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Paper 20
Entered: July 16, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC,
Petitioner,

v.

ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE, KWANGWOON UNIVERSITY RESEARCH INSTITUTE FOR INDUSTRY CORPORATION, and INDUSTRY-ACADEMIA COOPERATION GROUP OF SEJONG UNIVERSITY,
Patent Owner.

IPR2021-00368
Patent 9,736,484 B2

Before JAMESON LEE, SALLY C. MEDLEY, and NATHAN A. ENGELS, *Administrative Patent Judges.*

ENGELS, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

Petitioner Unified Patents, LLC filed a Petition (Paper 2 ("Pet.")) for *inter partes* review of claim 4 of U.S. Patent No. 9,736,484 B2 (Ex. 1001, "the '484 patent"). Electronics and Telecommunications Research Institute, Kwangwoon University Research Institute for Industry Cooperation, and Industry-Academia Cooperation Group of Sejong University (collectively, "Patent Owner"), filed a Preliminary Response. Paper 10 ("Prelim. Resp.").

Under 35 U.S.C. § 314(a), an *inter partes* review may not be instituted unless the information presented in the Petition and any response thereto show "there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." Upon consideration of the Petition and the evidence of record, we determine that Petitioner has not demonstrated a reasonable likelihood of prevailing in establishing unpatentability of at least one claim of the '484 patent.

A. Related Matters

The parties indicate that the '484 patent is not the subject of any related administrative or judicial proceedings. *See* Pet. 73; Paper 3, 1.

B. Real Parties in Interest

Petitioner identifies itself as the real party-in-interest for Petitioner. Pet. 73. Patent Owner identifies itself as the real parties-in-interest for Patent Owner. Paper 3, 1.

Patent Owner contends that at least [redacted] should have been identified as a real party-in-interest by Petitioner and that the Petition should be denied pursuant to 35 U.S.C. § 312(a) for failing to identify all real parties-in-interest. *See* Prelim. Resp. 49–56. Because we determine Petitioner has not demonstrated a reasonable likelihood of prevailing in establishing unpatentability, we do not reach this issue.

C. The '484 Patent

Titled, "Apparatus for Encoding and Decoding Image Using Adaptive DCT Coefficient Scanning Based on Pixel Similarity and Method Thereof," the '484 patent relates generally to an encoding/decoding apparatus and method using an adaptive Discrete Cosine Transformation ("DCT") coefficient scanning based on pixel similarity. Ex. 1001, (54), 1:26–29. More particularly, the '484 patent describes an encoding/decoding apparatus and method which performs intra prediction onto input video, predicts pixel similarity based on pixel similarity information of coefficients to be encoded that is acquired from adjacent pixels in the intra-predicted video, and performs scanning (*e.g.*, DCT coefficient scanning) according to the predicted pixel similarity. *Id.* at 1:30–36.

Copied below is Figure 5 of the '484 patent.

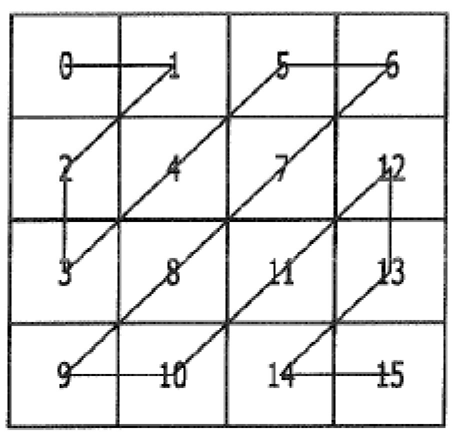


Figure 5 illustrates a typical zigzag scanning method. *Id.* at 5:51–52. The zigzag scanning method is devised in consideration that low frequency components of transformed coefficients acquired from the DCT and quantization are highly likely to be positioned in the upper left part of a two-dimensional plane. *Id.* at 5:56–60.

Copied below is Figure 6 of the '484 patent.

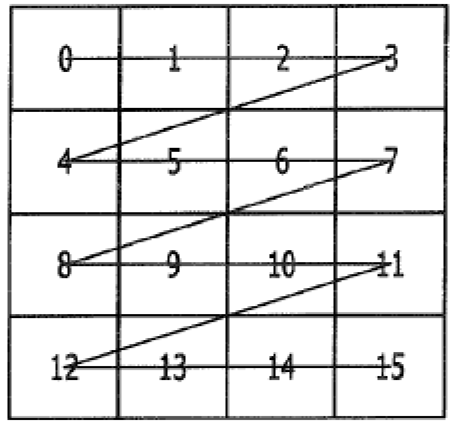


Figure 6 illustrates a typical horizontal scanning method. *Id.* at 5:52–54. The horizontal prediction mode is selected as an optimal mode when the pixel similarity in the horizontal direction is high. *Id.* at 6:16–18.

Copied below is Figure 7 of the ’484 patent.

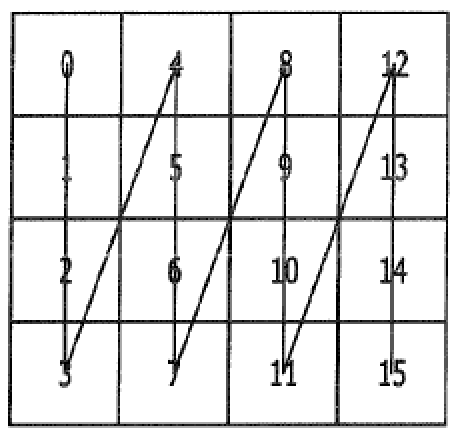


Figure 7 illustrates a typical vertical scanning method. *Id.* at 5:54–55. The vertical prediction mode is selected as an optimal mode in a rate-distortion optimization process when the pixel similarity in the vertical direction is high. *Id.* at 6:9–11.

Copied below is Figure 11 of the ’484 patent.

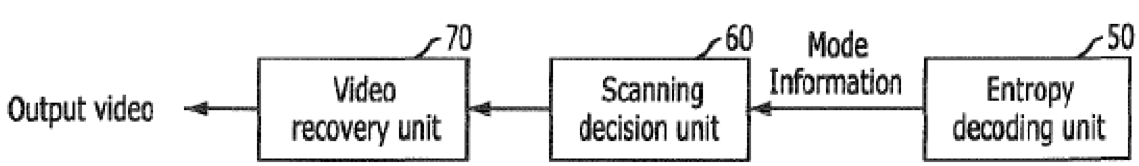


Figure 11 is a block view showing a decoding apparatus using an adaptive DCT coefficient scanning based on pixel similarity. *Id.* at 8:41–43. The decoding apparatus includes an entropy decoding unit 50, a scanning decision unit 60, and a video recovery unit 70. *Id.* at 8:45–48. The entropy decoding unit 50 receives an encoded video bitstream encoded in the encoding apparatus of Figure 4 using an adaptive DCT coefficient scanning based on pixel similarity and decodes it through an entropy decoding method. *Id.* at 8:49–52. Then, the entropy decoding unit 50 transmits the entropy-decoded video bitstream to the scanning decision unit 60. *Id.* at 8:53–55. The scanning decision unit 60 decides a scanning method for the coefficients decoded in the entropy decoding unit 50 according to an intra prediction mode. *Id.* at 8:56–59. The video recovery unit 70 finally recovers the coefficients by using the scanning method decided in the scanning decision unit 60 to recover the video. *Id.* at 8:60–62.

D. Challenged Claim

Claim 4, the only claim challenged in this proceeding, is reproduced below with formatting and bracketed labels added for clarity.

4. [4a] A non-transitory computer-readable storage medium storing instructions that, when executed by a processor, cause the processor to perform a method of decoding, the method comprising:

    [4b] performing entropy decoding of encoded video information in a bitstream to obtain transform coefficients for a current block;

    [4c] selecting a scanning mode for the transform coefficients; and

    [4d] scanning the transform coefficients based on the selected scanning mode;

    wherein the selecting of a scanning mode comprises:

        [4c1] selecting a horizontal scanning mode in response to the intra prediction mode being a vertical intra prediction mode; and

[4c2] selecting a vertical scanning mode in response to the intra prediction mode being a horizontal intra prediction mode.

E. Alleged Grounds of Unpatentability

Petitioner asserts that claim 4 is unpatentable based on the following grounds:

Claim Challenged	35 U.S.C. §	Reference(s)
4	102(b)	Nishi[1]
4	103(a)	Nishi
4	103(a)	Do,[2] Kobayashi[3]
4	103(a)	Do, Kalevo[4]

Petitioner relies on the Declaration of Joseph P. Havlicek, Ph.D. (Ex. 1002) in support of its contentions.

II. ANALYSIS

A. Legal Standards of Anticipation and Obviousness

Regarding anticipation, the Federal Circuit has stated that "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631(Fed. Cir. 1987). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, *i.e.*, identity of terminology is not required. *In re Bond*, 910 F.2d 831 (Fed. Cir. 1990).

Regarding obviousness, The Supreme Court set out a framework for assessing obviousness under § 103 that requires consideration of four

[1] U.S. Patent No. 6,426,975 B1, issued July 30, 2002, (Ex. 1014, "Nishi").
[2] English Translation of Korean Patent Application No. 0135364 B1, registered Jan. 13, 1998 (Ex. 1010, "Do").
[3] U.S. Patent Application No. 2005/0281337 A1, published Dec. 22, 2005 (Ex. 1023, "Kobayashi").
[4] WO 2001/054416 A1, published July 26, 2001 (Ex. 1011, "Kalevo").

factors: (1) the "level of ordinary skill in the pertinent art," (2) the "scope and content of the prior art," (3) the "differences between the prior art and the claims at issue," and (4) "secondary considerations" of non-obviousness such as "commercial success, long felt but unsolved needs, failure of others, etc." *Graham v. John Deere Co*, 383 U.S. 1, 17–18 (1966).[5]

B. Level of Ordinary Skill in the Art

In determining the level of skill in the art, we consider the type of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field. *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986); *Orthopedic Equip. Co. v. United States*, 702 F.2d 1005, 1011 (Fed. Cir. 1983).

Petitioner contends a person of ordinary skill in the art at the time of the invention would have had

> at least a bachelor's degree in electrical engineering or a closely related scientific field, such as physics, computer science, or computer engineering, or similar advanced post-graduate education in this area, with two years of experience with video processing systems. A person with less education but more relevant practical experience, depending on the nature of that experience and degree of exposure to image processing devices and algorithms, could also qualify as a person of ordinary skill in the field of the '484 patent.

Pet. 10 (citing Ex. 1002 ¶¶ 30–31; Ex. 1001, 1:26–36, 1:56–63). Patent Owner agrees with Petitioner's definition of a person of ordinary skill in the art. Prelim. Resp. 10. For the purposes of this decision, we apply the level

[5] The current record does not include any evidence of secondary considerations.

of skill advocated by Petitioner, which is supported by the testimony of Dr. Havlicek (Ex. 1002 ¶ 30), but delete the modifier "at least" for the level of education to keep the articulation from being vague and extending to the level of an expert.

C. Claim Construction

We construe claims "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." 37 C.F.R. § 42.100(b) (2019). Specifically, 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. *Phillips*, 415 F.3d at 1312–13.

Petitioner states that no claim terms require express construction and that the claims should be given their plain and ordinary meanings. Pet. 10. Patent Owner agrees, but Patent Owner proposes clarification of the plain and ordinary meaning of "horizontal intra prediction mode" and "vertical intra prediction mode." Prelim. Resp. 3–9.

Patent Owner contends the plain and ordinary meaning of the claim term "horizontal intra prediction mode" is a spatial prediction mode in which "every pixel in the current block . . . is predicted by the pixel on the same line and immediately to the left of the current block," and the plain and ordinary meaning of "vertical intra prediction mode" is a spatial prediction mode in which "every pixel in the current block . . . is predicted by the pixel in the same column and immediately above the current block." Prelim. Resp. 9–10 (citing Ex. 1002 ¶¶ 52, 54). Although Petitioner does not directly address the customary and ordinary meaning of those terms, Patent Owner's proposed constructions mirror explanations of those terms provided by Petitioner's declarant Dr. Havlicek. *See* Ex. 1002 ¶¶ 52, 54.

Specifically, Dr. Havlicek states "[o]ne commonly used intra prediction mode is called horizontal prediction. For horizontal prediction, every pixel in the current block . . . is predicted by the pixel on the same line and immediately to the left of the current block." *Id.* ¶ 52. Similarly, Dr. Havlicek states that "[a]nother commonly used intra prediction mode is called vertical prediction. For vertical prediction, every pixel in the current block . . . is predicted by the pixel in the same column and immediately above the current block . . . ." *Id.* ¶ 54.

The '484 patent's Specification describes the terms consistent with Dr. Havlicek's explanation. Consistent with figures provided by Dr. Havlicek (Ex. 1002 ¶¶ 52, 54), Figures 2 and 3 of the '484 patent, reproduced below, illustrate a pixel prediction method in the vertical direction and in the horizontal direction, respectively.

FIG. 2

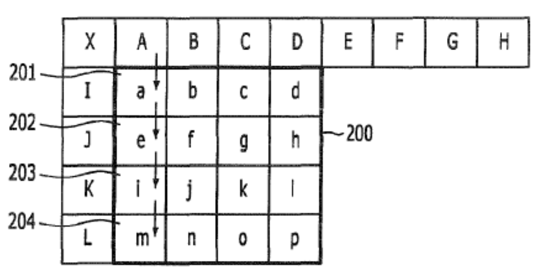
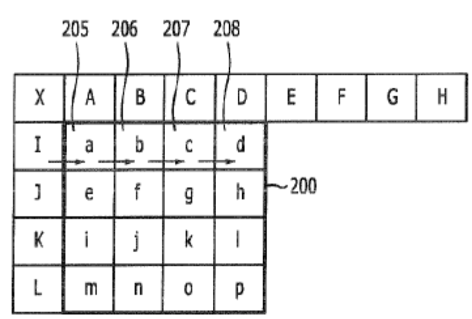


FIG. 3



Figures 2 and 3 of the '484 patent depict a 4x4 block 200 having pixels labeled a–p. Adjacent to the top of the block 200 is a row containing reference pixels A–H, and adjacent to the left of the block 200 is a column containing reference pixels I–L.

To illustrate vertical prediction, Figure 2 depicts that "pixel a 201, pixel e 202, pixel i 203, and pixel m 204 are predicted based on an adjacent pixel A in the vertical direction" (Ex. 1001, 2:26–28), and the Specification further explains that pixels b, f, j, and n are predicted based on adjacent pixel B; pixels c, g, k, and o are predicted based on adjacent pixel C; and pixels d, h, l, and p are predicted based on adjacent pixel D. *Id.* at 2:29–34. To illustrate horizontal prediction, Figure 3 depicts that "pixel a 205, pixel b 206, pixel c 207, and pixel d 208 are predicted based upon an adjacent pixel I in a horizontal direction," and so forth for the remaining rows. *Id.* at 2:37–39.

Both the '484 patent and Dr. Havlicek explain that vertical intra prediction and horizontal intra prediction predict "every pixel in the current block" (Ex. 1002 ¶¶ 52, 54) using the reference pixel "immediately to the left" (Ex. 1002 ¶ 52) or "immediately above" (Ex. 1002 ¶ 53) the current block. *Accord* Ex. 1001, 2:24–44 (describing horizontal intra prediction and vertical intra prediction of each pixel in a block based on "adjacent" pixels), 6:33–47 (describing Figure 8 as depicting horizontal intra prediction based on pixels "positioned adjacent to the left part of the current block" and vertical intra prediction based on pixels "positioned adjacent to the upper part of a current block"). The '484 patent states that vertical intra prediction and horizontal intra prediction depicted in Figures 2 and 3 are examples of two of nine prediction modes provided in the H.264/Advanced Video Coding standard. Ex. 1001, 1:64–2:23; *see* Ex. 1002 ¶¶ 74–75. Notably, each of the nine prediction modes depicted in the H.264 standard uses reference pixels immediately adjacent to the pixels of the current block. *E.g.*, Ex. 1023, Fig. 16 ("illustrating nine intra prediction modes" (¶ 32)).

Accordingly, the evidence of record shows that the phrases are terms of art. Reading the claim limitations in light of the Specification and the evidence of record, including Dr. Havlicek's explanations of the phrases as terms of art, we agree with Patent Owner that a person of ordinary skill would have understood the customary and ordinary meaning of "horizontal intra prediction mode" is a spatial prediction mode in which "every pixel in the current block . . . is predicted by the pixel on the same line and immediately to the left of the current block" and that the customary and ordinary meaning of "vertical intra prediction mode" is a spatial prediction mode in which "every pixel in the current block . . . is predicted by the pixel in the same column and immediately above the current block."

D. Summary of Prior Art References

1. Nishi

Titled "Image Processing Method, Image Processing Apparatus and Data Recording Medium," Nishi describes image processing methods, image processing apparatuses and data recording media in which, in variable-length coding of frequency components of an interlaced image signal, a sequence of the frequency components is adaptively rearranged. Ex. 1014, (54), 1:9–13.

Nishi describes the conventional prior art ("a conventional image processing apparatus") with respect to Figures 29–32. Figures 31(a)–31(c) are copied below.

Fig.31 (a)

0	1	5	6	14	15	27	28
2	4	7	13	16	26	29	42
3	8	12	17	25	30	41	43
9	11	18	24	31	40	44	53
10	19	23	32	39	45	52	54
20	22	33	38	46	51	55	60
21	34	37	47	50	56	59	61
35	36	48	49	57	58	62	63

Fig.31 (b)

0	1	2	3	10	11	12	13
4	5	8	9	17	16	15	14
6	7	19	18	26	27	28	29
20	21	24	25	30	31	32	33
22	23	34	35	42	43	44	45
36	37	40	41	46	47	48	49
38	39	50	51	56	57	58	59
52	53	54	55	60	61	62	63

Fig.31 (c)

0	4	6	20	22	36	38	52
1	5	7	21	23	37	39	53
2	8	19	24	34	40	50	54
3	9	18	25	35	41	51	55
10	17	26	30	42	46	56	60
11	16	27	31	43	47	57	61
12	15	28	32	44	48	58	62
13	14	29	33	45	49	59	63

Figures 31(a)–31(c) are diagrams each illustrating a scanning order in a scan which is selected in scan changing method. *Id.* at 32:12–14. As described in Nishi, a scan method is changed according to ON/OFF state information of an AC prediction in intra-frame prediction. *Id.* at 4:14–16. Further, when AC prediction is in the ON state, a scan method is changed according to a reference direction of prediction. *Id.* at 4:16–18.

When AC prediction is in the OFF state, a scan of quantized values is executed in the order shown in Figure 31(a). *Id.* at 4:25–27. In this order, the quantized values are uniformly scanned in the order from low-frequency components to high-frequency components. *Id.* at 4:31–33. When AC prediction is performed and a vertical direction is referred, a scan of quantized values is executed in the order shown in Figure 31(b). *Id.* at 4:33–35. In this order, the quantized values are scanned with a priority given to horizontal direction. *Id.* at 4:39–41. When AC prediction is performed and a horizontal direction is referred, a scan of quantized values is executed in the order shown in Figure 31(c). *Id.* at 4:41–44. In this order, the quantized values are scanned with a priority given to a vertical direction. *Id.* at 4:47–49.

2. Do

Titled "Method and Apparatus for Encoding DCT Blocks Using Block-Adapting Scan," Do describes a quantization scanning technique for a DCT coefficient in an image encoding and decoding process, and, in particular, a method and apparatus for encoding DCT blocks using a block-adaptive scan to increase the efficiency of a variable-length coding by adaptively transforming a scan pattern. Ex. 1010, 8–2.

Figure 4 is copied below.

Figure 4

Figure 4 illustrates a set of five scan patterns. *Id.* at 8–3. The sets of scan patterns are stored in the scan pattern storage units installed in the encoder and the decoder, respectively, and when the scan pattern is determined in the scan pattern determination units, the processor refers to it. *Id.* More specifically, Do's method and apparatus use a motion compensation image to determine a suitable scan pattern from a set of scan patterns for each

DCT-converted block of the motion compensation prediction difference image, converts the block of the motion compensated image into DCT, and analyzes and uses the coefficient for efficient and simple extraction of contour features. *Id.*

3. Kobayashi

Titled "Moving Image Coding Apparatus," Kobayashi describes an image coding apparatus that determines an image pattern of image data and, based on the determined image pattern, selects a prediction mode for generating predicted pixel values by predicting pixel values in a frame using pixel values in the same frame. Ex. 1023, (54), (57).

Figure 16 is copied below.

FIG.16

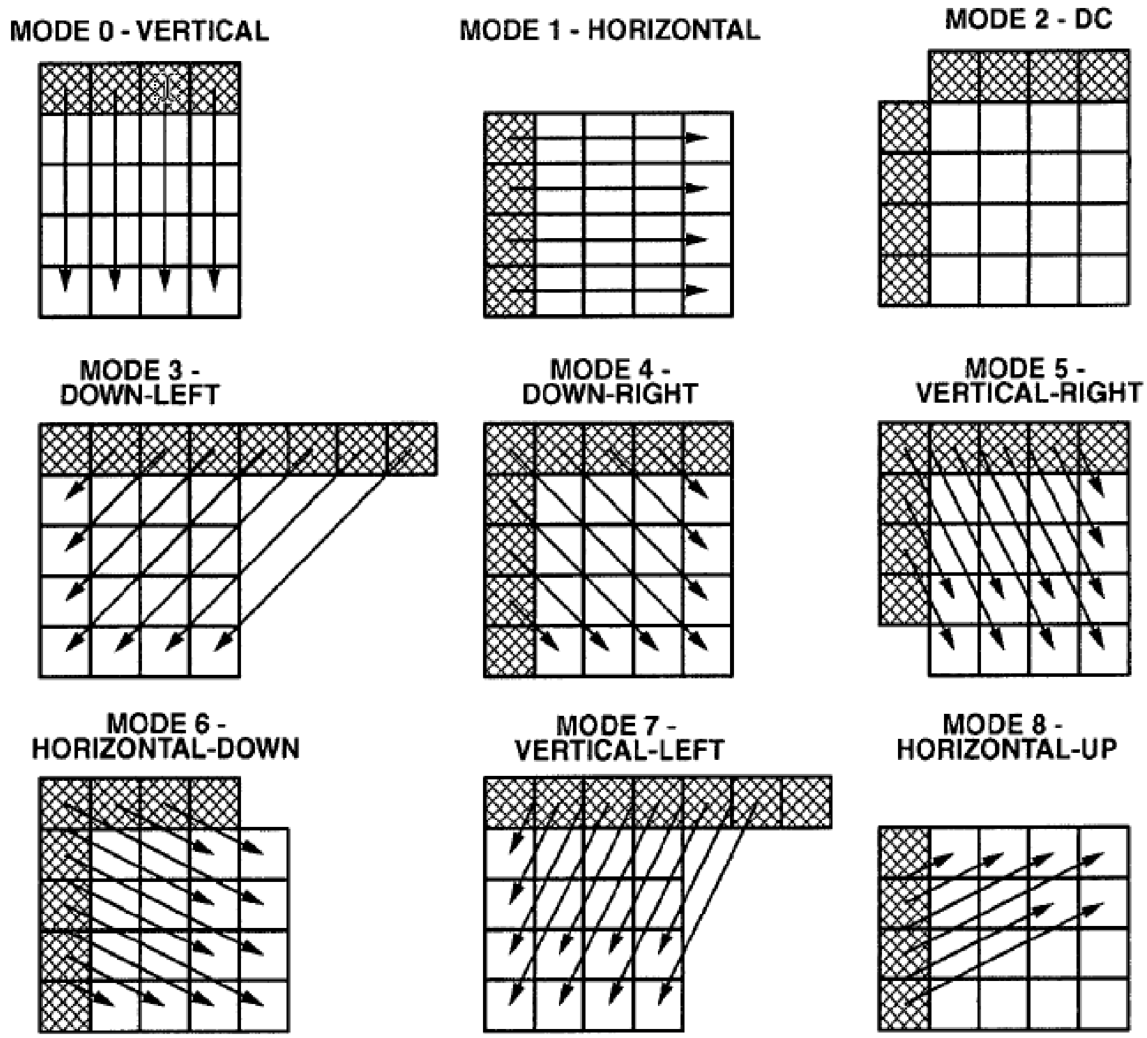


Figure 16 shows directions of prediction for use in nine different intra prediction modes. *Id.* at ¶ 114. For example, in the case of the vertical intra prediction mode (Mode 0), values of the pixels adjacent to the target block in the vertical direction are used as prediction values, and it is predicted that these pixel values continue in the vertical direction. *Id.* In addition to the vertical intra prediction mode (Mode 0), eight intra prediction modes (Mode 1 to Mode 8) are provided including a horizontal intra prediction mode (Mode 1). *Id.* at ¶ 115.

Figure 1 is copied below.

FIG.1

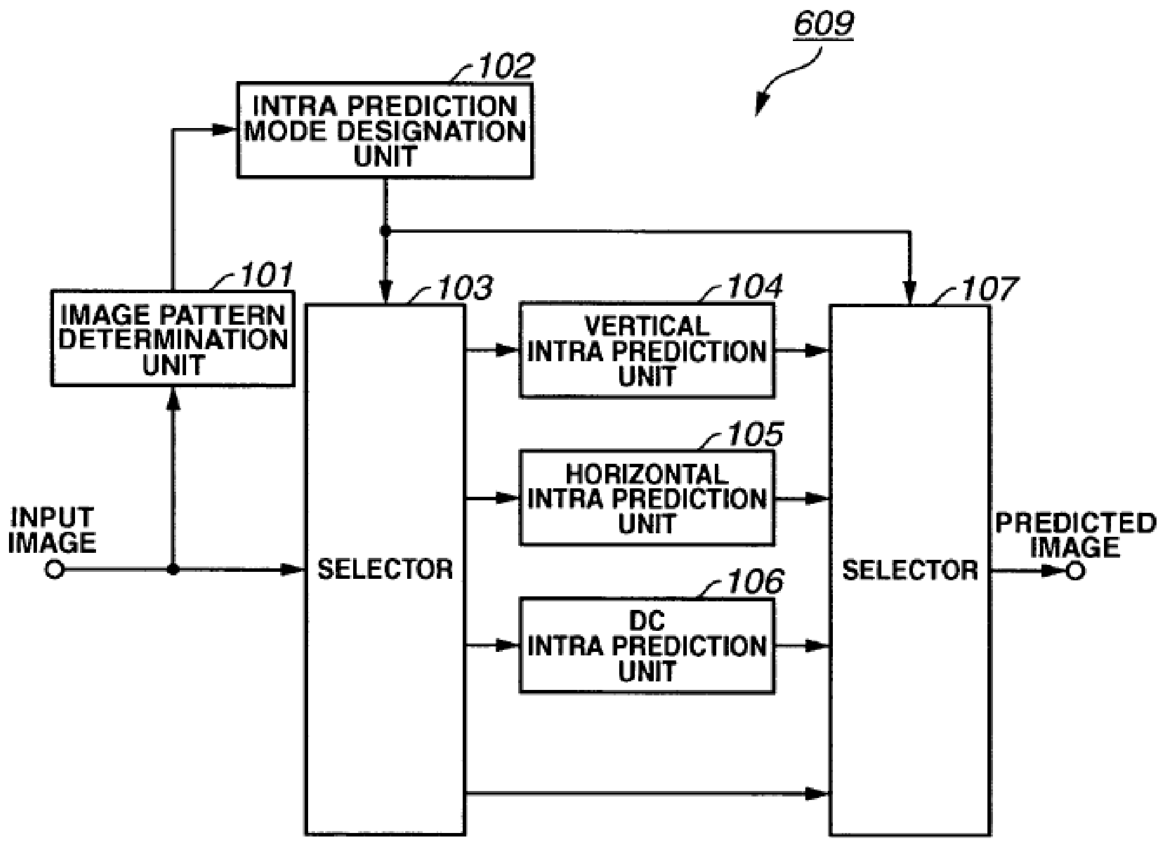


Figure 1 is a block diagram illustrating processing for intra prediction. *Id.* at ¶ 46. The intra prediction unit 609 includes an image pattern determination unit 101, an intra prediction mode designation unit 102, a selector 103, a vertical intra prediction unit 104, a horizontal intra prediction unit 105, a DC intra prediction unit 106, and a selector 107. *Id.* at ¶ 47. The image pattern determination unit 101 determines an image pattern by performing a Hadamard transform on an input image. *Id.* The intra prediction mode designation unit 102 designates an optimal intra prediction mode from among a plurality of intra prediction modes based on the image pattern determined by the image pattern determination unit 101. *Id.* The selectors 103 and 107 select one of the vertical intra prediction unit 104, the horizontal intra prediction unit 105 and the DC intra prediction unit 106, corresponding to the intra prediction mode designated by the intra prediction mode designation unit 102. *Id.* The vertical intra prediction unit 104 performs intra prediction using a vertical intra prediction mode. *Id.* The horizontal intra prediction unit 105 performs intra prediction using a horizontal intra prediction mode. *Id.* The DC intra prediction unit 106 performs intra prediction using a DC intra prediction mode. *Id.*

4. Kalevo

Titled "A Method for Encoding Images, and an Image Coder," Kalevo describes a method for encoding a digital image in which the digital image is divided into blocks. Ex. 1011, (54), (57). In the method, a spatial prediction for a block is performed to reduce the amount of information to be transmitted, where at least one prediction method is defined. *Id.* at (57).

Figures 5a–5l are copied below.

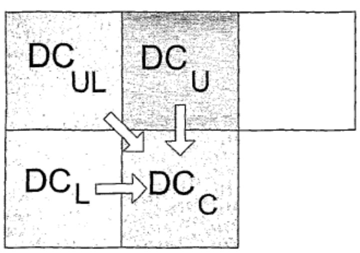


Fig. 5a

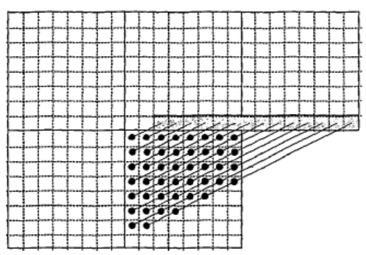


Fig. 5b

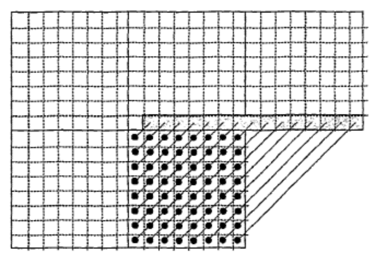


Fig. 5c

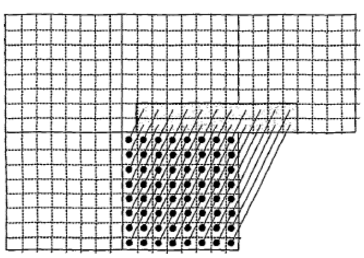


Fig. 5d

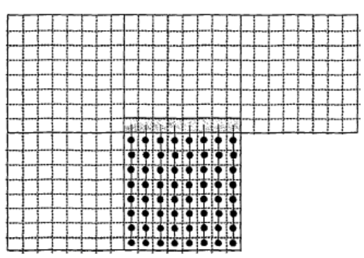


Fig. 5e

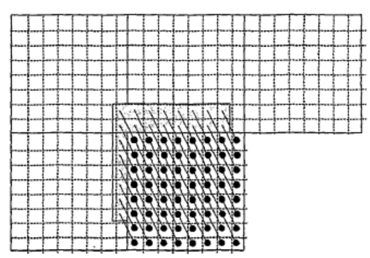


Fig. 5f

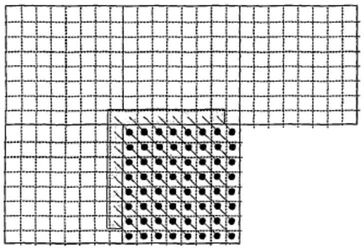


Fig. 5g

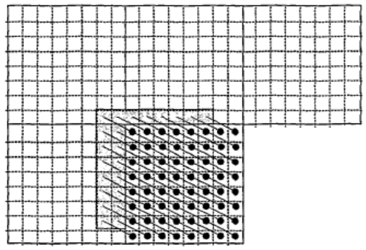


Fig. 5h

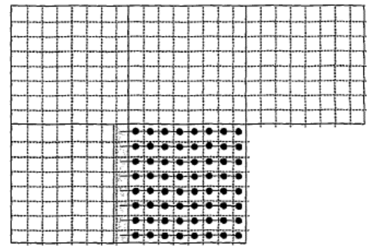


Fig. 5i

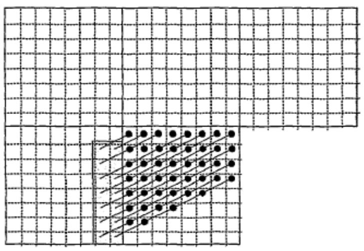


Fig. 5j

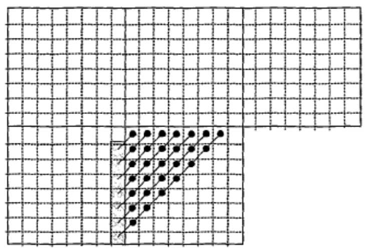


Fig. 5k

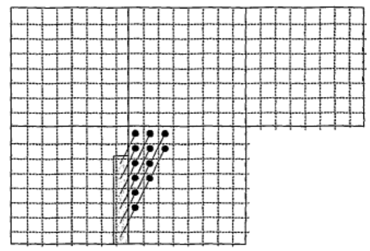


Fig. 5l

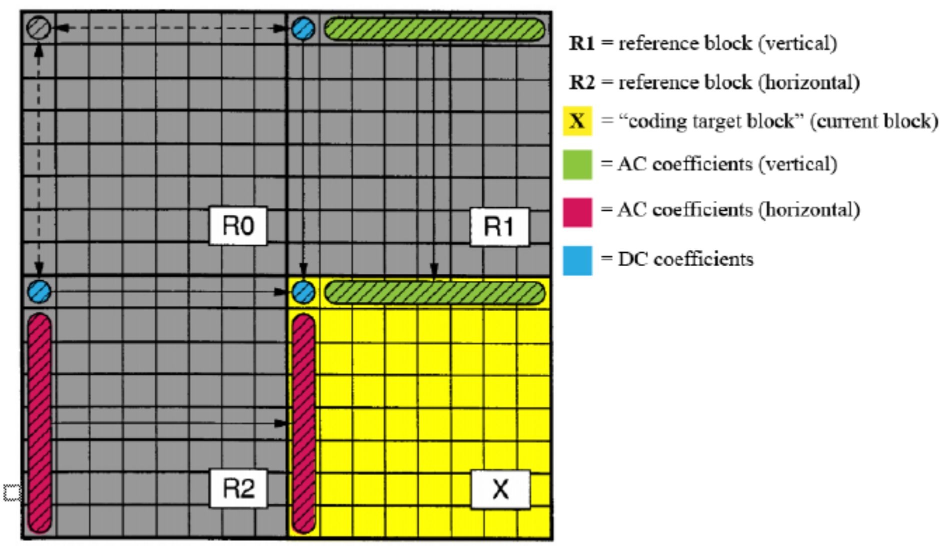
Figures 5a–5l depict prediction methods utilized by the method for encoding a digital image. *Id.* at 17:30–32. According to an embodiment of the method, a subset of prediction methods for each context class combination is defined and the prediction methods are prioritized (ranked) in each subset. *Id.* at 18:10–13. Then the prediction method used to predict the content of the current block C is selected from a subset of prediction methods. *Id.* at 18:13–15. Prediction methods P5 (Figure 5e) and P9 (Figure 5i) predict vertical and horizontal shapes in the current block C by extending image details into the current block C, either from above or from the left. *Id.* at 22:17–19. Depending on the selected method (P5 or P9), the reference pixel values at the boundary of either block U or L are copied to the current block C as depicted in Figures 5e and 5i. *Id.* at 22:19–22.

E. Grounds 1 and 2

With a limitation-by-limitation comparison of Nishi to claim 4, Petitioner argues claim 4 is unpatentable as anticipated by Nishi (Ground 1) or obvious in view of Nishi (Ground 2). With reference to the bracketed labels used in the reproduction of claim 4 above, we address limitations [4c1] and [4c2], which we determine to be dispositive of Grounds 1 and 2.

> *[4c] selecting a scanning mode for the transform coefficients; and*
>
> *wherein the selecting of a scanning mode comprises:*
>
> *[4c1] selecting a horizontal scanning mode in response to the intra prediction mode being a vertical intra prediction mode; and*
>
> *[4c2] selecting a vertical scanning mode in response to the intra prediction mode being a horizontal intra prediction mode.*

Petitioner argues Nishi discloses directional intra prediction, and Petitioner provides the following annotated version of Nishi's Figure 30 to support its arguments. Pet. 15.



Pet. 15. Petitioner's annotated version of Nishi's Figure 30 depicts a macroblock that has 16x16 pixels divided into four sub-blocks of 8x8 pixels. Pet. 16. The block to be encoded (the "current block") is labeled X and shaded yellow, with reference block R1 above the current block and reference block R2 left of the current block. Pet. 16. AC coefficients for R1 are in the uppermost row, shaded green, and AC coefficients for R2 are in

the left most column, shaded red. Pet. 16. According to Petitioner, "Nishi explains that either horizontal (lateral) or vertical (longitudinal) intra prediction is performed depending on whether block R1 or R2 is to be referenced." Pet. 16.

Contrary to Petitioner's arguments, however, Nishi does not disclose either horizontal intra prediction or vertical intra prediction consistent with the claims of the'484 patent. As explained above, we determine based on the evidence of record that the meaning of "horizontal intra prediction mode" is a spatial prediction mode in which "every pixel in the current block . . . is predicted by the pixel on the same line and immediately to the left of the current block" and that the meaning of "vertical intra prediction mode" is a spatial prediction mode in which "every pixel in the current block . . . is predicted by the pixel in the same column and immediately above the current block."

Dr. Havlicek states that Nishi's Figure 30 "shows an illustration of how a current block ('X') can be intra predicted using values in adjacent blocks" (Ex. 1002 ¶ 154), but Dr. Havlicek does not state, much less explain, how Nishi's discussion of using AC coefficients from the uppermost row or leftmost column of an adjacent block satisfies claim 4's recitation of vertical intra prediction mode or horizontal intra prediction mode. Nothing in Nishi discloses predicting every pixel in the current block using an immediately adjacent reference pixel. *See* Prelim. Resp. 11 (arguing Nishi's AC prediction "is a transform coefficient (*NOT* spatial) prediction mode in which AC coefficients (*NOT* pixels) of only one (*NOT* every) row or column is predicted by a transform coefficient (*NOT* pixel) of a row or a column on a distant (*NOT* immediately adjacent) boundary of a neighboring block").

Accordingly, we determine Petitioner has not satisfied its burden to show a reasonable likelihood that it would prevail in establishing that claim 4 is anticipated by Nishi. Petitioner does not adequately articulate an obviousness argument to address these deficiencies of Nishi, and we determine that Petitioner has not satisfied its burden to show a reasonable likelihood that it would prevail in establishing that claim 4 is unpatentable as obvious in view of Nishi.

F. Grounds 3 and 4

With a limitation-by-limitation comparison of claim 4 to Do and Kobayashi (Ground 3) and Do and Kalevo (Ground 4), Petitioner argues claim 4 is unpatentable as obvious. For the reasons explained below, we determine Petitioner has not articulated an adequate rationale for combining the references' teachings for each ground to arrive at the claimed invention, which is dispositive for Grounds 3 and 4.

Petitioner acknowledges that Do teaches applying a scan pattern to a "quantized DCT block of the motion compensation prediction difference image." Pet. 39 (quoting Ex. 1010 p. 8-3). As noted by Patent Owner and also Petitioner's expert Dr. Havlicek, Do's reference to motion compensation prediction indicates that Do teaches inter frame prediction, not intra prediction. Ex. 1002 ¶ 56 (noting that predicting a group of pixels in the current frame by using pixel values from a different location in a different frame is called motion compensation prediction), ¶ 174 ("Do does not mention intra prediction modes, including a horizontal or vertical intra prediction mode"); Prelim. Resp. 18–20; *see* Ex. 1010 p. 8-3 ("the basic idea of the present invention is that the contour features of the original image captured by the camera, the motion compensated image, and the motion compensation prediction image are similar to each other").

Petitioner addresses the fact that Do does not teach intra prediction by noting that Do's filing date "predated the adoption of directional intra-prediction modes in common standardized video codecs." Pet. 40 (citing Ex. 1010 p. 8-1). Petitioner argues that "[i]n the years after the filing of Do, standardized video codecs adopted a scheme of using various directional intra prediction modes to perform intra prediction on a current block using values from reference blocks to achieve additional compression." Pet. 40.

Petitioner suggests multiple different reasons that a person of ordinary skill would have added directional intra prediction to Do. First, Petitioner argues that a person of ordinary skill would have "looked to add directional intra prediction to the system of Do to provide the same advantages that directional intra prediction has provided to more modern video coding schemes such as H.264, such as increasing image compression." Pet. 43; *see* Pet. 60–61. Further, Petitioner contends that the fact that Do was filed before directional intra prediction had been incorporated into the most ubiquitous video encoding standards, shows "it was ready for improvement using the known directional intra prediction techniques." Pet. 43 (citing Ex. 1002 ¶¶ 186–188, 192; Ex. 1023 ¶¶ 12–13). Petitioner also suggests a person of ordinary skill would have looked at the intra prediction encoding mode as a "substitute for calculating the directional contours within an image as in Do based on the combined teachings of Do and Kobayashi," suggesting that such a change would have been substitution of one known method for another yielding predictable results. Pet. 44, 46, 63–64 (addressing Do in combination with Kalevo). Petitioner contends that such a substitution would have reduced the computational complexity of Do's calculations. Pet. 44–45, 47, 62–63, 65. And Petitioner also contends that "[o]nce directional intra prediction is added to Do's coding scheme, the [person of ordinary skill] would have understood from Kobayashi's teachings that the intra prediction method selected for coding a particular block would have acted as a quickly-determinable proxy for calculating an edge/contour direction according to the teachings of Do." Pet. 43–44 (citing Ex. 1002 ¶¶ 187, 191); *see* Pet. 61–62 (addressing Do in combination with Kalevo).

Patent Owner argues, and we agree, that Petitioner does not adequately address the significant differences between Do's teachings, including inter prediction, and the claimed invention, and we determine that Petitioner also does not adequately explain how and why a person of ordinary skill would have combined Do's teachings with Kobayashi or Kalevo to arrive at the claimed invention without improper hindsight. Prelim. Resp. 18–20, 22–24. First, although Petitioner acknowledges that Do does not teach or even mention intra prediction, Petitioner does not directly address the fact that Do teaches inter prediction. *See* Pet. 39–40. That leads to Petitioner freely referring to adding intra prediction to Do without explaining whether intra prediction can be added to Do without fundamentally changing the operation of Do. It is not explained by Petitioner whether the inter prediction of Do can even coexist with the addition of intra prediction, and if so, how. On the record presented by Petitioner, we do not know what is meant by adding intra prediction to Do. For instance, does the resulting system, subsequent to the proposed addition, perform both Do's inter prediction and the additional intra prediction? If so, the record does not show how that would work.

Further, contrary to Petitioner's arguments, the mere fact that Do was filed before directional intra prediction became part of some standard coding scheme does not establish that Do was ready for improvement using directional intra prediction or that such a modification would have been obvious. Do describes taking advantage of temporal redundancies, while the claimed invention's intra frame prediction centers on spatial redundancies. *See* Ex. 1002 ¶¶ 49–50, 56 (noting the differences between temporal prediction and spatial prediction). Dr. Havlicek's testimony downplays the relevance of motion compensated prediction to the '484 patent: "Because [motion compensated prediction] is not critical to an understanding of the '484 patent, I won't discuss it further here." Ex. 1002 ¶ 56. Further, Dr. Havlicek notes that motion compensated prediction is still used in modern video encoders, undermining Petitioner's argument that a person of ordinary skill would have considered Do ready for improvement. *See* Ex. 1002 ¶ 56 ("it can be helpful to know that [motion compensated prediction] exists in modern video encoders")). Indeed, Petitioner makes a number of conclusory statements regarding reducing the computational complexity of Do's calculations (*e.g.*, Pet. 44–45, 47). But none of Petitioner's arguments adequately explains why a person of ordinary skill would have selected Do as a base reference for combination with Kobayashi or Kalevo, given the significant differences between inter prediction and intra prediction, or why one would keep Do's scan pattern if inter prediction of Do is not used. Petitioner's proposed combination selects disparate teachings from each reference to arrive at the claimed invention through improper hindsight, without an articulation of reasoning with rational underpinnings. Such selective picking and choosing is inappropriate for an obviousness determination. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 448 (Fed. Cir. 1986)

Accordingly, having considered each of Petitioner's arguments and the evidence of record, we determine Petitioner has not shown a reasonable likelihood that it would establish the unpatentability of claim 4 as obvious over Do and Kobayashi, or Do and Kalevo.

III. CONCLUSION

For the reasons set forth above, we determine that Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to at least one claim of the ’484 patent, and we do not institute an *inter partes* review.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is DENIED.

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