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Paper 42
Entered: September 14, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC,
Petitioner,

v.

KOREAN ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY, KOREAN BROADCASTING SYSTEM, and HEVC ADVANCE LLC,
Patent Owner.

IPR2019-00725
Patent 9,838,720 B2

Before DENISE M. POTHIER, TREVOR M. JEFFERSON, and SHEILA F. McSHANE, *Administrative Patent Judges.*

POTHIER, *Administrative Patent Judge.*

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background and Summary

Unified Patents, LLC ("Petitioner") filed a Corrected Petition[1] (Paper 10, "Pet.") requesting institution of an *inter partes* review of claims 1–6 ("the challenged claims") of U.S. Patent No. 9,838,720 B2 (Ex. 1001, "the '720 patent"). Korean Advanced Institute of Science and Technology, Korean Broadcasting System, and HEVC Advance LLC (collectively "Patent Owner") filed a Preliminary Response. We granted Petitioner's request for additional briefing to address the issues of whether a document is a printed publication (Issue 1) and whether the claims of the '720 patent are entitled to a particular priority date (Issue 2) and to submit related declarations. Paper 11, 1. The parties submitted additional briefing and testimonial evidence. Papers 12, 14; Ex. 1044. Subsequently, we instituted *inter partes* review of the challenged claims. Paper 15 ("Dec. Inst.").

Patent Owner requested rehearing of the Decision to Institute. Paper 18 ("Req. Reh'g"). We denied the request. Paper 20 ("Reh'g Dec.").

Following institution, Patent Owner filed a Response (Paper 21, "PO Resp."), Petitioner filed a Reply (Paper 25, "Reply"), and Patent Owner filed a Sur-Reply (Paper 30,"Sur-reply"). A hearing was held on June 15, 2020, and a transcript of the hearing has been made part of the record. Paper 41.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

[1] We granted Petitioner's Unopposed Motion Seeking to Correct Clerical Mistake in Petition and ordered Petitioner to submit a Corrected Petition. Paper 9, 4.

For the reasons discussed below, we conclude that Petitioner has shown by a preponderance of the evidence that claims 1–6 of the '720 patent are unpatentable.

B. Related Matters

Patent Owner indicates U.S. Application No. 16/572,704 "is currently pending before the Patent Office and shares a claim of priority with the '720 patent to U.S. Patent Application No. 13/202,906" ("the '906 application"), which issued into U.S. Patent 9,485,512 B2 ("the '512 patent"). Paper 37, 1; Ex. 1006, codes (10), (21).

The parties indicate that they are unaware of any other, related matter involving the '720 patent. Pet. 1; Paper 4, 2.

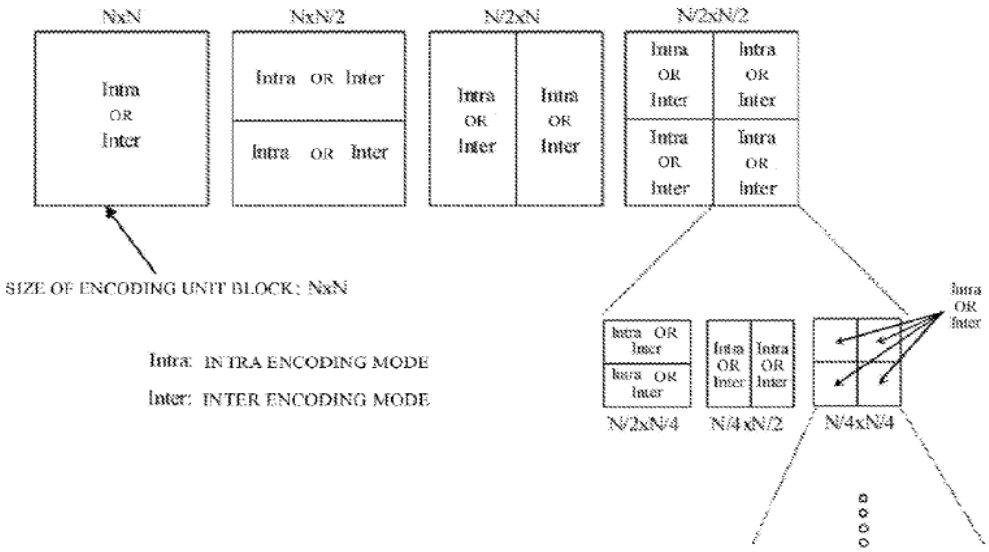
C. The '720 Patent (Ex. 1001)

The '720 patent issued December 5, 2017, from an application filed September 7, 2016, and indicates the '720 patent is a "[c]ontinuation of application No. 13/202,906, filed as application No. PCT/KR2010/001125 on Feb. 23, 2010, now Pat. No. 9,485,512." Ex. 1001, code (63); *id.*, codes (22), (45), 1:10–18; Ex. 1006, codes (10), (21)–(22), (86).

The '720 patent concerns a video encoding and decoding method that divides a picture into division blocks and encodes and decodes the division blocks. Ex. 1001, code (57), 1:23–26. Encoding efficiency can be improved by encoding and decoding division blocks (or sub-division blocks) using both inter and intra predictions and encoding a block video signal using square transforms or non-square transforms based on the division block's size. *Id.* at 1:23–33. These techniques attempt to resolve encoding efficiency, which degrades with high or ultra-high definition video encoding or when an encoding unit is a super-macroblock (e.g., size of 32x32 or

more) "that has the same or greater size than a macroblock" (e.g., size of 16x16). *Id.* at 2:41–42; *id.* at 2:4–7, 2:18–49, 5:29–40.

An exemplary super-macroblock, shown below as an NxN unit block on the far left, is reproduced from the '720 patent's Figure 2:



Id., Fig. 2. The above Figure 2 illustrates a super-macroblock (e.g., NxN unit block) divided into sub-blocks or division block types (e.g., two Nx(N/2) blocks, two (N/2)xN blocks, or four (N/2)x(N/2) blocks). *Id.* at 6:1–8, code (57), Fig. 2. The sub-blocks are encoded using intra or inter prediction encoding, and the super-macroblock can be encoded so that both intra and inter prediction encoding modes can be used in the final encoding mode to increase video encoding efficiency. *Id.* at 6:1–15, code (57), Fig. 2; *see id.* at 6:58–7:34, Fig. 3.

The '720 patent further discusses transform encoding "a residual signal of a super-macroblock having an increased size." *Id.* at 6:26–27. For example, the '720 patent describes "selectively applying a square transform kernel having a size of 16x16 or more, which is greater than existing sizes of

4x4 and 8x8, or a non-square transform kernel having a size of 16x8, 8x16, or more for a non-square transform according to a size of a division block." *Id.* at 6:29–34. Equation 2 of the '720 patent is a possible calculation if a square transform kernel having a size of 16x16 or more is applied to a super-macroblock:

$$Y=AX$$

where *X* denotes an NxN input video signal matrix, *A* denotes an NxN square transform kernel matrix, and *Y* denotes a transform coefficient matrix. *Id.* at 6:35–41. Equation 3 of the '720 patent includes a possible calculation for a non-square sub-block:

$$Y=A_1XA_2$$

where *X* denotes an Mx(M/2) input video signal matrix, A_1 denotes an MxM square transform kernel matrix, A_2 denotes an (M/2)x(M/2) transform kernel matrix, and *Y* denotes a transform coefficient matrix. *Id.* at 6:41–49.

D. The Challenged Claims

The '720 patent has six claims. *Id.* at 9:5–10:58. Petitioner challenges all six claims. Independent claim 1 is reproduced below.

> 1. A method of video decoding, comprising:
>
> [a] dividing a decoding unit block within a current slice into four first sub-decoding-unit-blocks;
>
> [b] dividing at least one first sub-decoding-unit-block among the four first sub-decoding-unit-blocks into four second sub-decoding-unit-blocks,
>
> [c] wherein each of the second sub-decoding-unit-blocks is a basis of a prediction mode, and
>
> [d] wherein the prediction mode for each of the second sub-decoding-unit-blocks is intra prediction mode or inter prediction mode;
>
> [e] transforming at least one second sub-decoding-unit-block among the four second sub-decoding-unit-blocks using a

> first transform kernel and a second transform kernel having a different size from the first transform kernel; and
>
> [f] performing prediction on the at least one second sub-decoding-unit-block according to the prediction mode for the at least one second sub-decoding-unit-block,
>
> [g] wherein the decoding unit block comprises the at least one second sub-decoding-unit-block divided into the first transform kernel, and the second transform kernel,
>
> [h] wherein the decoding unit block comprises at least one divided first sub-decoding-unit-block, divided into the four second sub-decoding-unit-blocks, and at least one undivided first sub-decoding-unit-block not divided into the four second sub-decoding-unit-blocks,
>
> [i] wherein the undivided first sub-decoding-unit-block is a basis of a prediction mode,
>
> [j] wherein the prediction mode for the undivided first subdecoding-unit-block is intra prediction mode or inter prediction mode,
>
> [k] wherein the transforming further comprises transforming the at least one undivided first sub-decoding-unit-block using a third transform kernel and a fourth transform kernel having a different size from the third transform kernel,
>
> [l] wherein the performing prediction further comprises performing prediction on the at least one undivided first sub-decoding-unit-block according to the prediction mode for the at least one undivided first sub-decoding-unit-block,
>
> [m] wherein the decoding unit block comprises the at least one undivided first sub-decoding-unit-block divided into the third transform kernel, and the fourth transform kernel, and
>
> [n] wherein the decoding unit block is a square block and the at least one first sub-decoding-unit-block is a square block.

Id. at 9:5–53 (bracketed lettering added).

Claims 2–5 depend from claim 1. Independent claim 6 recites "[a] method of video encoding" and has limitations similar to claim 1. *Id.* at 10:13–58; Prelim. Resp. 27 (stating claim 6 "recites the features consistent with claim 1").

E. Prior Art and Asserted Grounds

Petitioner asserted the following grounds of unpatentability in the Petition and, pursuant to 35 U.S.C. § 314(a), on September 16, 2019, we instituted *inter partes* review on these grounds:

Claims Challenged	35 U.S.C. §	References/Basis
1–6	102(a)(1), (2)[2]	Winken[3]
1–6	103	Winken, Kim[4]
1–6	102(a)(1)	JCTVC-R1013[5]
1–6	103	JCTVC-R1013, Kim

Pet. 4; Dec. Inst. 7.

Petitioner provides a Declaration of Michael Orchard, Ph.D. (Ex. 1002) and a Second Declaration of Michael Orchard, Ph.D. (Ex. 1053).

Patent Owner provides a Declaration of Dr. Clifford Reader (Ex. 2001) and a Second Declaration of Dr. Clifford Reader (Ex. 2028).

[2] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. §§ 102 and 103. Changes to §§ 102 and 103 apply to applications filed on or after March 16, 2013. We refer to the amended versions of §§ 102 and 103 (AIA) in this decision because, as explained later, the claims of this patent are entitled to a filing date no earlier than September 7, 2016.

[3] Winken, U.S. Publication No. 2013/0034171 A1, published February 7, 2013 (Ex. 1004, "Winken").

[4] Kim, U.S. Publication 2012/0128070 A1, published May 24, 2012 (Ex. 1010, "Kim").

[5] Jill Boyce et al., *Draft high efficiency video coding (HEVC) version 2, combined format range extensions (REext), scalability (SHVC), and multi-view (MV-HEVC) extensions*, 18th Meeting Joint Collaborative Team on Video Coding 1–535 (June 30–July 9, 2014) (Ex. 1005, "JCTVC-R1013").

F. Real Parties in Interest

Petitioner identifies Unified Patents, LLC as the real party in interest. Paper 23, 2. Patent Owner identifies Korea Advanced Institute of Science and Technology, Korean Broadcasting System, and HEVC Advance LLC as the real parties in interest. Paper 40, 1.

II. ANALYSIS

A. Legal Standards

A claim is unpatentable under 35 U.S.C. § 102 if a prior art reference discloses each and every element of the claimed invention, either explicitly or inherently. *Glaxo Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 1047 (Fed. Cir. 1995); *see MEHL/Biophile Int'l Corp. v. Milgraum*, 192 F.3d 1362, 1365 (Fed. Cir. 1999) ("To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention . . . ;" any limitation not explicitly taught must be inherently taught and would be so understood by a person experienced in the field.); *In re Baxter Travenol Labs*., 952 F.2d 388, 390 (Fed. Cir. 1991) (the dispositive question is "whether one skilled in the art would reasonably understand or infer" that a reference teaches or discloses all of the elements of the claimed invention).

A patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art;

(3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). "To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal of obviousness." *In re Magnum Oil Tools Int'l, Ltd*., 829 F.3d 1364, 1380 (Fed. Cir. 2016).

B. Level of Ordinary Skill in the Art

Petitioner asserts that

> A person of ordinary skill in the art at the time of the filing [of] the '720 Patent . . . would have had at least a Bachelor's degree in Computer Science, Computer Engineering, or Electrical Engineering, and two to three years of experience in digital video encoding and/or decoding . . . More work experience could substitute for education, and vice versa.

Pet. 16 (citing Ex. 1002 ¶¶ 99–104). Patent Owner provides testimonial evidence similarly indicating "one of ordinary skill in the art in the field of video compression . . . would have had a bachelor's degree in electrical engineering or computer science, or an equivalent degree, and two to three years of experience in the field of video compression." Ex. 2001 ¶ 74. We determine that the level of ordinary skill proposed by Petitioner is consistent with the '720 patent and the asserted prior art.

Dr. Orchard has a Ph.D. in Electrical Engineering. Ex. 1002 ¶ 6. He (1) is a professor of Electrical and Computer Engineering, teaching classes in digital signal processing and image processing, (2) has researched in the fields of image and video compression algorithms and image rendering and applications, and (3) has supervised Ph.D. students on various image and

video processing topics. *Id.* ¶¶ 6, 8–9, 13. He has served in various capacities for IEEE Transactions on Image Processing, OSA's Digital Image Processing and Analysis Conference, and the IEEE International Conference on Image Processing. *Id.* ¶¶ 12–13. He has also consulted in the fields of image and video processing at various companies. *Id.* ¶¶ 8, 10, 13. Dr. Orchard's qualifications are sufficient as a person of skill in the art for purposes of this proceeding under either Petitioner's or Patent Owner's proposed level of ordinary skill level.

Dr. Reader has a Doctoral degree, where he presented a thesis on "Orthogonal Transform Coding of Still and Moving Pictures." Ex. 2001 ¶ 6. He has performed research in video compression, including adaptive block transform coding, and presented a thesis was on "Orthogonal Transform Coding of Still and Moving Pictures." *Id.* He has various industry experience in digital imaging (*id.* ¶¶ 7–9, 13–14) and has been involved with developing MPEG standards (e.g., MPEG-1, MPEG2, MPEG-4, H.263, and H.264) (*id.* ¶¶ 10–16). He also consults in areas of imaging and video, including image and video compression and imaging. *Id.* ¶ 17. Dr. Reader's qualifications are sufficient as a person of skill in the art for purposes of this proceeding under either Petitioner's or Patent Owner's proposed level of ordinary skill level.

C. Claim Construction

On October 11, 2018, the Office revised its rules to harmonize the Board's claim construction standard with that used in federal district court cases under 35 U.S.C. § 282(b). *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51340 (Oct. 11, 2018) (amending 37 C.F.R.

§ 42.100(b) for petitions filed on or after November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). The instant Petition was filed on February 28, 2019 (Paper 3, 1), and, therefore, the revised district-court type claim construction standard applies to this proceeding. *Id.*; *see* Pet. 16 (stating "no explicit construction (beyond plain and ordinary meaning under the *Phillips* standard) is required").

Accordingly, we apply the principles set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc). Under that standard, the words of a claim are generally given their "ordinary and customary meaning," which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13; *see id.* at 1315 (stating "claims 'must be read in view of the specification, of which they are a part.'") (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995), *aff'd*, 517 U.S. 370 (1996)). "In determining the meaning of [a] disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). Extrinsic evidence is "less significant than the intrinsic record in determining 'the legally operative meaning of claim language.'" *Phillips*, 415 F.3d at 1317. Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Also, a "court does not interpret claim terms in a vacuum, devoid of the context of the claim as a whole." *Kyocera Wireless Corp. v. Int'l Trade Comm'n*, 545 F.3d 1340, 1347 (Fed. Cir. 2008) (citing *Hockerson–Halberstadt, Inc. v. Converse Inc.*, 183 F.3d 1369, 1374 (Fed. Cir. 1999); *ACTV, Inc. v. Walt Disney Co.*, 346 F.3d 1082, 1088 (Fed. Cir. 2003)). Instead, a "proper claim construction . . . demands interpretation of the entire claim in context, not a single element in isolation." *Hockerson–Halberstadt*, 183 F.3d at 1374; *see also ACTV*, 346 F.3d at 1088 (stating "[w]hile certain terms may be at the center of the claim construction debate, the context of the surrounding words of the claim also must be considered . . . .").

As we explained in the Decision to Institute, Petitioner contends that each claim term should be given its plain and ordinary meaning in this proceeding and that "no explicit construction (beyond plain and ordinary meaning under the *Phillips* standard) is required." Dec. Inst. 25 (quoting Pet. 16). Patent Owner, on the other hand, proposed construing these phrases found in the challenged claims: "a basis of a prediction mode," "divided into," and "a different size." Prelim. Resp. 19–25. We preliminarily construed each of those terms in the Decision to Institute, based on the record then before us. Dec. Inst. 26–29. Patent Owner made additional arguments on the construction of these terms and additionally proposes construing additional limitations found in the challenged claims, including "dividing a decoding unit block within a current slice into four first sub-decoding-unit-blocks" in step [a], "the at least one first sub-decoding-unit-block is a square block" in step [n], the "at least one undivided first sub-decoding-unit-block" in steps [h]–[m], and "dividing at

least one first sub-decoding-unit-block . . . into four second sub-decoding-unit-block" in step [b]. PO Resp. 15–27. Petitioner responds to Patent Owner's arguments in its Reply; Patent Owner further responds in its Sur-reply. Reply 11–22; Sur-reply 20–25. Below we address claim construction issues to the extent required to resolve the issues before us.

1. "dividing a decoding unit block within a current slice into four first sub-decoding-unit-blocks" in step [a], "dividing at least one first sub-decoding-unit-block . . . into four second sub-decoding-unit-blocks" in step [b], the "at least one undivided first sub-decoding-unit-block" or "the undivided first sub-decoding-unit-block" in steps [h]–[m], and "the at least one first sub-decoding-unit-block is a square block" in step [n]

We consider the above limitations in the context of claim 1 as whole and further construe these steps of claim 1 in the context of the Specification of the '720 patent and any relevant prosecution history.[6]

Claim 1 recites in pertinent part:

A method of video decoding comprising:

> [a] dividing a decoding unit block within a current slice into four first sub-decoding-unit-blocks;
>
> [b] dividing at least one first sub-decoding-unit-block among the four first sub-decoding-unit-blocks into four second sub-decoding-unit-blocks,
>
> [c] wherein each of the second sub-decoding-unit-blocks is a basis of a prediction mode,
>
> . . .
>
> [e] transforming at least one second sub-decoding-unit-block among the four second sub-decoding-unit-blocks using a first transform kernel and a second transform kernel having a different size from the first transform kernel
>
> . . .

[6] This discussion applies equally to independent claim 6, addressing "[a] method of video encoding" comprising similar recitations to claim 1. *See* Ex. 1001, 10:13–58.

> [h] wherein the decoding unit block comprises at least one divided first sub-decoding-unit-block, divided into the four second sub-decoding-unit-blocks, and at least one undivided first sub-decoding-unit-block not divided into the four second sub-decoding-unit-blocks,
>
> [i] wherein the undivided first sub-decoding-unit-block is a basis of a prediction mode,
>
> . . .
>
> [k] wherein the transforming further comprises transforming the at least one undivided first sub-decoding-unit-block using a third transform kernel and a fourth transform kernel having a different size from the third transform kernel,
>
> . . .
>
> [n] wherein the decoding unit block is a square block and the at least one first sub-decoding-unit-block is a square block.

Ex. 1001, 9:5–12, 16–19, 27–33, 37–41, 51–53.

Parties' General Contentions

Patent Owner proposes its interpretation of how claim 1's steps [a], [b], [h], and [n] should be construed. PO Resp. 15–19; Sur-reply 20–22. In particular, Patent Owner argues:

> Claim 1 recites step n, "the at least one first sub-decoding-unit-block is a square block." (Ex. 1001, 9:51-53). The phrase "at least one first sub-decoding-unit-block" appears first in step b, "dividing **at least one first sub-decoding-unit-block** among the four first sub-decoding-unit-blocks **into four second sub-decoding-unit-blocks**." (Bold added). Accordingly, "the at least one first sub-decoding-unit-block" in step n does **not** refer to the "at least one **undivided** first sub-decoding-unit-block" in steps h, i, j, k, l and m; rather, it refers to the "at least one **divided** first sub-decoding-unit-block," which is referenced in steps b and h.

PO Resp. 17.

"[F]ollowing its plain and ordinary meaning, Patent Owners propose that step a be construed to mean simply dividing a decoding unit block into

four first sub-decoding-unit-blocks" and an additional requirement should not be read into step [a] "specifying that each first sub-decoding-unit-block is either a square or non-square block." *Id.* at 15.

In the Sur-reply, Patent Owner additionally states "[t]he claim language speaks for itself. As shown in Patent Owner's color annotated chart below, claim 1's steps *b*, *h* and *n*, taken together, state that 'at least one first sub-decoding-unit-block' [in step [b]] means at least one 'divided' first sub-decoding-unit-block [in step [h]]." Sur-reply 20; *see id.* at 22 (stating "the antecedent basis of the claim language points to the 'divided' first sub-decoding-unit-block"). The described "chart" (*id.* at 20–21) is reproduced below:

Step *n*	**the at least one first sub-decoding-unit-block** is a square block
Step *b*	**dividing at least one first sub-decoding-unit-block** … into **four second sub-decoding-unit-blocks**
Step *h*	wherein the decoding unit block comprises **at least one divided first sub-decoding-unit-block, divided into the four second sub-decoding-unit-blocks**, and at least one undivided first sub-decoding-unit-block not divided into the four second sub-decoding-unit-blocks

Chart Containing Language (Annotated by Patent Owner with Color, Bolding, and Highlighting) Found in Claim 1's Steps [n], [b], and [h]

Id. at 21. The above chart reproduces portions of steps [n], [b], and [h], and includes bolding, colors, and highlighting added by Patent Owner to various language related to the "at least one first sub-decoding-unit-block" and "second sub-decoding-unit-blocks" language in claim 1. Patent Owner

argues "[t]he phrases in step *b* serve as antecedent basis for the phrases in step *h* and step *n* (*see* in red)." *Id.* at 20.

Petitioner argues that the Board's conclusion that the "sub-decoding-unit-blocks" in claim 1 are square is correct. Reply 15–17; *see id.* at 20 (stating "a POSITA[7] would have understood this to necessitate that all of the recited 'first sub-decoding-unit-block' are square"). Petitioner asserts, when construing steps [b] and [h], that Patent Owner ignores steps [i]–[m], which "support the Board's conclusion." *Id.* at 16. Petitioner further argues that "nothing in [] claim [1 step [n]'s] language suggests that the step is only directed to the 'divided' first sub-decoding-unit-block, as Patent Owner alleges." *Id.* Petitioner contends the terms "divided" and "undivided" first sub-decoding-unit-blocks are introduced in step [h]. *Id.* at 16–17 (citing Ex. 1001, 9:8–10, 26–30). Petitioner further argues that steps [i]–[m] are directed to the "undivided" first sub-decoding-unit-block, and the "divided" first sub-decoding-unit-block in step [h] "is never mentioned again by any of the claims." *Id.* at 17 (citing Ex. 1001, 9:31–50). Petitioner further argues that, even if step [n], "must be construed to apply to only one type of first sub-decoding-unit-block (*i.e.*, divided or undivided), nothing in the claim language suggests" that this step would only apply to "'divided' first sub-decoding-unit-blocks." *Id.*

In the Sur-reply, Patent Owner additionally argues "method claim steps in a patent are presumed not to require a specific order." Sur-reply 21; *id.* at 21 n.8 (citing *Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1342 (Fed. Cir. 2001)).

[7] A Person of Ordinary Skill In The Art.

Based on the parties' respective positions outlined above, we consider whether all "four first sub-decoding-unit-blocks" and "four second-sub-decoding-unit-blocks" recited in claim 1 are square.

We agree with Patent Owner that "not every process claim is limited to the performance of its steps in the order written." *See Loral Fairchild Corp. v. Sony Corp.*, 181 F.3d 1313, 1322 (Fed. Cir. 1999). Thus, just because step [n] follows from steps [i]–[m], which recite limitations related to "the undivided first sub-decoding-unit-block" (e.g., steps [i]–[j]) or "the at least one undivided first sub-decoding-unit-block" (e.g., steps [k]–[m])[8] (*see* Reply 17), this claimed order does not necessarily mean the recited "the at least one first sub-decoding-unit-block is a square" in step [n] is the same unit-block in step [k] directed to "the at least one undivided first sub-decoding-unit-block." Ex. 1001, 9:32–53. Given this principle, step [h]'s "at least one undivided first sub-decoding-unit-block" is not necessarily also step [n]'s "the at least one first sub-decoding-unit-block." Additionally, claim 1 recites "dividing at least one first sub-decoding-unit-block among the four first sub-decoding-unit-blocks" in step [b]. *Id.*, 9:8–10. As such, we have reconsidered and reject the implication that step [n]'s "the at least one first sub-decoding-unit-block" is limited to *the* recited "at least one undivided first sub-decoding-unit-block" recited in step [h]. *See* Dec. Inst. 21; *see* Rh'g Dec. 7–8.

[8] Claim 1 fails to maintain consistency in its language related to "the undivided first sub-decoding-unit-block," reciting both the "at least one undivided first sub-decoding-unit-block" and "the undivided first sub-decoding-unit-block." Ex. 1001, 9:29–50.

We further disagree with Petitioner that "the at least one first sub-decoding-unit-block" in step [n], when viewing the claim as a whole (e.g., with step [b]), does not specify this unit-block is a divided unit-block. *See* Reply 15, 17. That is, when viewing claim 1 as whole, claim 1's step [h] indicates that the "at least one *divided* first sub-decoding-unit-block" is same as the "at least one first-sub-decoding-unit-block" in step [b] because step [b] recites "dividing at least one first-sub-decoding-unit-block . . . into four second sub-decoding-unit-blocks" and step [h] further recites "the decoding unit block comprises at least one divided first sub-decoding-unit-block, divided into *the* four second sub-decoding-unit-blocks." *See* Ex. 1001, 9:8–10, 27–29 (emphases added); *see also* PO Resp. 17; *see also* Sur-reply 21.

However, this determination does not end our claim construction analysis (or resolve the priority issue in dispute), for we must also consider claim 1 in its entirety in the context of the '720 patent's Specification as an ordinarily skilled artisan would interpret the claim, including other recitations related to the "at least one undivided first sub-decoding-unit-block" and the "at least one second sub-decoding-unit-block." *See Phillips*, 415 F.3d at 1313.

For example, claim 1 recites in steps [a], [b], [h], and [n], when read collectively, that "the at least one first-sub-decoding-unit-block" (i.e., steps [b] and [n]) (1) "is a square block" (i.e., step [n]), resulting from "a decoding unit block" that is "divid[ed] . . . into four first sub-decoding-unit-blocks" (i.e., step [a]), and (2) is further "divided . . . into four second sub-decoding-unit-blocks (i.e., steps [b] and [h]). Ex. 1001, 9:6–10, 27–31, 51–53. Claim 1 further recites in steps [a], [b], and [n] collectively that the "decoding unit block," which is divided to create each of the "four first sub-decoding-unit-

blocks" of which the "at least one first sub-decoding-unit-block" (i.e., step [b] is one of these four "unit-blocks" (i.e., step [a]), "is a square block" (i.e., step [n]). *Id*., 9:6–10, 51–53.

Figure 2 of the '720 patent reproduced above in Section (I)(C) shows an example of square unit block (e.g., NxN decoding unit block on the far left) divided into four first sub-coding-unit-blocks (e.g., N/2xN/2 sub-unit-blocks on the upper, far right) . *Id.*, Fig. 2. This figure is the only visual example in the '720 patent of how to divide "unit-blocks" according to claim 1's "method of video decoding" (through the "reverse process of the encoding method"[9]). In this example, *each* of the four *divided* first decoding unit-blocks is square. *Id.*

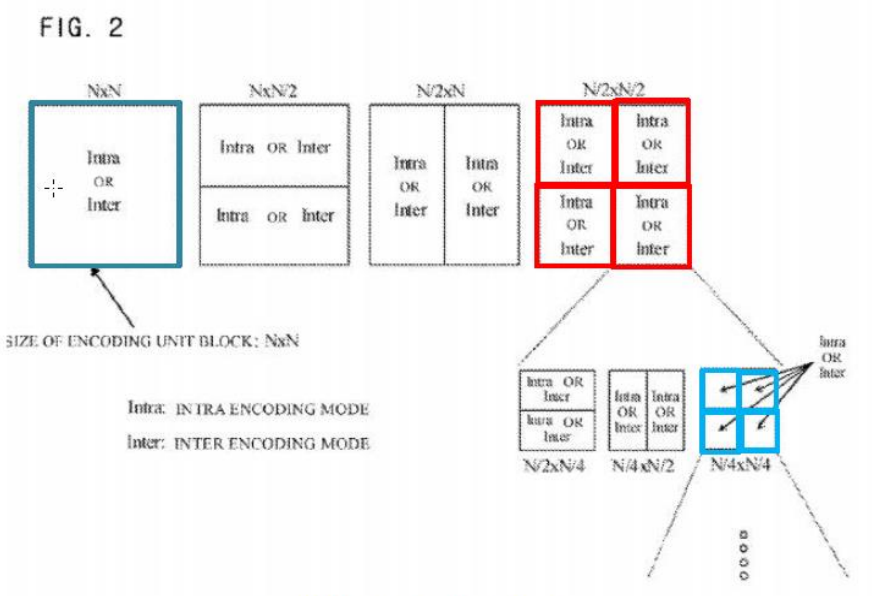
Thus, in the context of the '720 patent's Figure 2, an ordinarily skilled artisan would have understood that each of the recited "four first sub-decoding-unit-blocks" recited in claim 1's step [a] is a square block as Petitioner asserts. *See* Reply 18 (stating "the specification only discloses a block being divided into equal parts (e.g., four equal squares or two equal rectangles), as illustrated below. *See, e.g.*, Fig. 1-2."); *see id.* at 19 (reproducing Ex. 1001, Fig. 2)). This is because claim 1's step [n] requires both "the decoding unit block is a square block" (e.g., NxN block in Figure 2), and "the at least one first sub-decoding unit-block" (e.g., one of the N/2xN/2 blocks in Figure 2) to be "a square block," and claim 1's steps [a], [b], and [h] together further recite the "at least one first sub-decoding-unit-block" is one of "the four first sub-decoding-unit-blocks." *See* Ex. 1001,

[9] Although this figure illustrates the encoding process, the '720 patent explains the "decoding process is performed through a reverse process of the encoding method." Ex. 1001, code (57); *see id.*, 8:32–34.

9:6–10, 27–31, 51–53; *see* Reply 20 (stating "a POSITA would have understood this to necessitate that all of the recited 'first sub-decoding-unit-block' are square.").

Likewise, if the "at least one first sub-decoding-unit-block" of "the four first sub-decoding-unit-blocks" recited in claim 1's steps [a], [b], and [h] "is a square block" as step [n] requires (*see id.*, 9:6–10, 27–31, 51–53), then the '720 patent's Figure 2 shows this square "at least one first sub-decoding-unit-block" further "divid[ed] . . . into four second sub-decoding-unit-blocks" (i.e., steps [b] and [h]), which results in one of four square "second sub-decoding-unit-blocks" (e.g., one of the N/4xN/4 blocks on the lower right). *See id.*, Fig. 2. Thus, in the context of the '720 patent's Figure 2, an ordinarily skilled artisan would have understood *each* of the recited "four second sub-decoding-unit-blocks" recited in claim 1's step [b] is a square block. *See id.*

This understanding is further illustrated below, which shows a version of the '720 patent's Figure 2 annotated by Petitioner's expert, Dr. Orchard:



Ex-1001, Fig. 1 (annotated)

Ex. 1002 ¶ 74 (citing Ex. 1001, 2:18–28, 3:4–9, 8:27–32) (reproducing Ex. 1001, Fig. 2[10]). The above annotated Figure 2 shows a macroblock of NxN size divided into four N/2xN/2 size sub-blocks (in red) or sixteen N/4xN/4 size blocks (in blue).

Our determination is further supported by claim steps [c]–[d] and [i]–[j], which recite collectively "each of the second sub-decoding-unit-blocks is a basis of a prediction mode" and "the undivided first sub-decoding-unit-block is a basis of a prediction mode," where each mode "is intra prediction mode or inter prediction mode" (*id.*, 9:11–15, 32–36), when considering these limitations in the context of Figure 2. Figure 2 shows each of the four square N/2xN/2 blocks (upper, far right) and each of the four N/4xN/4 blocks (lower, far right) containing the words "Intra or Inter." *See id.*, 5:47–50, Fig. 2.

Dr. Orchard provides further support for our determination of how an ordinarily skilled artisan would understand claim 1. Dr. Orchard testifies

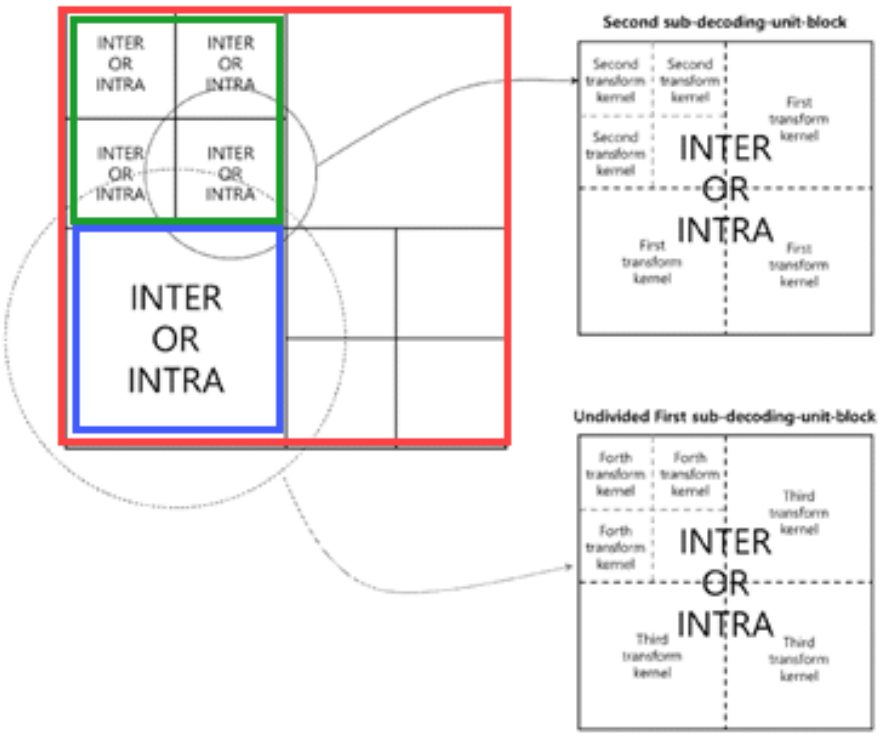
> a POSITA would have adopted a perspective consistent with the nature of the relevant contemporaneous encoding standards, which taught equal splits of blocks. Thus, as element n of Claim 1 of the '720 patent calls for a "first sub-decoding-unit-block" to be a "square block," a POSITA would understand the other "first sub-decoding-unit-blocks" to be square as well.

Ex. 1053 ¶ 35. We agree with Dr. Orchard, observing that the '720 patent describes "the ISO/IEC 14496-10 (MPEG-4 Advanced Video Coding) or H.264 standard, prediction encoding is performed by dividing a macroblock

[10] Although Dr. Orchard labeled the figure "Ex-1001, Fig. 1 (annotated)" at the bottom (Ex. 1002 ¶ 74), this figure is also correctly labeled "FIG. 2" of the '720 patent in the upper, left corner (Ex. 1001, Fig. 2).

into seven types of sub-blocks as shown in FIG. 1" (Ex. 1001, 2:4–10, Fig. 1), which, like Figure 2, shows unit-blocks divided into "four" sub-decoding "unit-blocks" that are all square. *See id.*, Fig. 1. We therefore agree with Dr. Orchard that "a POSITA would have understood the claims to call for an equal division of blocks upon reading the claim language" and "as element n of Claim 1 of the '720 patent calls for a 'first sub-decoding-unit-block' to be a 'square block,' a POSITA would understand the other 'first sub-decoding-unit-blocks' to be square as well." Ex. 1053 ¶ 35 (reproducing Ex. 1001, Fig. 2).

We additionally consider the prosecution history pertaining to the '720 patent in construing claim 1. During prosecution of the '720 patent, the claims were amended. *See* Ex. 1003, pp. 165–177. In one amendment, the following figure was provided (*see* Reply 21) "[f]or convenience of *understanding* . . . the amended claim 1."



Ex. 1003, p. 175 (bolding omitted) (emphasis added) (colors added). The above figure shows a square decoding unit block (annotated in red) dividing into *four square*, smaller first sub-decoding-unit-blocks, including an "Undivided First sub-decoding-unit-block" (annotated in blue), and another of the square first sub-decoding-unit-blocks (shown in green) divided into *four square*, smaller "Second sub-decoding-unit-block." *See id.* The amendment also explains the above figure shows the encoding unit block can include differently sized sub-blocks, which are bases of prediction modes. *Id.*, pp. 175–176. Given the above, we agree with Dr. Orchard that "the prosecution history . . . demonstrate[s] block division all show equal divisions of blocks." Ex. 1053 ¶ 35 (citing Ex. 1003, pp. 175–76).

Patent Owner argues "Petitioner does not explain why the diagram and arguments presented in the prosecution history of the '720 Patent mean that the claimed invention must be limited only to square blocks." Sur-reply 23 (citing PO Resp. 22; Ex. 2005, pp. 10–12[11]). Considering the evidence, however, and although the amendment does not state explicitly that the encoding block and sub-blocks are limited to squares, the figure found in amendment provides an "understanding for the amended claim 1" (Ex. 1003, p. 175 (bolding omitted)) and only includes squares blocks and sub-blocks. Thus, contrary to Patent Owner's assertions (Sur-reply), an ordinarily skilled artisan would have understood claim 1's "four first sub-decoding-unit-blocks" and "four second sub-decoding-unit-blocks" in the context of the prosecution history of the '720 patent to be squares.

[11] Exhibit 2005 appears to contain some of the same subject matter as Exhibit 1003, pp. 163–178. Pages 10–12 appear to be the same as pages 174–176 of Exhibit 1003.

Patent Owner further argues that we erred in construing "the at least one undivided first sub-decoding-unit-block" in step [k] to be limited to a square block in the Decision to Institute, because claim 1's step [n] recites "the at least one first sub-decoding-unit-block is a square block" without referring to "the at least one undivided first sub-decoding-unit-block." *See* PO Resp. 13. Patent Owner asserts "the claims of the '720 Patent are **not** limited to dividing a decoding unit block into only **four square first** sub-decoding-unit-blocks, or dividing at least one first sub-decoding-unit-block into **four square second** sub-decoding-unit-blocks." PO Resp. 3 (citing and quoting Ex. 1006,[12] 3:15–18). Quoting from column 3, Patent Owner states "the encoding unit block may be a square having an N*N size, and the encoding unit block may be divided into one or more square or non-square sub-blocks having any size." *Id.* at 15 (quoting Ex. 1006, 3:15–16). "[F]ollowing its plain and ordinary meaning" (*id.*), Patent Owner contends the '720 patent supports that the four "first sub-decoding-unit-blocks" and "second sub-decoding-unit-blocks" recited in claim 1 "include two square blocks **and two non-square blocks**" embodiments. *Id* at 3; *see id.* at 4, 13, 15–19, 32, 39 (citing either Ex. 1006, 3:15–18 or Ex. 1001, 3:13–16).

Patent Owner provides examples of a square unit block divided into four sub-blocks, where the "at least one second sub-decoding-unit-block" and "at least one undivided first sub-decoding unit-block" in steps [e] and [k] respectively are non-square blocks. *See, e.g.*, *id.* at 16, 32–38 (citing Ex. 2028 ¶ 45; Ex. 2032) (presenting Claim Charts #1–#2). Patent Owner further discusses "Petitioner['s] mischaracteriz[ations of] the disclosure of

[12] Although Patent Owner cites to the '512 patent (Ex. 1006), we refer to the '720 patent (Ex. 1001) in this section of the decision.

the ’512 Patent” (*id.* at 56), which is nearly identical to the ’720 patent, including disagreeing with Petitioner that each sub-block of a divided macro-block in the ’512 patent is the same size. *Id.* at 56–57 (citing Pet. 11; Ex. 1006, 3:15–18, 5:49–51, 6:6–18, Figs. 1–2; Ex. 2001 ¶¶ 47–50).

Petitioner interprets the identified language in column 3 in another way, and describes Patent Owner’s examples as a “theoretical ‘hybrid’ division” unsupported by the ’720 patent. Reply 18 (stating “neither Patent Owners nor Dr. Reader himself cite any intrinsic evidence”) (citing PO Resp. 16, 33–37; Ex. 1028 ¶¶ 25–28). Patent Owner responds, arguing “[t]he record is replete with numerous citations to intrinsic evidence presented by Patent Owners and Dr. Reader.” Sur-reply 22 (citing PO Resp. 31–38 (further citing Ex. 1006, 2:65–3:10, 3:13–44, 5:39–45, 6:5–9, 6:33–40, 6:46–64, Fig. 2)).

Column 3 of the ’720 patent states “the encoding unit block may be a square having an N*N size, and the encoding unit block may be divided into *one or more* square or non-square sub-blocks having any size.” Ex. 1001, 3:13–16 (emphasis added).[13] Patent Owner urges that the phrase “one or more” in column 3 should be interpreted to mean that the four “unit-blocks” in claim 1 may be two square and two non-square blocks in the view of an ordinarily skilled artisan. *See* PO Resp. 32–33. Yet, the ’720 patent shows dividing a square encoding unit block into two non-squares *or* four squares, as previously discussed. Ex. 1001, Fig. 2; *see* Tr. 43:15–21 (acknowledging Figure 2 does not show dividing an encoding unit-block into one square division). Thus, although we agree generally that claim language is not

[13] The same passage is found in the ’512 patent (Ex. 1006, 3:15–18).

limited to disclosures in figures (*see* PO Resp. 32), and Figure 2 of the '720 patent is "an example embodiment" (Ex. 1001, 5:49–50), this is the only figure available to inform an ordinarily skilled artisan as to how to understand and to interpret the language of column 3. *See id*., 3:13–16, Fig. 2. Furthermore, when considering the context of the entire '720 patent and the prosecution history, the record does not sufficiently support interpreting the Specification's phrase "one or more square or non-square sub-blocks" (*id.*, 3:15) to disclose using both square and non-square blocks together. Rather, given the record, we agree with Dr. Orchard that an ordinarily skilled artisan would have understood that the phrase "one or more square or non-square sub-blocks" in the '720 patent should be read in the "disjunctive." Ex. 1053 ¶ 36.

During the hearing, Patent Owner urges that "this language [in column 3] says there may be only one square. One or more means one, means two, it means three . . . ." Tr. 42:15–17. Yet, Patent Owner only produces examples where the four sub-blocks are *two* square sub-blocks and *two* non-square sub-blocks. *See also* PO Resp. 32–38. The record includes no examples of using one or three square sub-blocks. *See id.* That is, the record does not include any examples where a person of ordinary skill in the art would have understood there is only *one* square or *three* square sub-blocks. *See id*. Likewise, the record does not demonstrate any examples where there is only *one* or *three* non-square sub-blocks. *See id*. Patent Owner's position in this regard is entirely theoretical.

Based on the foregoing, although the '720 patent Specification uses the phrase "one or more square or non-square sub-blocks" (Ex. 1001, 3:15), this does not establish the phrase should be construed to mean that only one

of the four "first sub-decoding-unit-blocks" or four "second sub-decoding-unit-blocks" in claim 1 is a square block, or that three of the four "first sub-decoding-unit-blocks" or four "second sub-decoding-unit-blocks" are square blocks. Rather, based on the entire record, we determine that an ordinarily skilled artisan would have understood the phrase "one or more square or non-square sub-blocks" in the '720 patent's column 3 as a condensed or short-hand phrasing for what is shown in Figure 2 (i.e., either all divided blocks are squares or all divided blocks are non-squares).

Patent Owner also argues the phrase "any size" in the phrase "the encoding unit block may be divided into one or more square or non-square sub-blocks having any size" in the '720 patent (*id.*, 3:14–16) "contradicts Petitioner's assertions that the specification is limited to equal division of blocks." Sur-reply 22 (citing Ex. 1053 ¶ 36). But, a square or non-square sub-block that is "any size" does not preclude the blocks or sub-blocks from having equal divisions. For example, the '720 patent's Figure 2 shows square blocks with differently sized equal divisions (e.g., N/2xN/2 "equal divisions" and N/4xN/4 "equal divisions") or non-square blocks with differently sized equal divisions (e.g., N/2xN "equal divisions" and N/4xN/2 "equal divisions"). *See* Ex. 1001, Fig. 2. Additionally, Figure 2 includes a symbol that indicates further divisions to include other sizes.[14]

Moreover, Dr. Orchard's testimony does not disregard the "any size" phrase as Patent Owner argues. *See* Sur-reply 22. In fact, Dr. Orchard's testimony quotes the Response quoting the language "the encoding unit

[14] Notably, the phrase "any size" in the context of the '720 patent and Patent Owner's examples does not appear include block shapes other than square and rectangles. *See* Ex. 1001, Fig. 2; *see* PO Resp. 33–51.

block may be divided into one or more square or non-square sub-blocks having any size" from the Specification. *Compare* Ex. 1053 ¶ 36, *with* Ex. 1001, 3:14–16.

Patent Owner cites to further passages in the '720 patent to support the argument that the '720 patent "support[s] the 'hybrid' division." Sur-reply 22 (citing Ex. 1006, 2:65–3:10, 3:13–44, 5:39–45, 6:5–9, 6:33–40, 6:46–64, Fig. 2). We have already discussed Figure 2 and column 3, lines 13–16 of the '720 patent at length above. Other cited passages describe Figure 2 as "a diagram showing super-macroblock unit blocks and division blocks types for intra and inter prediction encoding," but do not further discuss whether the divided blocks can be a mix of square and non-square unit-blocks. Ex. 1001, 6:1–3; *see id.*, 2:64–3:3 (discussing "dividing" blocks with no further detail), 3:17–20 (discussing encoding using inter and intra prediction). Additional passages address "transform encoding" (*id.*, 6:27), which is applied to the residual signal after the unit-blocks have been divided for prediction purposes (*see id.*, 6:9–13)[15], but do not further discuss in what manner the blocks and sub-blocks are divided prior to transformation. *See id.*, 3:4–9 (discussing a variable block-size transform kernel), 3:21–40 (addressing transforming sub-blocks), 5:34–40 (discussing a variable block-size transform kernel), 6:27–57 (discussing transforming square and non-square input video signals).

Patent Owner also argues that Petitioner's assertion that the Specification of the '720 patent only discloses a block being divided into

[15] *See* Req. Rh'g 9 (explaining "the *output* of the prediction model is a residual frame, which is an input to the spatial model, which in turn applies a transform to the residual samples") (bolding omitted).

equal parts is inconsistent with what an ordinarily skilled artisan would have understood the '720 patent's Specification to convey. Sur-reply 22–23 (citing Ex. 2028 ¶¶ 25, 30). For support, Patent Owner relies on Dr. Reader's testimony. However, Dr. Reader reiterates the position taken by Patent Owner that the four "first sub-decoding-unit-blocks" (as well as the four "second sub-decoding-unit-blocks") can include two square blocks and two non-square blocks without any underlying evidence to support his position. Ex. 2028 ¶¶ 25, 30 (both citing Ex. 1001, 3:13–16); *see* Reply 18 (noting Dr. Reader does not cite "any intrinsic evidence to support" his position).

Lastly, related U.S. Application No. 16/572,704, which is currently pending before the Office, also recites "[a] method of video encoding comprising" "dividing at least one of the first sub-blocks . . . into two of second sub-blocks" and "each of the second sub-blocks is a non-square block" as well as "dividing at least one of the other first sub-blocks . . . into four of third sub-blocks" and "each of the third sub-block[s] is a square block." U.S. Application No. 16/572,704 Spec. 1 (claim 6) (filed September 17, 2019). Although this claim language is in a *related* application, it provides further evidence that, when the unit blocks are divided into four sub-blocks in the challenged claims, each sub-block is a square block.

In sum, we modify our previous preliminary determinations to the extent that we found that claim 1's step [n] explicitly recites that the "at least one undivided first sub-decoding-unit-block" in step [h] is a square block. *See* Rh'g Dec. 8 (stating "the recited 'at least one undivided first sub-decoding-unit-block' in claim 1's step k . . . 'is a square block'") (citing

Dec. Inst. 20–21), 9 (indicating the same based on claim 1's step n[16]), 11 (citing Ex. 1001, 9:37–41, 51–53). When considering claim 1 as a whole, the prosecution history, and how an ordinarily skilled artisan would have read claim 1 in the context of the '720 patent, we determine that the language "is a square block" in step [n] results in each of (1) the "four first sub-decoding-unit-blocks" in step [a] (including the "at least one first sub-decoding-unit-block" in step [b] and the "at least one undivided first-sub-decoding-unit-block" in steps [h], [k]-[m] (and similar limitation in steps [i]–[j])) and (2) the "second sub-decoding-unit-blocks" in step [b] (including the "at least one second sub-decoding-unit-block" in step [e]) being a square block.

2. "divided into"

In the Decision to Institute, we construed the phrase "divided into" recited in claim 1's steps [g] and[m] as follows:

> the phrase "the at least one second sub-decoding-unit-block divided into the first transform kernel, and the second transform kernel" within claim 1 means the second sub-decoding-unit block is separated into the recited kernels during the recited transformation. Similarly, the phrase "the at least one undivided first sub-decoding-unit-block divided into the third transform kernel, and the fourth transform kernel" in claim 1 means the at least one undivided first sub-decoding-unit block is separated into the recited kernels during the recited transformation.

Dec. Inst. 28.

Patent Owner requests that we reconsider this construction because "a sub-decoding block would not be 'separated into the recited kernels during

[16] The Decision on the Request for Rehearing incorrectly referred to "step m" but correctly cited to "Ex. 1001, 9:51–53," which is step [n] of claim 1.

the recited transformation'" (PO Resp. 25 (citing Ex. 1001, 2:48–57, 3:4–12, 4:20–35, 6:27–57; Ex. 1002 ¶ 26)) and "a POSITA would know that 'divided into' as recited in the claims means that a sub-decoding block is divided into transform *blocks*, so that transform kernels could be *applied* to those transform blocks for transformation" (*id.* at 25–26 (citing Ex. 2028 ¶ 40)). Patent Owner proposes that step [g] be construed as "the at least one second sub-decoding-unit block, which is *a residual block*, is divided into transform blocks in order to apply the first transform kernel and the second transform kernel *for transform*." *Id.* at 23; Sur-reply 24. Patent Owner also proposes a similar construction for claim 1's step [m] (PO Resp. 23–24, 26), as well as "identical constructions for these phrases as they appear in claim 6" (*id.* at 26).

Petitioner asserts that the Board correctly construed "divided into" to mean "separate[d] into parts." Reply 13. Petitioner argues that an ordinarily skilled artisan would have understood steps [g] and [m] "to require a direct relationship between the block that is being divided and the recited first and second transforms (element g) or third and fourth (element m) transform kernels" (i.e., "the specifically claimed relationship between the divided sub-decoding-unit-block(s) and applied transform kernels."). Reply 14 (citing Ex. 1002 ¶¶ 26–28, 40–42; Ex. 1053 ¶¶ 29–31, 34–35). Petitioner contends an ordinarily skilled artisan would have understood that the recited "decoding unit block" and "sub-decoding-unit-block" are not separated into kernels but rather are "divided into two parts . . . (*e.g.*, transform blocks")" and then "[a] specific transform ***kernel*** is then applied to each of these parts." *Id.* (citing Ex. 1053 ¶¶ 29–31, 34–35).

In response, Patent Owner contends Petitioner has not identified what "specifically claimed relationship" in claim 1 has been removed by Patent Owner's proposed construction. *See* Sur-reply 24–25.

Upon consideration, both parties agree that the recited "the at least one second sub-decoding-unit-block divided into the first transform kernel, and the second transform kernel" (i.e., step [g]) and "the at least one undivided first sub-decoding-unit-block divided into the third transform kernel, and the fourth transform kernel" (i.e., step [g]) in claim 1 involve separating the unit-blocks into transform blocks and then applying the transform kernels for transformation. *See* PO Resp. 23 (proposing that step [g] be construed as "the at least one second sub-decoding-unit block" is divided into transform blocks before applying the transform kernels for transformation); *see* Reply 14 (proposing the "decoding unit block" and "sub-decoding-unit-block" are "divided into two parts, (*e.g.*, transform blocks")" and then transform kernels are applied).

Due to the parties' agreement, we modify our construction in the Decision to Institute, such that: (1) the recited "the at least one second sub-decoding-unit-block divided into the first transform kernel, and the second transform kernel" within claim 1's step [g] means the second sub-decoding-unit block is separated into two transform blocks prior to applying (a) the first transform kernel to one transform block and (b) the other transform block to the second transform kernel; and (2) the recited "the at least one undivided first sub-decoding-unit-block divided into the third transform kernel, and the fourth transform kernel" in claim 1's step [m] means the at least one undivided first sub-decoding-unit block is separated into two transform blocks prior to applying, (a) the third transform kernel to one

transform block, and (b) the fourth transform kernel to the other transform block. We, however, decline to adopt the remainder of Patent Owner's proposed construction, including additional language that each unit-block "is a residual block," because this language is not found in the claim (*see* Ex. 1001, 9:24–26, 47–49) and Patent Owner has not demonstrated adequately that the claim terms define each recited "unit-block" as "a residual block." *See* PO Resp. 23–26; *see also Vivid Techs*, 200 F.3d at 803.

3. Remaining Terms in Dispute

We determine that it is not necessary to provide an express interpretation of any other term of the claims. *See Vivid Techs.*, 200 F.3d at 803 ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy."); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

D. Priority Date of the '720 Patent

In our Decision to Institute, we explained that the parties disputed the priority date of the challenged claims and, thus, whether Winken, Kim, and JCTVC-R1013 were properly considered as prior art. Dec. Inst. 8 (citing Pet. 3–4, 10–11; Prelim. Resp. 3–4, 26–60). Following consideration of the parties' respective arguments, we concluded that the challenged claims were not entitled to a priority date any earlier than September 7, 2016, the filing date of the application for the '720 patent, and accordingly, we also concluded that Winken, Kim, and JCTVC-R1013 are prior art. *Id.* at 9–23. We maintained this determination on rehearing. Rh'g Dec. 12 (declining to terminate the institution decision). The parties raised additional arguments regarding Patent Owner's priority claim in their post-institution briefing. PO Resp. 28–64; Reply 3–22; Sur-reply 3–12. Having considered those

additional arguments, we remain unpersuaded that the challenged claims are entitled to a priority date earlier than September 7, 2016, for the reasons that follow.

1. Parties' Initial Contentions

Petitioner argues the '512 patent's specification[17] does not support the "multiple transform kernels of different sizes" required by claims 1 and 6 of the '720 patent. Pet. 11 (citing Ex. 1002 ¶¶ 53–58, 68); *id.* at 11–15. Petitioner specifically contends "the '512 Patent only supports a process of dividing macroblocks into uniform sub-blocks where each sub-block is transformed using transform kernels of a single size." Pet. 12; *id.* at 11–14 (citing Ex. 1002 ¶¶ 47–70, 90; Ex. 1006,[18] 1:23–35, 2:4–17, 49–59, 3:6–11, 3:28–29, 4:35–39, 5:35–45, 50–51, 6:32–39, Fig. 1 (annotated); Ex. 1007, pp. 1–40; Ex. 1011). Petitioner identifies claim 1's steps [e] and [k], arguing these limitations are not supported in the specification. *See id.* at 14–15.

Patent Owner challenges Petitioner's assertions, contending that the '720 patent's claims are entitled to the '512 patent's filing date and that the '512 patent has adequate support for the claimed subject matter. PO Resp. 28–56; Sur-reply 3–12. Patent Owner argues that both "the at least one second sub-decoding-unit-block" in step [e] and "the at least one undivided first sub-decoding-unit-block" in step [k] are non-square blocks. *See* PO

[17] As previously discussed, the '720 patent claims continuity to the application for the '512 patent. Ex. 1001, code (63).
[18] Petitioner cites to the '512 patent's specification instead of its original written description filed as the '906 application. *See, e.g.*, Pet. 11 (citing Ex. 1006, 5:50–51). Patent Owner does not present any disputes relating to any differences between the '512 patent's specification and the original disclosure. For consistency, we refer to the '512 patent's specification when addressing the priority issue.

Resp. 3 (citing Ex. 1001, 9:5–52; Ex. 1006, 3:15–18), 13; Sur-reply 1 (stating "'at least one undivided first sub-decoding-unit-block' in claim 1's step k—is *not* limited to a square block"). Patent Owner argues that the '512 patent's specification provides adequate written support for steps [e] and [k] of independent claim 1 and similar limitations in independent claim 6 when considering its specification as a whole.[19] PO Resp. 3–5, 28–34 (citing *Hologic, Inc. v. Smith & Nephew, Inc.*, 884 F.3d 1357, 1363 (Fed. Cir. 2018)).

Patent Owner further argues the '512 patent discloses (1) "applying a kernel having a size that is equal to or less than the smaller number of pixels" (PO Resp. 3–4 (citing Ex. 1006, 3:30–43, 6:60–57)), (2) selectively applying a variable block-size transform kernel (*id.* at 4 (citing Ex. 1006, 3:5–11, 5:39–44)), (3) dividing an encoding unit block into one or more square or non-square sub-blocks having any size (*id.* (citing Ex. 1006, 3:15–18)), and (4) Equations 2 and 3 (*id.* (citing Ex. 1006, 6:40–56)). Based on these passages, Patent Owner contends the '512 patent discloses

> a smaller-sized transform kernel is obtained by further dividing a residual block for transformation, and, as the residual block is divided into transform blocks of any size, the transform blocks are transformed using one or more transform kernels of different sizes (i.e., selectively applying a variable block-size transform kernel according to a size of a divided block).

Id.

Patent Owner also asserts that the '512 patent reasonably conveys to an ordinarily skilled artisan "with knowledge of available video transforming coding techniques that the inventors had possession of the

[19] This discussion applies equally to claim 6. We focus our discussion on claim 1.

claimed invention, including step e and step k of claim 1." *Id.* at 5, 51. Patent Owner urges that "[s]upport for the claimed invention in the disclosure of the '512 Patent should be evaluated and determined against" an ordinarily skilled artisan's "background and knowledge." *Id.* at 10 (citing *Capon v. Eshhar*, 418 F.3d 1349, 1357 (Fed. Cir. 2005)).

Patent Owner addresses the evolution of video coding techniques. *Id.* at 6–11. According to Patent Owner, transformation using a single-size transform kernel had been applied "under the H-264 standard and the prior standards, before the second version of H.264 standard (H.264 AVC in 2005)" when "transformation using different transform kernel sizes" were adopted. *Id.* at 6 (citing Ex. 2001 ¶¶ 44, 53). Also, according to Patent Owner, partitioning or dividing data blocks for transformation was well-known in block-based coding techniques. *Id.* at 7–8 (citing Ex. 2001 ¶¶ 25–28, 31–37, 47–49; Ex. 2029, pp. 2040[20] (right col.), 2048 (Fig. 12)). Patent Owner also states block sizes for prediction and transformation can differ (*id.* at 8–9 (citing Ex. 2001 ¶ 34; Ex. 2028 ¶¶ 21, 36–38)) and can be determined "based on different factors" (*id.* at 9–10 (citing Ex. 2030, pp. 1–2; Ex. 2001 ¶ 38)).

Patent Owner contends that the phrase "a variable block-size transform kernel" found in the '512 patent's specification (*see* Ex. 1006, 3:8–9) is a term of art and that the Board should consider what this phrase and other passages in the '512 patent reasonably convey to an ordinarily skilled artisan. *Id.* at 3–4 (citing Ex. 1006, 3:5–11, 3:15–18, 3:30–43, 5:39–

[20] Although Exhibit 2029 is separately numbered pages 1–21, Patent Owner refers to the actual pages within the publication. We similarly will refer to the actual pages of the publication for consistency.

44, 60:40–46), 51–54 (further citing Ex. 1006, 5:34–40), 62–63. Specifically, Patent Owner argues "[a] skilled artisan in the video coding field would know that 'a variable block-size transform kernel' [discussed in the '512 patent] means a transform kernel having a variable size due to the dividing of a block, as supported by documentary evidence.[]" *Id.* at 52 (citing Ex. 2031,[21] p. 420) (internal footnote omitted); *id.* at 52–53 (citing Ex. 2031, p. 423), 62–64. Patent Owner reproduces Figure 3 and Table 1 of the Kaup paper, asserting that Figure 3 shows division blocks of varying sizes between 4x4 to 32x32 separately transformed. *Id.* at 53 (enlarging and annotated part of Figure 3). Patent Owner also contends the recitation "a" in "a variable block-size transform kernel" in the '512 patent should be considered as a whole, including that phrases "accordingly to a block size" and "selectively applying" in the '512 patent, contesting that "the phrase means that the transform kernel may have a plurality of sizes." *Id.* at 63 (citing Ex. 1001 3:5–10, 5:39–45).

Patent Owner also argues the meaning of "a" transform kernel should be considered in the context of the Specification. *Id.* at 61–62 (citing Rh'g Dec. 7; Ex. 1006, 3:6–11, 3:15–18, 3:30–43, 6:50–64) (referring to § V.B.2 of the Response). More specifically, Patent Owner argues "a transform kernel" disclosed in the '512 patent should be considered based on the Specification of the '512 patent "as a whole and the knowledge available in the art." *Id.* at 62 (citing Ex. 1006, 3:6–11, 3:15–18; 3:30–43, 6:57–64).

[21] Although citing to Exhibit 2032 (PO Resp. 52), "the Kaup Paper" is Exhibit 2031. PO Resp. 53. Also, although Exhibit 2031 is separately numbered pages 1–9 (page 1 is reproduced twice), Patent Owner refers to the actual pages within the publication. We similarly will refer to the actual pages of the publication for consistency.

Patent Owner argues that an ordinarily skilled artisan would have known "applying a transform kernel, *A*, according to block sizes to blocks sub-divided from a single residual block would result in two or more transform kernels." *Id.* (referring to § V.B.2 of the Response).

Concerning Equation 2 in the '512 patent, Patent Owner asserts the '512 patent conveys to an artisan that Equation 2 involves transformation using two different transform kernels, because the residual block can be further split into two different-sized transform blocks and then transformed using different sized transform kernels according to the transform block size. *Id.* at 4, 13–14 (citing Ex. 1006, 6:45–46, 48–50), 54 (citing Ex. 2001 ¶¶ 89–100; Ex. 2028 ¶¶ 77–84; Prelim. Resp. 31–42). Patent Owner provides examples where support for the claimed limitations, including steps [e] and [k], are allegedly found based on Equation 2. *See, e.g.*, *id.* at 38–49 (presenting Disclosures #1–#6 when "the at least one undivided first sub-decoding-unit-block" or "at least one second sub-decoding-unit-block" is a square block). Patent Owner also asserts "Diagrams 3–6 [found in the Preliminary Response[22]] are based on the testimony and opinion of Dr. Reader, who explains what the specification of the '512 Patent would reasonably convey to" an ordinarily skilled artisan. *Id.* at 54–55; *id.* at 55 n.25 (citing Dec. Inst. 19, 21) (indicating the Decision to Institute "relied on the Diagrams in explaining the reasons for instituting trial").

Patent Owner also asserts that the '512 patent supports embodiments where claim 1's step [e] "at least one undivided first sub-decoding-unit-block" is a non-square block and step [k]'s "at least one second sub-

[22] *See* Prelim. Resp. 34–41.

decoding-unit-block" is a non-square block. PO Resp. 34–38. In these situations, Patent Owner argues the '512 patent reasonably conveys to a POSITA that the inventors had possession of transforming unit-blocks using two transform kernels by applying Equation 3 to non-square blocks. *See id*. Patent Owner provides examples where support for the claimed limitations, including steps [e] and [k], are allegedly found based on Equation 3. *Id.* at 32–38, 49–51.

Patent Owner further discusses "Petitioner['s] mischaracteriz[ations of] the disclosure of the '512 Patent." *Id.* at 56. Patent Owner disagrees that the sub-blocks in the '512 patent are transformed by transform kernels having the same size as the other kernels. *Id.* at 57 (citing Pet. 12). Patent Owner also disagrees that the '512 patent has no support for different-sized transforms kernels. *Id.* at 57–58 (citing Pet. 12; Ex. 1006, 3:5–11, 3:15–18, 6:62–65).

Patent Owner further contests Dr. Orchard's testimony, asserting (1) the discussed "coding element (v)" is not recited in the claims of the '720 patent and (2) the testimony implies the claimed invention must select to use either multiple transforms having distinct transform sizes or one variable block-size transform but that the '512 patent discloses blocks or sub-blocks can be further partitioned into transform blocks, which are smaller than the blocks used for prediction. *Id.* at 58–61 (citing Ex. 1002 ¶¶ 45, 53, 64–65, 68; Ex. 1006, 3:6–9, 3:30–43, 5:39–45, 6:57–64; Ex. 2011, p. 6, § 4; Ex. 2014, p. 523; Ex. 2028 ¶¶ 92–93; Ex. 2030, p. 1; Ex. 2031, § 2 (Table 1); Ex. 2032, pp. 421, 423; Dec. Inst. 16).

2. Petitioner's Reply

Petitioner states that, to establish sufficient written description to support a priority claim, a claim element cannot be merely obvious in light of the disclosure of a priority application, but must be necessarily present in the priority application. Reply 2 (citing *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010), *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299 (Fed. Cir. 2008), and *Hologic*, 884 F.3d at 1363).

Petitioner argues the '512 patent's specification does not disclose using transform kernels of different sizes when decoding sub-blocks of a single macroblock. *Id.* at 3 (citing Pet. 14; Ex. 1002 ¶¶ 49–69, 72). Petitioner argues Equations 2 and 3 in the '512 patent's specification do not support multiple transform kernels of differing sizes based on the disclosure, an ordinarily skilled artisan's understanding, and the prosecution history of the '512 patent. *Id.* at 4. Petitioner asserts Patent Owner does not rely on intrinsic evidence but rather its expert's testimony to show that an ordinarily skilled artisan could have been motivated to consider using multiple transform kernels of different sizes. *Id.* at 2–3.

For Equation 2 of the '512 patent, Petitioner argues the disclosure supports using a single transform kernel to transform a square block or sub-block. *Id.* at 4–5 (quoting Ex. 1001, 6:35–41) (reproducing Equation 2) (citing Dec. Inst. 19). Petitioner argues that Patent Owner does not dispute that Equation 2 uses a single transform. *Id.* at 5 (citing PO Resp. 13–14, 45). Petitioner asserts Patent Owner instead argues that "a variable size transform kernel" addressed in the '512 patent means using multiple transform kernels, which has been rejected by the Board. *Id.* at 5 (citing Pet. 14–15; Ex. 1002 ¶ 54; Dec. 15–19; Rh'g Dec. 7–8). Petitioner contends "'***a*** variable block-

size transform ***kernel***' means that once a size transform kernel size is selected (*e.g.*, based on the size of the macroblock to be decoded), that single transform kernel is applied uniformly throughout the decoding process for that decoding block." *Id.* (citing Pet. 15; Dec. 15–19).

Petitioner also asserts Patent Owner misreads the '512 patent's discussion of Equations 2 and 3 related to multiple kernel matrices to disclose multiple transform kernels. *Id.* at 5–6 (citing PO Resp. 13–14, 51–54; Ex. 1006, 6:32–34). Petitioner contends the term "transform kernel" is a well-understood term and one skilled in the art would have known that a "transform kernel" is distinct from a "transform kernel *matrix*." *Id.* at 6 (bolding omitted) (citing Ex. 1002 ¶¶ 56–58; Ex. 1053 ¶¶ 21–25, 28, 33; Ex. 1006, 6:40–49), 7–8 (citing Ex. 1053 ¶¶ 14–25; Ex. 1002 ¶¶ 56–68; Ex. 1024). Petitioner further argues that the '512 patent makes the same distinction between "kernel" and "kernel *matrix*" for Equation 3 of the '512 patent. *Id.* at 6–7 (citing Ex. 1006, 6:50–56; Ex. 1002 ¶¶ 56–58; Ex. 1053 ¶¶ 12–25) (bolding omitted). Petitioner compares Equation 8.1-13a of Exhibit 1024 to Equation 3 of the '512 patent, asserting both apply a single transform kernel to a macroblock. *Id.* at 7–9 (citing Ex. 1024, p. 195; Ex. 1006, 6:40–53). Petitioner concludes that Equation 3 of the '512 patent does not disclose two different transform kernels but rather two transform kernel matrices. *Id.* at 9.

Petitioner also argues the intrinsic evidence shows the '512 disclosure contemplated improving prediction, not transformation, and Patent Owner only shifted prosecution to transformation in 2015. *Id.* at 3 (citing Ex. 1007, pp. 252–59, 395–97, 441–53; Ex. 1002 ¶¶ 37–45, 47; Pet. 8–9), 9. Petitioner asserts the prosecution history of the '512 patent confirms that

transformation uses only a single transform kernel. *Id.* at 3, 9–11. As an example, Petitioner identifies original claim 7 of the '512 patent, which recites "the square sub-blocks are transformed by applying *a* square transform *kernel*" and original claim 10, which recites blocks are transformed "by applying the non-square transform kernel." *Id.* at 9–10 (citing Ex. 2006, 2) (bolding omitted); *see id.* (further citing Ex. 1007, pp. 442–45; Ex. 1002 ¶ 47; Ex. 1053 ¶ 25). Petitioner also argues an ordinarily skilled artisan would have understood the "square kernels" in claim 10 to be the square transform kernel matrices in Equation 3. *Id.* at 10–11 (citing Ex. 1053 ¶ 25; Ex. 2006, 2; Ex. 1006, 6:48–56).

3. Patent Owner's Rebuttal

Patent Owner argues that Petitioner has not met its burden, reiterating that the '720 patent is entitled to its claim of priority to the filing date of the '906 application, which issued as the '512 patent. Sur-reply 1. Patent Owner repeats that the '512 patent discloses an "encoding unit block may be divided into one or more square or non-square sub-blocks having any size." *Id.* at 4 (quoting Ex. 1006, 3:15–18). Patent Owner contends an ordinarily skilled artisan would understand column 3, lines 15 through 18 of the '512 patent to mean dividing a unit block or sub-block into transform blocks of different sizes for several reasons. *Id.* at 4 (citing Ex. 2001 ¶¶ 83–85, 101–105, 136–141; Ex. 2028 ¶¶ 20–22, 54–73). For non-square transformations, Patent Owner argues the '512 patent discloses using two transform kernels of differing sizes. *Id.* at 4–5 (citing Ex. 1001, 6:48–52; Dec. Inst. 20; Rh'g Dec. 8; Ex. 2001 ¶¶ 93–100, 103–105, 136, 147; Ex. 2028 ¶¶ 47–53, 0–72; PO Resp. 31–38, 49–51; Prelim. Resp. 37–42). For square transformation, Patent Owner asserts the '512 patent's disclosure would convey to an

ordinarily skilled artisan that the disclosure has support for dividing a sub-block into blocks of different sizes for applying transform kernels. *Id.* at 5 (citing Ex. 1006, 3:5–11, 3:30–43, 5:39–44, 6:40–48, 6:50–57; PO Resp. 38–48; Prelim. Resp. 31–36; Ex. 2028 ¶¶ 54-69; Ex. 2001 ¶¶ 86–92, 142–146).

Patent Owner further argues that some of Petitioner's assertions are factually incorrect, misleading, and irrelevant. *Id.* at 5–7. These include that (1) a variable block-size transform kernel is a single transform kernel applied uniformly through the decoding process for a decoding block (*id.* at 5 (citing Reply 5, 9–11; Pet. 14–15)), and omitting that the '512 patent discloses decoding unit block or sub-blocks into smaller transform blocks (*id.* at 6 (citing Ex. 1006, 3:15–18; PO Resp. 51–54; Ex. 2031, p. 420; Ex. 2001 ¶¶ 101–105, 184, 227–233; Ex. 2028 ¶¶ 43–72)), (2) Petitioner shifted the claim's focus on transformation rather than basing priority determinations on the '512 patent's disclosure (*id.* at 6–7 (citing Reply 3, 9; Pet. 8–9)), and (3) original claim 10 in the '906 application discloses transforming a non-square first-sub-decoding-unit-block rather than just an encoding unit block (*id.* at 7 (citing Reply 11; Pet. 8–9; Ex 2006 (claims 4, 10))).

Patent Owner also argues that the Petitioner raises belated and new theories and introduces, impermissibly, new evidence. *Id.* at 1, 7–8 (citing *Dell Inc. v. Acceleron, LLC*, 818 F.3d 1293, 1301 (Fed Cir. 2016); Trial Practice Guide, 77 Fed. Reg. 48,756, 48,767 (Aug. 14, 2012)). Patent Owner argues that the new theories and evidence include the testimony of the Second Dr. Orchard Declaration related to "(i) dimensionality of transforms[] ([Ex. 1053] ¶¶ 12–13), (ii) matrix operators ([*id.*] ¶¶14–17),

(iii) matrix-matrix multiplication ([*id.*] ¶¶ 18–20), (iv) single 2-D transforms on non-square blocks ([*id.*] ¶¶ 21–22, 26, 31–33), (v) *A* in Equation 2 and *A1*/*A2* in Equation 3 as 1-D transform matrices ([*id.*] ¶¶ 23–25), (vi) 2-D transform kernels ([*id.*] ¶¶ 26–28), and (vii) requirements in claim elements g and m ([*id.*] ¶¶ 29–31)." Sur-reply 8 (internal footnote omitted) (referring to Exs. 1053–1054). Patent Owner also argues Petitioner provides no reason why the alleged new arguments and evidence could not have been presented in the Petition. *Id.* at 9.

Patent Owner further asserts the new arguments are flawed. *Id.* at 9–12. Patent Owner argues Petitioner has the burden to set forth how the challenged claims are to be construed and that the term "transform kernel" in the claims was not construed in the Petition or the Reply. *Id.* at 9 (citing 35 U.S.C. § 316(e); 37 C.F.R. § 42.104(b)(3)). Patent Owner also argues Petitioner's claim construction would exclude Equation 3 from the scope of claim 1's steps [e] and [k] and fails to conform with canons of claim construction. *Id.* at 10. Patent Owner further asserts Exhibit 1024 shows that a transform kernel matrix and a transform kernel are not distinct. *Id.* at 10–11 (citing Ex. 1024, pp. 193–194; Ex. 1054, p. 258).

4. Discussion

Having considered the parties' arguments and cited evidence, we remain unpersuaded that the challenged claims of the '720 patent are entitled to a priority date any earlier than September 7, 2016, the filing date of the '720 patent.

"In an *inter partes* review, the burden of persuasion is on the petitioner to prove 'unpatentability by a preponderance of the evidence,' 35 U.S.C. § 316(e), and that burden never shifts to the patentee." *Dynamic*

Drinkware, LLC v. Nat'l Graphics, Inc., 800 F.3d 1375, 1378 (Fed. Cir. 2015). Determining whether the '720 patent is entitled to its claimed earlier priority date is an appropriate inquiry for the Board in an *inter partes* review (IPR) because such a determination impacts whether Winken, JCTVC-R1013, and Kim—all intervening publications—qualify as prior art. *See Rackspace US, Inc. v. PersonalWeb Techs., LLC*, IPR2014-00058, Paper 10 at 13–21 (PTAB Apr. 15, 2014) (determining in an *inter partes* review that an intervening publication was prior art after finding the challenged patent was not entitled to its claimed earlier priority date).

Based on the claim construction discussed above in Section (II)(C)(1), the '720 patent's disclosure does not fully support the claimed invention where the recited four "first sub-decoding-unit-blocks" and "second sub-decoding-unit-blocks" recited in claim 1 "include two square blocks and **two non-square blocks**" as Appellant argues. PO Resp. 3 (citing Ex. 1006, 3:13–18); *see id.* at 4–5, 13, 15–19, 32–38 (providing example where the '720 patent allegedly supports embodiments where "at least one second sub-decoding-unit-block" and the "at least one undivided first sub-decoding-unit-block" are non-square blocks), 42, 54, 57–58, 62; *see also* Sur-reply 1, 4–5 (discussing Equation 3). As explained, we disagree that the recited "at least one second sub-decoding-unit-block" in claim 1's step [e] and "the at least one undivided first sub-decoding-unit-block" in claim 1's step [k] are non-square blocks. Rather, we determine that the recited "at least one second sub-decoding-unit-block" and "the at least one undivided first sub-decoding-unit-block" in claim 1 are square unit-blocks when construing the challenged claim as a whole in context of the '720 patent, its prosecution history, and what ordinarily skilled artisan would have understood.

Thus, although Equation 3 in the '720 patent uses "two transform kernels of differing sizes" (Dec. Inst. 20; *see* Rh'g Dec. 8 (stating the same)), we disagree that that the Specification reasonably conveys to one skilled in art to apply Equation 3 (Ex. 1001, 6:42–49) to the recited "at least one second sub-decoding-unit-block" and "the at least one undivided first sub-decoding-unit-block" in claim 1 (and similarly in claim 6) during the "transforming" steps [e] and [k], such that (1) the recited "at least one second sub-decoding-unit-block among the four second sub-decoding-unit-blocks us[es] a first transform kernel and a second transform kernel having a different size from the first transform kernel" as claim 1's step [e] recites; and (2) "the at least one undivided first sub-decoding-unit-block us[es] a third transform kernel and a fourth transform kernel having a different size from the third transform kernel" as claim 1's step [k] recites. *See* PO Resp. 3–4, 13, 16, 34–38, 42, 49–50, 54–55, 62, 68 (discussing Equation 3).

Because the recited unit-blocks in claim 1's steps [e] and [k] are square blocks, an ordinarily skilled artisan would have instead recognized that Equation 2 (Ex. 1001, 6:34–41) in the '720 patent, not Equation 3, is used during claim 1's transforming steps [e] and [k] for the following reasons. The '512 patent describes that "square sub-blocks in each CU block may be transformed by applying *a* square transform kernel." Ex. 1006, 3:28–29 (emphasis added); *see id.*, 3:30–35. Both parties also agree that Equation 2 in the '720 patent applies to transforming square unit-blocks and sub-blocks. *See* Reply 4 (indicating "Equation 2 . . . is applied when transforming square blocks and sub-blocks"); *see* PO Resp. 4 (stating "Equation 2 . . . [is] applied to transform a square transform block"), 30–31 (indicating the recited "'second sub-decoding-unit-block' and 'undivided

first sub-decoding-unit-block' . . . will become residual signals that are transformed."). As such, we focus our discussion mainly on Equation 2 and other pertinent passages in the '512 patent.

The '512 patent describes applying transforming encoding to "a residual signal of a super-macroblock" using "a square transform kernel." Ex. 1006, 6:32–35. More specifically, the '512 patent states applying the square transform kernel to a super-macroblock's residual signal using Equation 2 below:

$$Y=AX$$

See id., 6:32–33, 40–45. Equation 2, above, shows *Y* equals *A* times *X*, where *Y* is a transform coefficient matrix, *A* is an NxN square transform kernel matrix, and *X* is an NxN input video signal matrix. *Id.*, 6:45–47.

Additionally, as Patent Owner explains, "the **output** of the prediction model is **a residual frame**, which is an **input** to the spatial model, which in turn **applies a transform** to the residual samples and quantizes the results." Req. Rh'g 9 (citing Ex. 2001 ¶¶ 54-56; Ex. 1043, 3 (Fig. 3.3)). Based on the record, the resulting divided blocks and sub-blocks (after prediction but prior to transformation) thus would be the described "input video signal matrix" or variable *X* in Equation 2, which is a square signal (e.g., NxN). Ex. 1006, 6:45. Likewise, because the "at least one second sub-decoding-unit-block" and "the at least one undivided first sub-decoding-unit-block" in claim 1's steps [e] and [k] are square unit-blocks for reasons previously discussed, their resulting input signals (e.g., after prediction in steps [c]–[d] and [i]–[j] or similar steps in claim 6) would also be square. Thus, an ordinarily skilled artisan would have understood that Equation 2 would be used to apply a

square transform kernel to these square input signals (e.g., residual signals) during transformation.

Stated differently, Equation 2 of the '512 patent describes using *a* transform kernel or *one* transform kernel matrix (e.g., *A*) during transformation (*see id.*, 6:40–47), not two transform kernels of different sizes as claim 1's steps [e] (i.e., first and second transform kernels) and [k] (i.e., third and fourth transform kernels) recite. *See* Ex. 1001, 9:16–19, 37–41. Also, the accompanying description for Equation 2 (*see* Ex. 1006, 6:40–47) and other passages in the '512 patent describe applying one or a single transform kernel to blocks or sub-blocks. For example, the '512 patent described "selectively applying *a* square or non-square transform kernel to a residual signal" (Ex. 1006, 2:56–57 (emphasis added)) or "applying *a* transform kernel . . . when the selected block is transformed using the residual signal" (*id.*, 4:37–39 (emphasis added)). *See id.*, 3:31–32 (stating "a square transform kernel . . . may be applied"), 6:34–35 (stating "selectively applying a square transform kernel"), 6:57 (stating "[w]hen a square or non-square kernel transform is applied"), 6:62 (stating "applying a kernel"). Similarly, original claim 7 recites "the square sub-blocks are transformed by applying *a* square transform kernel." Ex. 2006, p. 2 (emphasis added). Dr. Orchard testifies similarly. *See* Ex. 1053 ¶ 11 (noting the '720 patent's specification "only discloses using a single transform kernel for transformation."). Thus, we find that applying a single kernel to the recited "unit-block" that is a square is substantiated by the '512 patent when considering this patent in the context of its specification and as one skilled in the art would have understood the claim.

Accordingly, Equation 2 of the '512 patent does not describe "transforming at least one second sub-decoding-unit-block among the four second sub-decoding-unit-blocks using a first transform kernel and a second transform kernel having a different size from the first transform kernel" as step [e] recites, or "transforming the at least one undivided first sub-decoding-unit-block using a third transform kernel and a fourth transform kernel having a different size from the third transform kernel" as step [k] recites.

Patent Owner argues that an ordinarily skilled artisan would have known that "applying a transform kernel, *A*, according to block sizes to blocks sub-divided from a single residual block would result in two or more transform kernels." PO Resp. 62 (referring to § V.B.2[23]). Patent Owner asserts the '512 patent conveys to an artisan that Equation 2 involves transformation using two different transform kernels, because the residual block can be further split or divided into two different-sized transform blocks and then transformed using different sized transform kernels according to the transform block size. *Id.* at 4, 13–14, 54–55; *see* Sur-reply 5. Patent Owner provides examples where purported support for claim 1's steps [e] and [k] are found based on Equation 2. PO Resp. 38–49.

We disagree that Equation 2 discusses *further* dividing a unit-block or a residual signal (e.g., variable *X* described as "an NxN input video signal matrix") (*see* Ex. 1006, 6:32–36, 40–48), the residual signal being a resulting signal after division and prediction but prior to transformation as discussed previously. In fact, in the context of the '512 patent, the phrase

[23] Section V.B.2 covers pages 29 through 51 of Patent Owner's Response.

"divide" (or a derivative of this word) is only used when addressing dividing the block or sub-blocks for purposes of prediction, not dividing for transformation. For example, the '512 patent states: "An input picture is divided into encoding unit blocks. The coding unit (CU) blocks are divided into sub-CU blocks. The sub-CU blocks are encoded by selectively using at least one of intra prediction encoding and inter prediction encoding." *Id.*, code (57); *see id.* at 2:67–3:5 (describing the same), 3:46–55 (describing the same), 8:30–34 (also describing the same). Other examples also apply. *See id.*, 3:16–17 (stating "the encoding unit block may be divided into one or more square or non-square sub-blocks"), 3:59–4:3 (discussing "dividing the input picture into encoding CU blocks" and then performing prediction), 6:14–18 (discussing "dividing a super-macroblock into sub-blocks" and performing prediction), 7:4–5, 15–16 (stating "the input picture i is divided into encoding unit blocks" and "unit block j to be encoded is divided into sub-block" prior to prediction), Fig. 3 (showing dividing encoding unit blocks prior to prediction at steps S105, S111, S112). Dr. Orchard also testifies similarly concerning the '720 patent. *See* Ex. 1053 ¶ 35 (indicating "the '720 patent specification and prosecution history is similarly remarkably devoid of teachings regarding the division of blocks.").

Thus, when considering the disclosures of the '512 patent as a whole in the context of its specification, we find that there is insufficient written description in the '512 patent to convey reasonably to an ordinarily skilled artisan further splitting or dividing the recited unit-blocks in claim 1's steps [e] and [k] (i.e., steps [g] and [m]), such that the transforming steps [e] and [k] of the recited "first sub-decoding-unit-block" and "second-sub-decoding-

unit-block" use two transform kernel having differing sizes as claim 1's steps [e] and [k] require.

As for Patent Owner's examples in Section V.B.2 of its Response (*see* PO Resp. 31–51), we have already addressed why subsections 2.(1)–(2) (*see id.* at 34–38), which address transforming non-square unit-blocks (*see id.* at 32–34), are not applicable to claim 1's steps [e] and [k] and thus cannot demonstrate possession of the claimed subject matter in the challenged claims. *See id.* at 34–38; *see id.* at 32–34 (showing a similar example that transforms non-square blocks). We refer to the discussion above for more explanation.

Turning to sub-sections 2.(3)–(6) (*see id.* at 38–51), Patent Owner alleges these examples demonstrate how the '512 patent supports transforming a square block using two transform kernels of differing sizes as claim 1's steps [e] and [k] recites. *See id.* at 38–51. For each of these examples, Patent Owner asserts that "dividing blocks for transforming involves the same manner of division as illustrated in Fig. 2 [of the '512 patent]." *Id.* at 38. For support, Patent Owner cites to "Section II.B." *Id.* (further citing Ex. 2028 ¶ 54). In Section II.B, Patent Owner contends "those familiar with image processing techniques knew to partition, or divide, an input signal into smaller blocks for both prediction and transformation." *Id.* at 7; *see id.* at 7–10 (citing Ex. 2001 ¶¶ 25–28, 31–37, 47–49; Ex. 2029, pp. 2040, 2048; Ex. 2030, pp. 1–2).

Regarding cited Exhibit 2029 ("the IEEE Paper") (*see id.* at 8), the IEEE Paper discusses "*transform coding*" or "TC" where "the input image . . . is partitioned into (usually square) blocks of pixels which are then encoded as separate entities." Ex. 2029, p. 2040 (right column). The IEEE Paper

states a "segmentation divides the image into square regions that vary in size between 32x32 to 4x4 pixels and appropriate coding techniques . . . are then used for each block." *Id.* The IEEE Paper also discusses "Variable Block Size Segmentation" (*id*., Title (bolding omitted)) or a partitioning a residual image using "the VE segmentation" (*id.*, p. 2047 (right column)), which involves splitting the residual image blocks into smaller blocks if certain thresholds are met (*id.*, p. 2048 (left column), Fig. 12). Although the IEEE Paper discusses a known transforming technique, the '512 patent does not address partitioning square unit-blocks *during transformation* as previously discussed (*see generally* Ex. 1006), including using the VE segmentation technique discussed in the IEEE Paper involving thresholds, such that an ordinarily skilled artisan would have recognized the transformation technique addressed in the IEEE Paper are applied to the transformation process discussed in the '512 patent's invention. Also, knowledge of this particular transform coding technique by an ordinarily skilled artisan does not reasonably convey that the '512 patent's invention uses the IEEE Paper's "VE segmentation" process (*id.*, p. 2047) when transforming square blocks, or that dividing blocks for transforming involves the same manner of division as illustrated in the '512 patent's Figure 2 for prediction, as Patent Owner argues. *See* PO Resp. 8, 38.

Regarding Exhibit 2030 ("Bracamonte"), Bracamonte discusses "a Variable Block-Size Transform Scheme" that divides an input image into blocks of *N* x *N* pixels and applies a linear transform. Ex. 2030, Title (bolding omitted), p. 1 (left column, § 1). Bracamonte states this results in "using a variable size for *N* when coding different regions of the same input image." *Id.*; *see id.*, p. 2 (left column) (Table 1 showing block sizes of 4x4,

8x8, 16x16, and 32x32). Bracamonte further teaches "[s]everal factors influence the size selection of the block *N* x *N* pixels in transform-based image coding." *Id.*, p. 1 (§ 2).

As understood, in this scheme, *a* given, but variable size, N, is used for different regions of the input image (*see id.*, p. 1 (§ 1)), such that blocks in one region may use one block size (e.g., 4x4) and blocks in another region may use another, but still one block size (e.g., 16x16). Thus, even if an ordinarily skilled artisan would have understood the discussed "a variable block-size transform kernel according to block size" in the '512 patent (Ex. 1006, 3:8–9) uses the same technique discussed in Bracamonte, the block size would vary in *different* regions of the input image, such the block size in one region (e.g., the recited "at least one second sub-decoding-unit-block" in claim 1's step [e]) may differ from that in another region (e.g., the recited "the at least one undivided first sub-decoding-unit-block" in claim 1's step [k]). But, Bracamonte explains that an ordinarily skilled artisan would not understand the disclosed "variable block-size transform kernel" to use different kernel sizes when coding a particular block (e.g., either "at least one second sub-decoding-unit-block" or "the at least one undivided first sub-decoding-unit-block") located in the same region of an input image.

Thus, although the '512 patent discusses "applying a variable block-size transform kernel according to block size" (*id.*), we disagree with Patent Owner that this written description is sufficient to disclose that the '512 patent reasonably conveys to one skilled in the art that "transforming" coding involves further partitioning both the recited "second sub-decoding-unit-block" in claim 1's step [e] and the recited "the at least one undivided first sub-decoding-unit-block" in claim 1's step [k] into blocks of different

sizes and thus, results in using two transform kernels of different sizes as the steps require. *See, e.g.*, PO Resp. 40–41 (arguing a skilled artisan would understand "a variable block-size transform kernel involves using one of at least two variable block-size transform kernels, . . . which encompasses one or more transform kernels of different sizes"). Rather, absent disclosures in the '512 patent as to how and if square unit-blocks are divided during transformation as previously discussed, the '512 patent reasonably conveys that traditional transformation techniques were used in claim 1's steps [e] and [k], including transforming square unit-blocks using a one-size transform kernel as both Dr. Orchard and Dr. Reader testify. *See* Ex. 1002 ¶¶ 40–41, 55; *see* Ex. 2001 ¶¶ 36–38; *see* Ex. 2028 ¶ 21.

Patent Owner further asserts that the phrase "a variable block-size transform kernel" found in the '512 patent's specification (*see* Ex. 1006, 3:8–9) is a term of art as of February 23, 2010, and that the Board should consider what this phrase and other passages in the '512 patent reasonably convey to an ordinarily skilled artisan. PO Resp. 3–4 (citing Ex. 1006, 3:5–11, 3:15–18, 3:30–43, 5:39–44, 60:40–46), 51–54 (further citing Ex. 1006, 5:34–40), 62–63 (referring to § (V)(C)[24]); *see* Ex. 2028 ¶¶ 74–76. Specifically, Patent Owner argues "[a] skilled artisan in the video coding field would know that 'a variable block-size transform kernel' [discussed in the '512 patent] means a transform kernel having a variable size due to the dividing of a block, as supported by documentary evidence." PO Resp. 52 (citing Ex. 2031, p. 420); *id.* at 52–53 (citing Ex. 2031, p. 423) (reproducing Figure 3 and Table 1 (both annotated)), 62–64.

[24] Section (V)(C) is located on pages fifty-one through fifty-five. PO Resp. 51–55.

As discussed previously, the ’512 patent discloses “selectively applying a variable block-size transform kernel according to a block size.” Ex. 1006, 3:8–9. Other similar passages are also discussed in the ’512 patent. *See id.*, 5:41–44 (stating “selectively applying a size of a variable block-size transform kernel according to a size of the CU block or sub-CU block so that both the intra and inter predictions can be applied to sub-CU blocks within each CU block”), 8:37–38 (stating “a variable block-size transform kernel is selectively applied”). Additionally, original claim 2 recited “transforming . . . by selectively applying a variable block-size transform kernel according to a block size.” Ex. 2006, p. 2.

We discussed variable block-size segmentation and variable block-size transform scheme when addressing the IEEE Paper and Bracamonte. There, we determined that the IEEE Paper addresses a specific type of variable block-size transform coding rather than explaining what the phrase “a variable block-size transform kernel” would mean to one skilled in the art. *See generally* Ex. 2029. As for Bracamonte, it discusses that variable block-size transform schemes use “a variable size . . . when coding different regions of the same input image” (Ex. 2030, p. 1), but does not address using two different transform kernels when transforming a particular unit-block in the same region, such as the recited “at least one second sub-decoding-unit-block” and “the at least one undivided first sub-decoding-unit-block” in claim 1’s step [e] and [k].

As for Exhibit 2031, the Kaup paper discusses “Variable-Blocksize Transform Coding of Four-Color Printed Images.” Ex. 2031, p. 420. The Kaup paper, like the IEEE paper, addresses a specific type of variable blocksize transform coding concept using quadtree decomposition but does

not explain what the term "variable block-size transform kernel" means to an ordinarily skilled artisan. *See id.* The Kaup paper also discusses segmenting color components into blocksizes varying from 4x4 to 32x32 pixels and applying the Discrete Cosine Transform to single blocks. *Id.*, p. 423; *see id.*, p. 424 (Fig. 3). Thus, to the extent the Kaup paper explains what the phrase "variable block-size transform kernel" means to an ordinarily skilled artisan (which we do not agree it does), the Kaup paper discusses applying one transform to a single block (e.g., *the* Discrete Cosine Transform), rather than two differently sized transforms to the recited unit-blocks in claim 1's steps [e] and [k]. *See id.*, pp. 423–424.

Thus, the phrase "a variable block-size transform kernel" in the '512 patent does not reasonably convey to an ordinarily skilled artisan that the recited "at least one second sub-decoding-unit-block" and "the at least one undivided first sub-decoding-unit-block" in claim 1's step [e] and [k] of the '720 patent respectively would be divided into two differently sized transform kernels as recited. Ex. 1001, 9:16–19, 24–26, 37–41, 47–50.

Patent Owner further argues the '512 patent discusses applying *a* transform kernel "according to a block size" (Ex. 1006, 3:8–9) and the encoding unit block may be divided into sub-blocks "having any size" (*id.* at 3:17–18). *See* PO Resp. 57–58; *see* Sur-reply 4. Although the Specification may disclose sub-blocks of different sizes, we fail to see how this disclosure supports that "at least one second sub-decoding-unit-block" and "the at least one undivided first sub-decoding-unit-block" in claim 1's step [e] and [k] would each be transformed using *two* different transform kernels, one transform kernel "having a different size from" another transform kernel as these steps further require.

For these reasons, we disagree that Patent Owner's scenarios (e.g., Disclosures #1–#7) support using two differently sized transform kernels when transforming unit-blocks, as claim 1's steps [e] and [k] require. *See* PO Resp. 38–51; *see* Ex. 2028 ¶¶ 55–73 (discussing Disclosures #1–#7). As previously explained, the '512 patent reasonably conveys to one skilled in the art to apply *a* kernel to the unit-blocks in steps [e] and [k] rather than transforming a block using one kernel size and then further dividing the same block and using another transform kernel of a smaller size as Patent Owner argues. *See*, *e.g.*, PO Resp. 43–50.

Moreover, as we previously noted (*see* Dec. Inst. 21; *see* Rh'g Dec. 8–9), the record and evidence does not demonstrate that an ordinarily skilled artisan, in the context of the '512 patent, would have necessarily understood that the recited "at least one *undivided* first sub-decoding-unit-block" in step [k] would limit the term "undivided" to mean only that there is no more block division for prediction purposes. *See* PO Resp. 23–25 (urging for an understanding that the "undivided" block in the claims is divided into transform blocks for transformation). We thus disagree with Dr. Reader's testimony (*see*, *e.g.*, Ex. 2028 ¶¶ 58, 62–63) in this regard.

Accordingly, considering the evidence developed through trial, we determine that the '512 patent's disclosure does not provide sufficient written description support for the challenged claims of the '720 patent. When considering the '512 patent as a whole in the context of its specification and as one skilled in the art would have understood, the '512 patent supports transforming the recited "first sub-decoding-unit-block" and "second-sub-decoding-unit-block" in claim 1's steps [e] and [k] respectively (and similar limitations in independent claim 6) using *a* transform kernel.

However, the '512 patent does not sufficiently support dividing the unit-blocks into two different transform kernels and transforming the unit-blocks using the two transform kernels, one "having a different size from" the other, as claim 1's steps [e] (i.e., "transforming at least one second sub-decoding-unit-block among the four second sub-decoding-unit-blocks using a first transform kernel and a second transform kernel having a different size from the first transform kernel") and [k] (i.e., the transforming further comprises transforming the at least one undivided first sub-decoding-unit-block using a third transform kernel and a fourth transform kernel having a different size from the third transform kernel") require.

On the full record, we thus conclude that the challenged claims are not entitled to a priority date any earlier than September 7, 2016, the filing date of the application for the '720 patent, and Winken, Kim, and JCTVC-R1013 are prior art.

E. Ground 1: Anticipation of Claims 1–6 over Winken

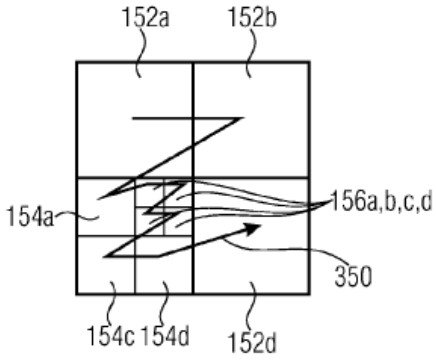
1. Winken (Ex. 1004)

Winken was published on February 7, 2013. Winken "relates to coding schemes for different spatially sampled information components of a picture of a scene, . . . comprising an array of information samples, such as in videos or still pictures." Ex. 1004 ¶ 2.

Winken explains that pictures or sample arrays for pictures are usually decomposed into blocks having different sizes (e.g., quadratic or rectangular), and the blocks are predicted by either inter-picture or intra-picture prediction. *Id.* ¶¶ 3, 84, 169. Winken states that more than one prediction parameter can be associated with a single block, and the prediction signals for a block are usually transformed. *Id.* For transform

coding, Winken states the blocks can be further split before applying a transform, the transform blocks can be equal to or smaller than the blocks used for prediction, a transform block can include more than one of the blocks that are used for prediction, and different transform blocks can have different sizes representing quadratic and rectangular blocks. *Id.* ¶¶ 3, 185–187. Winken states coding efficiency can be increased by using larger block sizes. *Id.* ¶ 4.

Winken discloses encoder 10 has divider 20 with subdivider 28, which divides a picture into blocks of different sizes, and decoder 100 has divider 104 with decoder 104a, which rebuilds the sub-divisions chosen by divider 20. *Id.* ¶¶ 38–39, 59, 61, 64, 74–76, 78–79, Figs. 1–2. For example, Winken's Figure 3C (shown below) is an example of a quadtree structure that includes a treeblock divided into four sub-blocks or nodes 152a–d:



Id. ¶¶ 40, 82, 84–87, Fig. 3C. Winken's Figure 3C shows sub-block 152c sub-divided into four smaller sub-blocks 154a–d and upper right block 154b further divided into four blocks 156a–d. *Id.* In Winken's Figure 3C, blocks 152a–d have half the width and height of treeblock 150, sub-blocks 154a–d have half the width and height of block 152c, and block 156a–d have half

the width and height of sub-block 154b. *See id.* ¶ 82. Reference sign 350 shows the resulting scan order of the treeblock. *Id.* ¶ 108.

Winken additionally discloses that subordinate array dimensions may differ from primary array dimensions, and a scaling factor in the horizontal and vertical direction can determine the dimension ratio of primary array dimension to the subordinate array dimension. *Id.* ¶ 88. In the case where the scaling factors in the horizontal and vertical directions differ, the resulting prediction and residual blocks of the subordinate array would not be squares (e.g., non-square residual blocks), but the encoder/decoder could agree to sub-divide into square blocks when a block is non-square. *Id.* For example, where the subordinate arrays have half the width but the same height as the primary array, the residual blocks would be twice as high as wide but could be vertically split to obtain two square blocks. *Id.*

Winken states encoder 10 also includes residual precoder 14 that subjects each residual sub-region to a transformation having transform coefficients. *Id.* ¶ 68, Fig. 1. Winken's encoder 10 further has residual reconstructor 16 reconverting the coefficients into a residual signal through re-transformation, and decoder 100 with reconstructor 106 acting like element 16. *Id.* ¶¶ 38–39, 68–69, 75, Figs. 1–2.

2. Analysis

In our Decision ton Institute, we concluded that the arguments and evidence advanced by Petitioner demonstrated a reasonable likelihood that claims 1–6 of the '720 patent would have been unpatentable under 35 U.S.C. § 102 as anticipated by Winken. Dec. 32–33. Here, we determine whether Petitioner has established by a preponderance of the evidence that the challenged claims are anticipated over Winken. 35 U.S.C. § 316(e). We

previously instructed Patent Owner that "any arguments for patentability not raised in the response may be deemed waived." Paper 16, 7; *see also* 37 C.F.R. § 42.23(a) ("Any material fact not specifically denied may be considered admitted."); *In re Nuvasive, Inc.*, 842 F.3d 1376, 1379–82 (Fed. Cir. 2016) (holding Patent Owner waived an argument addressed in the Preliminary Response by not raising the same argument in the Patent Owner Response). Additionally, the Board's Trial Practice Guide states that the Patent Owner Response "should identify all the involved claims that are believed to be patentable and state the basis for that belief." Consolidated Trial Practice Guide, 66 (November, 2019).[25]

At the outset, Petitioner argues Winken qualifies as prior art because the '720 patent is not entitled to a priority date earlier than September 7, 2016. *See id.* at 3–4, 10, 16–17; Ex. 1001, 1 (22). Patent Owner disagrees, asserting Winken is not prior art because the '720 patent is entitled to a priority date of February 23, 2010. PO Resp. 64. Because the '720 patent is not entitled to a priority date earlier than September 7, 2106, as previously discussed, we determine Winken qualifies as prior art.

a. Claim 1's Undisputed Limitations

Petitioner asserts that Winken anticipates claim 1 under 35 U.S.C. § 102(a)(1) and (2). Pet. 4, 16–47 (citing Ex. 1002 ¶¶ 20–83, 108–192; Ex. 1004 ¶¶ 2–9, 14–17, 20–23, 64, 68, 70, 72, 76, 79–88, 97–98, 101, 103, 107, 152–154, 169, 181, 183, 185–187, 193, Figs. 1–3C, 8); Reply 22–25. Patent Owner disagrees with Petitioner's assertions, focusing its arguments

[25] *Available at* https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf.

on Winken's failure to teach claim 1's steps [e] and [k]. *See* PO Resp. 64–69.

Having considered the parties' arguments and cited evidence, we conclude that steps [a]–[d], [f]–[j], and [l]-[n] of challenged claim 1 are described in Winken based on the preponderance of the evidence. With a complete record before us, we agree with and adopt Petitioner's analysis related to claim 1's undisputed steps. Petitioner's anticipation analysis, as supported by Dr. Orchard's Declaration, relies on testimony as to where each element of the challenged claim 1 is disclosed in Winken. Pet. 16–47.

In this regard, the record establishes that Winken discloses the corresponding limitations of claim 1: (1) "[a] method of video decoding"[26] (Pet. 18 (citing Ex. 1004 ¶¶ 6–9, 14–16, Fig. 2; Ex. 1002 ¶¶ 76–78)), (2) step [a]'s[27] "dividing a decoding unit block within a current slice into four first sub-decoding-unit-blocks" (e.g., blocks 152a–d in Figure 3A) (*id.* at 19–21 (citing Ex. 1004 ¶¶ 3–4, 23–25, 63–68, 80–82, 169, 181, 183, Figs. 2–4; Ex. 1002 ¶¶ 20–83, 110–114) (reproducing Ex. 1003, p. 175) (reproducing Ex. 1004, Figs. 3A–B)); (3) step [b]'s "dividing at least one first sub-decoding-unit-block among the four first sub-decoding-unit-blocks into four second sub-decoding-unit-blocks" (e.g., blocks 154a–d in Figure 3B) (*id.* at 22–23 (citing Ex. 1004 ¶¶ 80–82, Figs. 3A–3B; Ex. 1002 ¶¶ 20–83, 115–117) (reproducing Ex. 1003, p. 175) (reproducing Ex. 1004, Figs. 3A–B)); (4) step [c]'s "wherein each of the second sub-decoding-unit-blocks is a basis of

[26] We do not decide whether the preamble is limiting. Regardless, claim 1's preamble is described in Winken.
[27] As previously noted, the Petition uses different nomenclature for each element than steps [a]–[n]. However, we maintain our nomenclature in this decision for consistency.

a prediction mode" (*id.* at 24–26 (citing Ex. 1004 ¶¶ 20–22; Ex. 1002 ¶¶ 20–83, 118–121) (reproducing both Ex. 1003, p. 175 and Ex. 1001, Fig. 4)); and (5) step [d]'s "wherein the prediction mode for each of the second sub-decoding-unit-blocks is intra prediction mode or inter prediction mode" (*id.* at 26–27 (citing Ex. 1004 ¶ 20; Ex. 1002 ¶¶ 20–83, 118–124)).

The record further establishes that Winken discloses the corresponding limitations of claim 1: (6) step [f]'s "performing prediction on the at least one second sub-decoding-unit-block according to the prediction mode for the at least one second sub-decoding-unit-block" (*id.* at 29–31 (citing Ex. 1004 ¶¶ 20–23, 82, 84, 88, 107, Figs. 1, 3A–3C; Ex. 1002 ¶¶ 20–83, 129–131) (reproducing Ex. 1004, Fig. 1)); (7) step [g]'s "wherein the decoding unit block comprises the at least one second sub-decoding-unit-block divided into the first transform kernel, and the second transform kernel" (*id.* at 31–34 (citing Ex. 1004 ¶¶ 3, 20, 68, 82–84, Figs. 3A–3B; Ex. 1002 ¶¶ 20–83, 132–136; Ex. 1003, p. 175) (reproducing Ex. 1003, p. 175) (reproducing Ex. 1004, Figs. 3A–B)); (8) step [h]'s "wherein the decoding unit block comprises at least one divided first sub-decoding-unit-block, divided into the four second sub-decoding-unit-blocks, and at least one undivided first sub-decoding-unit-block not divided into the four second sub-decoding-unit-blocks" (*id.* at 34–36 (citing Ex. 1004 ¶ 79, Figs. 3A–3B; Ex. 1002 ¶¶ 20–83, 137–140; Ex. 1003, p. 175) (reproducing Ex. 1003, p. 175) (reproducing Ex. 1004, Figs. 3A–B)); (9) step [i]'s "wherein the undivided first sub-decoding-unit-block is a basis of a prediction mode" (*id.* at 36–38 (citing Ex. 1004 ¶¶ 3, 20; Ex. 1002 ¶¶ 20–83, 141–143; Ex. 1003, p. 175) (reproducing Ex. 1003, p. 175)); and (10) step [j]'s "wherein the prediction mode for the undivided first sub-decoding-unit-block is intra

prediction mode or inter prediction mode" (*id.* at 38 (citing Ex. 1004 ¶ 20; Ex. 1002 ¶¶ 20–83, 141–146) (referring to steps [f] and [i]))

The record even further establishes that Winken discloses the corresponding limitations of claim 1: (11) step [l]'s "wherein the performing prediction further comprises performing prediction on the at least one undivided first sub-decoding-unit-block according to the prediction mode for the at least one undivided first sub-decoding-unit-block" (*id.* at 41–42 (citing Ex. 1004 ¶¶ 20–23, 82–84, 88, 107, Figs. 3A–3C; Ex. 1002 ¶¶ 20–83, 151–153)); (12) step [m]'s "wherein the decoding unit block comprises the at least one undivided first sub-decoding-unit-block divided into the third transform kernel, and the fourth transform kernel" (*id.* at 42–45 (citing Ex. 1004 ¶¶ 3, 68, 72, 84–87; Ex. 1002 ¶¶ 20–83, 154–158; Ex. 1003, p. 175) (reproducing Ex. 1003, p. 175) (reproducing Ex. 1004, Figs. 3A–B)); and (13) step [n]'s "wherein the decoding unit block is a square block and the at least one first sub-decoding-unit-block is a square block" (*id.* at 45–47 (citing Ex. 1004 ¶¶ 4, 79, Figs. 3A–C; Ex. 1002 ¶¶ 20–83, 159–162; Ex. 1003, p. 175) (reproducing Ex. 1003, p. 175) (reproducing Ex. 1004, Figs. 3A–B)).

That leaves disputed steps [e] and [k]. We address the parties' contentions below before analyzing these remaining recitations.

b. Claim 1's step [e] – "transforming at least one second sub-decoding-unit-block among the four second sub-decoding-unit-blocks using a first transform kernel and a second transform kernel having a different size from the first transform kernel"

i. Parties' Contentions

Regarding step [e], Petitioner asserts Winken discloses this element, including that a given coding block in Winken "can be transformed using

multiple transform blocks of varying sizes." Pet. 17 (citing Ex. 1004 ¶¶ 2, 4, 17; Ex. 1002 ¶¶ 76–78), 27–31 (citing Ex. 1002 ¶¶ 20–83, 125–128). Petitioner refers to page 175 of Exhibit 1003 (*id*. at 28 (citing Ex. 1003, p. 175)), reproduced *supra* Section (II)(C)(1), which was used by Patent Owner "[f]or convenience of understanding . . . the amended claim 1" in the '906 application that matured into the '720 patent. Ex. 1003, p. 175 (bolding omitted). Petitioner argues that Winken discloses at least one sub-block (e.g., sub-blocks 154a–d) and maps one of these exemplary blocks (e.g., sub-block 154a) to the recited "at least one second sub-decoding-unit-block" in step [e]. *See* Pet. 28.

The Petition asserts this block is transformed using transform blocks of differing sizes, mapping these different sized transform blocks to the recited "first transform kernel" and "second transform kernel." *Id.* at 28 (citing Ex. 1004 ¶¶ 3, 68, 85–86; Ex. 1002 ¶¶ 76–78, 128), 29 (citing Ex. 1002 ¶¶ 125–128) (reproducing Ex. 1003, p. 175). The Petition explains Winken discloses that transform blocks can be the same or smaller than the blocks used for prediction. *Id.* at 28 (quoting Ex. 1004 ¶ 3) (citing Ex. 1002 ¶¶ 76–78, 128). Petitioner states that the same sub-block can be divided into more than one transform block and that different transform blocks can have different sizes, mapping this teaching to the recited "a second transform kernel having a different size form the first transform kernel" recited in step [e]. *Id.* at 28–29 (citing Ex. 1004 ¶¶ 85–87). Petitioner further contends an ordinarily skilled artisan would have understood that using transform blocks of differing sizes, as Winken teaches, requires using transform kernels of different sizes, as recited. *Id.* at 29 (citing Ex. 1002 ¶¶ 76–78, 128).

Patent Owner argues that Petitioner has not explained how Winken teaches "a method for mixing an inter prediction mode and an intra prediction mode and transforming two prediction residual blocks at different hierarchical levels using two transform kernels having different sizes, as required in claims 1–6 of the '720 Patent." PO Resp. 64. Patent Owner thus contends Petitioner does not explain how Winken teaches claim 1's steps [e] and [k]. *Id.* at 65–66 (citing Pet. 33–34, 44–45; Ex. 1004 ¶¶ 3, 20, 68, 85–86, 185–187); Sur-reply 15. Patent Owner asserts that Petitioner simply concludes blocks may be transformed by multiple transform blocks of different sizes without sufficient explanation or specific guidance on how Winken provides this teaching. PO Resp. 66 (quoting Pet. 41); *see id.* at 67 (citing Pet. 40–41); *see also id.* at 68; *see also id.* at 69 (citing Ex. 1002 ¶ 68; Ex. 2028 ¶¶ 101–106).

Patent Owner also contends Petitioner does not point to any teaching in Winken that corresponds to or is analogous to Equations 2 and 3 in the '512 patent for teaching claim 1's transforming steps [e] and [k]. *Id.* at 66, 68. As an example, Patent Owner addresses Petitioner's discussion of "a rectangular transform block" and how these blocks can have different sizes and can be either quadratic or rectangular (*id.* at 68 (citing Pet. 40–41; Ex. 1004 ¶¶ 3, 86)), asserting this discussion fails to explain transforming a rectangular transform block with distinct transform sizes as opposed to a quadratic transform block. *Id.*

Patent Owner further argues that Dr. Orchard's testimony does not explain adequately how transform kernels of different sizes are applied to blocks or sub-blocks. *Id.* at 66 (citing Ex. 1002 ¶¶ 76–78, 147–150). Patent Owner contends that Dr. Orchard's testimony explains that all proposals

(except for one proposal at the "the April 2010 HEVC standardization meeting") select a single transform size (*id.* (citing Ex. 1002 ¶¶ 40–41)) and that the single, variable block-size transform is the "default understanding for a POSITA" (*id.* at 67 (quoting Ex. 1002 ¶ 53)). Patent Owner further asserts that Dr. Orchard's "'default understanding' is in the context of coding units that are constrained by the rigid size of 16x16 macroblocks," rather than considered in the context "of larger sizes" for coding units "in a hierarchical data structure" as explained by Dr. Reader. *Id.* (citing Ex. 2028 ¶ 103); *see id.* at 69 (citing Ex. 1002 ¶ 68).

Petitioner disagrees, asserting that Patent Owner only addresses the conclusions in the Petition and ignores where the Petition addresses steps [e] and [k]. Reply 23 (citing Dec. 33 (citing Pet. 28–29, 33–34, 40–41, 43–45)). Petitioner also states "Patent Owner alleges that the Petition (and Dr. Orchard) applied an improper double standard by requiring that the '512 Patent disclose more details for the purposes of priority tha[n] it required of *Winken* to determine that the elements of claim 1 were known in the prior art." *Id.* at 23–24. Petitioner contends case law supports "this purported double standard," alleging that the enablement standard under 35 U.S.C. § 112 is higher than the standard for anticipation under 35 U.S.C. § 102. *Id.* at 24–25 (quoting *Rasmusson v. SmithKline Beecham Corp.*, 413 F.3d 1318, 1325 (Fed. Cir. 2005)).

In response, Patent Owner argues Petitioner's Reply states steps [e] and [k], in the context of addressing priority, require an additional unclaimed limitation related to the transform kernel's structure (e.g., 2-D transform kernels, not transform kernel matrices) and distinct transform kernel operations. Sur-reply 13 (citing Reply 5–8, 13–14; Ex. 1053 ¶¶ 22–35); *see*

id. at 13–14. Patent Owner then argues that the Petition and Reply do not specify where this alleged structure and operation required by steps [e], [g], [k], an [m] are disclosed in Winken, and that the claims should be construed consistently in the context of priority and anticipation. *See id.* at 14 (citing *Southwall Tech., Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1576 (Fed. Cir. 1995)). Patent Owner further argues that Winken is not enabling and thus cannot anticipate the claims of the '720 patent. *Id.* at 15–16 (citing *In re NTP, Inc.*, 654 F.3d 1279 (Fed. Cir. 2011)). Patent Owner contends, for the sake of argument, that Winken is distinguishable from a prior art disclosure in *Rasmusson* because Winken lacks "a fully disclosed process." *Id.* at 16–17.

ii. Analysis

Having considered the parties' arguments and cited evidence, we conclude that step [e] of challenged claim 1 is described in Winken based on the preponderance of the evidence. With a complete record before us, we agree with and adopt Petitioner's analysis related to claim 1's step [e]. *See* Pet. 27–29.

The Petition cites to various portions of Winken to disclose step [e]'s limitations and, as discussed above, provides explanation as to how these paragraphs teach the recited limitation. *See id.* at 28–29 (citing Ex. 1004 ¶¶ 3, 68, 85–87) (comparing Winken's division to that in Ex. 1003, p. 175). For example, Winken teaches "a transform block [can] include[] more than one of the blocks that are used for prediction" (e.g., block can have multiple transform blocks), "blocks (or corresponding blocks of a sample array) . . . can be further split before applying the transform," and "[d]ifferent transform blocks can have different sizes." Ex. 1004 ¶ 3; *see id.* ¶¶ 85–86,

185. This disclosure collectively discloses a transform block can be further split, resulting in a transform block having multiple transform block sizes before applying transform kernels. *See id.* ¶¶ 3, 86, 185. We thus disagree with Patent Owner that the Petition merely concludes that Winken teaches transforming blocks using multiple transform blocks of different sizes, as step [e] recites, with no specific guidance or without pointing to teachings in Winken, as argued. PO Resp. 65–66.

Moreover, Patent Owner does not address the disclosures of any of Petitioner's cited passages in Winken (Pet. 28–29 (citing Ex. 1004 ¶¶ 3, 68, 85–87)), or explain how they do not teach claim 1's step [e]. *See id.* at 64–69. Nor has Patent Owner explained adequately why "[t]he claim construction discussed in the priority context" needs to be "applied" or "explained in connection with the anticipation" (Sur-reply 14) or that it is somehow inconsistent (*see id.*). In any event, we apply the same claim construction for the priority and claim construction analyses.

Similarly, Dr. Orchard explains how an ordinarily skilled artisan would have understood Winken's disclosures, including Winken's disclosure that blocks and sub-blocks can be divided for prediction, and that the prediction blocks can be further sub-divided into transform blocks. Ex. 1002 ¶¶ 77–78 (citing Ex. 1004 ¶¶ 68, 79, 83, 85–86, Figs. 3C, 4 (reproducing Ex. 1004, Figs. 3A–4)); *see also* Ex. 1002 ¶¶ 125–128 (addressing claim 1's step [e]). As such, we disagree with Patent Owner's assertion that Dr. Orchard's testimony does not explain adequately how transform kernels of different sizes are applied to blocks or sub-blocks and simply concludes that Winken teaches step [e]. *See* PO Resp. 66 (citing Ex. 1002 ¶¶ 76–78, 147–150).

Also, Patent Owner does not assert that anything specific in the cited paragraphs of Dr. Orchard's testimony concerning step [e] is incorrect, instead arguing alleged errors in other paragraphs of Dr. Orchard's testimony, which were not relied upon for step [e]. *See id.* at 66–67, 69 (citing and discussing Ex. 1002 ¶¶ 40–41, 53, 55, 68, 147–150; Ex 2028 ¶ 103).

Regarding Patent Owner's arguments related to Equations 2 and 3 of the '512 patent, claim 1's step [e] does not recite Equations 2 and 3. Ex. 1001, 9:16–19. Thus, to the extent argued (*see* PO Resp. 66, 68), Winken does not have to disclose transforming the unit-block using Equations 2 or 3 in order to teach step [e]'s limitations.

We further disagree that "the Petition (and Dr. Orchard) applied an improper double standard by requiring that the '512 Patent disclose more details for the purposes of priority tha[n] it required of Winken to determine that the elements of claim 1 were known in the prior art." *See* Reply 23–24 (citing to PO Resp. 66–69); *see* Sur-reply 14–15. When addressing the priority issue, we explained how the '512 patent lacks any details related to how unit-blocks are divided after prediction but prior to transformation. In contrast with the '512 patent, Winken discusses dividing blocks for transformation purposes. For example, Winken states "[f]or transform coding, the blocks (or the corresponding blocks of a sample arrays) . . . can be *further split before applying the transform.*" *See* Ex. 1004 ¶ 3 (emphasis added). Winken also includes other examples that address dividing a block for transformation purposes. *See id.* ¶ 85 (stating "The prediction blocks shown in FIG. 3c can be *further divided into smaller blocks for the purpose*

of residual coding") (emphasis added), 86 (stating "each prediction block can be divided into a number of residual blocks . . . .").

Patent Owner additionally argues Winken does not teach "a method for mixing an inter prediction mode and an intra prediction mode and transforming two prediction residual blocks at different hierarchical levels using two transform kernels having different sizes, as required in claims 1-6 of the '720 Patent." PO Resp. 64. Yet, Patent Owner provides no further explanation with support as to why Winken fails to disclose a method of using both inter/intra prediction modes (i.e., steps [c]–[d] and [i]–[j]) and transformation. *See id.* at 64–69. It is well-settled that counsel's arguments cannot take the place of factually supported objective evidence. *See In re Huang*, 100 F.3d 135, 139–40 (Fed. Cir. 1996). Also, as previously addressed, the Petition cites to several passages in Winken, with explanation as to how Winken discloses steps [c]–[e] and [i]–[k] of claim 1, which we find persuasive. *See, e.g.*, Pet. 24–29 (citing Ex. 1004 ¶¶ 3, 20–22, 68, 85–87; Ex. 1002 ¶¶ 20–83, 121–128; Ex. 1003, p. 175), 36–41 (citing Ex. 1004 ¶¶ 3, 20, 68, 85–87, 185–187; Ex. 1002 ¶¶ 20–83, 141–150; Ex. 1003, p. 175).

Patent Owner argues that Petitioner's Reply states steps [e] and [k], in the context of addressing priority, require additional unclaimed limitations related to the transform kernel's structure (e.g., 2-D transform kernels, not transform kernel matrices) and a distinct transform kernel operation. Sur-reply 13 (citing Reply 5–8, 13–14; Ex. 1053 ¶¶ 22–35); *see id.* at 13–14. When construing claim 1's steps [e] and [k] in the claim construction section (§ (II)(C)(1)), and in determining Winken discloses these steps, we do not

rely on this portion of Petitioner's discussion and thus find this argument moot.

Lastly, Patent Owner argues that Winken is not enabling and thus cannot anticipate the claims of the '720 patent. *Id.* at 15–16 (citing *In re NTP, Inc.*, 654 F.3d 1279 (Fed. Cir. 2011)). Although Patent Owner implies this argument was raised in its Response (*id.* at 16 (citing PO Resp. 65–69)), Patent Owner never asserted Winken was not enabling but rather, at best, asserted that Winken fails to show a process of mixing inter and intra prediction modes and transforming residual blocks using two transform kernels having different sizes. PO Resp. 65; *see id.* at 65–69. Above, we addressed these arguments. Accordingly, we determine the argument that Winken is not enabling (Sur-reply 15–16) is untimely. *See* Paper 16, 7 (indicating that "any arguments for patentability not raised in the response may be deemed waived."); *see also* 37 C.F.R. § 42.23(a) and *Nuvasive, Inc*., 842 F.3d at 1379–82.

Additionally, a reference is presumed to be operable and a presumption of operability should be rebutted with specific evidence unless a reference appears not to be enabling on its face. *See In re Sasse,* 629 F.2d 675, 207 USPQ 107 (CCPA 1980); *see In re Morsa,* 713 F.3d 104, 110 (Fed. Cir. 2013); *see also In re Antor Media Corp.*, 689 F.3d 1282 (Fed. Cir. 2012). Patent Owner has not demonstrated that Winken is not enabling on its face and as discussed above, we determine that Petitioner has provided adequate notice of how Winken teaches claim 1's step [e]. *See In re Jung*, 637 F.3d 1356, 1363 (Fed. Cir. 2011).

For the foregoing reasons, Petitioner has shown Winken discloses claim 1's step [e] by a preponderance of the evidence.

c. Claim 1's step [k] – "transforming the at least one undivided first sub-decoding-unit-block using a third transform kernel and a fourth transform kernel having a different size from the third transform kernel"

Regarding step [k], Petitioner states Winken discloses this element, including that a given coding block in Winken "can be transformed using multiple transform blocks of varying sizes." Pet. 17 (citing Ex. 1004 ¶¶ 2, 4, 17; Ex. 1002 ¶¶ 76–78), 39–41 (citing Ex. 1002 ¶¶ 20–83, 147–150). Similar to claim 1 step [e], Petitioner reproduces a portion of page 175 of Exhibit 1003 (*id.* at 40 (citing Ex. 1003, p. 175)), reproduced *supra* in Section (II)(C)(1), which was used by Patent Owner "[f]or convenience of understanding . . . the amended claim 1" in the 906 application that matured into the '720 patent. Ex. 1003, p. 175 (bolding omitted). Petitioner argues Winken discloses a given sub-block (e.g., sub-block 152a) and maps this exemplary block to the recited "at least one undivided first sub-decoding-unit-block" in step [k]. Pet. 40–41 (citing Ex. 1004 ¶¶ 3, 68, 185–187). The Petition also asserts that transform blocks can be the same or smaller than the blocks used for prediction and that different transform blocks can have different sizes, mapping these different sized transform blocks to the recited "third transform kernel" and "fourth transform kernel." *Id.* (citing Ex. 1004 ¶¶ 3, 68, 85–86; Ex. 1002 ¶¶ 76–78, 149) (reproducing Ex. 1003, p. 175). Referring to step [e], the Petition explains that Winken discloses the "transform blocks can be applied at different levels of granularity, including sub-block 152 level," and teaches that a given sub-block can be transformed by multiple transform blocks, requiring transform kernels of different sizes. *Id.* at 41 (citing Ex. 1004 ¶¶ 3, 86; Ex. 1002 ¶¶ 76–78. 147–150).

The parties present the same arguments for claim 1's step [k] as claim 1's step [e]. *See* PO Resp. 64–49; *see* Reply 23–25; *see* Sur-reply 13–17.

Having considered the parties' arguments and cited evidence, we conclude that claim 1's step [k] is described in Winken based on the preponderance of the evidence before us and under the claim construction set forth in § (II)(C). We agree with and adopt Petitioner's analysis related to claim 1's step [k]. *See* Pet. 39–41. We additionally refer to our discussion in Section (II)(E)(2)(b) addressing the parties' contentions.

d. Remaining Claims 2–6

As for dependent claims 2–5, the Petition argues Winken discloses the limitations found in these claims. Pet. 48–55 (citing Ex. 1004 ¶¶ 3, 4, 64, 68, 70, 72, 76, 79, 85–87, 97–98, 101, 103, 107, 152–154, 185–187, 193, Figs. 1, 3C; Ex. 1002 ¶¶ 20–83, 163–176) (reproducing Ex. 1004, Figs. 1, 3C) (reproducing Ex. 1003, p. 175) (referring to § VII.A.1 of the Petition).

As for independent claim 6, Petitioner argues Winken discloses the limitations found in this claim, presenting a mapping similar to claim 1, as previously discussed. *Compare* Pet. 55–60 (referring to §§ VII.A.2 of the Petition and limitations 1.1–1.14), *with id.* at 18–47. Patent Owner does not present separate arguments for these claims. *See* PO Resp. 64–69.

Having considered the parties' arguments and cited evidence, we conclude that challenged claims 2–6 are anticipated by Winken based on the preponderance of the evidence before us. For arguments for claim 6 that are similar to claim 1, we refer above for our determination.

In conclusion, we conclude that challenged claims 1–6 are anticipated by Winken based on the preponderance of the evidence.

F. Ground 2: Obviousness of Claims 1–6 Based on Winken and Kim

1. Kim (Ex. 1010)

Kim is the pre-grant publication for the '906 application, which matured into the '512 patent. Ex. 1010, code (21); Ex. 1001, code (63). Kim was published on May 24, 2012. Ex. 1010, code (43). Kim concerns a video encoding and decoding method that divides a picture into coding unit blocks and encodes and decodes the partitioned coding unit blocks. Ex. 1010 ¶ 1, code (57). Kim discloses that encoding efficiency can be improved by encoding and decoding partitioned blocks using both inter and intra predictions and encoding block video signals using a square transform or a non-square transform based on the division block's size. *Id.* ¶¶ 1, 10, 70.

Kim shows a super-macroblock unit as an NxN unit block in Figure 2, which is identical to Figure 2 of the '720 patent and the '512 patent. *Compare id.* at Fig. 2, *with* Ex. 1001, Fig. 2 and Ex. 1006, Fig. 2. Figure 2 illustrates a super-macroblock (e.g., NxN unit block) divided into sub-blocks or division blocks (e.g., Nx(N/2), (N/2)xN, or (N/2)x(N/2)). Ex. 1010 ¶¶ 45–46, code (57), Fig. 2. The division blocks are encoded using intra or inter prediction encoding, and both encoding modes can be used for increasing video encoding efficiency. *Id.*

Kim describes dividing an input picture into encoding unit blocks, determining whether to perform intra or inter prediction encoding on the current picture, dividing the blocks into sub-blocks accordingly, and repeating until reaching the final sub-block, the final encoding unit block in the current picture, and the final picture. *Id.* ¶¶ 55–61, Fig. 3 (S103–S105, S110, S112, S114–S117). Kim also discusses transform encoding "a residual signal of a super-macroblock having an increased size" by

"selectively applying" a square or non-square transform kernel according to a size of a division block. *Id.* Preferably, according to Kim, transform encoding involves comparing the smaller pixel number between horizontal and vertical pixel numbers of a division block and applying a kernel having a size equal to or less than the smaller pixel number. *Id.* Kim includes Equations 2 and 3, which we discussed above when addressing the '720 patent and the '512 patent. *Id.* ¶¶ 49–51.

2. Analysis

In our Decision to Institute, we concluded that the arguments and evidence advanced by Petitioner demonstrated a reasonable likelihood that claims 1–6 of the '720 patent would have been unpatentable under 35 U.S.C. § 103 as obvious over Winken and Kim. Dec. 33–37. Here, we determine whether Petitioner has established by a preponderance of the evidence that the challenged claims are obvious over Winken and Kim. 35 U.S.C. § 316(e).

Petitioner contends Kim qualifies as prior art because the '720 patent is not entitled to an earlier priority date than September 7, 2016. *See id.* at 3–4, 10, 17; Ex. 1001, code (22). Patent Owner disagrees, asserting Kim is not prior art because the '720 patent is entitled to a priority date of February 23, 2010. PO Resp. 64. Because the '720 patent is not entitled to a priority date earlier than September 7, 2016 as previously discussed, we determine Kim qualifies as prior art.

a. Claim 1

Petitioner asserts that claim 1 is alternatively obvious over Winken and Kim. Pet. 16–47 (citing Ex. 1002 ¶¶ 20–83, 108–192; Ex. 1004 ¶¶ 2–9, 14–17, 20–23, 64, 68, 70, 72, 76, 79–88, 97–98, 101, 103, 107, 152–154,

169, 181, 183, 185–187, 193, Figs. 1–3C, 8; Ex. 1010 ¶¶ 1, 9–10, 12, 22–39, 63–68, 106, claim 1, Figs. 2, 4); Reply 22–27. Petitioner relies on Kim, when combined with Winken, to teach dividing the decoding unit block and sub-unit-blocks and performing prediction limitations recited in the claims (e.g., claim 1's steps [a]–[d], [f], [h]–[j], [l], and [n]). *See id.* at 19, 21–22, 24, 26–27, 29, 31, 34, 36–38, 41–42, 45, 47 (discussing Kim).

Patent Owner disagrees with Petitioner's assertions, focusing its arguments on Winken failure to teach claim 1's steps [e] and [k] and the combinability of Winken and Kim. *See* PO Resp. 64–71.

Having considered the parties' arguments and cited evidence, we conclude that challenged claims 1–6 would have been obvious over Winken and Kim based on the preponderance of the evidence. As for the arguments related to Winken, we are not persuaded and refer to our previous discussion under Section (II)(E) (Ground 1).

We add that Kim additionally teaches a known technique for mixing an intra prediction mode and inter prediction mode and transforming residual blocks—albeit not using two transform kernels having different sizes as recited. That is, Kim describes dividing an input picture into encoding unit blocks, determining whether to perform intra or inter prediction encoding on the current picture, dividing the blocks into sub-blocks accordingly, and repeating this process until reaching the final sub-block as well as transform encoding a residual signal of a super-macroblock by selectively applying a square or non-square transform kernel. Ex. 1010 ¶¶ 55–61, Fig. 3 (S103–S105, S110, S112, S114–S117).

As for the combinability argument, Patent Owner asserts that the reasons provided to combine Winken and Kim in the Petition are "nothing

but general statements not tailored to the claimed invention," including that the references "are directed to the same field of endeavor" and both relate to "improving efficiency of H.264 encoding and decoding" and "use the same techniques of dividing a video frame into blocks and applying transform kernels to those blocks." PO Resp. 70 (quoting Pet. 17–18).

We disagree with Patent Owner because Petitioner has provided an articulated reasoning with some rational underpinning beyond general statements to support the motivation to combine Winken and Kim. *See* Pet. 17–18 (citing Ex. 1004 ¶¶ 2–5; Ex. 1010 ¶¶ 1, 10, 12; Ex. 1002 ¶¶ 42–53, 106); *see also* Reply 25 (citing Pet. 16–18, 24–27; Ex. 1002 ¶ 106). These rationales include that both are directed to improving H.264 video encoding and decoding efficiencies. Pet. 17 (citing Ex. 1004 ¶¶ 2–5; Ex. 1010 ¶¶ 1, 9–10, 38–39; Ex. 1002 ¶¶ 47, 68, 76–78, 106). For example, Kim teaches that its encoding block video signal technique of using square or non-square transforms according to the size of the partitioned coding unit block improves encoding efficiencies and is more effective. Ex. 1010 ¶¶ 1, 10. Additionally, Dr. Orchard testifies that Kim's technique teaches providing "better 'flexibility in selecting an encoding mode.'" Ex. 1002 ¶ 106 (citing Ex. 1010 ¶¶ 38, code (57)); *see* Reply 27 (citing Ex. 1002 ¶ 106). Given these teachings, one skilled in the art would have recognized that including Kim's encoding/decoding technique in Winken's encoding/decoding technique would have similarly improved Winken's encoding efficiencies and provided flexibility in selecting an encoding mode in the same way, and would result in a more effective and flexible encoding/decoding technique for Winken. *See* Pet. 18 (stating "POSITA would have been motivated to combine Winken and Kim with a reasonable expectation of success since the

combination: . . . uses known techniques to improve similar methods in the same way to yield predictable results.") (Ex. 1002, ¶ 106); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. at 417. Petitioner provides yet further rationales to combine Kim with Winken. *See* Pet. 17–18; *see* Reply 25–27.

Patent Owner also argues that Petitioner's reasons to combine Winken and Kim "are flatly contracted [sic] by Petitioner's own argument as to why the '512 Patent does not support the claims of the '720 Patent and how Winken teaches the claimed invention." PO Resp. 70. In particular, Patent Owner asserts that Petitioner argues that the '512 patent only supports transforming sub-blocks using transform kernels of the same size, whereas the claims of the '720 patent recite dividing macroblocks into sub-blocks of different sizes that are transformed using kernels corresponding to their size. *Id.* In Patent Owner's view, Petitioner's argument "contradict[s] Petitioner's reasons as to why the same disclosure from the '512 Patent would be combined with Winken." *Id.* at 71.

We do not agree that Petitioner's reasons to combine Winken and Kim contradict Petitioner's position taken concerning the effective priority date of the '720 patent. To be sure, Kim is the printed publication of the '906 application, which matured into the '512 patent (*see* Ex. 1010, codes (10), (21)) discussed when addressing the earliest priority data for the '720 patent. However, as Petitioner explains, the proposed ground based on Winken and Kim in "the Petition only looks to *Kim*'s disclosures related to *prediction* for combination with *Winken*" process of encoding/decoding

(Reply 26) and not its "*transformation* techniques disclosed by the '512 Patent." Reply 26.[28]

In the Sur-reply, Patent Owner contends the Petition's reliance on Kim for prediction and not transformation "is contradicted by the record." Sur-reply 17. Quoting from Dr. Orchard's Declaration when addressing claim 1's steps [c] and [d], Patent Owner argues that Petitioner asserts that Winken discloses sub-blocks may be used for or processed using inter or intra prediction. *Id.* (quoting Ex. 1002 ¶¶ 121, 124). We do not discern how this testimony related to prediction encoding conflicts with Petitioner's position related to Kim's and the '512 patent's disclosure of transformation coding. Indeed, Patent Owner indicates that these types of encoding are distinct coding concepts. *See* PO Resp. 6 (stating "[p]rediction and transformation . . . are two fundamental video coding technical concepts") (citing Ex. 2001 ¶ 53).

Patent Owner also argues Petitioner fails to show that an ordinarily skilled artisan would have been motivated to combine Winken and Kim because

> the video encoding process includes both prediction and transformation and a POSITA would have been discouraged from making such combination undermining and contradicting the transformation proposed by Petitioner at least for the reasons that such combination would . . . not contribute to the flexibility and the efficiency of encoding.

[28] Above, when addressing the effective priority date of the '720 patent, Petitioner argued that the claims of the '720 patent—namely claim 1's steps [e] and [k] (and similar limitations in claim 6) related to *transforming* "unit-blocks"—were not entitled to a claimed priority date of February 23, 2010.

Sur-reply 18 (citing Ex. 2028 ¶¶ 108–109). This argument is unavailing because Patent Owner has not demonstrated sufficiently why both Kim's prediction *and transformation* techniques must be applied to Winken or why an ordinary artisan would not be able to recognize how to apply Kim's prediction encoding techniques alone to Winken, without also applying its transformation encoding techniques. To the contrary, we credit Dr. Orchard's testimony as noted above that an ordinarily skilled artisan would have adapted Winken's method to include Kim's prediction encoding techniques. *See* Ex. 1002 ¶ 106. Based on the complete record, we determine that an ordinarily skilled artisan would not have been discouraged from only applying Kim's prediction technique to Winken.

After having considered entire record, we conclude that challenged claim 1 would have been rendered obvious over Winken and Kim based on the preponderance of the evidence before us.

b. Remaining Claims 2–6

As for dependent claims 2–5, the Petition argues Winken and Kim teach the limitations found in these claims. Pet. 48–55 (citing Ex. 1004 ¶¶ 3, 4, 64, 68, 70, 72, 76, 79, 85–87, 97–98, 101, 103, 107, 152–154, 185–187, 193, Figs. 1, 3C; Ex. 1010 ¶¶ 1, 8–10, 12, 14, 17, 22–28, 31–36, 38–39, 46, 53, 64, 70, 76, 79, Figs. 1, 3; Ex. 1002 ¶¶ 20–83, 163–176) (reproducing both Ex. 1004, Figs. 1, Fig. 3C) (reproducing Ex. 1003, p. 175) (referring to § VII.A.1 of the Petition).

As for independent claim 6, Petitioner argues Winken and Kim teach the limitations found in this claim, presenting a mapping similar to claim 1 previously discussed. *Compare* Pet. 55–60 (referring to §§ VII.A.2 of the Petition and limitations 1.1–1.14), *with id.* at 18–47. For claims 2–6, Patent

Owner does not present separate arguments for these claims. *See* PO Resp. 64–71.

Having considered the parties' arguments and cited evidence, we conclude that challenged claims 2–6 would have been obvious over Winken and Kim. For arguments relating to claim 6 that are similar to claim 1, we refer to the discussion above for our determination.

In sum, we conclude that challenged claims 1–6 would have been obvious over Winken and Kim Based on the preponderance of the evidence before us.

G. Grounds 3 and 4: Anticipation of Claims 1–6 Based on JCTVC-R1013 and Obviousness of Claims 1–6 Based on JCTVC-R1013 and Kim

1. JCTVC-R103 (Ex. 1005)

JCTVC-R1013 describes encoding and decoding video by iteratively dividing a macroblock into a series of sub-blocks and smaller sub-blocks. Ex. 1005 ¶ 0.3, pp. 20–21 (§ 6.3.2–6.3.3), pp. 48–49 (§ 7.3.8.4–7.3.8.5), 112–152 (addressing decoding processes). JCTVC-R1013 discusses dividing a picture into slices or tiles, each slice/tile being a sequence of coding tree units. Ex. 1005, p. 19. For example, JCTVC-R1013 describes a slice segment divided into 4 coding tree units and two dependent slices, one having 32 coding tree units and another having 24 coding tree units. *Id.*

JCTVC-R1013 describes processing coding tree blocks in coding tree units, and assigning each coding tree block a partition signal to identify the block sizes for intra and inter prediction and for transform coding. *Id.* at 20, 112–152 (addressing decoding process using intra and inter prediction modes). JCTVC-R1013 also discusses that "partitioning is recursive quadtree partitioning," and "[t]he quadtree is split until a leaf is reached,

which is referred to as the coding block." *Id.* at 20. JCTVC-R1013 states "[t]he prediction tree specifies the . . . size of prediction blocks," and "[t]he transform tree specifies the . . . size of the transform blocks." *Id.*

JCTVC-R1013 also teaches that the prediction residual signal may be transformed using transform blocks. *Id.*, xvii, pp. 9–10 (§ 3.168), 20–21 (§ 6.3.2–6.3.3), 52 (§ 7.3.8.8), 157–159 (addressing transformation).

2. Analysis

In our Decision ton Institute, we concluded that the arguments and evidence advanced by Petitioner demonstrated a reasonable likelihood that claims 1–6 of the '720 patent would have been unpatentable under 35 U.S.C. § 102 as anticipated by JCTVC-R1013 and obvious over JCTVC-R1013 and Kim. Dec. 46–48 (citing Pet. 61–77). On the complete record, we determine that Petitioner has established by a preponderance of the evidence that the challenged claims are anticipated by JCTVC-R1013 and would have been obvious over the combination of JCTVC-R1013 and Kim.

Petitioner argues JCTVC-R1013 qualifies as prior art because the '720 patent is not entitled to a priority date earlier than September 7, 2016. *See* Pet. 3–4, 10, 61–62; Ex. 1001, 1 (22). Dr. Stephen Wenger also testified that JCTVC-R1013 was uploaded and made publicly accessible by October 1, 2014. Ex. 1009 ¶¶ 9, 18–29.

In its Preliminary Response, Patent Owner argued JCTVC-R1013 was not a printed publication. Prelim. Resp. 64–74. In the Decision to Institute, we determined the evidence in the record provided a threshold showing that JCTVC-R1013 was publicly accessible. Dec. Inst. 45; *see id.* at 38–45. Patent Owner does not repeat this challenge in its Response. *See generally* PO Resp.

Patent Owner's sole argument for these grounds is that JCTVC-R1013 and Kim are not prior art because the '720 patent is entitled to a priority date of February 23, 2010. PO Resp. 71. Because we determined that the '720 patent is not entitled to a priority date earlier than September 7, 2016 as previously discussed, we determine JCTVC-R1013 and Kim qualify as prior art.

For completeness, we additionally refer to the Petition's mapping (Pet. 4, 62–86) for findings related to claims 1–6, and our discussion related to these grounds addressed in the Decision to Institute (Dec. Inst. 38–48). In this regard, the record contains persuasive arguments and evidence presented by Petitioner regarding the manner in which JCTVC-R1013 alone or in combination with Kim teaches the corresponding limitations of claim 1: (1) "a method of video decoding" [29] (Pet. 64 (citing Ex. 1005, p. xvii, ¶¶ 0.2–0.3; Ex. 1002 ¶¶ 47, 68, 79–83, 193–195) (referring to § VII.B.2 of the Petition)), (2) step [a][30] (*id.* at 64–65 (citing Ex. 1005, pp. 20–21, 48, 228; Ex. 1002 ¶¶ 20–83, 196–198) (referring to limitation 1.P)); (3) step [b] (*id.* at 65–66 (citing Ex. Ex. 1005, pp. 20–21, 48; Ex. 1002 ¶¶ 20–83, 199–201) (referring to limitation 1.P)); (4) step [c] ((*id.* at 66–67 (citing Ex. 1005, pp. 20–21, 48–49, 96–97; Ex. 1002 ¶¶ 20–83, 202–204) (referring to limitation 1.P)); (5) step [d] (*id.* at 67–68 (citing Ex. 1005, pp. 48–49, 96–97; Ex. 1002 ¶¶ 20–83, 205–206) (referring to limitation 1.P)); (6) step [e] (*id.* at 68–69 (citing Ex. 1005, pp. 20, 52, 157–159; Ex. 1002 ¶¶ 20–83, 207–210)

[29] We do not decide whether the preamble is limiting. Regardless, claim 1's preamble is described in JCTVC-R1013.
[30] As previously noted, the Petition uses different nomenclature for each element than steps [a]–[n]. However, we maintain our nomenclature in this decision for consistency.

(referring to limitation 1.P)), (7) step [f] (*id.* at 69–70 (citing Ex. 1005, pp. 112–152; Ex. 1002 ¶¶ 20–83, 211–212) (referring to limitations steps [c], [d], and limitation 1.P)); (8) step [g] (*id.* at 70–71 (citing Ex. 1005, pp. 9, 20–21, 48, 52, 157–159; Ex. 1002 ¶¶ 20–83, 213–217) (referring to limitation 1.P)); (9) step [h] (*id.* at 71–72 (citing Ex. 1005, pp. 20–21, 48, 228; Ex. 1002 ¶¶ 20–83, 218–221) (referring to limitation 1.P)); (10) step [i] (*id.* at 72–73 (citing Ex. 1005, pp. 20–21, 48, 96–97, 228; Ex. 1002 ¶¶ 20–83, 222–224) (referring to limitation 1.P)); (11) step [j] (*id.* at 73 (citing Ex. 1005, pp. 48–49, 96–97; Ex. 1002 ¶¶ 20–83, 225–226) (referring to limitation 1.P)); (12) step [k] (*id.* at 74–75 (citing Ex. 1005, pp. 9, 20–21, 48–49, 52, 157–259, 228; Ex. 1002 ¶¶ 20–83, 227–230) (referring to steps [b], [e], and limitation 1.P)); (13) step [l] (*id.* at 75 (citing Ex. 1005, pp. 112–152; Ex. 1002 ¶¶ 20–83, 231–232) (referring to steps [i], [j], and limitation 1.P)); (14) step [m] (*id.* at 75–77 (citing Ex. 1005, pp. 9, 20–21, 48–49, 52, 157–159, 228; Ex. 1002 ¶¶ 20–83, 233–236) (referring to steps [a], [h], [k], and limitation 1.P)); and (15) step [n] (*id.* at 77 (citing Ex. 1005, p. 20–21, 48, 228; Ex. 1002 ¶¶ 20–83, 237–238) (referring to limitation 1.P)).

We additionally adopt the Petitioner's similar findings for claims 2–6. Pet. 77–86 (citing Ex. 1005, pp. xvii, 9, 20–21, 23–25, 48–49, 52, 96–97, 157–159, 161–173, 228, §§ 1., 6.3, 7.31; Ex. 1002 ¶¶ 20–83, 239–263) (referring to limitation 1.P, § VII.B.3 of the Petition, and steps [a]–[n])).

Having considered the parties' arguments and cited evidence, we conclude that challenged claims 1–6 would have been anticipated by JCTVC-R1013 and rendered obvious over JCTVC-R1013 and Kim based on the preponderance of the evidence.

3. Conclusion for Grounds 3 and 4

Based on the preponderance of the evidence before us, we conclude that challenged claims 1–6 would have been anticipated by JCTVC-R1013 and obvious over JCTVC-R1013 and Kim.

III. CONCLUSION[31]

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–6	102	Winken	1–6	
1–6	103	Winken, Kim	1–6	
1–6	102	JCTVC-R1013	1–6	
1–6	103	JCTVC-R1013, Kim	1–6	
Overall Outcome			1–6	

[31] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–6 of the ’720 patent have been shown to be unpatentable; and

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

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