

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.

Case IPR2023-00941
U.S. Patent No. 7,414,599

PATENT OWNER'S SURREPLY

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Table of Exhibits

Exhibit	Description
2001	Certified File History for U.S. Patent No. 7,414,599
2002	U.S. Patent Publication No. 2004/0041750 (“Abe”)
2003	U.S. Patent Publication No. 2004/0145547 (“Oh”)
2004	Digital Integrated Circuits, A Design Perspective 2nd ed. (2003)
2005	Claim Construction Order, Inv. No. 337-TA-1351
2006	Declaration of Jared Frisch
2007	Declaration of Derek Andros
2008	[PROTECTIVE ORDER MATERIAL – NCT INFORMATION] Declaration of Andrew Wolfe, Ph.D.
2009	Replay the Display, <i>Mass Production of AMOLED – Samsung’s Dramatic Success That Changed the History of Displays</i> , Samsung Display Newsroom (Feb. 17, 2003) (https://global.samsungdisplay.com/31098)
2010	Society of Information Display, <i>Mobile Displays Technology and Applications</i> (Achintya K. Bhowmik et al.) (2008)
2011	Dawson et al., <i>Design of an Improved Pixel for a Polysilicon Active-Matrix Organic LED Display</i> , Society of Information Display (1998)
2012	Akimoto et al., <i>An Innovative Pixel-Driving Scheme for 64-Level Grey-Scale Full-Color Active Matrix OLED Displays</i> , Society of Information Display (2002)
2013	Shirasaki et al., <i>Full Color Polymer OLED Display Driven by a-Si:H TFT Utilizing a New Current-Programmed Method</i> , International Display Workshop (2003)

2014	Chih-Lung, Lin, <i>Pixel Circuit with High Immunity to the Degradation of TFTs and OLED for AMOLED Displays</i> , IMD/IDMC/ASIA Display Digest (2008)
2015	Yoo et. al., <i>302-ppi High-Resolution AMOLED using Laser-Induced Thermal Imaging</i> , Society of Information Display (2005)
2016	Yoon Jeong-hyun, <i>Samsung Display Achieves the Highest Definition Quality With Tenacity. Full HD AMOLED “Revolution,”</i> BIZ Insight (2013) (including certified English translation)
2017	Sung-eun Kim, <i>Climbing Mt. Fuji on Handstand?</i> (including certified English translation)
2018	[PROTECTIVE ORDER MATERIAL – NCT INFORMATION] Samsung Galaxy S21 AMOLED Display Claim Chart
2019	[PROTECTIVE ORDER MATERIAL – NCT INFORMATION] Samsung Display Galaxy S21 Circuit PDR (including certified English translation)
2020	Teardown Photos of Samsung Galaxy S21 Product
2021	Baek Byung-yuel, <i>Professor Kwon Wins Top Scientist Award of 2021</i> , The Korea Times (2021)
2022	Jeon Ha-yeon, <i>Distinguished Professor Oh-Kyung Kwon, An Authority on Displays, Received the Korea’s Best Scientist and Technology Award</i> , Hanyang News Portal (2021)
2023	Sung Kyun Kwan University, <i>2016 Karl Ferdinand Braun Prize for AMOLED</i> , Society for Information Display (2016)
2024	U.S. Patent No. 9,666,132
2025	U.S. Patent No. 8,941,309
2026	Teardown Photos of MobileSentry Product

2027	Teardown Photos of Mengtor Product
2028	Teardown Photos of Phone LCD Parts Product
2029	Teardown Photos of Mobile Defenders Product
2030	Teardown Photos of Injured Gadgets Product
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2041	Teardown Photos of Parts4LCD Product
2042	Teardown Photos of DFW Product
2043	Declaration of Aris Silzars, Ph.D.
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2046	[PROTECTIVE ORDER MATERIAL – NCT INFORMATION] Declaration of Kwangsae Lee
2047	<i>Samsung Display Co., Ltd. v. BOE Tech. Co., Ltd. et al.</i> , Case No. 2- 23-cv-00309, Compl. (E.D. Tex. Jun. 26, 2023)

2048	Curriculum Vitae of Andrew Wolfe, Ph.D.
2049	Study of Leakage Current in n-channel and p-channel Polycrystalline Silicon Thin-film Transistors by Conduction and Low Frequency Noise Measurements, C.T. Angelis, et. al, J. Appl. Phys. 82, 4095- 4101 (1997)
2050	Transcript of February 23, 2024 Deposition of Daniel Foty, Ph.D.
2051	Sourcely Plus AMOLED Display Claim Chart
2052	Injured Gadgets AMOLED Display Claim Chart
2053	Transcript of June 24, 2024 Deposition of Daniel Foty, Ph.D.
2054	Order No. 60, Granting Complainant's Motion <i>In Limine</i> No. 1, Inv. No. 337-TA-1351

I. Introduction

After the Institution Decision identified significant concerns in the Petition's obviousness theories, Petitioner moved to "supplement" the record. The Board denied Petitioner's motion because "[r]ather than answering these concerns directly," the Board found "the proposed supplemental information proceed[ed] in a new direction," and Dr. Foty's "proposed supplemental declaration change[d] Petitioner's theory of obviousness." Paper 27, 8-9, 11. The same is true of Petitioner's Reply, which tries to assert many of the same new theories the Board previously identified as new and therefore improper.

By way of example, Petitioner again attempts to use an "extra" transistor from Kimura Figure 36 for the shared-emission-line claims, after the Board explicitly rejected Petitioner's attempt to change theories to make this very modification, identifying it as "new and not in any way addressed or referred to in the Petition." Paper 27, 11.

Incredibly, without citing Paper 27, Petitioner attempts now to justify this change from the Petition's theories (which were based on Kimura Figure 33) to new theories allegedly based on Kimura's circuit of Figure 36 by claiming the Board "invited" new theories based on Figure 36. Reply, 14. Not so. Petitioner plainly mischaracterizes the Board's Institution Decision, presenting selective quotations and ignoring Paper 27. The Board did not

“invite[] the parties to develop the record on whether the ‘Figure 36 embodiment, would still meet all the requirements of the first, second, third, fourth, and fifth transistor’ in base claim 7.” Reply, 14.¹ Rather, in stark contrast, the Board invited only further evidence as to “whether the Figure 33 embodiment, *after being modified to make the fourth and fifth transistor always turn on and off together*, as Petitioner proposes *based on the Figure 36 embodiment*, would still meet all the requirements...” DI, 52.

Petitioner’s persistent efforts to change its theories are perhaps unsurprising, given that, as Petitioner now admits, the modification it proposed in the Petition would render Figure 33 inoperable and its other modifications are similarly flawed. Petitioner’s new theories are themselves reason to reject its Reply. *See* Reply, 10; Trial Practice Guide at 73-74 (Nov. 2019) (“The Board is not required to attempt to sort proper from improper portions of the reply....”). Further, Petitioner’s characterizations of the Board’s opinions are revealing of the approach pervading Petitioner’s Reply. Petitioner seeks to assert new and flawed theories for the initialization-transistor claims, disregards the record evidence on PMOS and NMOS

¹ All emphasis added except when otherwise noted.

transistors, and fails to substantively engage with the objective evidence of non-obviousness.

Finally, the developed record now demonstrates that Petitioner’s level of ordinary skill is incomplete, and that under a proper definition, Petitioner’s declarant, Dr. Foty, fails to qualify as a POSITA—as an Administrative Law Judge has found in a parallel International Trade Commission proceeding. For this independent reason, Petitioner has not and could not meet its burden. And even were Dr. Foty able to meet the level of ordinary skill, his testimony would be deserving of less weight given his lack of understanding of relevant aspects of the technology.

II. Petitioner Fails to Show a *Prima Facie* Case of Obviousness

A. Kimura Does Not Teach or Suggest a Shared Light-Emitting Signal (Claims 1-6 and 13-18).

Petitioner has now conceded that modifying the circuit of Kimura’s Figure 33 to use a shared light-emitting signal to control the gates of the “fourth” and “fifth” transistors would render the circuit inoperable. *See* Reply, 10 (“Samsung’s sole argument against a shared light-emitting signal is that bodily incorporation into Fig. 33 renders the circuit inoperable. POR, 38-44. That is true, but”).

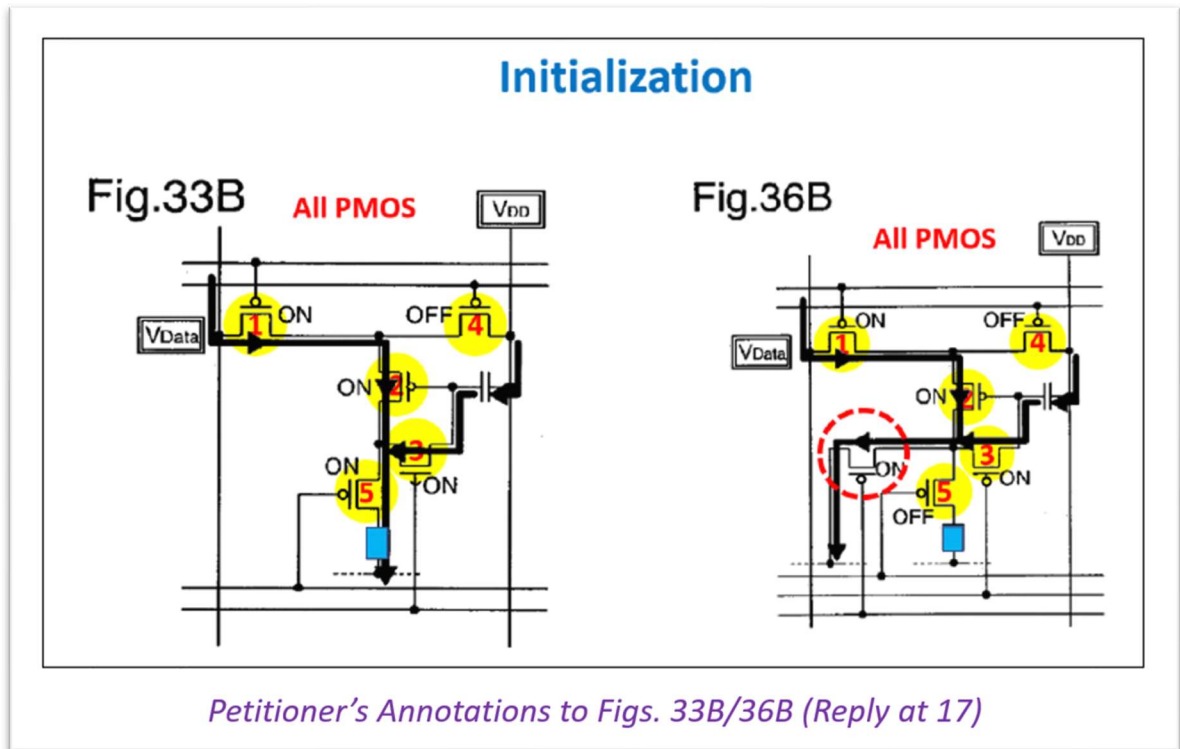
This concession is dispositive for the claims requiring such a shared gate signal. As the Board has already recognized, the Petition's obviousness grounds were based on precisely this theory:

On the basis of the use of a shared light emitting signal in the Figure 36 embodiment to control the fourth and fifth transistors, ***Petitioner concludes that it would have been obvious to use a shared light emitting signal in the Figure 33 embodiment to control the fourth and fifth transistors.*** *Id.* [Pet. 64-65.] No other modification to the Figure 33 embodiment was proposed by Petitioner to account for this feature.

Paper 27, 7-8; *see id.*, 10 (“Neither the Petition nor the first declaration of Dr. Foty proposed any modification of the Kimura’s Figure 33 embodiment ... beyond simply applying the same light-emitting signal to the gates of transistors four and five.”). That is, the Petition’s proposed modification was limited to applying the same gate signal to the “fourth” and “fifth” transistors of that circuit in the Figure 33 embodiment. The Board therefore denied Petitioner’s Motion to Submit Supplemental Information, which sought to “change[] Petitioner’s theory of obviousness.” *Id.*, 11.

Petitioner persists in its improper attempts to change to new and different obviousness arguments that were not set forth in the Petition. In its Reply, Petitioner introduces over ten pages of new testimony (Ex.1029, ¶¶55-71) and now attempts to satisfy the shared light-emitting signal claims by

citing to the *Figure 36 embodiment in its entirety*, including “the ‘extra’ transistor (circled in red) in Fig. 36B” (Reply, 18):



This attempt to rely on the “extra” transistor circled in red—i.e., TFT 3612—is effectively the same new theory that Petitioner attempted to introduce in its Motion to Submit Supplemental Information. In denying that motion, the Board credited Patent Owner’s explanation that the “supplemental declaration relies on an *additional transistor from Figure 36, transistor 3612*, which was neither referenced nor discussed in the Petition or Dr. Foty’s original declaration with respect to claim 13.” Paper 27, 10 (quoting Paper 19, 5). As the Board explained, the “additional modifications *including adding*

another transistor, are new and not in any way addressed or referred to in the Petition or Dr. Foty's first declaration." Paper 27, 10-11. Petitioner did not move for rehearing, nor have any basis to do so. Yet Petitioner now attempts to change its obviousness theory to one based on the same modifications the Board pointed out were "new and not in any way addressed or referred to in the Petition or Dr. Foty's first declaration." *Id.*²

Petitioner incredibly asserts that the Board "invited" it to assert a new theory based on Figure 36 and its "extra" transistor 3612:

At institution, the Board agreed but observed that Fig. 36 "[uses] six transistors, not five as in the case of the Figure 33 embodiment," and invited the parties to develop the record on whether the "Figure 36 embodiment, would still meet all the requirements of the first, second, third, fourth, and fifth transistor" in base claim 7. ID, 51-52. The unequivocal answer is "yes."

Reply, 14. The Board never invited a change to a new theory. Petitioner provides a selective quotation of only a portion of the Board's statement,

² Petitioner's attempt to downplay its change to a new theory by asserting Figure 36 is "merely an extension of Figure 33" (Reply, 14) is also meritless. As Dr. Wolfe explains, Figure 36's circuit has additional circuit elements, additional lines, and materially different timing. Ex.2008, ¶200:12-21.

omitting the portion shown below in bold, with Petitioner’s selective quotation underlined:

It is questionable whether the Figure 33 embodiment, after being modified to make the fourth and fifth transistor always turn on and off together, as Petitioner proposes based on the Figure 36 embodiment, would still meet all the requirements of the first, second, third, fourth, and fifth transistor, as recited in claim 7. Based on the present record, we find that Petitioner has not provided an adequate explanation as to this potential discrepancy.

DI, 51-52.

That is, Petitioner selectively quotes the Board’s institution decision to suggest there was an “invitation” to rely on Figure 36 for claim 7, when the Board was actually questioning “whether the Figure 33 embodiment, after being modified ... as Petitioner proposes based on the Figure 36 embodiment” would satisfy this claim.

Petitioner’s latest new theory should be rejected for the same reasons the Board rejected its earlier new theory. “Petitioner may not submit new evidence or argument in reply that it could have presented earlier, e.g. to make out a prima facie case of unpatentability,” and a reply brief should not “proceed in a new direction with a new approach.” Trial Practice Guide at 73-74 (Nov. 2019). Petitioner’s attempt to change to a new theory is improper,

and it has conceded that the Petition's actual theory would render the modified circuit inoperable, demonstrating the lack of (among other things) a motivation to make the modifications or a reasonable expectation of success.

B. Kimura Does Not Teach or Suggest the Claimed “Initialization Transistor” (Claims 2, 8, 16, 18).

As to the claims requiring an “initialization transistor,” the Board's institution decision accurately described fatal flaws in the Petition's theories:

Based on its identification of an undesirable consequence of using the fifth transistor as an erasure transistor to reset the capacitor voltage, Petitioner proposes a modification to incorporate an additional transistor from Kimura's embodiment of Figure 16 and 17, into Kimura's Figure 33 embodiment to reset the capacitor voltage. Pet. 51-56.

Patent Owner asserts that Petitioner “Conflates ‘Initialization’ with ‘Erasure.’” Prelim. Resp. 16. On this record, that appears to be true.... Based on the preliminary record, we agree with Patent Owner that “Kimura uses ‘erasure’ to mean ‘forcibly plac[ing] [the EL device] in a non-light-emitting state.” Prelim. Resp. 16 (alterations in original).

DI, 47-48.

Petitioner's reply on this element is hard to follow. It appears to assert three arguments, all of which the Board properly rejected in its prior rulings.

First, the Reply asserts that Petitioner provided “numerous reasons” for its modification (Reply, 19), and that “Samsung responds to **only one** of these reasons, mistakenly asserting ‘Petitioner’s flawed reading of ‘erasure’ is the **sole** premise” for “combin[ing] Figures 16-17 with Figure 33.” Reply, 20 (emphasis in original). Not so. As the Board has recognized, “[i]t is only based on Petitioner’s identification of an undesirable consequence of using the fifth transistor as an erasure transistor that Petitioner proposes a modification to incorporate an additional transistor from Kimura’s embodiment of Figure 16 and 17, into Kimura’s Figure 33 embodiment to reset the capacitor voltage.” Paper 27, 13-14.

Petitioner’s sole theory as to why an initialization transistor “is readily applicable to the baseline circuit of Fig. 33” and could be placed where Petitioner proposes was based entirely on equating erasure and initialization, which misreads Kimura. *See* Pet., 52-53 (arguing Kimura teaches “the erasure [transistor] can be placed in any location” and “[t]hus a POSITA would have been motivated to place the initialization transistor” where Petitioner proposes).

Second, the Reply makes another attempt to conflate “erasure” and “initialization,” arguing these operations are “not entirely ‘distinct’ from one another” because in Figure 16, the initialization period “occurs entirely within

the erasure period.” Reply, 26. The two are different operations, reinforced by the fact that they only *partially* “overlap.”

Additionally, Petitioner asserts that “erasure” and “initialization” are not “entirely” distinct because those operations are not “necessarily performed by ‘separate and distinct’ transistors.” Reply, 20. But even if certain transistors might, in some circuits, play a role in supporting both “erasure” and “initialization” it does not follow that these *functions* are somehow the same. They are not. Critically, Petitioner does not and cannot dispute that Kimura defines “erasure” to mean “forcibly plac[ing] [the EL device] in a non-light-emitting state.” Kimura, ¶410. So it is perplexing that Petitioner continues to ask the Board to rely on Kimura’s statement that “the erasure TFT can be placed in any location, provided that it is a location *at which electric current supplied to the [LED] can be cut off* at an arbitrary timing” (Reply, 21, quoting Ex.1002, [0658]) to support an argument about where to place an initialization transistor that would serve the very different function of *resetting the capacitor voltage to a default initialization value*.³

³ Dr. Foty admitted during deposition that the transistor he seeks to add would not “cut off” current flow to the EL element (as an “erasure TFT” would need to do). See POR, 33. Incredibly, he now shifts to a strained assertion that a (continued...)

Third, recognizing the deficiency in the Petition’s theory, the Reply again attempts to change Petitioner’s rationale for adding the “initialization” transistor of Figure 16/17 to Figure 33:

Even assuming “erasure” and “initialization” are separate operations in *other embodiments*, it makes no difference to Petitioner’s argument because the “erasure” transistor discharges the capacitor, which is the function required by the claims. *See, e.g.*, claim 8 (“sixth initialization transistor ***for discharging the data signal voltage stored in the capacitor***”). That is exactly what TFT 3310 does. It simply does not matter whether TFT 3310 also performs other functions.

Reply, 21 (emphasis in original).

As an initial matter, this argument appears to improperly use the challenged claims of the ’599 patent as the basis for modifying Kimura, whereas the issue is whether the modification would have been obvious based on the teachings of the prior art.

It is also a new theory, which is improper in reply. As to Kimura’s teachings, the Petition’s theory was that the “initialization” transistor 1607

transistor *that plays no role in cutting off current* can still be an “erasure TFT” as long as it does not “*prevent the cutting-off of flow of current . . . via the actions of the other parts of the circuitry.*” Ex.1029, ¶85 (emphasis in original).

and the “erasure TFT” 3310 were supposedly analogous as they both allegedly served to initialize or reset the capacitor to a specific default initialization voltage:

Kimura discloses that the fifth transistor in Fig. 33 [TFT 3310] “can also be used as an erasure [transistor]” that resets the capacitor voltage to a **default initialization value**. EX1002, [0658]....

Pet., 51.

Just like Fig. 17B, during initialization in Fig. 33A the sixth transistor [added from Figs 16/17] turns on and creates a current path (shown by purple arrow) that discharges the capacitor to an **initialization/reset value** EX1002, ¶[0666]; *see also id.*, [0425] (discussing “VReset” voltage); EX1003, ¶¶221-230 and ¶¶155-158.

Pet., 53.

When the initialization transistor is added to Fig. 33A, the resulting circuit is shown below where the sixth transistor’s source is coupled to one capacitor terminal and its drain connects an “**initialization voltage**” EX1003, ¶¶318-322.

Pet., 79.

As Petitioner now appears to recognize, Kimura does not describe Figure 33 or its erasure TFT 3310 as involving such resetting of the capacitor to a default voltage. Even if some voltage from the capacitor may “discharge”

through this transistor, there is no indication that the transistor is being used to *initialize the capacitor to a default voltage*.⁴ Accordingly, Petitioner has not shown it would be obvious to add TFT 1607 (which is used in Figures 16/17 to “initialize” the capacitor with a default voltage Vreset) to the Figure 33 embodiment (which is never described as involving “initialization” or any default or reset voltage).

Petitioner introduces another material change to its “initialization transistor” modification, asserting that “Petitioner applied Kimura’s reset/initialization transistor 1607 to Kimura Figs. 33/36 as the claimed ‘initialization transistor’ that discharges the capacitor.” Reply, 19 (citing Pet., 51-56). This is a new theory. Petitioner had proposed to add this transistor to Figure 33, but did not discuss (let alone support) adding it to Figure 36. *See* Pet., 51-56.

⁴ As Dr. Wolfe explained, Figure 33B shows “the first phase of the capacitor programming” in which “there appears to be some discharging of that node [the capacitor]” but “there’s also this VData coming in” (i.e., the programming data voltage). Ex.1028, 203:4-5, 203:20, 205:6. Hence, the current flow (and the voltage on the capacitor) “depends on the value of Vdata and the relative resistivity of the four transistors.” *Id.*, 205:15-206:2. The result of Figure 33B is an *indeterminate* capacitor voltage.

Rather, the Petition described its proposed modification (adding transistor 1607 to Figure 33) and the circuit of Figure 36 as *alternative* ways to solve the problem of undesired light emission in Figure 33. *See* Pet., 19 (“One way Kimura solves this problem is adding a dedicated initialization transistor (labelled sixth transistor) as shown in Fig. 36B below Another solution taught by Kimura (where the initialization transistor is placed in a different location) is discussed in connection with claim 8 *infra*.”). The Petition never raised the possibility of somehow combining these alternative approaches.

C. A POSITA Would Not Have Been Motivated to Change Kimura Figure 33 to an “All-PMOS” Circuit (All Claims).

Petitioner appears to have abandoned its argument that replacing all of the NMOS transistors with PMOS transistors would have led to manufacturing benefits, after the Board correctly found this argument was “incomplete” (DI, 31), and after Patent Owner showed any such alleged benefits would not apply given Kimura’s CMOS architecture (POR, 20-25).

Additionally, Petitioner does not contest that the Petition relied on alleged all-PMOS modifications of Kimura circuits proposed by Dr. Foty as the sole basis for its patentability challenges.⁵

Rather, Petitioner elected to “focus[] its reply on the ‘general interchangeability’ rationale” (Reply, 4)—i.e., the theory that it would have been obvious to implement an all-PMOS version of Kimura Figure 33 because allegedly “there is general interchangeability of nMOS and pMOS transistors used as switching transistors” (DI, 23). This theory likewise fails.

The record evidence confirms that for particular transistors in the pixel circuits at issue here, there are material differences between NMOS transistors and PMOS transistors—including in their leakage current, speed, and size—that would affect the design and operation of a pixel circuit for an AMOLED display. *See* POR, 13-14.

Petitioner asserts that leakage current is not a “meaningful concern” for its *modifications* simply because it is not expressly discussed in Kimura or the

⁵ As Patent Owner explained in its Response (POR, 9 n.1), Petitioner relied on a hypothetical “all-PMOS” circuit in its analysis for all of the challenged claims, including those that may not require PMOS transistors. *See, e.g.,* Pet., 72 (“Even though claim 7 is not limited to PMOS devices, Kimura’s all-PMOS embodiment was used for consistency.”).

'599 Patent. This is a non-sequitur. While Kimura may not identify leakage current concerns in its *actual embodiments*, at issue are Petitioner's proposed *modifications* to Kimura's embodiments, modifications Kimura does not discuss nor contemplate. Significantly, Kimura identifies the particular transistors that could be either NMOS or PMOS, and it never states the transistor in Figure 33 that Petitioner maps to the claimed "third" transistor could be a PMOS transistor. As Dr. Wolfe explains, a POSITA would be concerned about leakage current through this transistor because leakage could change the brightness of the pixel from its intended value, and it was known to POSITAs that leakage current was higher in PMOS than NMOS transistors. Ex.2008, ¶¶70, 63. Petitioner alleges that a "modest" amount of leakage current would be "unimportant," based only on Dr. Foty's unsupported assertions. Reply, 7. Yet this only underscores that leakage was a relevant consideration that needed to be assessed (and controlled) to avoid operational problems. As Dr. Wolfe explains, what is important "is to design something *so that* the impact of the leakage is imperceptible." Ex.1028, 174:2-3.

Similarly, Petitioner's argument that "PMOS switching transistors operated faster than needed for common refresh rates" ignores that Dr. Wolfe's testimony was directed to common refresh rates *for LCDs* at the time, not OLED displays (Ex.1028, 99:8-17), and overlooks Dr. Wolfe's explanation

that faster refresh rates were known to be beneficial. *Id.*, 98:1-102:18. Indeed, the refresh rate of a display relates to more than just the speed of the pixel circuit, and optimizing the speed of the pixel circuit allows for more flexibility in the operation of the device while still attaining a desired refresh rate. *Id.*

Even if Petitioner were correct that the leakage current, size, and speed considerations *could* be addressed and might not *preclude* a POSITA from achieving an all-PMOS pixel circuit, the evidence developed in this proceeding certainly establishes that these are among the relevant functional differences between PMOS and NMOS transistors to a POSITA for particular transistors in the AMOLED pixel circuits at issue, such as the “third” transistor. Therefore, Petitioner would need a *motivation* for a POSITA to make the modifications necessary to its proposed all-PMOS redesign, and cannot rely on a theory of “simple and obvious design choice” (Pet., 21) without any technical motivation. *E.g.*, POR, 13-14; *Lumenis Be Ltd. v. BTL Healthcare Technologies A.S.*, IPR2021-01275, Paper 8, 30 (Feb. 8, 2022) (“finding of obviousness based on design choice is *precluded* where the difference between the claimed feature and prior art results in a functional difference”); *In re Gal*, 980 F.2d 717, 719 (Fed. Cir. 1992).

Likewise, Kimura’s disclosures cannot support a theory of “general interchangeability” that would apply to *all* the transistors in Kimura that

Petitioner seeks to modify. While Petitioner and Dr. Foty cite to passages from Kimura that reference changing “simple switching devices” from NMOS to PMOS in other embodiments (not Figure 33), they identify no disclosure suggesting that TFT 3309 (the alleged “third” transistor in Figure 33) or its counterpart in other embodiments—which Kimura never identifies as a “simple switching device”—could be similarly modified. Pet., 19-21, Reply, 5, Ex.1003, ¶147-150.

In the institution decision, the Board quoted Kimura’s disclosure, in another embodiment, that “TFTs 304 and 306 *function as simple switching devices, and therefore any polarity may be used.*” (DI, 21, quoting Ex.1002, [0438]), and determined for purposes of institution that Kimura’s “interchangeability teaching is described generically for all ‘switching transistors’” (DI, 24). Yet, the developed record shows that certain transistors in Kimura’s pixel circuits do not function as simple switching devices. The driving transistor does not, and the “third” transistor (TFT 3309) also does not function as a *simple* switching device. As Dr. Wolfe explains:

As shown in Figure 33, the “third” transistor is located within the pixel circuit such that it controls the flow of charge to the capacitor during programming and holds charge on the capacitor during emission. Kimura Fig. 33. The charge on the capacitor in turn determines the brightness of the pixel.

Ex.2008, ¶70. “[A] POSITA would have recognized that leakage current in the third transistor could alter the charge stored on the capacitor,” and “[i]t would thus be particularly important to mitigate any potential leakage current for this transistor.” *Id.* While Petitioner asserts that a *certain* amount of leakage in TFT 3309 may be tolerable (Reply, 7), this only underscores that the transistor is not serving as a “simple switching device,” and why it makes sense that Kimura never describes this transistor (or its counterpart in any other embodiment) as such.

III. Level of Ordinary Skill (and Dr. Foty’s Failure to Qualify)

The ’599 Patent is directed to “[a] pixel circuit in an organic light emitting device capable of realizing high gradation representation by self-compensating a threshold voltage, and a method for driving the same.” ’599 Patent, [Abstract]. Accordingly, as Patent Owner and Dr. Wolfe have explained, a POSITA would need to have “experience in active matrix display design and electroluminescence,” in addition to a relevant technical degree. POR, 7-9, Ex.2008, ¶¶45-49. This skill level was adopted by the Administrative Law Judge in the parallel ITC investigation, who expressly rejected Dr. Foty’s proposal that merely “2-3 years of circuit design experience” would suffice. Ex.2005, 12.

In this proceeding, Petitioner and Dr. Foty similarly seek to define the level of skill as requiring only a relevant Bachelor's degree and "2-3 years of circuit design/analysis experience," Pet., 13 (citing Ex.1003, ¶31), with no experience in active matrix display design or electroluminescence. Yet since submitting his original declaration, Dr. Foty has admitted a POSITA would also need familiarity with specific aspects of active matrix display design, such as the "operation of the driving transistor, threshold-voltage compensation and its relationship to image quality, the impact of shared signal lines on aperture ratio, and the initialization, e.g., discharging a capacitor, of a pixel circuit." Ex.1029 ¶14 ("I agree that a POSITA would know all of these things."). Similarly, Dr. Foty has acknowledged that:

Q So, when your definition says two to three years of circuit design analysis experience, you're reading into that that a person of ordinary skill in the art with that experience should also be familiar with *the functionalities of FETs, the design and analysis of analog and digital circuits comprised of FETs, and the operational behavior of light-emitting devices such as LEDs, in the context of pixel circuits in the display.*

A I regard that as being compatible, *what I condensed down to two to three years of circuit design analysis experience,* someone with that education and experience would understand the things above.

Ex.2053, 38:4-18.

Given Dr. Foty's admissions that his intended definition of "circuit design/analysis experience" requires familiarity with numerous concepts specifically relating to active matrix display design and electroluminescence, his definition as written is (at a minimum) incomplete. An accurate definition should reflect "experience in active matrix display design and electroluminescence," as Dr. Wolfe has articulated (Ex.2008, ¶48)—and Dr. Foty now claims to have "condensed down" into his definition.

Petitioner claims that "Samsung and its expert manufacture a POSITA dispute where one does not, and should not exist" (Reply, 2)—insinuating this dispute is a matter of mere semantics. It is not. Dr. Foty, on whom Petitioner relies to claim obviousness, has no experience in display design let alone active matrix design, and therefore does not qualify as even a POSITA. Indeed, in the parallel ITC investigation, Judge Moore recently determined "that Dr. Foty does not meet the level of ordinary skill in the art for the '599 and '593 patents that I adopted," and therefore excluded his expert testimony pursuant to Federal Circuit precedent. Ex.2054, 5, 8; *see Kyocera Senco Indus. Tools Inc. v. Int'l Trade Comm'n*, 22 F.4th 1369, 1376-77 (Fed. Cir. 2022) ("To offer expert testimony from the perspective of a skilled artisan in

a patent case—like for claim construction, validity, or infringement—a witness must at least have ordinary skill in the art.”).

The lack of relevant knowledge is especially pertinent here. As Patent Owner has explained, Petitioner and Dr. Foty’s misunderstanding of Kimura’s teachings—e.g., failing to understand the difference between erasure and initialization—underscores how experience in active matrix and electroluminescent displays (which Dr. Foty lacks) is critical to understand the content of the prior art. *See* POR, 8-9.

IV. Objective Evidence Reinforces Non-Obviousness

A. Copying

The evidence of copying—and its nexus—is largely undisputed. Petitioner does not provide any substantive rebuttal to Patent Owner’s showings that (i) SDC’s pixel circuit practices the claims; (ii) the copied products practice the claims in the same manner; and (iii) the copied products are strikingly similar replicas of SDC products.

First, regarding SDC’s pixel circuits, Patent Owner and its expert showed the exemplary Galaxy S21 display practiced the claims (POR, 54-56, Ex.2008, ¶137), with a supporting expert claim chart mapping in greater detail the display to every claim element. Ex.2018. Petitioner does not assert that any claim element is not met. Lacking a substantive response, Petitioner

attempts to characterize Patent Owner’s showing as “too cursory” (Reply, 29), when the POR (at pages 54-56) presented an annotated schematic and teardown photo for the Galaxy 21 with a bulleted list explaining how the annotated circuit elements map to each claim limitation, and the expert provided a claim chart with additional supporting detail mapping the display to every claim element. Ex.2018.

Second, Petitioner does not address (let alone rebut) Patent Owner’s evidence showing that representative displays from Sourcely Plus (Ex.2051) and Injured Gadgets (Ex.2052) practice the claims in the same manner as SDC—underscoring the nexus between copying and the claimed features of the invention. *See Liqwd, Inc. v. L’Oreal USA, Inc.*, 941 F.3d 1133, 1138 (Fed. Cir. 2019) (“[T]he proponent of objective evidence offered to show nonobviousness, such as copying, must show that a nexus exists But where there is evidence of actual copying efforts, that evidence is always relevant.”).

Third, Petitioner does not dispute that Patent Owner’s evidence shows these representative displays and others—including products of Petitioner BOE—are strikingly similar to SDC’s, down to the physical layouts and shapes of pixel circuit elements. While Petitioner objects to Dr. Wolfe’s citation to a teardown photograph of Petitioner BOE’s display because it is “from a district court Complaint prepared by Samsung” (Reply, 34), Petitioner

does not dispute it shows Petitioner BOE's display, identify any relevant differences from SDC's pixel circuit, or offer any evidence of independent development. As Dr. Wolfe's explains, the copied products are so similar in even their physical layout that they can only be explained by deliberate copying. *See* Ex.2008, ¶¶156-160; *cf. Institut Pasteur v. Focarino*, 738 F.3d 1337, 1347-48 (Fed. Cir. 2013).

While Petitioner complains Dr. Wolfe did not personally know the source of some displays, Petitioner disregards that Dr. Wolfe cited and relied on testimony of Dr. Silzars who attested to their provenance, the teardown analysis on those displays, and the authenticity of the photographs from the teardown analysis. Ex.2008, ¶159 (citing Ex.2043).

B. Praise and Industry Recognition

Patent Owner presented evidence showing the “named inventors have received recognition *for their innovative achievement of developing the pixel circuits of the '599 Patent.*” POR, 57. Petitioner mischaracterizes this as merely praise “for the inventors,” when Patent Owner and Dr. Wolfe showed the praise is specifically linked to the claimed inventions. POR, 56-58; Ex.2008, ¶¶151-155. For example, Dr. Kwon's receipt of the Korea Best Scientist and Engineer Award was for his work in developing a “*pixel circuit*

that can compensate for the deviation in the characteristics of the TFT for current control” (Ex.2022, 2)—i.e., technology claimed in the ’599 Patent.

C. Failures of Others, Long-Felt Need, and Skepticism

The ample evidence of failures of others, long-felt need, and skepticism is largely undisputed. For instance, Petitioner does not contest such evidence provided in Ex.2011 (1998 SID Paper by Sarnoff, Kodak, and Princeton); Ex.2012 (2002 SID paper by Hitachi); Ex.2013 (2003 paper by Casio); and Ex.2014 (2008 paper). Petitioner also does not dispute that Ex.2010, a book chapter recounting efforts by numerous research groups to devise suitable pixel circuits for AMOLED displays, evidences failures of numerous others before the ’599 Patent.

Petitioner’s attempts to discount Exhibit 2015 (which discusses the same pixel circuit as Figure 3 of the ’599 Patent and explains its advantages) on the ground that it was written by Samsung employees, ignore (among other things) that it was published in a peer-reviewed technical publication of the Society for Information Display.

As for nexus, there is no substantive dispute that SDC’s pixel circuit practices the challenged claims, and Petitioner does not raise any substantive dispute that the benefits of display uniformity and high aperture ratios result

from the structures recited in the claims.⁶ Petitioner makes a legally flawed argument that because certain limitations allegedly could be found in prior art nexus is not shown. But “proof of nexus is not limited to only when objective evidence is tied to the supposedly ‘new’ feature(s)”; “[w]here the allegedly obvious patent claim is a combination of prior art elements ... the patent owner can show that *it is the claimed combination as a whole that serves as a nexus for the objective evidence.*” *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1330 (Fed. Cir. 2016).

As Patent Owner explained, and Petitioner does not rebut, the ’599 Patent’s claimed inventions provided a unique set of benefits unattainable in the prior art. POR, 65. Petitioner purports to find evidence of *certain limitations* in Kimura (Reply, 30-32), but no prior art disclosure provided the benefits that result from the claimed inventions’ combination of elements such as (a) emission transistors sharing a single emission control line (*e.g.*, ’599 Patent at 6:52-7:2, Fig. 3, cls. 1, 14-15); (b) a switching transistor and a

⁶ Contrary to Petitioner’s argument, specific discussion of “aperture ratio” benefits in the patent is not required; what is pertinent are “*advantages inherent in what is specifically disclosed in a patent*”—here, aperture ratio benefits flowing from the ’599 Patent’s circuit design. *In re Vamco Mach. & Tool, Inc.*, 752 F.2d 1564, 1577 n.5 (Fed. Cir. 1985) (emphasis in original).

threshold voltage compensation transistor sharing a single scan line (*e.g., id.*, 6:19-51, Fig. 3, cl. 7); and (c) an initialization transistor turning ON and OFF by the scan signal of the previous pixel row (*e.g., id.*, Fig. 3, cls. 2, 16). *See* POR, 63-65. It is a combination of features in the '599 Patent that “allowed for a smaller footprint and greater aperture ratio, and improved manufacturability, with compensation” in a pixel circuit composed entirely of PMOS TFTs. POR, 64; *cf. Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019) (“[O]bjective indicia must be directed to what was not known in the prior art ... [which] may well be the novel combination or arrangement of known individual elements.”) (cleaned up).

Petitioner asks the Board to ignore the '599 Patent's contribution to improved aperture ratio because Samsung Display has other patents on pixel layout arrangements that provide other aperture ratio improvements. (Reply, 31-32.) That is illogical and contrary to precedent. That other inventions allowed for *additional* improvements in aperture ratio is immaterial. Moreover, nexus can be satisfied even where the success of a patented product “was, in fact, based on two factors,” one “undisputedly covered” by the claims, and the other “undisputedly not covered.” *Ecolchem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1378 (Fed. Cir. 2000).

V. Conclusion

Patent Owner respectfully submits the Board should find the challenged claims patentable.

Date: July 12, 2024

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that the present paper contains 5585 words based on the word count indicated by the word-processing program used to generate the paper and excluding those portions exempted by 37 C.F.R. §§ 42.24(a) and (b).

Date: July 12, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6, I hereby certify that the foregoing Patent Owner's Surreply and accompanying Exhibits 2053 and 2054 were served by electronic mail on the following counsel of record for petitioner:

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