, 13, and 15 to Sourcely Plus AMOLED Display)).” We *deny* Petitioner’s First Motion to Strike as to the following statement from page 66 of Patent Owner’s Response: “Petitioner Mianyang BOE copied Samsung Display’s pixel arrangements to commercialize AMOLED displays for products including the iPhone 12. Ex. 2009, ¶319.”

We *dismiss as moot* Petitioner’s Second Motion to Strike and Petitioner’s Motion to Exclude.

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not shown Unpatentable
1, 2, 4–10, 13, 15	103(a)	Matthies, Yamada		1, 2, 4–10, 13, 15
1, 4–10, 13, 15	103(a)	Phan	1, 4–10, 13, 15	
2	103(a)	Phan, Yamada		2
1, 2, 4–10, 13, 15	103(a)	Murai, Yamada		1, 2, 4–10, 13, 15
Overall Outcome			1, 4–10, 13, 15	2

IV. ORDER

Accordingly, it is

ORDERED that claims 1, 4–10, 13, and 15 of the ’683 patent are unpatentable;

FURTHER ORDERED that claim 2 of the ’683 patent is not unpatentable;

FURTHER ORDERED that Petitioner’s First Motion to Strike (Paper 23) is *granted-in-part* and *denied-in-part* as indicated above;

FURTHER ORDERED that Petitioner’s Second Motion to Strike (Paper 32) is *dismissed as moot*;

FURTHER ORDERED that Petitioner’s Motion to Exclude (Paper 38) is *dismissed as moot*; and

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

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