

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC., AMAZON.COM SERVICES LLC,

Petitioner,

v.

NOKIA TECHNOLOGIES OY,

Patent Owner.

Case No. IPR2024-00626

U.S. Patent No. 11,805,267

**PETITIONER'S REPLY TO
PATENT OWNER'S RESPONSE**

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The '267 patent and Walker contain straightforward discussions of motion prediction concepts such as prediction and precision. PO seeks to redefine these concepts in an effort to somehow distinguish the prior art. However, PO's new definitions are contrary to the '267 patent, and PO's other arguments misrepresent the Petition. Therefore, Ground 1 invalidates all challenged claims.

Ground 2 provides an independent basis for finding all challenged claims unpatentable. PO does not dispute the combination of Karczewicz-I and Karczewicz-II teaches all limitations but attacks the motivation to combine. PO's arguments should be rejected because they apply wrong legal standards and fail to address the motivations explained in the Petition.

I. GROUND 1

A. “prediction”

PO does not allege error in the Board's construction of “prediction” or its determination that Walker's weighted predictions satisfy this construction. Instead, PO relies on a new construction that contradicts the '267 patent. If rejected, there is no dispute that Walker teaches “prediction.”

1. Walker teaches “prediction” under plain meaning and the Board's construction.

Walker teaches the claims as written. The claims require “prediction[s].” The POPR admitted that Walker teaches weighted predictions. POPR, 1, 17, 55.

The Board correctly noted that “the ’267 patent ... mathematically describes the predictions as a combination of weights and pixel values” and “all the formulas involve multiplying pixel values in reference blocks with weights.” D.I., 16. The Applicant did not dispute that weighted predictions teach the claimed first and second predictions during prosecution. D.I., 20; Ex-1007, 000280-81; Pet., 21 n.5. While PO tried distinguishing the prosecution history (POPR, 49), the POR abandoned that argument. And PO alleged in district court that weighted predictions in H.265 infringe the ’267 patent. Ex-1025, 000046-48.

At institution, the Board determined “prediction” encompasses “values used for prediction that are calculated by mathematical operations including multiplying pixel values in reference blocks with weights.” D.I., 16-17. Applying this construction, the Board determined that Walker’s “(pred0)w0 and (pred1)w1 are the claimed ‘predictions’.” *Id.*

PO does not dispute or identify any error with this construction. POR, 20-21; Ex-1024, 169:12-170:14 (“I don’t see anything I disagree with [in Board’s construction].”). Therefore, Walker teaches “first” and “second prediction” under the Board’s correct construction.

2. PO’s construction should be rejected.

The POPR argued that prediction has a “clear” meaning that excludes “intermediate value[s].” POPR, 46. The Board rejected this construction (D.I., 13-

17), and PO does not attempt to defend it. Instead, PO formulates a new meaning with intent and approximation requirements that were mentioned nowhere in PO's previous construction.

PO's construction does not clarify the meaning of "prediction" because it uses "prediction" as part of its definition: "a value or set of values generated through some coding process that is itself intended to approximately represent the pixel values for a block and that can then be used to form a residual that represents the error between the *prediction* and its original value." POR, 20.

This construction is contrary to the '267 claims. Claim 1 refers to four values as predictions: (1) "first prediction," (2) "second prediction," (3) "combined prediction" before right-shifting, and (4) "combined prediction" after right-shifting. Only the last is subtracted from pixel values to determine a residual.¹ The first three predictions are intermediate values that are not compared with pixel values. All three have a higher precision and are orders of magnitude greater than the pixel values used to form the residual. The combined prediction before right-shifting is several times larger than pixel values, and since claim 4 obtains the second prediction by left-shifting pixel values, it is also significantly larger than a

¹ For decoder claims 19-36, no predictions are used to form a residual.

pixel value.² These predictions do not “approximately represent” pixel values and are not subtracted from a pixel value to create an error/residual.

The '267 specification confirms that “prediction” encompasses intermediate values that are not “intended to approximately represent” pixel values. As the Board recognized, “the patent specification and claims describe prediction values, possibly intermediate values, that are combined to form other prediction values.” D.I., 16. The specification includes an embodiment where a first prediction P1 is combined with a second prediction P2 to form a combined prediction (P1+P2+32) before being right-shifted into combined prediction P.

$$P1=(3*E_1-17*F_1+78*G_1+78*H_1-17*I_1+3*J_1+1)>>1$$

$$P2=(3*E_2-17*F_2+78*G_2+78*H_2-17*I_2+3*J_2+1)>>1$$

The bi-directional prediction signal may then be obtained using:

$$P=(P1+P2+32)>>6.$$

Ex-1001, 14:11-25. P1, P2, and their sum (P1+P2+32) are many times larger than pixel values. They are never compared to pixel values to determine a residual.

Furthermore, the combined prediction is already a prediction before being right-shifted by 6 bits (equivalent to dividing by $2^6=64$). Ex-1001, 13:43-55; Ex-1003,

² Left-shifting and right-shifting are equivalent to multiplying and dividing by 2^n respectively, where n equals the number of bits shifted. Ex-1001, 13:43-55, 14:4-10; Ex-1003, ¶¶15-16; Ex-1024, 53:17-54:19, 56:4-13, 272:22-275:9.

¶15; Ex-1024, 56:4-13, 274:12-275:9. PO's claim construction excludes these predictions.

For support, PO takes a single sentence in the "Background" section out of context to require "the difference between original and prediction signals [be] encoded." Ex-1001, 2:1-51; POR, 20; Ex-2015, ¶66. But PO contradicts the claims because the '267 patent does not encode the difference between the original pixel value and the first (or second) predictions. It only does so for the combined prediction, whose precision has been decreased to match that of the pixel value.

Additionally, PO's construction introduces indefiniteness based on subjective intent of whether a value is "intended to approximately represent" pixel values. The specification provides no guidance or objective boundaries for making such an assessment. Dr. Richardson testified that whether one value "approximately represents" another is not based on objective criteria, but solely on "intention." Ex-1024, 179:5-183:20. Contrary to the numerical examples in his declaration, he testified that 5 can approximately represent 32,000 as long as the former is intended to approximate the latter. Ex-1024, 180:11-182:16. Yet, Dr. Richardson could not explain whose intention mattered or how intent would be determined, other than a conclusory know-it-when-I-see-it opinion that, conveniently, excludes Walker's weighted predictions for lacking the requisite intent. Ex-1024, 183:13-192:18.

3. Walker’s weighted predictions are “predictions.”

Walker’s weighted prediction matches what the ’267 patent calls a “prediction.” Claim 4 recites “said second prediction is obtained by shifting values of said second reference block to the left.” Ex-1001, cl.4, *see also* 14:4-10. This is equivalent to multiplying pixel values by weight 2^n . *Supra* §I.A.2 n.1; Ex-1003, ¶16; Ex-1024, 53:17-54:19, 272:22-273:10. Therefore, the second prediction is obtained from a pixel value multiplied by a weight.

Dr. Richardson provides an example with hypothetical numbers, purportedly showing that weighted predictions are not predictions. POR, 28-29; Ex-2015, ¶¶101-102. It is wrong. Dr. Richardson reasons that $(w_0 \cdot \text{pred}_0)$ and $(w_1 \cdot \text{pred}_1)$ “would result in a prediction error that is around the same order of magnitude as the pixel value itself.” Ex-2015, ¶102. But at his deposition, he testified that “a value of five [can] approximately represent a pixel value [of] 32,000.” Ex-1024, 179:5-183:20.

B. “precision”

PO agrees with Petitioner’s construction but asks the Board to adopt a new construction focused on the number of possible values, rather than the number of bits. PO’s construction contradicts the ’267 patent, and regardless, Walker satisfies both constructions.

1. Walker teaches the second precision under the undisputed construction of “precision.”

PO admits that Petitioner’s construction of “precision” is correct: “a *number of bits* needed to represent possible values.” POR, 21. In motion prediction, pixel values and predictions are represented by uncompressed binary numbers. Ex-1003, ¶14; Ex-2016, 52:15-20. The number of bits needed to represent these numbers is simple:

Decimal	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000

The precision of a variable depends on the number of bits needed to represent its possible values. For example, when a variable’s possible values are 1-8, four bits

are needed. Multiplication increases the number of bits needed to represent the product:

<u>Decimal</u>	<u>Binary</u>
$\begin{array}{r} 5 \\ \times 6 \\ \hline 30 \end{array}$	$\begin{array}{r} 101 \\ \times 110 \\ \hline 11110 \end{array}$

There is no need to speculate on how many bits are needed for Walker’s calculations because Walker is explicit. Table 2 states the number of bits needed to represent weighted predictions:

TABLE 2

Op- eration No.	Operation	Bitwidths Involved	Bitwidth of Operation Result
1	(pred0)w0, (pred1)w1	8 bits * 8 bits	16

Ex-1004, ¶84. Dr. Freedman explained that “the column named ‘Bitwidth of Operation Result’ includes the number of bits needed to store the result of each operation based on the possible values of the result” and “[t]he row corresponding to Operation No. 1 indicates that ‘(pred0)w0’ has a bitwidth of 16, which means that 16 bits are needed to represent the possible values of ‘(pred0)w0.’” Ex-1003, ¶¶82; Pet., 21-22. He further explained that “[t]his is consistent with binary

arithmetic because pred0 has 8 bits, w0 has 8 bits, and therefore, 16 bits (8+8) would be needed to represent the possible values of their product.” *Id.*

This is basic math: multiplying pred0 by a weight creates a larger variable, and 16 bits are needed to represent its possible values. PO admits that Walker’s samples (pred0 and pred1) and weights (w0 and w1) all have 8 bits of precision, and their product (e.g., (pred0)w0) “can result in a bitwidth of 16.” POR, 30. Since the number of bits needed to represent possible values of the weighted prediction is 16 bits, Walker’s weighted predictions have a precision of 16 bits. Pet., 12, 21-22.

2. PO’s construction contradicts the patent.

Despite agreeing with Petitioner’s construction, PO argues for a different construction. Instead of analyzing the *number of bits* needed to represent possible values, PO focuses on the number of possible values: “the Board should adopt a construction ... such that the more possible values a variable can take in an instance, the greater the precision of that variable.” POR, 25; Ex-1024, 213:11-214:4.

PO cites zero intrinsic support. Nor can it. In the specification’s examples, 8-bit pixels are multiplied by constants (the numerical filter coefficients in equations for P1 and P2) and summed/shifted/combined, resulting in “precision M [which] is higher” because it is “16 bits.” Ex-1001, 12:41-13:18. This is consistent with Petitioner’s analysis above, which looks to the number of bits needed. Throughout

this discussion—and the '267 patent as a whole—*there is no discussion of the number of possible values.*

The '267 patent confirms the simple math that PO denies. Under PO's construction, left-shifting a variable does not increase its number of possible values, and thus does not increase its precision. Ex-1024, 58:6-60:17, 244:5-244:17. However, claim 4 left-shifts pixel values of the second reference block, which have a “first precision,” to obtain the second prediction with a “second precision” “higher than said first precision.” Ex-1001, cls.1, 4.

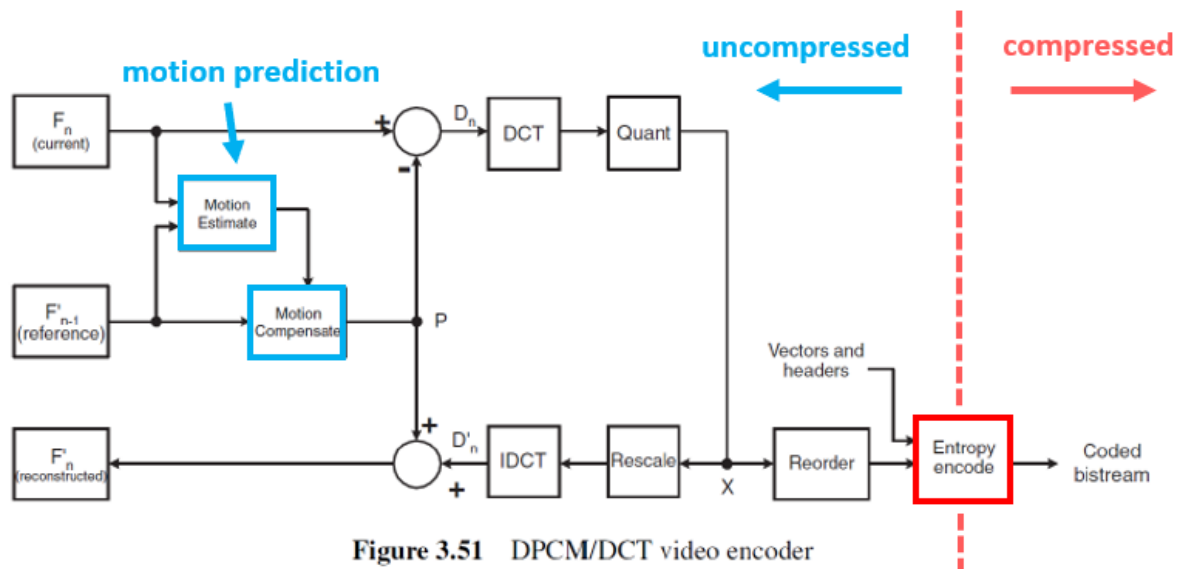
According to PO, it is “absurd” to “increase a variable's precision [using] multiplication.” POR, 25. But claim 4 refutes this argument by increasing precisions with left-shifting, which is mathematically equivalent to multiplication. Ex-1003, ¶16; Ex-1024, 53:17-54:19, 272:22-273:10.

Fundamentally, PO's construction is divorced from the context of the '267 patent, which is directed to motion prediction. Ex-1001, Title (“Motion prediction in video coding”), Abstract. Both experts agree that pixel and prediction values are represented by *uncompressed* binary numbers during motion prediction. Ex-1003, ¶14; Ex-2016, 51:20-54:12; Ex-1024, 73:16-74:8; Ex-1012, 000059; Ex-1028, 000053; Ex-1024 78:3-81:2. Using uncompressed binary numbers leads to the simple examples explained above for Walker and the '267 patent.

Ignoring the '267 patent, PO and its expert fault Dr. Freedman for analyzing “uncompressed representations of binary data.” POR, 22-23; Ex-2015, ¶¶71-73.

This is telling because PO’s arguments are based on speculation about how numbers might be compressed, based on the number of possible values, to use fewer bits. However, both experts agree that compression is performed in the last step of the video encoding process, known as entropy encoding, which takes place *after* motion prediction. Ex-2016, 45:6-21, 49:12-50:17; Ex-2015, ¶¶46-47

(annotations added):



In Dr. Richardson’s video encoder overview, ***uncompressed*** binary numbers are provided as input to the motion prediction stages (motion estimation and compensation), which occur first. Ex-1024, 73:16-74:8 (“FN which illustrates a current frame, I think it would be reasonable to describe that as an uncompressed

video frame.”). As Dr. Richardson admitted, a *compressed* bit stream is produced by entropy coding, which “is the last stage” in the encoding process. Ex-1024, 71:6-17 (“[Entropy coding is] a process of producing a compressed or encoded bit stream.”).

PO speculates on compression schemes and different number systems. When deposited, Dr. Richardson revealed that he considered hypothetical number systems and entropy coding techniques. Ex-1024, 222:8-223:1 (“I could chose to use the bit pattern 0001 to represent the value of four and so on ...”), 224:10-19 (“I can assign 1110 to represent four, that's also available to me.”), 223:2-224:9 (admitting he had entropy coding in mind).

PO’s speculations lead to baffling and self-contradictory results. For example, PO admits the value “6” is represented by 3 bits. POR, 22-23. Yet, PO claims that the set (0, 2, 4, 6) can be represented by just 2 bits because there are “four possible values.” POR, 23. As another example, PO argues that measuring 15,000,000nm is *not* more precise than measuring 15cm. POR, 25. Similarly, PO’s expert testified that a ruler that measures in centimeters (from 1-10cm) is just as precise as a ruler that measures in millimeters (from 1-10mm). Ex-1024, 215:12-218:15. To PO, measuring nanometers, millimeters, and centimeters is all the same because the number of possible values does not change. But even middle or high-school students know that measuring in nanometers or millimeters is more precise

than measuring in centimeters, regardless of whether the measured value happens to be a round number or not.

3. Walker teaches the second precision even under PO's incorrect construction.

Even if “precision” refers to the number of possible values for a variable, Walker’s weighted predictions still have a second precision higher than that of its pixel values. Walker multiplies 8-bit pixels with 8-bit weights (Ex-1004, ¶¶34, ¶44, ¶84), which Dr. Richardson admits can “take a number of possible values.” Ex-2015, ¶¶121-122. Dr. Richardson admits that multiplying a variable *with a variable weight* increases the number of possible values (Ex-1024, 227:18-230:2), and therefore precision under PO’s construction.

PO’s hypotheticals (POR, 23-25, 32-33) assume a constant weight. Those hypotheticals are irrelevant to Walker, which features variable weights. Ex-2015, ¶¶121-122.

PO also argues that “(pred0)w0 and (pred1)w1 may have different precisions” if w0 and w1 are different. POR, 33-35. However, the parties agree that “precision” looks to the number of bits needed to represent “possible values” rather than just a particular value. Ex-1003, ¶¶39-42, ¶74, ¶¶82-83, ¶95 (consistently using “precision” as being determined based on possible values). Walker uses 16 bits because 16 bits are needed to represent the possible values that can result from

its calculations. This looks to possible values rather than particular instances of pred0, pred1, w0 and w1.

C. Walker teaches reference blocks made up of pixels

PO's reference-block argument misrepresents the Petition. According to PO, the Petition identified "pred0 and pred1" as Walker's first and second reference blocks. POR, 35-36. This is incorrect, and all of PO's subsequent arguments about blocks and pixels stem from this false premise.

PO conflates Walker's reference blocks (e.g., macroblocks 520 and 580 of Figure 5) with *samples* from Walker's reference blocks (e.g., pred0 and pred1). The Petition explains that Walker's pred0 and pred1 are "*samples* from the reference blocks" but does not equate the samples (pred0 and pred1) with the reference blocks themselves. Pet., 20, 22-23; Ex-1003, ¶77, ¶87.

Regarding reference blocks, the Petition explains that the "best matching macroblocks" in previous and subsequent reference pictures (e.g., shown as 520 and 580 in Figure 5 of Walker) teach the first and second reference blocks, respectively. Pet., 17-18; Ex-1003, ¶68. The "best matching macroblocks" are alternatively called "prediction blocks" in Walker. Pet., 19-20, 22; Ex-1003, ¶76, ¶85.

Regarding *samples* from reference blocks, the Petition explains the samples are (a) pixel values from a reference block for "a motion vector pointed to an

integer pixel position” or (b) fractional pixel values interpolated based on pixel values from a reference block for a motion vector pointing to a “fractional (subpixel) position.” Pet., 3-4; Ex-1003, ¶¶12-13. The Petition used Walker Figure 5 to address the base case of motion prediction where motion vectors point to integer pixel positions.³ Pet., 17-19; Ex-1004, Fig. 5.

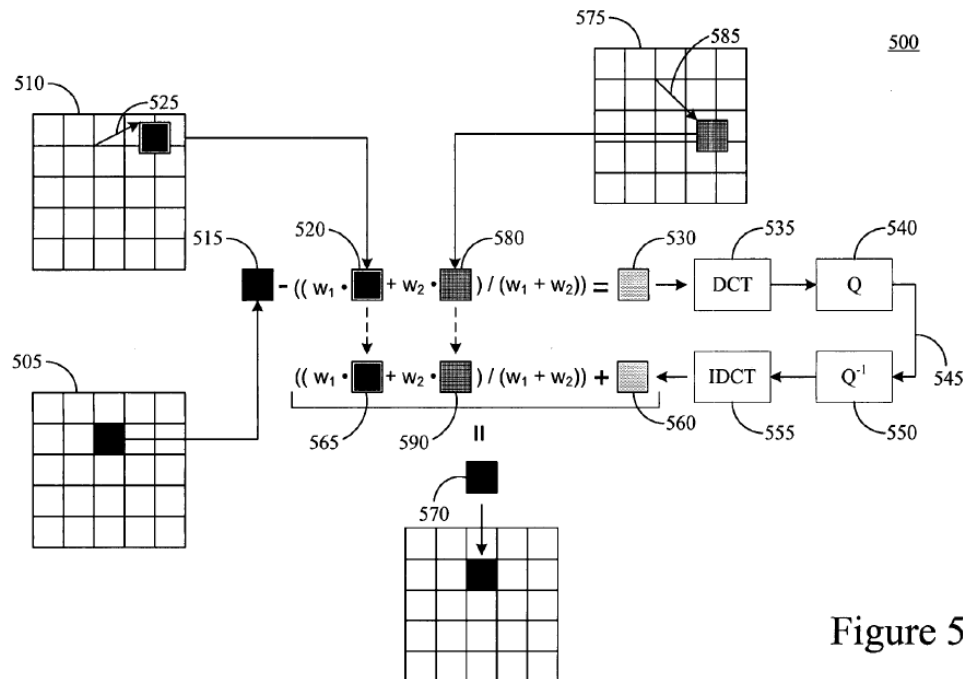


Figure 5

The Petition used an example where pixel values from macroblocks 520 and 580⁴ were directly used as samples for bi-prediction when motion vectors 525 and 585

³ PO's arguments also fail because they apply only to the scenario where "fractional motions vectors are used." POR, 37. Claim 1 does not require fractional motion vectors.

⁴ Dr. Richardson admits macroblocks 520 and 580 are regions of pixels from reference pictures. Ex-1024, 248:1-250:19.

point to integer pixel positions in reference pictures 510 and 575. Pet., 17-23; Ex-1003, ¶12; Ex-1004, Fig. 5, ¶34.

Figure 9 of Walker addresses scenarios where motions vectors point to subpixel (fractional pixel) positions. The Petition cited Figure 9 when explaining Walker's teachings for various claims related to subpixel positions. Pet., 27-30. In this case, rather than using pixel values directly, the samples (e.g., squares "a" to "o") are calculated by interpolating pixels (e.g., circles "A" to "I") from the reference block. Pet., 27; Ex-1003, ¶¶102-106 ("As indicated in Walker's figures, the integer pixels are the pixels in the reference block. ... They are the input to the FIR filter that is used for interpolating sub-pixels, including half pixels."); Ex-1004, Fig. 9, ¶114.

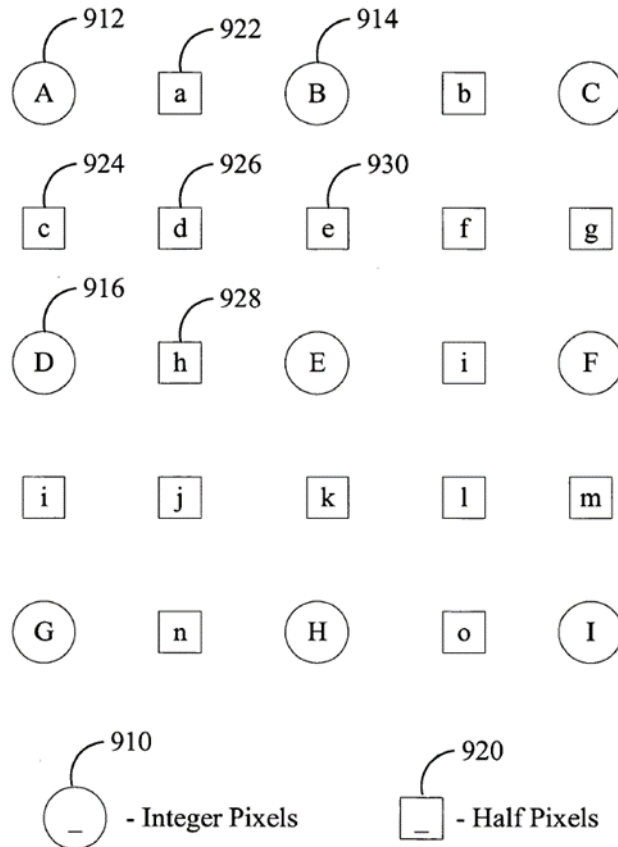


Figure 9

Dr. Richardson admits that Walker’s Figure 9 depicts “integer pixels [that] are from a reference block of pixels” and “sub-pixel positions ... being interpolated ... between neighboring integer pixel positions.” Ex-1024, 252:10-253:7.

Petitioner explained that pixel values of the reference blocks have 8-bit precision, citing Walker ¶30 and ¶60. Pet., 19; Ex-1003, ¶¶73-74. Paragraph 30 states that “[p]ixels can be defined by an 8-bit luminance value (Y) and two 8-bit chrominance values (Cr and Cb).” Ex-1004, ¶30. Paragraph 60 explains that the samples pred0 and pred1 are 8-bit values. Since the samples are pixel values from

the reference blocks when motion vectors point to integer pixels, this further shows the pixel values' precision of 8 bits. Ex-1004, ¶60.

In summary, Petitioner demonstrated that Walker teaches the claimed “first” and “second reference block.” PO’s arguments to the contrary (the entirety of POR, 35-38) are based on misrepresentations.

D. Dependent claims

1. Claims 2, 8, and 14

According to PO, Petitioner points to Walker’s predictions (e.g., pred0/pred1) as reference blocks, which is problematic because interpolation is not performed on pred0/pred1. POR, 38. However, PO misrepresents the Petition and again conflates Walker’s reference blocks with the *samples* obtained from those blocks. *Supra* §I.C.

As the Petition explained for Walker’s two-step process, when motion vectors point to subpixel positions, *samples* (e.g., pred0, pred1) are obtained from reference blocks by interpolating neighboring integer pixels. Pet., 28; Ex-1003, ¶104; Ex-1004, ¶114, Fig. 9. Next, “the interpolation results are used in determining a weighted prediction for motion prediction.” Pet., 28; Ex-1003, ¶107; Ex-1004, ¶111 (teaching multiplying interpolation results with weights to determine weighted predictions). Because Walker’s weighted prediction (e.g., (pred0)w0) is obtained by interpolating pixel values to get an interpolation result

(e.g., pred0) and applying a weight (e.g., w0) to the interpolation result, the weighted prediction “is obtained by interpolation using pixel values.” PO overlooks the first interpolation step for computing Walker’s weighted prediction.

2. Claims 3, 9 and 15

PO’s argument is similarly flawed because it conflates the samples from reference blocks (e.g., pred0) with the reference blocks themselves. *Supra* §I.C, §I.D.1.

3. Claims 4, 10, and 16

PO argues that Petitioner does not establish a causal relationship between the use of an integer motion vector and a power of two weight. POR, 40-41. However, the claims do not require a causal relationship, merely that left shifting happens “in an instance” where a motion vector points to an integer sample. Petitioner explained that Walker’s weighted prediction is applicable to both integer and sub-pixels, citing Walker’s example where the weight is 4. Pet., 31-32; Ex-1003, ¶115; Ex-1004, ¶37. Walker thus suggests a weight of 4 being applied to an integer motion vector at least “in an instance” – which is all the claim requires (“The method according to claim 2, wherein *in an instance*...”). *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002 (Fed. Cir. 2016) (“[C]ombinations of prior art that sometimes meet the claim elements are sufficient to show obviousness.”).

Both experts agree that left-shifting was known as a simpler substitute for multiplication. Dr. Freedman explains that “left-shifting is a simpler operation than multiplication” and “left-shifting to multiply a value by a coefficient ... was well known in the art.” Ex-1003, ¶¶115-116 (citing Ex-1013, Ex-1015). Dr. Richardson agrees (Ex-1024, 277:15-278:2) but speculates that “the extra test (of whether or not w_1 is a power of two) *may* well negate any advantages of carrying out some multiplications as left-shifts.” Ex-2015, ¶122 (emphasis added). However, Dr. Richardson admitted that detecting powers of two in binary is simple because they all have a single “1” followed by “0s”:

Decimal	Binary
2	10
4	100
8	1000

Ex-1024, 284:8-292:2; Ex-1023. That is why it was common to replace multiplication with left-shifting, which was taught in textbooks for computer hardware and software compilers. Ex-1027, 000021; Ex-1026, 000017.

The simple task of detecting a power of two would not have posed a problem or obviated the motivation to combine. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (“[A] given course of action often has

simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.”) (citation omitted).

II. GROUND 2

PO only disputes the motivation to combine. But PO applies the wrong legal standard and does not even address all of the motivations explained by Petitioner. Therefore, all challenged claims are unpatentable based on Ground 2 alone.

A. The combination is straightforward.

Karczewicz-I and Karczewicz-II teach the same calculation of averaging interpolated pixel values. Pet., 39; Ex-1003, ¶139. Karczewicz-I teaches bi-prediction for H.264 that averages two integer or interpolated pixel values. Pet., 42-43; Ex-1003, ¶¶142-143, 149. Likewise, Karczewicz-II teaches calculations for averaging two integer or interpolated pixel values. Pet., 41-43; Ex-1003, ¶¶144-147, 150. Karczewicz-II optimizes this calculation by preserving higher-precision intermediate values. *Id.* The combination simply applies the exact optimization of Karczewicz-II to modify the corresponding calculation in Karczewicz-I. Pet., 39-40; Ex-1003, ¶141.

This simply uses a known technique to improve a similar device/method. Pet., 52-53. PO admits that the references share the same architecture. POR, 46-47. The combination does not change the architecture; it simply uses more bits for intermediate calculations, as Karczewicz-II teaches.

The Petition walks through three examples where the bi-prediction in Karczewicz-I averages different permutations of integer and interpolated pixel values. These examples are not arbitrary—they follow the exact optimization scenarios taught by Karczewicz-II for averaging integer, half, and center pixel values. Pet., 43-52; Ex-1003, ¶¶151-168. PO admits that these three scenarios are among “possible scenarios” of motion vector calculation and does not dispute that the modifications for each scenario implement Karczewicz-II’s optimization of preserving higher-precision intermediate values. POR, 48-51; Ex-1024, 81:3-12, 100:11-102:7.

B. PO fails to rebut the motivations in the Petition.

PO argues that “Petitioners fail to identify plausible motivation...” POR, 46. But Petitioner presented express motivations to combine that PO left unrebutted. For these reasons alone, there was a motivation to combine.

- Prior-art (Ex-1016, 1008-1010) provided express motivation to apply Karczewicz-II’s teaching of preserving higher-precision intermediate values. Pet., 52; Ex-1003, ¶¶169-171.
- The combination merely changes when rounding occurs and would not have changed the principle of operation. Pet., 53; Ex-1003, ¶173.

Petitioner identified two additional motivations that PO disputes. First, PO argues there is no motivation because Karczewicz-I and II “already share a

common, albeit ubiquitous, architecture.” POR, 47. But PO has it exactly backwards. That Karczewicz-I and Karczewicz-II apply their teachings to a common architecture *reinforces* the motivation to combine. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007) (“[I]f ... a person of ordinary skill in the art would recognize that it would improve similar devices in the same way...”).

Second, Karczewicz-I and Karczewicz-II both encompass motion prediction calculations that average interpolated [pixel] values. Pet., 39-40. PO attempts to dispute this (POR, 47-48) but is contradicted by its expert. Dr. Richardson admitted Karczewicz-I describes “bi-prediction” that involves “averaging of two predictions,” where the predictions include integer or interpolated (fractional) pixel positions. Ex-2015, ¶86; Ex-1003, ¶139; Ex-1024, 81:3-12, 101:6-102:7. He also admitted Karczewicz-II teaches obtaining effective value of pixels for “motion-compensated prediction” (Ex-2015, ¶90) and averaging integer, half, and center pixels (Ex-2015, ¶141).

C. PO applies wrong legal standard.

PO admits that a well-known research team led by Marta Karczewicz filed two patent applications (Karczewicz-I and Karczewicz-II) regarding motion prediction and interpolation for H.264. PO argues there is no motivation because Marta Karczewicz did not combine these applications into one. POR, 43-45. However, this is contradicted by PO’s admission that Karczewicz-I incorporates by

reference the substance of Karczewicz-II (through VCEG-AI33). POR, 44-45.

Moreover, there are numerous reasons why an applicant would choose to file several smaller applications as opposed to one large application, and the “obviousness test is not controlled by what a prior art inventor would have done...” *In re Coutts*, 726 F. App'x 791, 792 (Fed. Cir. 2018).⁵

PO argues that obviousness is limited to disclosures within the four corners of a reference (e.g., Karczewicz-I), and anything not explicitly stated (e.g., a combination with Karczewicz-II) was not obvious to the author. But by demanding a single reference that discloses the entire combination, PO conflates obviousness for anticipation, a fallacy the Federal Circuit has repeatedly cautioned against. *Honeywell Int'l Inc. v. 3G Licensing, S.A.*, 124 F.4th 1345, 1355 (Fed. Cir. 2025) (reversing PTAB decision that found lack of obviousness because primary reference did not use claimed approach because it “conflat[ed] ... the relevant standards for obviousness and anticipation”); *Duro-Last, Inc. v. Custom Seal, Inc.*, 321 F.3d 1098, 1107 (Fed. Cir. 2003). PO’s expert admitted that his own patents did not include everything that was known on the topic. Ex-1024, 25:14-20, 35:8-37:12.

⁵ Dr. Richardson applied the wrong legal standard by not presuming a POSITA was aware of relevant art (Karczewicz-I and Karczewicz-II). Ex-1024, 148:7-149:16.

Second, PO alternatively appears to suggest that a heightened obviousness standard applies when inventors for prior-art references are “exceptionally skilled.” POR, 44. As the Supreme Court clearly set out in *Graham* and reiterated in *KSR*, the obviousness inquiry considers the level of ordinary skill in the pertinent art. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966); *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). PO’s argument is flawed because the skill level of the inventors of prior-art references is not at issue in the obviousness inquiry. *Endress + Hauser, Inc. v. Hawk Measurement Sys. Pty. Ltd.*, 122 F.3d 1040, 1042 (Fed. Cir. 1997) (“The ‘person of ordinary skill in the art’ is a theoretical construct ... and is not descriptive of some particular individual.”).

Additionally, PO’s argument that Karczewicz-I is not a prior art publication under §311(b) (POR, 56-57) has been rejected by the Federal Circuit. *Lynk Labs, Inc. v. Samsung Elecs. Co.*, 125 F.4th 1120, 1127 (Fed. Cir. 2025).

D. PO’s alleged technical inefficiency does not exist and does not negate the motivation to combine.

PO argues that the combination would be “costly” and would require “‘separate code branches’ for various scenarios” that are “inefficient and undesirable.” POR, 51-53. But this is contradicted by the evidence and PO’s expert.

As an initial matter, PO’s arguments miss the point because the combination does not create the scenarios explained for Ground 2. Rather, since H.264 already

included bi-prediction and interpolation—with two motion vectors that could point to integer, half-pixel, or center-pixel positions—the three scenarios of motion vectors pointing to different permutations of integer or sub-pixel locations were already present for H.264. Ex-1003, ¶139; Ex-1024, 81:3-12, 101:6-102:7; Ex-1006, ¶¶93-102; Ex-1014, 000190-93. The combination simply uses more bits when calculating these scenarios that were encountered during pre-existing H.264 encoding/decoding. *Id.* Therefore, even if code branches or other costs were needed to handle these three scenarios for the combination, they are generic costs that were already needed for H.264 *even without the combination*.

PO fails to address the fact that Karczewicz-II already provides motivation to use its optimizations for averaging interpolated pixel values, applied to three scenarios. Pet., 43-51. While PO argues the combination would carry out Karczewicz-II's calculations “millions of times per second” (POR, 52-53), PO's expert admitted that, even without the combination, Karczewicz-II's calculations are carried out millions of times per second. Ex-1024, 145:21-146:18. Therefore, Karczewicz-II provides motivation to use its teachings despite this alleged cost. PO cannot argue, on the one hand, that the inventors of Karczewicz-II are “people of extraordinary skill in the art” (POR, 3) while arguing, on the other, that Karczewicz-II discloses inefficient and untenable techniques.

PO argues that code branches make the combination inefficient. Its expert alleges that the combination adds “separate code branches” that would incur “likely significant computational cost.” Ex-2015, ¶146. However, in deposition, Dr. Richardson admitted that code branches are ubiquitous, stating “I don't think I could write a video codex even a very simple one without using conditional execution.” Ex-1024, 271:7-16, 267:9-16. Dr. Freedman explains that “it would be convenient and simple to maintain the higher [precision] throughout the sequence of calculations”; the modification of Karczewicz-I involves “a tiny change” and “a few lines of code.” Ex-2016, 102:7-103:22.

Additionally, PO and its expert argue that the combination creates additional hardware cost, where “an encoder implementing Dr. Freedman’s three scenarios would be forced to allocate additional space in which to store each possible intermediate prediction value computed for a first motion vector while the second prediction is calculated.” Ex-2015, ¶¶144-145; POR, 51-52. But PO and its expert misunderstand Dr. Freedman’s three scenarios. Ex-1024, 130:5-18 (“I’m not sure I completely understand [Dr. Freedman’s three scenarios].”). Karczewicz-II treats each type of motion vector the same across the three scenarios. For example, when a motion vector points to a half-pixel, all three scenarios use a non-rounded half-pixel value. Pet., 61-65; Ex-1003, ¶210, ¶213, ¶216; Ex-1006, ¶103, ¶105, Tables 5, 6, 8; Ex-1024, 118:14-121:4 (confirming that Karczewicz-II teaches one method

of calculating non-rounded half-pixel value). Therefore, only one value needs to be stored for the first motion vector.

PO further argues that encoders need to “repeatedly test possible pairs of motion vectors,” which increases the alleged costs. POR, 52. However, the need to repeatedly test potential predictions is present regardless of whether higher-precision intermediate values are used. Any purported cost is not caused by the modifications of Karczewicz-I. Moreover, PO’s expert admitted that there were “ways of ... minimizing the complexity and limiting your number of searches so that it’s a small number.” Ex-1024, 159:5-160:11. And contrary to PO’s assertion (POR, 52), Dr. Richardson admitted that the cost of repeated testing does not apply to decoding. Ex-1024, 159:5-160:18. PO’s expert further testified that minimizing computational complexity was important for real-time applications (Ex-2015, ¶55), but many applications are not real-time (Ex-1024, 140:2-5). For video codecs, performance is often improved at the expense of increased computational complexity. Ex-1024, 271:17-272:8. Therefore, even if there were a tradeoff, it would not obviate the motivation to combine. *See, e.g., Raytheon Co. v. Sony Corp.*, 727 F. App’x 662, 667 (Fed. Cir. 2018) (combination rendering the CCD sensor design less efficient than the original does not obviate the motivation to combine); *Medichem*, 437 F.3d at 1165.

PO additionally argues that the '267 patent criticizes all code branches. POR, 52-53. Not so. The patent refers to a specific inefficiency of using two code branches to round up or down (Ex-1001, 4:14-23), because using higher accuracy for intermediate values would simplify that particular calculation (*id.*, 4:36-43). Moreover, it is irrelevant whether the patentee sought to avoid this particular code branch. *Standard Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985) (“[O]ne should not go about determining obviousness under § 103 by inquiring into what patentees (i.e., inventors) would have known or would likely have done.”). The '267 patent's discussion of code branches as “Background Information” proves that separate code branches were known and used in the prior art, despite their alleged inefficiency or cost.

III. CONCLUSION

For the reasons explained above, the challenged claims are unpatentable twice over based on Grounds 1 and 2.

Date: March 24, 2025

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Petitioner's Reply to Patent Owner's Response contains 5,341 words and therefore complies with the 5,600 word type-volume limit specified by 37 C.F.R.

§42.24(c)(1). The word count does not include those portions excepted by 37 C.F.R. §42.24(c) and was calculated by Microsoft Word 365.

Date: March 24, 2025

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on March 24, 2025, a complete copy of the foregoing Petitioner's Reply to Patent Owner's Response was served via email to all parties to this proceeding at the addresses indicated:

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