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Paper 11
Dated: February 12, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC. and AMAZON.COM SERVICES LLC,
Petitioner,

v.

NOKIA TECHNOLOGIES OY,
Patent Owner.

IPR2024-01139
Patent 6,950,469 B2

Before SCOTT B. HOWARD, STEVEN M. AMUNDSON, and JASON M. REPKO, *Administrative Patent Judges*.

REPKO, *Administrative Patent Judge*.

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

I. INTRODUCTION

Amazon.com Inc. and Amazon.com Services LLC (collectively, "Petitioner") filed a petition requesting *inter partes* review of claims 1–7, 9, and 14–51 of U.S. Patent No. 6,950,469 B2 (Ex. 1001, "the '469 patent"). Paper 3 ("Pet."). Nokia Technologies Oy ("Patent Owner") filed a Preliminary Response. Paper 9 ("Prelim. Resp.").

To institute an *inter partes* review, we must determine "that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a) (2024). For the reasons discussed below, Petitioner has shown a reasonable likelihood that it would prevail with respect to at least one challenged claim. Thus, we institute an *inter partes* review.

A. Related Matters

According to the parties, the '469 patent is involved in the following proceedings: *Nokia Technologies Oy v. Lenovo (Shanghai) Electronics Technology Company*, No. 5:19-cv-00427 (E.D.N.C.); *Nokia Technologies Oy v. Amazon.com Inc.*, No. 1:23-cv-01236 (D. Del.); *Nokia Technologies Oy v. HP Inc.*, No. 1:23-cv-01237 (D. Del.); *Nokia Technologies Oy v. Apple Inc.*, No. 2-16-cv-01440 (E.D. Tex.); *In the Matter of Certain Electronic Devices, Including Computers, Tablet Computers, and Components and Modules Thereof*, Inv. No. 337-TA-1208 (USITC). Pet. 101; Paper 4, 2 (Mandatory Notices).

B. The '469 Patent

The '469 patent relates to sub-pixel interpolation for motion-compensated encoding and decoding of video. Ex. 1001, 1:4–7.

Modern video compression standards use motion-compensated temporal prediction to reduce redundant information. *Id.* at 2:57–60. In

motion-compensated temporal prediction, a video frame's content is predicted from other frames using the frame-to-frame motion of objects or regions. *Id.* at 2:60–65. These methods derive motion information by describing the relationship between the current frame's pixels and the corresponding pixels in another frame, called the "reference frame." *Id.* at 3:53–58. The method uses motion information to transform the reference frame's prediction pixels to construct an approximate representation of the current frame, called the "prediction frame." *Id.* at 3:45–61. The difference between the prediction frame and the current frame is the prediction error. *Id.* at 3:61–64. The current frame can be efficiently encoded using the motion and prediction information. *Id.* at 3:64–4:3.

Motion estimation can be performed at the sub-pixel level. *Id.* at 6:49. This is typically done in two stages: (1) The first stage determines a motion vector having a full-pixel resolution using any appropriate motion-estimation scheme, and (2) the second stage refines that motion vector to the desired sub-pixel resolution. *Id.* at 6:49–60. The sub-pixel values are estimated by interpolation. *Id.* at 6:57–7:3.

Two interpolation schemes are relevant to our analysis here: Test Model 5 (TML5) and Test Model 6 (TML6). *Id.* at 8:43–53.

TML5 estimates the values of the ¼ resolution pixels using estimates of ½ resolution sub-pixels. *Id.* at 11:15–18. According to the '469 patent, TML5 is computationally complex. *Id.* at 11:14–32. Also, TML5 truncates the pixel values, resulting in a lower precision, and requires storing the ½ resolution sub-pixels to interpolate the ¼ resolution sub-pixels. *See id.*

According to the '469 patent, TML6 is similar to TML5 except that the maximum precision is retained throughout the process by not clipping or rounding the intermediate values. *Id.* at 11:35–39. Instead, TML6 obtains the

¼ resolution sub-pixels directly from intermediate values, which are neither rounded nor clipped. *Id.* at 13:9–13. According to the '469 patent, TML6 requires higher-precision arithmetic and more memory than TML5. *Id.* at 13:22–29.

According to the '469 patent, "the sub-pixel interpolation method according to the invention provides advantages over each of TML5 and TML6." *Id.* at 37:33–35. Unlike TML5, the '469 patent's method calculates ¼ resolution sub-pixels directly from the original image pixels or the ½ resolution sub-pixels using linear interpolation. *Id.* at 37:36–41. Thus, the '469 patent's method does not lose precision of the ¼ sub-pixel values via truncation or clipping of intermediate values. *Id.* at 37:41–46. And, unlike TML6, the '469 patent's method does not require high-precision arithmetic in all sub-pixel calculations. *Id.* at 37:66–38:24.

C. Claims

Claims 1–7, 9, and 14–51 are challenged. Claims 1, 18, 19, 23, 27, 31, 34, 35, 42, 46, 49, 50, and 51 are independent. Claim 1, which is illustrative of the claimed invention, is reproduced below.

> 1. A method of interpolation in video coding in which an image comprising pixels arranged in rows and columns and represented by values having a specified dynamic range, the pixels in the rows residing at unit horizontal locations and the pixels in the columns residing at unit vertical locations, is interpolated to generate values for sub-pixels at fractional horizontal and vertical locations, the fractional horizontal and vertical locations being defined according to $½^x$, where x is a positive integer having a maximum value N, the method comprising:
>
> a) when values for sub-pixels at $½^{N-1}$ unit horizontal and unit vertical locations, and unit horizontal and $½^{N-1}$ unit vertical locations are required, interpolating such values

directly using weighted sums of pixels residing at unit horizontal and unit vertical locations;

b) when values for sub-pixels at $½^{N-1}$ unit horizontal and $½^{N-1}$ unit vertical locations are required, interpolating such values directly using a choice of a first weighted sum of values for sub-pixels residing at $½^{N-1}$ unit horizontal and unit vertical locations and a second weighted sum of values for sub-pixels residing at unit horizontal and $½^{N-1}$ unit vertical locations, the first and second weighted sums of values being calculated according to step (a); and

c) when a value for a sub-pixel situated at a $½^{N}$ unit horizontal and $½^{N}$ unit vertical location is required, interpolating such a value by taking a weighted average of the value of a first sub-pixel or pixel situated at a $½^{N-m}$ unit horizontal and $½^{N-n}$ unit vertical location and the value of a second sub-pixel or pixel located at a $½^{N-p}$ unit horizontal and $½^{N-q}$ unit vertical location, variables m, n, p and q taking integer values in the range 1 to N such that the first and second sub-pixels or pixels are located diagonally with respect to the sub-pixel at $½^{N}$ unit horizontal and $½^{N}$ vertical location.

Ex. 1001, 45:6–40.

D. Evidence

Name	Reference	Exhibit No.
TML6	H.26L Test Model Long Term Number 6 (TML-6) draft0 Reference Code	1005
Fandrianto	US 5,594,813, issued Jan. 14, 1997	1006

Petitioner submitted the Declarations of Kannan Ramchandran, Ph.D. (Ex. 1003) and Dr. Stephan Wenger (Ex. 1008). In support of its Preliminary

Response, Patent Owner submitted the Declaration of Douglas A. Chrissan, PhD. Ex. 2001.

E. Asserted Grounds

Petitioner asserts that claims 1–7, 9, and 14–51 are unpatentable on the following grounds. Pet. 2.

Claims Challenged	Pre-AIA[1] 35 U.S.C. §	Reference(s)/Basis
1–7, 9, 14–51	103	TML6, Fandrianto

II. ANALYSIS

A. Discretionary Denial Under 35 U.S.C. § 314(a)

Petitioner and Patent Owner are parties in related litigation involving the '469 patent in the District of Delaware (the "Related Litigation"). Prelim. Resp. 66; Pet. 98–99. Patent Owner argues that the Board should exercise its discretion to deny the Petition under section 314(a) in view of the parallel litigation. Prelim. Resp. 66. For the reasons that follow, we disagree.

Under section 314(a), the Director has discretion to deny institution of a petition for *inter partes* review. *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016). In determining whether to exercise that discretion on behalf of the Director, the Board considers an early trial date in related litigation in an assessment of all relevant circumstances of the case—including the merits—to balance considerations such as system efficiency, fairness, and patent quality. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019,

[1] Congress amended § 103 when it passed the Leahy-Smith America Invents Act (AIA). Pub. L. No. 112–29, § 3(c), 125 Stat. 284, 287 (2011). Here, Petitioner asserts that the previous version of § 103 applies. Pet. 1 n.2.

Paper 11 at 5 (PTAB Mar. 20, 2020) (precedential) ("*Fintiv* Order"); Katherine K. Vidal, *Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation*, Director Memorandum, 1–3 (USPTO June 21, 2022) ("Memo on Discretionary Denial").[2] Under this assessment, the Board evaluates the following factors ("*Fintiv* factors"):

> 1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
>
> 2. proximity of the court's trial date to the Board's projected statutory deadline for a final written decision;
>
> 3. investment in the parallel proceeding by the court and the parties;
>
> 4. overlap between issues raised in the petition and in the parallel proceeding;
>
> 5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
>
> 6. other circumstances that impact the Board's exercise of discretion, including the merits.

Fintiv Order 5–6. In evaluating the *Fintiv* factors, "the Board takes a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review." *Id.* at 6. In the sections that follow, we analyze each of these factors in light of the facts of this case.

1. First Factor: Whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted

"A district court stay of the litigation pending resolution of the PTAB trial allays concerns about inefficiency and duplication of efforts. This fact

[2] https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf.

has strongly weighed against exercising the authority to deny institution under [*NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 (PTAB Sept. 12, 2018) (precedential)]." *Id.*

Petitioner argues that, as of the Petition's filing, a schedule has not been entered in the Related Litigation. Pet. 98–99. According to Patent Owner, Petitioner has not requested a stay. Prelim. Resp. 67.

Absent specific evidence, the Board typically "will not attempt to predict how the district court in the related district court litigation will proceed because the court may determine whether or not to stay any individual case . . . based on a variety of circumstances and facts beyond our control and to which the Board is not privy." *Sand Revolution II LLC v. Cont'l Intermodal Grp.*, IPR2019-01393, Paper 24, 7 (PTAB June 16, 2020) (informative, designated July 13, 2020). We decline to speculate here. Thus, the first *Fintiv* factor is neutral.

2. Second Factor: Proximity of the court's trial date to the Board's projected statutory deadline for a final written decision

"If the court's trial date is earlier than the projected statutory deadline, the Board generally has weighed this fact in favor of exercising authority to deny institution under *NHK*." *Fintiv* Order at 9. "The PTAB will weigh this factor against exercising discretion to deny institution under *Fintiv* if the median time-to-trial is around the same time or after the projected statutory deadline for the PTAB's final written decision." Memo on Discretionary Denial 9.

Here, neither party has submitted median time-to-trial statistics. *See* Pet.; Prelim. Resp. Petitioner argues that, although a schedule has not been entered, any trial is expected to be well after the Board's Final Written Decision. Pet. 98. According to Patent Owner, the District Court has not set

a trial date in the Related Litigation. Prelim. Resp. 67. Because there is no trial date, the second *Fintiv* factor weighs against exercising our discretion to deny institution.

3. Third Factor: Investment in the parallel proceeding by the court and the parties

The Board also has considered the amount and type of "work" already completed in the parallel litigation by the court and the parties at the time of the institution decision. *Fintiv* Order 9. "[M]ore work completed by the parties and court in the parallel proceeding tends to support the arguments that the parallel proceeding is more advanced, a stay may be less likely, and instituting would lead to duplicative costs." *Id.* at 10.

According to Patent Owner, "Granting institution would be a waste of administrative resources, as the Court has spent significant time reviewing [Petitioner's] 101 motions filed twelve and a half months ago on October 31, 2023." Prelim. Resp. 67.

Apart from the motions identified by Patent Owner, neither party has identified any other progress. The Board in *NHK* determined that the parallel proceeding in that case was in an "advanced state" when expert discovery was scheduled to end in less than two months and a jury trial was scheduled to begin in six months. *NHK*, Paper 8 at 20. By contrast, the district court in the Related Litigation has yet to issue a claim construction order, set a trial date, or make other determinations on the merits in that litigation. *See* Pet. 98–99; Prelim. Resp. 67. Considering the time invested by the parties and the district court in the Related Litigation and the amount that remains to be done, the third *Fintiv* factor weighs against exercising our discretion to deny institution.

4. Fourth Factor: Overlap between issues raised in the petition and in the parallel proceeding

Petitioner argues that "it is unclear whether any overlap exists between this Petition and issues that might be raised in the district court, as the parties have not yet exchanged preliminary infringement or invalidity contentions." Pet. 98. Patent Owner argues that, apart from the motions that Petitioner has already filed, "any remaining issues that [Petitioner] will raise are unknown." Prelim. Resp. 68.

Because any overlap between issues raised in the Petition and in the Related Litigation is unknown, the fourth *Fintiv* factor weighs against exercising our discretion to deny institution. But our decision on discretionary denial would be unchanged even under Patent Owner's view that this factor is neutral. *See infra* Section II.A.7.

5. Fifth Factor: Whether the petitioner and the defendant in the parallel proceeding are the same party

"If a petitioner is unrelated to a defendant in an earlier court proceeding, the Board has weighed this fact against exercising discretion to deny institution under *NHK*." *Fintiv*, Paper 11 at 13–14. Here, it is undisputed that Petitioner is a defendant in the Related Litigation. *See* Pet. 98–99; Prelim. Resp. 68. But no trial date has been set. *See supra* Section II.A.2. Thus, the fifth *Fintiv* factor is neutral.

6. Sixth Factor: Other circumstances that impact the Board's exercise of discretion, including the merits

When considering whether to discretionarily deny a petition, the Board assesses "all the relevant circumstances in the case," including the Petition's merits. *Fintiv* Order 14–16.

Patent Owner argues that there are other relevant circumstances here: the challenged patent has expired and similar art and argument were raised

in other *inter partes* reviews, in ITC investigations, and at the Brazilian Patent Office. *See* Prelim. Resp. 68–69.

We disagree with Patent Owner that the challenged patent's expiration favors discretionary denial here. *Id.* at 68. "Although a patentee has fewer rights when its patent has expired, it nevertheless maintains some rights, such as bringing an action for past damages." *Apple Inc. v. Gesture Tech. Partners, LLC*, Nos. 2023-1501, 2023-1554, 2025 WL 299939 at *3 (Fed. Cir. Jan. 27, 2025) (citing *Keranos, LLC v. Silicon Storage Tech., Inc.*, 797 F.3d 1025, 1033 (Fed. Cir. 2015); *Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc.*, 655 F.3d 1291, 1299 (Fed. Cir. 2011)) (cleaned up). For example, Patent Owner alleges that Petitioner infringed the '469 patent and seeks damages. *See* Ex. 1010, 575–76 (¶¶ 475–482), 589–90.

Patent Owner argues that earlier *inter partes* reviews, ITC investigations, and civil actions raise the same art and similar arguments. *See* Prelim. Resp. 68–69. But Patent Owner does not assert that any of those proceedings resulted in decision on the merits regarding the obviousness of the challenged claims. *See id.* For example, the earlier *inter partes* reviews were terminated due to settlement before the Board decided whether to institute review. *See* IPR2020-01685, Paper 21; IPR2021-00035, Paper 19; IPR2021-00036, Paper 18.

According to Patent Owner, the Brazilian Patent Office ruled that Fandrianto, TML6, and other references did not constitute grounds for modifying the scope of protection and rights conferred by the Brazilian counterpart of the '469 patent. Prelim. Resp. 69. But different countries have "varying legal and procedural requirements for obtaining patent protection." *See Caterpillar Tractor Co. v. Berco, S.p.A.*, 714 F.2d 1110, 1116 (Fed. Cir. 1983). Patent Owner does not explain the relevance of that proceeding

in view of, among other things, any differences in claim scope and any differences in patentability requirements. *See* Prelim. Resp. 69. Indeed, the Court of Appeals for the Federal Circuit has "cautioned against indiscriminate reliance on foreign file histories." *Starhome GmbH v. AT&T Mobility LLC*, 743 F.3d 849, 858 (Fed. Cir. 2014).

If the Board "determines that the information presented at the institution stage presents a compelling unpatentability challenge, that determination alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*." Memo on Discretionary Denial 4–5. But "where the Board determines that the other *Fintiv* factors 1–5 do not favor discretionary denial, the Board shall decline to discretionarily deny under *Fintiv* without reaching the compelling merits analysis." *Commscope Techs. LLC v. Dali Wireless, Inc.*, IPR2022-01242, Paper 23 at 4–5, (Vidal Feb. 27, 2023).

There are no circumstances under the sixth *Fintiv* factor—or any other factor—that would lead us to conclude that we should exercise our discretion to deny institution here. Because the first five *Fintiv* factors do not favor discretionary denial here, we do not reach the compelling merits analysis. *See id.*

Thus, we disagree with Patent Owner that the Board should exercise its discretion to deny the Petition under § 314(a) in view of the parallel litigation.

B. 35 U.S.C. § 325(d)

1. Principles of Law

Under 35 U.S.C. § 325(d), the Board may discretionarily deny a petition that presents the same or substantially the same art or arguments as

were previously presented to the Office. To evaluate arguments for discretionary denial under § 325(d), the Board uses a two-part framework:

> (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and
>
> (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims. If a condition in the first part of the framework is satisfied and the petitioner fails to make a showing of material error, the Director generally will exercise discretion not to institute *inter partes* review.

Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8–9 (PTAB Feb. 13, 2020) (precedential).

2. First Part of the Framework

Under the first part of the *Advanced Bionics* framework, previously presented art includes art listed on an Information Disclosure Statement (IDS) and "art made of record by the Examiner." *Id.* at 7–8. Here, the Petition's challenges are based on TML6 and Fandrianto. Pet. 2. TML6 is substantially the same as art previously presented to the Office because the '469 patent discusses TML6. *See, e.g.*, Ex. 1001, 8:43–53, 11:33–13:29. Fandrianto was made of record by the Examiner. Ex. 1002, 310; Ex. 1001, code (56). Thus, the first part of the framework is satisfied, and we must proceed to the second part.

3. Second Part of the Framework

Under the second part, we must determine "whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims." *Advanced Bionics*, Paper 6 at 8. For the reasons discussed in this section, Petitioner has demonstrated a material error by the

Office. In arriving at this conclusion, we consider *Becton, Dickinson* factors (c), (e), and (f). *See id.* at 9 n.10 (citing *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17–18 (Dec. 15, 2017) (precedential as to § III.C.5, first paragraph)).

Becton, Dickinson factor (c) is "the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection." *Becton, Dickinson*, Paper 8 at 17–18. For example, "if the record of the Office's previous consideration of the art is not well developed or silent, then a petitioner may show the Office erred by overlooking something persuasive under factors (e) and (f)." *Advanced Bionics*, Paper 6 at 10.

Petitioner argues that TML6's source code was neither provided to the Office on an IDS nor listed on the patent's cover, meaning that the TML6 code itself was not cited by the Applicant or Examiner. Pet. 99–100 (citing Ex. 1001, code (56); Ex. 1002). Petitioner argues that, although Fandrianto is cited on an IDS, the Examiner never applied Fandrianto in a rejection or discussed it. *Id.* at 100.

Patent Owner argues that the Examiner adequately considered TML6's "substantive disclosures." Prelim. Resp. 30. Patent Owner argues that any differences between the TML6 code and the '469 patent's description of that code is irrelevant, manufactured, and a red herring. *Id.* at 31–32. In Patent Owner's view, the name of a particular function in the TML6 code is not material to the arguments, and the challenged patent describes the TML6 code in detail. *Id.* (citing Ex. 1001, 11:64–12:2). Patent Owner argues that Petitioner has not shown any error in the Examiner's evaluation of TML6 and Fandrianto. *Id.* at 36–37.

Under *Becton, Dickinson* factor (c), we agree with Petitioner that evaluating the '469 patent's description of TML6 is meaningfully different from evaluating the code itself. *See Becton, Dickinson*, Paper 8 at 17–18. Specifically, Petitioner points out, "Although the '469 patent accurately summarizes certain portions of the TML6 sub-pixel interpolation scheme in its Background section [Ex. 1001, 11:33–13:39], the TML6 source code relied on [in the Petition (Ex. 1005)] includes far greater coverage of the components and functionalities of the TML6 codec and was thus not considered by the Examiner." Pet. 99.

Although Patent Owner and Dr. Chrissan assert that the function names in the source code are "immaterial" (Prelim. Resp. 31–32; Ex. 2001 ¶ 79), the TML6 code relied upon in the Petition contains the actual calculations in thousands of lines of code, which detail the specific data structures (e.g., *imgY, img4Ytmp, mref*) and specific algorithms (e.g., *oneforthpix*) used. *Compare* Ex. 1005, *with* Ex. 1001, 11:33–13:39. We see no evidence on this record that the Examiner evaluated the code itself, which is the basis for Petitioner's challenge.

Also, the Examiner did not use the TML6 code or Fandrianto in any rejection. *See* Ex. 1002, 325–27 (Office Action dated Aug. 26, 2004), 303–09 (Office Action, dated Sept. 9, 2004), 318–21 (Office Action, dated Mar. 14, 2005). Under *Becton, Dickinson* factor (c), this weighs against denying the Petition under § 325(d). *Becton, Dickinson*, Paper 8 at 17–18. Patent Owner argues that the Examiner of the '469 patent also examined Fandrianto. Prelim. Resp. 32–33. Still, *Becton, Dickinson* factor (c) looks at the extent to which the Fandrianto was evaluated during examination, and there is no discussion or analysis of Fandrianto in the '469 patent, apart from its inclusion on the IDS. *See* Ex. 1002, 303–09, 318–21, 325–27.

Even assuming that evaluating the summary of TML6 in the challenged patent's background were the same as evaluating the TML6 code, Petitioner has shown under *Becton, Dickinson* factors (e) and (f) that the Office erred by overlooking the TML6-Fandrianto combination for the reasons discussed below in the analysis of Petitioner's challenges. *See infra* Section II.E. That is, we disagree with Patent Owner that Petitioner has failed to meet its burden. Prelim. Resp. 36–37.

Thus, none of *Becton, Dickinson* factors (c), (e), and (f) weigh in favor of denying the Petition under § 325(d).

4. Conclusion

We do not exercise our discretion to deny the Petition under § 325(d).

C. Level of Ordinary Skill in the Art

According to Petitioner,

> A person of ordinary skill in the art ("POSITA") at the time of the alleged invention of the '469 patent would have had a (1) Bachelor's degree in electrical engineering, computer engineering, computer science, or a comparable field of study such as physics, and (2) approximately two to three years of practical experience with video encoding/decoding. Additional experience can substitute for the level of education, and vice-versa.

Pet. 11 (citing Ex. 1003 ¶ 41).

Patent Owner argues that a person of ordinary skill in the art "would be an electrical and/or computer engineer with one to two years of experience relating to video coding hardware and/or software." Prelim. Resp. 26.

We need not resolve this dispute at this stage because the decision here would be the same under either definition. If the parties believe that the level of skill in the art would affect the outcome in this case, the parties must brief that issue. The failure to describe how a different level of skill in the art

is determinative will be a forfeiture of that argument. If there is a dispute regarding the level of ordinary skill in the art, then the parties are also encouraged to submit evidence, other than conclusory expert testimony, that supports their position.

D. Claim Construction

The Board is required to construe only those terms that are in controversy, and only to the extent necessary to resolve the controversy. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Neither party argues that the Board needs to construe any terms to determine whether to institute an *inter partes* review. *See* Pet. 11; Prelim. Resp 26. On the current record, no terms are in controversy. Thus, no claim term needs to be construed in this decision.

E. Obviousness over TML6 and Fandrianto

Petitioner asserts that claims 1–7, 9, and 14–51 are unpatentable as obvious over TML6 and Fandrianto. Pet. 2.

1. TML6

a. Overview

According to Petitioner, TML6 is excerpted from the source code for "Test Model Long Term Number 6." *Id.* at 12 (citing Ex. 1008 ¶¶ 15, 21).[3] Dr. Wenger claims to have "contributed heavily to certain portions of the TML-6 source code in [Exhibit 1005]." Ex. 1008 ¶ 21.

Petitioner asserts that the interpolation method implemented in the TML6 code is described in the '469 patent's background section. *See* Pet. 14 (citing Ex. 1001, 11:33–39). According to the '469 patent, TML6 was

[3] Exhibit 1008 is the Declaration of Dr. Stephan Wenger.

developed as part of the work ongoing in the ITU-Telecommunications Standardization Sector, Study Group 16, Video Coding Experts Group (VCEG), Question 6. Ex. 1001, 8:43–52; *see also* Section I.B (discussing TML6). The approach implemented in TML6 was proposed for incorporation into ITU-T recommendation H.26L. *Id.* at 8:46–49. TML6's purpose was evaluation and further development. *Id.*

Dr. Wenger testifies that, before each meeting, VCEG participants could submit the test-model documents, among other things, for discussion at the upcoming meeting. Ex. 1008 ¶ 19. According to Dr. Wenger, "Test models, including TML-6, typically consist of two documents: (i) a group of files that together make up a fully functional 'source code' of a working video encoder and decoder; and (ii) documentation explaining the functionality of the source code in prose." *Id.*

b. Patent Owner's Arguments

In Patent Owner's view, the Board should deny institution because the Petition lacks a reason to combine the TML6 source-code files. Prelim. Resp. 38–39 (citing *Securus Techs., Inc. v. Global Tel*Link Corp.*, 701 F. App'x 971, 976–77 (Fed. Cir. 2017); *Health Care Logistics, Inc. v. Kit Check, Inc.*, IPR2019-00388, Paper 7 at 15 (PTAB June 3, 2019)). According to Patent Owner, each source-code file is a separate reference because the files were authored by multiple people over several years. *Id.* at 39 (citing *Kyocera Wireless Corp. v. ITC*, 545 F.3d 1340, 1351–52 (Fed. Cir. 2008)). In particular, Patent Owner argues that the files were authored by VCEG participants and their colleagues. *Id.* at 40 (citing Ex. 1008 ¶¶ 15, 19, 20, 35; *CA, Inc. v. Simple.com, Inc.*, 780 F. Supp. 2d 196, 254 (E.D.N.Y. 2009)). Also, Patent Owner argues that the Board should consider that sub-pixel value interpolation is only a small part of TML6. *Id.* at 39 n.4.

c. Analysis

We disagree with Patent Owner that TML6 is not a single reference. TML6 is unlike the GSM specification at issue in *Kyocera. See* 545 F.3d at 1351–52. As Patent Owner points out, the Court of Appeals for the Federal Circuit found that the GSM standard comprised different specifications that were authored by different subsets of authors at different times. *Id.*, *cited in* Prelim. Resp. 39. But that was not the sole basis for concluding that the GSM standard was not a single prior-art reference. Rather, the Court found that "the GSM standard includes hundreds of individual specifications drafted by approximately ten different subgroups, each with its own title and separate page numbering," and that each specification "stands as a separate document in its own right." *Id.* In determining that each relevant GSM standard did not incorporate the others by reference, the Court characterized the referencing practice as "vague," explaining that "the GSM standard is simply not a coherent whole document that can be assigned a single prior art date of creation." *Id.*

Here, in contrast to *Kyocera*, the single compressed file called "tml6pre.zip" has a single date of public accessibility: March 28, 2001. *See* Ex. 1008 ¶ 38; Ex. 1003 ¶ 46; Ex. 1017, 1. Also, unlike the GSM standard in *Kyocera*, the evidence at this stage indicates that the TML6 source-code files are a coherent whole. For instance, Dr. Wenger testifies that TML6, like other test models, contain "a group of files that *together* make up a fully functional 'source code' of a working video encoder and decoder." Ex. 1008 ¶ 19 (emphasis added). Patent Owner makes a similar statement: "The *whole* codec is designed *to work together* with the interpolation scheme that existed at the time, but only certain parts define the interpolation process itself." Prelim. Resp. 39 n.4 (emphasis added). Indeed, TML6's purpose was

testing, evaluation, and further development, as Dr. Wenger testifies (Ex. 1008 ¶ 19) and explained in the '469 patent (Ex. 1001, 8:46–49). The source-code files were packaged together in a single compressed file called "tml6pre.zip." Pet. 12–13 (citing Ex. 1004 ¶¶ 45–46; Ex. 1005; Ex. 1008 ¶¶ 15, 18–38). This suggests that the files were meant to be used and distributed together, rather than individually, as the GSM standard specifications in *Kyocera* were. *See* 545 F.3d at 1351–52.

Notably, in *Kyocera*, the Court found that each specification in the GSM standard had its own title. *Id.* By contrast, the '469 patent refers to TML6 as a whole, rather than citing the specific function and the separate file name—e.g., the *oneforthpix* function in the *Image.c* file. *See, e.g.*, Ex. 1001, 8:43–52 ("The interpolation schemes proposed in both TML5 and TML6 will now be described."). There is no evidence at this stage that the functions or individual files were thought of as separate documents. In this way, the '469 patent further supports a conclusion that TML6 is a single prior-art reference. *See id.*

Thus, we determine that TML6 is a single reference and that a reason to combine the separate files is unnecessary.

2. Fandrianto

Fandrianto generally relates to a programmable architecture for calculating motion vectors and prediction errors. *See* Ex. 1006, 1:7–10. Fandrianto claims that its motion-vector searching is fast and efficient because it uses two high-speed, multi-ported register files in the architecture's data path: DP memory and DPCM memory. *Id.* at 3:55–62. DP memory is a best-match block memory, and DPCM memory is a search memory. *Id.* For motion-vector searching with one-half or one-quarter accuracy, the DPCM memory stores a search window. *Id.* at 5:28–32. The

search window is largely an interpolated search matrix generated from a less-accurate estimation operation. *Id.* Fandrianto estimates motion information for half pixels and quarter pixels after estimating motion information for integral pixels. *Id.* at 5:6–9, 5:26–32. This improves prediction accuracy, according to Fandrianto. *Id.* at 5:26–28.

Of relevance to Petitioner's obviousness rationale, Fandrianto generates quarter pixels using horizontal, vertical, or diagonal interpolation. *Id.* at 8:29–10:58. In the limited-memory embodiment, the order for generating and comparing the quarter-pixel estimation search blocks and selecting the full- and half-pixel estimation for overwriting "are somewhat discretionary." *Id.* at 8:15–20.

3. Claim 1

Petitioner argues that claim 1 would have been obvious in view of TML6 and Fandrianto. Pet. 21–58. According to Petitioner, a person of ordinary skill in the art would have implemented Fandrianto's interpolation into TML6's video encoder. *Id.* at 21–29. Petitioner also argues that implementing the quarter sub-pixel interpolation in Fandrianto's hardware, instead of TML6's software, would increase interpolation speed. *Id.* at 29 (citing Ex. 1003 ¶ 130).

Patent Owner argues that Petitioner's obviousness rationale is insufficient (Prelim. Resp. 41–46), Petitioner incorrectly describes Fandrianto's interpolation process (*id.* at 46–61), and a person of ordinary skill in the art would not have combined TML6 and Fandrianto (*id.* at 61–64).

At this stage and on this record, we disagree with Patent Owner's arguments and determine that it is reasonably likely that Petitioner would

prevail in showing that claim 1 is unpatentable over the TML6-Fandrianto combination.[4] Our reasoning follows.

a. Petitioner's Obviousness Rationale

i. Same Field and Problem

Petitioner argues that TML6 and Fandrianto share the same field (motion-prediction video encoding), address the same problem (frame-to-frame sub-pixel motion), and solve that problem by half- and quarter-pixel interpolation. Pet. 22 (citing Ex. 1001, 8:43–9:9, 11:33–13:29, Figs. 13(a)–(c); Ex. 1005, 16–24, 115–16; Ex. 1006, 5:26–28).

In Patent Owner's view, a person of ordinary skill in the art looking to modify TML6's source code for a complete video-coder implementation would not consider Fandrianto's hardware architecture, which moves pixel data around in a limited-memory system. Prelim. Resp. 41–42. Patent Owner argues that Fandrianto's teachings focus on resource-constrained systems. *Id.* at 42–43. According to Patent Owner, Fandrianto's hardware was obsolete at the time of the invention. *Id.*

The current record, though, better supports Petitioner's view that (1) both references address frame-to-frame sub-pixel motion for motion-prediction video encoding and (2) at the time of the invention, solving this problem involved a tradeoff between improved accuracy and computational efficiency. *See* Pet. 22–23. That is, the accuracy of TML6's four-value interpolation may sometimes be worth the computational expense, but

[4] The arguments in Patent Owner's Preliminary Response do not specifically address the preamble. *See* Prelim. Resp. Even so, Petitioner has the burden to show that the challenged claims are unpatentable. Thus, we have reviewed Petitioner's arguments and evidence submitted in connection with the pre-amble. *See* Pet. 29–39. We find them to be sufficient on the current record.

Fandrianto's two-value method may be needed in resource-constrained applications when computational efficiency is paramount. *Id.* at 23–24 (citing Ex. 1005, 58, lines 593–625; Ex. 1006, Fig. 5, 10:51–58). So, even if Fandrianto's teachings apply to only resource-limited systems, Petitioner has sufficiently shown that a person of ordinary skill in the art seeking to modify TML6's source code for at least that case would have looked to Fandrianto's teachings. *See id.* at 22–23.

ii. Fandrianto's Express Motivation

According to the Petition, Fandrianto's express teachings would have led one of ordinary skill in the art to combine Fandrianto with TML6: "Various interpolation techniques may be used in the derivation of a given quarter pixel estimation block, depending on various factors such as the amount of memory available." *Id.* at 22 (quoting Ex. 1006, 7:32–35). From this, Petitioner argues "Fandrianto teaches a quarter-pixel interpolation technique suitable for a 'limited memory' architecture." *Id.* (citing Ex. 1006, 7:36–37; 8:16–21, Fig. 2).

Patent Owner argues that Fandrianto lacks any express teaching that would have led a person of ordinary skill in the art to incorporate its interpolation method in TML6. Prelim. Resp. 43. In Patent Owner's view, the part of Fandrianto quoted by Petitioner (Ex. 1006, 7:32–35, *quoted in* Pet. 22) merely restates that Fandrianto is related to a programmable architecture, not a video-coding method. Prelim. Resp. 43. Patent Owner argues that video standards are developed before optimized hardware supporting that standard, and thus, one of ordinary skill in the art "would not be motivated to develop new video interpolation methods simply because Fandrianto's architecture was programmable." *Id.* at 43–44.

Patent Owner's argument, though, mischaracterizes Petitioner's reliance on that quote. *See id.* Petitioner is not arguing that Fandrianto's programmable architecture is the sole basis for developing a new video interpolation method. *See* Pet. 22. Rather, Petitioner is merely quoting Fandrianto to support its view that the quarter-pixel interpolation technique is suitable for a limited-memory architecture. *Id.* (citing Ex. 1006, 7:36–37; 8:16–21). Fandrianto expressly supports this reasoning. *See id.*

Thus, we disagree with Patent Owner's argument about Fandrianto's express motivation. Prelim. Resp. 43–44.

iii. Multiple Calculations for Same Sub-Pixel Location

According to Patent Owner, "Performing multiple (even if finite) distinct procedures to calculate a result for the same sub-pixel location is either wasteful (if the results are, by design, the same) or would require more steps in the interpolation process to determine the correct value, wasting storage or bandwidth capacity." Prelim. Resp. 44. Patent Owner argues that a person of ordinary skill "would be motivated to avoid either calculating the same result more than once or creating an interpolation scheme where the same motion vector leads to different results depending on the calculation method, thus giving purpose to performing the various procedures." *Id.*

Patent Owner, though, does not provide any citations to the record or the Declaration of Dr. Chrissan (Ex. 2001) to support this argument. *Id.* To the extent that Patent Owner relies on its other arguments for support here, we disagree for the reasons discussed above.

Even so, Patent Owner's argument about wasteful calculations (*id.*) assumes that the same result would be calculated multiple times under Petitioner's proposed combination. But Petitioner proposes using Fandrianto's interpolation method as an "alternative" in some situations in

place of TML6's method. Pet. 22–23. Because Patent Owner's argument assumes that the methods would be used in parallel, it mischaracterizes Petitioner's reasoning. *See* Prelim. Resp. 44.

Also, Patent Owner's argument does not squarely address Petitioner's reasoning that Fandrianto's two-value method may be needed in resource-constrained applications but TML6's four-value interpolation is to be used when accuracy is paramount. Pet. 23–24 (citing Ex. 1006, Fig. 5, 10:51–58; Ex. 1005, 58, lines 593–625). And, for the reasons discussed in Sections II.E.3.a.i and ii, we determine that Petitioner's argument is sufficiently supported at this stage.

Thus, we disagree with Patent Owner's arguments about wasting storage or bandwidth capacity. *See* Prelim. Resp. 44.

iv. Simple Substitution

Petitioner argues that the TML6-Fandrianto combination would have been nothing more than a simple substitution yielding predictable results. Pet. 24.

Patent Owner disagrees, pointing to the technical specifications for Fandrianto's hardware and TML6's software: pixel depth, ALU capabilities, memory-access scheme, and others. Prelim. Resp. 45. In Patent Owner's view, "It is hard to imagine two supposedly similar disclosures that would be more challenging to combine or interchange." *Id.* at 45–46.

Patent Owner's argument about these technical specifications raises factual issues that are best resolved on a fully developed record. *See id.* Even so, Patent Owner provides no citations to the record in its assessment here. *See id.* Nor does Patent Owner provide any substantive reasons why the differences that it identifies are relevant to Petitioner's combination or would have led to any specific technical challenges. *See id.* Although trial

could produce additional evidence that may ultimately support Patent Owner's argument, we see little reason to believe that incorporating Fandrianto's interpolation scheme into TML6 in the way that Petitioner proposes would be beyond the capabilities of one of ordinary skill in the art. Indeed, a person of ordinary skill in the art is a person of ordinary creativity—not an automaton. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

v. Conclusion

Thus, Petitioner's obviousness rationale is adequately supported at this stage and on this record.

b. Method Steps (a) and (b)

Claim 1's steps (a) and (b) recite,

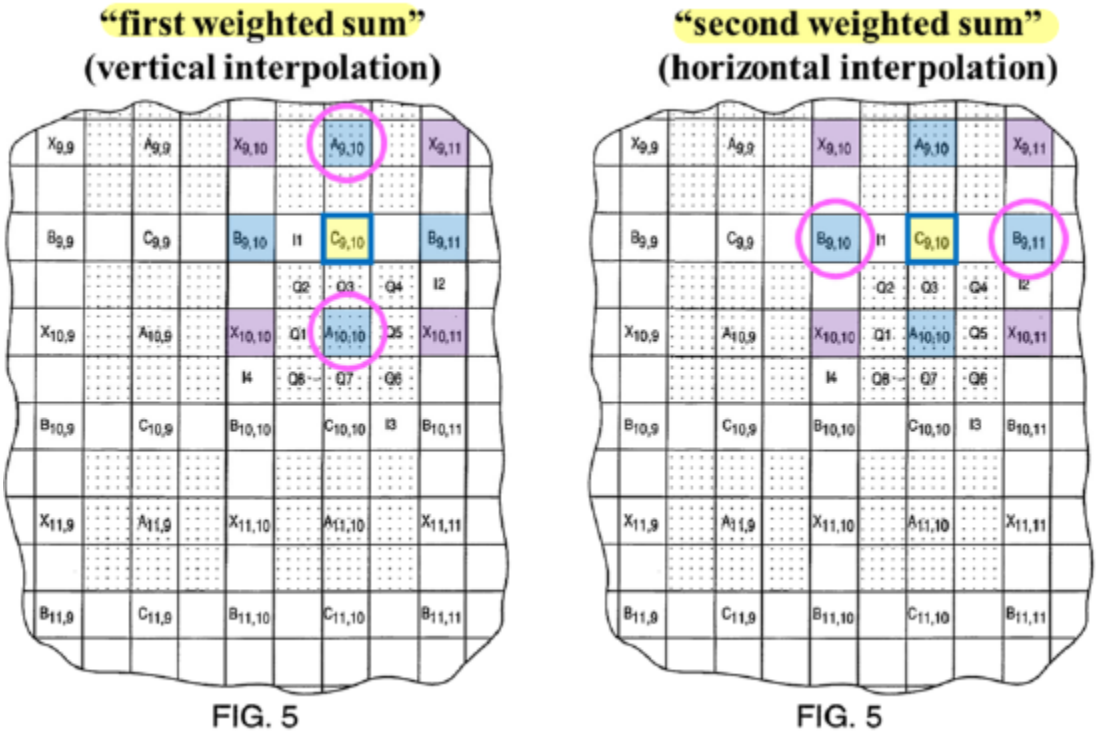
> a) when values for sub-pixels at $\frac{1}{2}^{N-1}$ unit horizontal and unit vertical locations, and unit horizontal and $\frac{1}{2}^{N-1}$ unit vertical locations are required, interpolating such values directly using weighted sums of pixels residing at unit horizontal and unit vertical locations;
>
> b) when values for sub-pixels at $\frac{1}{2}^{N-1}$ unit horizontal and $\frac{1}{2}^{N-1}$ unit vertical locations are required, interpolating such values directly using a choice of a first weighted sum of values for sub-pixels residing at $\frac{1}{2}^{N-1}$ unit horizontal and unit vertical locations and a second weighted sum of values for sub-pixels residing at unit horizontal and $\frac{1}{2}^{N-1}$ unit vertical locations, the first and second weighted sums of values being calculated according to step (a); and

Ex. 1001, 45:16–29.

Petitioner refers to a sub-pixel at $\frac{1}{2}^{N-1}$ unit horizontal and $\frac{1}{2}^{N-1}$ unit vertical location, when N equals 2, as a "half-half sub-pixel." *See, e.g.*, Pet. 7 n.4, 49. Thus, we adopt that nomenclature in our analysis below.

Petitioner argues that TML6's function *oneforthpix* discloses step (a). *Id.* at 39–47. Patent Owner does not dispute this. *See* Prelim. Resp. We have reviewed the relevant part of TML6 and agree that Petitioner's analysis is sufficient at this stage. Pet. 39–47.

Petitioner argues that the TML6-Fandrianto combination teaches step (b) using a choice of a first weighted sum and a second weighted sum, calculated according to step (a) when directly interpolating values for sub-pixels at $½^{N-1}$ unit horizontal and $½^{N-1}$ unit vertical locations. *Id.* at 53. Petitioner illustrates Fandrianto's first and second weighted sums in the figure below. *Id.* at 50.



The above figure illustrates vertical interpolation on the left and horizontal interpolation on the right based on Fandrianto's Figure 5. *Id.* The interpolation methods are for the half-half sub-pixel $C_{9,10}$ (blue outline,

yellow highlighting). *Id.* at 49. According to Petitioner, the sub-pixel $C_{9,10}$ can be interpolated by either interpolation method. *Id.* The method on the left uses $A_{9,10}$ (blue circled in magenta) and $A_{10,10}$ (blue circled in magenta), which are above and below $C_{9,10}$. *Id.* Thus, Petitioner argues that "Fandrianto discloses interpolating half-half sub-pixels using either the 'first weighted sum' of the 'A' sub-pixels at half unit horizontal and unit vertical locations, or the 'second weighted sum' of the 'B' sub-pixels at unit horizontal and half unit vertical locations, with respective weights in each weighted sum equal to '1.'" *Id.* at 50 (citing Ex. 1003 ¶ 159).

From these teachings, Petitioner argues that it would have been obvious to modify TML6's *oneforthpix* function to calculate "a first weighted sum of values for sub-pixels residing at half unit horizontal and unit vertical locations (a vertical weighted sum as disclosed in TML6) and a second weighted sum of values for sub-pixels residing at unit horizontal and half unit vertical locations (a horizontal weighted sum as disclosed in Fandrianto), and to interpolate the half-half sub-pixels using a choice of either the first weighted sum or the second weighted sum." *Id.* at 51 (citing Ex. 1003 ¶ 159). Petitioner argues that one of ordinary skill in the art would have modified TML6 in this way for the reasons discussed above. *See supra* Section II.E.3.a.

Patent Owner argues that Fandrianto's limited-memory architecture is incompatible with TML6's approach. Prelim. Resp. 62. According to Patent Owner, the table below illustrates the barriers to combining Fandrianto's architecture with TML6's software encoder. *Id.* at 62–63.

	Fandrianto	TML6
Pixels interpolated for unit, half-unit sub-pixel positions	2	6
Sub-pixels interpolated for half-unit, half-unit sub-pixel positions	0 or 2	6
Final or intermediate input values used for half-unit, half-unit interpolation	Final	Intermediate
Bit depth of half-unit sub-pixels used for quarter-pixel interpolation	8	18
Use of intermediate values for half-pixels	No	Yes
Operations performed on pixel data for interpolation	Adding and dividing by 2	Multiplying, adding, dividing by numbers larger than 2 (e.g., 2048 or 4096), performing several of these operations in a single step

Patent Owner argues that Fandrianto cannot be "modified to accommodate: (i) a filter tap length greater than 2; (ii) the use/storage of intermediate resolution values (e.g., higher/variable bit-depths); and (iii) the use of filter coefficients greater than 1 (i.e., Fandrianto just makes straightforward averages)." *Id.* at 63 n.13. In Patent Owner's view, Fandrianto and TML6 have nothing in common apart from relating to sub-pixels. *Id.* at 63 (citing Ex. 2001 ¶ 76). Patent Owner argues that a person of ordinary skill in the art

would not have made the combination because TML6 is "more sophisticated than Fandrianto." *Id.* at 64 (citing Ex. 2001 ¶ 77).

But it is well settled that "a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements." *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012) (citations omitted). Nor is the test for obviousness whether a secondary reference's features can be bodily incorporated into the structure of the primary reference. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). And, as discussed above, a person of ordinary skill in the art is a person of ordinary creativity. *KSR*, 550 U.S. at 421.

Here, Petitioner sufficiently explains that "TML6 and Fandrianto disclose methods for interpolating quarter-quarter sub-pixels using the same inputs and basic arithmetic." Pet. 26. Both methods are based on estimating new data points from the surrounding ones. *See id.* at 25. The features compared by Patent Owner (Prelim. Resp. 62–63) simply highlight the different ways of accomplishing this. Petitioner sufficiently explains that the differences are the result of a tradeoff between improved accuracy and computational efficiency. *See* Pet. 22–23. Thus, we disagree with Patent Owner that the identified differences (Prelim. Resp. 62–63) weigh against Petitioner's combination.

Patent Owner argues that adding Fandrianto to TML6 "defeats the whole purpose of TML6's design improvement over TML5." *Id.* at 63. In Patent Owner's view, TML6 improves upon TML5 because TML6 does not round or clip intermediate values, retaining maximum precision throughout the interpolation. *Id.* at 64 (citing Ex. 1001, 11:35–39). Patent Owner argues that modifying TML6 with Fandrianto would have undermined this

advantage because TML6's 6-tap filter would have needed to be removed and the modification step would have needed to be reintroduced. *Id.*

We disagree with Patent Owner for reasons similar to those discussed above: Petitioner has shown that there exists a tradeoff, and some features that could be regarded as an improvement come with associated costs. Pet. 22–23. Although Patent Owner characterizes TML6 as "a design improvement over TML5" (Prelim. Resp. 63), the '469 patent explains that neither test model "is optimum for application in both encoder and decoder." Ex. 1001, 13:36–39. Rather, the '469 patent discusses the tradeoffs between TML5 and TML6:

> TML6 is computationally less complex than TML5, as fewer truncating and clipping operations are required. However, a disadvantage of TML6 is that high precision arithmetic is required both in the encoder and in the decoder. High precision interpolation requires more silicon area in ASICs and requires more computations in some CPUs.

Id. at 13:20–26. This discussion better supports Petitioner's reasoning about making tradeoffs when implementing interpolation methods. *See* Pet. 22–23.

Thus, Petitioner has sufficiently shown that the proposed combination teaches or suggests steps (a) and (b).

c. Method Step (c)

Claim 1's step (c) recites,

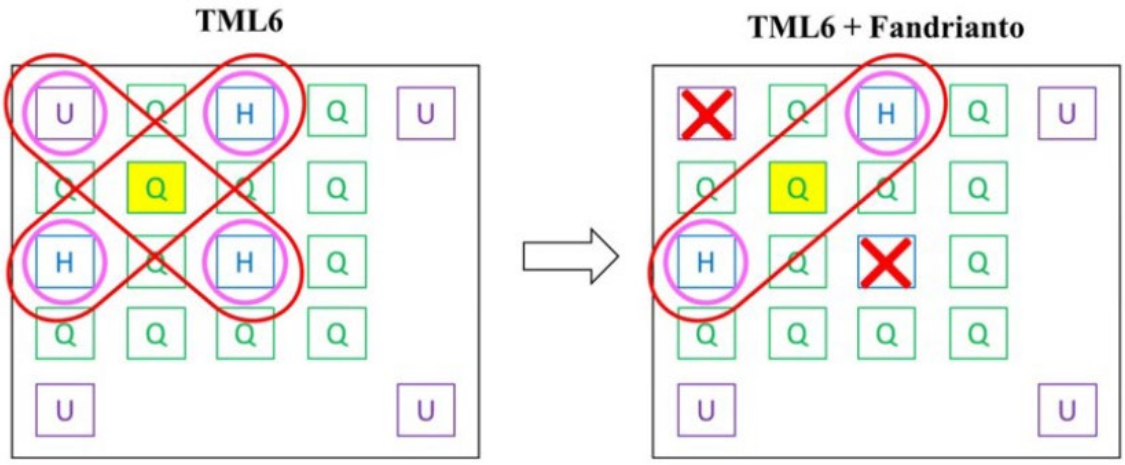
> c) when a value for a sub-pixel situated at a $\frac{1}{2}^{N}$ unit horizontal and $\frac{1}{2}^{N}$ unit vertical location is required, interpolating such a value by taking a weighted average of the value of a first sub-pixel or pixel situated at a $\frac{1}{2}^{N-m}$ unit horizontal and $\frac{1}{2}^{N-n}$ unit vertical location and the value of a second sub-pixel or pixel located at a $\frac{1}{2}^{N-p}$ unit horizontal and $\frac{1}{2}^{N-q}$ unit vertical location, variables m, n, p and q taking integer values in the range 1 to N such that the first and second sub-pixels

> or pixels are located diagonally with respect to the sub-pixel at $\frac{1}{2}^N$ unit horizontal and $\frac{1}{2}^N$ vertical location.

Ex. 1001, 45:30–40.

Petitioner and Patent Owner call "a sub-pixel situated at a $\frac{1}{2}^N$ unit horizontal and $\frac{1}{2}^N$ unit vertical location," when N equals 2, a "quarter-quarter sub-pixel." *See, e.g.*, Pet. 7 n.4, 54; Prelim. Resp. 47. Thus, we follow that naming convention in our analysis below.

Petitioner argues that it would have been obvious to arrive at step (c) by using Fandrianto's method of interpolating quarter-quarter sub-pixels in TML6 or by using Fandrianto's technique on its hardware. Pet. 57–58. Petitioner illustrates this rationale with the figure below. *Id.*



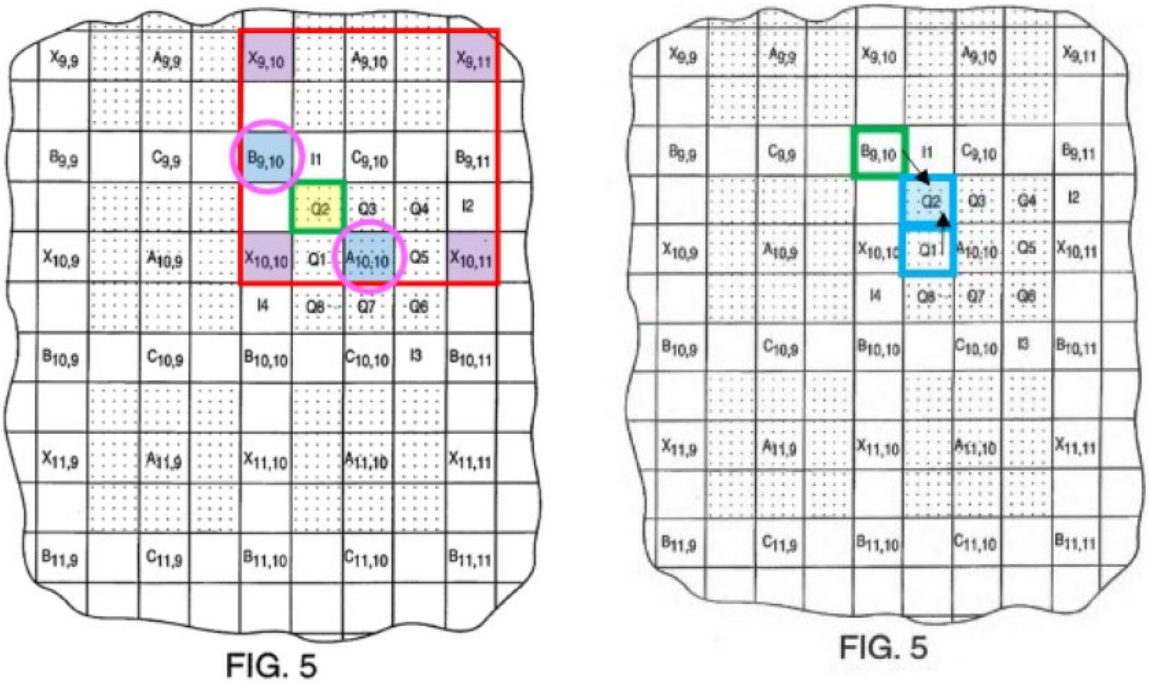
The figure on the left represents TML6's method, and the figure on the right represents the method under the TML6-Fandrianto combination. *See id.* The figures identify the values used in the interpolation using magenta and red circles. *See id.* Specifically, on the right, the value for the quarter-quarter sub-pixel Q (green outline, yellow highlighting) is interpolated using the weighted average of (1) a first sub-pixel H (blue outline circled in magenta and red) at a $\frac{1}{2}^{N-m}$ unit horizontal and $\frac{1}{2}^{N-n}$ unit vertical location and (2) a second subpixel H (blue outline circled in magenta and red) at a $\frac{1}{2}^{N-p}$ unit

horizontal and $½^{N-q}$ unit vertical location. *Id.* The first and second sub-pixels are located diagonally adjacent to the highlighted quarter-quarter subpixel Q—i.e., "the sub-pixel at $½^{N}$ unit horizontal and $½^{N}$ vertical location," when N equals 2. *Id.* at 58 (citing Ex. 1003 ¶¶ 173–175). This is different from TML6, which uses two additional locations: the boxes marked with a red "X" in the figure on the right, and those with red and magenta circles in the figure on the left. *Id.*

Petitioner argues that one of ordinary skill in the art would have modified TML6 to omit two locations from its scheme for the reasons discussed above. *See supra* Section II.E.3.a.

Patent Owner argues that step (c) requires that quarter-quarter sub-pixels be interpolated from either (1) a diagonally opposed pixel and a diagonally opposed sub-pixel or (2) two diagonally opposed sub-pixels. Prelim. Resp. 57–59. According to Patent Owner, Fandrianto's interpolation of pixel Q2 meets neither of these requirements because the "A block 72" memory stores quarter-pixel Q1 values when the quarter-quarter sub-pixel Q2 is interpolated. *Id.* at 46–57, 60–61.

Patent Owner's argument focuses on Fandrianto's embodiment shown in Figure 5 and characterizes the Petition's description of this embodiment as inaccurate. *See id.* at 50. Patent Owner's argument is illustrated in the figure below from the Preliminary Response. *Id.* at 48.



On the left is Fandrianto's Figure 5 as annotated in the Petition. *Id.* (citing Pet. 56). On the right is the same figure with Patent Owner's annotations. *Id.* According to Patent Owner, Petitioner is incorrect that A block 72 stores half-pixel value $A_{10,10}$ (left, magenta circle, blue fill) when Q2 (left, green outline, yellow fill) is interpolated. *Id.* at 49. In Patent Owner's view, Q2 (right, blue outline, blue fill) is interpolated using $B_{9,10}$ (right, green outline) and Q1 (right, blue outline, no fill) because A block 72 stores previously interpolated quarter-pixel values. *Id.* Patent Owner argues that because $B_{9,10}$ and Q1 are not diagonally adjacent pixels or sub-pixels, Fandrianto does not teach the interpolation recited in step (c). *Id.*

Figure 5, above, shows part of interpolated search matrix 400. Ex. 1006, 8:29–33. In particular, matrix 400 has four completely interleaved matrices corresponding to blocks 70, 72, 74, and 76 containing pixels $X_{r,c}$, $A_{r,c}$, $B_{r,c}$ and $C_{r,c}$. *Id.* Here, subscripts *r* and *c* refer to the row and column of the interleaved matrix. *Id.* For example, $A_{10,10}$ means row 10 and column 10. *See id.* Patent Owner argues that the Petition ignores the difference between

the memory locations and the values stored in those locations. Prelim. Resp. 50. In particular, Patent Owner argues that (1) the values in the blocks change during interpolation and (2) A block 72 memory stores quarter-pixel Q1 values, not those labeled $A_{r,c}$ when quarter-quarter sub-pixel Q2 is interpolated. *Id.* (citing Ex. 1006, 3:55–62, 3:39–44, 4:18–21, 5:6–9, 5:33–44, 7:38–44).

The basis for Patent Owner's argument is Fandrianto's example in which D block 82 stores values $A_{0,0}$ to $A_{1,16}$ to free up A block 72, allowing it to hold the current quarter-pixel interpolated block. *Id.* at 51 (citing Ex. 1006, 8:29–36). Fandrianto refers to the current quarter-pixel interpolated block as $Q_{r,c}$. Ex. 1006, 8:29–36. Likewise, Figure 5, above, shows quarter pixels labeled Q1 through Q8. Prelim. Resp. 48. As for Petitioner's alleged mistake, Patent Owner argues that Fandrianto's "diagonal interpolation" of A block 72's data refers to quarter pixel $Q_{r,c}$—not half-pixel $A_{10,10}$—because Fandrianto uses the word "diagonal" to mean the memory-block arrangement instead of the spatial relationship of the subpixel locations. *Id.* at 52–54.

The table below summarizes Patent Owner's view of the embodiment described in Fandrianto's column 8. *Id.* at 55 (citing Ex. 1006, 8:4–57).

DP & DPCM Memory Blocks	**Stored Values for After Interpolating Q1**
A block (DPCM)	quarter-pixel value located at quarter unit horizontal and unit vertical (labeled ***"Q1"*** in Figure 5 of Fandrianto)
B block DPCM	half-pixel values located at unit horizontal and half unit vertical (labeled $\mathbf{B_{r,c}}$ in Figure 5 of Fandrianto)
D block (DP)	half-pixel values located at half unit horizontal and unit vertical (labeled $\mathbf{A_{r,c}}$ in Figure 5 of Fandrianto)

That is, Patent Owner argues that Fandrianto's quarter-pixel interpolation method holds the current quarter pixel interpolated block in A block, and the current quarter-pixel interpolated block right before calculating Q2 is Q1. *Id.* at 54 (citing Ex. 1006, 8:33–35), 54 n.10 (citing Ex. 1006, 8:58–67), 54 n.11 (citing Ex. 1006, 8:33–40).

Patent Owner argues that, unlike Fandrianto (*id.* at 60–61), claimed step (c) requires two diagonally located pixels or sub-pixels. *Id.* at 57–59 (citing Ex. 1001, 36:41–44, 37:46–49, 41:12–15, 42:49–62, Figs. 15, 21(a)–(b)). Whether step (c) requires two diagonally located pixels or sub-pixels is not in controversy at this stage because it is consistent with Petitioner's view. *Compare id.*, *with* Pet. 56 (annotating two diagonally located half pixels with magenta circles in Fandrianto's Figure 5 and arguing that they correspond to the pixels in step (c)). Rather, at this stage, the dispute between the parties is over Fandrianto's teachings.

We disagree with Patent Owner's argument because it does not squarely address Petitioner's rationale. In particular, Petitioner argues that "A block 72 and B block 74 contain 'A' and 'B' data, respectively, because Fandrianto *does not require a specific order* for deriving pixels Q1–Q8." Pet. 55–56 n.12 (citing Ex. 1003 ¶¶ 168–171; Ex. 1006, 7:26–8:20, 10:51–58, Figs. 3B, 5) (emphasis added). That is, Petitioner relies on one possible ordering out of several. *Id.* And a product in the prior art that at least sometimes "embodies a claimed method nonetheless teaches that aspect of the invention." *Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1326 (Fed. Cir. 2003).

The current record supports Petitioner's argument: Fandrianto states that "the order in which the quarter pixel estimation search blocks are generated and compared, and the selection of obsolete full and half pixel estimation search blocks to be overwritten are *somewhat discretionary*." Ex. 1006, 8:16–20 (emphasis added). For instance, Fandrianto discloses an example in which Q3 pixels are interpolated before the Q2 pixels and Q2 pixels are derived by horizontally interpolating Q3 pixels with the results of vertically interpolating data in the B block 74 and the X block 70. *Id.* at 10:53–56.

Patent Owner's argument is based on the particular ordering in the description of the embodiment in Figure 5. *See* Prelim. Resp. 51 (citing Ex. 1006, 8:29–36). Yet Fandrianto expressly states, "The order shown in FIG. 5 about the pixel element $A_{10,10}$ *is therefore illustrative*." Ex. 1006, 8:19–21 (emphasis added). In the Preliminary Response, Patent Owner argues as if the order in that embodiment is the only possible one. *See* Prelim. Resp. 46–61.

Thus, we disagree with Patent Owner and preliminarily find that Petitioner has sufficiently shown that Fandrianto teaches step (c).

d. Conclusion

At this stage and on this record, it is reasonably likely that Petitioner would prevail in showing that claim 1 is unpatentable over the TML6-Fandrianto combination.

Although the above analysis states that Board disagrees with Patent Owner's arguments or agrees with Petitioner's, a trial could produce additional evidence that may support a determination in the Final Written Decision that unpatentability has not been adequately proven. Everything above should be viewed in that context and should not be understood to be a final determination.

4. Claims 2–7, 9, and 14–51

Patent Owner argues that, for the same reasons as claim 1, the remaining claims would not have been obvious over the TML6-Fandrianto combination. Prelim. Resp. 64–65. In particular, Patent Owner argues that claims 2–7, 9, and 15–17 are not rendered obvious by the TML6-Fandrianto combination for the same reasons as given for claim 1 because claims 2–7, 9, and 15–17 all depend from claim 1. *Id.* (citing *Callaway Golf Co. v. Acushnet Co.*, 576 F.3d 1331, 1344 (Fed. Cir. 2009)). Patent Owner argues that Petitioner's challenge to independent claims 18, 23, 27, 31, 34, and 50, and the claims that depend from those claims must fail for the same reasons as the challenge to claim 1 because Petitioner relies on the reasoning about step (c) from its claim 1 challenge. *Id.* at 65 (citing Pet. 83, 86). Lastly, Patent Owner argues that claims 19, 35, 42, 46, 49, and 51, and the claims that depend from those claims must fail for the same reasons as the

challenge to claim 1 because Petitioner relies on the reasoning about step (b) from the claim 1 challenge. *Id.* (citing Pet. 86, 92, 94–96).

At this stage and on this record, we disagree with Patent Owner's arguments about claim 1 for the reasons presented in Section II.E.3, and thus, we also disagree with Patent Owner's arguments directed to claims 2–7, 9, and 15–51 for the same reasons.

Petitioner argues that claim 14 would have been obvious over the TML6-Fandrianto combination. Pet. 73–76. Patent Owner does not present an argument specific to the subject matter recited in claim 14. *See* Prelim. Resp.

Apart from the arguments discussed above, Patent Owner does not present arguments specifically directed to claims 2–7, 9, and 14–51. *See id.* Even so, Petitioner has the burden to show that the challenged claims are unpatentable. Thus, we have reviewed Petitioner's arguments and evidence submitted in connection with claims 2–7, 9, and 14–51. We find Petitioner's arguments and evidence to be sufficient at this stage and on this record.

III. CONCLUSION

Petitioner has shown by a reasonable likelihood that at least one challenged claim is unpatentable. Thus, we institute an *inter partes* review on all claims challenged in the Petition and on all grounds in the Petition.

IV. ORDER

It is

ORDERED that, under 35 U.S.C. § 314(a), an *inter partes* review of claims 1–7, 9, and 14–51 of the '469 patent is instituted for all grounds in the Petition; and

FURTHER ORDERED that, under 35 U.S.C. § 314(a), *inter partes* review of the '469 patent is instituted on this Decision's entry date, and under 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is given of the trial's institution.

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