

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.

IPR2023-00987
Patent 9,818,803 B2

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

LEE, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Mianyang Boe Optoelectronics Technology Co., Ltd., Wuhan China Star Optoelectronics Semiconductor Display Technology Co., Ltd., Tianma Microelectronics Co. Ltd., and Visionnox Technology, Inc. (collectively “Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–5 and 19–21 (“challenged claims”) of U.S. Patent No. 9,818,803 B2 (Ex. 1001, “the ’803 patent”). Paper 1. Samsung Display Co., Ltd. (“Patent Owner”) filed a Preliminary Response. Paper 9 (“Prelim. Resp.”).

We have authority to determine whether to institute review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. Upon consideration of the contentions and the evidence of record before us, we conclude Petitioner has shown a reasonable likelihood that it would prevail in establishing unpatentability of at least one challenged claim of the ’803 patent. Accordingly, we institute an *inter partes* review of all challenged claims of the ’803 patent on all grounds set forth in the Petition.

II. BACKGROUND

A. *Real Parties in Interest*

Petitioner identifies itself and its subsidiaries as real parties in interest. Pet. 3. Patent Owner identifies Samsung Display Co., Ltd., as the real party in interest. Paper 7, 2.

B. *Related Matters*

The parties identify the following two proceedings as related to the ’803 patent (Pet. 3; Paper 7, 2):

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

2. *Samsung Display Co., Ltd. v. BOE Technology Co., Ltd.*, Case No. 2-23-cv-00309 (E.D. Tex.).

C. *The '803 Patent*

The '803 patent is directed to “a pixel arrangement structure of an organic light emitting diode (OLED) display.” Ex. 1001, 1:18–19. The '803 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 1:38–40. The '803 patent notes, however, 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 1:40–45. The '803 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 of the pixels. *Id.* at 7:25–32.

The '803 patent states that a “pixel refers to a minimum unit for displaying an image (for example, the minimum addressable unit of the display).” Ex. 1001, 3:55–57. The '803 patent also states 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.” *Id.* at 1:59–62.

Figure 1 of the '803 patent is reproduced below.

FIG. 1

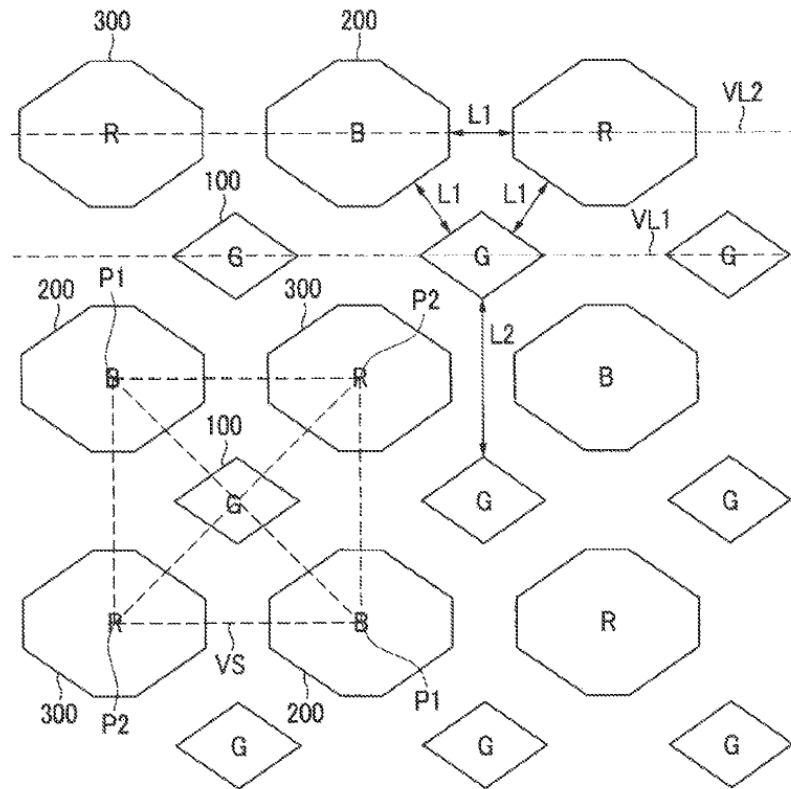


Figure 1 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 2:66–67. “[T]he pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300.” *Id.* at 3:52–55. First pixels 100 emit green light, second pixels 200 emit blue light, and third pixels 300 emit red light. *Id.* at 4:11–12, 4:30–31, 4:43–44.

According to the '803 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, 4:4–7. “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 4:14–18. “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 4:18–21.

According to the ’803 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, 4:32–34. The ’803 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 5:20–23.

The ’803 patent further states:

[T]he 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, 5:9–19.

Figure 2 of the '803 patent is reproduced below.

FIG.2

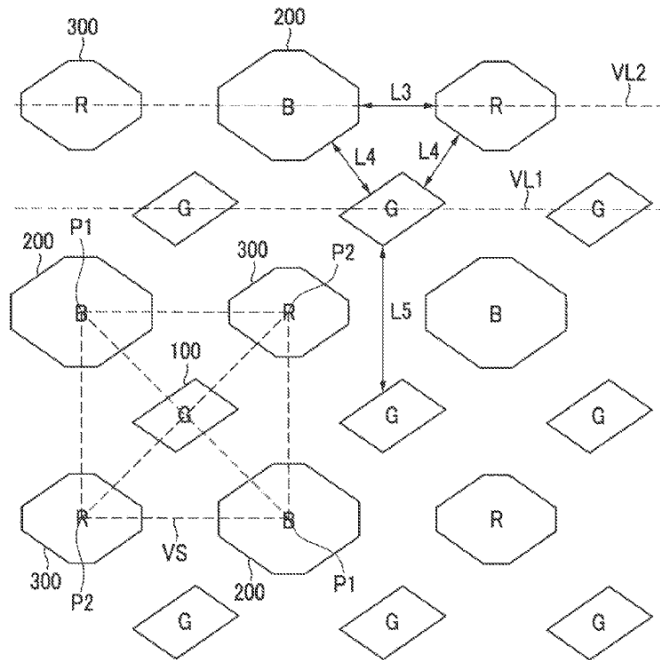


Figure 2 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 3:1–3. In Figure 2, “[t]he plurality of first pixels 100 have the same quadrilateral shape (e.g., a parallelogram)” and “the second pixels 200 have a larger area than the third pixels 300.” *Id.* at 5:67–6:2. According to the '803 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 6:44–49.

Figure 5 of the '803 patent is reproduced below.

FIG.5

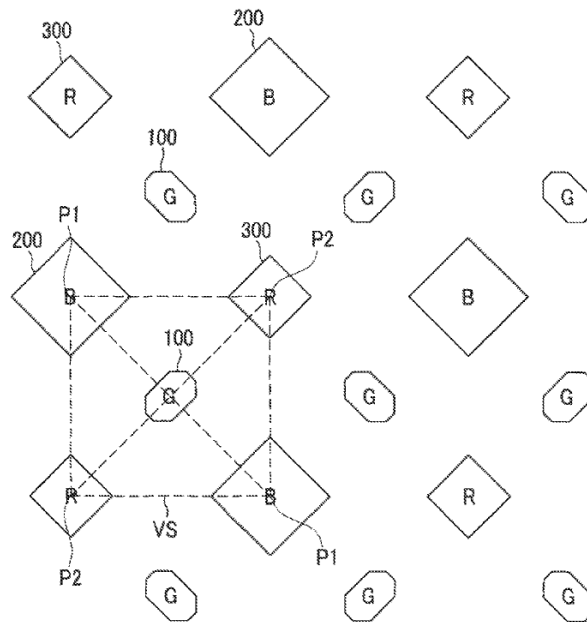


Figure 5 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 3:9–10. According to the '803 patent, “the neighboring first pixels 100 have a octagonal shape and are symmetrical to each other, while the second pixels 200 have a larger area than the third pixels 300.” *Id.* at 8:31–34. The '803 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 8:34–38.

D. Illustrative Claim

Claim 1 is independent and claims 2–5 and 19–21 each depend, directly or indirectly, from claim 1. Claim 1 is reproduced below:

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 having a center coinciding with a center of a virtual square;

[1-a(2)] a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;

[1-a(3)] another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line from among the plurality of pixels; and

[1-a(4)] a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

[1-b] wherein the second pixel has a larger area than that of the third pixel, and

[1-c] wherein the first pixel is configured to emit green light.

Ex. 1001, 8:58–9:9.¹

E. Prior Art and Declaration Evidence

Petitioner relies on the following evidence:²

U.S. Patent No. 6,897,855 B1, filed Feb. 16, 1999, issued May 24, 2005 (Ex. 1004, “Matthies”);³

¹ The bracketed labels correspond to those used by Petitioner to reference the claim elements. *See* Pet. 20–34, 46–54, 65–74. We use the same labels here for ease of reference, understanding, and consistency.

² The ’803 patent issued from Application No. 13/614,197, filed September 12, 2013, and claims priority to KR 10-2012-0022967, filed March 6, 2012. Ex. 1001, codes (21), (22), (30).

³ Petitioner incorrectly states that Matthies issued on May 23, 2005, when it actually issued one day later on May 24, 2005. Pet. 11; Ex. 1004, code (45). This does not affect whether Matthies qualifies as prior art.

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”);⁴ and

U.S. Patent No. 6,366,025 B1, filed Feb. 24, 2000, issued Apr. 2, 2002 (Ex. 1008, “Yamada”).

Petitioner also relies on the Declaration of P. Morgan Pattison, Ph.D. Ex. 1003. Patent Owner has not submitted any declaration testimony with its Preliminary Response.

F. The Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims of the ’803 patent are unpatentable based on the following grounds (Pet. 5):

Claims Challenged	35 U.S.C. §	References
1–5, 19–21	103(a) ⁵	Matthies, Yamada
1–4, 19–21	103(a)	Phan
5	103(a)	Phan, Yamada
1–5, 19–21	103(a)	Murai, Yamada

⁴ Murai is a Japanese-language publication (Ex. 1006) that was filed with an English translation (Ex. 1007, 1–15) and a declaration attesting to the accuracy of the translation (*id.* at 16). Our citations to Murai refer to the English translation. Petitioner appears to have cited Murai’s “Registration Date” of April 23, 2020, as being the publication date. *See* Pet. 15; Ex. 1007, code (24). It is unclear based on the present record whether this is the correct date for qualifying Murai as a “printed publication” under pre-AIA § 102(b). The parties should further address this issue at trial.

⁵ 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 ’803 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.

III. ANALYSIS

We now consider Petitioner’s asserted grounds and Patent Owner’s arguments to determine whether Petitioner has met the “reasonable likelihood” standard for institution under 35 U.S.C. § 314(a).

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.⁶ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

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. 12 (citing Ex. 1003 ¶¶ 37–40). 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

⁶ The present record does not include any evidence of secondary considerations of nonobviousness.

operation. *Id.* (citing Ex. 1003 ¶ 40). Patent Owner does not dispute Petitioner’s proposed level of ordinary skill in the art at this time, noting that “[f]or purposes of this Preliminary Response, Patent Owner does not believe it is necessary to define the level of ordinary skill in the art.” Prelim. Resp. 10.

At this preliminary stage and on this record, we adopt Petitioner’s statement of the level of ordinary skill in the art. It is supported by the testimony of Dr. Pattison and not disputed by Patent Owner. Further, it 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).

C. Claim Interpretation

We use the same claim construction standard that would be used to construe a 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) (2022). The claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) is applicable.

Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is

dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

The specification may reveal a special definition given to a claim term by the patentee, or the specification or prosecution history may reveal an intentional disclaimer or disavowal of claim scope by the inventor. *Id.* at 1316. “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).

If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The disavowal, if any, can be effectuated by language in the specification or the prosecution history. *Poly-Am., L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016).

Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368 (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))).

Petitioner states that “[f]or purposes of this petition . . . the terms of the ’803 patent’s claims do not require further construction and can be afforded their plain and ordinary meaning.” Pet. 12. Patent Owner points out that “the Administrative Law Judge in the related ITC Investigation

No. 337-TA-1351 issued a claim construction order” which “did not construe any claim terms of the ’803 patent.” Prelim. Resp. 10 (citing Ex. 2001). Patent Owner further states that “the parties in the ITC Investigation submitted a list of claim constructions to which the parties agreed, which included certain claim terms of the ’803 patent.” *Id.* (citing Ex. 2002). Patent Owner indicates however that, for the purposes of its Preliminary Response, it “does not believe that any specialized constructions are necessary,” and that “[t]he Petition fails to establish a reasonable likelihood of prevailing under any claim interpretation.” *Id.*

On the current record, we agree with the parties that it is not necessary to conduct express claim construction for any claim term.

D. Alleged Obviousness of Claims 1–5 and 19–21 over Matthies and Yamada

1. Overview of 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 by “[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.

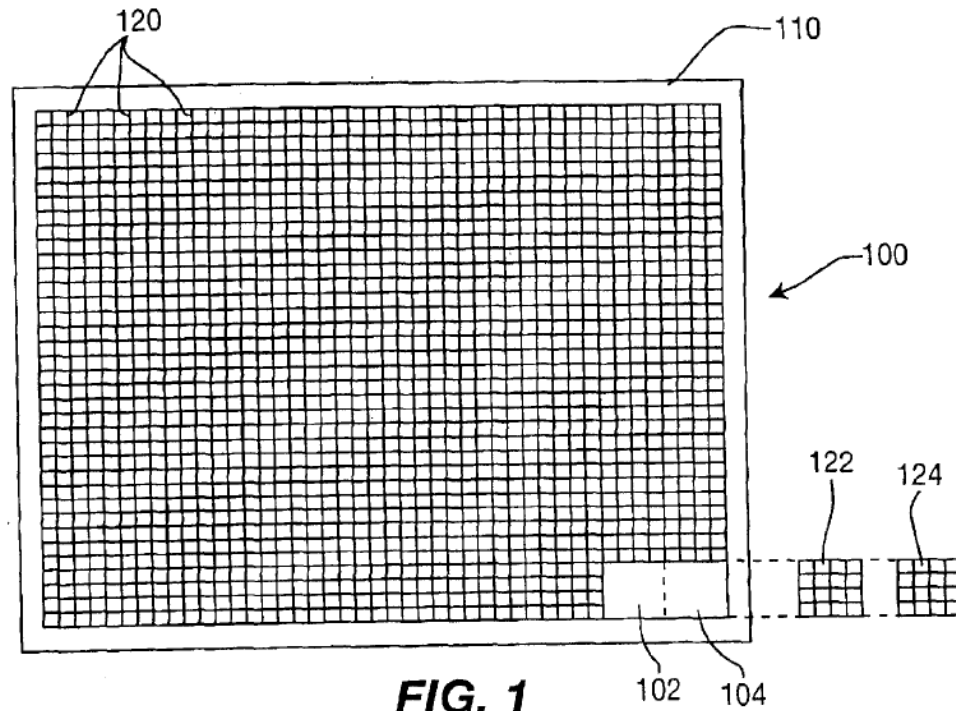


Figure 1 “is a front plan drawing of a large area display device from which two tiles have been removed.” Ex. 1004, 3:49–50. According to Matthies, “display 100 is a tiled display in which emissive or reflective elements, on which the image pixels are formed, are built as relatively small arrays on tiles 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.

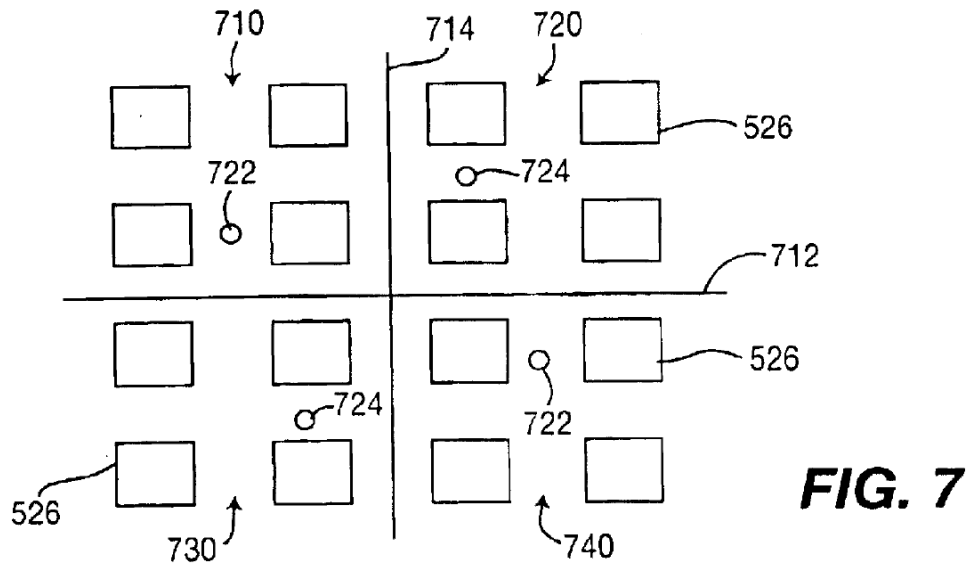


Figure 7 “is a pixel diagram which shows an exemplary pixel layout for portions of four tiles.” Ex. 1004, 4:6–7. “In the layout shown in FIG. 7, the active portions 526 of the pixels are centered in their respective pixel regions and the vias which connect the row and column electrodes of the display 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.

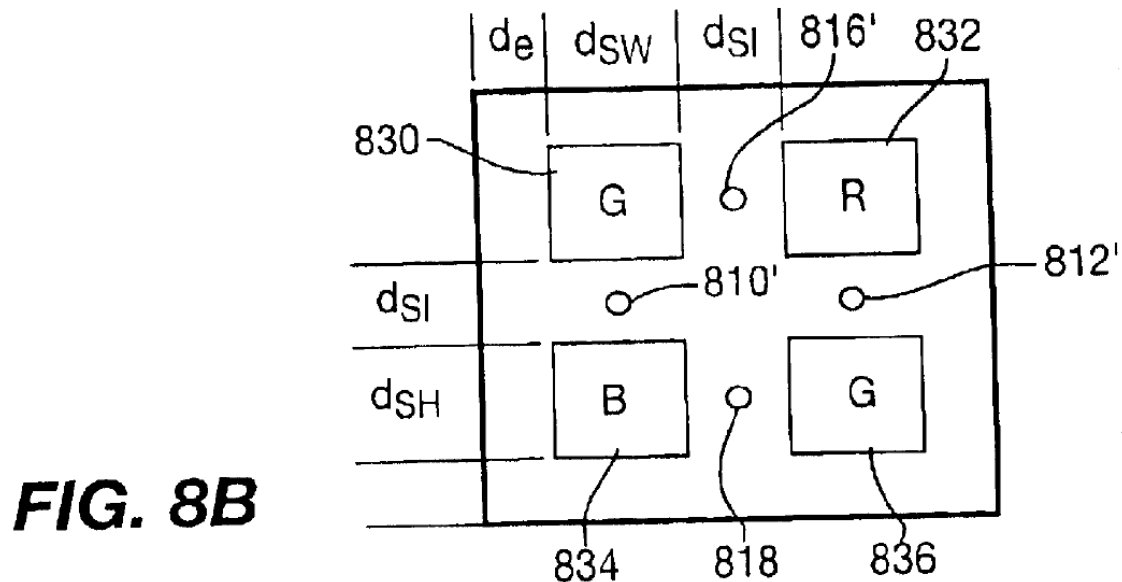


Figure 8B is “a front-plan view of an alternative single color pixel structure which includes separate sub-pixels.” Ex. 1004, 4:12–13. According to Matthies, Figure 8B illustrates a “color pixel structure” that “includes four sub-pixel elements, 830, 832, 834 and 836.” *Id.* at 16:62–64. “Two of these 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_{SL} , 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. *Overview of 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, 1R, and 1G for the display pixel of the respective color . . . arranged in a matrix configuration.” *Id.* at 2:55–60. 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 identical emissive areas in size,” “in order to obtain the same luminance at the display pixels having a low emission efficiency, a current larger than that supplied to the other display pixels having a high emission efficiency must be supplied.” *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. Yamada describes:

By 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. Yamada states that “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.

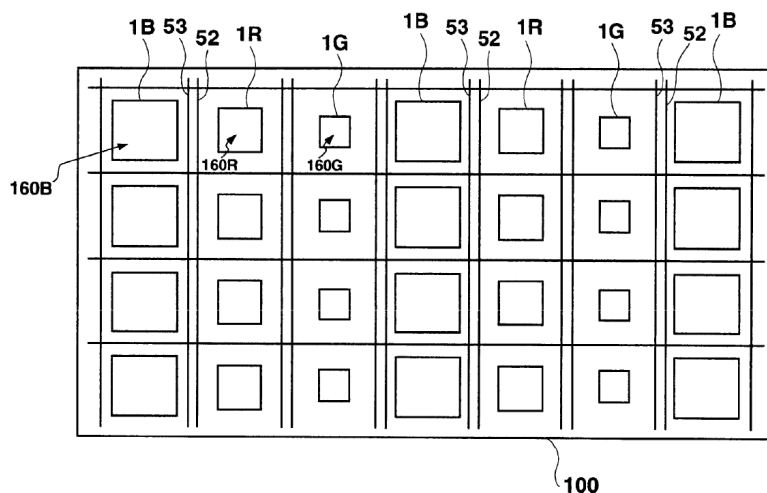


Fig. 4

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.

3. *Independent Claim 1*

The preamble of claim 1 recites “[a] pixel arrangement structure of an organic light emitting diode (OLED) display.” Ex. 1001, 8:58–59.

Petitioner asserts: “Matthies discloses a tiled ‘electronic display device.’” (Ex. 1004, 1:8–10.) The display can be an ‘OLED . . . display’ that includes OLED ‘pixel forming elements.’” Pet. 20 (citing Ex. 1004, 5:29–30, 6:18–22, 16:40–43). Therefore, even assuming that the preamble of claim 1 is limiting, it is disclosed by Matties. Patent Owner does not present a counterargument in this regard.

For reasons explained by Petitioner, Matthies discloses, in one exemplary embodiment, each of limitations 1-(a), 1-a(1), 1-(a)(2), 1-a(3), 1-a(4), and 1-c.

Limitation 1-(a) recites “a plurality of pixels for displaying an image on the OLED display.” Ex. 1001, 8:60–61. Petitioner explains:

Matthies relates to an “OLED . . . display device.” (Ex. 1004, 3:6–7, 5:29–30, 6:18–22, 16:40–43.) This device is formed as a “tiled display” that includes a multitude of “picture element[s]”

or “pixels.” (Ex. 1004, Abstract; *see also id.*, 2:35–37.) In one embodiment, the display pixels can be formed from “red(R) . . . , green (G) . . . and blue (B) . . . sub-pixels,” each of which is formed from an “OLED material[.]” (Ex. 1004, 16:40–44; 13:1–2.)

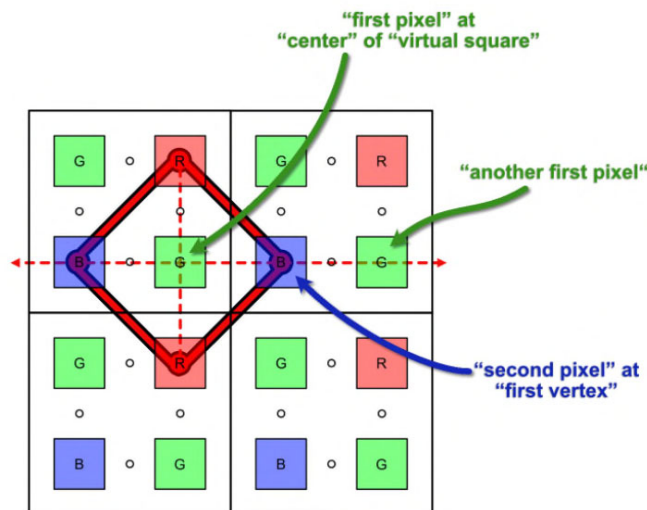
The sub-pixels receive “image data for display.” (*Id.*, 2:58–63.) Each sub-pixel can [be] “controlled by a single row and column electrode pair.” (*Id.*, 16:38–41; *see also id.*, 9:10–13; Fig. 2.) There can be a large number of sub-pixels in each of the display’s tiles (*i.e.*, from 16 to 896). (*Id.*, 5:54–61.)

In the ’803 patent, the “term pixel refers to a minimum unit for displaying images.” (Ex. 1001, 1:31–32; 3:55–56.) Matthies includes such a “plurality of pixels” (its red, green, and blue OLED sub-pixels are its display’s minimum unit). And, Matthies’ sub-pixels together form an “OLED display” for “displaying an image.” (Ex. 1003, ¶¶ 151–159.)

Pet. 21. Patent Owner presents no counterargument in this regard.

Petitioner’s assertions are supported by the cited evidence. We are sufficiently persuaded that Matthies discloses limitation 1-(a).

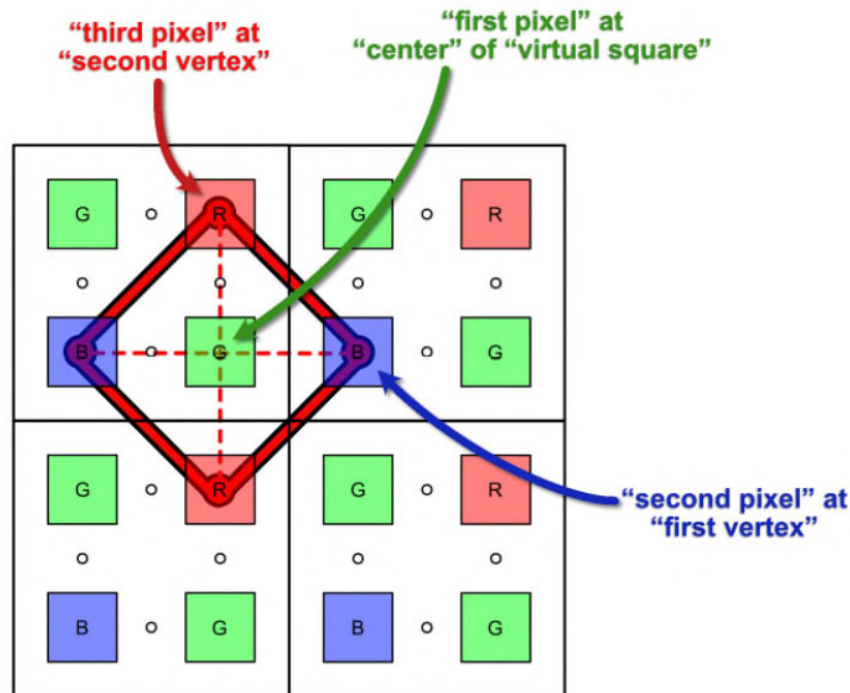
Petitioner then presents an expanded version of tile 124 in Figure 1 of Matthies, reproduced below with Petitioner’s color annotations, to illustrate how limitations 1-a(1), 1-(a)(2), 1-a(3), and 1-c are met by Matthies:



In this illustration, Petitioner expands tile 124 in Figure 1 of Matthies, with color annotations, to show Matthies's disclosure of limitations 1-a(1), 1-a(2), 1-a(3), and 1-c. Pet. 25–29.

Specifically, the illustration shows a first pixel (green) having a center coinciding with the center of a virtual square (red sides), which is limitation 1-a(1). The illustration shows a second pixel (blue) separated from the first pixel and having a center at a first vertex of the virtual square, which is limitation 1-a(2). The illustration shows another first pixel (green) on a line defined by the center of the virtual square and the first vertex, where the first pixel, the second pixel, and the other first pixel are consecutive pixels on the line, which is limitation 1-a(3). Limitation 1-c recites that the first pixel is configured to emit green light. As shown in the illustration, the first pixel is green. Patent Owner does not present counterarguments with regard to these contentions of Petitioner. We find these assertions of Petitioner to be supported by the disclosures of Matthies as cited by Petitioner on pages 25–29 of the Petition.

Petitioner then presents an expanded version of tile 124 in Figure 1 of Matthies, reproduced below with different color annotations from Petitioner, to illustrate how limitation 1-a(4) is met by Matthies:



The illustration shows a third pixel (red) separated from the first pixel (green) and the second pixel (blue), and having a center at a second vertex neighboring the first vertex of the virtual square. Pet. 29–30. Patent Owner does not present counterarguments with regard to these contentions of Petitioner. We find these assertions of Petitioner to be supported by the disclosures of Matthies as cited by Petitioner on pages 25–30 of the Petition.

What remains is limitation 1-b, which recites “wherein the second pixel has a larger area than that of the third pixel.” Ex. 1001, 9:7–8. Matthies does not disclose this limitation because, according to Matthies’s Table 2 and Figure 8, all pixels are the same size. Ex. 1004, 17:16–30. Thus, Petitioner relies on Yamada for teaching limitation 1-b.

Petitioner explains:

Matthies explains that it also “contemplates both larger and smaller pixel apertures.” ([Ex. 1004,] 17:36–28.) Further, sub-pixel spacing can also be made “different” if needed. (*Id.*,

17:31–33; *see also id.*, 19:9–10 (referencing the use of “different pixel pitches”).)

Yamada provides an example of an array of red, green, and blue pixels that are differently sized and have different amounts of pixel-to-pixel spacing. Like Matthies, Yamada relates to an “electroluminescent display apparatus.” (Ex. 1008, 1:6–10.) Also like Matthies, Yamada explains that such a display includes red, blue, and green “pixel[s] . . . arranged in a matrix configuration.” (*Id.*, 2:55–60; *see also id.*, 6:44–7:2.) In such a display, the different colors’ “emission layer[s]” have different “emission efficienc[ies].” (*Id.*, 2:53–54.) To account for this, Yamada re-sizes the pixels “in accordance with . . . emission efficiency.” (*Id.*, 2:5–60, 3:16–27.) Yamada explains that in a typical OLED display, the “green pixel” has the highest efficiency and is thus made smallest, while the “blue pixel” has the lowest efficiency and is made largest. (*Id.*, 7:3–12, 8:19–28; 8:47–52; 10:52–55; 11:4–15; *see also* 3:38–44, 3:51–57.)

Pet. 30–31.

Petitioner relies on Yamada’s Figure 4 (Pet. 21), reproduced below:

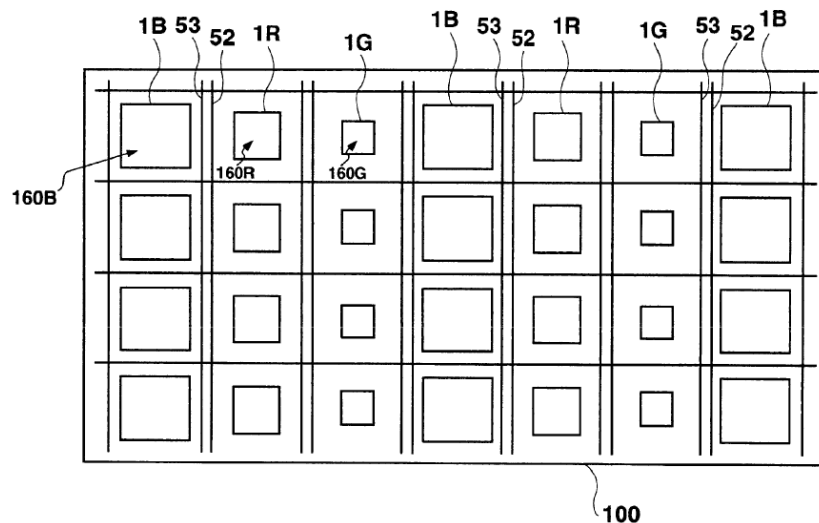


Fig. 4

Figure 4 shows the emissive regions areas of the electroluminescent display apparatus according to an embodiment of Yamada. Ex. 1008, 6:24–26.

Yamada describes what is shown in Figure 4 as follows:

As shown in FIG. 4, the display pixels for the various colors are arranged in a matrix configuration on the substrate. The emissive areas of the display pixels differ among 1R, 1B, and 1G. Specifically, in the case of FIG. 4, the emissive area of the green display pixel 1G is provided as the smallest. Emissive regions 1R and 1B of the other colors are formed with a larger area than that of emissive region 1G. More specifically in this case: Area of green emissive region 1G < area of red emissive region 1R < area of blue emissive region 1B.

The order in size of the areas of the green, red, and blue emission regions 1G, 1R, and 1B is dependent on the emission efficiency of the emissive materials of the organic EL element 160. Therefore, 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 7:3–18. Yamada also indicates that its teachings are applicable to an arrangement of the display pixels in a “delta layout” and a “diagonal layout” besides the “stripe layout” shown in Figure 4. *Id.* at 12:37–40. Yamada further provides a specific example of an area ratio among pixels of different colors: “The ratio of emissive areas of the colors required to achieve a luminance of “1” among all the colors is set to $1/10:1/3.8:1/1.8=1:2.6:5.6$.” *Id.* at 11:8–10.

Petitioner further explains:

Following these teachings, rather than making all the sub-pixels all the same size, a POSITA [person of ordinary skill in the art] would have understood that Matthies’ sub-pixels should be re-sized in accordance with their emission efficiencies such that the “first pixels” (the green sub-pixels) are smallest, the “second pixels” (the blue sub-pixels) are largest, and the “third pixels” (the red sub-pixels) have an intermediate size. The same “quad sub-pixel structure” taught by Matthies would continue to be used (just with re-sized pixels). (See [Ex. 1003] ¶¶ 222–224).

Pet. 32.

As motivation to combine, Petitioner points to Yamada's teaching that it is a problem in prior art OLED devices that the red, green, and blue pixels all have the same size, because the different colored pixels have different emissive efficiencies. Pet. 39 (citing Ex. 1008, 2:55–63). Petitioner notes Yamada's disclosure that to achieve consistent pixel luminance with same-sized pixels, the pixels with lower emission efficiencies, such as blue, must be supplied with a larger current than the pixels with higher emission efficiencies, such as green, and that that causes the pixels supplied with a larger current to have a shorter life span. *Id.* (citing Ex. 1008, 2:55–66). Petitioner further notes Yamada's disclosure that when the size of pixels of different colors are the same, color balance is difficult to achieve and would require adjustments in the supplied current which causes deterioration of pixels supplied with the higher current. *Id.* (citing Ex. 1008, 3:1–6).

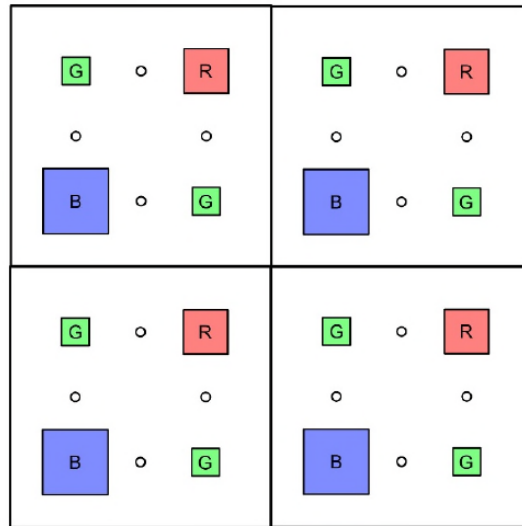
Petitioner explains:

To address this problem, Yamada teaches that the pixels with lower emission efficiencies (*blue) should be made larger than pixels with higher emission efficiencies (green). (*See* [Ex. 1008], 3:38–44, 3:51–57; 7:3–12, 8:19–28; 8:47–52; Figs. 4, 9.) Because the pixels have different sizes, luminance can be balanced while supplying each of the pixels with similar amounts of current or power. (*See id.*, 3:65–4:9.) This avoids the deterioration problem experienced in prior art OLED displays with same-sized pixels and “extend[s] the life of the display devices.” (*See id.*, 4:5–14; *see also* 10:61–11:3.) As an added benefit, the overall display design becomes “simplified” and “extremely easy to control” as each pixel is supplied with “the same amount of power.” (*Id.*, 4:57–5:8; *see also id.*, 5:41–49; Ex. 1003, ¶¶ 268–273.)

Pet. 39–40. Additionally, Petitioner asserts that one of ordinary skill in the art would have recognized that applying Yamada's re-sizing teachings to

Matthies would have provided Matthies with greater design flexibility. *Id.* at 43. In that regard, Petitioner explains that reducing the size of the more luminant green and red pixels while leaving the size of the blue pixels the same would create additional space for Matthies’s vias. *Id.* at 43–44 (citing Ex. 1003 ¶ 297).

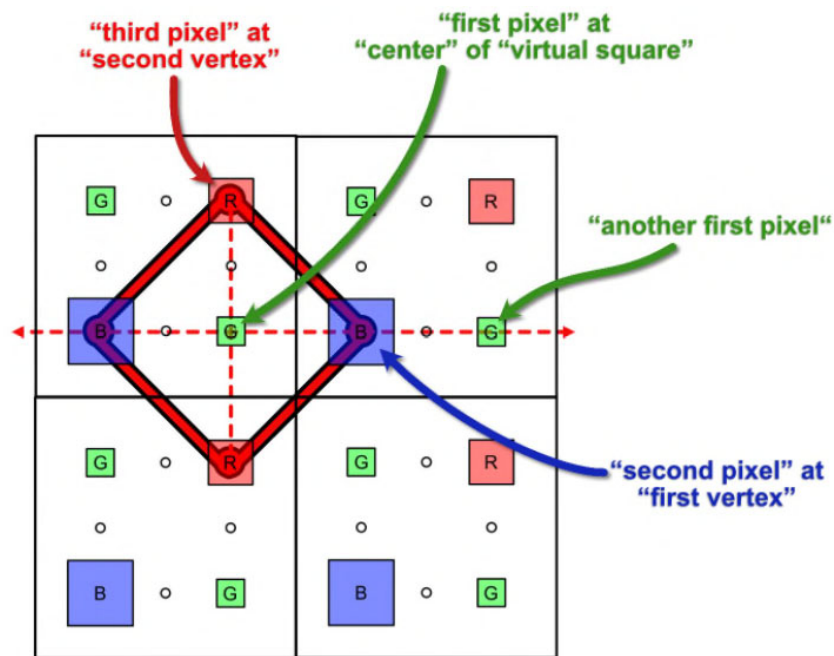
Petitioner provides an illustration of a modified tile of Matthies, with pixels re-sized according to Yamada’s formula of 1:2.6:5.6 for green to red to blue:



Pet. 33. The illustration shows Matthies’ “quad sub-pixel structure” but with the sizes of the sub-pixels modified according to the formula given in Yamada for green to red to blue as 1:2.6:5.6. *Id.* at 32. Petitioner explains: “consistent with Matthies’ teachings, it continues to be the case that no pixel occupies more than ‘1/4 of the total pixel area.’” *Id.* (citing Ex. 1004, 15:67–16:2, 13:11–14).

Petitioner then provides the following illustration of a modified Matthies pixel configuration according to the re-sizing teachings of Yamada, with color annotations to show satisfaction of all elements of claim 1, i.e.,

the claimed virtual square, the claimed first pixel at the center of the virtual square, the claimed another first pixel, the claimed second pixel at the first vertex of the virtual square, and the claimed third pixel at a second vertex of the virtual square, where the first pixel, the second pixel, and the other first pixel being consecutive pixels on a line defined by the center of the virtual square and the first vertex, *where the second pixel is larger than the third pixel*, and where the first pixel emits green light:



Pet. 33. In this illustration from the Petition, Petitioner has modified Matthies' pixel configuration according to the re-sizing teachings of Yamada. *Id.*

Petitioner's assertions are logical and supported by the cited evidence. Notwithstanding Patent Owner's arguments to the contrary regarding why the teachings of Matthies and Yamada may not properly be combined, which we discuss below, we are sufficiently persuaded that Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 1 over Matthies and Yamada.

a. *Discussion of Patent Owner Arguments*

Patent Owner disputes Petitioner’s rationale for combining Matthies with Yamada. In particular, Patent Owner notes that Yamada uses an active matrix OLED (AMOLED) display, which is different than Matthies’s passive matrix OLED (PMOLED) display. Prelim. Resp. 14, 17–18 (citing Ex. 1004, 10:31–33; Ex. 1008, 1:6–9). In light of that difference, Patent Owner argues that Petitioner has not established a reasonable expectation of success in making the combination. Prelim. Resp. 19–26. Patent Owner also criticizes Dr. Pattison’s testimony that “it was well-known and routine in the art to resize OLED pixels to improve display lifetime” because he “says nothing about how the OLED pixels *in the passive matrix display tiles of Matthies* could be sized differently from one another.” *Id.* at 20–21 (citing Ex. 1003 ¶¶ 306–307, 310). Patent Owner additionally notes that Matthies teaches “pixel forming elements evenly spaced up to the edges of the tiles,” whereas Yamada teaches differently-sized pixels. *Id.* at 26 (citing Ex. 1004, 5:47–48); *see also id.* at 24–25 (discussing irregularly shaped pixels in Yamada’s Figure 5). On that basis, Patent Owner argues that “Petitioner does not even attempt to explain how differently sized pixels could be used with Matthies’ pixel geometry.” *Id.* at 26–29.

At this stage, Petitioner’s contentions are supported by Dr. Pattison’s testimony, and Patent Owner’s positions, though extensively supported with citations to the underlying record, amount to attorney argument. Notwithstanding, we look forward to the parties further developing the record at trial on the potential incompatibilities in Petitioner’s combination, including the differences between PMOLED and AMOLED technologies

and any differences in pixel geometry between Matthies and Yamada. We will be better able to decide these issues with a fully developed record.

Patent Owner also asserts that an ordinarily skilled artisan would have taken other avenues in making the combination even if the references are combinable. In particular, Patent Owner argues that an ordinarily skilled artisan (1) would have started with Matthies's embodiments using an RGB triple subpixel structure arranged in a stripe pattern (Prelim. Resp. 29–32); (2) would have modified Matthies's quad subpixel structure so that it has two blue pixels instead of two green subpixels (*id.* at 32–35); and/or (3) would not have reduced the area of the green pixels (*id.* at 35–38). We feel that these issues involving alternative design pathways would be best decided in the context of a fully developed record.

b. Conclusion

For the foregoing reasons, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 1 over Matthies and Yamada.

4. Dependent Claims 2–5 and 19–21

Petitioner addresses in detail these claims on the alleged ground of obviousness over Matthies and Yamada. Pet. 34–39. The reasoning to combine teachings of Matthies and Yamada are also explained. *Id.* at 39–45. Patent Owner's arguments pertain only to Petitioner's reasoning to combine the teachings of Matthies and Yamada, and are the same as those presented in the context of claim 1 and already discussed above.

On the current record, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of each of claims 2–5 and 19–21 over Matthies and Yamada.

E. Alleged Obviousness of Claims 1–4 and 19–21 over Phan

1. Overview of Phan

Phan is a U.S. patent directed to a “display comprising pixels and dots.” Ex. 1005, 1:18–19. Phan describes 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:

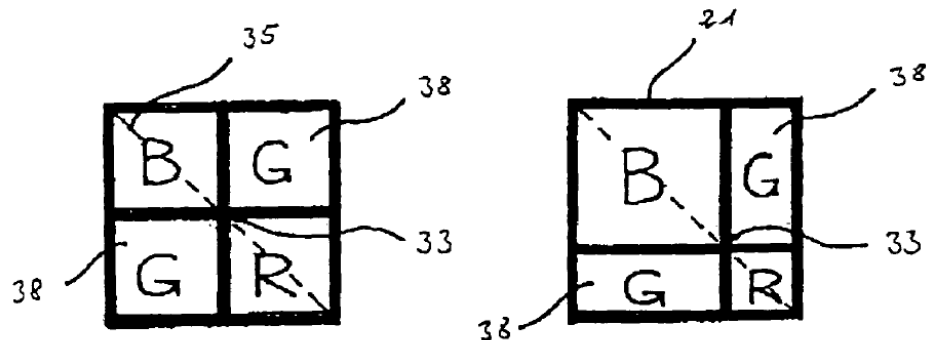


FIG. 11a

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,⁷ 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.

2. *Independent Claim 1*

Claim 1’s preamble recites “[a] pixel arrangement structure of an organic light emitting diode (OLED) display.” Ex. 1001, 8:58–59. Phan describes that its invention provides a display of the kind comprising pixels and dots, including “Organic Light Emitting Diode (OLED).” Ex. 1005, 1:18–24, 2:51–53. On that basis, Petitioner asserts the preamble is met. Pet. 46. Notwithstanding Patent Owner’s argument to the contrary, discussed below, we find that Phan teaches, or at least fairly suggests, sufficient for institution, that its disclosed display technologies may be implemented as an OLED display.

For limitation 1-(a), which recites “a plurality of pixels for displaying an image on the OLED display,” Petitioner identifies Phan’s “dots” as the claimed pixels. Pet. 47. Petitioner explains: “According to Phan, a typical ‘display’ includes ‘so-called pixels’ that ‘consist of so-called dots representing the three basic colours of red, green, and blue.’ (Ex. 1005, 1:57–61.) The ‘[d]ots are sources of luminous radiation the light’ for purposes of generating a display. (*Id.*, 1:61–64.)” Petitioner also explains that in Phan each dot has a receiver of its own that allows it to be addressed

⁷ What Phan refers to as a “dot” corresponds to what the ’803 patent refers to as a “pixel” because, as noted above, the ’803 patent states: “Here, the pixel refers to a minimum unit for displaying an image.” Ex. 1001, 3:55–56.

and controlled by control circuitry through a network. *Id.* at 46–47 (citing Ex. 1005, 5:12–19; Fig. 5). Petitioner identifies Phan’s “dots” as Phan’s minimum unit for display. *Id.* at 47. Petitioner further notes that Phan’s invention relates to a display, comprising pixels and dots, that employs display technologies like “Organic Light Emitting Diode (OLED). *Id.* (citing Ex. 1005, 1:18–29).

Patent Owner presents no counterargument in this regard. Petitioner’s assertions are supported by the cited evidence. We are sufficiently persuaded that Phan discloses limitation 1-(a).

Petitioner relies on Phan’s Figures 11a, 11b, and 12 to account for limitations 1-(a), 1-a(1), 1-(a)(2), 1-a(3), 1-a(4), 1-b, and 1-c. Pet. 48–54. Figures 11a and 11b are reproduced below:

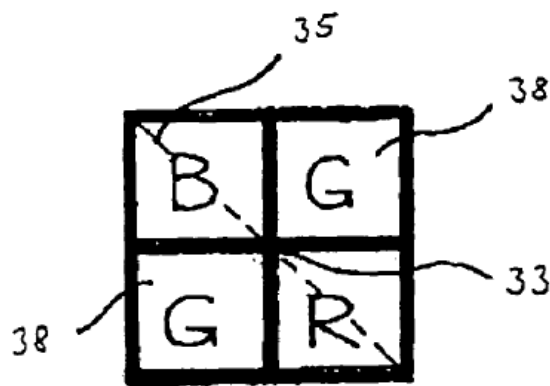


FIG. 11a

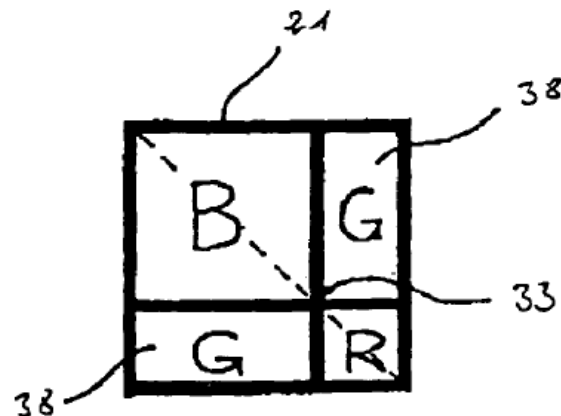


FIG 11b

Figure 11a shows a square quad pixel where the crosspoint is in the center of the four dots (individual elements) of equal light emitting area and space, contoured by black mask or black barrier ribs with the same structure. Ex. 1005, 3:64–67. Figure 11b shows a typical square quad pixel where the crosspoint moving along the diagonal line forms two dots (individual

elements) of equal light emitting area and space of green color (G). *Id.*
at 4:1–4. Petitioner asserts that either “quad pixel” is intended for use in the
“quad pixel display” of Figure 12. Pet. 49 (citing Ex. 1005, 5:47–60).

Figure 12 is reproduced below:

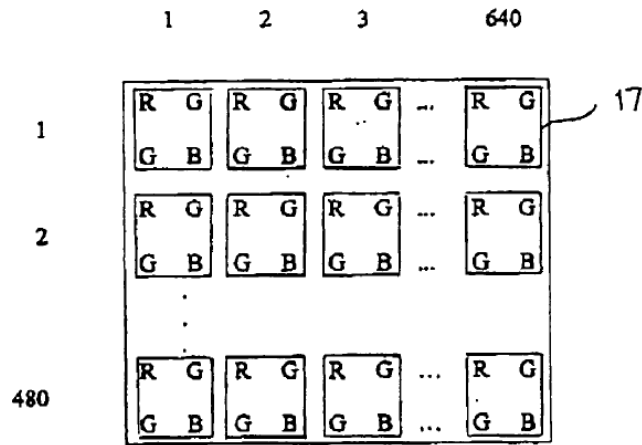


FIG. 12

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

Petitioner provides an illustration of what results when applying the quad pixel of Figure 11b into the display structure of Figure 12, as follows:

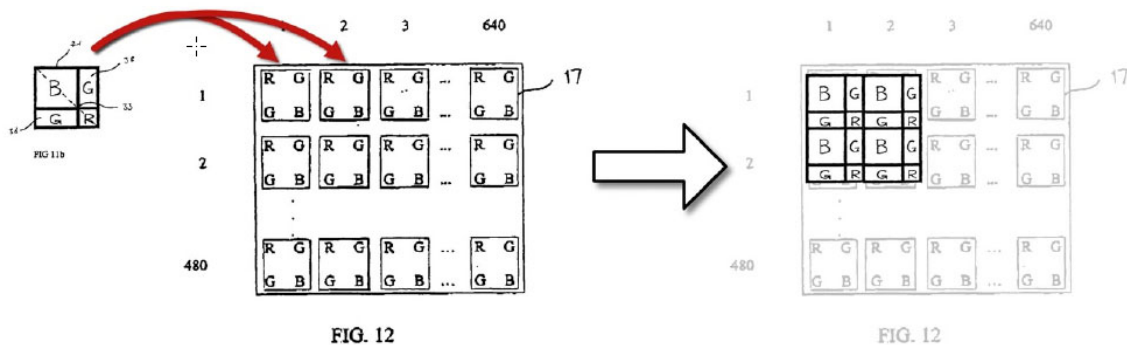


FIG. 12

FIG. 12

Pet. 49. The figure shows substituting into the display structure of Figure 12 the quad pixel arrangement of Figure 11b for each quad pixel in Figure 12.
Id.

Petitioner asserts that one of ordinary skill in the art would have been motivated to apply the quad pixel structure of Phan's Figure 11b into the pixel display structure of Phan's Figure 12. *Id.* at 58. According to Petitioner, one of ordinary skill in the art would have considered the quad pixel structure of Figure 11b a starting place when implementing the rest of what Phan teaches. *Id.* (citing Ex. 1003 ¶ 400). Petitioner explains:

The “quad pixel” designs of Figures 11a and 11b are also characterized as “typical.” (Ex. 1005, 5:47–54.) This would have both further motivated a POSITA [person of ordinary skill in the art] to use and give a POSITA every reason to believe that those pixels can be successfully employed with the displays referenced elsewhere in Phan. (Ex. 1003, ¶¶ 401–403; *see also* Ex. 1005, 7:12–17 (explaining that Phan's examples are not meant to be limited and are instead intended to be “varied”).)

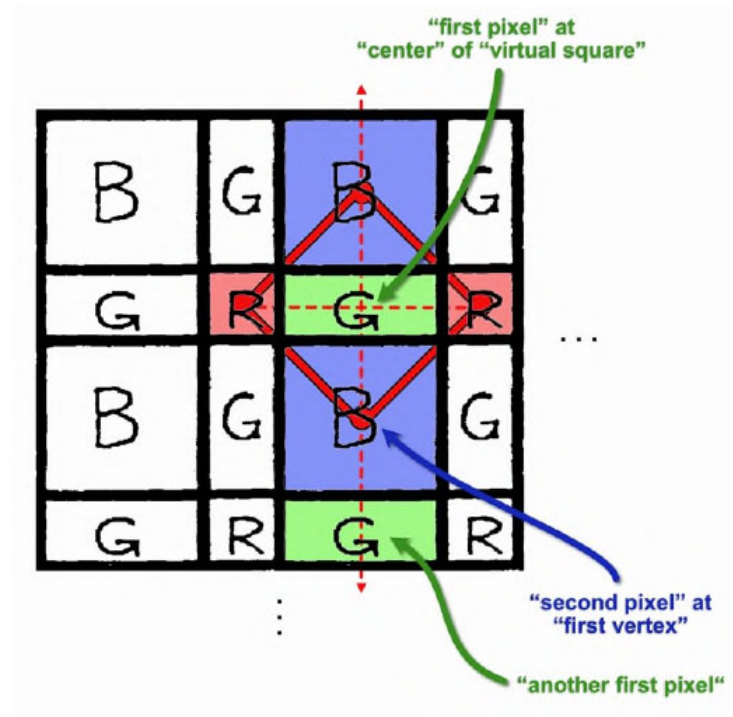
Id. at 58–59.

Petitioner further explains:

Phan teaches that its pixel dots are “regularly disposed” and arranged in a “square.” The square pixels are then arranged in a grid or matrix where every pixel is “identically” shaped. (*See, e.g., id.*, 4:29–32; 4:41–43; 5:47–54.) Due to the use of a square pixel shape that is regularly arranged in an identically repeating matrix, Phan's dots form a “**virtual square**” with a green dot at its “**center**.”

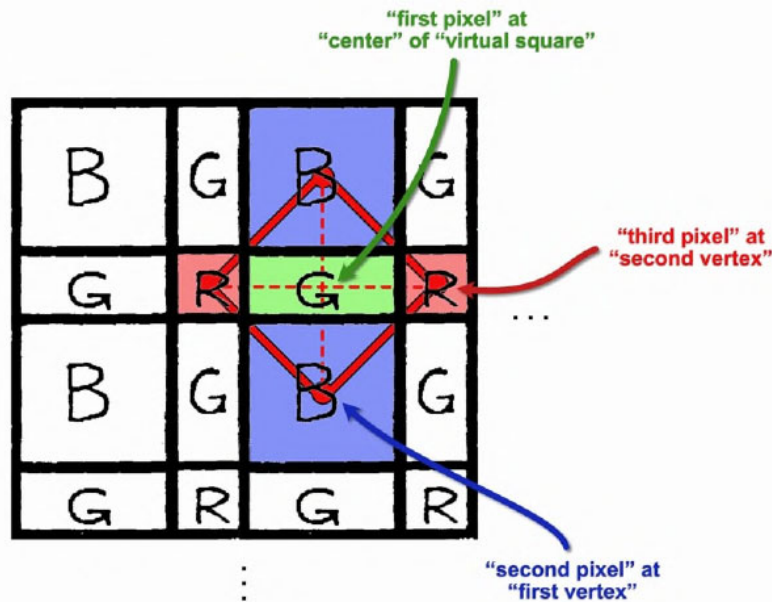
Id. at 50.

Petitioner then uses the following illustration, with color annotations, to illustrate how limitations 1-a(1), 1-(a)(2), 1-a(3), and 1-c are met by applying the quad pixel structure of Phan's Figure 11b into the pixel display of Phan's Figure 12:



The illustration is Petitioner's depiction of the resulting arrangement when the quad pixel structure of Phan's Figure 11b is substituted into the pixel display structure of Phan's Figure 12. Pet. 51–52. In this illustration, the first pixel at the center of a virtual square (marked by red solid lines) is identified (limitation 1-a(1)), a second pixel separated from the first pixel and having a center at a first vertex of the virtual square is identified (limitation 1-a(2)), and another first pixel on a line defined by the center of the virtual square and the first vertex, where the first pixel, the second pixel, and the other first pixel are consecutive pixels on the line, are identified (limitation 1-a(3)). The illustration also identifies the first pixel as emitting green light (limitation 1-c).

Petitioner then provides the following illustration, with color annotations, to show how limitations 1-a(4) and 1-b are met by applying the quad pixel structure of Phan's Figure 11b into the pixel display of Phan's Figure 12:



This illustration is Petitioner's depiction of the resulting arrangement when the quad pixel structure of Phan's Figure 11b is substituted into the pixel display structure of Phan's Figure 12, which shows a first pixel at the center of a virtual square, a second pixel at a first vertex of the virtual square, and a third pixel at a second vertex of the virtual square. Pet. 52–53. In this illustration, Petitioner identifies a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square (limitation 1-a(4)). Also in this illustration, Petitioner shows that the second pixel (blue) has a larger area than that of the third pixel (red) (limitation 1-b).

Notwithstanding the contrary arguments of Patent Owner, discussed below, we are sufficiently persuaded that Phan does disclose a virtual square as is required by claim 1. Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 1 over Phan.

a. Discussion of Patent Owner Arguments

Patent Owner argues that “Petitioner fails to show that the embodiments of Phan on which it relies even disclose an OLED display.” Prelim. Resp. 39. In particular, Patent Owner argues that Phan’s mention of OLED displays appears only in Phan’s field of the invention, which is merely a “listing of every conceivable display technology.” *Id.* at 39–40. Patent Owner explains that this “does not show that any embodiments in Phan are OLED displays.” *Id.* at 40. Patent Owner additionally cites Phan’s teaching that “each color dot has a receiver of its own to convert digital information transmitted through a network and that the network preferably is an optical fiber network” as evidence that Phan’s embodiments pertain to “something other than an OLED.” *Id.* (citing Ex. 1005, 5:16–20). Patent Owner further argues that “neither Phan nor Petitioner explains how Phan’s embodiments can be combined with an OLED display.” *Id.*

At this stage, we find Petitioner’s showing sufficient for institution.⁸ Phan expressly states that its “invention relates to a display comprising pixels and dots, including but not limited to the following display technologies: . . . Organic Light Emitting Diode (OLED), . . . as well as a method for controlling the (said) display.” Ex. 1005, 1:18–29. Although Patent Owner disputes that this mention of OLED displays establishes that Phan’s teachings are applicable to OLED displays (*see* Prelim. Resp. 40), we find this disclosure sufficient for institution because we must consider Phan

⁸ Neither party addresses whether the preamble is limiting. Because Petitioner shows sufficiently that Phan teaches the preamble, we need not determine whether the preamble is limiting. *See Realtime Data*, 912 F.3d at 1375.

“for everything it *teaches* by way of technology,” which is “not limited to the particular *invention* it is describing.” *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). Petitioner also has put forth un rebutted testimony from Dr. Pattison that an ordinarily skilled artisan would have expected success implementing Phan’s pixel designs in the display types referenced elsewhere in Phan (e.g., OLED) (*see, e.g.*, Ex. 1003 ¶¶ 327, 401–403), whereas Patent Owner has only put forth attorney argument at this stage. Thus, based on the present record, we find that Phan teaches, or at least fairly suggests, that its disclosed display technologies may be implemented as an OLED display.

We also have considered Patent Owner’s argument that Phan’s mention of a preferred embodiment—where each color dot has a receiver of its own to convert digital information transmitted through an optical fiber network—suggests something other than an OLED display. Prelim. Resp. 40 (citing Ex. 1005, 5:16–20). Even if we were to agree with the premise of Patent Owner’s argument, however, we do not agree on the present record that this preferred embodiment necessarily limits other teachings in Phan. We also note that this argument amounts to an attorney’s interpretation of Phan that is unsupported by other evidence or testimony. Patent Owner will have an opportunity to further develop its argument at trial.

Patent Owner asserts that Petitioner fails to show that Phan discloses a virtual square. Prelim. Resp. 40. Patent Owner notes that “Petitioner proposes combining Phan’s quad pixel arrangement in Figure 11b with the quad pixel display in Figure 12,” but asserts that “for Phan’s arrangement to work there would need to be space for circuitry

such as signal lines and power lines.” *Id.* at 40–41. Patent Owner points out that “Phan’s Figure 12 shows spaces between quad pixels where, for instance, signal and/or power lines or other circuitry would apparently need to be present.” *Id.* at 41–42 (citing Ex. 1005, Fig. 12).

Patent Owner disputes Petitioner’s interpretation of its illustration, which is based on Petitioner’s conception of how Phan’s quad pixel arrangement from Figure 11b would be implemented in the display of Figure 12. Prelim. Resp. 40–44. In particular, Patent Owner criticizes how “Petitioner offers no justification for changing Phan to remove the gaps between adjacent quad pixels.” *Id.* at 42–43 (citing Ex. 1003 ¶ 350). Patent Owner argues that, in an OLED display, “there would need to be space for circuitry such as signal lines and power lines.” *Id.* at 40–41 (citing Ex. 1001, 3:58–61; Ex. 1008, 1:23–33, 6:55–60, Figs. 4, 5). Patent Owner notes testimony from Dr. Pattison that allegedly supports Patent Owner’s argument. *Id.* at 43 (quoting Ex. 1003 ¶ 360) (Dr. Pattison testifying that an ordinarily skilled artisan “would have understood that when implemented in a display, there would be at least some physical space between to [sic] the dots so as to allow for the required signal lines passing between the dots.”). According to Patent Owner, had Petitioner maintained the necessary space in Phan’s Figure 12, then Petitioner’s proposed pixel arrangement would not “exhibit the virtual square arrangement required by the claims of the ’803 patent.” *Id.*

Patent Owner’s arguments call into question whether Petitioner has taken too much liberty in its interpretation of how Phan’s quad pixel arrangement from Figure 11b would be implemented in the display of Figure 12. Petitioner’s contentions at this stage are supported by

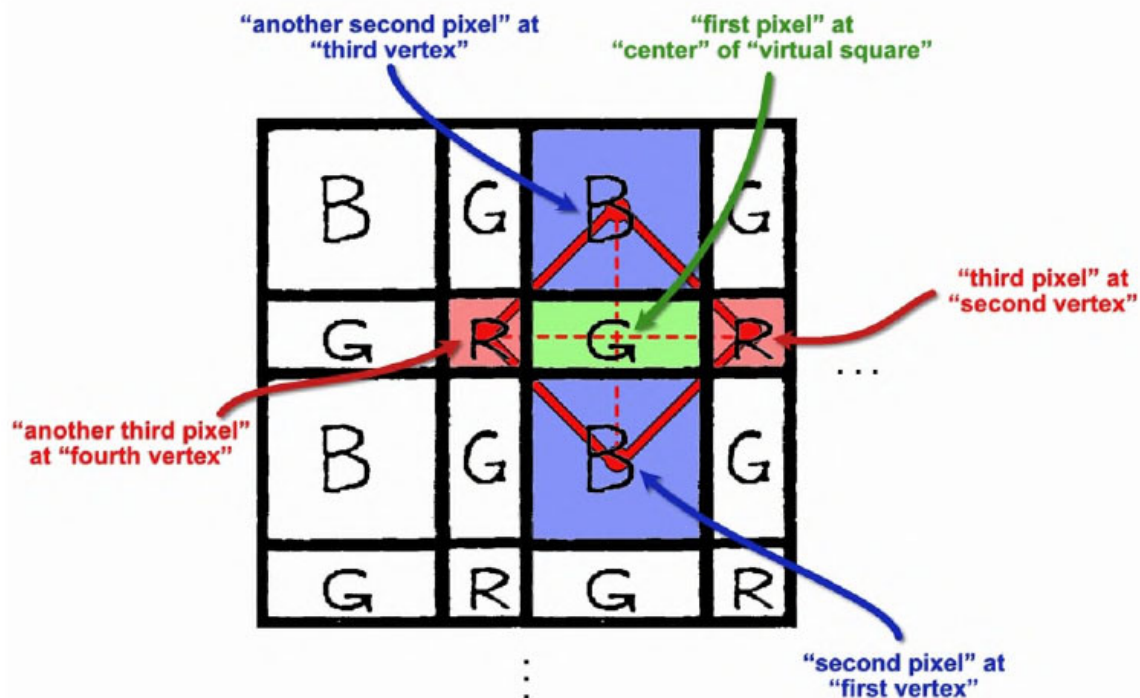
Dr. Pattison's testimony, whereas Patent Owner's positions amount to attorney argument. Notwithstanding, we look forward to the parties addressing at trial whether it would have been obvious or even possible to maintain the distances Petitioner posits in the illustrations on pages 50–53 of the Petition for an OLED display implementation.

b. Conclusion

For the foregoing reasons, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 1 over Phan.

3. Dependent Claims 2–4 and 19–21

Petitioner addresses in detail these claims on the alleged ground of obviousness over Phan. Pet. 55–58. Petitioner uses the following illustration to show that Phan's pixel display incorporating the quad pixel structure of Figure 11b satisfies all features of claims 2–4 and 19–21:



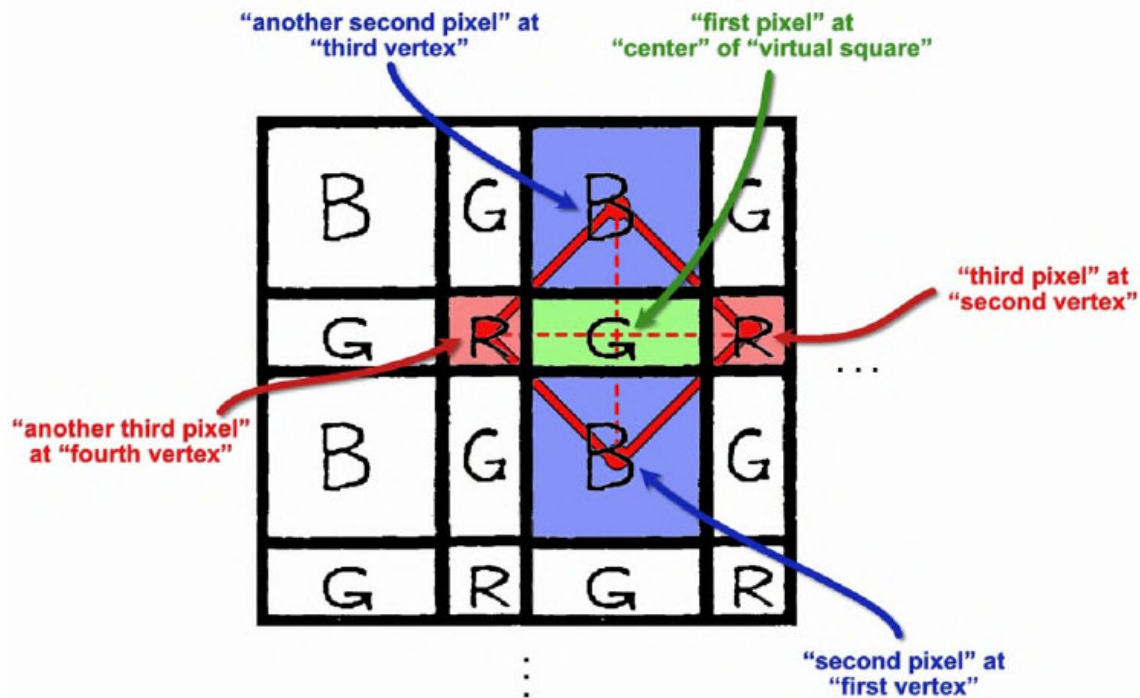
Pet. 54–58 (citing Ex. 1003 ¶¶ 374–398). The illustration is Petitioner’s depiction of the resulting arrangement when the quad pixel structure of Phan’s Figure 11b is substituted into the pixel display structure of Phan’s Figure 12, which shows a first pixel, a second pixel, another second pixel, a third pixel, and another third pixel.

Patent Owner does not present arguments additional to those it has presented for independent claim 1, which we have addressed above. On the current record, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of each of claims 2–4 and 19–21 over Phan.

F. Alleged Obviousness of Claim 5 over Phan and Yamada

Claim 5 depends from claim 4 and further recites “wherein the first pixel. The second pixels, and the third pixels have polygonal shapes, and each of the second pixels and each of the third pixels has a larger area than the first pixel.” Ex. 1001, 9:27–31.

The illustration Petitioner relies on to show satisfaction of claim 4 is again reproduced below:



Pet. 58. The illustration is Petitioner's depiction of the resulting arrangement when the quad pixel structure of Phan's Figure 11b is substituted into the pixel display structure of Phan's Figure 12, which shows a first pixel, a second pixel, another second pixel, a third pixel, and another third pixel. *Id.*

Petitioner explains:

Phan explains that the dots making up its pixels can be formed as a "square quad." (Ex. 1005, 5:47–54.) For instance, in Fig. 11a, each dot is an "equal" part of the "square" pixel (and thus is also square). (*Id.*, 5:47–50.) And, in Fig. 11b, while the overall pixel still has a square shape, the "crosspoint" that separates the dots has "mov[ed]" along a "diagonal line" resulting in square and rectangular shaped dots. (*Id.*, 5:51–54.)

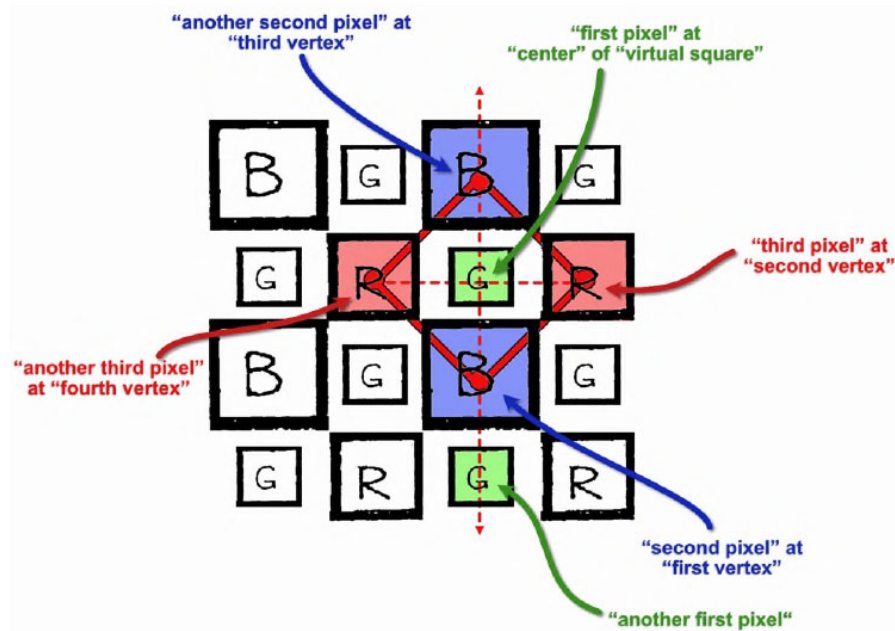
Id. at 59. Thus, according to Petitioner, each of the dots shown in the illustration above is either square or rectangular, both of which are polygonal as is required by claim 5. *Id.*

Claim 5 requires each of the second and the third pixel to be larger than the first pixel. Phan teaches that its second pixel (blue pixel) can be made larger than its first pixel (green pixel). Ex. 1005, Fig. 11b. But Phan does not express whether its third pixel (red pixel) also should be made larger than the first pixel (green pixel). Petitioner asserts that it would have been obvious to one of ordinary skill in the art to re-size Phan's dots according to Yamada's teachings of sizing the pixels according to the emission efficiency of each color's emissive element, i.e., the pixel with a color having the highest emission efficiency, green, is made the smallest, and the pixel with a color having the lowest emission efficiency, blue, is made the largest. Pet. 60–62. To provide a motivation to combine teachings, Petitioner states:

A POSITA would have been motivated to apply Yamada to Phan in the manner discussed above for the same reasons it would have been obvious to apply Yamada to Matthies. (Ex. 1003, ¶¶ 433–442.) As explained, it was well-known that adjusting pixel size—and making pixels with lower emission efficiencies (like blue pixels) larger and pixels with higher emission efficiencies (like green pixels) smaller—reduces deterioration and improves display life. . . . A POSITA would have recognized that applying Yamada to Phan would have similarly improved the life of Phan's display. (Ex. 1003, ¶¶ 434–437.) By making the blue pixels largest and the green pixels smallest, display deterioration and dot failure would have been reduced. (*Id.*)

Id. at 62–63. Additionally, Petitioner asserts that re-sizing pixels according to their emission efficiency was also known to simplify display design. *Id.* at 63. Petitioner explains that that is because with such re-sizing each pixel can be supplied with the same current or power. *Id.* (citing Ex. 1003 ¶¶ 438–439).

Petitioner provides an illustration of the resulting pixel display structure which applies Yamada's pixel sizing teachings to Phan:



The illustration is Petitioner's depiction of the resulting pixel display structure that incorporates Yamada's teaching about sizing pixels according to their emission efficiency to Phan's pixel display. Pet. 61–62. Petitioner explains that the blue dots maintains its original size, the green dots are made the smallest, and the red dots are of an intermediate size between the blue dots and green dots. *Id.* at 61. Thus, according to Petitioner, the sizing requirements of claim 5 is met by the combined teachings of Phan and Yamada.

Patent Owner argues that Petitioner fails to show that the combination of Phan and Yamada discloses a virtual square. Prelim. Resp. 44–45. However, we find Petitioner has made a sufficient showing on pages 61–62 of the Petition, based on the record evidence and the cited testimony.

Patent Owner also disputes Petitioner's reasons for combining Yamada with Phan as being inconsistent with Phan's disclosures of moving

the crosspoint of its quad pixel arrangement along a diagonal line. Prelim. Resp. 45–47 (citing Ex. 1005, 5:51–54, Figs. 11a, 11b). In particular, Patent Owner argues that “Petitioner ignores Phan’s teaching about resizing pixels along the diagonal line and breaks up the pixels into an arbitrary structure through hindsight without any support in Phan or Yamada.”⁹ *Id.* at 47.

At this stage, Petitioner’s contentions are supported by Dr. Pattison’s testimony, whereas Patent Owner’s positions amount to attorney argument. Notwithstanding, we feel that evaluating Petitioner’s application of Yamada’s resizing of pixels based on emission efficiency to Phan’s quad pixel arrangement would be best accomplished in the context of a fully developed trial record. In particular, the parties should address the compatibility of Yamada’s teaching of pixel resizing with Phan’s teaching of moving the crosspoint of a quad pixel group along a diagonal line.

For the foregoing reasons, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 5 over Phan and Yamada.

G. Alleged Obviousness of Claims 1–5 and 19–21 over Murai and Yamada

1. Overview of 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

⁹ Patent Owner also relies on other arguments it makes against the Matthies–Yamada ground. *See* Prelim. Resp. 49–53. We discussed those arguments above. *See supra* § III.D.3.a.

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

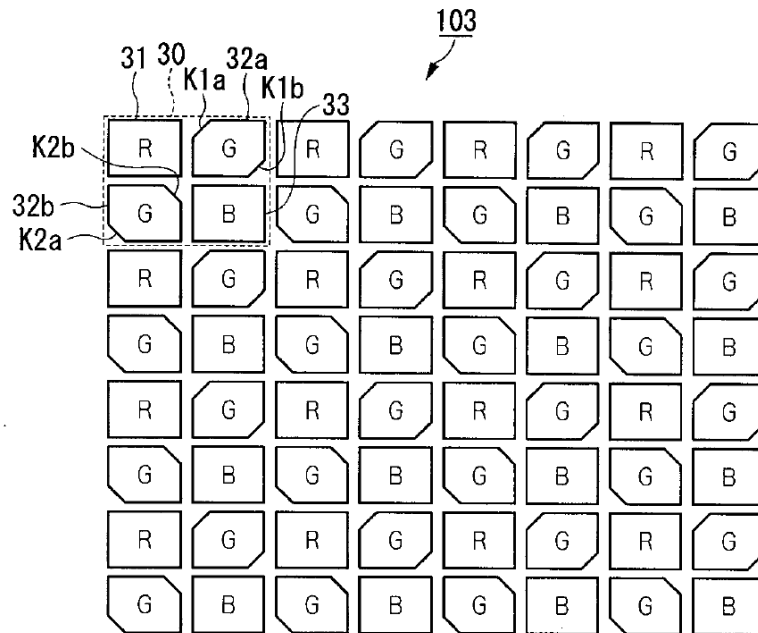


Figure 3 is “a plane view illustrating dot shape and dot arrangement in a color image display device.” Ex. 1007 ¶ 27. “The unit pixels 30 are configured by four dots: one first dot 31, two second dots (32a and 32b), and one third dot 33, as a combined display unit.” *Id.* ¶ 28. “[T]he second dots (32a 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.*

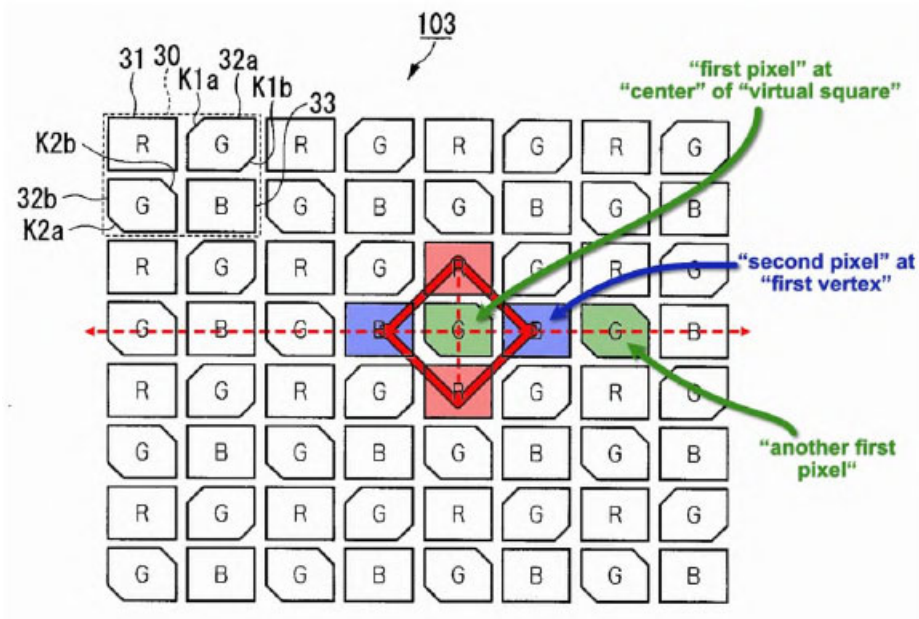
According to Murai, “the first auxiliary dot and the second auxiliary dot [may] be shaped having cut-off portions wherein at least one corner of the rectangular shape is cut off, and to be disposed so that there is a cut-off portion near a space between the first auxiliary dot and the second auxiliary dot.” Ex. 1007 ¶ 11.

2. *Petitioner's Assertions*

We determined above that Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 1–5 and 19–21 over Matthies and Yamada. We also determined above that Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 1–4 and 19–21 over Phan, and claim 5 over Phan and Yamada. We will be instituting review on all challenged claims and all challenged grounds in the Petition. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348 (2018) (holding that the Board may not institute review on fewer than all claims challenged in the petition); 37 C.F.R. § 42.108(a) (2022) (“When instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.”).

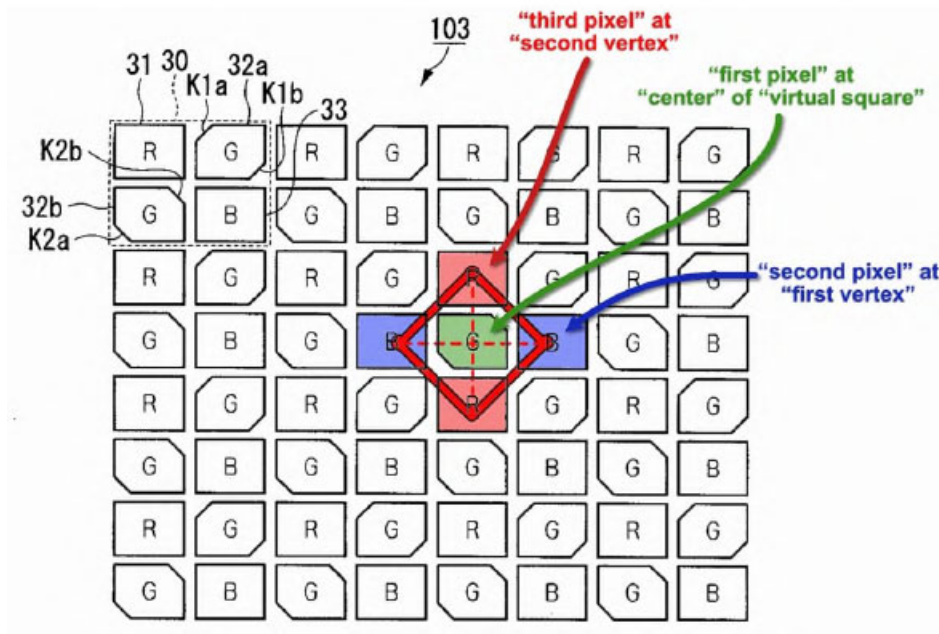
Notwithstanding our decision to institute review on all challenged claims and grounds, we include the following discussion regarding this ground. Petitioner relies on the Figure 3 embodiment of Murai as disclosing all recitations of claim 1 except for limitation [1-b], and Petitioner relies on the combined teachings of Murai and Yamada to account for limitation [1-b].

To explain its mapping of the “virtual square” limitations in claim 1, Petitioner provides an annotated version of Murai’s Figure 3 on page 70 of the Petition, as reproduced below:



In this version of Murai's Figure 3, Petitioner identifies a red-lined virtual square, a first pixel at the center of the virtual square, a second pixel at a first vertex of the virtual square, and another first pixel, where the first pixel, the second pixel, and the other first pixel are consecutive pixels on a horizontal line formed by red dashes. Additionally, the first pixel at the center of the virtual square is shown as emitting green light.

Petitioner provides another annotated version of Murai's Figure 3 on page 71 of the Petition, as reproduced below:



In this version of Murai's Figure 3, Petitioner identifies a third pixel at a second vertex of the virtual square.

For limitation [1-c], which requires the second pixel to have an area larger than the third pixel, Petitioner relies on the combined teachings of Murai and Yamada. Pet. 71–74.

3. Patent Owner's Arguments

Patent Owner argues that the combination of Murai and Yamada relied upon by the Petitioner does not disclose the claimed virtual square. Prelim. Resp. 54. Patent Owner asserts that in Petitioner's illustrations of Murai's Figure 3, Petitioner "has placed the upper and lower vertices of the 'virtual square' deceptively off the centers of the red dots to make a non-square figure look like a square." *Id.* at 54–55 (citing Pet. 68). According to Patent Owner, "when the vertices are placed at the centers of the red dots as the claims require, the resulting shape is not a square." *Id.* at 55. Patent Owner argues that "[a] virtual square simply would not form when rectangular dots are arranged in a grid as shown in Petitioner's drawing

reproducing Figure 3 of Murai,” and that “Petitioner does not provide any reason why a POSITA would have modified the Figure 3 embodiment to have square-shaped dots when combining the embodiment with Yamada.” *Id.* at 56.

Patent Owner further argues that “even if the Figure 3 embodiment is . . . is redrawn with square dots, the virtual square required by the claims still may not be formed,” because “[w]hile Murai states that color dots can have a square shape, it does not disclose that the quad pixel structure (called ‘unit pixel’ in Murai) that contains four of the color dots can be anything other than an oblong rectangle.” *Id.* at 56–57 (citing Ex. 1007 ¶¶ 17, 30). Patent Owner asserts that “[i]f the quad pixel structure’s shape is maintained as an oblong rectangle as Murai teaches, then a virtual square would not form even if the individual dots have a square shape.” *Id.* at 57.

Patent Owner asserts that Petitioner does not “argue that a POSITA would have changed the shape of the quad pixel structure of Figure 3 from an oblong rectangle to a square when combining Murai with Yamada.” *Id.* Patent Owner asserts that a virtual square may “not be formed unless the horizontal and the vertical spaces between the dots are equal in their sizes.” *Id.* Patent Owner asserts that “Murai does not state or imply that the horizontal spaces and the vertical spaces between the dots are equally sized,” and that “Yamada discloses having different spacings between columns of pixels compared to the spacings between rows of pixels.” *Id.* at 57–58.

Patent Owner also notes that “the ’803 patent claims require blue pixels to be larger than red pixels, but in Murai all of the red and blue pixels have the same size. *Id.* at 58 (citing Ex. 1007, Fig. 6(a)–(b)). Patent Owner asserts that “there is no principled way to change the pixel sizes in Murai

while being consistent with Murai’s teachings” and that “Petitioner’s bare assertion that a POSITA would have changed the sizes while creating a virtual square is unsupported and implausible.” *Id.* at 58–59.

Patent Owner further argues that “Murai discloses problems associated with liquid crystal display (LCD) devices and means for solving the problems.” Prelim. Resp. 59 (citing Ex. 1007 ¶¶ 2–14). Although Patent Owner acknowledges that Murai mentions OLED displays in paragraph 58, Patent Owner argues that Murai “does not explain how its solutions for LCD devices can be used with OLED display” *Id.* (citing Ex. 1007 ¶ 58). Thus, Patent Owner argues that “Yamada’s teachings regarding the efficiency and the life of organic emissive layers do not apply to Murai[’s displays], and a POSITA would not have been motivated to reduce Murai’s pixel sizes based on Yamada.” *Id.* Patent Owner also disputes that Murai’s dots can have different sizes. Prelim. Resp. 59–60. Rather, Patent Owner argues that “Murai merely suggest[s] that the position of the cutoff portion of the dots can vary” in order to “prevent dots having the same color (or a similar color) from being adjacent in the diagonal direction to avoid streaks in that direction.” *Id.* (citing Ex. 1007 ¶¶ 11–12).

Patent Owner also argues that (1) Petitioner’s proposed combination would frustrate Murai’s objective to improve the overall aperture ratio (Prelim. Resp. 61, 63 (both citing Ex. 1007 ¶ 42)); (2) “Yamada’s technique of resizing the pixels would create irregularly shaped pixels, rather than square or rectangular pixels,” with “no principled reason or basis in Murai or Yamada to cut off corners from green and red pixels as Petitioner asserts.” (*id.* at 61); and (3) “because the sizes of the emissive areas remain largely unchanged, Yamada’s goal of achieving a balanced pixel luminance would

not be achieved” by “Petitioner’s proposed modification of Murai includ[ing] adding small cutouts to the red dots.” (*id.* at 61–62).

Patent Owner additionally argues that, even if an ordinarily skilled artisan “were to combine Murai’s quad subpixel structure with Yamada, there was no motivation to maintain two green subpixels in the structure.” Prelim. Resp. 66–67. Instead, Patent Owner contends that an ordinarily skilled artisan would have included two blue pixels in the quad pixel structure given that blue pixels have the lowest emission efficiency. *Id.* Patent Owner also argues that, if an ordinarily skilled artisan would have made the combination, that artisan would not have started with Murai’s RGBG quad pixel structure and instead would have started with Yamada’s RGB structure arranged in a stripe pattern. *Id.* at 64–66 (citing Ex. 1007, Fig. 7).

As above, Petitioner’s contentions at this stage are supported by Dr. Pattison’s testimony, whereas Patent Owner’s positions amount to attorney argument. Notwithstanding, we look forward to the parties addressing at trial whether Murai’s teachings are applicable to OLED displays. The parties also should develop the record as to whether an ordinarily skilled artisan would have started the combination with Murai’s quad pixel arrangement in the first instance, reduced the sizes of the green and red pixels while keeping blue pixels the same size, and maintained two green pixels. The parties also should develop the record as to whether an ordinarily skilled artisan would have understood the combination of Murai and Yamada to result in a virtual square. We feel that these issues would be best decided in the context of a fully developed record.

4. *Conclusion*

We do not make any preliminary conclusion with respect to the alleged obviousness of claims 1–5 and 19–21. The issues require additional consideration based on evidence to be developed during trial.

IV. CONCLUSION

For the foregoing reasons, we conclude that the information presented in the Petition and Preliminary Response establishes a reasonable likelihood that Petitioner would prevail in establishing that at least one of claims 1–5 and 19–21 of the '803 patent is unpatentable.

V. ORDER

In consideration of the foregoing, it is

ORDERED that *inter partes* review of all challenged claims, i.e., claims 1–5 and 19–21 of the '803 patent, is instituted on all grounds stated in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial; the trial will commence on the entry date of this decision.

IPR2023-00987
Patent 9,818,803 B2

PETITIONER:

K. Patrick Herman
Richard F. Martinelli
Xiang Wang
Orrick, Herrington & Sutcliffe LLP
P52PTABDocket@orrick.com
RFMPTABDocket@orrick.com
XW0PTABDocket@orrick.com

PATENT OWNER:

David A. Garr
Scott C. Weidenfeller
Covington & Burling LLP
dgarr@cov.com
sweidenfeller@cov.com